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The Impossible Trinity and Financial Stability

The Incidence of Trilemma Regimes on the (In)stability of Stock Markets and Credit Aggregates (1922-2013)

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PhD in Economic History

THE IMPOSSIBLE TRINITY AND FINANCIAL STABILITY

The Incidence of Trilemma Regimes on the (In)stability of Stock Markets and Credit Aggregates (1922-2013)

VOLUME I

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A mi familia por haberme apoyado, nutrido y amado cada paso del camino
A mis maestros por haber formulado todas las preguntas apropiadas
A mis antiguos y futuros alumnos: ustedes son mi motivación

To my family for your support, nurture and love every step of the way
To my teachers because you have asked all the right questions
To my past and future students: you give me a sense of purpose

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List of Acronyms

ABS	Asset Backed Securities
ACF	Autocorrelation Function
ADF	Augmented Dickey-Fuller (1979) unit root test
AE	Advanced Economy
AIC	Akaike Information Criterion
AO	Additive outlier
ARIMA	Autoregressive integrated moving average
BBI	Bull Bear Indicator (*singular form)*
BBIs	Bull Bear Indicators (*plural form)*
BGG	Bernanke, Gertler & Gilchrist (1999)
BIC	Bayesian Information Criterion
BIS	Bank for International Settlements
BoE	Bank of England
BoP	Balance of Payments
BP	Bandpass filer (Christiano & Fitzgerald, 2003)
BWS	Bretton Woods System
CAGR	Compounded annual growth rate
CBOE	Chicago Board Options Exchange
CBWS	Convertible Bretton Woods System
CDO	Collateralised Debt Obligation
CDS	Credit Defaul Swap
CH	Canova & Hansen (1995) seasonality test
CIRP	Covered Interest Rate Parity
CRRA	Constant Relative Risk Aversion
DSGE	Dynamic Stochastic General Equilibrium model
DTI	Debt to Income ratio
DPD	Dynamic Panel Data
ECB	European Central Bank
EME	Emerging Market Economy
EMH	Efficient Market Hypothesis
EMS	European Monetary System
EMU	European Monetary Union
EPU	European Payments Union

ERP	European Recovery Programme (Marshall Plan)
EWMA	Exponentially Weighted Moving Average
FDI	Foreign Direct Investment
FDR	Franklin Delano Roosevelt
FGLS	Feasible Generalized Least Squares
FOMC	Federal Open Markets Committee
FXR	Exchange Rate Regime
GARCH	Generalised Autoregressive Conditional Heteroskedasticity
GBBI	Global Bull Bear Indicator
GBBIL	Long-run Global Bull Bear Indicator
GBBIM	Medium-run Global Bull Bear Indicator
GBBIS	Short-run Global Bull Bear Indicator
GES	Gold Exchange Standard
GFC	Great Financial Crisis (2007-09)
GFD	Global Financial Data
GLS	Generalized Least Squares
HEGY	Hylleberg, Engle, Granger & Yoo (1990) test for seasonal integration
HP	Hodrick & Prescott (1997) filter
IBRD	International Bank for Reconstruction and Development
IFS	International Financial Statistics
IMF	International Monetary Fund
IMFS	International Monetary and Financial System
IQR	Interquartile range
IT	Inflation targeting
JST	Jordà, Schularick & Taylor Macrohistory database (2017)
KCR	Capital Control Regime
KePl	Keynesianism Plus Policies
KPSS	Kwiatkowski, Phillips, Schmidt, & Shin (1992) unit root test
LAW	Leaning Against the Wind
LBBI	Local Bull Bear Indicator
LBBIL	Long-run Local Bull Bear Indicator
LBBIM	Medium-run Local Bull Bear Indicator
LBBIS	Short-run Local Bull Bear Indicator

LHA	Left-hand axis
LM	Lane & McQuade (2014)
LOLR	Lender of Last Resort
LS	Level shift
LSE	London Stock Exchange
LTI	Loan to Income ratio
LTV	Loan to Value ratio
MBBR	Minimal Balanced Budget Rule
MBS	Mortgage Backed Securities
MLE	Maximum likelihood estimation
MRV	Magud, Reinhart & Vesperoni (2014)
MV	Magud & Vesperoni (2015)
NBER	National Bureau of Economic Research
NYSE	New York Stock Exchange
OMO	Open Market Operation
OLS	Ordinary Least Squares
OPEC	Organization of Petroleum Exporting Countries
PBL	Portfolio Balance Literature
PBWS	Post-Bretton Woods System
PC	Principal component
PCA	Principal Component Analysis
PCBWS	Pre-Convertible Bretton Woods System
PCSE	Panel Corrected Standard Error
PP	Phillips & Perron (1988) unit root test
PPP	Purchase Power Parity
RHA	Right-hand axis
SGP	Stop-Go Policy
SIFI	Systemically Important Financial Institution
TARP	Troubled Asset Relief Program
TBTF	Too Big to Fail
TC	Temporary change
TEU	Treaty of the European Union / Maastricht Treaty
ThM	Thatcherism-Monetarism
TP	Turning point analysis

TPBC	Turning point and business cycle consensus
TR	Trilemma regime
TR I	Trilemma regime with fixed exchange rate and closed capital account
TR II	Trilemma regime with fixed exchange rate and open capital account
TR III	Trilemma regime with flexible exchange rate and closed capital account
TR IV	Trilemma regime with flexible exchange rate and open capital account
VaR	Value at risk
VAR	Vector Autoregression model
VIX®	Volatility Index calculated by CBOE
WB	World Bank Group
WDM	War-time Demand Management
WWI	First World War
WWII	Second World War
ZLB	Zero Lower Bound

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Mi familia ha sido, desde siempre, una compañía incansable, un lugar de descanso y el origen de todas las oportunidades que me han convertido en quien soy hoy. Durante estos cuatro años, he compartido con ellos tanto los momentos de alegría como de desazón que han sido parte integral de este proceso. A mis padres, Germán y Amalia, a Juandi, María, Cata y Michael les agradezco las horas por *Facetime*, los cientos de mensajes por *WhatsApp*, todas las horas compartidas cuando hemos tenido la rara oportunidad de vernos y la buena energía que sé que me envían desde la distancia antes de una presentación, de una discusión o de una reunión importante. A Isabela y a Matías fue una dicha verlos y dejar la tesis de lado para disfrutar de mi papel de tío por un par de semanas. A Nico, sé que siempre estás ahí acompañándome.

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A research visit in Davis, California, during the fall quarter of 2017 provided an excellent opportunity to allow my ideas to settle and shape the final structure of this dissertation. First, I want to thank the Department of Economics at UC Davis and Chris M. Meissner who sponsored my visit and was a very attentive and supportive host. There, my research benefitted greatly from the comments of Alan M. Taylor, Oscar Jordà, Katherine Russ, Paul Bergin, Barry Eichengreen, Kris Mitchener, Carmen Reinhart and Harold James. During this period, I was invited to present a preliminary version of the third chapter at Rutgers University, where I received helpful comments and insights from Michael D. Bordo, Hugh Rockoff, Eugene White, and John Landon-Lane. Without their input, the local version of the Bull Bear Indicator and the broadening of the database from six to twelve countries would not have been included in this thesis.

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History Association (2017), el *Workshop on the History of Exchange Rates* (2017), el *UC3M Inter-University PhD Workshop in Economic History* (2017), el *LSE Graduate Seminar on Financial and Demographic History* (2018), el *World Economic History Congress* (2018) y los seminarios de estudiantes de la Universidad de Barcelona (2016-18), Universidad de Valencia (2016, 2018), Universidad de Zaragoza (2017) y UC Davis (2017).

Ha habido una cantidad inmensa de desconocidos que han apoyado indirectamente este trabajo a través de foros de internet como *Matlab Answers*, *Stata List*, *ResearchGate* y *the Stata blog.* En los momentos más oscuros de la programación ofrecían respuestas rápidas a los problemas que iban surgiendo. A estos héroes sin nombre les hago una mención especial pues, como dice el refrán, el diablo está en los detalles.

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Prologue – A Personal Note

Choosing a research subject, more so distilling a research question out of an assortment of possibilities, was a daunting task. With the benefit of hindsight, today I understand that the book that you hold in your hands or that you are reading on a screen is as much a result of chance, of the summation of coincidences, as it is my merit. As I believe our deeds define us, I wish this prologue to serve as an explanation of how this thesis came to be.

After studying finance and foreign relations in Colombia, I wanted to follow in my brother's footsteps and become a banker, probably a CFO or a CEO at a major bank or financial corporation. I had seen Wall Street (the 1987 version), and Gordon Gekko's lifestyle was very appealing to me. In 2005, I was fortunate enough to land my first job as a trader for institutional investors at a Colombian bank. I was in charge of dealing with forex, public and private debt and liquidity products for insurance companies and trusts.

After the shock and awe of the first few weeks, I came to understand something that for me, at the time, was a simple truth: one market is just like any other market. Whether you deal with tomatoes, derivatives or real estate the trick is to buy at a lower price than that at which you can sell the product. As I understood the mechanics underlying the whole process and built relationships with my clients, the job became monotonous. In 2005-06 markets in Colombia were reasonably stable, except for a dramatic shift in the yield curve that lasted a few months.

In March 2006, around the time when Ben Bernanke started his two-period role as chairman of the US Federal Reserve, I asked for a transfer and was given a position as market risk analyst for the trading desk at the bank. Working in the middle office gave me a whole new perspective and nuanced my understanding of markets. The risk of buying a tomato is entirely different from that of purchasing a house or a foreign currency. This new perspective of the risks underlying investments came hand in hand with the idea of predictability in asset markets. The idea behind risk management is that, if analysts model asset prices correctly, one might "guesstimate" the maximum probable loss for a given period and confidence level. This number, the Value at Risk (VaR), is one of the inputs banks need to calculate the level of capital regulators require them to hold at any point in time to remain both liquid and solvent.

Of course, this demanded a more in-depth knowledge of mathematics, statistics, computer programming and database management than what I had at the time. However, the philosophy behind it all was, to say the least, titillating. During that period, I had to read a lot, and in so doing encountered issues related to the valuation of financial derivatives for the first time. Throughout the second quarter of 2007, the bank I worked for started dealing in plain vanilla options, and both cross-currency and interest rate swaps. Of course, as part of the risk management team, my boss expected that I acquire in-depth knowledge of the inner workings of these products; I was staring at the full breadth and depth of my ignorance in the face.

Then, lightning struck. On August 9, 2007, I saw a news flash on a Bloomberg ® screen:

> *"**BNP Paribas Freezes Funds as Loan Losses Roil Markets**. (…) BNP Paribas SA, France's biggest bank, halted withdrawals from three investment funds because it couldn't ``fairly'' value their holdings after U.S. subprime mortgage losses roiled credit markets."* (Boyd, 2007, p. 1).

That was the first time I had ever heard of subprime lending, mortgage-backed obligations, securitisation, asset-backed securities and many other terms from the financial jargon that would make it to the front pages of newspapers around the world during the next lustrum.[1]

[1] Neal (2015), dates the first relevant credit event a few days earlier.

> *"In early August, 2007, IKB Deutsche Industriebank in Germany, had to get a capital injection of $4.8 billion from a consortium of German Banks. IKB's Special Investment Vehicle (SIV) had invested in an exotic Collateralized Debt Obligation (CDO) created by Goldman Sachs in the US, which it now found was worthless"* (p. 294).

As the saying goes, “things work until they stop working” and this applied to the very sophisticated financial models the industry was using. Financial institutions the world over appeared to implement the best practices according to the Basel I and Basel II Accords on Capital Adequacy (Basel Committee on Banking Supervision, 1988, 2006). These institutions valued derivatives following the international standards on volatility estimation and used the state-of-the-art asset pricing techniques discussed in the most recent literature. Most institutions, albeit not all of them, were prudent (or at least followed strictly the regulatory guidelines at the time) both in their investments and forecasts for macroeconomic conditions. However, none of those measures prepared the industry for the shock that came; we just did not know enough.

Confronted by what to me appeared as an unchartered scenario in the financial sector, I decided to leave the bank and start my MSc in Finance at the Barcelona Graduate School of Economics. I reasoned that if I wanted to understand what was happening, the best place to be was an institution at the forefront of research in asset valuation and risk management. I expected to use this year to bridge the gaps in my understanding of finance and financial markets.

During the first term, I was taking a mandatory course on stochastic processes, that strange discipline that arises from the marriage of calculus and probability, when on September 15, 2008, Lehman Brothers collapsed. We were all asking the same question: “How could we have missed it?” This sentiment was echoed by her majesty the Queen of England herself, when, during the inauguration of a building at LSE on November 5, 2008, she asked why, if the credit crisis was so massive, no one had seen it coming (Greenhill, 2008).

We kept asking the same question over and over again during the master’s degree. The thought process teachers followed was that models contained beautiful and very sophisticated equations that could explain and even predict reality 95% of the time. Of course, if the success rate of a doctor’s diagnosis or of a football team were 95%, they would be deemed the best doctor or football team in history, by far. However, I argued with myself, the economy-wide effect of one inaccurate doctor or a failing football team is negligible. Instead, the consequences of using a misspecified valuation model that assumes, for example, that housing prices in real terms cannot decrease can be and have been, devastating.

A first answer to the broad question of crises prevention and prediction came in the form of Ben Bernanke. It was quite revealing to me that, at a time when the world was on the brink of facing an economic crisis like no other, the chairman of the Federal Reserve was an academic whose doctoral dissertation had been on the Great Depression. This gave me an inkling of the relevance of understanding history to explain current phenomena. However, almost half a decade would pass before I picked up this idea again.

By the end of the master degree, I wanted to pursue a PhD in finance at Pompeu Fabra and developed a research project on the predictive power of stochastic discount factors. I was confident that asset markets had to be predictable, at least within certain bounds defined by the interplay between interest rates and risk-adjusted returns. Much to my dismay, I was not admitted to the program and, in August 2009, I returned to Colombia.

The situation in the job market was dramatic: finance professionals were losing their jobs left and right not only in Wall Street but also in other developed and developing financial systems. The profession of the financier was discredited after the turmoil caused by the financial crises in the US, and its symptoms started showing their face in Europe, adding to a global sense of despair. In that very gloomy scenario, I revived my teenage dream of becoming a teacher. This dream was my own, not a foreign idea whose appeal or convenience made me adopt it, but a dream constructed when I was alone in my room reading, studying and listening to music.

Luck was on my side once again, and I was hired in 2010 by my *alma mater*, Universidad Externado de Colombia, as a professor and researcher at the School of Finance, Government and International Relations. During the next four years, I kept working on stochastic discount factors, the efficient market hypothesis, and I collaborated on two publications on financial crises. It was then that I read Kindleberger's

"*Manias, Panics, and Crashes*" for the first time. Then, I recalled Ben Bernanke's thesis on the Great Depression and started reading anything I could get my hands on that dealt with financial crises in the long-run.

In 2013, encouraged by the University, I applied to the PhD in economic history at Universitat de Barcelona. I believed then, as I do now, that financial models disconnected from the realities of the macroeconomy increase systemic risk, cause a myopic perception of reality, and fail at big-picture conclusions. Larry Summers said it best when, in criticising the efficient market hypothesis and its corollary —the law of one price— as the paramount of asset pricing, he compared empirical (financial) economists with ketchup economists:

> *"They have shown that two-quart bottles of ketchup invariably sell for twice as much as one-quart bottles of ketchup except for deviations traceable to transactions costs, and that one cannot get a bargain on ketchup by buying and combining ingredients once one takes account of transactions costs. Nor are there gains to be had from storing ketchup, or mixing together different quality ketchups and selling the resulting product. Indeed, most ketchup economists regard the efficiency of the ketchup market as the best-established fact in empirical economics"* (Summers, 1985, p. 634).

I arrived in Barcelona in August 2014 and started working with my supervisor, María Ángeles Pons, on the idea of comparing the Latin American debt crisis of the 1980s with the European crises of the 2010s. At first, the issue seemed quite appealing, except that every big name working on the history of financial crises and financial stability was doing some work related to this topic. Secondly, it was too broad a subject for a dissertation: too many countries, too many particular situations, too many categories to compare and contrast.

During the first academic term of 2014, I attended a course on the history of economic thought. One of the first readings was a letter by Deirdre N. McCloskey, addressed to a first year PhD student.

> *"It's pretty simple to know when you have a dissertation worth doing. It will come from The World, not from The Literature. You will care*

> *about it, because (if you are wise) you will have chosen an area that just plain interests you (…) that excites your indignation or your anger or your love"* (McCloskey, 1997, p. 2).

As I continued reading without deciding on a final topic, I found the letter, addressed to Her Majesty, by the British Academy eight months after the LSE affair. In answering the question of why the most brilliant minds in the world had not seen the crisis coming, the academy indicated that,

> *"[T]he difficulty was seeing the risk to the system as a whole rather than to any specific financial instrument or loan. Risk calculations were most often confined to slices of financial activity, using some of the best mathematical minds in our country and abroad. But they frequently lost sight of the bigger picture. (…) There was a broad consensus that it was better to deal with the aftermath of bubbles in stock markets and housing markets than to try to head them off in advance. (…) This fuelled the view that we could bail out the economy after the event. (…) Everyone seemed to be doing their own job properly on its own merit. And according to standard measures of success, they were often doing it well. The failure was to see how collectively this added up to a series of interconnected imbalances over which no single authority had jurisdiction"* (Besley & Hennessy, 2009, pp. 1-3).

Of course! The consensus had to be wrong! We, as a species, could not have our hands tied in the face of financial crises! I knew enough about the bounded predictability of financial markets and the limits of the efficient market hypothesis to expect that there should be some warning signal before a crisis unravelled —and the literature on early-warning signals seemed to agree. From a historical perspective it was surprising (and puzzling) that during the golden age of development (1950-70), crises had been less frequent and pervasive than during other time periods.

During a couple of months, I pondered the questions of the nature of money, the origin and power of credit and leverage, and came to realise that money and credit had not been defined uniformly nor worked equally throughout history. That was when monetary and exchange rate regimes caught my eye as a possible culprit for the anatomical differences in the evolution of asset prices and credit aggregates in history. Regimes were overarching and long-lasting enough to affect financial systems in different countries, but still sufficiently diverse in the long-run for me to develop hypotheses tests and econometric models.

When I thought about a research question for my thesis the only words that came to mind, at first, were "Do the rules of the game matter for booms and busts?" The rest of the story is contained in the next seven chapters.

A final caveat in the spirit of trilemmas has to do with the length of this dissertation. Rose (2011) describes the conundrum I faced in writing these lines as follows:

> *Any book that seeks to conduct a scholarly review and extension of a broad topic, as this one does, faces a trilemma: it can be comprehensive, balanced, or interesting, but not all three. Suppose it is balanced and compelling, providing a single coherent and interesting viewpoint in a fair-minded way. In this case, it simply cannot be a comprehensive review of all the relevant territory, since discordant notes will inevitably have been omitted. On the other hand, a book may be comprehensive and interesting, but then it cannot be impartial; evidence must be unfairly discounted to ensure that everything fits into a single mindset.* (p. 658)

The fact that I have tried to write both a comprehensive and balanced account may make for a difficult read, with few clear-cut results and abundant caveats. For that, I apologise in advance.

Germán Forero-Laverde
Barcelona, 2018

Introduction

"The occurrence of manias, panics, and crashes, and their ultimate scope, also depended very much on the monetary and capital-market institutions of the time."
(Kindleberger & Aliber, 2005, p. vii)

"By studying the behavior of financial markets under a variety of macroeconomic and policy environments, financial historians can provide much needed insights that help in devising policies that promote the efficient and stable operation of financial markets."
(Bordo & Wheelock, 2009, p. 444)

The quest for financial stability is the new holy grail of international macroeconomics. In particular, the issue has again come to the fore after the Great Financial Crisis (GFC) of 2007-09 challenged the truism that price stability and financial stability were "highly complementary and mutually consistent objectives, to be pursued within a unified policy framework" (Bernanke & Gertler, 1999, p. 18). As indicated by Borio and Lowe (2002), "while low and stable inflation promotes financial stability, financial imbalances can still build up without any noticeable pick up in inflation" (P. 19).[2] The fact that since the 1990s there has been a sustained expansion of credit and monetary aggregates in the presence of stable prices was presented by Borio (2006) as the "Great Liquidity Expansion Puzzle" (p. 1).

As a consequence of this conundrum, a whole body of research, that springs from the works of Bagehot, Kindleberger, and Minsky, has gained momentum. Their works are being re-read and their hypotheses tested by mainstream economists using the most recent advances in macroeconomic modelling (Martin, 2013). As we will discuss in Chapter 1, the Bank for International Settlements' view of policy-makers leaning

[2] It is surprising that the Bank for International Settlements (BIS) was discussing the decoupling of financial and price stability several years before the GFC, while mainstream journals and economists were still focused on what was called the Jackson Hole Consensus (Jones, 2015). We discuss this in depth in Chapter 1. An interesting review of the literature on the link between financial and price stability and criticism of the Bernanke-Gertler view is provided by Kuttner (2012).

against the accumulation of financial imbalances, rather than just waiting to clean up the mess after a crisis ensues, is being considered both in academic and policymaking circles the world over. Evident manifestations of this have been the rise of financial stability to a policy objective and the renewed interest in macroprudential measures as a mechanism to hinder asset price booms (Jones, 2015).[3] This new perspective is a refreshing shift from the Greenspan-Bernanke doctrine that stated that policymakers could not identify bubbles and thus should not try to outsmart the market by trying to prick them (Posen, 2006).

This is not to say, however, that work on financial stability had come to a halt before the GFC, but complacency did occur in academic and policy-making circles. There was a "belief that for advanced economies, destabilizing, systemic, multi-country financial crises were a relic of the past", like the crisis that preceded the Great Depression, and that now they were mostly banished to developing countries, as in the Latin American crisis of the 1980s or the Asian crises of 1997-98 (Reinhart & Rogoff, 2009b, p.1). The crash in 1987 and the burst of the dot.com bubble from which the American economy recovered quickly were corollaries in this new understanding of financial stability. However, "the [great financial] crisis exploded these and other myths which had taken hold based on very little firm empirical evidence, and with scant regard for the lessons of history" (Jordà, Schularick & Taylor, 2015, p. S1).

The reality check imposed by the events of 2007 to those who thought of the Great Moderation as an end-of-history event was earth-shattering (Smets, 2014). Just a few years earlier, in his Presidential Address to the American Economics Association, Robert E. Lucas Jr. stated that the main issue in modern macroeconomics, the "central problem of depression prevention has been solved, for all practical purposes, and has

[3] Freixas, Laeven & Peydro (2015), argue that the goal of financial stability has been given to central banks since their inception. They posit the cases of the Bank of Sweden (1668) and the Bank of England (BoE) (1694), who promoted financial stability via lender-of-last-resort (LOLR) activities. We argue that the current debate goes far beyond a crisis-contingent reaction as a LOLR into the more preventative role suggested by the macroprudential literature. We concur with Borio (2014a) that the financial stability objective of central banking has proved elusive throughout history.

in fact been solved for many decades" (2003, p. 1). By the end of the 2010s the macroeconomic implications of financial instability and its most dramatic manifestation, a financial crisis, were thoroughly and painfully remembered.

Motivation: Finance, Growth, (In)stability, and Crises

The literature that studies the link between finance and growth has been able to establish that countries with better functioning financial systems grow faster as they are more efficient pooling and reassigning savings, and they facilitate investment through the creation of new financial instruments. This causal relationship, which runs more strongly from finance to growth, has positive effects on productivity and capital accumulation (Levine, 2005). An added benefit of robust and well-functioning financial systems is that they add stability to the growth process by allowing long-term investment and mitigating the volatility in the exchange rate. However, two caveats are noteworthy.

On the one hand, the robustness of the link between finance and growth becomes weaker as countries become wealthier; on the other hand, large financial systems, if poorly regulated, can also be a source of financial fragility (Beck, 2012). The latter is true since larger financial systems have an increased capacity for risk-bearing and a higher propensity to take on risk (Almarzoqi, Naceur & Kotak, 2015; Rajan, 2006)

Regarding this two-sided nature of the link between the real economy and the financial system, Irving Fisher (1933) noted that "equilibrium is stable though delicate. When it departs from certain limits, there is a point in which the natural tendency is now not to return to the previous equilibrium but to depart further from it" (p. 339). This reference, which was made initially concerning debt overhang and debt deflation in the context of the Great Depression, highlights the main feature of financial instability: both the financial system and the real economy seem to tolerate limited levels of stress. Once the breaking point is reached and surpassed equilibrium conditions are unattainable, and a crisis ensues.

Usually, the increasing level of stress to the financial system is measured by the accumulation of financial imbalances: the overextension of firm or household balance sheets, excessive growth in credit aggregates or asset prices, rapid increases in the level of public debt, or unsustainable deficits in the current account (Borio & White, 2004).[4] These imbalances distort agents' decision-making inducing overborrowing and overinvestment (Assenmacher-Wesche & Gerlach, 2010).[5]

To exemplify, although initially a credit boom may be associated with better macroeconomic performance via increases in investment and consumption, it may be unsustainable in the long-run (Dell'Ariccia, Igan, Laeven & Tong, 2013). If additionally, asset price booms are supported by this increasing economy-wide leverage, then the instability in the system may be extensive as investors take on ever-increasing amounts of risks (Claessens & Kose, 2013; Minsky, 1986, 1992). This excessive risk-taking during the boom phase can have substantial unwanted effects on the real economy once imbalances unwind during downturns (Jones, 2015). Several studies have found that credit booms increase the likelihood of financial crises and worsen their effects on the real economy (see Freixas, Laeven & Peydro, 2015 for a review)

Defining financial stability is tricky since meanings vary across stakeholders (bankers, central banks and regulators, investors, and tax-payers). While identifying financial crises and asset price or credit booms and busts *ex-post* is a straightforward task, the challenge comes forth when we require a functional definition *ex-ante*. Following Borio & Drehmann (2009):

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[4] The term "financial imbalances" is pervasive in the literature: 217,000 results in a simple search in google scholar, against 3,100,000 for the term "financial crisis". However, the definition of what constitutes a financial imbalance seems to be contingent in the study. This is reminiscent of Justice Potter Steward's comment in 1964 regarding a definition for "obscenity": "I know it when I see it" (Roubini, 2006, p. 101). The common usage of the word implies excessive (usually above-trend) growth in some measure of credit aggregates, asset prices, and / or liquidity as in Assenmacher-Wesche & Gerlach (2010) and Borio (2014b).

[5] The accumulation of imbalances causes a "risk perception gap" on the part of investors since market agents behave as if risk decreased during booms (allowing them to invest safely) and increased during busts (inducing fire sales and general divestiture). This misperception leads to the "paradox of financial stability" where the system looks and feels more robust when in reality it is most vulnerable: high prices and low volatility are mistaken for robustness while they are diagnostic of an extreme accumulation of imbalances (Borio, 2014c). As Borio (2006) indicates, the proper way to think about this issue is that risk accumulates during booms and materialises during busts.

"We define financial distress / a financial crisis as an event in which substantial losses at financial institutions and/or the failure of these institutions cause, or threaten to cause, serious dislocations to the real economy, measured in terms of output foregone. We define financial instability as a set of conditions that is sufficient to result in the emergence of financial distress / crises in response to normal-sized shocks. These shocks could originate either in the real economy or the financial system itself" (p. 4)

According to Kindleberger & Aliber (2005) accumulated financial instability materialises in a financial crisis in the presence of a crash, a panic or both.[6] While a crash usually involves a drastic reduction in asset prices or the failure of financial institutions, panics are related to liquidity hoarding and flight-to-quality shifts in portfolios. Bordo et. al., (2001) and Claessens & Kose, (2013) further indicate that in a scenario of financial crisis, several situations usually occur concurrently: substantial reductions in asset prices and credit volumes in a context of high volatility, financial disintermediation, liquidity dry-outs, substantial decreases in foreign lending, and economy-wide solvency issues that manifest in deteriorating balance sheets.

All these compounded effects lead to debt overhang situations for households and firms alike which depresses consumption, investment and finally employment and output. This general equilibrium effects circle back to the financial system "creating a vicious cycle whereby weaknesses in the financial sector and real economy reinforce each other" (Freixas et al., 2015, p. 143). The primary expression of these feedback effects is the pass-through of the crisis from failing to healthy institutions and from a single asset class to all the financial market. This pass-through occurs through defaults within the financial sector and the effect that credit crunches may have on industries that are highly dependent on the

[6] This is not to say, however, that financial instability is a perfect predictor of financial crises. Schularick & Taylor (2012) find that while the predictive power of credit growth on financial crises is high, it is not exempt of Type I (false positives) and Type II (false negative) errors. This implies that crises may occur with no previous instability and that in some cases, large imbalances may not lead to crises.

financial system to function correctly (Beck, 2012). While crises affect the whole economy, in relative terms those at the bottom are usually hit hardest, usually increasing inequality (Atkinson & Morelli, 2003). To resolve the ensuing recession generally requires government intervention which increases the fiscal pressure and has adverse effects on the level of public debt (Freixas et al., 2015).

Evidence on the effect of financial crises on economic performance is varied.[7] For instance, Bordo et al. (2001), show that recessions with financial crises as defined above are more severe than standalone recessions. Additionally, they show that there is an adverse effect of financial crises on the depth of the recession and not the reverse. In the same line Jordà, Schularick & Taylor (2011) show that, since the Second World War, recessions that coincide with financial crises are up to 1/3 costlier than normal recessions. Furthermore, Jordà, Schularick & Taylor (2015) indicate that the asset class where the crises are triggered, and the leverage level at the time of the crises are determinant to the effects of a crash on the real economy. A final issue regarding the impact of financial crises on the real economy is that recovery from recessions associated with financial crises takes longer than from "normal" recessions: asset prices, credit levels, employment and output remain depressed for more extended periods and recover more slowly (Claessens & Kose, 2013; Claessens, Kose & Terrones, 2013). Consequently, both financial instability and financial crises as its ultimate manifestation have been deemed a subject of interest for researchers, policymakers and regulators all over the world.

Statement of the Problem

The subject of the origin of financial instability, its mutation into economy-wide crises and their implications on output, employment and fiscal conditions is titillating, pertinent and at all lights relevant. However, attempting to grasp it in all its breadth and depth in a doctoral thesis would be both overly ambitious and naïve.

[7] Since crises are rare events, studying them requires the pooling of data for several countries and for long periods of time, as is done in most of the studies discussed in what follows. We will comment on this issue in Chapter 1.

As a first approximation, we have chosen to focus on some of the critical elements presented in the previous section with the purpose of tending to them both in depth and with rigour. The overarching question that will guide our endeavours is the following:

> *Is the accumulation and unwinding of financial imbalances in asset prices and private domestic credit, in advanced economies, contingent on the exchange rate and capital control regimes in place between 1922 and 2013, and if so, how do the sources of instability change according to the institutional arrangements in place?*

This approach to the issue is relevant on four distinct accounts. First, we approach the issue of financial instability from an institutional perspective and aim at understanding how a given institutional setup facilitates or hinders the accumulation of financial imbalances. Secondly, by broadening our analysis from financial crises to a broader definition of instability, we increase sample size while mitigating selection bias: while most crises imply financial instability not all cases of financial instability imply crises. In third place, the joint analysis of stock markets and asset prices acknowledges that the financial system can create money endogenously and allows for a relationship between asset and credit markets.[8] Finally, we expect that the stylized facts that arise from our analysis may lead to policy recommendations regarding financial regulation, the intervention of monetary authorities in asset markets, and issues about the nascent macroprudential regulation literature.

In our statement of the problem, we have chosen a narrow object of study, a straightforward theoretical framework, a limited set of countries to survey, and a well-demarked time-period to cover. As we bounded the research question, the trade-off between scope and depth was always present and led to the exclusion of several elements which, although of interest for the general topic, would have made identification more challenging. In what remains of this section we will address each of these choices in turn.

[8] We discuss this issue in depth in Chapter 1 and **Error! Reference source not found.**.

Asset Prices and Credit Aggregates: The Financial Cycle

Until recently, the workhorse Keynesian Dynamic Stochastic General Equilibrium models (DSGE) did not include structural links between financial markets and the real economy. On the one hand, asset prices were redundant in agents' consumption/investment decisions (Airaudo, Nisticò & Zanna, 2015). On the other hand, the banking system's sole function was to reassign resources between liquidity-abundant and liquidity-strapped agents. These models envisioned the banking system as an amplifier of shocks through the financial accelerator but not as a generator of instability through endogenous money creation (Schularick & Taylor, 2012).[9]

These two elements of the financial sector's function in a capitalist economy play a critical role in the accumulation of imbalances and the appearance of financial crises. Claessens & Kose (2013) find that financial crises are usually preceded by joint booms in asset prices and credit aggregates and that these two variables usually follow similar patterns as the crisis unravels. This coincidence is not random as crises are not usually triggered by exogenous shocks but rather by the endogenous accumulation of financial imbalances in the system (Freixas et al., 2015). As a point in case, Almunia et al., (2010) compare the Great Depression of the 1930s and the GFC of the mid 2000s through this lens and find striking similarities: substantial real estate booms, declining lending standards that fueled expansion in credit, an accumulation of global imbalances, a reversal of expectations with sharp falls in asset prices, fire sales, and depressed spending. This pattern, however, is not exclusive of major

[9] Freixas et al., (2015) highlight several other issues with the current use of DSGE models in the study of financial stability. First, they indicate that the model needs to be calibrated with data for normal times and thus parameters do not reflect crises or systemic risk events. Secondly, the model cannot account for the non-linearities that are natural during crises. Since there is no endogenous risk-taking by agents in the economy, then the financial system can only amplify but not be the source of shocks which need to be exogenous. In most of the credit models, there is no place for excessive credit supply, which is one of the driving forces of the Minsky / Kindleberger line of reasoning. Finally, DSGE models rarely include heterogeneous agents that may account for financial imbalances accumulating in only some sectors of the economy (property prices or stock markets for example).

global systemic risk events but a pervasive regularity in the history of financial instability (Claessens & Kose, 2013).[10]

The fact that the booms and busts in assets and credit share cyclical regularities has led to the idea of a financial cycle whose evolution is related to changes in agents' attitudes and perceptions regarding financial risk (Ng, 2011; Schüler, Hiebert & Peltonen, 2015). According to Borio & Lowe (2004), this cycle is described through some measure of excessive growth in asset prices and the amount of private sector leverage. Drehmann, Borio & Tsatsaronis (2012) indicate that peaks in the cycle coincide closely with crises years. This, they argue, provides evidence of the relevance of the financial cycle in proxying for the accumulation of imbalances.

An added benefit of approaching the issue of financial stability from the perspective of the financial cycle is that while all financial crises, by definition, imply the presence of accumulated imbalances, the reverse is not necessarily true. In some cases, the ticking bomb of financial instability might be defused, or never reach the real economy, as the dot.com crises in the US in the early 2000s or the crash of 1987 in the UK stock market can attest.[11] Since financial crises are, fortunately, rare events, shifting our focus towards the financial cycle will increase the variability of our dependent variables and increase our universe of available observations.[12]

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[10] This perspective of a joint boom-bust cycle in assets and credit was popularised by Kindleberger in his *Manias, Panics and Crashes*. In it, he describes the history of financial instability since the Tulipmania of the 1630s until present day through Minsky's (1986) financial instability hypothesis, which we will discuss at length in Chapter 1. However, we can trace accounts of this relationship back to Bagehot's (1873) *Lombard Street: A Description of the Money Market*. In Chapter VI: *Why Lombard Street is Often Very Dull, and Sometimes Extremely Excited*, Bagehot presents the main elements of financial crises: real and financial shocks, the importance of credit and liquidity, and swift changes in prices of both assets and money.

[11] Presenting cases of "defused financial instability" is impossible as it would require determining which critical elements or policy decision *prevented* a crisis from happening. If this sort of analysis could be done, the issue of financial instability would have long been resolved.

[12] We discuss this issue at length in Chapter 2.

Furthermore, in their study of the financial cycle, Borio, James & Shin (2014) argue that the institutional setup of the International Monetary and Financial System (IMFS) is critical as different arrangements have different elasticities which may amplify or curtail thy cycle's amplitude.[13] Borio (2014b) further argues that this setup depends on three critical elements: "the financial regime, the monetary regime and the real-economy regime" (p. 185). We will further exploit this finding in the following section.

Institutions and the Rules of the Game: The Macroeconomic Trilemma

In their book on systemic risk and financial crises, Freixas et al. (2015) define financial crises (systemic risk events) as follows:

> *Systemic risk events can be sudden and unexpected, but the history of financial crises (including the 2008 global crisis) tells us that systemic risk events are mostly built up endogenously over time in the absence of appropriate policy responses. For example, credit booms and subsequent asset price bubbles develop over an extended period of time. (…) Key drivers of such forms of systemic risk are considered to be financial innovation, financial deregulation, financial globalization, competition policy and monetary policy* (pp. 13-15).

While this definition is in line with others we have provided throughout the text, it highlights a distinct element that is relevant in establishing a theoretical framework for the analysis of financial instability: endogeneity in the build-up of imbalances. From an institutional perspective, if financial (in)stability is endogenous to the economy and the financial system, then both its setup and the changes it suffers through time should matter for the accumulation and unwinding of financial imbalances. Precisely, this is what we suggest with the quotes that open this introduction.

However, to operationalise the definition provided above, we need to narrow down the set of conditions to which we will pay attention in

[13] This idea is reminiscent of Calomiris & Haber's (2014) *Fragile by Design: The Political Origins of Banking Crises and Scarce Credit.*

this dissertation to be able to make significant contributions. In that sense, this project will only cover, broadly, two of the drivers suggested by Freixas et al., (2015) for the endogenous accumulation of financial imbalances: financial globalisation and monetary policy.[14]

In choosing a theoretical framework that allows us to bring these drivers together, we found in the framework of the macroeconomic trilemma a unique tool of analysis. Although we will discuss it in depth in Chapter 1, the trilemma indicates that out of three desirable policy goals —stable exchange rates, free capital flows, and autonomous monetary policy—policymakers can choose only two (Obstfeld, Shambaugh & Taylor, 2005). This idea can be traced back to Keynes (1930) as shown by Obstfeld & Taylor (2017). However, to our knowledge, the first formal definition of the open economy trilemma as used throughout this dissertation is offered in Obstfeld & Taylor (1997).[15] The way in which a country resolves this conundrum at a given point in time is what we will refer to as a trilemma regime.

This impossible trinity constitutes a "tie that binds" policy choices in a way that allows us to cover both financial globalisation through the free capital flows and exchange rate corners of the trilemma, and monetary policy in the remaining vertex (Aizenman, Chinn & Ito, 2013).[16] An approach to the issue from the perspective of economic history is

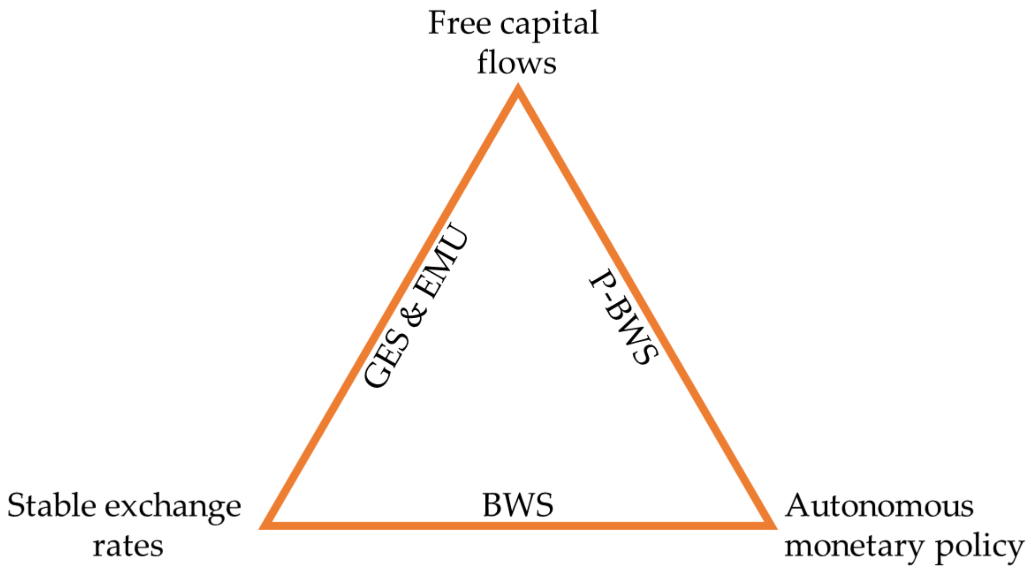
[14] Even though we believe competition policy and financial innovation are relevant issues to consider, they deal more with issues of market microstructure rather than with the broader macroeconomy, and thus we choose to leave them for further research on this subject. We will cover a case study on financial repression/deregulation in **Error! Reference source not found.**.

[15] Several of authors attribute the idea of the macroeconomic trilemma to Mundell (1963) and Fleming (1962). However, while the idea of a trilemma is naturally present in their work, it was neither their idea to posit it as a tradeoff nor is it a conclusion of their work. We thank an anonymous reviewer for bring this to our attention.

[16] The term "tie that binds" applied to the trilemma was first coined by Obstfeld, Ostry & Qureshi (2018a). However, proof that there is a binding tradeoff between the three policy goals for both developed and developing economy was provided by Aizenman, Chinn & Ito (2010, 2013).

pertinent as, since the 1920s, developed economies have made the transit from one edge to another in this triangle (see Figure 1).[17]

Figure 1: Macroeconomic trilemma



Note: Taken from Obstfeld, Shambaugh & Taylor (2005) and Bordo & James (2015). GES stands for Gold Exchange Standard, occurring roughly between 1924-36. BWS stands for the Bretton Woods System, occurring roughly between 1944-1971. P-BWS stands for Post-Bretton Woods System, occurring for many countries since the end of the Bretton Woods System (1971) until currently. EMU stands for the European Monetary Union, in place for a diverse array of Western European countries since 1999.

However, reality is far more nuanced than the trilemma theory allows, and this categorisation is not clean cut, particularly around the dates of regime changes. For example, as we will show in Section 1.4.1, on the eight years before the start of the Second World War, starting with the failure of the Austrian *Credit-Anstalt* in 1931, several countries that partook in the gold exchange standard started imposing capital controls (Eichengreen & Portes, 1987). Similarly, as we will show in Section 1.4.2.2, one of the causes for the demise of Bretton Woods was increased capital mobility through legal loopholes and the Eurodollar market (Bordo & Schwartz, 1999; Borio, James & Sing, 2014; Neal, 2015). Furthermore, as we will show in Section 1.4.4, during the managed float regime, several

[17] In their book "*Global Capital Markets: Integration, Crisis and Growth*", Obstfeld & Taylor (2004) use the framework of the macroeconomic trilemma to explain the evolution of financial globalisation for the last 150 years.

European countries took until 1988 to eradicate capital controls (OECD, 1993). Indeed, rather than standing on the edges, different policy configurations should be plotted somewhere within the triangle. We will include these nuances throughout the document in the different econometric specifications performed.[18]

It is noteworthy that a series of papers in the tradition of Baxter and Stockman (1989) find that the exchange rate regime in place is irrelevant for the evolution of macroeconomic aggregates. Additionally, research on capital controls since the early work of Grilli & Milesi-Ferreti (1995), Quinn & Inclan (1997), and Quinn (2003) find conflicting evidence on the effect capital controls play on economic growth and specific indirect risk measures such as output volatility. The contribution in our use of the trilemma framework is that these two dimensions can be tested jointly. Even if each of the corners of the trilemma is arguably unrelated to financial stability, the interactions between different policy choices, namely standing on one of the sides of the triangle, need not be. A similar approach, in applications unrelated to financial stability, has been followed by Obstfeld, Shambaugh & Taylor (2004) and by Klein & Shambaugh (2015). To our knowledge, this is the first work that studies the financial stability implications of the financial cycle under different trilemma configurations.

Choice of Countries: Twelve Advanced Economies

As argued in previous sections, financial crises and extreme financial instability events are rare. Even stock market booms and busts, which are frequent when compared to other asset classes, are spaced out in time. Consequently, the sample size for any given country is small, and to arrive at robust conclusions, requires expanding the database from a single time series into a wide panel (Schularick & Taylor, 2012; Jordà, Schularick & Taylor, 2015). This, of course, has the added benefit of increasing heterogeneity and cross-sectional variation (Aizenman, Chinn & Ito, 2016).

[18] A narrative of the historical evolution of the different trilemma regimes is presented in the Section 1.4.

However, choosing an excessively broad database may be counterproductive since the factors that underlie financial instability and crises in rich and developing countries may be substantially different (Borio & Lowe, 2002). For example, regarding currency crises, Bordo, Meissner & Stucker (2010) argue that they usually occur due to capital flow reversals and sudden stops, they are likelier if levels of debt denominated in foreign currency are high and international reserves are low. Some of these issues, are specific to emerging market economies (EMEs) and are rarely present in advanced economies (AEs). Consequently, to avoid bad pooling, in the sense that we may be further entangling sources of financial instability that are specific to EMEs or AEs, we have chosen to work with twelve advanced economies: Australia, Canada, Denmark, France, Germany, Italy, Japan, Netherlands, Norway, Sweden, Switzerland, and the United Kingdom.

The exclusion of the United States from the database is intentional as throughout the dissertation we will use the behaviour of the US stock market and credit aggregates to proxy for a global financial cycle and thus will include it within the explanatory variables. This is a similar approach to that of Rey (2013, 2015, 2016), Passari & Rey (2015) and Miranda-Agrippino & Rey (2015).

As in Taylor (2015), choosing advanced economies minimises the risk of pooling countries with different development levels. An added benefit is that in panel regression analysis when countries are very disparate, the demands and assumptions underlying country fixed effects are incredibly high.[19] This is not an issue when countries, though heterogeneous, still have underlying conditions that render comparisons

[19] As a thought experiment, suppose we were to include in the database a country like Colombia. In a simple regression analysis of financial imbalances against macroeconomic aggregates with country fixed effects, the argument would go something like this: After controlling for GDP, inflation, capital flows, interest rates, unemployment, and any other controls that you may think relevant, everything that makes Colombia different from the advanced economies in the sample is contained in the coefficient for the "Colombian dummy". This includes the fact that Colombia has had a long-lasting armed conflict, civil unrest, mafia and drug-dealing issues, it is the third most unequal country in the world and mostly produces staples and commodities. We believe this is demanding too much of a single variable.

sensible. Finally, recent studies on financial stability and crises have focused exclusively on emerging market economies (EMEs) as an extension of the Lucas dictum presented above. However, the recent financial crisis has shown that AEs are not immune to financial stability issues and financial crises, thus imbuing their study with a renewed relevance.

Still, Obstfeld, Ostry & Qureshi (2018b) highlight that identifying the role the exchange rate and capital control regimes play in developed economies may be challenging on three accounts. First, advanced economies are usually on the receiving end of safe-haven cash flows when the world economy is in a downturn. Second, most advanced economies have a fixed exchange rate among themselves as a large part of them belong to the eurozone. Third, similar policy regimes across developed countries do not afford sufficient cross-country variation.

We agree with the first criticism and will confirm whether this is the case in the different specifications throughout the dissertation. However, Menna & Tobal (2018) provide conflicting evidence indicating that overall reliance of advanced economies on foreign credit is negligible when compared to EMEs. The second caveat is moot in our case since only five of the 12 countries in the database belong to the euro, and regarding country-year observations, the "euro observations" correspond to less than 7% of the total.[20] In Chapter 3 we will argue that while there may be little variation in exchange rate regimes and capital control regimes separately, their interactions produce trilemma regimes with sufficient cross-country and time-series variability.

An added benefit of using this selection of countries is that they closely resemble the ones in the database used by Schularick & Taylor (2012) and Jordà, Schularick & Taylor (2011, 2013, 2015) and made available online as the Jordà, Schularick & Taylor (2017) Macrohistory

[20] Countries formally in the eurozone are France, Germany, Italy and the Netherlands. The fifth country is Denmark that has a fixed exchange rate to the euro since inception. We have in total 1104 country-year observations with countries and 75 "euro observations". Where pertinent we will perform tests to confirm if there is some euro effect on the behaviour of financial stability.

database (JST). This makes our results comparable to theirs as we cover roughly the same countries and period.[21]

Finally, the variety of advanced economies in the sample afford us the opportunity of tending to another open question in the literature related to whether financial instability behaves differently in bank-based or market-based systems. The a priori belief would be that bank-based systems suffer more than market-based systems in the face of financial instability as the latter offer more financial products allowing for better diversification of risks (Helbling & Terrones, 2003).

According to Levine (2005), market-based systems suffer from free rider problems as individual investors have no incentives to research individual companies as all information is publicly disseminated. Bank-based systems face informational asymmetry between well-informed insiders and outsiders usually kept in the dark. Conversely, he indicates that market-based systems, with their tailor-made products, offer more opportunities for risk sharing than bank-based systems. Still, he finds that at a country level there is no evidence that the finance-growth relationship is contingent on the system's structure. Still, he does not touch on the issue of financial instability directly.

As a first step, we follow Demirguc-Kunt & Levine (1996) who present a ranking of a broad set of countries according to the development of their financial systems with data for 1986-93. They offer, among others, aggregate indices of stock market development and banking development, broken down into financial intermediary development and credit to GDP ratios. We present their results for the countries in the database in Table 1.

[21] When compared to the JST database, we have excluded Belgium, Finland, Portugal and Spain as they are all in the euro-zone and their inclusion would not increase cross-country variability.

Table 1: Ranking of financial system development for selected countries

	Banking development		Stock market development
	Intermediaries	*Credit*	
Australia	11	16	13
Canada	17	24	14
Denmark	21	21	26
France	8	6	21
Germany	9	5	3
Italy	22	27	29
Japan	2	2	1
Netherlands	7	9	12
Norway	15	14	20
Sweden	25	20	17
Switzerland	1	1	9
United Kingdom	5	3	4
Total countries in sample	**42**	**42**	**41**

Note: All data obtained from Demirguc-Kunt & Levine (1996). Each column offers the ranking for each country out of the total number of countries in the sample. Higher rankings represent more developed countries in each category. *Intermediaries* refers to Findex 1, presented in Table 6 (p.314). It reflects the ratio of liquid liabilities to GDP and the ratio of domestic credit to the private sector to GDP. *Credit* refers to domestic credit to the private sector to GDP from Table 5 (p. 309). *Stock marked development* corresponds to Index 1 presented in Table 2 (p. 302). It reflects market capitalisation, total value traded to GDP, and turnover.

We find that France, Germany, the Netherlands, Japan, Switzerland and the United Kingdom have well-developed banking systems, in stark contrast with Denmark, Italy, and Sweden, whose banking systems rank in the bottom half of the 42 countries in the study. Conversely, we find that Germany, Japan, Switzerland, and the United Kingdom have well-developed stock markets, followed by the Netherlands, Australia, and Canada. The French, Danish, and Italian stock markets rank in the bottom half of the sample according to a measure of development which includes market capitalisation, the value of trades and turnover. This cross-country differences in the development of national financial systems suggest that, from the start, we will need to include specific controls to target these differences in econometric specifications.

However, a cardinal ranking of countries according to the size of their financial system gives us no indication on whether they are bank based or market-based. To distinguish between both types of countries, we surveyed several studies on the issue. We present a summary of them in Table 2.

Table 2: Bank-based VS market-based systems

Study	LEV	AG	AMA	BZ	AB	VEY	Conclusion
Australia	Market	Market	Market	Market	Market	Market	Market-based
Canada	Market	Market	Market	Market	Market	Market	Market-based
Denmark	Bank	Market	Bank	Bank	Market	Market	
France	Bank	Bank	Bank	Market	Market	Bank	Bank-based
Germany	Bank	Bank	Bank	Bank	Bank	Bank	Bank-based
Italy	Bank	Bank	Bank	Bank	Bank	Bank	Bank-based
Japan	Market		Bank	Bank	Bank		Bank-based
Netherlands	Bank			Market	Bank		
Norway	Bank				Bank		Bank-based
Sweden	Market		Bank	Market			
Switzerland	Market						
United Kingdom	Market		Market	Market	Market	Market	Market-based
Bank-based system (green)			**Market-based system** (orange)				

Note: Levine (2002), LEV; Allen & Gale (2000), AG; Amable (2003), AMA; Bijlsma & Zwart (2013), BZ; Allard & Blavv (2011), AB; Veysov & Stolbov (2012), VEY. The conclusion summarises the results of the studies. The case for Japan was defined using Levine (2005). The case for France was defined using Morley (2002).

We can see from Table 2 that out of the twelve countries, the United Kingdom, Australia, and Canada are closer to market-based financial systems while France, Germany, Italy, Japan, and Norway are closer to bank-based systems. This will be a useful characterisation of countries when we test whether the trilemma regimes have a more substantial effect on credit (stocks) in bank-based (market-based) systems. Contradictory results in the surveys we covered do not allow us to classify the remaining countries with confidence.

Choice of Period: From the Genoa Conference to the Post-GFC Consensus

The extended period that it takes for financial imbalances to accumulate and for trilemma regimes to change requires that we adopt a historical perspective in our study.[22] However, a question that begs an answer is how far back in time should we search before it is enough to fulfil the purpose of our research?

Most historical studies that use the framework of the trilemma to discuss waves of globalisation begin in the last third of the nineteenth century, with the start of the classical gold standard.[23] However, we argue that the rigours of the straitjacket imposed by the macroeconomic trilemma were not entirely evident during this period. According to Eichengreen (2008), it was not until the interwar period, when the increasing demands for a domestic policy that fostered full employment and growth made themselves evident through social movements and the rise of labour parties in many European countries. This meant that during the classical gold standard (1870-1914) countries with open capital accounts and fixed exchange rates, while evidencing the trade-off of losing monetary policy autonomy, did not care much for the political cost of forfeiting its use. Obstfeld, Shambaugh & Taylor (2004) suggest a similar train of thought when they argue that "The period's [the interwar years] relevance is clear: arguably it was in this epoch that the trilemma forcefully made its presence felt for the first time in the great debate over the political economy of macroeconomics" (p. 78).

After the First World War, the Financial Commission of the League of Nations organised a conference in Brussels in 1920 to set the basis for restoring the system of fixed exchange rates that had failed with the war but had so successfully fostered trade and stability since the 1870s. Increased demands for social spending after the war and the complexities behind resolving the reparations to the victors of the war made the

[22] The main issue with social sciences vis-à-vis natural sciences is that we cannot perform experiments. Consequently, we cannot (and should not) create a systemic risk event to understand its inner workings (Abramitzky, 2015).

[23] Bordo & Schwartz (1999), Bordo et al., (2001), Obstfeld and Taylor (2004).

conference unsuccessful, and it was reconvened in Genoa from April 10 to May 19, 1922 (Neal, 2015). Eichengreen & Sussman (2000) argue that partly because of this conference, the share of foreign exchange kept as reserves increased from 20% before the beginning of the war up to 40% by the end of the 1920s. During this conference, the Financial Commission suggested a return to the gold standard, but instead of using gold coins, countries would make their currencies convertible into gold while accumulating reserves in other convertible currencies such as the British pound or the US dollar (Bordo & Schwartz, 1999).

The Genoa Conference marks the first real attempt to return to the *antebellum* conditions of monetary stability afforded by the gold standard. The natural consequence of returning to the gold (exchange) standard was that countries would have to face the political costs of the rigours of the trilemma, as they would need to assign a higher priority to domestic policy goals. Consequently, we choose to begin our study at this point.

On the other hand, to maximise the number of observations, and to include systemic risk events like the global financial crises or the European sovereign debt crises of the 2010s, we will extend our research as close to the present as the data allows us to.

Some Initial Caveats

When constructing the research project, one of the main difficulties was delimiting the object of study and the theoretical framework in such a way that the research question was interesting, relevant and could be covered comprehensively in the corpus of the dissertation. In doing so, we have chosen to leave out elements that are relevant to the evolution of financial instability, and that would be the first natural extensions of this work.

Stock Indices or Housing Prices

Up to now, in the exposition of our research question and on the relevance of the financial cycle we have focused on a general approach to the evolution of asset prices. Throughout the rest of the dissertation, we will restrict our definition of asset prices to market-wide, capitalisation-weighted stock market indices, to the detriment of property prices or the value of other assets. Several reasons motivate our choice.

First, Borio & Lowe (2002) find that in historical accounts of boom-bust cycles in asset prices prevalence is given to housing prices, while mainstream macroeconomics focuses mostly on equity prices. Consequently, a historical analysis of expansion and contractions phases in stock markets may serve to bridge the gap between the two kinds of literature. Furthermore, Brunnermeier & Schnabel (2016) indicate that crises after asset price booms occur regardless of the asset class involved and conclude that the excessive focus on property price bubbles, particularly after the GFC, is misplaced.

The alternative, using an index that aggregates equity and property prices, is infeasible because the behaviour of expansions in both variables is substantially different (Assenmacher-Wesche & Gerlach, 2010). On the one hand, housing price cycles are more protracted while equity booms and busts are more frequent (Claessens, Kose & Terrones, 2013). On the other hand, equity prices react quickly to monetary policy and general economic conditions while housing prices move more gradually (Assenmacher-Wesche & Gerlach, 2010).

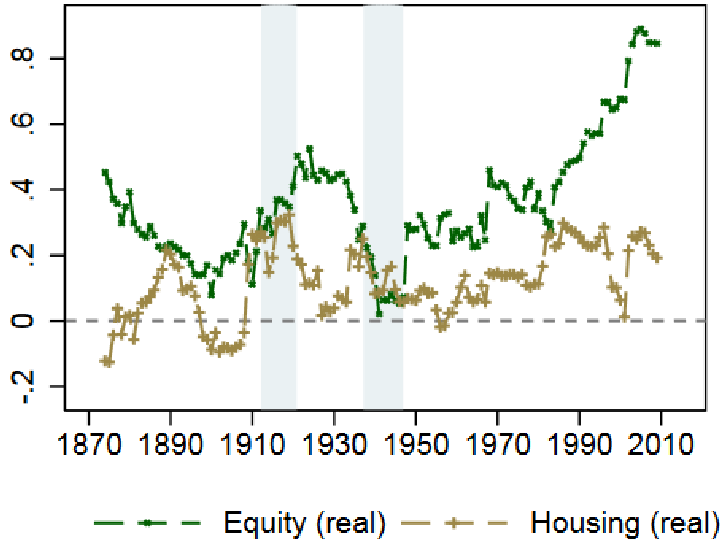
Additionally, stock markets are interesting as stand-alone objects of study because of their high liquidity, particularly in market-based developed financial systems (Levine, 2002). This characteristic allows them to quickly reflect changes in impending economic conditions and agents' expectations (Chen, Roll & Ross, 1986). In that sense, they offer researchers more variability and a more substantial number of boom and bust phases than housing or commercial property prices (Borio & Lowe, 2002; Bordo & Landon-Lane, 2013).

A substantial benefit of using stock market indices is that with more volatility and more booms and busts, we include in the database expansion and contraction phases that did not result in financial crises but rather just remained as periods of heightened financial instability. This is desirable as it will aid in mitigating the endogeneity issue in the relationship between financial stability and the trilemma regime (Claessens & Kose, 2013; Jordà, Schularick & Taylor, 2015).[24]

[24] In the case of a regime change concurrent with heightened financial instability, it is difficult to disentangle whether the regime change caused the instability, or the

A final argument to favour stock prices above those of property has to do with the correlation across markets from an international perspective. Jordà, Knoll, et al. (2017) suggest that cross-country correlations between stock markets are substantially higher than cross country-correlations across housing markets, as shown in Figure 2.[25]

Figure 2: Cross-country co-movement across total returns for real equity and housing for developed economies



Note: Figure taken from Jordà et al. (2017). The legend to the figure reads "Rolling decadal correlations. (…) Cross-country correlation coefficient is the average of all country pairs for a given asset class. Country coverage differs across time periods" (p. 21).

In that sense, it is natural to expect that, as exposure to international links is more salient for stock markets, the exposure to the international financial institutions that make-up the trilemma will also be more easily identified.

However, focusing on the stock market is not without caveats. While property usually represents the lion's share of household wealth, the share of households that participate in the stock market is not as relevant. Still, the share of the equities in total assets as a proportion of

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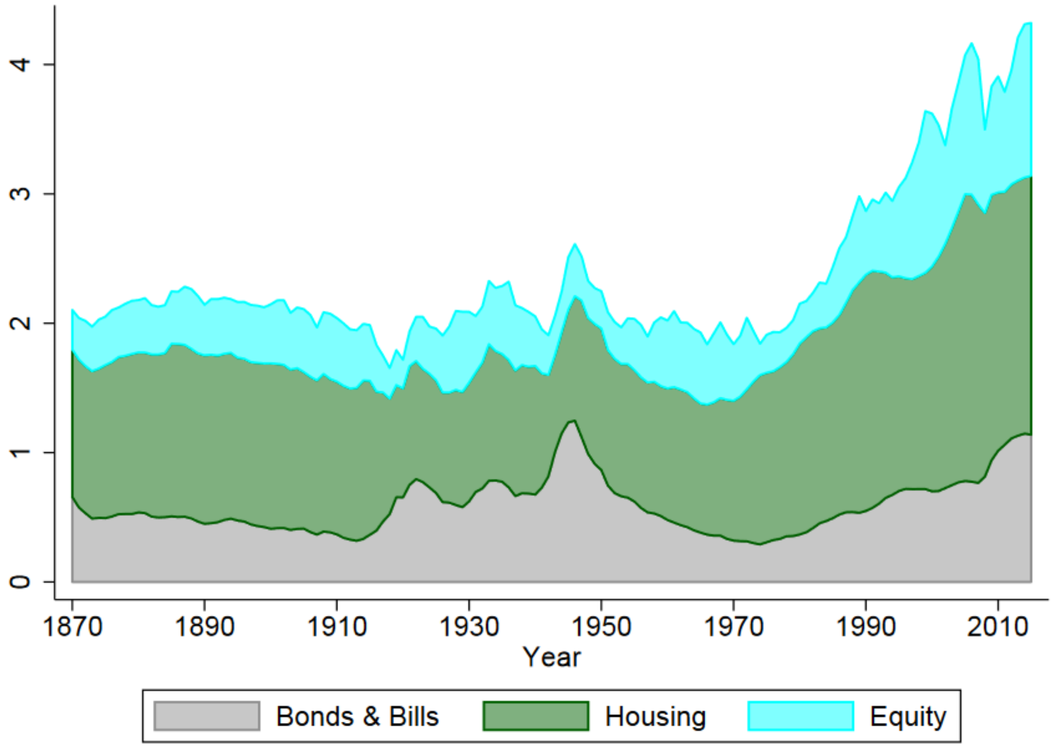
instability caused the regime change. Given that the accumulation of imbalances is a lengthy process and that regime change is not instantaneous, our identification strategy is strongly exposed to fuzziness in the variables.

[25] We thank Dmitry Kuvshinov for authorizing the use of the figures from Jordà, Knoll, et al (2017) and Kuvshinov & Zimmerman (2018).

GDP, while smaller than housing, is a representative figure. This is shown in Figure 3, extracted from the appendix to Jordà, Knoll et al. (2017, p. A63), which depicts the composition of total assets by type for 17 advanced economies.[26]

Figure 3: Assets considered in the study as a proportion of GDP (Figure A.4)



Note: "Average of asset-to-GDP shares in individual countries, weighted by real GDP. Equity is the total stock market capitalisation. Housing is the stock of housing wealth. Bonds and bills are the stock of public debt" (p. A63).

Finally, Figure 4 obtained from Kuvshinov & Zimmerman (2018, p. 6), shows the evolution of stock market capitalisation in the same seventeen economies from a long-run perspective. In 0 we include the country by country graphs.

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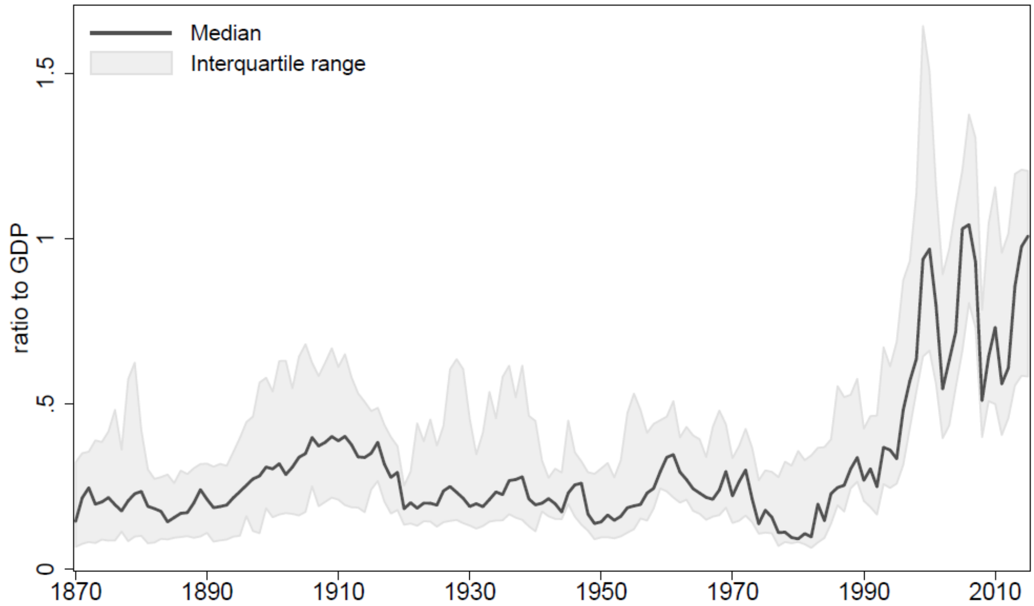
[26] The countries which are included in the series but excluded from our database are Belgium, Finland, Portugal, and Spain. We don't expect that any of these is large enough to drive the results.

Figure 4: Stock market capitalisation in advanced economies (Figure 1)



Note: "Stock market capitalisation to GDP ratio, 17 countries. The solid line and the shaded area are, respectively, the median and interquartile range of the individual country capitalisation ratios in each year" (p. 6)

The main takeaway from Figure 3 and Figure 4 is that the stock market represents an important, albeit not the foremost, component of total assets traded in an economy. Specifically, market capitalisation to GDP remains stable around 25% until the 1990s, when a "big bang" occurs driven not by new issues but mostly by increases in asset prices driven by lower equity premiums (Kuvshinov & Zimmerman, 2018). Consequently, we proceed with the study of stock markets bearing in mind both the benefits and caveats presented above.

Types of Debt and Fiscal policy

On the one hand, the literature on the financial cycle that we will describe in Chapter 1 focuses on private debt in the understanding that its dynamics are different from those associated with public debt. The latter is destined to public investment and is rarely associated with imbalances in either stock or property markets. In our definition of credit aggregates, we further exclude credit from foreign sources due to data availability since there are no long-run comparable series on foreign lending in the twelve countries in the database. Consequently, as we mention in Chapter 2, our definition of credit is restricted to domestic private credit to the non-financial sector, namely corporate loans, mortgages and household lending.

On the other hand, in his seminal contribution, Mundell (1963) presents the effects of monetary and fiscal expansions on output under fixed and flexible exchange rates in scenarios of open and closed capital accounts. Later, authors such as Grilli & Milesi-Ferreti (1995), Quinn & Inclan (1997), and Rose (2011) extend on this work and link different sides of the unholy trinity with fiscal policy. Regarding financial stability, Almunia et al., (2010), Claessens & Kose (2013), and Claessens, Kose & Terrones (2013), among many others, include the role fiscal policy plays on the evolution and resolution of financial crises. However, since we exclude public debt from our framework of analysis, it is only natural that we further omit references to fiscal policy as these two elements are strongly related and one cannot be understood in the absence of the other.

Monetary Regimes

In studying financial stability, several studies have covered the role that different monetary policy regimes have played in history (Kindleberger & Aliber, 2005; Bernanke & Mishkin, 1997; Bordo & Schwartz, 1999; Bordo, 2018). In their surveys, they have included the evolution of central banks from private companies to public institutions independent of the government, their changing roles and objective functions, their use of the LOLR capacity, the different tools at their disposal and their effect on the stability of the financial system, and the role of bail-out clauses for the evolution and recovery of crises episodes.

Tending to these issues is critical when speaking of financial stability, and even more important when crises occur. Still, it would cause us to move away from the framework of the macroeconomic trilemma where the only discussion of monetary policy is whether it is autonomous or the residual of international macroeconomic policies. Additionally, including monetary policy regimes in our analysis could lead to the problem of having too many moving parts, which would make disentangling effects more complicated.

Real economy implications and contagion

The main difference between our analysis and the traditional literature on financial crises or the macroeconomic trilemma is that we will not focus on the real-economy implications of policy choices or imbalance accumulation. Instead, our choice is to simplify the analysis by observing the evolution of financial stability under different trilemma regimes while *controlling* for general economic conditions. Furthermore, we refrain from analysing the contagion effects of financial instability across countries, markets, or asset classes.

Causation

The solutions to the macroeconomic trilemma that a country implements at a given point in time are the result of political economy considerations and may be strongly conditional on prior situations of financial instability. This creates an issue of endogeneity that complicates establishing causal relationships in our analysis.

To disentangle all these effects, if possible, is a challenging and demanding undertaking that requires both technical precision and very choice cases that allow for identification. Throughout the dissertation, we will mostly present evidence on correlation and contingency of the behaviour of financial imbalances under the different regimes in place. Only in the final chapter do we make claims on causality and is meant to serve as an example of all the work to come.

A Technical Issue: Identifying Financial Imbalances

A final noteworthy issue is the problem of the identification of financial imbalances. While the literature on financial crises usually employs binary sequences to mark systemic risk events, our focus is on a broader category that cannot be sufficiently summarised by indicator functions. Conversely, the literature on financial imbalances and the financial cycle uses filtering techniques such as the Hodrick & Prescott (1997) filter or the band-pass filter (Christiano & Fitzgerald, 2003) to identify above or below trend growth in the different variables: the asset or credit gaps.

In Chapter 2 we discuss these techniques and their shortcomings at length and, as a first relevant contribution of this research, offer a new set of variables, the Global and Local Bull Bear Indicators, to address some of these issues. These variables offer a measure of the direction and intensity of the accumulation and unwinding of imbalances, they require few statistical *a priori* assumptions, and observe phenomena to different time horizons. Therefore, the allow us to endow our analysis with a much-needed perspective on the persistence of the accumulation of imbalances in time.

The Structure of the Dissertation and its Contributions

The rest of this thesis is structured in three parts. Part I, titled "Setting the Stage", contains two chapters, designed to offer a comprehensive literature review on the topics to be treated, to present the database we will employ throughout, and to present our new measure of booms and busts. Part II, titled "Panel Data Evidence" contains two chapters in which we find evidence for the nexus between the different exchange rate and capital control regimes and the evolution of stock markets and credit aggregates to different time horizons. Part III, titled "Time Series Evidence" contains two case studies, presented in paper format, which are intended to provide in-depth analysis of relevant cases and showcase the power of the methodology we have designed. The fact that these chapters are presented as papers, unfortunately, warrants some repetition both between them and concerning the first and second parts of the dissertation. The seventh and final chapter of the dissertation offers conclusions and policy recommendations. In what follows we describe each chapter in detail.

Chapter 1

In this chapter, we present the theoretical and historical review for the rest of the dissertation. In a first section, we present the idea of the financial cycle, understood as the one arising from the interaction between the boom-bust cycles in asset prices and credit markets, as described in the seminal works of Kindleberger & Aliber (2005) and Minsky (1986, 1992). We remark on the idea of feedback between asset and credit markets, which leads to an amplification of the effects above as in the works of Jorda, Schularick & Taylor (2011, 2013, 2015). This will motivate the discussion of the British case as presented in Chapter 5. In our characterisation of the financial cycle, we underscore the differences between a boom and a bubble and highlight the implications of the financial cycle for the real economy.

The second section of the chapter presents the financial stability debate in which authors like Bernanke & Gertler (1999, 2001) favour the view of "benign neglect" towards the accumulation of financial imbalances. Conversely, authors like Bordo & Jeanne (2002), Borio & Lowe (2002, 2004), Borio & White (2004) and Freixas, Laeven & Peydro (2015), urge monetary authorities and macroprudential regulators to "lean against the wind" for both asset prices and credit markets.

A third section presents the macroeconomic trilemma as the central theoretical framework for the dissertation, discussing the role that exchange rate regimes and capital controls play in the evolution of macroeconomic fluctuations, financial (in)stability, and the financial cycle. As we will discuss in the corresponding section, we do not study the role of monetary policy on financial instability or the financial cycle beyond the mechanisms at play. We argue that the study of monetary policy regimes exceeds the scope of this work as the trilemma framework only posits the possibility of monetary autonomy, regardless of the institutional framework in place.[27] We do discuss, however, recent criticisms to the trilemma framework that indicate that there exists a global financial cycle which, under open capital accounts, causes the transmission of monetary conditions from centre to periphery countries thus rendering the possibility of autonomous monetary policy moot. We conclude this chapter by presenting the more salient features of the international financial history since the end of the First World War, from the perspective of the unholy trinity.

Chapter 2

The chapter begins with a presentation of the database to be used in constructing the dependent variables in this analysis: stock market indices,

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[27] Further research may cover issues such as the independence of the central bank, its LOLR capacities, or the implementation of an inflation targeting regime. However, for this dissertation reviewing the literature on these issues is uninformative.

and real private credit to the non-financial sector. A second section presents the construction of the dummy sequences necessary to characterise exchange rate, capital control, and trilemma regimes. A third section discusses the issues of measurement of expansions and contractions in time series. A fourth section reviews the more frequently used methodologies, highlighting their benefits and shortcomings. A fifth section presents the methodology for constructing the Global and Local Bull Bear Indicators (GBBIs and LBBIs) to characterise the short, medium, and long-run evolution of financial time series. A sixth section presents the empirical results of applying the methodology to a selection of the different series discussed. The seventh section of this chapter develops an empirical exercise in which the whole methodological toolkit is applied to the stock market in the United Kingdom to establish the more salient commonalities and differences across methodologies.

The main contribution in this chapter is the development of the LBBI series which allow for the characterisation of expansions and contractions to different time horizons. These series re-express the growth rates in real credit and stock market indices to the short, medium and long-run as standard deviations away from their average growth rate. They represent an innovation when compared to either binary sequences for crises or the assets and credit gaps which are usual in the financial cycle literature. We expect this methodology can be extended to other financial and economic time series and will enrich the literature by allowing for more nuanced stylized facts.

An additional contribution that will undoubtedly push forward further research endeavours is the characterisation of expansions and contractions in both assets and credit series for all the countries in the database. We present tables with the dating of expansions and contractions and three distinct measures for each phase: duration, amplitude and severity. This new identification of booms and busts will allow for comparisons across countries and, within the same country, across time.

Chapter 3

This chapter focuses on the behaviour of the boom-bust cycle in asset prices under different trilemma regimes defined by the interaction of fixed or flexible exchange rates and open or closed capital accounts. In this case, following the literature, the existence (or lack of) autonomous monetary policy is treated as the residual of the decision on the other two components of the trilemma.

To address the research question, we first present a theoretical framework as well as the database we will employ. In this section, we discuss the pertinence of including the LBBIs to proxy for the global financial cycle proposed by Rey (2015) and discuss its similarities to the VIX index that is usually employed in the literature. Secondly, we offer a summary of expected results based on the review in Chapter 1. A third section completes the description of the econometric specification and tests for its appropriateness. It concludes by presenting the unconditional regressions of the stock market model. The fourth section offers our empirical results by first discussing the existence of structural breaks in the coefficients by trilemma regime or by type of phase. We then discuss the relevant findings for each trilemma configuration. A fifth section presents several robustness checks to assess the stability of our results. A final section concludes.

This chapter makes several contributions to the literature. First, it provides a long-run perspective on the consequences of the different solutions to the macroeconomic trilemma on the evolution of asset prices. Second, it is the first study that we know of that tries to link the trilemma with financial stability. Third, it provides evidence of a global financial cycle that plays a role in the evolution of domestic stock market indices regardless of the exchange rate and capital control regime. Fourth, we find that the drivers for the evolution of stock market prices do change by trilemma regime in ways that are consistent with the macroeconomic literature. Fifth, drivers of the stock market also change when we observe expansions and contractions separately, which highlights the difficulty in addressing the issue from a policy perspective since diverse institutional setups and macroeconomic conditions allow financial imbalances to accumulate or unwind through different channels. Finally, we suggest interesting lines for further research that may allow glimpsing at causality rather than just referring to correlation.

Chapter 4

This chapter follows a similar structure to Chapter 3 but focuses on the link between trilemma regimes and imbalances in real credit growth. In this case, we also find that the behaviour of imbalances is contingent on the trilemma regime, on whether expansions or contractions take place, and depending on the country's financial system being either market-based or bank-based.

The contributions of this chapter are in line with those of Chapter 3. Regarding our results, a first relevant finding is that there is a co-movement across domestic credit markets, a global financial cycle, that is sufficiently proxied by the real credit LBBIs for the United States. Secondly, we find that the drivers for real credit growth, including the global cycle, are contingent both on the trilemma regime in place and on whether credit is facing an expansion or a contraction. Our findings, however state-contingent, are consistent with the macroeconomic literature surveyed. This serves to highlight the challenges in addressing the financial stability question: changes in the institutions in place and general economic conditions will alter the channels and drivers of financial stability.

Chapter 5

This chapter presents the first case study in this dissertation, where we investigate if the behaviour of the boom-bust cycle in the UK stock market between 1922 and 2015 varies with domestic and international economic policy. The former is characterised by a transition from *laissez-faire* economy to big government and the subsequent resurgence of monetarism, while the latter follows the framework of the macroeconomic trilemma. First, we test for differences in several characteristics of expansions and contractions by policy regime. Second, we check whether a global financial cycle drives the UK stock market and test the stability of the relationship by regime.

Since this chapter follows a paper format, the introduction motivates the relevance of the British stock market for this analysis and presents a puzzle about the integration of the UK stock market with the global financial cycle since the Genoa conference of 1922. A first section characterises the different international and domestic economic policy regimes in the UK. A second section presents the data and methodology to describe the boom-bust cycle. A third section identifies and describes bull and bear phases in stock prices and tests for differences in duration, amplitude, and severity of bull and bear phases contingent on the institutional setting. The fourth section explores the time-varying nature of the co-movement of the UK stock market and a global cycle. A final section highlights our contributions and offers concluding remarks.

The contributions of this chapter can be broken down in three. First, we find that expansions and contractions are symmetrical regardless of the domestic economic policy or trilemma regime in place. Secondly, we find that the traditional story of international capital integration is only applicable to short-run results, but that the specifications using the medium and long-run indicators show that there may be a role for a global risk aversion channel that alters the way in which markets integrate. Finally, we find that the evolution of short and medium-run imbalances is majorly affected by the way in which the UK solved the macroeconomic trilemma while the long-run imbalances seem to be affected by both trilemma and domestic policy regimes.

Chapter 6

This chapter presents the second case study in this dissertation, where we evaluate joint evolution of stock markets and credit aggregates in Britain. We argue that the relationship need not be stable in time and that the regulatory framework in place, characterised by repression/ liberalisation should play a critical role in the causal link between the components of the financial cycle. To tackle this issue, we broke down the period of study between a period of financial repression (1922-79) and a period of liberalised financial markets (1980-2013) and tested for a structural break in the relationship.

The introduction to the chapter summarises the literature n the financial cycle and motivates the United Kingdom as a relevant case study. A first part offers first evidence of the existence of the financial cycle for the UK. In the second section, we describe the historical context of the deregulation process that occurred in the UK financial market in the later part of the 1970s to argue for the existence of a structural break in both credit and stock market institutions. The third section of the chapter presents the empirical results from the VAR approach. A final section concludes and offers avenues for further research.

There are several relevant contributions in this chapter. First, we find evidence of a break in the causal relationship between real credit and stock market growth in 1979, the peak year in the deregulation process for the UK. Secondly, we find bi-directional causality during the financial repression period and argue that the effect of this relationship on general financial stability should be muted as capital controls, and quantity credit restrictions characterised the period. Finally, during the liberalised period we find evidence of unidirectional causality from credit to the stock market and argue that while monetary authorities and regulators need not worry about asset prices beyond their effect on expected inflation and the output gap, more attention should be paid to the evolution of credit aggregates which can foster asset price booms if left unchecked.

A final essay summarises the lessons learnt and highlights the contributions of the whole research. The epilogue offers a catalogue of intriguing questions and further lines of research that we hope may contribute to the furthering of our knowledge on this fascinating topic.

PART I: Setting the Stage

Chapter 1. The Financial Cycle, Trilemma Regimes, and Financial Stability: What Do We Know?

"So-called 'lessons' are learnt, forgotten, re-learnt and forgotten again. Concepts rise to prominence and fall into oblivion before possibly resurrecting. They do so because the economic environment changes, sometimes slowly but profoundly, at other times suddenly and violently. But they do so also because the discipline is not immune to fashions and fads. After all, no walk of life is"
(Borio, 2014b, p. 182).

As a point of departure, it is necessary to take stock of what has been said in the literature regarding the issue of financial stability and macroeconomic policy regimes. While financial crises and systemic risk have always been of interest for researchers, policymakers, pundits and reporters, the recent years after the GFC and the European debt crises have seen a myriad of studies arise, covering topics such as the determinants of crises, their evolution, and the best policy responses to mitigate adverse general equilibrium effects. In this chapter, we perform a structured revision of that ample literature focusing on select themes.

In Section 1.1 we review the literature on the financial cycle that has arisen from the works of the BIS but whose fundamental ideas go back to Hayek, von Mises and Robins in the 1920s (Bordo & Landon-Lane, 2013). We discuss the evidence of links between asset prices, credit aggregates, and financial crises and then take stock of the channels and mechanisms through which the relationship runs. Section 1.2 discusses one of the more salient debates in macroeconomics since the end of the twentieth century, regarding the role that asset prices and credit aggregates should play in the decision-making process of monetary authorities. Section 1.3 first covers the macroeconomic trilemma and surveys the evidence on its applicability as a binding principle. This same section then examines the link between two of the policy choices —the exchange rate and capital control regime— with the behaviour of stock markets and credit aggregates. In this section, we address the issue of monetary policy by offering a rendition of a more recent debate that argues that the current macroeconomic trilemma has been replaced by a dilemma since an autonomous monetary seems to be impossible under open capital accounts. We do not delve further on issues such as the independence of central banks or their role as a lender of last resort because under the original framework of the trilemma the only reference to monetary policy concerns whether it is autonomous or not but does not relate to the institutional framework under which policy is implemented. Finally, Section 1.4 offers a stylized description of the period starting in the Genoa Conference of 1922 and running until present from the perspective of the impossible trinity. Section 1.5 offers some concluding remarks.

1.1. Is There a Financial Cycle? What We Know About Fluctuations in Asset Prices and Credit Aggregates.

In theory, increases in stock prices, in order to be sustainable, should happen through an increase in expected income from those investments or through a reduction of their risk profile (Blanchard & Watson, 1982). Whenever asset prices increase disconnected from fundamentals — building financial imbalances— they are most likely to correct this increase when the unsustainable trend is evidenced.[28] This boom-bust process has become relevant for policymakers because it adds volatility to the behaviour of asset prices, increases financial instability, affects consumption and real economic activity (Bernanke & Gertler, 1999). As a

[28] A clarification we need to make has to do with the existence of rational or irrational bubbles in asset markets; this idea implies investors, knowingly or unknowingly, pay more for an asset than is justified (Brunnermeier & Schnabel, 2016). To characterise a bubble, a researcher would require a fundamental value or fair price, defined as the discounted future dividend stream from a given stock, to contrast it with the market price at any time *t*. However, fundamental pricing models are subject to the same uncertainty as the issuer's future cash flows or the adequate discount rate for investors (Gürkaynak, 2008). Thus, testing for bubbles becomes, in the end, a test for the validity of the underlying pricing model and turns the debate into an ideological one where supporters and detractors from the idea of market efficiency fight over how best to ascertain the price of an asset (Borio & Lowe, 2002). In our discussion of financial imbalances throughout this dissertation we do not intend to identify bubbles, nor do we presume that bubbles happen in asset markets. We will steer clear of this issue and analyse the dynamics of stock prices and credit aggregates as a process where both busts and booms can be observed. In doing so, it is not to be understood that a boom is, per se, a bubble or that a crash refers to it bursting.

matter of fact, according to Borio & Lowe (2002) "Large swings in asset prices figure prominently in many accounts of financial instability" (p. 8). The financial instability generated by the boom-bust cycle in asset prices leads, in some cases to financial crises which not only threaten the financial market but the entire economy by impairing growth, increasing the duration of normal recessions and increasing inequality (Assenmacher-Wesche & Gerlach, 2010; Atkinson & Morelli, 2011).

On the other hand, Dell'Ariccia et al., (2013) indicate that credit booms force policymakers to face a dilemma. From a positive perspective, the expansion of credit fosters growth via increased investment. However, if this expansion occurs too quickly then imbalances accumulate, agents may face excessive leverage through relaxed lending standards which may swiftly turn into a debt overhang problem if a crisis ensues. They argue further that even though credit booms have been present throughout history, they have become more recent since the 1980s, and provide three drivers for their occurrence.

First, they mention financial deregulation and indicate that a third of the recent credit booms have happened concurrently with financial reform.[29] Borio (2006), adds that deregulation facilitates access to credit both foreign and domestic. Furthermore, Reinhart & Rogoff (2013) argue that the shifts from financial repression to financial liberalisation explain the increases in volatility in the growth of domestic credit. In this same line of reasoning, Freixas et al., (2015) suggest a mechanism by indicating that changes in the regulatory framework affect the incentive structure of intermediaries with regards to risk-taking.

Second, Dell'Ariccia et al., (2013) argue that increased capital flows, a form of credit from abroad, fosters credit booms and illustrate this with the elimination of capital controls in the late 1970s. Finally, they establish that credit booms and robust economic growth are strongly related and

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[29] Pistor (2013), argues that financial deregulation is a misnomer since there is no such thing as an unregulated market. Usually "deregulation" refers to the "delegation of rule making to different, typically non-state actors, with the understanding that in all other respects they enjoy the full protection of the law. (…) That, however, does not make these markets rule-less or external to the law" (p. 321). With this in mind, we will use the term deregulation and liberalisation interchangeably.

that the average GDP growth during credit booms is statistically higher than in their absence.[30]

The idea of credit booms as dangerous phenomena is not new. In his 1933 work on debt deflation, Irving Fisher highlighted that credit magnifies the risk of financial speculation and that great crises (1873, 1929) could not have occurred had there not been a credit boom.[31] Later, Minsky argued that the procyclicality of credit, with expansions during booms and contractions during economic downturns increased the probability of financial crises (Kindleberger & Aliber, 2005). The argument has been brought to the present by Taylor (2013), among others, when he indicated that debts dynamics increase the risk of financial crises.

In their work disentangling the role of increasing debt on financial crises, Dell'Ariccia et al., (2006), indicate that credit booms are usually the "harbinger" of financial crises is not undeserved bad reputation. They offer substantial empirical evidence: once controlling for the expansion of credit, other determinants of financial crises such as asset price growth, and a worsening of the trade balance loose significance. In a similar direction, Schularick & Taylor (2012) indicate that credit growth is the "single best predictor of future financial instability" and that the role of credit goes well beyond the one afforded to it by the financial accelerator we will discuss in Section 1.1.2 (p. 1059).[32]

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[30] Since the relationship between credit and economic growth is endogenous, the authors do not claim causality.

[31] In his work, Fisher spoke about how price deflation increased the real burden of debt thus increasing financial risk and making it more harmful than when it occurred in underleveraged economies. He highlighted that the role of debt overhang surpassed all other arguments for explaining big disturbances.

[32] These findings have a natural extension in the early-warning literature, whose goal is to try to establish, ex-ante, when the accumulation of imbalances is sufficiently large to result in a financial crisis. In a series of studies, Jordà, Schularick & Taylor (2010), Borio, James & Shin (2014), and De Bonis & Silvestrini (2014) suggest that the credit gap may be the most relevant predicting variable for financial crises. However, Alessi & Detken (2014) argue that the use of credit growth as the single predictive variable would imply that all credit booms are bad and may result in crises which contradicts the empirical evidence. Consequently, they suggest using additional variables such as property and equity prices. Taylor (2015) summarises this story clearly: "the lesson of macroeconomic history is that we ignore credit at our peril. Credit booms often go wrong. Although no

In the last few decades, the interaction between financial market dynamics and macroeconomic fluctuations has become central to mainstream economic research (Airaudo et al., 2015). Research has shifted from a scenario where asset prices and credit were studied independently to a framework where the financial system is tackled as a single object of study. In their taxonomy of financial crises, Claessens & Kose (2013) provide an argument for this shift. They identify that sharp increases in asset prices and credit, as well as consistently deteriorating current accounts, contribute to the likelihood of future credit crunches and asset price busts. They further indicate that the considerable macroeconomic implications of swings in asset prices and credit warrant the need for their constant monitoring and the careful study of whether increases in prices and levels constitute distortions from what would be explained by fundamentals. Brunnermeier & Schnabel (2016), highlight that the way asset booms are financed is critical since substantial debt financing increases the probability of economy-wide spillovers once the imbalances unwind. In this way, they establish a communication channel between asset price busts and the increases in default rates in the system.

Interestingly, this idea of studying the joint evolution of assets and credit dates back to the works of the Austrian School of Economics (Hayek, Von Mises) in the 1920s. Their stylized argument is that "an asset price boom whatever its fundamental cause, can degenerate into a bubble if accommodative monetary policy allows bank credit to rise to fuel the boom" (Bordo & Landon-Lane, 2013). This notion, which clearly predates the more mainstream idea of a business cycle, has been hoisted by economists like Minsky (1986, 1992), Kindleberger & Aliber (20015), and recently by Borio & Lowe (2002, 2004) Borio (2006, 2014a, 2014b, 2014c) and many at the Bank for International Settlements. It is precisely in the BIS research where the term "financial cycle" was coined to "denote self-reinforcing interactions between perceptions of value and risk, attitudes towards risk and financing constraints, which translate into booms followed by busts" (Borio, 2014b, p. 183).

indicator can predict perfectly, credit aggregates contain predictive information about the likelihood of future financial crises" (p. 18).

In his seminal work on this issue, Borio (2014b) highlights five main features of the financial cycle. First, it is most parsimoniously described in terms of property prices and credit. Although, as we argue in the introduction, in our research we favour the use of equity prices, this motivates a first natural extension of this dissertation. Second, when compared with the business cycle, the financial cycle is both longer and has more amplitude. Thirdly, recessions that coincide with the contraction phase of the financial cycle are more severe than "normal recessions". The properties of the economy that allow for this to happen will be covered in Section 1.1.1. Fourth, it is useful as a measure of accumulated stress in the financial system. Finally, its length and amplitude depend on the financial, monetary and real economy regimes in place.

Regarding financial policy, Borio (2014b) argues deregulation reduces credit constraints which fosters expansions in credit. Concerning monetary regimes, he indicates that a narrow focus on short-term inflation and output makes authorities myopic to the accumulation of financial imbalances. With respect to the real-economy policy regime, he indicates that globalisation in trade and productivity shocks foster asset price booms. We describe our perspective on policy regimes and their effect on the financial cycle in Section 1.3.

1.1.1. The Financial Cycle and Macroeconomics: The Role of Excess Elasticity

The differences that Borio (2014b) identified between the financial and business cycle arise from the fact that the former accounts for the monetary nature of the economy and for the ability of the financial system to create money endogenously, while the latter only reflects on the cyclical movement in real aggregate economic activity and output. Consequently, financial and business cycles need not be synchronised, and financial imbalances can accumulate or unwind regardless of the phase for the latter.

This distinction is made clear in a study for seven countries from 1960-2011, where Drehmann et al. (2012) find that the financial cycle has become longer since the deregulation wave of the late 1970s and that peaks and troughs in financial and business cycles not always coincide.[33] However, this does not mean that they are unrelated. A critical finding in this paper is that financial cycle peaks are closely associated with financial crises and that economy-wide recessions —business cycle peak-to-trough movements— feature GDP reductions 50 per cent larger when concurrent with the contraction phase of the financial cycle.

This suggests that there is a changing nature in the amplitude and frequency of the financial cycle which merits study, especially given that it bears an effect on real economic activity. In this direction, Borio & White (2004) and Borio (2014b) propose the concept of financial elasticity of an economy.

> *"This notion seeks to capture a system's inherent potential to allow financial imbalances to build up over time, with endogenous forces failing to rein them in, until the imbalances eventually unwind, possibly resulting in financial instability"* (Borio & White, 2004, p. 1).[34]

Furthermore, financial elasticity is directly related to the institutions in place. Namely the level of regulation, the time horizon and optimisation function for monetary authorities, the choice of an exchange rate and capital control regimes, the existence of safety nets, and implicit or explicit bail-out clauses. These institutions provide the framework for the accumulation of imbalances as they modify the available sources of funding, the structure of incentives for additional risk-taking or rent-seeking, and the buffers available to absorb macroeconomic or financial shocks among others (Borio & White, 2004). We will present a survey of the channels and mechanisms for the accumulation and unwinding of financial imbalances in the following section.

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[33] They include Australia, Germany, Japan, Norway, Sweden, the United Kingdom, and the United States. The study is relevant since it includes six of the countries in our database.

[34] Borio & White (2004) focus specifically on the accumulation rather than the unwinding of imbalances since it is in the build-up of systemic risk when the seeds of financial instability are sown. They view asset price crashes and contractions in credit as a natural consequence of the boom process.

A final issue regarding financial elasticity is that rather than being a national phenomenon it seems to be of a global nature. International financial integration has arguably led to the transmission of global monetary conditions from centre countries to the periphery via cross-border financial flows, the availability of foreign funding in national economies, and international credit and risk aversion cycles (Borio, James & Shin, 2014; Obstfeld, 2015, Passari & Rey, 2015). In this literature, the global financial cycle is usually proxied by two measures. A first alternative is to use the VIX index, which reflects the implied volatility of the plain vanilla put and call options in the Standard & Poor's 500 index for the US stock market (CBOE, 2014). A second measure is the first principal component of a wide array of asset returns covering stocks, corporate and public bonds, and commodities. Rey (2015), Passari & Rey (2015) and Miranda-Agrippino & Rey (2015) find these two variables are strongly related.

According to Borio (2014b), incorporating the financial cycle/elasticity framework within the current models of macroeconomic fluctuations requires three significant shifts in our understanding of the problem. First, the horizon of macroeconomic models and policymaking must be broadened to include the medium term. Secondly, the monetary nature of the financial system needs to be fully grasped in the models by acknowledging that the financial system is not only in charge of reassigning resources. Finally, it must account for the global nature of the system since financial integration is probably the most salient feature of recent financial history.

Even though the idea of a financial cycle is not new, and it has both an intellectual appeal and supporting empirical evidence, it has not been fully integrated into macroeconomic modelling or policymaking. Assenmacher-Wesche & Gerlach (2010) suggest two major caveats that hinder the credibility of this framework, and which we aim to address throughout the dissertation.

On the one hand, they argue that the correlation between asset prices and credit aggregate may be driven by some unobserved factor such as interest rates or output growth. In our analysis in Chapter 6, we will include as controls several macroeconomic variables that may, alternatively, be driving this relationship.

On the other hand, the literature on the financial cycle does not prove sufficiently whether asset prices are necessary input for the formulation of monetary policy. While we do not offer a formal model for alternative monetary policy rules as in Bernanke & Gertler (1999) or Bordo & Jeanne (2002), in Chapter 6, we offer a first inkling of an answer by testing the direction of causality between credit aggregates and stock markets. If asset prices are driving the relationship, it is natural that policymakers and regulators include their evolution in designing a framework for financial stability.

1.1.2. Channels and Mechanisms

Following the periodisation by Schularick & Taylor (2012), throughout the twentieth century, models for the interactions between the financial system and the real economy have evolved significantly. A first family of models, following on the works of Modigliani & Miller (1958) and Friedman & Schwartz (1963), reflects two distinct perspectives. First, according to the money view, changes in monetary aggregates affect short-run growth and output but are neutral in the long-run. Secondly, the idea of irrelevance in financing decisions by firms and households suggested that real economic decisions were disconnected from financing choices. Consequently, in this first family of models, which includes seminal works on the business cycle, both money and the structure of the financial system are irrelevant.

A second family of models, which we will term the orthodox view as in Borio & White (2004), arises from the early works of Fisher (1933) but only gains traction half a century later with papers by Bernanke (1983), Gertler (1988), Bernanke & Blinder (1988), and Bernanke, Gertler & Gilchrist (1999) (henceforth BGG). In this strand of literature, money and credit matter beyond the level of a given monetary aggregate. Moreover, credit frictions are included in this type of models such that "sharp increases in insolvencies and bankruptcies, rising real debt burdens, collapsing asset prices, and bank failures - are not simply passive reflections of a declining real economy, but are in themselves a major factor depressing economic activity" (Bernanke, Gertler & Gilchrist, 1999, p. 1343). Furthermore, BGG indicate that their model better explains how small *exogenous* shocks to the economy can be amplified to have significant real effects. In this family of models, distortions arise from differences in relative prices, mainly from sticky prices and inflationary shocks (Borio & Lowe, 2004).

A third family of models that we will refer to as the unorthodox view as in Borio & White (2004) argues that the role of credit is not just that of an amplifier of shocks, as in the orthodox view but instead can serve as a source of shocks and financial instability. This literature draws on the financial instability hypothesis that posits that the financial system is naturally unstable and subject to endogenous asset and credit booms and busts that further cause financial instability (Minsky, 1986, 1992). For authors in this unorthodox view, distortions to the consumption/saving decision lead to the accumulation of imbalances in the balance sheets of households and firms (Borio & Lowe, 2004). Since this literature allows for *endogenous* shocks, it opens the possibility of a feedback loop between credit and asset prices, as posited by the financial cycle, which gives rise to the accumulation of imbalances. While the orthodox view requires an external shock for a crisis to occur, in these models the accumulation of disequilibria takes time to occur, and as financial fragility increases, even endogenous events such as changes in sentiment may trigger a crisis (Borio & Drehmann, 2009). A final implication of the endogenous models of macroeconomic fluctuations is that financial cycles are distinct from economic cycles and thus demand separate attention. In this case, asset and credit booms and busts as well as excessive risk-taking, debt overhang and liquidity constraints all serve as transmission mechanisms that are relevant in explaining the accumulation of imbalances (Freixas, at al., 2015).

In what remains of this section we will discuss the different channels that both the orthodox and unorthodox literature find for the evolution of macroeconomic fluctuations. It is noteworthy that throughout the dissertation our framework of analysis will include a combination of the channels and mechanisms posited by both strands of the literature as we see them as complementary rather than conflicting.

1.1.2.1. The Orthodox View

The conventional explanation of economic fluctuations has been developed since the end of the Second World War until the present. In this view, inflation serves as the primary measure of economic distortions, and there is a "divine coincidence" between stable prices and output around its natural non-inflationary level (Blanchard & Galí, 2007). Contrarily, inflationary impulses distort relative prices, investment choices, and causes unemployment and stagnated growth (Borio & White, 2004).

According to this view, the financial system is an amplifier of economic impulses, and the source of financial imbalances is either run-away inflation or exogenous shocks to the economy. In this setup, non-linear relationships are usually abstracted away or left as second order effects and the assumption that all agents are rational is well accepted (Borio, 2006).[35] In what follows we discuss the main channels that have been identified for the behaviour of macroeconomic fluctuations under this view.

Investment channel: Positive shocks to the supply side of the economy, like a new technology that becomes mainstream and increases productivity, increase the profits of firms. This may have a positive effect on the price level by reducing production costs (Borio & White, 2004). Stable or decreasing prices, which translate into low levels of the interest rate in an inflation targeting regime, fosters investment on physical capital via a reduction in the funding cost, which increases the investment opportunity set, and through increases in Tobin's Q (Tobin, 1969; Hatzius et al., 2010).[36] On the

[35] The rational expectations hypothesis implies that all agents (firms, households, policymakers) are aware of the true model for the economy and optimise their decision-making accordingly.

[36] The investment opportunity set for a firm is defined as all the available projects with positive net present value. Since the present value of future cash flows increases with lower discount rates, a decrease in the cost of funds for the firm will cause that some projects with low expected returns become profitable in expectation (Smith & Watts, 1992).

asset side, higher expected future cash flows may put upward pressure on the stock market, pushing down the cost of equity for firms even further (Kindleberger & Aliber, 2005).

Consumption channel: After a positive supply shock, higher productivity may put upward pressure on aggregate demand and consumption, via higher salaries, which also fosters growth in output (Borio & Lowe, 2002). Because of higher income for workers, overall creditworthiness of households may improve and foster productivity-driven credit booms (Freixas et al., 2015).

Household wealth channel: This channel links increases in household wealth to increases in spending and works through a different mechanism as the investment or consumption channels (Bernanke & Gertler, 1999; Mishkin & White, 2002). As equity or property prices increase, households approach their wealth or total saving goals faster and need to save less of their current income (Kindleberger & Aliber, 2005).[37] This immediately translates into higher present consumption and increased aggregate demand. The effect is broader if the asset class that experiences the increase in prices is widely held and represents a significant proportion of a group's wealth (Brunnermeier & Schnabel, 2016) This is one of the transmission channels for monetary policy into household consumption (Bernanke & Kuttner, 2005).

Financial accelerator and the balance sheet channel: BGG introduce financial frictions in the standard model by including costly state verification, where banks need to pay a premium to enforce payment of financial contracts. This leads to higher costs in external finance vis-à-vis internal funds for firms (Freixas et al., 2015). The external finance premium in the BGG framework is inversely related to the net worth of borrowers: the wealthier a borrower, the lower the cost to enforce the contract. Since a borrower's wealth

[37] In their 2015 paper, Airaudo et al., refer to this channel as the financial wealth channel when it refers specifically to increases in the stock market. They highlight that it may work differently for stock price and housing price increases as the former are more liquid than the latter.

moves procyclically with the economy, because it is related to both profit and asset prices, so does its creditworthiness and access to cheap external finance. As credit is both cheap and readily available, investment expenditure increases which may foster economic growth, expected future cash flows, and asset prices. This process results in feedback between the real economy and the financial system (Bernanke & Gertler, 1999). For the channel to work correctly, the asset class that experiences the price increase must be subject to pledge as collateral for the loan, particularly in the case of households (Claessens & Kose, 2013).

Under this framework, increasing inflation brings forth a "money illusion" where the real value of debt for firms and households decreases relative to income (Fisher, 1933). Additionally, it decreases the real cost of liabilities thus fostering further indebtedness and credit expansion (Bordo & Schwartz, 1999; Kindleberger & Aliber, 2005). Contrarily, when asset prices decrease, the collateral base is reduced, and a credit crunch may occur (Bordo & Jeanne, 2002).

Monetary policy transmission channel: A restrictive monetary policy increases the cost of credit and reduces its availability. This shrinks the investment opportunity set for firms as well as their available funding for new projects which, consequently, hinders investment. The impulse can depress asset prices since expected future cash flows are lower and discount rates are higher. The higher cost of credit also has an impact on consumption from households and aggregate demand (Bernanke, 1983). The opposite is also true; lax monetary policy can positively affect asset prices and credit availability by decreasing the cost of funds from firms and households and widening the investment opportunity set for companies (Gerdesmeier, Reimers & Roffia, 2010).

Asset substitution channel: Changes in the monetary policy stance need not affect all asset classes and firms simultaneously. A relaxation of the monetary policy stance, where money becomes cheap, decreases the interest rate of government securities first given their liquidity. As agents begin searching for more profitable investments, there is a substitution of assets in their portfolio, where they start buying less-liquid assets: long-term government securities, corporate bonds, equities, real estate, and commodities. Consequently, if this pecking order is followed, there is a lag in the price increases from one asset class to the next as the relaxation in policy persists in time (Bordo & Landon-Lane, 2013). This channel was specifically targeted by the implementation of the Quantitative Easing Program of the Federal Reserve under the tenure of Ben Bernanke (Bordo, 2014).

Foreign flows channel: In the original BGG model, the framework does not allow for international capital flows as they posit a closed economy. However, several extensions in the model have shifted toward an open economy setup thus giving relevance to foreign capital flows and effects running through both current and capital accounts. From the perspective of the current account, persistent surpluses in a given country, as in Asia before the GFC, lead to the possibility of increased foreign investment in deficit countries (Borio, 2014b).[38] This increasing capital flows into a country act as a foreign source of credit that may amplify credit expansions mainly if the domestic monetary policy stance is tight and high real interest rates make foreign investment more attractive (Claessens & Kose, 2013).[39] As foreign flows come into a country's capital or property market, prices increase thus fueling asset price booms. Additionally, since the foreign currency becomes more abundant, it depreciates vis-à-vis the local currency, which provides an added windfall for foreign investors.[40] This may very quickly foster feedback between foreign inflows and asset and credit booms in the economy and

[38] This is the mechanism for the excess saving hypothesis that aims at explaining the GFC.

[39] This mechanism complicates the role of monetary authorities since, if they wish to curtail credit growth by increasing interest rates, they will make the inflow of foreign investment more attractive and increase the economies exposure to currency depreciation and sudden stops (Kindleberger & Aliber, 2005).

[40] Investments in certain asset classes open to foreigners may be more attractive for outside capital since they earn both the real rate of return on their investment and the depreciation of their currency against the local one.

increase the economy's exposure to sudden stops in the flow of capital from abroad (Kindleberger & Aliber, 2005; Claessens & Kose, 2013).

Once the crisis strikes, the main channel of transmission from distress in the financial sector to the real economy is the increase in credit restrictions and the possibility of a credit crunch. This distorts the intertemporal allocation of funds between savers and investors as well as the consumption/saving decision for households. As asset prices decrease and collateral-worthy credit shrinks, debt overhang problems ensue, investment and consumption plummet and both employment and output contract affecting overall welfare (Freixas et al., 2015).

1.1.2.2. The Unorthodox View

The unorthodox explanation for economic fluctuations argues that financial instability arises in an economy where there is endogenous money creation and where the financing restriction is not continually binding. In this model, if the accumulated stock of debt is sufficiently high, the unwinding of imbalances does not require a large shock to occur (Maffezzoli & Monacelli, 2015). Therefore, changes in the policy regime in place are relevant insofar as they may lower financing and monetary restrictions promoting the role of the financial system in the accumulation of imbalances (Borio & White, 2004).

Therefore, the main difference between the orthodox and unorthodox models is that in the latter, price stability is not sufficient for financial stability. Under this view, financial mechanisms are at the centre of our understanding of economic fluctuations in output and inflation. Furthermore, non-linearities are of paramount importance rather than abstracted away, and rational expectations are not consistently binding under all states of nature (Borio, 2006). The role of credit as described here, although related to the balance sheet channel of the orthodox view, argues for the endogenous accumulation of imbalances and thus runs through different channels.

Feedback channel: The most relevant innovation under this view in contrast to the mainstream model is the existence of a feedback mechanism between asset price and credit growth on the one hand, and from the financial system to the real economy on the other hand (Borio & Drehmann, 2009). According to Smets (2014), it is the health of the financial sector that determines both the amount of endogenous money creation and the price of risk. As an example, reduced interest rates increase the prices of long-term bonds held by banks and allow for the additional creation of credit/deposits while at the same time compressing risk premia.

Following Kindleberger & Aliber (2005) and Minsky (1992, 2006), the underlying dynamics of the endogenous model follow a standard pattern that fits most financial crises in recent history. The accumulation of imbalances initiates with a displacement —the end of a war, the implementation of new technology, or a process of financial liberalisation— which causes changing expectations about the future in the economy. Through the investment channel discussed above, improving economic conditions lead to growing investment, a reduction in risk premia and higher expected cash flows from firms which cause increases in asset prices. As euphoria sets in, balance sheets look more robust, and lending conditions are relaxed. As a result, a feedback loop between asset prices and credit follows: price increases of collateral-worthy assets improve the general creditworthiness of investors which assume more leverage to invest in the boom. Imbalances continue to accumulate as the incentives to take on risks are altered. As investors and lenders mistake cyclical developments for improving economic conditions, balance sheets become overextended (Borio & White, 2004).

During this phase, speculation occurs in two distinct phases. In a first moment, improving economic conditions foster increased investment under a rational expectations framework. In a second stage, expectations about future returns become disconnected from reality, and the "greater fool principle" comes into play.[41] Under

[41] Malkiel (2016) suggests that under the greater fool principle, a speculator will be willing to buy an unreasonably priced asset even under rational expectations if he believes that before the bubble bursts, he will find someone more foolish than himself to

this distorted reality, lenders stop caring for the ultimate cash flows that would, in a rational framework, guarantee payment of their obligations (Kindleberger & Aliber, 2005; Malkiel, 2016).

In this model, the idea is that periods of prolonged prosperity induce agents to shift from stable hedge-financing regimes towards crises-prone Ponzi-financing regimes that are solely evidenced in the presence of a shock: a "Minsky moment"(Minsky, 1992).[42] Such an event takes the form of a small shock that alters expectations and puts downward pressure on asset prices. As the value of investments decreases, overleveraged agents liquidate them to stop further losses and pay off whatever portion of their liabilities they can. This puts further decreases collateral-worthy asset prices, induces fire sales and leads to bankruptcies at the household level. Since the shock is transmitted swiftly to the banking sector, credit conditions worsen, a credit crunch may occur, and financial institutions in distress may fail (Kindleberger & Aliber, 2005). This dynamic process issue is summarised by Menna and Tobal (2018): "Excessive credit growth in the upturn of the financial cycle leads financial institutions to deleverage massively in the downturn. This, in turn, generates negative externalities by diminishing asset prices and, therefore, by creating capital losses for several financial institutions" (p.2). This chain of events decreases both production and aggregate demand, causing contractions in output and employment. As described, the feedback mechanism operates both

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purchase the asset at an even higher price. According to Kindleberger & Aliber (2005), this dynamic resembles a game of hot potato.

[42] Minsky (1992) distinguished three distinct types of investors based on their leverage levels. Hedge finance units would be able to service their debt on their cash flows alone. Speculative finance units would be able to pay the interest on their obligations, albeit not the principal, on income alone. Finally, for Ponzi finance units, income is not enough to cover either interests or principal payments of their debt. The shock brought by the Minsky moment, the fire sales in assets and the subsequent debt overhang may cause hedge finance units to shift into speculative finance or even Ponzi finance units. Pistor (2013) highlights that this model fully incorporates the fact that the stability underlying the system is both an issue of social choice and institutional design. This idea further strengthens the proposition of the excess elasticity hypothesis discussed above.

during expansions and contractions thus amplifying the financial cycle.

Lending standards channel: As economic conditions improve during expansion phases, default rates decline, and lenders become more prone to lending, decreasing down payments and reducing the standard requirements for granting a loan (Kindleberger & Aliber, 2005).[43] In general, lending standards change over time and are a function of the preferences and beliefs of bank managers about impending economic conditions which need not be rational and may be distorted by the cyclical dynamics discussed above (Freixas et al., 2015).

Animal spirits: Keynes (1936), suggests that apart from the instability caused by speculation, human nature, psychology, and our natural tendency towards action rather than inaction, play an essential role in the evolution of instability in the system. He refers to this pushing force as animal spirits which may drive part of agents' decision-making process. Fisher (1933) describes the role of animal spirits in the process of incurring into debt for profit. He argues that the cycle begins with substantial prospective gains, followed by the anticipation of quick capital gains to be made by selling in the immediate future. The cycle continues with increasing promotion of investment opportunities to ill-informed potential investors by aiming at exploiting their greed and culminates in frauds, swindles and Ponzi schemes. Throughout the process, herding behaviour occurs, where agents that did not participate in the early phase of the boom see their peers obtaining quick capital gains and, through a catching-up-with-the-Joneses effect, wish to partake in the benefits of investment in the boom (Abel, 1990). Excessive optimism about economic conditions, herding, investor greed, and the urge for quick money are the underlying drivers for the euphoria phase during expansions (Shefrin, 2002; Kindleberger & Aliber, 2005).

[43] An excellent example of this is the increase in subprime mortgage lending before the GFC (Maddaloni & Peydró, 2011).

Asymmetric information channel: Under a scenario of decreasing asset prices, if firms' balance sheets are weak and the price of collateral-worthy assets falls, banks face an adverse selection problem as they can no longer screen between good and bad borrowers (Mishkin & white, 2002). At low levels of net worth, illiquidity and insolvency are indistinguishable for outsiders, a confusion that may lead to market freezes (Claessens & Kose, 2013).

Financial innovation: Financial innovation is one way in which the financial system can circumvent regulation. Minsky (1992) argues that under the quantitative theory of money, the authorities target an unchanging money item whose velocity is presumed fixed and thus its growth rate bears a direct and linear relationship to the price level. The issue, however, is that for any definition of the money target, the financial system finds a way to create new forms of money: bills of exchange, cheques, certificates of deposit, credit card debt, collateralised debt obligations and so on.[44] This dynamic nature of money is what causes credit growth to be endogenous since new forms of money do not require new high-powered money to be put into circulation. This dynamic process is one that requires ever-changing regulation to conform to the needs and practices of different monetary arrangements (Kindleberger & Aliber, 2005).

Risk-taking channel: During asset price booms the inverse relationship between prices and discount rates explains a compression of the risk premia awarded to investors. This distortion may lead to economy-wide shifts in consumption, investment, and leverage (Jones, 2015). As with credit and asset prices, risk perceptions are procyclical: optimistic calculations of default probabilities, losses given default, Value at Risk, volatilities, and correlations occur more frequently during periods of economic expansion (Borio 2014c). The compression of risk premia is misconstrued as a

[44] As an example, M0 is defined as currency in circulation, M1 is M0 plus demand deposits, M2 is M1 time deposits, M3 is M2 plus highly liquid government securities. Each increasing value of M contains new definitions of endogenous money.

decrease in risk while it represents the opposite: a persistent accumulation of financial imbalances (Borio & Drehmann, 2009).[45] This misidentification of current conditions fosters additional risk-taking on the part of agents who see the combination of low volatilities and high asset valuations and erroneously believe "this time is different" a la Reinhart & Rogoff (2009a). This leads to overinvestment across asset classes and shifts in the supply of credit on the part of banks (Freixas et al., 2015).

The risk-taking mechanism can be further subdivided into two distinct channels. The first is the preference channel which relates to the time-varying evolution of risk appetite. In this case, under a rational expectations framework, there is a habit formation process through which investors and bankers get used to compressed risk premia and thus are willing to take in increasing amounts of risk in their persistent search for yield (Rajan, 2006). Evidence for this channel has been identified particularly during periods of persistently lax monetary policy (Assenmacher-Wesche & Gerlach, 2010; Claessens & Kose, 2013). The second is the agency channel which relates to the persistent risk-taking incentives for financial intermediaries that arise from their limited liability. Since banking activities are naturally highly leveraged but stockholders have limited liability they have an incentive to increase the risk profile of the financial institution to maximise profits (Freixas et al., 2015).[46]

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[45] Reductions in risk premia cannot occur indefinitely as agents would not be willing to be paid less for assuming riskier investments which is the implication of a negative risk premium. Consequently, theory predicts risk premia has a zero-lower-bound.

[46] In the corporate finance literature, for example Myers (1977), it is standard to discuss the conflict of interest between bondholders and stockholders in terms of plain vanilla options. When thinking about the banks as companies and focusing on the liability side of the balance sheet, the stockholder in the bank can be thought of as the owners of a call option on the future cash flows of the company with strike price at the level of debt. Contrarily, the bondholder can be thought of as being short a put option on the company's cash flow with the same strike price. Thus, the stockholder has an incentive to undertake more risk as it maximises the present value of his option, while the bondholder, who has a bounded payoff in the debt level, has no such incentive. For a discussion of plain vanilla options refer to Annex 11.

In summary, the interactions between the financial system and the real economy are complex, difficult to model or to stylize. Two different and sometimes conflicting views about the issue have been put forth by mainstream and heterodox economists since the first third of the twentieth century. In the following section, we discuss the paramount present-day policy implications of these two competing views.

1.2. What to Do About Booms and Busts? Leaning Against the Wind VS Benign Neglect

The previous section has highlighted the main difference between the orthodox and the unorthodox views of the links between the financial system and the real economy. While the former focuses on the role played by inflation in generating distortions and awards the financial system the role of amplifying external shocks, the latter understands the financial system as a creator of endogenous money that under specific elastic policy configurations allows for the accumulation of financial imbalances which may foster financial instability.

These theoretical differences translate into a real policy debate between those who believe that monetary authorities and regulators should neglect the behaviour of asset prices and credit aggregates as long as they do not affect expectations about future inflation and output, and those who believe that authorities should lean against credit and asset booms in order to hinder their potential to generate financial stability. In the following sections, we discuss each of these views.

1.2.1. Benign Neglect

The implication from the orthodox view presented in Section 1.1.2.1 is that authorities should not intervene in asset markets if they do not affect inflation, aggregate spending or economic growth (Bernanke & Gertler, 2001; Roubini, 2006). The pre-GFC consensus dictated that authorities should follow the standard inflation targeting approach and after a crisis occurred, they should focus on cleaning up the mess by lowering interest rates and making liquidity readily available (Assenmacher-Wesche & Gerlach, 2010). The underlying assumption for this view is that bubbles cannot be measured or identified ex-ante, that attempting to burst them could bring forth unintended consequences, and that, according to the Lucas dictum (2003) the problem of macroeconomic depressions had been solved for advanced economies (Jordà, Schularick, & Taylor, 2015). This approach to the issue brought forth an asymmetric response to financial instability: no *ex-ante* preventative measures and extreme *ex-post* reactions to financial crises (Roubini, 2006).

Those who favour this view offer several arguments for a hands-off approach to the accumulation of imbalances on the part of the authorities. First, in line with the Schumpeterian view of creative destruction, some argue that crises, with their characteristic asset price deflations and bankruptcies, have a purgative power as they cleanse the economy from insolvent companies, greedy investors, and the distortionary effects of the previous booms (Kindleberger & Aliber, 2005).

A second argument relates to the divine coincidence: the idea that the optimal policy followed by monetary authorities to stabilise prices also allows for output to achieve its maximum potential (Freixas et al., 2015). In this view, the optimal focus is one centred on stable prices rather than attempting at controlling too many variables with a single tool.[47] Even if the divine coincidence did not occur exactly, the track record of inflation targeting regimes was satisfactory up to the GFC (Rose, 2007).

A third argument that is usually wielded by those who favour the benign neglect approach is focused on the nature and identification of bubbles.[48] Dell'Ariccia et al., (2013) and Brunnermeier & Schnabel (2016) contend that discriminating between fundamentally-driven asset price expansions and bubbles is challenging as it presumes that monetary authorities can safely assess the correct value of an asset at any point in time. According to Mishkin & White (2002) and Jones (2015), this would imply that regulators and authorities have an informational-upper-hand

[47] This idea follows Tinbergen's (1952) proposition that there should be as many tools as goals for economic policy to be successful. This has been misconstrued to say that each objective must be targeted by a single instrument, while a more comprehensive interpretation is "that the interrelationships between objectives arising from the single economic structure had to be taken fully into account. In general, this calls for a balance in the use of the instruments" (Borio, 2014a, p.12)

[48] As argued in footnote 28, we refrain from using the term bubble in our analysis. However, the literature on the lean VS clean debate uses the term extensively.

on market participants which would contradict the efficient market hypothesis. In his 1999 testimony before the Committee on Banking and Financial Services of the US House of representatives, Fed Chairman, Alan Greenspan stated:

> *"Should an asset bubble arise, or even if one is already in train, monetary policy properly calibrated can doubtless mitigate at least part of the impact on the economy. And, obviously, if we could find a way to prevent or deflate emerging bubbles, we would be better off. But identifying a bubble in the process of inflating may be among the most formidable challenges confronting a central bank, pitting its own assessment of fundamentals against the combined judgment of millions of investors"* (Greenspan, 1999).

If, on the other hand, both agents and regulators have the same information, the rational expectations hypothesis indicates that bubbles would never take place.[49] Finally, Posen (2006) argues against a bubble-popping approach because bubbles, in theory, are not driven by fundamentals but by either animal spirits or the greater fool theory, which implies that the monetary policy mechanism linking liquidity conditions and asset prices should not operate.

According to Bernanke & Gertler (1999), responding aggressively to expected inflation stabilises the economy with no added value coming from intervention in the asset market. In their model, the financial accelerator implies that increasing asset prices affect price stability in the long-run and thus do imply a policy response. Posen (2006) goes even further and indicates that no amount of monetary discipline can substitute sufficient financial regulation and supervision. According to this argument, those who favour leaning against the wind are attaching to monetary policy a role that it is not prepared to execute.

The benign neglect perspective is not without criticism. Bordo & Jeanne (2002), for example, suggest that the excessive focus of its

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[49] One of the criticisms of the efficient market hypothesis is grounded on empirical evidence about the existence of bubbles. Pastor & Veronesi (2006) provide an example of this literature using the NASDAQ bubble of the 1990s as a case study.

proponents on the existence of bubbles has put forth a veil on the relevant issue in the discussion. They indicate that the question of whether authorities should affect asset prices is valid even without the existence of bubbles since asset classes, as productive sectors of the economy, can overheat. In their evaluation of the issue, the show that the optimal monetary policy is non-linear, and they find evidence for what we call "Goldilocks conditions for monetary intervention": if the bubble is too small intervention is not needed; if the bubble is too massive, intervention may cause a credit crunch and a financial crisis.

Brunnermeier & Schnabel (2016), argue that a pure cleaning strategy, in which authorities only intervene once financial instability has materialised, is exceptionally costly since by then the level of economic dislocation can be too high. Smets (2014) concurs and indicates that it is because of that excessive cost and dislocation of resources and incentives that benign neglect is no longer a viable option.

The main criticism to the benign neglect view, however, is that it does not account correctly for the nature of recessions that occur after financial booms (Borio, 2014a). Since this approach to financial crises requires authorities to provide as much liquidity as necessary once the imbalances unwind, investors' expectations and risk perceptions may be distorted as they consistently expect liquidity support and bail-outs to the financial system in the face of a systemic risk event (Bordo & Landon-Lane, 2013).[50] There are several adverse consequences of this policy which we address in turn.

First, the "Greenspan put" induces moral hazard since, ex-ante, investors may be more willing to participate in a boom and finance their investments with credit if they know that when the imbalances unwind,

[50] This massive liquidity support policy has come to be known as the "Greenspan put" after the stock market crash of October 1987 (Bordo & Landon-Lane, 2013). The name refers to put options, a financial derivative in which the issuer commits to buy an asset from the acquirer of the contract at a fixed price in the future. The acquirer pays a premium and has the possibility (option) of exercising his or her right (selling the underlying asset) at the date of maturity. An acquirer will exercise the right only if the market price of the asset is below the agreed upon price in the contract (strike price). Consequently, the contract is similar to insurance for the acquirer in case the asset's price falls below a previously agreed level (Wilmott, 2006).

they will be bailed-out (Freixas et al., 2015). A second effect, the standard liquidity trap, runs through the risk-taking channel discussed above, where the availability of cheap money for too long may delay adjustment of investors' expectations and risk perceptions. If the system was over-indebted before the crisis, it might occur that the lax policy is not sufficiently transmitted to the economy as agents are unwilling to borrow, and banks that suffered significant losses through non-performing loans may be unwilling to lend. Moreover, ever-increasing interventions by the central bank in the market may cause the interbank market to shrink, and risk premia to compress even further (Borio, 2014b).

Third, lax monetary policy may help hide weaknesses in the balance sheets of firms as their debt service is abnormally low for prolonged periods. Consequently, incentives for the elimination of excess capacity may be hindered (Borio, 2014b; Freixas et al., 2015). It is in scenarios of financial distress, where the probability of bankruptcy increases, that firms undertake gamble for resurrection strategies, they increase their leverage and undertake a high-risk project in hopes to increase future cash flows (Myers, 1977; Hart, 1993).

Fourth, persistently low long-run interest rates affect the profitability of portfolios in insurance companies and pension funds, which may force them to embark on a search for yield by increasing their risk exposure and putting further upward pressure on asset prices (Rajan, 2006). This process may have long-term effects for households as their expected future income decreases. Low profitability of insurance and pension companies may revert to future government expenditures through stronger demands on the failsafe offered by the social safety net (Freixas et al., 2015).[51]

All these distortions show that during the bust phase of the financial cycle, authorities face a trade-off between fostering economic recovery and preserving financial stability (Brunnermeier & Schnabel, 2016). If too much emphasis is put on economic recovery to the detriment of financial stability, compressed risk premia and abundant liquidity may

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[51] This is particularly true when there is a minimum pension guarantee for retirees offered by the government or demanded by law from the private pension system.

interact to foster asset price inflation even further. An excellent summary of this vicious circle is offered by Giavazzi & Giovannini (2010) in their description of low interest rate traps:

> "*low interest rates induce too much risk taking and increase the probability of crises. These crises, in turn, require low interest rates to maintain the financial system alive. Raising rates becomes extremely difficult in a severely weakened financial system, so monetary authorities remain stuck in a low interest rates trap*" (p. 16).

1.2.2. Leaning Against the Wind (LAW)

The unorthodox view of the links between the financial system and the real economy implies that insofar as financial imbalances can accumulate endogenously in the system while the price level is under control, monetary authorities should take a more activist approach concerning the evolution of asset prices and credit aggregates. The main motivation for this view is that financial imbalances accumulate during long periods and the two or three-year time horizon of the current inflation targeting regime is insufficient when trying to observe this process (Assenmacher-Wesche & Gerlach, 2010; Borio, 2014b).

Additionally, it has been well established that the unwinding of financial imbalances in the form of financial crises, asset prices busts, and credit crunches is a costly process that affects output, employment and social welfare (Roubini, 2006). The natural consequence is that authorities, in this view, should lean against the wind of asset price and credit growth, even if this implies a tradeoff between short-run economic performance and long-run financial stability. The alternative, allowing the booms to run their course, can result in the bust process described in Section 1.1.2.2, including the collateral-led credit crunch. Bordo & Jeanne (2002) and Jones (2015) suggest that a LAW policy can be thought of as paying an insurance premium against the risk of a credit crunch. The premium for this insurance is paid in terms of growth: monetary authorities will adopt a stricter monetary policy during boom phases, thus having an adverse effect on short-run output, employment and inflation and, in exchange, they will curtail the effect of the dislocations that arise as the financial imbalances eventually unwind (Borio, 2006).

An additional motivation for this type of policy is put forward by Jordà, Schularick & Taylor (2010), when they indicate that, since financial crises are not random events, it is the responsibility of policymakers to design early warning indicators and a variety of responses depending on the way events unravel.[52] Borio (2014a), goes beyond and indicates that the achievement of price and financial stability on the part of central banks, requires additionally that they lean against the accumulation of imbalances.

Some criticism has been put forward by Goodhart (2001) and Jones (2015) to the inflation target observed by central banks. They argue that the fact that the CPI target only includes prices of goods and services makes the measure blind to financial instability. Consequently, Goodhart suggests that including asset prices, particularly housing, in the calculation of CPI might serve the purpose of curtailing booms and busts.

Kuttner (2012), goes further and suggests that this policy of leaning against financial imbalances does not need to contradict inflation and output stabilisation, and in that sense may be fully functional under an inflation targeting regime. In this same regard, Cecchetti et al., (2000) and Borio & White (2004) indicate that if the public were aware of the implementation of the LAW policy, it would cancel out the harmful effects of the "Greenspan put" in the same manner as inflation targeting helps in anchoring inflation expectations. This may be useful in the quest to resolve the low interest trap described above.

Brunnermeier & Schnabel (2016) suggest that while a LAW policy may mitigate crises, its implementation is non-trivial: just as with Bordo & Jeanne's Goldilocks conditions, "leaning interest rate policy may become

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[52] The idea of developing early-warning systems for financial crises is not new. Early works, mostly related to predicting currency crises, go back to Frankel & Rose (1996), Sachs, Tornell & Velasco (1996), Kaminsky, Lizondo, & Reinhart (1998), Kaminsky & Reinhart (1999), and Goldstein, Kaminsky & Reinhart (2000). However, since the purpose of this dissertation is not to make predictions about the evolution of financial instability, we only survey the subset of the early-warning literature that relates to credit as an important predictor of systemic risk events (Claessens & Kose, 2013; Claessens, Kose & Terrones, 2013; Dell'Ariccia et. al. 2013; Taylor, 2013; Freixas et al., 2015).

ineffective if it comes too late or is too weak and it can be harmful if it is too strong" (p.505). Consequently, with LAW policies there is a constant tension between the correct timing and the size of the intervention.

Roubini (2006) offers a literature review of the arguments in favour of a LAW policy focused on pricking asset price bubbles. He argues that several studies find that the economic implication of the unwinding of imbalances are significant enough to provide at least a reasonable doubt surrounding the question of whether central banks should focus on asset price booms in their quest for financial stability. With regards to the issue of the difficulties central banks face in identifying bubbles, he highlights that measuring the output gap or expected inflation is, likewise, subject to measurement and model error, and still central banks make decisions acknowledging the uncertainty in their estimations. Under the traditional Taylor rule framework, the effect of increasing uncertainty in the estimation of expected CPI y and output gap will reflect in the strength of the central bank's policy response. However, regardless of the model's estimation error, the coefficients assigned to the independent variables are always different from zero. In his review, Roubini (2006) also indicates that the need for a LAW policy is especially salient when the bubble is thought to be endogenous —contingent on the system's ability to create money— as in this case, it will surely react to impending monetary conditions. Finally, he criticises the asymmetric response of central banks to financial stability. Reacting sharply to bursting bubbles but curtailing the response vis-à-vis asset price booms is, as argued above, a source of moral hazard and excessive risk-taking.

A final argument with regards to the benefits of LAW against cleaning up the effects of a crisis is related to the alternative policy option: macroprudential regulation. The emergence of this idea lays in the recognition that financial booms cause a composition effect that makes both firms' and fiscal balance sheets look more robust than they really are (Borio, 2014c). The regulatory nature of the macroprudential approach makes it preventative, allowing for the creation of buffers during the upward phase of the financial cycle.[53] According to Freixas et al., (2015), if macroprudential regulation worked perfectly, there would be no need for monetary policy to lean against the wind. While the former would oversee preserving financial stability, the latter could remain focused on price stability: two goals for two instruments.

There are two main benefits of macroprudential policy in the management of financial instability. First, macroprudential tools aim at making credit-financed asset purchases more expensive as credit growth accelerates. This is achieved by increasing the required capital and liquidity buffers for banks during credit booms and, as a consequence, should make the financial system more resilient when confronted with systemic risk events (Freixas et al., 2015). Second, since the main focus of macroprudential policy is financial stability, the manoeuvring space for monetary policy to deal with price stability increases and the risk of reaching the zero-lower-bound in the face of a crisis is reduced (Smets, 2014).

Still, the macroprudential approach, with all its theoretical appeal is largely untested which raises several issues. First, the interactions between macroprudential and monetary policy decisions are unknown. Second, since macroprudential regulation does not affect the ever-growing shadow banking system, there is a large space for regulatory arbitrage between those institutions that are regulated and those that are not (Freixas et al., 2015). Third, our understanding of how to best implement macroprudential policies is still at an early stage which leads to limits both

[53] Following Freixas et al. (2015), macroprudential instruments address both time-varying and cross-sectional risks. The former refers to the risks that arise during different phases of the financial cycle. Among the tools employed to address this dimension of risks we find countercyclical capital buffers, time-varying liquidity surcharges, changing risk weights targeting specific sectors or asset classes, time-varying restrictions on loan to value (LTV), debt to income (DTI) or loan to income (LTI) ratios. The latter is related to the evolution of systemic risk, defined as the aggregation of the individual risks of financial institutions, which may be larger than their simple sum due to covariance and network effects. Some of the available tools to affect this dimension include systemic liquidity and capital surcharges, levies imposed for trading outside of a clearinghouse framework, the ability to break up firms that fall in the too-big-to-fail (TBTF) category, among others. An extensive list and discussion of these measures can be found in Table 9.2 and the associated text in Freixas et al., (2015).

from an intellectual and a political economy perspective as we discuss ahead (Borio & White, 2004)

Therefore, after accounting for the different caveats that economists and policymakers face when implementing macroprudential regulation, at least for the time being, there is a relevant role for monetary policy in leaning against the accumulation of financial imbalances (Freixas et al., 2015). A strong argument that favours this view is provided by Smets (2014) and Brunnermeier & Schnabel (2016) who argue that monetary policy may be to blunt to target specific sectors and this, precisely makes it less subject to the regulatory arbitrage suggested above. This is pertinent since changes in the cost of liquidity as determined by the overnight lending rate, and changes in its availability via open market operations and the level of haircuts imposed by the central bank transfers smoothly to the economy, affecting regulated and shadow banking institutions alike in a contemporaneous way.

However, there are several criticisms of the LAW approach to monetary policy. The first argument against this view, which is also the main argument in favour of the benign neglect view presented in Section 1.2.1, relates to the impossibility central banks face when identifying the appearance of a bubble. It is well established that tightening monetary policy as a reaction to changes in asset prices may put significant downward pressure on economic growth and inflation (Assenmacher-Wesche & Gerlach, 2010). Consequently, there is a strong argument against favouring type I error —acting as if there is a bubble when none is present—, which may be far costlier than exposing the economy to type II errors —assuming there is no bubble when one is in the makings (Freixas et al., 2015).[54]

[54] In our reading of the arguments about the value of attempting to curtail an asset price expansion, we found that the underlying debate is whether the long-run economic effect of a bubble bursting is sufficiently large as to merit reducing the rate of growth. While the authors of the financial cycle literature highlight that the financial recessions are costlier than normal recessions, authors like Posen (2006) suggest that the cost of a bubble bursting is far lower than what is usually assumed. He argues that the real costs spring not from the bubble but from the weakness of the financial sector which should be addressed by regulation and not monetary policy. The difficulty in arriving at a consensus is that we require counterfactual analysis that allows comparing the real cost

In their seminal contributions to the question of whether monetary authorities should target stock market prices, Bernanke & Gertler (1999, 2001) argue against the notion on two accounts. On the one hand, attempting to prick a bubble is risky business as it may, unintentionally, bring about a panic. On the other hand, there is no particular reason why the stock market should be singled out, and in a *reductio ad absurdum* argument, they suggest that by that same logic any shock that alters the natural real rate of interest should be targeted by policymakers. Posen (2006) supports this last argument by indicating that in the same way that monetary policy does not react to developments in any one sector of the economy, it should not react to the misfortunes of a given asset class or subset of borrowers. Even if such a strategy were desirable, Jones (2015) suggests that monetary policy is too blunt a tool to target a single asset class and suggests that any attempt to do so would resemble trying "to perform brain surgery with a sledgehammer" (p.11).

It is worthy to highlight two final criticisms to the LAW approach to monetary policy. On the one hand, Posen (2006) argues that monetary policy toolbox is restricted to open market operations and short-term interest rate movements which are aimed at affecting investors' expectations.[55] He argues that during a mania central banks are hardly the only source of liquidity in the economy and that banks' ability to create money endogenously can fuel a boom even if monetary policy is tight. "If investors believe in supra-normal market returns being available to them, a mere rise in short-term interest rates will only tell them they need to invest more" (p. 114). Smets (2014) advances the argument further and argues that monetary policy tools can only affect the volume of credit, albeit tangentially, and does not affect the composition of loans, thus being unable to affect the risk-taking channel discussed above.

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of a financial recession vis-a-vis what would have happened if the boom in asset prices had been targeted early on. As we have stated elsewhere, this sort of analysis is highly speculative and should not drive policymaking.

[55] Note that the paper was written well before the implementation of the quantitative easing programs of the Bernanke tenure in the Federal Reserve, and he does not account for previous historical examples like the asset purchase performed by the Federal Reserve during between February 24 and July 27, 1932 (Wheelock, 1992).

On the other hand, Borio (2006) suggests that there are substantial political economy implications when following a policy of leaning against the wind. If the primary mandate of a central bank is to keep price stability in the long-run, tightening the monetary policy stance under stable prices may be an untenable policy, even if it may hinder deflationary forces when the imbalances unwind in the future. This may undermine the credibility of the central bank, increase political pressures, and generate time inconsistencies since the time horizons for attaining price and financial stability are different (Smets, 2014).

In the following section, we review the literature on the open macroeconomy trilemma which, as indicated in the introduction, will provide our characterisation of the time-varying institutional framework under which the accumulation and unwinding of financial imbalances occur.

1.3. The Unholy Trinity and Financial Stability: A Theoretical Approach

The restrictions and tradeoffs imposed by the macroeconomic trilemma have commanded the attention of macroeconomists and economic historians for more than half a century. The idea is that of an impossible trinity, as the one presented in Figure 1, that forces authorities to choose two out of three desirable goals: stable exchange rates, free and autonomous monetary policy, and free capital flows (Obstfeld, Shambaugh, & Taylor, 2005).[56] An extensive literature on the trilemma is devoted to testing its validity as a straitjacket that conditions policy for both developed and developing countries. The first formal test of the

[56] A simple thought experiment serves to illustrate why the three goals are simultaneously untenable. Under open capital accounts, if a country wishes to fix its exchange rate, capital inflows (outflows) must be met with decreasing (increasing) interest rates to avoid pressure on the peg. This implies sacrificing monetary autonomy as was the case during the classical gold standard. If a country wishes to gain access to autonomous monetary policy, one option is to close the capital account and thus eliminate the effect of foreign capital inflows/outflows on the exchange rate, as was the case during the Bretton Woods regime. The second alternative is to keep the capital account open and let the currency fluctuate so that the nominal exchange rate becomes the residual of the interaction between capital flows and the monetary policy stance.

trilemma that we know of is provided by Aizenman, Chinn & Ito (2013), who measure and identify the operation of the trilemma expressed as a trade-off between the three desirable policy objectives. They find that the impossible trinity is a tie that binds both developed and developing countries. However, most of the empirical research on the trilemma has been aimed at determining whether under particular choices of exchange rate regimes (FXRs) and capital control regimes (KCRs) monetary policy autonomy is compromised.

In seminal contributions, Obstfeld, Shambaugh & Taylor (2004, 2005) find that both capital controls and the exchange rate regime affect the level of monetary autonomy a country can achieve. They show that while a combination of floating exchange rates and capital controls yields unfettered monetary autonomy, under stable exchange rates and capital controls autonomy seems only partially reduced. In that same direction, Eichengreen & Hausmann (1999) identify that the interplay of exchange rates and capital controls plays a significant role in determining the volume of capital flows and the reaction of interest rates to global conditions. Furthermore, Obstfeld (2015) and Klein & Shambaugh (2015) identify the existence of autonomous monetary policy under scenarios of financial integration under flexible or free-floating exchange rates. However, Klein & Shambaugh (2015) indicate that under fixed exchange rates targeted or temporary capital controls do not offer additional monetary policy autonomy. In that sense, the only capital controls that seem to provide monetary independence in the face of pegs are those that are credible, long-standing and broad-reaching.

On the other hand, several researchers contest the validity of the trilemma in a context of financial integration. Rey (2015) identifies that in a financially integrated world, monetary conditions spread from centre countries to the periphery via gross capital flows and leverage (the global financial cycle) in a way that is unrelated to the exchange rate regime and that renders the trilemma moot by hindering monetary policy autonomy. Passari & Rey (2015) and Obstfeld (2015), nuance these findings and indicate, that while they are correct for long-run interest rates, under floating exchange rates the short-term interest rate of periphery and centre countries seem to be uncorrelated. Furthermore, Aizenman, Chinn & Ito (2016) find that higher levels of trade, financial development, and gross debt increase financial linkages between the core and periphery countries. They show that, under the framework of the trilemma, these financial linkages are affected by the exchange rate regime: countries with greater exchange rate stability tend to be more sensitive to changes in the centre country's monetary policy. Saxena (2008) concurs and shows that as emerging markets move toward more exchange rate flexibility, their interest rates seem to de-link from the US reference rate.

Moreover, Obstfeld, Ostry & Qureshi (2018b) identify the mechanisms that hinder the effectiveness of monetary policy under financial integration. First, since borrowers can substitute domestic loans for foreign credit, the effect of monetary policy on asset prices is curtailed. Second, long-term rates, which are correlated with the global financial cycle, may have a more significant impact on economic variables than short-term rates. Finally, under flexible exchange rates, a currency appreciation may induce borrowing abroad and amplify the boom-bust cycle in assets and credit.[57]

Another important strand of literature links the trilemma to issues of financial stability and financial crises. On the one hand, Bordo & James (2015) identify a second policy trilemma relating financial stability to capital flows and exchange rates. On the other hand, Obstfeld, Shambaugh & Taylor (2010) and Aizenman (2018) link the original trilemma to financial stability directly.[58] This second approach is also followed in other

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[57] It is noteworthy that not all countries appear to be subject to these findings. Obstfeld et al. (2018a) distinguish between emerging market economies (EMEs) and advanced economies (AEs). They find that in EMEs the transmission of global shocks to domestic variables is magnified under fixed exchange rates while flexible exchange rates insulate part of the shocks. Contrarily, identifying the role of the FXR on AEs is challenging for two reasons. First, AEs suffer shocks asymmetrically because they act as safe havens, so even during crises, they receive foreign inflows. Secondly, in their database that starts in 1986, most advanced economies in Europe have fixed exchange rates, reducing variability, and making identification difficult. In this dissertation, we tend to this issue by studying advanced economies from a long-run perspective.

[58] Aizenman (2017, 2018) suggests the existence of a macroeconomic quadrilemma where financial stability is added to the three desirable policy goals. We do not agree with this view since it implies that a country would need to sacrifice financial stability in order to

studies. For example, in the aftermath of the Latin American debt crisis, Diaz-Alejandro (1985) argued that the combination of fixed exchange rates and free capital movement lead to macroeconomic instability, including the explosive growth of external debt. In that same direction, Eichengreen & Portes (1987), found that exchange rate flexibility is better to face crises because it removes constraints on monetary and fiscal policies when capital accounts are open. Bernanke & Gertler (1999) and Bernanke, Gertler & Gilchrist (1999) offer a similar argument. They find that fixed exchange rates are undesirable in the face of financial instability because monetary policy is required to increase interest rates to avoid devaluations. A tighter monetary policy stance may depress asset prices, reduce corporate profits, put undue pressure on bank's balance sheets and slow the expected rate of economic activity. This association, as predicted by the trilemma, seems to be weakened only in the face of strict capital controls or if the international monetary system is cooperatively managed. Later, Bordo et al. (2001) adopt the periodisation of the macroeconomic trilemma since the late 19th century to explain the increasing frequency, albeit not the severity of financial crises. Obstfeld & Taylor (2004) have found in the framework of the impossible trinity a fertile ground to construct a narrative for the evolution of capital markets, financial integration, and crises throughout the long twentieth century and beyond.

In the rest of this section, we will discuss the relationship between the different choices afforded by the trilemma and impending macroeconomic conditions, financial stability, the stock market and credit aggregates. We will omit the question of monetary autonomy as this has been thoroughly addressed in the literature, and only discuss the role of

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gain monetary autonomy or free capital movement or exchange rate stability or that, contrarily, full financial stability can be obtained through some permutation of capital controls, exchange rate flexibility and monetary policy autonomy. Our view is closer to that of the elasticity of the regime in which financial (in)stability is a consequence rather than one of the three classic policy choices. In that sense, financial stability should be thought of as a public good, such as employment, economic growth, or inequality reduction (Shiller, 2012).

the theoretical global financial cycle on different markets and under different choices of exchange rate and capital control regimes.[59]

1.3.1. The Trilemma and the Macroeconomy

In what follows we discuss the literature on the relationship between exchange rate and capital control regimes and macroeconomic fluctuations.

1.3.1.1. Exchange Rate Regime and the Macroeconomy

One of the seminal works trying to find a link between exchange rate regimes and the macroeconomy is Baxter & Stockman (1989). They see no statistically significant differences in the behaviour of macroeconomic aggregates or international trade flows under different exchange rate regimes, except for the volatility of real exchange rates.[60] These findings, among others, led Obstfeld & Rogoff (2000) to identify the high volatility in exchange rates and its apparent disconnect from real economic activity as one of the six major puzzles in international macroeconomics. They argue that the links between the exchange rate and the real economy are apparently solid and still the feedback experienced from short-run volatility is surprisingly weak.[61] They suggest that since most prices for tradable goods are set in local currency, the pass-through of exchange rate shocks is slow and occurs only as exporters and importers adjust their prices to changes in the exchange rate. Thus, it should not be short-run

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[59] As stated in the introduction, the issue of changes in the monetary policy regimes such as granting independence to the central bank, giving monetary authorities a single mandate that focuses on price stability or a dual mandate that includes output growth, or the role of the central bank as a LOLR, are interesting and may provide further insight into the evolution of financial stability. However, these issues do not fit within the trilemma framework which only discusses whether monetary policy is autonomous or not. Consequently, we do not include these different institutional characteristics in the corpus of the dissertation and leave their study for further research.

[60] The definition of the exchange rate regime is contingent on the study. The most granular characterisation we have found is the one offered by Ilzetzki, Reinhart & Rogoff (2017), who distinguish 15 different exchange rate arrangements that range from the currency union (without a national legal tender) to the free-falling exchange rate.

[61] Asici (2011), also posits the relevance of the exchange rate regime as it is both endogenous to the system and the stage where real and nominal shocks interact with macroeconomic policies.

volatility but long-run trends which would affect general economic conditions. More findings in this direction include a series of papers by Rose (2011, 2014) where he finds that even though the exchange rate may be the most crucial asset price in an economy, the choice of FXR seems to bear little effect on macroeconomic outcomes, particularly growth and inflation. He indicates that macroeconomic and financial consequences under fixed exchange rates or flexible rates combined with inflation targeting are surprisingly similar.

However, this literature is not all about negative results. Aizenman, Chin & Ito (2010), indicate that greater exchange rate stability is associated with higher output volatility and lower inflation, mainly if financial development is at an intermediate stage. They also suggest that volatility in output can be contained when the country accumulates international reserves. Further findings are offered by Levy-Yeyati & Sturzenegger (2003), who use a wide panel of countries since the end of the Bretton Woods period and separate the results between developed and developing countries. They find that for developed countries there appears to be no link, while for developing countries fixed exchange rates seem to be associated with slower growth. They suggest that neither speculative attacks against the currency nor the credibility of the peg seem to be relevant in explaining their results and revert to the increased output volatility found by Baxter & Stockman. They conclude suggesting that "for a given distribution of shocks, fixed regimes display a higher output response due to the prevalence of quantity adjustments in the presence of limited nominal flexibility". (p. 1188)

1.3.1.2. Capital Control Regime and the Macroeconomy

Regarding the link between capital controls and the macroeconomy, the literature offers several stylized facts. Eichengreen & Rose (2014), indicate that KCRs are highly durable, much more so than FXRs. They find that they are not adjusted or removed as a function of economic growth, inflation, terms of trade, domestic credit nor after the effect of financial crises. Instead, much like the restrictive trade policy regimes, capital controls are relaxed and removed as a function of a country's development. Grilli & Milesi-Ferreti (1995) indicate that capital controls are more likely when national income is low, the share of government participation in the economy is significant, there are current account imbalances, and the exchange rate is managed. Additionally, Miniane (2004) and Eichengreen & Rose (2014) indicate that enforceability is crucial and, for capital controls to function correctly, a sizeable bureaucratic apparatus is required.[62]

In studies that investigate causality between capital controls and the real economy, Mathieson & Rojas-Suarez (1992), and King & Levine (1993) show that financial openness is consistent with economic growth as they increase allocative efficiency. In that sense, policies that alter the efficiency of the financial system in allocating resources may impinge negatively on growth. Quinn & Toyoda (2008) concur, indicating that those findings apply to both developing and industrial countries.

On the other hand, Klein & Olivei (2008) find that the positive link between liberalisation and economic growth is mostly driven by developed economies while developing countries seem not to benefit from liberalised capital accounts. By the same token, Grilli & Milesi-Ferreti (1995) find that controls coincide with higher inflation and lower interest rates. Additionally, both Henry (2003) and Quinn & Toyoda (2008) find that stock market liberalisation has an independent positive effect on economic growth.

However, financial openness is not necessarily good *per se.* A whole new branch of literature on capital controls refers to them as prudential measures. Instead of treating them as yes or no values where the capital account is either fully open or fully closed, it nuances capital controls and

[62] Regarding the motives to impose capital controls, Mathieson & Rojas-Suarez (1992), offer several possibilities. First, avoiding volatile short-term flows. Second, to avoid the outflow of domestic saving. Third, to allow for the implementation of structural reform programs in an environment of reduced external shocks. Finally, capital controls serve to stabilise the domestic tax base. Grilli & Milesi-Ferreti (1995) argue that capital controls serve as a measure of financial repression that allows governments to reduce the real interest rate. They also highlight that the incentive a government has to implement controls is inversely related to the level of independence the central bank enjoys. Finally, Eichengreen & Wypolsz (1993) indicate that taxes on foreign exchange transactions, a form of controls, may serve to mitigate self-fulfilling currency crises like the one suffered by the European Monetary System (EMS).

uses them as a stabilisation measure. For example, Farhi & Werning (2014), present capital controls not as a gate which is to be fully opened or closed, but rather as a continuum that can be exploited countercyclically. They suggest that in the face of excessive growth in inflows, taxes can be levied to mitigate the entrance of capitals and, during a sudden reversal, subsidies can be provided to halt or even reverse outflows. This new literature is close to the "walls and gates" of which Klein & Shambaugh (2015) offer an excellent summary. Heathcote & Perri (2016), use a two-country model to show that under certain specific conditions individual and competitive capital controls can be welfare improving via positive effects on the international interest rate, terms of trade, and international risk sharing.

1.3.2. The Trilemma and Financial Stability

In what follows we discuss the literature on the link between exchange rate and capital control regimes and financial stability.

1.3.2.1. Exchange Rate Regimes and Financial Stability

In a first approach to identifying the linkages between exchange rate regimes and financial stability, Eichengreen and Hausmann (1999), discuss three mechanisms at play. First, they describe moral hazard: as pegs serve as insurance against exchange rate risk, they increase unhedged foreign borrowing.[63] Additionally, since the commitment to a peg is more credible in the short-run, fixed exchange rates also skew financial flows toward shorter maturities exposing firms to increased maturity mismatches. The second mechanism is the original sin, where countries are unable to borrow abroad in domestic currency or to longer horizons. In this case, both defending the peg or allowing the exchange rate to float come with a cost. On the one hand, a depreciation of the national currency leads to an increased cost of foreign debt in local currency. On the other hand, a relentless defence of the peg by raising interest rates increases non-performing short-term loans. In both cases, corporate bankruptcies ensue, and the banking system may be exposed to high-stress conditions. Finally, they argue that since financial contracts are intertemporal transactions,

[63] Bordo et al. (2001) coincide with these findings.

they require both enforceability and commitment to operate smoothly. Consequently, countries with shallow and fragile markets, where enforcement is difficult, need strong central banks, able to act diligently as LOLRs.

This is an issue of high contention in the literature. On the one hand, Almunia et al. (2010) argue that central banks under flexible exchange rates and open capital accounts have the means to act aggressively in the face of shocks while fixed exchange rates curtail their LOLR capacities. Conversely, Domac & Martinez (2003) and Eichengreen & Hausmann (1999), indicate that LOLR capacities under flexible exchange rates may increase moral hazards as they offer an implicit bail-out clause to irresponsible bankers. Additionally, Eichengreen and Rose (2004) argue that fixed exchange rates should foster financial stability as they discipline policymakers by discouraging erratic policies. We expect that the variability in these findings is due to the choice of countries and period.

Generally, studies linking FXRs with financial stability tend to focus on the effect of pegged exchange rates. From a broad perspective, Asici (2011) proposes that if the fixed exchange rate regime is inconsistent with the current structural, political, and financial features of the country, it may lead to consumption booms as investors seek to purchase assets while they are cheap, just before the peg fails. Furthermore, Fornaro (2015) indicates that, under a peg, financial crises have the most substantial adverse effects on output and consumption. Bordo & James (2015), concur and highlight that the most damaging episodes of capital inflows have occurred under fixed exchange rates. They argue that flexible exchange rates provide a self-stabilising mechanism which mitigates the harmful effects of excessive capital flows as they lead to currency appreciation, reduce both competitiveness and trade and, consequently, reduce the attractiveness of new inflows.

Additionally, Kindleberger & Aliber (2005) indicate that the credibility of the peg is crucial when a country is confronted with a sudden stop in capital flows. If the peg is credible, an increase in the interest rate may cause investors to bring funds into the country. However, if the peg is not credible, it is possible that an increase in the interest rate may be met with further fund outflows. In their seminal study of exchange rate regimes since the late 19th century, Bordo & Schwartz (1999), indicate that the most credible pegs occurred during the classical gold standard. During the period, convertibility into gold at a fixed parity provided a nominal anchor to the currency but came at the expense of exposure to foreign shocks via the balance of payments. Bordo et al. (2001), find that credibility of pegs has diminished substantially after 1913, partly because of increased capital flows and partly because of the democratisation process that has led interest groups to demand monetary policy to focus on domestic issues.

In an interesting discussion, Ghosh, Ostry & Qureshi (2015), aim to determine whether the poles in the exchange rate regime continuum are safer than the middle ground, as generally found in the literature. Using a database for 50 EMEs from 1980-2011, they test the behaviour of macroeconomic and financial vulnerabilities under different regimes and find that instability is greater under less flexible regimes. They conclude that the apparent safety of the hard peg, even when credible, may be mostly illusory regarding growth. While it may be true that banking or currency crises do not usually materialise under fixed exchange rate regimes, the authors provide evidence of strong output reductions which they refer to as growth crises. Conversely, the free-floating exchange rate appears to be the least crises prone of all regimes.

Regarding the middle ground, they find that the managed float is as safe as a floating regime if the central bank intervenes to limit overvaluation and avoids defending overvalued exchange rates. Menna & Tobal (2018) nuance these findings by indicating the flexible exchange rates act as shock absorbers and allow to reduce the welfare cost of an exogenous crisis to zero. However, if the crisis is endogenous, as in the global financial cycle proposed by Rey (2015), then the policymaker cannot reduce the welfare cost to zero and will require additional tools, such as capital controls.

1.3.2.2. Capital Control Regimes and Financial Stability

Regarding capital controls and financial stability, Reinhart & Rogoff (2013) mention the existence of a regulatory cycle in which, as the lessons of the previous crisis are forgotten, relaxation of restrictions occurs, which sets the stage for the new accumulation of imbalances. As the crisis ensues, the pendulum turns back to regulation and financial repression of which capital controls is just one manifestation. This regulatory cycle is apparent in the literature. On the side of financial repression, Reinhart & Rogoff (2009a) and Jordà, Schularick & Taylor (2011), using a database for banking crises, indicate that the prevalence of crises was reduced during periods of stringent capital controls such as the Bretton Woods period. However, in transitioning to financial openness, Claessens & Kose (2013) indicate that financial crises often follow capital inflow expansions after poorly sequenced liberalisations of the capital account. Freixas et al., (2015) concur, indicating that two of the more relevant reasons for the recent increase in global systemic risk has been the liberalisation of the capital account and financial market reform. Finally, Alberola, Erce & Serena (2015) find that capital controls have occasionally been used during expansive economic phases to prevent credit booms and financial instability.

Regarding currency crises specifically, Grilli & Milesi-Ferreti (1995) indicate that in the presence of fixed exchange rates, free capital flows can lead to high volatility in both foreign exchange reserves and interest rates which can hinder the stability of the peg. Additionally, Bordo, Meissner & Stuckler (2010) indicate that currency crises occur under capital account openness due to capital flow reversals or sudden stops. These harmful events are also likelier if there are high levels of foreign currency denominated debt and low levels of international reserves. If investors expect that the foreign currency debt will not be repaid, then the speculative attack against the currency may lead to a liquidity crisis and a self-fulfilling credit crunch.

Further arguments for the stabilising role of capital controls are provided by Brunnermeir & Sannikov (2015) who show that under incomplete markets and imperfect trade, capital controls can be welfare enhancing. They argue that controls may mitigate the financial instability that arises from excessive exposure to short-term foreign currency denominated debt. In a relevant qualification of these results, Menna &

Tobal (2018) indicate that the effect of foreign capital flows on domestic credit is asymmetric between AEs and EMEs. The latter usually have less developed financial systems and are more reliant on foreign credit thus facing increased exposure to sudden stops. They indicate that EMEs could probably use capital controls to mitigate external shocks. Finally, Jeanne & Korinek (2010) and Korinek (2011) indicate that Pigouvian taxes on excessively risky financial instruments, like short-term foreign currency debt, may be welfare enhancing as they mitigate financial fragility. However, they find no reason beyond prudential motives, to impose capital controls and thus argue that it would be difficult to justify fully closed capital accounts.

1.3.3. The Trilemma and the Financial Cycle

In this section, we focus on the literature that links exchange rate and capital regimes with the proxy variables for the financial cycle: stock markets and credit aggregates

1.3.3.1. Exchange Rate Regimes and Stock Markets

Regarding the links between the exchange rate regime and the stock market, Dornbusch and Fischer (1980) indicate, using a flow perspective, that changes in the exchange rate affect the competitiveness and expected future cash flows of companies, which in turn affect their valuations. A second effect runs through the current account position which plays a role in asset accumulation for firms. From an equilibrium perspective, usually termed the Portfolio Balance Literature (PBL), Branson (1983) and Frankel (1983), indicate that the exchange rate is the residual after clearing the supply and demand for assets. Since in the discounted cash-flow asset-pricing model, both the expectation about changes in the value of the currency and about the future performance of the company play a role, the authors offer a feedback mechanism between stock markets and exchange rates. Additionally, Gavin (1989) indicates that the stock market does play a role in the evolution of output, profitability, aggregate demand, and finally on the foreign exchange market through wealth and liquidity channels.

The empirical studies on the link between stock and foreign exchange markets can be broken down into three different branches. A first family of models studies the direct links between the exchange rate and the stock market in a given country or panel of countries. A second family of models, tests for the existence of a global financial cycle as an underlying driver for stock markets, exchange rates or both. A final family of empirical papers studies the direction of causality between exchange rates and stock markets.

Family 1: Links Between Exchange Rates and Stock Markets

Four long-run studies find a connection between stock markets and exchange rates. First, Bordo & Wheelock (2009), using a panel of ten countries since the interwar years, find that capital controls, exchange rates regimes, and financial regulations affect the links between domestic economic performance and stock markets. Secondly, Hau & Rey (2006), use data for several OECD countries from 1980 until 2001 to build a dynamic portfolio choice model where exchange rates and stock prices interact. They find that since the share of any given stock market in a global portfolio varies with the value of the index, maintaining constant country and currency exposure requires positive returns of an index to be met with sales of that asset to purchase shares from the other components of the portfolio. This result contradicts the theory that strong stock markets coincide with strong currencies. A third study by Martin, Schuknecht & Vansteenkiste (2007), using an unbalanced panel of industrialised and developing countries from 1984 until 2006, finds that the countries that have fixed exchange rates experienced less pronounced booms and busts than their counterparts. For these countries, both the unwinding of imbalances and the recovery from shocks are slower than for countries with flexible exchange rates. Finally, Bahmani-Oskooee & Saha (2016), using an unbalanced panel of monthly data for nine countries from 1980 until 2014, indicate that the effect of exchange rate variation in the stock market is uncertain given that it affects import and export-oriented firms in opposite directions. They find exchange rates have asymmetric effects on the stock market both in the short and long-run.

Two short-run, geographically-restricted studies find conflicting results. On the one hand, Smith (1992), using quarterly data from 1974-88, finds that the German and Japanese stock market indices play a role in explaining the exchange rate against the US dollar. Excluding the stock market from the analysis leads to omitted variable bias. On the other hand, Nieh and Lee (2001), who using daily data covering from October 1993 until February 1996, found no significant long-run relationship, nor predictive capacity, between stock prices and exchange rates in the G-7 countries.

Two final studies focus on the market microstructure of the stock market and its relationship to the exchange rate. First, Jorion (1990), using a database that covers the period 1971-87, finds a different effect of the exchange rate on the stock price of domestic companies and those that operate internationally. Second, Morley (2002) investigates the relationship between stock markets and exchange rates in Germany, France, Italy the Netherlands, and the UK for the 1980s and 1990s by focusing on the difference between bank-based and market-based systems. He finds a stable short-run relationship between exchange rates and the stock market for the UK and the Netherlands (market-based systems), while there is less evidence for France and Germany (bank-based systems). Finally, he finds that deregulation has strengthened the relationship in all cases.

Family 2: The Global Financial Cycle as a Common Driver

A second family of models tests for the existence of a global financial cycle as an underlying driver for stock markets, exchange rates or both. Phylaktis & Ravazzolo (2005) study the link between exchange rates and stock markets in five Pacific basin countries between 1980 and 1998. They find a link that runs through the US stock market, probably via increases in international trade on the one hand and through the creation of country funds that allow the investment on otherwise restricted markets on the other. Pavlova & Rigobon (2007), build an international asset pricing model where they include demand shocks. They find that the same latent factor drives both stock and foreign exchange markets, associated to the international discount factor and the relative prices of goods and that the link between exchange rates and stock markets will be positive or negative depending on whether there is a supply or demand shock. In that same line, Aizenman, Chinn & Ito (2016), find that countries with higher exchange rate stability experience lower co-movement between its stock market and that of the centre countries. The mechanism they identify is that a shock in a country with flexible exchange rates may lead investors to concentrate their holdings in countries with stable exchange rates to hedge against the shock. Regarding extreme cases, Ning (2010) finds both upper and lower tail co-movement between exchange rates and stock markets for the US, the UK, France, Germany, and Japan.

Family 3: The Direction of Causality

A final family of empirical papers studies the direction of causality between exchange rates and stock markets. Zhao (2010) finds that even if there is no linear relationship between stock market prices and the exchange rate for China, there is a bidirectional volatility spillover between both markets. Two studies, Kollias, Mylonidis & Paleologou (2012) and Tsagkanos & Siriopoulos (2013), test the relationship between the euro-dollar and a basket of European stocks between 2002-10 and 2003-12 respectively. They find that the direction of causality is time variant. While in tranquil periods causality runs from the exchange rate to the stock market, in crises periods, causality is reversed. Kollias et al., (2012) find that causality in either direction only holds in the short-run, while Tsagkanos & Sriopoulos (2013) find that the relationship holds in the long-run.

1.3.3.2. Capital Control Regimes and Stock Markets

Regarding the link between capital account openness and the stock market, Bordo & Wheelock (2006, 2009), find that capital control policies influence the relationship between domestic economic performance and the evolution of the stock market. For a sample of developed countries, periods of open capital accounts and international capital integration are usually associated with stock market booms. Additionally, several studies discuss the effect of stock market liberalisation, a process by which foreign investors are allowed to purchase shares in the domestic stock market.

On the one hand, Levine & Zervos (1998), identify that emerging countries' stock markets tend to become more liquid, larger, more volatile, and more integrated after liberalisation. They tie their results with the finance and growth literature which highlights that more liquid stock markets tend to foster economic growth and risk sharing. On the other hand, Henry (2000a, 2000b), finds that the announcement of liberalisation measures cause abnormal increases in equity prices during the eight months before implementation. Additionally, he finds that the growth rate of investment increases above the non-liberalization median for up to three years after the liberalisation occurs. He argues that the mechanisms run via a reduction in the equity premium, a possible decrease in the risk-free rate and an increase in the viable investment projects caused by the reduction in the hurdle rate.

Three recent case studies focus on the effect of capital controls on the stock market during specific time periods. First, Forbes, Fratzscher, Kostka, & Straub (2016), find that the implementation of capital controls in Brazil during 2006-13 caused foreign investors to shift their portfolio composition, reducing the share of Brazilian stocks and bonds an increasing exposure in other developing countries that they did not expect to implement controls. They argue the effect runs through a signalling process in which investor's expectations about future developments are altered. Secondly, Gillas, Tsagkanos & Siriopoulos (2016), focus on the Athens Stock Exchange after the imposition of harsh and sudden capital controls in July 2015. They find that this event increased the undiversifiable risk in the stock market and reduced the profit prospects of investors. Finally, Graham, Peltomäki & Sturludóttir (2015), find that there is an inverse relationship between time-varying global market integration and weak form informational efficiency of stock markets for Nordic countries. The imposition of capital controls in Iceland after the GFC seems to have improved the stock market's efficiency.

1.3.3.3. Exchange Rate Regimes and Credit Aggregates

Regarding the links between exchange rates and credit, Eichengreen & Rose (2004), in a panel of over 100 countries from 1975-92 and Eichengreen & Arteta (2002), using a panel of 75 countries over 1975-97, find that banking crises in emerging markets seem to be uncorrelated with the exchange rate regime in place. Contrarily, Domac & Martinez (2003) using a comprehensive dataset of banking crises both in industrial and emerging markets for the period 1980-97, find that exchange rate stability is associated with less banking crises in developing countries. They also find that lack of exchange rate flexibility seems to increase the cost of crises either because credit-fueled consumption booms suddenly fail when the economy slows down, or because of the impossibility of injecting capital to the financial system during the crises given the restrictions imposed by the fixed exchange rate.

Regarding the evolution of borrowing from abroad, Bordo, Meissner & Stuckler (2010), using a database of 45 countries since 1973 until 2003, identify that fixed exchange rates allow for increased foreign borrowing as suggested by the original sin literature discussed above. Claessens and Kose (2013) concur and indicate that this policy generates dependency of firms on stable exchange rates. However, Dell'Ariccia et al. (2013) find that credit booms seem to occur more often in countries with fixed exchange rates since monetary policy must be aimed at maintaining the peg and thus cannot effectively react to the boom.

Concerning domestic borrowing, Boudias (2015), study the role of the exchange rate regime on credit dynamics for emerging market economies from 1980 until 2012. They find that countries with fixed exchange rates experience higher credit expansions during normal periods, but the relation reverses during outflows, where exchange rate rigidity coincides with stronger restrictions to credit. They also find that during normal periods higher fixity in the exchange rate equates to higher liability dollarisation as suggested by the moral hazard hypothesis. Other studies, like Magud, Reinhart & Vesperoni (2014) (MRV) and Magud & Vesperoni (2015) (MV), focus on extreme cases of capital inflow booms and sudden stops. On the one hand, MRV uses an unbalanced panel of emerging markets from 1990 until 2008 and finds that, during capital inflow bonanzas, fixed exchange rates accelerate domestic credit growth while exchange rate flexibility negatively affects the credit to GDP ratio. They add that in scenarios of robust economic growth, inflation compresses real interest rates, and encourages further expansions in domestic credit. On the other hand, MV find that during sudden stops, credit contracts less under flexible exchange rates but recovery remains anaemic after the shock.

Conversely, under fixed exchange rates the contraction in credit during the shock is substantial, but recovery is quick. MRV suggest two possible mechanisms for their findings. First, under fixed exchange rates, the sterilisation of foreign inflows by the central bank is usually incomplete which may lead to a bank intermediation channel. A second mechanism they posit is that the credit multiplier may be more significant in economies with fixed exchange rates, which would be consistent with exchange rate risk guarantee implicit in the peg.

Finally, regarding the existence of a global factor Passari & Rey (2015), find that domestic credit growth, as the stock market, is negatively correlated with the VIX in all periods except during the GFC. While for Passari & Rey this relationship seems to hold regardless of the exchange rate regime in place, Obstfeld et al. (2018b) find that banking leverage is more sensitive to the global cycle under fixed exchange rate regimes for EMEs.

1.3.3.4. Capital Control Regimes and Credit Aggregates

While the literature on capital controls and credit is scarce, the literature on capital flows (namely in liberalised contexts) and credit is rich. Lane & McQuade (2014) (LM) highlight several links through which capital flows, particularly after liberalisation, can affect domestic credit. First, they indicate that current account imbalances can affect the rate of output growth, domestic spending, exchange rates, inflation an asset prices, all channels that transfer directly to the level of domestic credit. Jordà, Schularick & Taylor (2011) find that this link between current account imbalances and domestic credit has become particularly relevant since the mid-1970s.

Additionally, LM highlight that the transmission channels can also exist when the current account is balanced. They show, in line with Borio, James & Shin (2014) and Borio (2016), that gross international capital flows can affect financing conditions faced by domestic banks and firms as well as the availability of assets for investment under balanced current accounts. Consequently, all these papers suggest that the net current account may be a misleading indicator in trying to understand the link between capital flows and credit.

Dell'Ariccia et al., (2013) indicate that, in a financially integrated world, domestic banks can search for funds from foreign depositors and creditors, while firms can access funds from offices abroad and international investors through the bond market. These mechanisms explain why they find that massive capital inflows, usually after deregulation, are associated with increased funds available for banks and general relaxation in credit constraints. Additionally, Menna & Tobal (2018) suggest as Rey (2015) that global financial conditions affect domestic financial variables via capital flows even in the context of flexible exchange rates. This exposure to the global cycle, they argue, leads to excessive credit growth during the upturn phase and massive deleveraging during the downturn. Of course, it follows that these channels should become inoperative in the presence of controls.

1.4. The Trilemma in History: Policy Regimes Since the Interwar Years

"No policy regime in history has simultaneously achieved sustained monetary and financial stability. The search for adequate anchors in the monetary and financial spheres has proved elusive" (Borio, 2014a, p. 7)

The primary goal of this section is to present an account of the most critical developments in the evolution of exchange rate arrangements and capital control regimes, in a historical perspective, since the end of the First World War until present. The most important takeaway is already stated in the opening quote, the idea of a coincidence between price and financial stability is a fallacy with little to none historical evidence to back it.

The classical gold standard, which had operated consistently since the early 1870s, collapsed with the beginning of the Great War in 1914 (Bordo & Schwartz, 1999). However, the gold standard of the late 19th century was not a gold-coin standard, as in the modern era, where gold pieces circulated as a means of payment. Instead, organisational adjustments and international arrangements allowed for governments and central banks to concentrate the gold stock in vaults and demand that, to exercise convertibility, a minimum amount of currency had to be presented. This came to be known as the gold-bullion standard. Still, the real costs of mining and transporting gold, as well as the decreasing availability of new reserves in the context of booming economies required governments to supplement their gold holdings with convertible currency, usually pounds or dollars. This came to be known as the gold-exchange standard and was the ultimate form of the classical gold standard before its demise. This structure of operation would also be the institutional framework to which many countries would aim to return after the conflict was over (Eichengreen & Sussman, 2000).

It was during the classical gold standard era when price stability and financial stability were closest since the price of gold served as a nominal anchor to prices, even without a stated inflation target, and the convertibility constraint, which was clear, visible, and binding for all, curtailed financial expansion, at least during normal times (Borio & Lowe, 2002; Borio, 2014a). This is not to say that there was a complete absence of financial crises (1873, 1893, and 1907 come to mind). However, according to Bordo et al. (2001), out of all the monetary policy regimes from the 1870s until the present, this was the period where financial crises were less frequent. Since the financial system was deregulated, waves of endogenous credit expansion brought instability to the system (Borio & Lowe, 2002). Whenever a crisis ensued, convertibility to gold was suspended as part of the rules of the game. However unstated, it was clear that countries would return to convertibility once the waters were calm, imbalances in domestic and foreign accounts were resolved, and a sense of normalcy returned to investor behaviour (Bordo & Rockoff, 1996).

For individual countries, partaking in the classical gold standard was tantamount to a hard peg which, under open capital accounts, restricted the autonomy of monetary policy. For these countries, the level of the nominal interest rate was just the residual that came from the interaction of capital flows and the maintenance of a fixed parity to gold (Borio & Lowe, 2002).

At the centre of the system before the advent of the First World War was Britain, which followed a domestic policy that fostered countercyclical capital flows and stabilised the system. When the British economy slowed down, given a constant supply of high-powered money, interest rates fell, foreign investment became more attractive and thus through commodity imports and capital exports gold would flow towards the rest of the world. This trade deficit would allow other countries to follow export-led growth (Eichengreen & Portes, 1987; Eichengreen & Sussman, 2000). Then, lightning struck, and the Great War unfolded.

1.4.1. The Interwar Years (1919-44)

The interwar period, in stark contrast with the classical gold standard, is a period of extreme price and financial instability brought upon developed economies by the First World War and the failed policy responses to its monetary and economic consequences.

A first significant outcome of the First World War was a strong entanglement of debts between allied countries. Following Neal (2015), the US was a creditor to several allied countries like Britain ($4.7bn) and France ($4.0bn). At the same time, both Britain and France lent $3.2 and $3.5 billion to Tsarist Russia respectively, and France borrowed $3.5bn from Britain. As the Bolshevik revolution took place in 1917, Russia reneged its debts to the allied powers. By the end of the war, the UK suggested they would be willing to forgive what was owed to them if the US would return in kind, but the latter refused. This left France with two large creditors and only whatever reparations it could extract from the Germans as a means to honour its debt. This would cause a dramatic shift in the source and direction of capital flows, as we will discuss ahead.

According to Cendejas et al. (2017), the effects of the war were asymmetric. Even though non-neutral countries suffered dramatic output losses, among the combatants, the central powers were worse off than the allied powers.[64] In contrast, the neutral countries (Nordic countries, Switzerland and the Netherlands) experienced faster growth. As a case in point, Switzerland developed their machine tool, energy and financial sectors as they quickly transitioned into the second industrial revolution. Once the war was over, recovery policies, focused on investment in modern technology fostered a full-speed industrialisation process across Europe.

As a consequence of the destruction of physical capital, the accumulated debts and the enormous fiscal burden of the war effort, the recovery across combatants and neutrals was not uniform, which in turn prevented the return to the antebellum normality of 1914. France, Belgium and the central powers were capital-hungry as they experienced most of the destruction. Still, their level of domestic saving was insufficient to cover their investment needs (Accominotti & Eichengreen, 2016). Even though the Great War was mostly a European affair, capital demands and indebtedness in Latin America also increased because of policies targeting a quick industrialisation objective which required massive investment (Eichengreen & Portes, 1987).

The combination of low stocks of domestic savings and increasing investment needs in continental Europe and Latin America meant that capital had to come from abroad, and since Britain's investment income dropped dramatically after the war, it was the United States who took on the role of the new world's creditor after the conflict. Although the story of the ascent of the United States as an industrial power well exceeds the scope of this narrative, we know that both resource abundance and exploitation played a significant role (Wright, 1990). Two additional characteristics allowed the US to become the centre of international finance. First was the fact that during the conflict the US' physical capital remained untouched allowing both investment and savings to thrive (Accominotti & Eichengreen, 2016). In second place, the US never abandoned the gold standard during the war, but rather increased its

[64] An exception has to be made for the UK, which was gravely affected by the dislocation of international markets.

accumulated gold stocks with the ever-mounting payments for supplies they received from the allied nations (Neal, 2015).

However, the Fed was not willing (or knowledgeable enough) to run a countercyclical policy and, as the economy was booming in 1924 and 1927, it relaxed even further the monetary policy stance. This was also true in the case of credit, where the Fed allowed banks to issue as much credit as necessary if it was restricted to productive uses, following what Bordo & Schwartz (1999) refer to as a "procyclical needs-of-trade doctrine". This meant that the US did not run the required import surplus (or capital account deficit) to warrant the stability of a new gold standard (Eichengreen & Portes, 1987; Eichengreen & Sussman, 2000).[65]

Still, the underlying threats to financial stability fostered by the Fed's policy were unforeseeable by the end of the war. At the time, all policymakers knew and cared about was that under the *antebellum* monetary arrangement, economies had boomed and trade had blossomed. Consequently, the Financial Commission of the League of Nations organised a conference in Brussels in 1920 to set the basis for restoring the system of fixed exchange rates and currency convertibility into gold. Increased demands for social spending after the war and the complexities behind resolving the reparations to the victors of the war, as we will discuss ahead, made the conference unsuccessful, and it was reconvened in Genoa from April 10 to May 19, 1922 (Neal, 2015). During this conference, the Financial Commission suggested a return to the gold exchange standard as described above, where reserves could be accumulated in bullion, or convertible currencies such as the British pound or the US dollar (Bordo & Schwartz, 1999).

The main issue at the time was how to determine the level at which exchange rates should be stabilised, a difficult question that originated heated debates, particularly in the United Kingdom (Eichengreen & Portes, 1987).[66] Eichengreen & Sussman (2000) argue that partly because of

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[65] The case during the Great Depression was even worst since the Fed kept a tight monetary policy for too long causing merchandise imports and capital outflows to collapse at the same time (Eichengreen & Sussman, 2000).

[66] In his 1931 *Essays in Persuasion*, in the section on The Return to the Gold Standard, Keynes wrote

this conference, the share of foreign exchange kept as reserves increased from 20% before the beginning of the war up to 40% by the end of the 1920s. A final recommendation that resulted from the conference was that the new countries, created after the conflict, the successor states, should institute central banks of issue with the monopoly over the national currency, with the goal of entering the scheme of fixed exchange rates under the new gold exchange standard (Neal, 2015).[67]

Since the end of the war and well into 1922, the Weimar Republic was unable to implement a robust, nation-wide tax structure, control inflation, or foster economic recovery. This meant that, even though the reparations had been halved from 226 to 132 billion gold marks by the Reparations Commission in 1921, Germany remained delinquent in its obligations. The problem was that reparations were the only source of income France could tap to pay its obligations to the United Kingdom and the United States. This explains why, in early 1923, they invaded the German Ruhr, an industrial area located in the west of the country (Neal, 2015).

> *"Those who advocate the return to a gold standard do not always appreciate along what different lines our actual practice has been drifting. If we restore the gold standard, are we to return also to the pre-war conceptions of bank-rate, allowing the tides of gold to play what tricks they like with the internal price level, and abandoning the attempt to moderate the disastrous influence of the credit-cycle on the stability of prices and employment? Or are we to continue and develop the experimental innovations of our present policy, ignoring the "bank ratio" and, if necessary, allowing unmoved a piling up of gold reserves far beyond our requirements or their depletion far below them? In truth, the gold standard is already a barbarous relic."*

The full text can be found in https://gutenberg.ca/ebooks/keynes-essaysinpersuasion/keynes-essaysinpersuasion-00-h.html#Alternative_Aims

[67] Two other relevant shifts to the financial system increased its vulnerability to shocks. On the one hand, the successor states saw the appearance of investment and industrial banks whose goal was to finance reconstruction, while Latin American and Anglo-Saxon banks focused on retail deposits and short-term loans to industry (Eichengreen & Portes, 1987). On the other hand, firms postponed the issue of bonds to finance their investment needs with the expectation of a reduction of yields as financial conditions returned to normalcy. This led to the increased use of short-run bank loans while inexpensive debentures could be issued. In the case of Germany, where bank capital had been depleted due to hyperinflation, banks insisted on extending loans on a thin capital basis with the expectation of Reichsbank would act as a LOLR if need be (Borio, James & Shin, 2014).

The beginning of a resolution for the issue came with the establishment of the Dawes plan in 1924 (Kindleberger & Aliber, 2005). Under this plan, the Reichsbank would be reorganised under allied supervision, and then a loan of 800 million gold marks (200 million US dollars) would be extended to Germany so that payments could be reestablished.[68] An additional part of the plan was the establishment of the German mark's convertibility into gold, making Germany the third country to return to the gold exchange standard after Latvia (August 1922) and Sweden (April 1924) (Bernanke & James, 1991; Neal, 2015). The UK followed suit in April 1925 and established convertibility at the prewar parity of $4.86, which was overvalued between 5 and 15% (Bordo & Schwartz, 1999). France, on the other hand, returned to the gold exchange standard in 1926 at a devalued parity when compared to the prewar level (Neal, 2015).[69]

The *en masse* return to convertibility and the establishment of the renewed gold exchange standard coincided with what Neal (2015) refers to as "the five good years" (1924-28). This was a period of expanding international trade and increased prosperity where the new countries that arose after the Great War were able to access international capital markets in London and New York. The sense of generalised optimism reflected in the culture and consumerism of the "Roaring Twenties", and ignited stock market booms in several countries.[70] However, countries learnt that

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[68] The new director of the Reichsbank was Hjalmar Schacht, who had contact with JP Morgan, the US banker, and Montagu Norman, the Governor of the Bank of England (1920-44) (Neal, 2015).

[69] Following Bernanke & James (1991), the countries in our database returned to the gold exchange standard as follows: Australia: April 1925; Canada: July 1926; Denmark: January 1927; France: August 1926 (peg) and July 1928 (full convertibility); Germany: September 1924; Italy: December 1927; Japan: December 1930; the Netherlands: April 1925; Norway: May 1928; Sweden: April 1924; United Kingdom: April / May 1925. Neither Switzerland nor the United States left the gold standard during the Great War.

[70] Australia: December 1920 – February 1929; Canada: December 1920 – September 1929; France: November 1920 – July 1924 and November 1926 – February 1929; Netherlands: July 1924 – February 1929; Sweden: May 1922 – July 1929; United States: October 1923 – September 1929 (Bordo & Wheelock, 2006, Table 1). It is important to note whenever we cite this source that to our knowledge there is no single source that presents a similar monthly dating of stock market busts for the whole twentieth century. One of the relevant contribution of this dissertation is to present a coherent dating for expansions

returning to convertibility as in the pre-war gold standard was only half the story since the choice of the peg's level was also of paramount importance for both economic and stock market developments.

The contrasting situation between France and the United Kingdom is illuminating. While the undervalued French franc attracted flows from abroad, the overvalued British pound caused capital outflows. This reflected directly on the performance of their stock markets: while between the time when convertibility was re-established and following peak the nominal French index rose at an average 40% compounded annual growth rate (CAGR), the British index growth at a modest 7.4% CAGR (Bordo & Wheelock, 2009). Additionally, this caused an adjustment problem: while the constant gold outflows from the UK generated deflationary pressures, the gold inflows to the US and France were sterilized by the Fed and the Banque de France, preventing the expansion of the monetary base and preventing Hume's price-specie mechanism to work (Bordo & Schwartz, 1999; Eichengreen, 2008).[71]

This maladjustment brought about a shortage of monetary gold and consequently shifted the system towards accumulating reserves in either dollars or pounds, which made it even more vulnerable to shocks and attacks on the peg of either currency (Eichengreen & Portes, 1987; Bordo & Schwartz, 1999). A final issue related to credibility since the emergence of labour parties and increasing social demands made deflationary pressures

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and contractions in stock markets and credit aggregates for the period 1922-2015 using the methodology presented in Chapter 2.

[71] The role of Emile Moreau, governor of the Banque de France (1926-30) was critical. He had a dual goal of achieving convertibility of the franc and, from a political economy perspective, bringing France back as a relevant centre of the international monetary system. This required harnessing enough gold reserves to lend out to preserve financial stability in France and to generate political alliance to France. By 1928, Moreau declared that convertibility was fully re-established. In a move aimed a recovering France's pre-eminence in the international arena, with the available stockpile of gold, started offering reconstruction loans to the new countries in central Europe (Neal, 2015). Accominotti & Eichengreen (2016), show that concurrent with this move, there was a shift in the relevance of financial centres: while bond issuance troughed in New York and London by 1928, a quarter of all new issues took place in Paris between 1929 and 1932. This did not in itself cause the demise of the system but did make cooperation across central banks even more difficult when the Great Depression struck (Mouré, 1992)

on both prices and wages untenable from a political perspective (Bordo & Schwartz, 1999; Eichengreen & Sussman, 2000; Eichengreen, 2008).

Consequently, the interwar gold exchange standard was weaker, more vulnerable and less stabilising than its classical pre-war counterpart. The convertibility constrain in the new gold standard was unable to contain "waves of financial instability in the wake of excessive credit expansion, often accompanied by sharp asset price increases" (Borio, 2014a, p.6). The growing financial instability by the end of the 1920s reflected in increased volatility in stock market volatility and more generally in the capital markets of core countries, which led to a decrease in foreign lending.

The French approach to the reestablishment of the gold standard was successful: Gold reserves doubled between 1926 and 1929, tripled by 1930 and had increased four-fold by 1931 when the total gold stock for France was one-quarter of all monetary gold in the planet (Eichengreen & Sussman, 2000). Since France's demand for gold increased at a much faster pace than global supply, most other countries in the world kept depleting their stocks which, to keep convertibility required shrinking money supply and putting downward pressure on the prices of all other goods (Neal, 2015).

Deflation, particularly in agricultural and perishable goods, usually becomes a self-reinforcing process: the prices of wheat fall in the international market, but farms and households have a fixed level of income that is required to survive and cover their obligations.[72] This implies that, for them to make their monthly payments, output needs to increase, which ends up putting further downward pressure on international wheat prices.[73] This deflationary dynamic is of paramount importance in explaining the two critical events that took place between 1929 and 1933: the Great Depression in the United States and the stream of

[72] Recall from the debt-deflation theory (Fisher, 1933), that as prices decrease the real burden of fixed debt payments increases.

[73] In the case of non-perishable goods inventories can increase for a while before production needs to be cut-back and firms need to downsize.

currency crises that is a hallmark of the 1930s (Eichengreen & Portes, 1987).[74]

Several events conflated to give rise to the perfect storm. First, price deflation led to decreased production, increasing inventories, worker layoffs, shrinking investment, and worsening expectations of future capital flows (Bernanke, 1994; Galbraith, 2009). Second, the "Roaring Twenties" saw one of the longest and most significant stock market booms, up to that moment in US history, characterised by both fundamental and speculative components (Fisher, 1933; Mishkin & White, 2002; Kindleberger & Aliber, 2005). Third, debt deflation played a role in causing a debt-overhang problem for households, firms, and agricultural producers which lead to a stream of defaults and increased instability in the US and European financial systems alike (Kindleberger & Aliber, 2005; Galbraith, 2009;). The best-known manifestation of all these underlying forces was the stock market crash of October 1929 in the New York Stock Exchange.

As a consequence, the level of new bond issues fell dramatically, 64 per cent in 1929, as a credit crunch spread through developed economies. Still, a resurgence of capital exports, concurrent with the Young plan of 1929-30, took place, with cross-border flows and debt issues tanking again in 1931 (Accominotti & Eichengreen, 2016).[75]

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[74] Most countries abandoned convertibility by the end of the 1930s, except for the United States which devalued the currency in 1933-34 from $20.67 to $35.00 per ounce and remained convertible until August 15, 1971. Currency crises spread like a tsunami: Austria (1931), Germany (1931), UK (1931), the U.S. dollar (1933), France (1936), Switzerland (1936), and the Netherlands (1936) (Eichengreen & Portes, 1987; Bernanke & James, 1991; Neal, 2015).

[75] By 1930 Germany was still unable to make good on the agreement set forth by the Dawes Plan of 1924. Consequently, a new agreement, informally known as the Young Plan, was first signed in Paris, on June 7, 1929, with the final details ironed-out in The Hague Agreement of January 30, 1930. This plan was designed by a commission chaired by Mr Owen D. Young. In it, creditor countries agreed to reduce the outstanding value of German reparations by 20% and extend the maturity of loans until 1988. At the time, the central banks of the United States, the United Kingdom, France, Belgium, Italy, and Japan founded the Bank for International Settlements (BIS) in Basel, Switzerland, and gave it the responsibility of clearing the German payments and distributing to the creditor countries (Bergmann, 1930; Neal, 2015).

Generally, adverse economic conditions and a world-wide scarcity of monetary gold led to a collapse in foreign trade. Financial markets followed, as developing countries, principally the successor states, were both unable and unwilling to pay their foreign obligations. On the one hand, the lack of foreign exchange made it ever more challenging for indebted countries to raise the money to pay their creditors. On the other hand, the fact that capital markets had dried up and there were no possibilities of obtaining more funds abroad discouraged debtors from trying to keep their reputation by honouring their debts (Eichengreen & Sussman, 2000; Eichengreen, 2008).

As in the Minsky model of financial stability described in Section 1.1.2.2, all the accumulation of imbalances in the form of debt overhang, decreasing income from landholders due to price deflation, the sudden stop in trade flows, and the lack of foreign reserves materialized in the failure of *Credit Anstalt*, the largest bank in Austria in 1931. In 1930, the *Credit Anstalt* had been forced to absorb the *Bundesanstalt*; a landbank burdened with loans to farmers and landowners that were defaulting on their obligations left and right. This thoroughly deteriorated the *Anstalt's* balance sheet, and income kept decreasing as deflation kept wreaking havoc the world over. Early in 1931, the *Anstalt* received two large loans from the BIS and the BoE, which were exhausted by mid-1931. As this happened, the Austrian central bank's foreign reserves dried up and all foreign payments were suspended, with the blessing of foreign creditors who, in return, demanded a guarantee on their claims by the Austrian government (Eichengreen & Portes, 1987; Neal, 2015).

While the failure of the *Credit Anstalt* was primarily a domestic issue, it became an international shock as a consequence of the strong debt linkages across countries fostered by the Dawes and Young plans of 1924 and 1930, and the enlarged levels of debt in Latin America and the successor countries (Eichengreen & Portes, 1987). Foreign investors alerted to the worsening situation in Austria, realised that Germany and several Central and Eastern European countries were facing similarly dire situations, as they were excessively dependent on their ability to roll over short-run loans. Unfortunately, in facing the pressure from foreign investors, the *Reichsbank* was unable to act as a LOLR because its gold reserves were running low which caused a twin crisis: a run on German banks was compounded with an attack on the mark's peg to gold. As in the Austrian case, transfers of short-term debt abroad were suspended for 18 months (until 1933) as to prevent additional pressure on the exchange rate (Eichengreen & Portes, 1987; Eichengreen & Sussman, 2000; Eichengreen, 2008; Neal, 2015).

The global scope of the deflationary process implied that the debt overhang issue was not exclusive to Germany or Austria. British banks who had borrowed in London to extend loans to Central European countries were also affected as their income was negatively impacted by the suspensions of 1931 (Accominotti, 2012).[76] This issue was made public in the Macmillan report, published during the summer of 1931, where they indicated that credit was inherently unstable, and showed the full scope of the British exposure to the default on short-term loans from her debtors in continental Europe. (Eichengreen & Portes, 1987; Taylor, 2015). After 77 months in the gold exchange standard, and amidst a run against the pound that the BoE was unable to curtail, the United Kingdom became the first European country to suspend convertibility.[77] A large group of countries followed suit and left the arrangement by the end of the year: Canada, Denmark, Finland, Japan, Norway, New Zealand, and Sweden (Bernanke & James, 1991; Eichengreen & Sussman, 2000). From the perspective of the macroeconomic trilemma, this was a first best solution to attain monetary autonomy and absorb shocks from abroad.[78]

However, recent research by Urban & Straumann (2012) has shown that "most countries in the 1930s quickly returned to fixed exchange-rate

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[76] The exposure of British and German Banks to worsening financial conditions in Austria and Central and Eastern European countries is reminiscent of many other crises that would occur throughout the twentieth century. The most recent example is the exposure of French and German banks to defaulting Greek debt in the sovereign debt crisis of 2010 in Europe (Varoufakis, 2015).

[77] Australia had suspended convertibility in December 1929 (Bernanke & James, 1991).

[78] The fact that the Federal Reserve maintained a tight monetary policy since the beginning of the depression and as late as mid-1932, forced countries that wanted to gain monetary autonomy as a means of reacting to shocks to sever ties with the international monetary and financial system (Bordo & Schwartz, 1999).

regimes after halting gold convertibility. They had broken their golden fetters in order to devalue their currencies, not to abandon the gold standard altogether" (p.22). Following a methodology for the determination of exchange rate regimes similar to our approach in Chapter 2, they show that the countries in our database, among many others, remained pegged to gold or sterling during most of the 1930s. We present a summary of their results in Table 3, which is extracted directly from Appendix 1 in their paper (pp. 44-45).

Table 3: Incidence and type of currency pegging (Urban & Straumann, 2012, pp. 44-45)

	1930	*1931*	*1932*	*1933*	*1934*	*1935*	*1936*	*1937*	*1938*	*1939*
Australia	g 33	s 83	s 100	s 100	s 100	s 100	g 100	g 100	g 100	g 100
Canada	g 100	g 73	--	--	g 90	g 100	g 100	g 100	g 100	g 100
Denmark	g 100	g 75	--	s 81	s 100	s 100	g 100	g 100	g 100	g 100
France	g 100	g 100	g 100	g 100	g 100	g 100	g 73	--	s 67	g 100
Germany	g 100	g 98	g 100	g 100	g 83	g 100	g 100	g 100	g 100	g 100
Italy	g 100	g 100	g 100	g 29	g 87	g 58	g 100	g 100	g 100	g 100
Japan	g 100	g 94	--	s 31	s 100	s 100	g 100	g 100	g 100	g 100
Netherlands	g 100	g 100	g 100	g 100	g 100	g 100	g 98	g 100	g 100	g 100
Norway	g 100	g 75	--	s 81	s 100	s 100	g 100	g 100	g 100	g 100
Sweden	g 100	g 75	--	s 79	s 100	s 100	g 100	g 100	g 100	g 100
Switzerland	g 100	g 100	g 100	g 100	g 100	g 100	g 100	g 100	g 100	g 100
United Kingdom	g 100	s 100	s 100	s 100	s 100	s 100	g 100	g 100	s 100	g 100

Note: "g = gold, s = sterling, – = no peg. The number in each cell reports the percentage of weekly observations that qualify as a peg to the noted currency. For 1939, the total observations are 33 weeks to recognise the outbreak of World War II. A peg to gold means the currency follows the US dollar through the end of 1932, the French franc until the end of 1935, and the US dollar thereafter" (p. 45).

The alternative to the abandonment of convertibility, implemented by a second group of countries including Germany and most Central and Eastern European countries, was to implement exchange controls, putting further negative pressure on the already diminished trade volume. [79] In this regard, policymakers of Commonwealth countries chose to preserve imperial preference and trade relationships instead of convertibility (Eichengreen & Sussman, 2000; Urban & Straumann, 2012).

[79] At the time capital controls were referred to as exchange controls (OECD, 1993; Mitchener & Wandschneider, 2015). We use both terms interchangeably.

Across the Atlantic, in the US, the first indication of problems appeared in wheat producing states since their farmers were first-hit by the deflation of commodity prices. However, by the end of the 1920s financial troubles had become country-wide as delinquencies increased not only in agricultural loans but also in mortgages (Neal, 2015). In the midst of increasing exchange controls in Europe, foreigners scrambling for funds recurred to their deposits in the US, one of the few sources of international liquidity that remained in place. This additional withdrawal of funds, a full-fledged sudden stop, worsened the financial crisis in the US as bank failures peaked.

Since the onset of the crises and throughout most of the period, monetary policy in the US remained tight, causing manufacturers to complain about a shortage of credit. It was only during the spring of 1932 that some monetary relaxation in the form of credit rediscounts, open market operations, and the purchase of long-run assets took place, and, at the time, the incidence of bank failures declined. However, this policy was short-lived, and by the fall, monetary stringency and bank insolvencies were back. It was only until the swearing in of Franklin Delano Roosevelt (FDR), on March 4th, 1933, that the depression began to subside.

FDR declared a bank holiday in his second day in office (March 6th) and advanced a sizeable legislative agenda focused on the recovery of the financial system and the economy. Among the many reforms that were implemented, convertibility of the dollar into gold was suspended in 1933 and re-established at a devalued parity of $35.00 an ounce in 1934; federal insurance of deposits was established, and the Glass-Steagall act regulating commercial and investment banking activity was put into place (Eichengreen & Portes, 1987; Eichengreen & Sussman, 2000; Neal, 2015). According to Borio & White (2002), this was the first time that price and financial stability were fully decoupled and, consequently, targeted through different anchors. This implied that under this period of inconvertible fiat currencies, endogenous money creation reigned free, albeit for a short period. Moreover, like the Greenspan put in the 1990s, deposit insurance and other regulations that established the financial safety net would foster additional risk-taking by banks and thus permit the further accumulation of imbalances (Borio, 2014a).

With the worst of the crisis in the rear-view mirror, stock markets in developed economies experienced new and robust expansions. These were related not only to economic recovery but to the abandonment of gold convertibility as flexible exchange rates allowed for a faster adjustment of the economies that had previously overvalued their exchange rates (Bordo & Wheelock, 2009).[80] The individual cases of Germany and France are worth highlighting (Eichengreen & Sussman, 2000; Neal, 2015).

On the one hand, Germany would not experience a stock market boom until the late 1950s because, while other countries recovered from the Depression, Germany still faced the burden of reparations and the limitations of the Treaty of Versailles. This explains, among other issues, the ascent of nationalist Adolf Hitler to power in 1933 (Bordo & Wheelock, 2009; Neal, 2015).

On the other hand, while France remained committed to the gold standard until 1936, all other major currencies had devalued, thus making the franc overvalued in relative terms. While French policymakers attempted to avoid current account imbalances via the imposition of tariffs, this immediately led to reciprocation by other gold block countries which, in turn, stifled economic expansion. By the time the French abandoned convertibility, the Second World War was looming on the horizon, and the economy could not reap the benefits of adjustment. Consequently, France would not experience a stock market boom until the 1950s (Eichengreen, 2008; Bordo & Wheelock, 2009; Neal, 2015).

The economic recovery from the Great Depression occurred amidst tariffs, capital controls and fear of high inflation as experienced after the First World War. Monetary latitude was seen as the harbinger of inflation and was heavily discounted by markets and investors, so prudence

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[80] Australia: September 1930 – March 1937; Canada: June 1932 – March 1937; Italy: May 1932 – July 1935; Japan: October 1930 – February 1934; Netherlands: June 1932 – March 1937; Sweden: May 1932 – March 1937; United Kingdom: June 1932 – December 1936 (Bordo & Wheelock, 2006, Table 1).

became the rule (Eichengreen & Sussman, 2000). In this context, only the US, the British Empire and the Soviet Union were large enough to produce the raw materials required for their economic expansions and industrialisation. Other colonial powers, such as the Netherlands, France or Italy, accelerated the rate of extraction of raw materials from their colonies.

The case of Germany and Japan was different. They had a late industrialisation, were militarily aggressive, and had limited access to raw materials that would allow economic expansion. This motivated the Japanese invasion of mainland China in the second Sino-Japanese War (1937) and the expansionist intent of Germany, beginning the reoccupation of the Ruhr (1936), the annexation of Austria (1938), and the invasion of Czechoslovakia (1938-9) and Poland (1939), all resource abundant territories that could fuel their expansionist agenda. Furthermore, as the victors occupied new territories, they exploited the vanquished by gaining control of the national central bank and issuing local currency to continue financing their war efforts. Since the Nazi Germans had fresh memories of the hyperinflation during the Weimar years, they were particularly careful and avoided inflationary note issuance (Hobsbawm, 1994; Neal, 2015). Lightning had struck a second time, and the Second World War was well underway.

The rise of military conflict in Europe and Asia caused capital flight to the United States, who once again became Europe's pantry during the Second World War. Because of this, by 1945, the US concentrated most of the world's monetary gold outside of the Soviet Union (Eichengreen & Sussman, 2000).

1.4.2. The Post-war and Bretton Woods (1944-71)

Quickly after its inception, the Bretton Woods system evolved into a dollar standard where countries pegged their currencies to the US dollar, and the United States established parity to gold at $35.00 an ounce. To gain monetary autonomy, the complexity of regulations during this period went far beyond capital controls and included issues of monetary and prudential nature: balance sheets were constrained, credit quantities and prices were limited in several advanced economies to allow for the governments' roll-over of wartime debt, and foreign exchange transactions were curtailed. This height in financial repressions is, arguably, one of the reasons that explain the decrease in amplitude of the financial cycle (Borio & Lowe, 2002; Borio, 2014a; Offer, 2017). According to Taylor (2013), the Bretton Woods period was virtually crises free, with only a few episodes in developing countries and no financial crises in advanced economies. However, the other side of the coin was that this financial instability came at the cost of high inefficiencies in resource allocation. By the end of the period increasingly ambitious macroeconomic policies, and the growing reliance of the system on the ever-growing foreign balances in US dollars made it dynamically unstable and would end up giving way to the bouts of inflation of the 1970s (Rose, 2007; Borio, 2014a).

According to Neal (2015) the military strategy of the Allied powers during the Second World War differed from the one of the Great War in that this time, the war would last until the Axis governments accepted defeat and surrendered unconditionally on May 8th, 1945. The goal was twofold. On the one hand, they wanted to avoid a resurgence of the reparations issue that characterised the interwar years, and on the other hand, they wanted to prevent Germany from ever having the possibility of industrialising or raising in arms against its neighbours. Consequently, the war in Europe lasted until Germany was fully occupied by the allied powers and it was divided into occupation zones. The war in Asia lasted until the complete surrender of Japan, on August 15th 1945, a week after Hiroshima and Nagasaki suffered the impact of two atomic bombs on August 6th and August 8th respectively.

From a social perspective, one of the hallmarks of the interwar period was the emergence of labour parties and the increase in social demands (Eichengreen, 2008). Consequently, the post-war pact, as described by Offer (2017), was built on the promise of economic growth and full employment. From the perspective of the trilemma, this came at odds with the system of fixed exchange rates, open capital accounts, and curtailed monetary autonomy that characterised the classical and interwar gold standards; if domestic social demands were to rise in the policy agenda, some degree of autonomous monetary policy would be required. It was in this context that the new financial architecture for the post-war period was to be designed (Obstfeld, Shambaugh & Taylor, 2004).

In July 1944, delegates of the 44 allied nations partook in the United Nations Monetary and Financial Conference that took place at the Mount Washington Hotel in Bretton Woods, New Hampshire.[81] While the conference was attended by over 700 delegates, the British delegation, led by John Maynard Keynes, and the delegation for the United States, led by Harry Dexter White, dominated both the discussions and the agreements reached (Neal, 2015).

On the one hand, the British view privileged monetary autonomy for policymakers so that they could tend to a broader domestic agenda. On the other hand, the US' delegation privileged the stability afforded by a rule reminiscent of the gold standard. The compromise was a system of fixed exchange rates, where countries would establish a parity either to the US dollar or gold, and their exchange rate would be allowed to float within a narrow band. The US would commit to a fixed price of gold at $35.00 an ounce with full convertibility on demand. The parity could only be changed in cases of fundamental disequilibrium when permanent balance-of-payments imbalances required it. However, this condition was never explicitly defined in the Articles of the Agreement. Moreover, to accommodate for the British demand for autonomous monetary policy, resolving the trilemma conundrum required capital controls, which were not only allowed but encouraged to protect the peg from speculative attacks. Finally, countries were given the responsibility of using domestic policy to offset short-term deficits (Bordo & Schwartz, 1999; Kindleberger & Aliber, 2005; Neal, 2015).

For this agreement to function smoothly an institutional setup was required. The idea was to design international monetary institutions that

[81] The idea of a post-war financial conference aimed at reconstructing the system for the upcoming return to normalcy was a usual practice. Recall our discussion of the financial conferences in Brussels (1920) and Genoa (1922) aimed at reconstructing the system after the Great War. The focus of their recommendations was the return to the gold exchange standard that had proved successful in fostering trade and stability in the last third of the nineteenth century.

would promote stability and foster growth while avoiding the mistakes made during the interwar period.[82] On the one hand, the International Bank for Reconstruction and Development (IBRD) was the lending institution in charge of financing the reconstruction after the destruction of the war by offering long-term credit.[83] On the other hand, the International Monetary Fund (IMF) was designed to finance short-term balance-of-payments deficits across countries with a twofold goal: to maintain the credibility of the pegs and to avoid the instability caused by foreign shocks (Kindleberger & Aliber, 2005).

However, the design of the IMF gave reason for a heated debate between the leading delegations. Keynes proposed an institution that would have its own currency, the Bancor, as a unit of account with a fixed parity to gold, affording the institution the capacity to act as a lender of last resort. Member countries would be endowed with deposits in the IMF that they could transfer to trading partners to finance their payments deficits. Harry D. White, on the other hand, proposed that countries would deposit gold and their domestic currencies in non-interest-bearing deposits to capitalise the institution. Each country would have a quota (share) determined by its gold holdings and trade volume and which would, in turn, define how much foreign currency it could buy from the institution and transfer to its trading partners. Since the US was the primary holder of monetary gold outside of the USSR, its view prevailed, it endowed both institutions with a quarter of their total capital and housed them in Washington D.C. (Bordo & Schwartz, 1999; Kindleberger & Aliber, 2005; Neal, 2015).

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[82] The competitive behavior of countries during the interwar years, their lack of cooperation to resolve external shocks, and the shortage of credit after the banking failures of 1931-33 fostered both the expansion of the Great Depression and the advent of the Second World War (Kindleberger & Aliber, 2005).

[83] Currently the World Bank Group is conformed by five different institutions: The International Bank for Reconstruction and Development, the International Development Association, the International Finance Corporation, the Multilateral Investment Guarantee Agency, and the International Centre for Settlement of Investment Disputes.

1.4.2.1. The Dollar Shortage and the Inconvertible Phase of Bretton Woods (1944-58)

The implementation of the system was challenging from the start. The first critical challenged faced by the new institutional setup was a dollar shortage in the international monetary and financial system (IMFS) which was caused by both excessive demand and short supply. On the one hand, as European countries needed to increase their imports to rebuild their economies and cover their basic demand for foodstuffs, the demand for dollars increased. On the other hand, high import tariffs in the US, the abundance of domestic production, and the scarce European production of export goods discouraged US imports from Europe thus reducing the availability of dollars. Finally, the share system in Bretton Woods had a built-in source of instability: since part of the quota had to be paid in either gold or US dollars, countries kept an overvalued exchange rate to minimise the cost of acquiring the necessary reserves. The persistent dollar deficit forced European countries to restrict imports and manage trade through bilateral agreements to shield their waning dollar accounts. (Neal, 2015).

Three different events, all outside of the Bretton Woods framework aided in resolving the dollar shortage and the bilateralism issue in international trade (Bordo & Schwartz, 1999). First, in June 1947 in the commencement address at Harvard University George Marshall, Secretary of State to Harry S. Truman, delineated the plan for the European Recovery Program (ERP) which would come to be known as the Marshall plan for Europe.[84] Under this program, over 12.5 billion dollars were transferred to Europe in the form of grants ($9,144.9 million), loans (1,139.7 million), and conditional aid to the European Payments Union (EPU) (1,542.9 million) between 1948 and 1950 (Neal, 2015).

According to Bordo & Landon-Lane (2013), the first wave of stock market booms in the post-war period may have been driven by the

[84] A similar programme was implemented for Japan in 1948. The financial adviser to general Douglas MacArthur was a banker from Detroit named Joseph M. Dodge. The Japanese reconstruction plan “Dodge plan” or “Dodge Line” was named after him (Fukui, 1972).

Marshall and Dodge plans. Bordo & Wheelock (2006, 2009) show that most of the countries in our database had stock market booms during the inconvertible phase of Bretton Woods. They argue that two other important drivers were the establishment of the GATT (1947) and the EPU (1950) as they fostered trade and economic recovery, and the Treaty of Rome (1957) which called for a complete elimination of restrictions to capital movements within the European Economic Community.[85]

Second, even though the generous aid from the ERP aided somewhat in reducing the dollar shortage, it was not enough. Consequently, on September 1949, and with the authorisation of the IMF, the UK devaluated the pound against the dollar by 30.5% (from $4.03 to $2.80 per pound). As most European countries followed suit, the exchange rate between European nations remained mostly unchanged with an average depreciation of 20% against the dollar (Eichengreen, 2008; Neal, 2015).

Finally, with the Marshall plan coming to an end, and by the suggestion of the US government, European nations established the EPU in September 1950.[86] The goal of this institution was to help European nations reduce their demand for dollars on a permanent basis by establishing a multilateral payments system and reaching full convertibility of currencies.[87] Countries that wanted to participate in the system needed to eliminate quantity restrictions on trade and could replace them temporarily with tariffs. A country's balance with the EPU was determined as the net value of all accounts payable to member countries minus all accounts receivable from member countries. By December 27, 1958, Belgium, France, Germany, Italy, Luxemburg, the

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[85] Bordo & Wheelock (2006, Table 1) date the booms as follows. Australia: July 1956 – July 1960; Canada: October 1953 – July 1956; France: December 1950 – April 1955; Germany: June 1957 – September 1960; Italy: July 1950 – September 1955; Japan: January 1950 – January 1953; Netherlands: April 1952 – June 1957;; United Kingdom: June 1952 – July 1955; United States: September 1953 – April 1956.

[86] It would operate retroactively to July 1950.

[87] In this context full currency convertibility meant that countries should be able to convert as much of their currency as necessary into dollars, the reserve currency under Bretton Woods, on demand. The mechanisms countries had to achieve this were increasing reserves and reducing balance-of-payments imbalances.

Netherlands and the United Kingdom announced that they would make their currencies externally convertible. This marks the beginning of the convertible phase of Bretton Woods (Eichengreen & Sussman, 2000; Neal, 2015).

Through these three strategies —the Marshall plan, one-time devaluations, and the establishment of the EPU— the dollar shortage was resolved between 1950 and 1952. However, as we will discuss ahead, countries continued acting as if the shortage persisted and it quickly turned into a dollar glut. By 1971 the supply of dollars was so overwhelming that it forced the US to eliminate convertibility as its gold stock was insufficient to back the outstanding dollar balances abroad (Bordo & Schwartz, 1999; Neal, 2015).

A further change that aided countries in their task of gathering foreign currency was the development of the Eurodollar market. While its development began in 1955, it became widespread during the convertible phase of the Bretton Woods agreement. Since the end of the Great Depression, US Regulation Q would have it that banks that enjoyed deposit insurance under the Glass-Steagall Act would have a cap on the interest they could offer on their deposits. As the Bank of England increased the interest rate to avoid a loss of reserves, the Midland bank first started offering high interest rates for depositors that would increase their dollar accounts in London. Once they received the dollars, they would sell them in the forward market which left them nominally with sterling debts at a lower cost than that charged by the BoE. This was a win-win situation for all: US depositors got a higher rate than that allowed by Regulation Q, the Midland Bank ended up with cheap sterling liabilities, and the BoE, in exchange for its regulatory forbearance, would reduce pressure on the peg by increasing the amount of dollars available in the City (Neal, 2015).

1.4.2.2. The Dollar Glut and the Convertible Phase of Bretton Woods (1959-71)

Even if from the previous section the Bretton Woods framework appears rigid on paper, it was a rather flexible arrangement in practice. On the one hand, regarding capital controls, Eichengreen & Sussman (2000), show that although they were critical to the functioning of the agreement they were neither universal nor impregnable. They suggest that capital controls were more pervasive and credible during the 1950s than during the 1960s as agents began finding loopholes and strategies to circumvent them. The divergence in monetary policy across developed nations put pressure on capital controls and "individuals engaged in legitimate, trade-related transactions to exploit leads and lags as a way of shifting capital across borders" (p. 33).[88]

On the other hand, with regards to the stability of the exchange rate, the pegs were altered on several occasions; a phenomenon that was not exclusive to developing economies. The first case was the general realignment of European currencies that began with a 30.5% devaluation of the pound sterling in 1949 to solve the dollar shortage. Additionally, the French franc had several one-time devaluations (1957, 1958 and 1969), the pound sterling had a second devaluation in 1967, and the Deutsche mark revalued in 1961 and 1969. Still, these changes in the peg were more of the exception than the rule during the period. Eichengreen & Sussman (2000) argue that exchange rate stability was fostered by economic growth across the board which made competitive devaluations unnecessary, and by price stability in commodities markets that mitigated the number of foreign shocks.

After full currency convertibility was achieved, the hay day of Bretton Woods began. The period from 1959 until 1971 was characterised by low inflation, and both high and stable real economic growth rates. This positive economic environment led to stock market and asset price booms, of varying amplitude and duration, in most advanced economies.[89]

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[88] Neal (2015) suggests that by the early 1970s two different approaches to policy were followed. On the one hand, Germany, Switzerland, and Japan targeted inflation and tried to keep prices in check relative to the US. On the other hand, the central banks in France, Italy and the UK followed their governments' directives to foster employment and to comply with the wage demands of union workers.

[89] Bordo & Wheelock (2006, Table 1) date stock market booms as follows. Australia: October 1966 – December 1967; France: August 1958 – April 1962; Italy: June 1958 – August 1960; Japan: December 1957 – June 1961; Netherlands: December 1957 – March 1961; Sweden: March 1958 – August 1961; United Kingdom: February 1958 – April 1961; United States: June 1962 – January 1966.

Additionally, during the period the dollar became the uncontested international reserve currency, partly because of a stable US monetary policy and partly because of the extended use of the currency in international trade (Bordo & Schwartz, 1999; Bordo & Wheelock, 2006). By 1958, the US monetary gold reserves were even more significant than at the end of the war. Throughout the 1960s, however, the current account surpluses in the US were not enough to finance its foreign investments and foreign liabilities quickly exceeded gold reserves. As the decade progressed, the US continued to finance the Vietnam War and their demand-oriented growth through an expansion of the money supply (Eichengreen & Sussman, 2000). This, under a scenario of fixed exchange rates, caused the US to export the inflationary pressure which became evident by the end of the 1960s and the early 1970s (Obstfeld, 2015).

Two cases of central bank cooperation were critical to the functioning of the Bretton Woods system during the 1960s, particularly in a scenario where the dollar-gold parity seemed untenable. First, to avoid mass conversions of the increasing foreign dollar balances into gold, the United States and central banks of other Western countries formed the gold pool in 1961. The idea behind the pool was to coordinate the purchases and sales of gold in London to maintain the $35.00 parity to gold. As argued by Bordo, Monnet & Naef (2017) the British devaluation in 1967 rather than the uncooperative attitude of the French since 1965, caused its demise in 1968. Second, to avoid speculative attacks against the pegs of the different currencies, the Basel Agreement, led by the US, established a swap network —a series of bilateral lines of credit between central banks. Central banks would create amounts of foreign currency both as assets and liabilities to their counterparties and make them available on demand (Kindleberger & Aliber, 2005).[90]

As in the US, many developed economies would favour domestic agenda goals such as full employment or economic growth and would reject the restraints imposed by the fixed exchange rates. This implied policymaker would dismiss the trade-off between high employment and

[90] A similar swap network between central banks was critical to the resolution of the Global Financial Crisis in 2008 (Financial Crisis Inquiry Commission, 2011).

higher price levels, the Phillips-curve relationship, as negligible and, therefore, keep adding fuel to the fire of inflationary pressures. (Bordo & Schwartz, 1999; Eichengreen & Sussman, 2000; Akansel, 2015). In this sense, apart from the US, three major countries cover the European quota of responsibility in the demise of the Bretton Woods Agreement: Britain, France and Germany.

First, during this period, Britain advanced the stop-go policy in which, to prevent further depletion of reserves via current account imbalances, they would try to curtail economic growth during booms (the stop phase), and then, when the balance was reached again, they would relax policy (go phase) (Middleton, 1989). Still, by the early 1960s, British reserves were below those of Germany, France and Italy. Secondly, the Banque de France accumulated a large amount of US dollar liabilities during the peak of US expenditure for the Vietnam War.[91] Finally, Germany was focused on keeping inflation under control through high interest rates, since the lax monetary policy of the Fed diverged from that of the Bundesbank, there was a massive shift of funds from the dollar to the mark area. When Britain devalued the pound in 1967 many investors started losing credibility in the Bretton Woods Agreement as it was the second most important reserve currency, but when both France and Germany started demanding the conversion of their increasing dollar reserves into gold the system's instability was made evident, and it began to crumble. On August 15th, 1971 President Richard Nixon closed the gold window ending, with the stroke of a pen, the last convertible currency regime in history (Kindleberger & Aliber, 2005; Neal, 2015; Bordo, Monnet & Naef, 2017).[92]

1.4.3. The Great Inflation (1972-85)

Instability in commodities markets characterised the period following the Bretton Woods agreement, mainly expressed in two oil shocks that

[91] Additionally, large capital flows from Vietnamese expatriates arrived in France (Neal, 2015).

[92] Eichengreen & Sussman (2000) indicate that the main problem with the system was that the dollar was overvalued relative to gold because the economy was growing will the supply of gold reserves was inelastic.

fostered bouts of inflation all over the world. Large capital movements became usual as a wave of deregulation of credit, capital flows and financial systems spread around developed and developing economies alike. The challenge of this new era was keeping prices stability while fulfilling the post-war promise of full employment and economic growth; its prime manifestation was the Volcker shock of the late 1970s where money supply was curtailed to reign back price growth at any cost. The lack of a nominal anchor to the currency and the deregulation of the financial system opened the door to financial crises that would reach a global scale (Borio & Lowe, 2002; Kindleberger & Aliber, 2005; Offer, 2017).

The crisis after the abandonment of convertibility by the US was long-lasting. The first price to go was that of gold, once it was understood that parity would not hold. As all foreign dollar deposits depreciated, bilateral exchange rates started fluctuating (Neal, 2015).[93] The only attempt by the US and other advanced economies to re-establish a system of pegged exchange rates in the spirit of Bretton Woods was formalised by the finance ministers of the G10 countries in the Smithsonian Agreement of December 1971. The idea behind the system was to establish fixed exchange rates between countries without a nominal anchor on gold. This setup was still subject to the Triffin Dilemma: the world would need ever-increasing levels of the reserve currency while the issuer of that currency would need to keep price stability at home to avoid exporting inflation.[94] As per the agreement, the US was to devalue the dollar price of gold by 8.5% (to $38.00 per ounce) while the other countries were to revalue their

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[93] Neal (2015) compares this change in the parity of the dollar to gold to the British devaluation of the pound in 1949 and concludes that

> *"If sorting out the various exchange rates took time when Britain devaluated in 1949, sorting out the much broader array of exchange rates across the world when the US dollar effectively floated in 1971 would take much longer and require more fundamental changes than simply creating the EPU for countries in Western Europe"* (p. 270).

[94] Precisely this dichotomy was what brought down the original Bretton Woods agreement as the foreign dollar balances substantially exceeded the amount of monetary gold held by the US as they had decided to finance the Vietnam War through monetary supply expansions rather than tax increases or an internationally financed coalition (Neal, 2015)

currencies such that the average devaluation of the dollar reached 12%. However, the system failed, on February 1973 the US devalued the dollar another 10% (to $42.00 an ounce of gold). The price of gold in the market reached $90.00 an ounce, so France and Germany decided to let their currencies float.[95] Most countries adopted floating exchange rates in March 1973 (Eichengreen & Portes, 1987; Kindleberger & Aliber, 2005; Neal 2015).

Under the Smithsonian agreement, West Germany, France, Italy, Belgium, the Netherlands, and Sweden agreed to maintain stable exchange rates among themselves (but not with the US or Canada) within a 2.25% band. By March 1972, they agreed that the fluctuation band among themselves could be reduced to 1.125% (the snake) and they established a wider band for currencies of the other signatories of the Smithsonian Agreement: US, Canada, and Japan (the tunnel). While the fall of the Smithsonian Agreement eliminated the tunnel, the snake continued to operate, albeit with changing members throughout the period. The Bundesbank was the leading member in this arrangement and the one who orchestrated its smooth operation (Eichengreen & Sussman, 2000; Neal, 2015).

In explaining the international monetary instability that occurred after Bretton Woods, Eichengreen & Sussman (2000) argue that the end of commodity money eliminated the traditional anchor for both monetary and fiscal policy. In the absence of an alternative framework of operation for the IMFS, large budget deficits, increasing inflation, volatility in exchange rates and commodities wreaked havoc around the world during the better part of the 1970s an early 1980s. During the period of the Great Inflation, the global economy suffered four successive shocks. First, an oil shock in 1973 where, in a price-setting move by the Organization of Petroleum Exporting Countries (OPEC), the dollar price of oil quadrupled in a few months. Second, a new oil shock in 1979, triggered by the Iranian revolution, caused the price of oil to double again. Third, the Volcker

[95] Increases in the price of gold were paralleled by the price of silver. The argument was that investor would buy precious metals because their price was increasing, and their price would increase because investors were buying it. This was a prime example of a mania as described in the Minsky model (Kindleberger & Aliber, 2005).

shock, where Paul Volcker, the chairman of the Federal Reserve increased interest rates dramatically to curtail inflation in the US. Fourth, there was a third oil shock in the early 1980s when the price of oil in dollars plummeted. It was only after these two last shocks and the Plaza and Louvre Accords of 1985 and 1987, that inflation and exchange rates stabilised, giving way the period known as the Great Moderation (Neal, 2015).

The effect of the first oil shock was asymmetrical on the European economies. Those that were more tightly linked to the German economy through the snake were less affected by the shock as the German mark appreciated between 30% and 40% relative to the dollar. Consequently, the price of oil in their local currencies was not as hard-hit. Contrarily, France and Italy continued devaluing their currencies against the dollar, so the effect of the oil shock was compounded with that of the currency depreciation. When the second oil shock hit, France and Italy, having learned the lesson, promoted the formation of the European Monetary System (EMS) and committed to pegging their currencies to the German mark. The effect on Britain was similar to the French and Italian cases, the pound floated, inflation soared and the proposal of the Labour party at the time was to increase foreign direct investment (FDI) in the oil fields in the North Sea.[96] Still, by 1976 the pound had sunk from $2.40 per pound to $1.555 (October 28). Seeing the increasing pressure on the pound, the IMF extended a stand-by loan for £2.3 billion. However, the loan has strings attached that discouraged Britain from ever using it: the IMF required a reduction in government debt, a cut to expenditures and the sale of government shares in petroleum companies (Eichengreen & Portes, 1987; Neal, 2015).

When faced with the realisation that inflation in the US was spinning out of control, the new Chairman of the Federal Reserve, Paul Volcker, changed the operating procedure of the Fed and, on October

[96] This was the main reason for Britain to opt-out of the EMS. Since Britain expected to become a net oil exporter, she had no interest in appreciating the pound when the price of oil increased. This was a measure that fit better oil-importing countries such as France, Italy or Germany. As the second oil shock struck, Britain had just become a net oil exporter and its decision to opt-out of the EMS turned out to be profitable.

1979, implemented an extremely contractive monetary policy. At the time, the focus of policy was not on interest but on monetary aggregates, the monetarist view, which served as an argument for central banks to justify extremely high (and unpalatable) interest rates in the quest for price stability (Borio & Lowe, 2004). This approach explains the important increase in interest rates, which led to a contraction of credit, and a sharp recession. By the end of 1979 inflation expectations reversed and the price of gold peaked. The increase in the US interest rate made it increasingly difficult for Latin American countries to roll-over their ever-growing stock of debt, and in 1982 an international debt crisis spread from Mexico to Argentina with just a few exceptions (Kindleberger & Aliber, 2005).

A second effect of the Volcker shock and the ensuing recession was a decrease in the demand for energy which caused an oil glut that began in 1980. By 1987 the price of oil had fallen from $35 a barrel to below $10. The EMS benefitted from these two sunspots: first, the Volcker shock caused the dollar to appreciate vis-à-vis other currencies making European exports more competitive; second, cheaper oil was a headwind for economic growth in Europe, particularly for oil-importing countries.[97] Exchange rates of countries within the EMS experienced frequent adjustments, twice in 1979, 1981 and 1982, and then once in 1983 and 1985.

During the late 1970s and early 1980s, another remarkable event that took place was the wave of financial deregulation that spread around the world. Quinn & Inclan (1997) argue that, while the first oil shock had motivated a temporary return to protectionism, as convergence in total factor productivity and real wages occurred between OECD countries, it made little sense to maintain protective measures in place: by the end of the 1970s the costs of protection were increasingly outweighing the gains. Additionally, the increasing value of the Eurodollar market and the way it became ever more intertwined with national economies made capital controls increasingly inefficient (Neal, 2015). This process of deregulation, however, was far more pronounced for industrialised countries that for emerging markets and developing economies (Aizenman, Chinn & Ito,

[97] Britain and Norway did not reap the benefits as they had become oil exporters late in the 1970s.

2008).[98] Part of the "deregulation package" at the time included the liberalisation of credit institutions, stock markets, and the step-wise elimination of capital controls (Borio & White, 2004; Offer, 2017). According to Drehmann et al. (2012), the wave of deregulation reinforced the procyclicality of the financial system and was one of the reasons for the increasing amplitude of the financial cycle since the early 1980s. They argue that the loosening of the nominal anchor to the currency compounded with the general trend in deregulation increased the elasticity of the financial system allowing for a more substantial accumulation of financial imbalances. In that sense, Bordo & Wheelock (2006) identify several stock market booms during the period. Some countries experienced a boom after the recovery from the first oil shock, and most countries share a boom that concurs with the beginning of deregulation and the reduction in oil prices of the early 1980s.[99]

1.4.4. The Great Moderation (1986-2015)

The hallmark of this period is the establishment of credible anti-inflation regimes in a context of independent central banks in developed economies.[100] The large macroeconomic fluctuations of the previous period seemed to give way to a period of stable prices compounded with low and stable GDP growth: The Great Moderation (Assenmacher-Wesche & Gerlach; Drehmann et al., 2012; Cendejas et al., 2017). In this new era, "financial liberalisation has gathered pace, nationally and internationally.

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[98] The United Kingdom eliminated capital controls in 1979, Japan in 1980, Australia in 1983, Netherlands between 1983 and 1986, France in 1986, Italy between 1988 and 1990, Sweden in 1989, and Norway in the late 1980s (OECD, 1993; Kindleberger & Aliber, 2005; Bordo & Wheelock, 2009; Offer, 2017).

[99] Australia: August 1977 – November 1980 and July 1982 – September 1987; Canada: October 1977 – November 1980 and July 1984 – July 1987; France: June 1981 – April 1987; Germany: August 1982 – April 1986; Italy: December 1977 – May 1981 and December 1982 – August 1986; Japan: September 1982 – December 1989; Netherlands: September 1981 – July 1987; Sweden: September 1980 – March 1984; United Kingdom: September 1981 – July 1987; United States: July 1984 – August 1987 (Bordo & Wheelock, 2006, Table 1).

[100] Monetary policy regimes take a variety of forms: monetary targeting, inflation targeting, the joint targeting of monetary aggregates and inflation, and systems that follow Taylor Rules focused on expected inflation and output gap (Eichengreen & Sussman, 2000). In what follows we do not distinguish between them.

Financial cycles appear to have grown in amplitude. Financial instability has re-emerged as a major policy concern" (Borio & Lowe, 2002, p. 23). After the dot.com bubble of the early 2000s and mainly after the GFC, the problem of financial stability has risen to take a primary role in the policy agenda.

The 1980s and 1990s featured decreasing inflation and energy prices as well as economic growth all over the world. Additionally, international capital markets throughout the period were far more integrated than during the financial repression era that culminated in the 1970s. All these elements fostered credit and stock market booms in the countries in the database. Some of the most memorable events in asset prices were the property and stock market booms in Japan and the Nordic countries (Norway, Sweden, and Finland) during the 1980s. This period saw more asset price booms than any other period in history in a dynamic that was described thoughtfully by Nobel Laureate Joseph Stiglitz in his appropriately titled book "The Roaring Nineties" (Bordo & Jeanne, 2002; Stiglitz, 2004; Kindleberger & Aliber, 2005; Bordo & Wheelock, 2009).[101]

After the substantial reductions in oil prices, the third oil shock of the early 1980s, the European satellites to the USSR preferred buying cheaper oil from their Western European countries instead of bartering their production for Soviet oil. The failure of the Soviet trade model and the weakness of the USSR was best exemplified by the fall of the Berlin Wall in November 1989. By October 1990, the German reunification was entirely underway. While, from a political standpoint, it was a relatively simple process that only implied annexing five new states to West Germany with appropriate representation in the new parliament, from a monetary purview it was a complex endeavour. To gain support from the East Germans, the Kohl government offered them largely overvalued exchange rates for the conversion of their currency to the German mark, a

[101] Bordo & Wheelock (2006, Table 1) date several stock market booms during the period. Australia: December 1990 – January 1994 and August 1998 – June 2000; Canada: January 1995 – April 1998 and August 1998 – August 2000; France: February 1995 – August 2000; Germany: March 1995 – February 2000; Italy: November 1995 – February 2000. Netherlands: January 1991 – August 2000; Sweden: September 1992 – February 2000; United Kingdom: June 1994 – December 1999; United States: April 1994 – August 2000.

headwind that made unification a profitable business (Neal, 2015).[102] However, the effect on price stability was patent, and the Bundesbank was forced to increase the interest rate to avoid inflationary pressures since the government in East Germany had expanded its monetary base substantially during the period before reunification.

This caused the Deutsche mark to strengthen vis-à-vis the dollar, a move that rippled through to all the European currencies that had pegged their currencies in the EMS framework. The Finnish markka, the Swedish kroner, the British pound and the Italian lira lost over 30% of their value against the dollar during this period; Britain, who had joined the EMS on the same month as the reunification, and Italy decided to drop out of the system in September 1992. The countries that did remain inside the EMS decided to broaden, at least temporarily, the fluctuation bands with respect to the German mark to ±15% as they were committed to the recently signed Treaty of the European Union (TEU) (Maastricht, February 1992) where the bases for the European Monetary Union and the common currency were established (Kindleberger & Aliber, 2005; Neal, 2015; Cendejas et al., 2017).

The TEU represented a triumph for German policymakers in setting up a roadmap for the establishment of the euro; they agreed that all countries that wanted to adopt the single currency needed to comply with five convergence criteria. First, the level of public debt could not exceed 60% of GDP. Second, budget deficits could not exceed 3% of GDP. Third, the inflation rate of a given country could not exceed the average of the three lowest inflations by more than 1.5%. Fourth, the long-term interest rate should not exceed by more than 2% the long-term average interest rate of the three countries with the lowest inflation levels. Fifth, countries should have participated for at least two years of the EMS. These criteria were designed to be conducive to price stability which had been central in the Bundesbank decision-making process. Complying with the convergence criteria, even if only in cooked books, allowed countries like

[102] The East-German Ostmark was trading at 12:1 with respect to the West German mark. The exchange rate offered was 1:1 for up to a months salary and 2:1 for every additional Ostmark thereafter (Neal, 2015).

Italy and Greece to enjoy lower costs of debt in foreign markets as risk premia decreased and the base rate of long-term bonds converged to the German level (Neal, 2015).[103]

After the liberalisation of capital movements in the early 1980s, and more clearly during the 1990s, there was a substantial increase in the stock of interbank funding, as well as an expansion of equity and bond financing for firms. This explains the increase of loans-to-deposit to values higher than one. This phenomenon of credit expansion, compounded with financial innovation, lax monetary policy, and low interest rates allowed for financial imbalances to accumulate in scenarios of low and stable inflation (Jordà Schularick & Taylor, 2011; Borio, 2014a; De Bonis & Silvestrini, 2014). As the world economy recovered from the crisis in the emerging markets of the late 1990s (Thailand, Indonesia, Russia, Brazil, Mexico, Argentina), capital flowed from developing to developed countries putting downward pressure on interest rates and making cheap money readily available. This reversed direction in capital flows explains the technology boom of the turn of the millennium which ended in the dot.com bubble of 2001-3 in the US stock market (Kindleberger & Aliber, 2005; Jordà Schularick & Taylor, 2011).

As the economy, property prices, and stock markets boomed in developed economies during the first lustrum of the 2000s, risk-taking incentives shifted, and agents began undertaking ever-more risky investments in a search for yield (Rajan, 2006). Suddenly, institutional investors, investment banks and commercial banks were investing in sophisticated new financial assets such as mortgage-backed securities (MBSs), collateralised debt obligations (CDOs), and asset-backed securities (ABSs). They hedged their risks by purchasing credit default swaps (CDSs) which would restore investors with the face value of a given security in case of a default by the issuer (Financial Crisis Inquiry Commission, 2011).

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[103] Greece finally adopted the euro in 2002. During the sovereign debt crises of the 2010s, it became common knowledge that Greece had faked its macroeconomic figures through the use of swaps and financial derivatives, aided by Goldman Sachs (Balzli, 2010; De Grauwe, 2010).

By the mid-2000s, Alan Greenspan, the Chairman at the Federal Reserve observed inflationary pressures and, within the Federal Open Markets Committee (FOMC), decided to increase the interest rate to curtail them. Suddenly, a whole subset of mortgage borrowers, termed the sub-prime borrowers, were facing difficulties making their payments as the interest rate they paid on their loans increased on every reset date.[104] By the fall of 2007, as default rates increased, investors who owned ABSs, CDOs, and MBSs could no longer asses their fair value and started restricting the withdrawal of funds from clients' accounts.[105] The Great Financial Crises unravelled between August 2017 and September 2018, when Lehman Brothers, the investment bank, filed for bankruptcy (Chapter 11) in a court in New York. However, the crisis was not only a US event, but also banks in England, Netherlands, Germany, Spain, and all around the world were facing difficulties as all the imbalances that had accumulated over more than a decade began unravelling. By 2008 the world economy was facing a sharp contraction in credit and aggregate demand, asset prices had fallen dramatically and systematically for over 12 months and the possibility of a new Great Depression was making headlines in newspapers all around the world (Financial Crisis Inquiry Commission, 2011; Neal, 2015; Borio, 2016).

As a way to resolve the looming crises, central banks quickly dropped the interest rate to the zero-lower-bound (ZLB), and a new wave of regulations took over the financial systems in most developed economies.[106] Additionally, unorthodox monetary policy tools were put in place such in the form of large asset purchase programs.[107] The idea behind these programs was to support aggregate demand, encourage credit-taking by firms and consumers and inducing investors to substitute their asset purchases from treasury bonds and government securities

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[104] Most sub-prime mortgages were adjustable rate contracts where the base rates would "reset" every quarter, semester or year.

[105] We described a detailed example of this in the prologue to this dissertation.

[106] The Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 is an excellent example for the US.

[107] One such programme advanced by the treasury was appropriately named Troubled Asset Relief Program. Its goal was to purchase toxic assets from banks to alleviate the strains on their balance sheets and their permanent need for capitalisation.

towards corporate debt and equity. The idea was that if the availability of funds for firms increased, at a reasonable cost, investment expenditure would recover, and output would react favourably (Bordo, 2014; Neal 2015). This process significantly increased the size of the central banks' balance sheet in the US and Europe and, at the time of this writing, they have still not returned to their pre-crisis level. Still, according to Neal (2014), by 2014 the Federal Reserve was turning a profit on the toxic assets it purchased during the height of the financial crisis.

By September 2018, the debate of whether the policy rate in the US and Europe has been too-low-for-too-long is still taking place, and a new strand of literature discusses the macroeconomic implications of policy rates at the ZLB (Gambacorta, Hofmann & Speerman, 2014; Summers, 2014; Wu & Xia, 2016). The Federal Funds rate has increased from the 0-0.25% range at the time of the crisis to the 1.50%-1.75% range, and inflation is only now returning the target level of 2% after remaining close to zero for over a decade. While the threat of deflation seems to have been dispelled both in the US and Europe, the unorthodox monetary policy package that was applied to resolve the GFC is still in place in several cases. The question remains if the GFC drew the Great Moderation to a close and inaugurated a new period characterised by economic nationalism *à la* Trump, protectionism in trade, closed borders, volatile currencies, and increased financial instability.

1.5. Concluding remarks

Financial (in)stability and financial crises have, once more, come to the fore of the research agenda for economic historians and international macroeconomists alike. As suggested by the quote that opens this chapter, this review has surveyed the lessons learnt, forgotten, and then re-learnt about how the cyclical behaviour of asset prices and credit levels impinges on macroeconomic fluctuations. Several takeaways from this review are worth of compilation.

First, the mainstream literature in macroeconomics argues that there is a divine coincidence between the monetary policy stance that warrants stable prices —the main policy objective— and the one that optimises output growth at non-inflationary levels. Furthermore, a second coincidence, as suggested by Bernanke & Gertler (1999), indicates that price stability is sufficient for financial stability. Within this framework, deviations from that "optimal" policy, as suggested by the Taylor rule, are expected to be costly in terms of output growth, employment and inflation. In their efforts to model economic fluctuations, authors in this strand of the literature have focused on the role of exogenous shocks to the economy, and have favoured transmission channels on investment, consumption and trade, understanding the financial system as an amplifier of those shocks. In their view, banks and financial institutions reassign resources from savers to borrowers, while their ability for endogenous money creation is abstracted out of the analysis. Consequently, the transmission channel for monetary policy in this setup generates no second-order effects on the economy: a lax policy increases credit and fosters investment growth and a tight policy restricts credit and hinders investment and growth.

Second, the heterodox literature we have reviewed argues that the coincidences that were thought to be stable in the mainstream model are spurious—the consequence of historical conditions— and that financial stability and price stability are independent policy goals that need to be addressed as such. They argue that the financial system is not merely an amplifier of shocks but rather, that its ability to create money endogenously and to innovate beyond the control of monetary authorities, endows it with the ability to cause shocks and instability in the system. This ability of the financial system is amplified by the existence of a global financial cycle that seems to drive perceptions and valuations of risk worldwide. Additionally, they understand that there is a robust feedback mechanism between asset prices and credit and thus they should be analysed jointly as a financial cycle. The natural consequence of this view is that, because of the cost of financial instability regarding output, employment, and inequality, a role should be assigned to asset prices and credit in the monetary policy reaction function beyond their effect on inflation and growth. In this view, financial imbalances accumulate and unwind through channels beyond those investigated by mainstream economists: there is a role for human psychology and animal spirits, and there are time-varying lending standards and risk perceptions which make the system inherently unstable.

Third, the choices made by different countries, at different times, with regards to exchange rates and capital controls, beyond their effect on macroeconomic fluctuations, have implications for developments in stock and credit markets and, ultimately, on financial stability. While there are abundant negative results in establishing a link between exchange rate regimes and the macroeconomy, there is also evidence of a link between fixed exchange rates and a lower amplitude in the boom-bust cycle for assets and credit. Still, the effect of exchange rates on asset prices and credit seems to be very much contingent on market microstructure elements and the identification of causality has proven difficult. With regards to capital controls, we identify two key findings. First, financial integration seems to be a key driver of financial instability, mainly through the global financial cycle discussed earlier. Second, processes of capital flow deregulations and stock market liberalisation are shown to be critical for the development of future financial instability.

To conclude, after this literature review on the link between the financial system and macroeconomic fluctuations we can circle back to the critical question that drives our research: What role does the interaction of exchange rate and capital control regimes play in the evolution of financial (in)stability through time and across countries? As we tend to this broad issue, we will also be able to shed light on some other questions that remain open in the literature: Is there evidence for a financial cycle that arises from the feedback between asset prices and credit aggregates? Is the boom and bust process of asset prices and credit, driven somehow by global financial conditions? Is there a place for asset prices and credit aggregates in the formulation of monetary policy? In what follows, we provide insights into all these relevant questions.

Chapter 2. Database and a New Indicator for Describing Bull and Bear Markets

The aim of this chapter is threefold. First, in Section 2.1, we will present the stock market and real credit series which will proxy for the components of the financial cycle throughout the rest of the dissertation. Second, in Section 2.2, we will discuss the definition of the exchange rate, capital control and trilemma regimes that will be employed in Chapter 3 and Chapter 4. Finally, in the remainder of the chapter, we will present the main methodological contribution of this dissertation: the global and local Bull Bear Indicators (GBBIs and LBBIs). We will compare these new measures, which will serve as our dependent variables in Part 2 and 3, against the usual methodological toolkit to measure expansions and contractions in financial time series to highlight their benefits and shortcomings.

2.1. Database: Stock Prices and Credit Variables

As discussed in the introduction, our research aims to find the implications that the different choices by policymakers to resolve the impossible trinity have on financial stability. To tackle this question our dependent variables will focus on the evolution of the financial cycle (see Section 1.1), understood as the changes both in stock prices and credit aggregates. We do not aim at a single measure for the financial cycle but rather at separate measures for asset prices and credit aggregates as we believe that the relationship between these two variables does not need to be stable through time.[108] We present a description of the construction of the database with a characterisation of sources in the following sections. An in-depth description of the statistical characteristics of the series can be found in Annex 2.

2.1.1. Stock Market Indices

We obtain monthly market-wide, capitalisation-weighted, indices with dividend reinvestment, in local currency in real terms from Global

[108] We will test this hypothesis in **Error! Reference source not found.**.

Financial Data (GFD).[109,110] They have been deflated by the source using the corresponding monthly CPI for each country. Whenever the data had weekly or daily frequency, we chose the observation for the last available trading day of each month. For applications where we use the series of annual frequency, we chose the datum for the last trading day in December as the observation for the year. In all cases, we reset the index to take a value of 100 in January 1950. Missing data were filled using the last available observation.

A brief description of the series for each country follows. While we discuss in-depth the different series used by the source to construct the stock market indices, some criticism has come from academics about the black-box nature of their construction. An alternative source of stock market indices is the Jordà, Schularick & Taylor (2017) macrohistory database (JST). In their online appendix, they thoroughly describe the sources they employ and offer a description of how the series are linked. In Annex 3 we compare both series and conclude that their growth rates, which will be critical throughout this dissertation, are strongly related. We will keep using the data from GFD because it has a monthly frequency while JST's data is annual. The higher frequency of data will be necessary for the remainder of this chapter as well as for Chapter 5.

Australia

The leading time series for Australia is Australia ASX all ordinaries with GFD extension with monthly frequency from January 1875 until January 1958 and daily frequency from January 1958 until September 2015. The index had an original base value of 500 for December 31, 1979. The base

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[109] We want to thank the Department of Economics at UC Davis for providing unlimited access to this database during a research stay in the Fall of 2017.

[110] Bordo & Wheelock (2006) highlight that comparing growth rates of stock market indices may be problematic because of differences in the composition of the index. While we understand this caveat, a similar case could be made for comparing GDP growth rates across countries since the underlying structures of the economies can be substantially different. For example, a country may focus more on the technology sector (Japan), and another may focus more on the whaling and shipping industry or the oil and mining sectors (Norway). This has not curtailed researchers from performing comparisons.

for deflating the series is December 2017. In this research, the series starts in January 1917.

There are no missing data. At any given point the index represents at least 92% of the Australian stock market by capitalisation.

Canada

The leading time series for Canada is Canada S&P/TSX 300 Composite with GFD extension with monthly frequency from January 1914 until January 1970, weekly from January 1971 until December 1975, and daily frequency from January 1976 until September 2015. The index had an original base value of 1000 for December 31, 1975. The base for deflating the series is December 2017. In this research, the series starts in January 1917.

There are no missing data in the series. Up to 1918, the index represents 20 companies. From then on, until 1937 the index represents over 100 companies from 15 sectors at any given time. Since 1937 the index represents about 71% of the market capitalisation in the Toronto stock exchange.

Denmark

The leading time series for Denmark is OMX Copenhagen All-Share Price Index with monthly frequency from January 1873 until January 1979 and daily frequency from January 1979 until September 2015. The index had an original base value of 100 for December 31, 1975. The base for deflating the series is December 2017. In this research, the series starts in January 1917.

No data are available for May and September 1940. The index represents 20 shares up to 1983, and a broader selection of stocks since then, however, the source does not provide the number of companies covered.

France

The leading time series for France is France CAC All-Tradable Total Return Index with monthly frequency from January 1885 until January 1991 and daily frequency from January 1991 until September 2015. The index had an original base value of 1000 for December 28, 1990. The base for deflating the series is December 1998. In this research, the series starts in January 1919, when the stock market reopened after the First World War.

No data are available from 1914 until 1918, for September 1939 and from June 1940 until February 1941 because the *Bourse* was closed due to the wars. There are missing observations for April 1974 and March 1979 when the *bourse* closed due to strikes. Before 1990, the series is based on the INSEE indices which cover about 300 companies. Starting in December 1990 the index is based on the SBF-250 (*Société des Bourses Françaises*) which covers 250 companies.

Germany

The leading time series for Germany is the CDAX Total Return Index with monthly frequency from December 1869 until December 1969 and daily frequency from January 1970 until September 2015. The index had an original base value of 1000 for December 31, 1987. The base for deflating the series is April 2010.

To tend to issues associated with the German hyperinflation of the beginning of the 1920s, we explored the possibility of using an index denominated in gold marks. However, the considerable variability and abnormal behaviour of both series before the end of 1923 led us to think that including any of the two series would increase measurement error. Thus we decided to cut the series and only use CDAX values starting in November 1923, the month in which Germany returned to the gold exchange standard where it remained until 1931 (Bernanke & James, 1991). A similar procedure is followed by Obstfeld, Shambaugh & Taylor (2004).

The GFD indicates that since 1924, a nominal index including 213 shares and covering all sectors was calculated. Price limits were set on the exchange starting in January 1943 and lasted until June 1948, when they were allowed to seek market levels as part of the currency stabilisation process. By July 1948, the Federal Office of Statistics (*Statistisches Bundesamt*) began calculating an index, which is used until 1956, that covered 300 companies. Since then and until 1969, the series follows the Commerzbank Index. For the more recent period, the series follows the CDAX index which, although officially inaugurated in 1988, has been extended by the *Deutsche Borse* back to 1970. This index represents the German domestic equity market in its entirety, including 670 firms listed on the Frankfurt Stock Exchange (*Frankfurter Wertpapierbörse* – FWB). Data refer to unified Germany after 1993 and Western Germany before this date.

Italy

The leading time series for Italy is the *Banca Commerciale Italiana* (BCI) Index which has a monthly frequency from September 1905 until December 1956 and daily frequency from December 1956 until September 2015. The index has an original base value of 1000 on December 31, 1972. The base for deflating the series is December 2010. In this research, the series begins in January 1917.

The GFD indicates that data has a yearly frequency for 1922-23 and the observation for may 1945 is missing. The index from 1905 to 1930 includes over 173 stocks. Beginning in 1931 and until 1939 the index includes 74 different shares, while from 1939 through 1975 the series follows the *Gruppo Edison* index of 24 stocks traded on the Milan Stock Exchange. The BCI index begins in January 1973 and covers 325 companies listed on the Milan Stock Exchange.

Japan

The leading time series for Japan is Tokyo SE price index with GFD extension with annual frequency from December 1878 to July 1914, monthly frequency from August 1914 until October 1946, weekly frequency from November 1946, until may 1948, daily frequency from June 1948 until September 1948, monthly frequency from September 1948 until January 1953, and daily frequency from January 1953 until September 2015. The index had an original base value of 100 for January 4, 1968. The base for deflating the series is December 2017. In this research, the series starts in January 1917.

Data for October 1923 is missing due to an earthquake that forced the Tokyo Stock Exchange to close. There is no data available for May 1940 and from September 1945 until April 1946 due to the Second World War. Black market trading resumed in May 1946, the official reopening of the stock exchange occurred in 1949. Before 1946, the Oriental Economist index is used, which covers about 30 stocks, from then on, the Nikkei-225 index is used.

Netherlands

The leading time series for the Netherlands is All-Share Price Index which has a monthly frequency from January 1919 until December 1979 and daily frequency from January 1980 until September 2015. The index had an original base value of 100 on December 31, 1983. The base for deflating the series is December 2010. In this research, the series begins in January 1919.

No data are available from May to August 1940, and from September 1944 until April 1946 where the stock exchange was closed. The pre-war index consisted of 50 stocks, while the post-war index employed until 1952 and included 27 industrial and non-industrial stocks. The current all share index, which starts in 1952, covers 137 shares. All indices were calculated by the Dutch Central Bureau of Statistics (*Centraal Bureau voor de Statistiek* - CBS)

Norway

The leading time series for Norway is the Oslo SE OBX-25 Stock Index with GFD extension with monthly frequency from August 1914 until October 1991, and daily frequency from October 1991 until September 2015. The index had an original base value of 100 for December 31, 1995. The base for deflating the series is December 2017. In this research, the series starts in January 1917.

No data are available for May 1940 due to the Second World War. The index covers industrial, banking, and whaling/shipping shares since 1918 until present. It covers 50 companies up until 1983 and all traded companies weighted by market capitalisation since then.

Sweden

The leading time series for Sweden is the OMX *Affärsvärldens* General Index which has a monthly frequency from January 1906 until December 1979 and daily frequency from January 1980 until September 2015. The index has an original base value of 100 on December 29, 1995. The base for deflating the series is December 1980. In this research, the series begins in January 1917.

According to GFD, the monthly Riksbank index is used to build the series from 1913-43. From 1944 onward the *Affärsvärldens* General Index (AFGX) is used. Nasdaq OMX took over the calculation of the index in April 2009 and changed its name. The AFGX includes over 110 stocks registered on the Stockholm Stock Exchange. This index is not calculated with dividend reinvestment.

Switzerland

The leading time series for the Swiss stock market is Switzerland Price Index with GFD extension with monthly frequency from January 1914 until December 1937, weekly frequency from January 1938 until January 1969, and daily frequency from January 1969 until September 2015. The index had an original base value of 400 for February 15, 1999. The base for deflating the series is December 2017. In this research, the series starts in January 1917.

There is no missing data. Up to 1925, the index includes 20 companies. From then until 1955 the Swiss National Bank (*Schweizerisches Nationalbank*) is used which covers 12 different sectors. From then onward, the index covers over 400 different stocks.

United Kingdom

The leading time series for the UK is the UK FTSE All-Share Return Index which has a monthly frequency from August 1694 until December 1964 and daily frequency from December 1964 until September 2015. The index has an original base value of 100 on December 31, 1992. The base for deflating the series is January 1987. This series has also been used *inter alia* by Morelli (2002) and Poon & Taylor (1991).

According to the GFD, the index corresponds exclusively to Bank of England shares from 1874 to 1922. Thus we use the UK Banker's Magazine All Securities as a secondary source. This series presents monthly data from August 1887 until July 1966. We linked both series in January 1933. We reconstruct the FTSE series backwards from 1932 until January 1917 based on the real variations of the Banker's Magazine series. In this research, the series begins in January 1917.

The UK Banker's Magazine series includes stocks from all sectors of the economy and is a market-weighted composition of the specific sector indices produced by the Banker's Magazine. The UK FTSE index is also a market-wide index as disclosed by GFD.

United States

The leading time series for the United States is the S&P 500 Composite Price Index with GFD extension with monthly frequency from January 1914 until December 1917, weekly frequency from January 1918 until December 1927, and daily frequency from January 1928 until September 2015. The index had an original base value of 100 for July 28, 1978. The base for deflating the series is December 2017. In this research, the series starts in January 1917.

The series has no missing data. According to the source, the index is a market-capitalisation series that was introduced in 1923 and calculated since 1918. For data before this period, GFD uses the Cowles Commission series which reconstructed the index back until 1871. The Cowles Commission series contains 90 different shares. The series since 1918 covers 233 different companies, and since March 1957 it covers 500 different shares. GFD does not provide information about the treatment of dividends.

2.1.2. Real Credit

We obtain annual nominal credit information from the Jordà, Schularick & Taylor (2017) Macrohistory database which is available online.[111] The series *tloans* contains total loans to the non-financial private sector in nominal terms expressed in billions of local currency. Schularick & Taylor (2012) indicate that:

> *"Total lending or bank loans is defined as the end-of-year amount of outstanding domestic currency lending by domestic banks to domestic households and non-financial corporations (excluding lending within*

[111] The full database can be found in http://www.macrohistory.net/data/

the financial system). Banks are defined broadly as monetary financial institutions and include savings banks, postal banks, credit unions, mortgage associations, and building societies whenever the data are available" (p. 1032-33)

We deflate it using the CPI series from the same database which contains the consumer price index with index equal 100 for 1990 for the thirteen countries.

The series for Canada, Denmark, Italy, Japan, the Netherlands, Norway, Sweden, Switzerland, the United Kingdom, and the United States run uninterruptedly from 1917 until 2013, the final year of the database. Australia has missing data for 1946 and 1947, which we filled with the available observation for 1945. According to the authors, for France, the data for 1939-45 was chain-linked backwards from data proved by Eric Monet for 1946-57. Even though our first choice was to use the series starting in 1946, we found abnormally high credit growth in 1946-47 (58%), 1947-48 (64%) and 1948-49 (30%). Consequently, we use the series starting in 1950. The series for Germany has missing data for 1921-23 and 1941-45. As in the French case, our first instinct was to use the series starting in 1946 but found abnormally high credit growth in 1948-49 (118%) and 1949-50 (84%). Consequently, we use the credit series for Germany starting in 1950.

We use these series bearing some caveats in mind. One the one hand, we use the series in levels rather than its ratio to GDP because, as suggested by Shin (2013) credit growth and GDP "dance to different tunes". Consequently, the trilemma regime in place, as indicated in Chapter 1, can have a different effect on the behaviour of output than on the behaviour of credit.[112] In order to disentangle the effects, we prefer to use the level of credit to GDP as a control rather than including it in the dependent variable as this may difficult identification.

On the other hand, a critique to the loan series employed by JST has to do with the fact that including only loans to the private non-financial sector excludes other relevant sources of credit, mainly as it solely refers to

[112] This is a similar choice to that of Claessens, Kose & Terrones (2013).

banking credit.[113] A secondary annual series of credit to GDP comes from the World Bank Group (WB)[114] and includes a broader definition of the financial system:

> "*Domestic credit provided by the financial sector includes all credit to various sectors on a gross basis, with the exception of credit to the central government, which is net. The financial sector includes monetary authorities and deposit money banks, as well as other financial corporations where data are available (including corporations that do not accept transferable deposits but do incur such liabilities as time and savings deposits). Examples of other financial corporations are finance and leasing companies, money lenders, insurance corporations, pension funds, and foreign exchange companies*" (World Bank Group, 2017).

This series is only available for a recent period. For Australia, Canada, France, Japan, the Netherlands, Norway, Switzerland, Sweden, the United Kingdom, and the United States it starts in 1960. For Germany, it starts in 1970, and for Italy, it starts in 1963. The series for Denmark only had eight observations, and we omitted it from the analysis. The series for Canada runs until 2008. All remaining series, run uninterrupted until 2016.

Using real GDP data from the World Bank, we obtained a broader measure of real credit. In Figure 5 we present a scatter plot of the logarithmic transformation of the series in levels.

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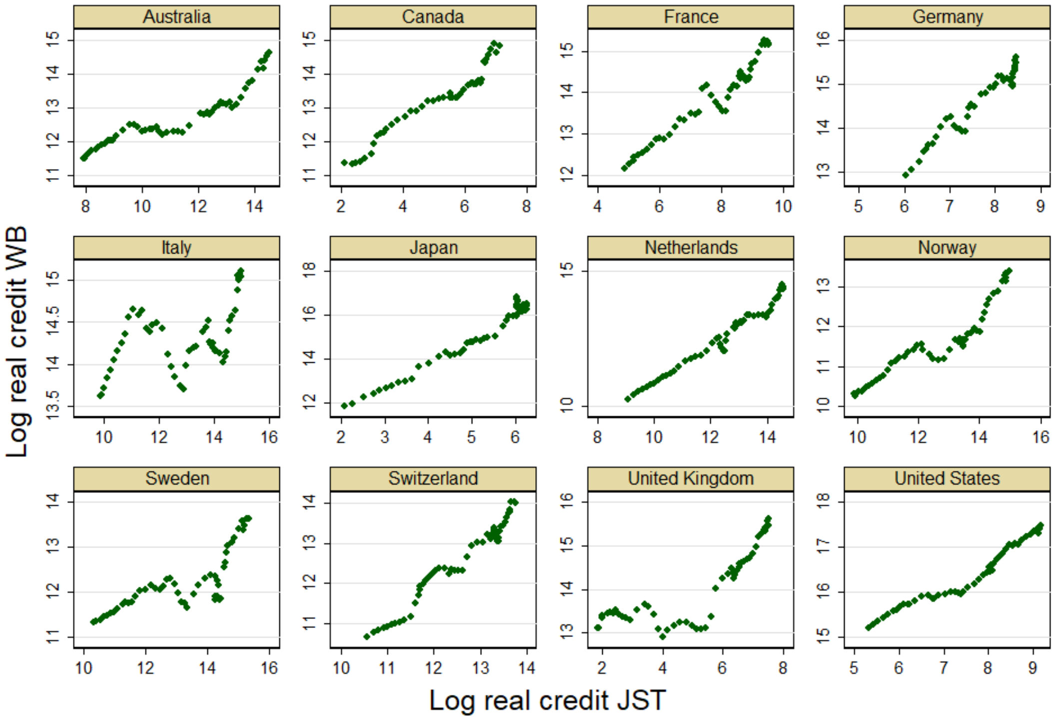
[113] We thank Michael D. Bordo and Eugene White from Rutgers University for bringing this to our attention and suggesting the alternative source.

[114] The series is available at https://data.worldbank.org/indicator/FS.AST.DOMS.GD.ZS

Figure 5: Scatterplot of real credit from JST and WB

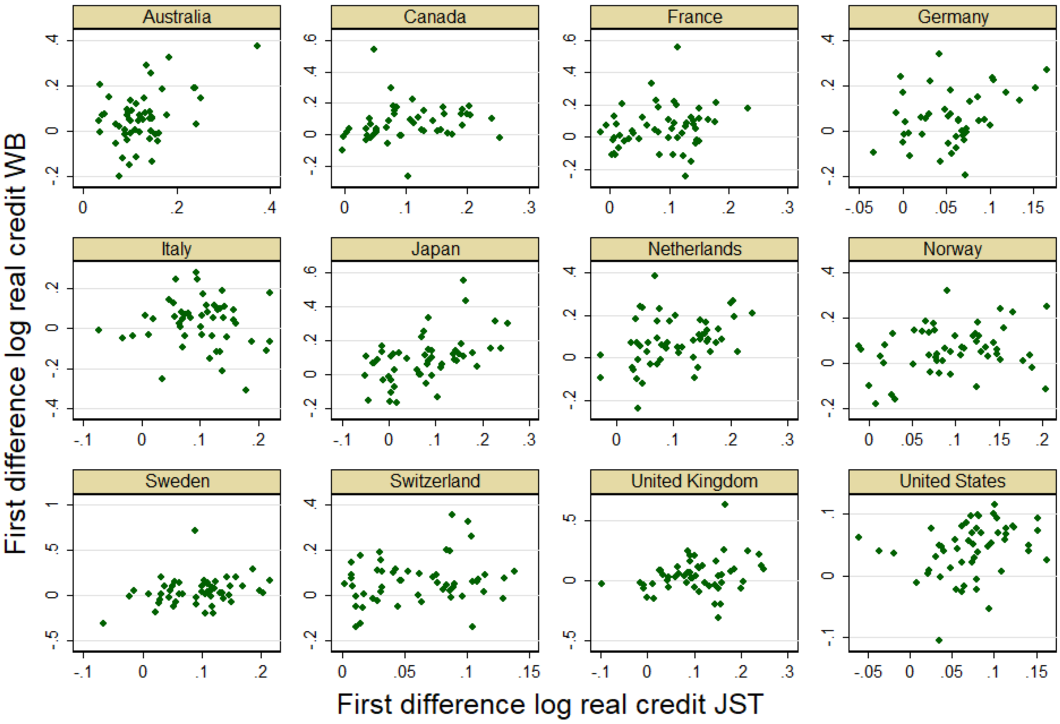


Note: The graph shows the scatterplot of the logarithmic transformation of the real credit series from JST on the X axis against the logarithmic transformation of the real credit series calculated from the WB database on the Y axis.

The figure shows that in general there appears to be a linear relationship between both series. We find important, albeit temporary, deviations from linearity in the series for Italy, Norway, Sweden, and the United Kingdom. We believe it is possible that this relationship is being driven by an unobserved common factor, such as output, that may be causing both variables to trend together.[115] To control for this possibility, we replicate the scatterplots for the first differences of the series in logarithms. This will show if the rates of change in both series, which will later indicate the way in which they accumulate imbalances, are linearly related as well. In Figure 6 we present such scatterplots.

[115] From Daniel's trend test in the statistical characterisation in 0, it is evident the real credit series in levels has a trend component in all cases.

Figure 6: Scatterplot of the growth rates of real credit from JST and WB



Note: The graph contains a scatterplot of the first difference of the logarithmic transformation of the real credit series from JST on the *X*-axis against the first difference of the logarithmic transformation of the real credit series calculated from the WB database on the *Y*-axis.

The scatterplots in Figure 6 show no relationship between the growth rates in both series. This is a strong indication that they are measuring different things and cannot be used as substitutes in our analysis. The main difference between both series is that the one obtained from the World Bank includes the net loans from the financial sector to the central government, and thus has a public debt component. As we argued in the introduction, the behaviour of public indebtedness is different from that of the leverage for firms or households, which is the main target of this study. We believe that including this broader definition of credit may distort the identification we want to perform and consequently, we will move forward only using the series from Jordà, Schularick & Taylor (2017). Additionally, we follow Assenmacher-Wesche & Gerlach (2010) in their indication that this narrow definition of credit is sufficient to identify consumer and firm-led asset price and credit booms.

As a corollary, Jordà, Schularick & Taylor (2015) indicate that the *tloans* series during the postwar period is driven heavily by mortgage loans as home ownership rates increased dramatically in developing countries. In this same direction, Beck (2012) indicates that "in rich countries the deepening of the financial sector does not come from enterprise lending (…) but from household lending" (p. 2). This increase in household leverage, as argued in Minsky's model, may be a source of financial instability that is sufficiently captured in the current series. Further research should aim to broaden this definition of credit to include foreign loans to the private sector, which none of the surveyed series cover.

2.2. Identifying Exchange Rate, Capital Control, and Trilemma Regimes

The goal of this section is to identify the different ways in which each country resolved the macroeconomic trilemma between 1922 and 2015. To do so, we will build on the approaches by Obstfeld, Shambaugh & Taylor (2004) and Klein & Shambaugh (2015). They interact capital control and exchange regime dummies to build four different states of the world, our trilemma regimes (TRs): open capital account with either fixed or flexible exchange rates, and closed capital account with either fixed or flexible exchange rates.

For the construction of exchange rate regime dummies, we obtained different exchange rate series from the Global Financial Database as well as from Edvinsson, Jacobson & Waldenstrom (2008) and Eitrheim, Klovland & Qvigstad (2003). In constructing these dummies, we look at *de facto* FXRs as we are more interested in what countries do than in what they say. We follow the methodology by Klein & Shambaugh (2015) to distinguish between hard pegs, soft pegs, and floating exchange rates. In their paper, they calculate monthly devaluations and revaluations of the exchange rate with respect to a base currency from 1973 until 2011.[116] The

[116] In constructing the exchange rate series, they are always expressed in units of the local currency per one unit of the base currency. Consequently, a negative (positive) percentage change in the series represents an appreciation (depreciation) of the local currency with respect to the base currency.

base currency is that to which the country has historically pegged its currency or the currency to which it is most likely to peg.

Some papers like Bernanke & James (1991) offer a complete dating of the period where countries in the database participated in the interwar gold exchange standard and dates for when they abandoned convertibility. However, recent research by Urban & Straumann (2012) has shown that even if the countries eliminated convertibility into gold, they kept a fixed exchange rate. We take this as an invitation to verify directly in the data whether a *de jure* departure from the gold standard coincided with *de facto* flexible exchange rates.[117] Bordo & Schwartz (1999) and Eichengreen (2008), argue that after the First World War several countries aimed to return to the *antebellum* normality and stability warranted by the gold standard. An example of this intention is provided by the Genoa Conference of 1922, which sets the starting point for this research, where the primary goal was the return to convertibility (Kindleberger & Aliber, 2005).

In our case, we will choose the US dollar as a base currency for every country in the database in 1922-32, and in 1935-44. During these two periods the price of gold in US dollars was fixed, first at $20.67 per ounce, and later at $35.00 per ounce. As seen in Figure 7, the period 1933-34 was one of depreciation of the dollar in terms of gold. Therefore, for those two years, we will choose the French Franc as a base currency since France was in the gold standard at the time.[118] During the Bretton Woods agreement (1944-71) the base currency for all countries was the US dollar. Subsequently, for the period 1972-98 the base currency for Australia, Canada, Germany, and Japan is the US dollar while for the remaining eight countries it is the German Mark. During the Economic and Monetary Union (EMU) (1999-2015), the base currency for the European countries outside the eurozone is the euro while for the remaining countries it is the US dollar. We present a summary in Table 4.

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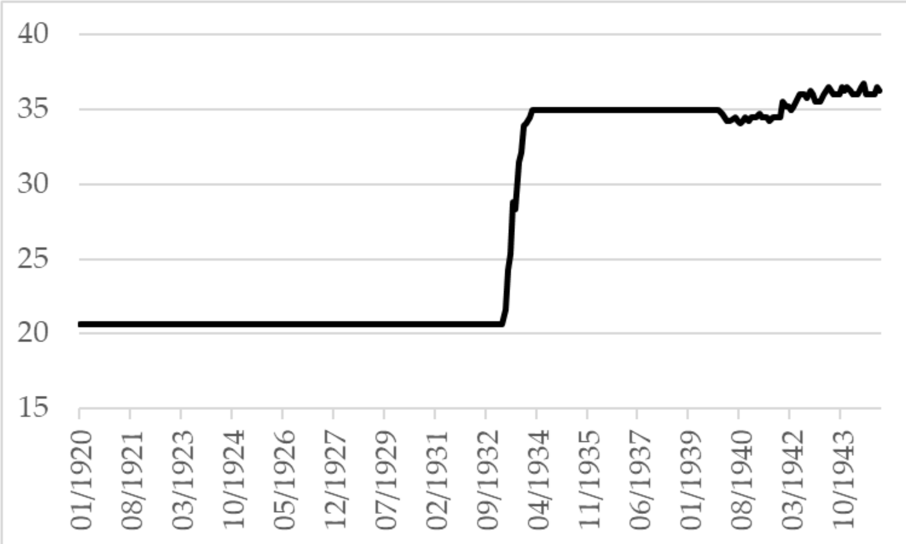
[117] To control for other mis-classifications of exchange rate regimes we have built our own series for the whole period of study. Further research should contrast our classification to those already available in the literature.

[118] A similar argument is followed by Urban & Straumann (2012).

Figure 7: Price of an ounce of gold in US dollars (1920-44)



Note: Data from Global Financial Data. The series corresponds to the gold bullion price per ounce in dollars in New York.

Table 4: Base currency to determine exchange rate regimes by period

	1922-32	1933-34	1935-71	1972-98	1999-2015
Australia	US Dollar	French Franc	US Dollar	US Dollar	US Dollar
Canada	US Dollar	French Franc	US Dollar	US Dollar	US Dollar
Denmark	US Dollar	French Franc	US Dollar	German Mark	Euro
France	US Dollar	Gold	US Dollar	German Mark	US Dollar
Germany	US Dollar	French Franc	US Dollar	US Dollar	US Dollar
Italy	US Dollar	French Franc	US Dollar	German Mark	US Dollar
Japan	US Dollar	French Franc	US Dollar	US Dollar	US Dollar
Netherlands	US Dollar	French Franc	US Dollar	German Mark	US Dollar
Norway	US Dollar	French Franc	US Dollar	German Mark	Euro
Sweden	US Dollar	French Franc	US Dollar	German Mark	Euro
Switzerland	US Dollar	French Franc	US Dollar	German Mark	Euro
United Kingdom	US Dollar	French Franc	US Dollar	German Mark	Euro

Note: To obtain the base country we follow Shambaugh (2004), Obstfeld, Shambaugh & Taylor (2010), and Klein & Shambaugh (2015)

To determine the exchange rate regime for a given country at a given time we follow Shambaugh (2004) and Obstfeld, Shambaugh & Taylor (2010) through the following algorithm. First, using monthly exchange rates against the base currency, we identify as hard pegs those years where the difference of the logarithms of the maximum and minimum value of the exchange rate during a given year is below 0.04. Additionally, we mark as hard pegs those years where for 11 out of 12 months the change in the exchange rate is below 1%.[119] As a third step, we indicate as floats the years where the difference of the logarithms of the maximum and minimum value of the exchange rate during a given year is above 0.1 or when the monthly change for any given month during a year is above 2%. All remaining years are marked as soft pegs. Finally, we use a censoring rule, so that hard pegs occur at least during two successive years, and soft pegs are preceded or followed by either a hard peg or a soft-peg.[120] We characterise the participation of the countries in the database in the different FXRs in Figure 8.

The main issue with this classification concerns eurozone countries who face two exchange rate regimes concurrently.[121] On the one hand, among themselves, they have a fixed exchange rate since they all use the Euro as a single currency and have thus forfeited their autonomous monetary policy. On the other hand, vis-à-vis the rest of the world they have a flexible exchange rate and they have autonomous, albeit joint, monetary policy. Consequently, a shock should transmit differently to a Eurozone country which floats against the dollar (i.e. the Netherlands,), than to a country that pegs to the euro (i. e. Denmark) in that the former has a seat at the European Central Bank (ECB), and it can influence Eurozone monetary policy. If a boom in the stock market or in credit aggregates in the Netherlands begins, they can alert the ECB and try to influence policymakers to increase the short-term rate or contract money supply. If the ECB increases the rate to accommodate the Dutch needs, and Denmark is going into recession, the Danish will be forced to either deepen their recession to hold the peg or abandon the peg to regain access

[119] The original classification is more stringent and demands that the exchange rate not vary at all during 11 out of 12 months.

[120] An issue that arises from using this methodology is that a country may be classified as pegging *de facto* even when *de jure* it said to be floating. This is the case in Sweden since the year 2000, as indicated by the Riksbank. Still, when a country chooses to let the exchange rate float under open capital accounts, the main purpose is to gain autonomy from the centre country's monetary policy. The fact that without purposefully looking for exchange rate stability, the Swedish Krona remained within the hard or soft peg bands indicates that said autonomy was not exercised in a way that required an adjustment via the exchange rate.

[121] We thank an anonymous reviewer for bringing this issue to our attention.

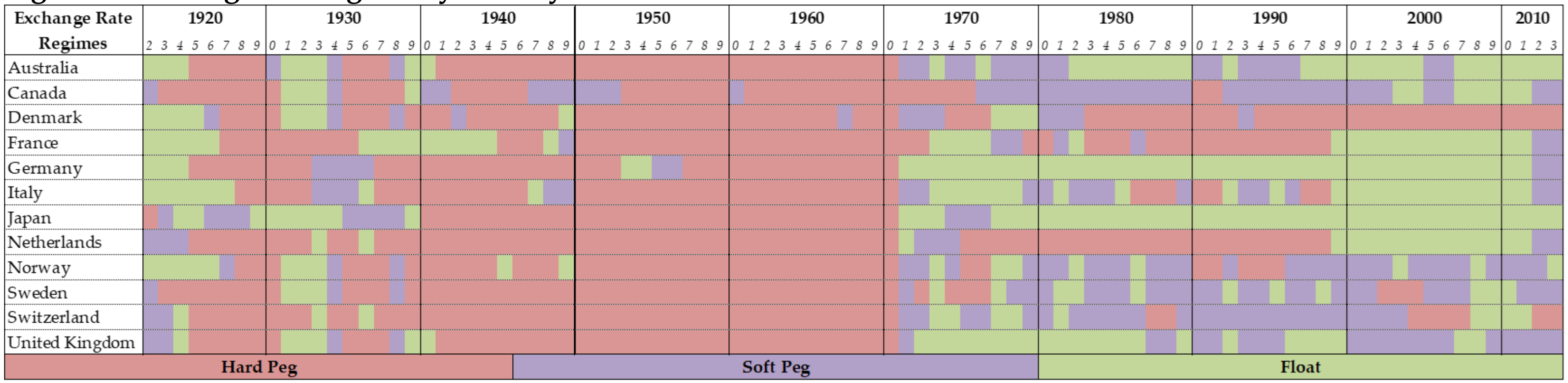
to their monetary autonomy. The ECB does not need to accommodate the needs of the Danish, but they do need to accommodate the needs of the Dutch. This is the main issue we wish to reflect with the different classification for eurozone countries and Denmark.

For the construction of capital control regimes, we exploit several sources. For the period 1922-38, we follow Obstfeld, Shambaugh & Taylor (2010) who have coded capital controls based on documents issued by the League of Nations in 1930 and 1938. These measures of capital controls cover all countries in the database except Australia, Canada and Norway.[122] For Australia and Canada we obtain data from Mitchener & Wandschneider (2014), and for Norway, we follow Øksendal (2006). For the period 1939-44, we extend the last observation in Obstfeld, Shambaugh & Taylor (2010) for Denmark, France, Germany, Italy, Japan, the Netherlands, and Norway. For Australia, Canada, Sweden, Switzerland, and the United Kingdom, we follow OECD (1993) that indicates that they established comprehensive exchange controls at the beginning of the war.[123] For 1944-48 we follow OECD (1993). For 1949 we use Grilli & Milesi-Ferreti (1995). For 1950-2004 we follow Quinn & Toyoda (2008). For 2005-13 we follow the updated version of Aizenman, Chinn & Ito (2010,2013).

[122] We thank Alan Taylor for providing access to this data.

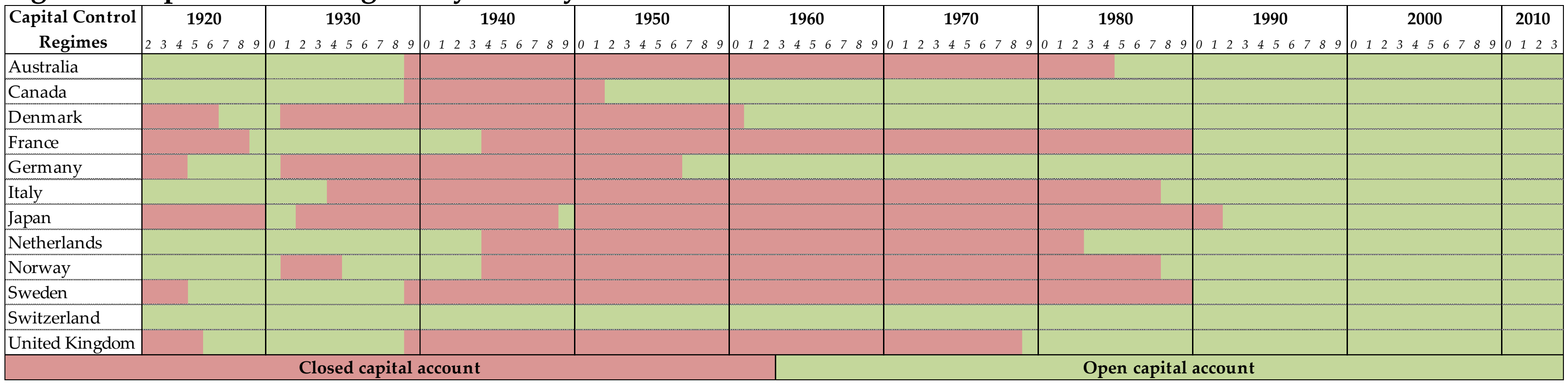
[123] OECD (1993) generally refers to exchange controls, making no distinction between capital and current account.

Figure 8: Exchange rate regime by country



Note: Exchange rates obtained from Global Financial Data. Calculations follow Shambaugh (2004), Obstfeld, Shambaugh & Taylor (2010) and Klein & Shambaugh (2015).

Figure 9: Capital control regime by country



Note: Data obtained from OECD (1993), Grilli & Milesi-Ferreti (1995), Øksendal (2006), Quinn & Toyoda (2008), Obstfeld, Shambaugh & Taylor (2010), Aizenman, Chinn & Ito (2010, 2013), and Mitchener & Wandschneider (2014).

All these sources employ *de jure* measures of capital controls, which pose a well-established shortcoming in the literature since probably what countries do and what they say they do, are not always the same thing. Bearing this in mind, we present the state of *de jure* controls on the capital account by country in Figure 9.

To construct trilemma regime, we follow Obstfeld, Shambaugh & Taylor (2004) and aggregate under the term fixed exchange rates both hard and soft pegs. The underlying logic to do this is that either of them represents a clear intention on the part of the authorities to manage the exchange rate.

We then build four different scenarios combining fixed and flexible exchange rates and open and closed capital accounts. Table 5 presents the number of observations and percentage of the database in each case. Rows correspond to capital account openness, and columns refer to exchange rate flexibility. The marginal rows and columns show the unconditional number of observations and share of each FXR and KCR on the full sample.

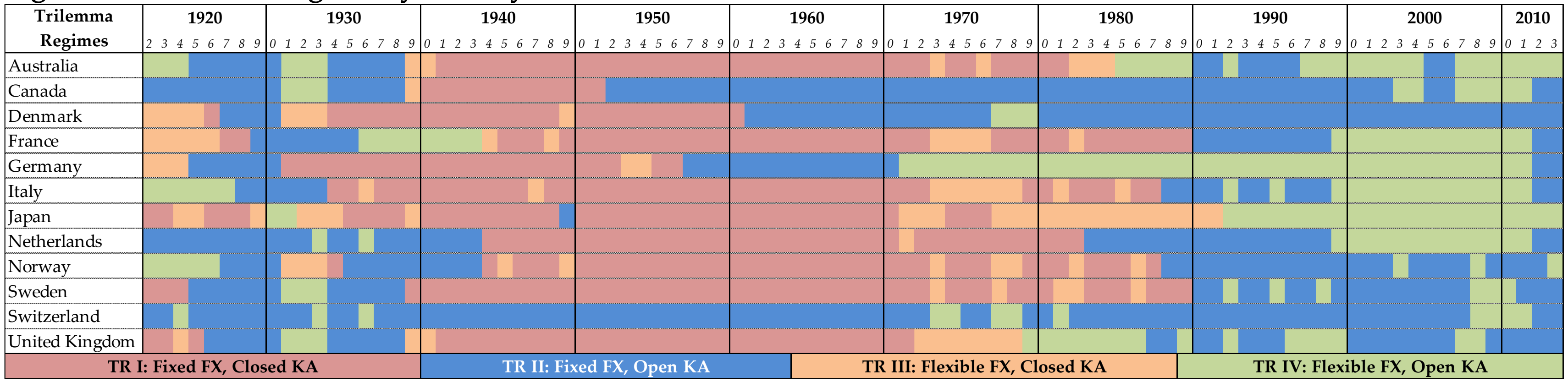
Table 5: Observations in the database by regime

		FXR		
		Fixed	*Flexible*	
KCR	*Closed*	388 35.1%	94 8.5%	482 43.7%
	Open	412 37.3%	210 19.0%	622 56.3%
		800 72.5%	304 27.5%	

Note: The top number in each cell corresponds to the number of observations in each regime. The bottom number is the percentage of the database that falls under each regime.

In the following figure, we show how the four distinct trilemma regimes evolved, by country, throughout the period of study.

Figure 10: Trilemma regime by country



Note: The four trilemma regimes arise from the combination of the exchange rate and capital control regimes. The fixed exchange rate regime contains both soft pegs and hard pegs. FX refers to the exchange rate. KA refers to the capital account.

Two elements are noteworthy from Table 5 and Figure 10. First, they both highlight that *ex-ante*, there appears to be sufficient time-series and cross-sectional variation in the data to allow for exploration of the dependent variable under each regime. Second, given the definition of the trilemma discussed in Chapter 1, the trilemma regime where exchange rates are flexible, and the capital account is closed (TR III) is suboptimal since the authorities would be sacrificing two out of the three desirable goals. This explains why this solution is the least frequent of the combinations. In Chapter 3 and Chapter 4 we will argue further, that some of the observations that fall in this category may be misidentified due to the *de jure* nature of the capital control dummy discussed above.

2.3. Are all Booms and Busts Created Equal? The Need for a New Measure to Identify Expansions and Contractions.

Since the works of Joseph A. Schumpeter and Nicolas D. Kondratieff waves of varying frequency have been both theorised and evidenced in economic data giving origin to a field of research devoted to identifying the secular trend and the underlying cycles in economic and financial time series (Metz, 2011). The literature on financial crises has profited from these developments in series decomposition to expand on the study of booms and busts in asset and credit markets.[124] Regardless of the technique used, results in this search for expansions and contractions usually take one of two forms.

A first usual result is a sequence of dates for peaks and troughs that allow studying booms and busts according to their rate of change (amplitude), length (duration) and severity. These dates, usually extracted

[124] For reasons of readability, throughout the text, we use the terms boom, expansion and bull or bust, contraction and bear interchangeably. We understand that *a priori*, not all expansions are booms, nor all contractions busts, and when necessary we will establish a distinction. Additionally, regarding bulls and bears, the origin of the terms is uncertain, but Wall Street lore indicates that, while bulls attack with an upward movement of their heads to maximize the damage done by their horns, bears exploit their height and while standing on their hindquarters usually swipe in a downward motion with their paws. Concurrently, Gonzalez et al. (2005, p. 470) state that "bull markets are associated with persistently rising share prices, strong investor interest, and enhanced financial well-being" while bear markets are defined conversely.

from quarterly or yearly data, are unidimensional in the sense that they do not allow researchers to analyse whether a boom or a bust had any effect on medium or long-run growth-rates after its ending date. The relevance of this idea, which we define as persistence, has been stated by Borio & Lowe (2002) when they indicate that they "focus on cumulative processes, rather than growth rates over just one year. Vulnerabilities are generally built up over an extended period, rather than in a single year" (p. 12). Unfortunately, persistence, as defined here, is unobservable with the current methodological toolkit.

The second type of result, a series of ones and zeros that indicates the presence of either booms or busts, presents researchers with several challenges. A first issue is a "lack of consensus on the mechanics of measurement, such as the choice of indicators and the method used to construct them" (Schüler et al., 2015, p. 2). Sarferaz & Uebele (2009) also identify the effects of these methodological disagreements. Secondly, these dummy series result from financial data, which in its original state show features such as strong and changing variability, and other properties that make them distinctive (Pagan & Sossounov, 2003). Summarizing their evolution in a yes / no sequence implies a loss of information and the assumption that the transition from a calm period to a crisis period is an instantaneous change of state and not a process that occurs over time. A final issue is that in a series where ones represent crises and zeros represent calm periods, researchers treat all crises as identical events. As indicated by Romer & Romer (2015) "This binary classification surely obscures some important information about the variation in the severity of crises. It also means that errors in classification are likely very consequential" (p. 2).

We believe that these methodological limitations have sharply restricted the depth of the analysis and quality of the results obtained through econometric analysis to focus excessively on the short-run drivers, effects, and characteristics of both booms and busts. We argue that the current methodological toolkit composed of diverse techniques both in the time and frequency domain offers a myopic perspective of the behaviour of booms and busts which does not allow for differences in persistence across time or for a nuanced characterisation of booms and busts based on their inherent characteristics.

Consequently, the first aim of the remainder of this chapter, and its main contribution is to present a new methodological approach for the characterisation of expansions and contractions in time series: the Bull Bear Indicator (BBI). These series, which we calculate globally (GBBI) or locally (LBBI), measure the direction and intensity of bull and bear markets, in standard deviations, to different time horizons: short, medium and long-run.[125] When constructing them, we exploit the empirical distribution of the underlying data allowing it to speak for itself, without an *a priori* definition of what constitutes a boom or a bust. Finally, BBIs allow us to perform the usual analysis of amplitude, duration, and severity while providing insight on the evolution of the underlying time series to different time horizons.

The second aim of what follows is to perform an application of this methodology to identify how it measures up to the current methodological toolbox and to provide insight into plausible drivers for booms and busts. To that end, we have chosen to analyse the UK stock market from January 1922 until September 2015. In our empirical analysis, we contrast the results obtained using the BBI methodology with those obtained through the most frequently used methods in the current toolkit, namely: the Turning Point Algorithm (TP) (Bry & Boschan, 1971), the Hodrick & Prescott (1997) filter (HP), the severity index (Harding & Pagan, 2002b and Agnello & Schuknecht, 2011), and the band-pass filter (BP) (Christiano & Fitzgerald, 2003). The categories for comparisons will be the number of contraction and expansion phases by methodology as well as their duration, amplitude and severity.

We find that the Local Bull-Bear Indicator (LBBI), in its short, medium and long-run specifications provides as much information as alternative methodologies and allows for further nuance and detail in the

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[125] While the global indicators measure expansions and contractions with respect to the average growth rate and standard deviation of the full sample, the local indicator takes stock of the changing mean and standard deviations in the series. This process corrects for the excessive importance that global indicator assigns to periods of extreme returns or volatility. Further discussion can be found in section 2.3.

analysis of amplitude, duration, and severity. These indicators aggregate in three measures sufficient information about the return structure of the series to different time horizons to perform in-depth studies.[126] Moreover, since LBBIs are continuous time series, they exceed by far the informational content of the binary sequences that are usually employed in the financial crises literature. In our analysis of the different methodologies, we find that the dispersion in the measures of amplitude, duration, and severity, indicates that each bull and bear is a unique event, with specific characteristics that need not be shared across phases. In this sense, an added value of the measure we propose is that it allows researchers to identify and work with a higher level of granularity.

2.4. The Current Methodological Toolkit for Identifying Bull and Bear Markets

The techniques available for the study of the boom-bust cycle in time series are diverse. Sections 2.4.1 and 2.4.2 present non-parametric techniques in the time domain: the turning point algorithm (TP) (Bry & Boschan, 1971 and Pagan & Sossounov, 2003) and the severity index (Harding & Pagan, 2002b and Agnello & Schuknecht, 2011). Section 2.4.3, devoted to spectral analysis, presents parametric time series decomposition methods in the time and frequency domains. As a case for the former, section 2.4.3.1 presents the Hodrick and Prescott (1997) filter (HP), while for the latter, section 2.4.3.2 discusses the bandpass filter (BP) as in Christiano & Fitzgerald (2003). Our choice of these methodologies is based on an extensive survey of the literature that found that they are the most frequently used in the characterisation of expansions and contractions in financial and economic time series.[127]

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[126] Following the financial literature, the term return refers to the period growth rate in the price of an asset (Campbell, Lo & MacKinlay, 1997). Consequently, throughout the dissertation we use both terms interchangeably.

[127] While a full literature review can be found in Forero-Laverde (2016), we present here a selection of papers by technique to motivate their inclusion in this section as the most frequently used techniques in the literature. TP: Bry & Boschan (1971), Hodrick & Prescott (1997), Harding & Pagan (2002a, 2005), Helbling & Terrones (2003), Pagan & Sossounov (2003), Bordo & Wheelock (2006, 2009), Drehmann et al., (2012), Bordo & Landon-Lane (2013), Claessens & Kose (2013), Schüler, Hiebert & Peltonen (2015). HP:

2.4.1. Turning Point Algorithm (TP)

A well-known example of a time domain method is the TP algorithm which describes local maxima and minima of a time series under a preset group of conditions. The result is a series of dates for peaks and troughs with intermediate sections classified as contractions (bears) or expansions (bulls) (Harding & Pagan, 2005). One of the most frequently used algorithms in business cycle literature is the one developed by Bry & Boschan (1971) to mimic the recession dates found by National Bureau of Economic Research (NBER), which they apply to several economic time series. Three decades later, Pagan & Sossounov (2003) implement these instructions for a long-run monthly index for the US stock market from January 1835 until May 1997 and offer a summary of the rules (Pagan & Sossounov, 2003, pp. 44-45):

I. Determination of initial turning points in data.

- I.A. Choice of peaks and troughs in symmetric windows of X months around each price observation.
- I.B. Enforcing of alternation.

II. Censoring operations

- II.A. Elimination of turns within six months of beginning and end of series
- II.B. Elimination of peaks (troughs) at both ends of series which are lower (higher) than values closer to the end
- II.C. Elimination of cycles with a shorter duration than Y months both for peak-to-peak and trough-to-trough.
- II.D. Elimination of phases (peak-to-trough or trough-to-peak) with a shorter duration than Z months (unless fall/rise exceeds 20%)

III. Statement of final turning points

This simple algorithm produces results that are robust to changes in sample size, although not to window size (Harding & Pagan, 2002a).

Borio & Lowe (2002, 2004), Borio & White (2004), Schularick & Taylor (2012), Assenmacher-Wesche & Gerlach (2010), Gerdesmeier, Reimers & Roffia (2010), Ng (2011), Shin (2013), Borio (2014a, 2014b). BP: Bordo et. al., (2001), Drehmann et al., (2012), Schüler, Hiebert & Peltonen (2015)

However, it leaves several choices for researchers allowing for different results using the same inputs. Additionally, the method lacks statistical foundation, difficulting both inference and hypothesis testing (Harding & Pagan, 2002b).

2.4.2. Severity Index

Harding & Pagan (2002b) use the turning point algorithm to identify boom and bust periods and then identify measures for the duration of the phases and cycles as well as their amplitude. The duration (D_i) of a phase is the distance in months between a peak (trough) and the next trough (peak). The amplitude (A_i) is the percentage change during the period. Agnello & Schuknecht (2011) construct a severity index which corresponds to Harding & Pagan's (2002b) "triangle approximation" to cumulative movements. The base of the triangle is the duration, and the height of the triangle is the amplitude of the cycle. The severity index for phase i is obtained as

$$S_i = \frac{1}{2}(D_i * A_i) \qquad (1)$$

There are several caveats to the use of the triangular methodology. First, two busts with comparable (A_i) but different (D_i) will have different severity indices, in which the method assigns a higher index to the longer event. In that sense, the severity index may be masking relevant events that happen quickly while over-weighting events that occur over extended periods of time. Additionally, severity indices for booms may be much larger, in absolute value than those for busts because the value of (A_i) has a lower bound of -100% as prices cannot take negative values. Another explanation for the prevalence of more severe booms than busts, as in Agnello & Schuknecht (2011) has to do with the assymetric reaction of policy makers towards booms and busts as discussed in Chapter 1. Monetary authorities are more prone to act in the face of crises than in the face of booms as it is politically costly to hamper an observable and profitable boom to lower the unobservable risks of a future recession (Dell'Ariccia et al., 2013; Freixas et al., 2015).

2.4.3. Time Series Decomposition: Filtering

While the turning point algorithm and the severity index use the original data, filtering techniques work under the assumption that any time series can be decomposed into various orthogonal components: trend, one or several cyclical components, and an error term. These decompositions can be performed on the time or the frequency domain.

On the one hand, models in the time domain rest on the idea that the current value of a variable is a function of its previous observations or previous observations of other time series. On the other hand, the frequency domain approach is interested in systematic or sinusoidal variations within the data which is attractive as it involves only a few kinds of primary oscillations (Fourier transforms). In other words, "the time domain approach may be thought of as regression of the present on the past, whereas the frequency domain approach may be considered as regression of the present on periodic sines and cosines" (Shumway & Stoffer, 2006, p. 174). This series decomposition is performed through linear filters, which are "linear transformation of the data that leaves intact the components of the data within a specified band of frequencies and eliminates all other components" (Christiano & Fitzgerald, 2003, p. 436). The idea is that there are low, high and band-pass filters depending on the type of frequencies they extract and those that they discard (Metz, 2010).

The filtering approach, however, is subject to several caveats. First, the cyclical component is strongly reliant on the method used to detrend the series. Second, ignoring serial correlation and the structure of disturbances may lead to spurious relationships (Mills, 2009). Third, following Gallegati, Gallegati, Ramsey & Semmler, (2015), filters in the frequency domain require time series to be stationary. This issue is partially solved since there are some filters, to which we restrict our analysis, that can be performed in the time domain with the desired properties still formulated in the frequency domain: the Hodrick & Prescott (1997) and band-pass filters (Christiano & Fitzgerald, 2003).[128]

[128] Following Gallegati et al., 2015:

> *"Well-known examples of time domain filters derived by approximating the frequency domain properties of ideal band-pass filters are the Baxter and King*

Fourth, Stock & Watson (1998) and Sarlan (2001) indicate that separating the trend and the cyclical component in a time series only makes sense when they are independent. If there is an underlying factor that affects and links both components, detrending the series will only result in a loss of information that may otherwise be relevant. Harding and Pagan (2002a, 2002b) indicate that trend and cyclical components are intertwined, and thus detrending would be similar to extracting a permanent component of a series.[129] "Indeed, the act of removing a stochastic trend actually eliminates one of the major driving forces of the business cycle and is, therefore, to be avoided" (Harding & Pagan, 2002b, p. 380). Finally, filters may report periodicities that are not really in the observed time series because of the underlying assumption of a specific data generating process. The results from filtering may also be driven by relevant historical events or structural breaks in the series (Cendejas, Muñoz & Fernandez-de-Pinedo, 2017).

2.4.3.1. The HP Filter

The Hodrick & Prescott (1997) filter (HP) is a one-sided high-pass filter designed to decompose a time series in a trend component assumed to vary smoothly over time with a stable second difference, and an

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(1999) and Christiano and Fitzgerald (2003) approximate band-pass filters which apply two-sided moving averages to time series. These alternative finite sample filters differ for the assumptions about the spectral density of the variables and the symmetry of the weights of the filter. Regarding the first assumption, the approximation by Baxter and King assumes independent and identically distributed variables, whereas Christiano and Fitzgerald assume a random walk. As to the latter, Baxter and King develop an approximate band-pass filter with symmetric weights on leads and lags in order to avoid the filter introducing phase shift in the cycles of filtered series, whereas Christiano and Fitzgerald asymmetric filter has the advantage to avoid losing observations at the beginning and end of the sample. Finally, the implicit differencing incorporated in both filters results in stationary time series even when the underlying time series is integrated of order one or two" (p. 6).

[129] Other types of filters such as the Beveridge-Nelson (1981) and the unobserved component model may allow for the existence of correlations between trend and cycle components (Morley, Nelson & Zivot, 2002). However, we do not tackle this type of filters because while the Beveridge-Nelson filter assumes a perfect negative correlation between components, the inclusion of a correlation in the unobserved components model requires an *ex-ante* assumption about the stochastic process followed by the trend.

independent cyclical component. The HP filter is a parametric approach which depends on the choice of a smoothing parameter λ which penalises the growth component over the cyclical component. Lower values of λ yield models that adapt faster to changes in the data.[130]

The filter extracts a trend from an observed time series with a weighted moving average and returns high-frequency component (usually frequencies higher than 40 quarters for quarterly data). It does so with the added benefit that it can be performed on nonstationary time series although the literature has shown that the filter produces artificial long-term cycles if the series is integrated of order 1 (Metz, 2011).

Additionally, even if the filter does not have a cycle, as it is based on trend extraction, there are some distortions in the cyclical component due to leakage (low frequencies that are not filtered out) and compression of cycles (Cendejas et al., 2017). Finally, Hamilton (2017) indicates that even for series that are known to behave as or close to martingales, the HP filter generates, by construction, a serial dependence within the cyclical component of the series. This added structure is not a feature of the data but imposed by the filtering process.

2.4.3.2. The Band-Pass Filter

The band-pass filter is a two-sided, symmetric filter designed to minimise the adjustment error of a cycle between a preset bandwidth. The central assumption underlying the band-pass filter, as presented by Stock & Watson (1998) and Christiano & Fitzgerald (2003), is that of a minimum and maximum cycle length. Any cycles or information of shorter (longer)

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[130] Mills (2009) discusses a paper by CEV Leser (1963) titled "Estimation of quasi-linear trend and seasonal variation" and published in the Journal of the American Statistical Association. About it, he states

> *Conrad Leser's paper directly considers trend extraction from an observed series using a weighted moving average, but derives the weights using the principle of penalised least squares, in which a linear combination of two sums of squares is minimised. The first sum of squares contains the deviations of the observations x_t from the trend μ_t, the second contains the second differences of successive trend values $\Delta^2\mu_t$, with the linear combination of the two being defined by the weights of unity and λ. (…) However, the paper's importance lies in the fact that the method developed by Leser is exactly that proposed some 2 decades later by Hodrick and Prescott (1997) and which has entered into macroeconomic modelling as the HP filter!* (Mills, 2009, pp. 226-227)

frequency than the lower (upper) bound of the bandwidth will be smoothed-out of the time series. A useful characteristic of this method is that it can be used to decompose a time series into as many orthogonal cyclical components as the researcher might need by using different bandwidths. For example, in a study of the long-run behaviour of the financial cycle for seven countries, Drehmann, et al., (2012) use the band-pass filter to extract the medium term component of credit and asset prices to explain its determinants. Several caveats are present for the band-pass filter. First, since the various cyclical components are orthogonal, the underlying assumption is that the determinants of their behaviour should be different. Second, the decomposition can show cycles that are nonexistent if the series are integrated. Finally, results may be driven by outliers and structural breaks if present (Metz, 2010).

2.5. A New Approach: The Bull Bear Indicator

Our goal in this section is to construct a measure that complements the methodologies discussed in Section 2.4 and improves upon their failings in characterising expansion and contraction phases present in time series. To do so, we first need to describe the inner workings of the return structure to different time horizons in the series presented in section 2.1.

Let $\mathbf{R}$ be an n-period linear return matrix in which rows will represent time and column vectors $\mathbf{r_n}$ will hold the growth rate from period t-n until t.[131] Thus, the position $r_{t,n}$ in the matrix can be obtained from $r_{t,n} = (P_t/P_{t-n}) - 1$, where P_t corresponds to the value of the variable at time t.[132] The index n represents the different time horizons to which we calculate returns. Following the traditional financial literature, short-run returns cover up to one year, medium-run returns up to three years and long-run returns up to five years (Bodie, Kane & Marcus, 2002).

Figure 11 shows the 3D plots of matrix $\mathbf{R}$ for the UK monthly real stock market index when n takes all integer values between 1 and 60

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[131] Regarding notation, we denote matrices in capital letters and in bold. Vectors are noted in lower-case letters and also in bold. Scalars, variables, and constants are italicised.

[132] We prefer to express simple returns as $(P_t/P_{t-1}) - 1$ rather than as $\ln(P_t) - \ln(P_{t-1})$ because, as shown in Forero-Laverde (2010), the logarithmic approximation to returns overestimates losses while it underestimates gains.

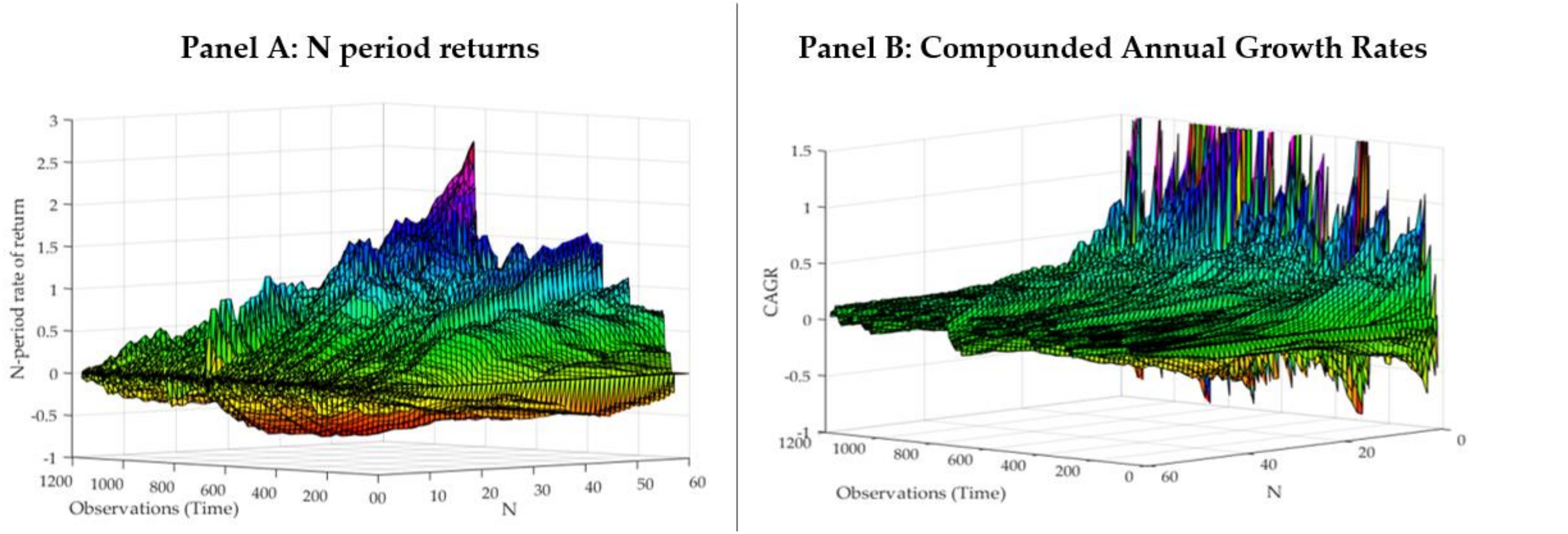
months.[133] To exemplify, the series contained in vector $\mathbf{r_{24}}$ contains the two year returns and vector $\mathbf{r_{60}}$ contains the five year growth rate. Panel A shows the n period growth rates. However, since the series for two different values of *n* are not comparable, in Panel B we present each series reexpressed as a CAGR to ensure comparability. Note that the axis for the values of *n* in Panel B is reversed.

The main takeaway from Panel A in the figure is that returns for the stock market are not only time-varying but that their evolution is contingent on the horizon of observation. Naturally, returns to longer time horizons (larger values of *n*) are larger than those to short horizons. Additionally, when reexpressed as CAGR (Panel B) what we observe is that returns to smaller values of *n* are noisier than those where *n* approaches 60.

In that sense, in Panel B one can observe how shocks that affect short-run returns become smoothed out as the lens through which they are observed increases in perspective. This process of increasing the value of *n* allows us to distinguish between shocks that affect short-run, medium-run and long-run returns. A second issue that shapes the surface in Panel B is the formula employed to calculate the CAGR (See note to Figure 11). While monthly returns are exponentiated to the power of 12, 5-year returns are exponentiated to the power of 0.2. Consequently, it is natural for vectors where *n* is large to have smaller values and lower variability than vectors where *n* is small. To exemplify, for an annual rate of return of 10% (25%) when n=1 to persist until n=60 would require the price of the index at time $t+60$ to be 61% (204%) larger than the price at time t.

[133] Results are similar for all other time series discussed in section 2.1.

Figure 11: R matrices for the UK stock market index (1922-2015)



Note: Panel A shows the evolution of the period rates of return calculated as $r_{t,n} = (P_t/P_{t-n}) - 1$, where P_t is the value of the index at time t and n takes integer values from 1 to 60 moths. The series where n=12, for example, contains annual returns, while the series where n=28 contains the 28-month growth rates. Panel B shows the same results for matriz **R** expressed as compounded annual growth rates (all are annual return equivalents) which are calculated as $r_{t,CAGR} = \left(1 + r_{t,n}\right)^{12/N} - 1$. In Panel B, note that the axis for n has the values reversed.

To summarise the information contained in matrix **R**, we follow the literature on the term structure of interest rates and select the first 12 vectors (corresponding to the short-run or money market horizon), and two equally spaced vectors per year, corresponding to the 18, 24, 30, 36, 42, 48, 54 and 60 month returns.[134] For annual series *n* will take integer values from one to five, where the one-year return represents the short-run, the returns for two and three years represent the medium-run, and the returns for four and five years represent the long-run.

To highlight some traits of the information contained in **R** we draw a heat map of the selected vectors for the UK stock market index. We follow a vector by vector colouring rule: observations farther away to the left (right) of the distribution will be coloured in red (green), as they represent the worst (best) returns in the full sample. The shading becomes darker as returns move closer to the tails of the distribution. We distinguish four different shades of red (green) for percentiles 1 (99), 5 (95), 10 (90) and 25 (75). Returns in the interquartile range (IQR) are not coloured.

Figure 12 shows several remarkable features. First, on a vector-by-vector basis, it shows clustering of positive and negative returns which can be understood as persistence from a time series perspective.[135] Second, moving from left to right, it is evident, as we discussed in the description of Figure 11, that some phases of expansion (in green) and some phases of contraction (in red) affect only short-run returns, while others affect the medium-run, and even the long-run as well. This can be thought of as persistence from a crossectional perspective. For example, the bear phase occurring by the end of 1926 only affects the returns up to 8 months but does not show up either in the medium or long-run panels.

Conversely, the bear phase that occurs at the beginning of the 1970s and the bull phase that follows in 1971, affect medium-run returns and can be thought of as more persistent phases. Finally, the bear phase that occurs

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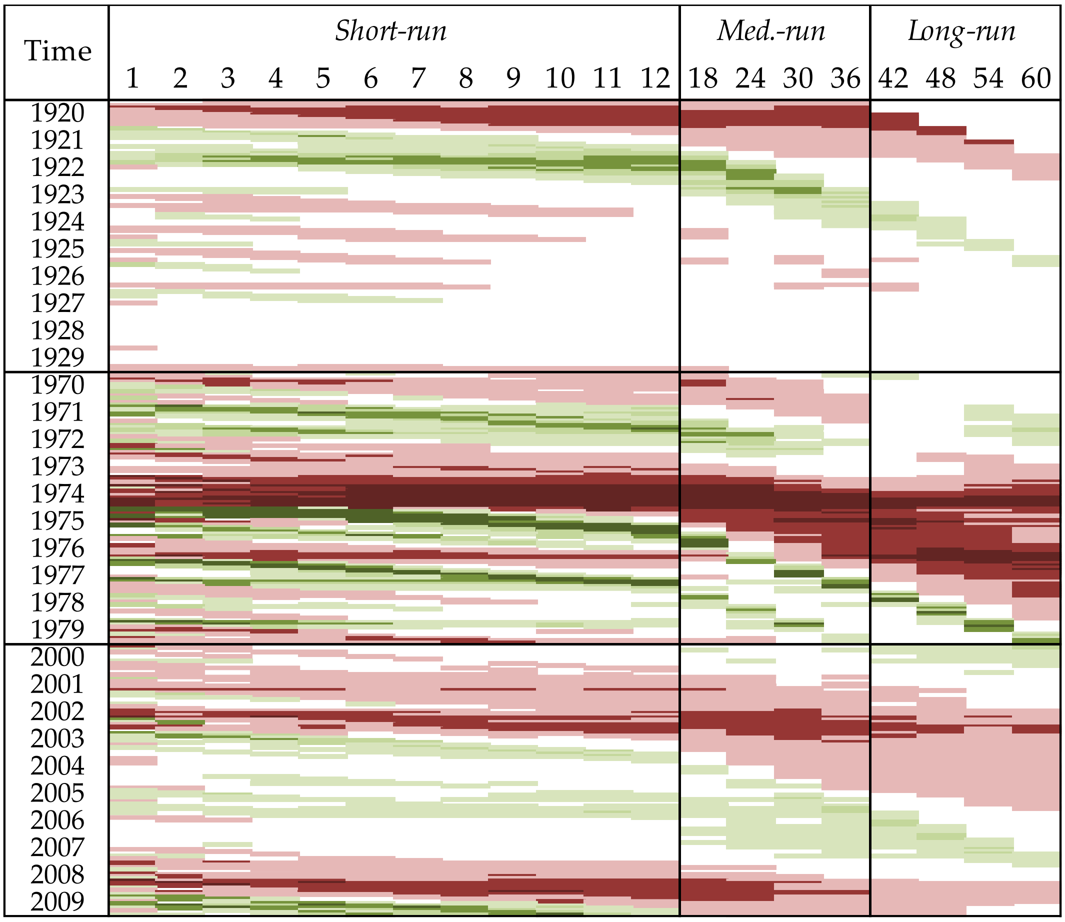
[134] In Section 2.6.2 we show that the 20 selected vectors represent the whole surface.

[135] This is what Fama & French (2008) refer to as the momentum anomaly: "Stocks with low returns over the last year tend to have low returns for the next few months and stocks with high past returns tend to have high future returns" (p. 1653)

in 1973, and the recovery that follows, affects returns to every time horizon, indicating even stronger persistence. A third feature has to do with the intensity of the shading. Since the colouring rule is followed for the full sample, the darkest shades of red (green) indicate the worst (best) returns in the full series. From Figure 12 we can see that the worst crash in the 98 years covered from 1917 to 2015 occurred in the 1973-74 and that the subsequent short recovery was one of the strongest in the sample.

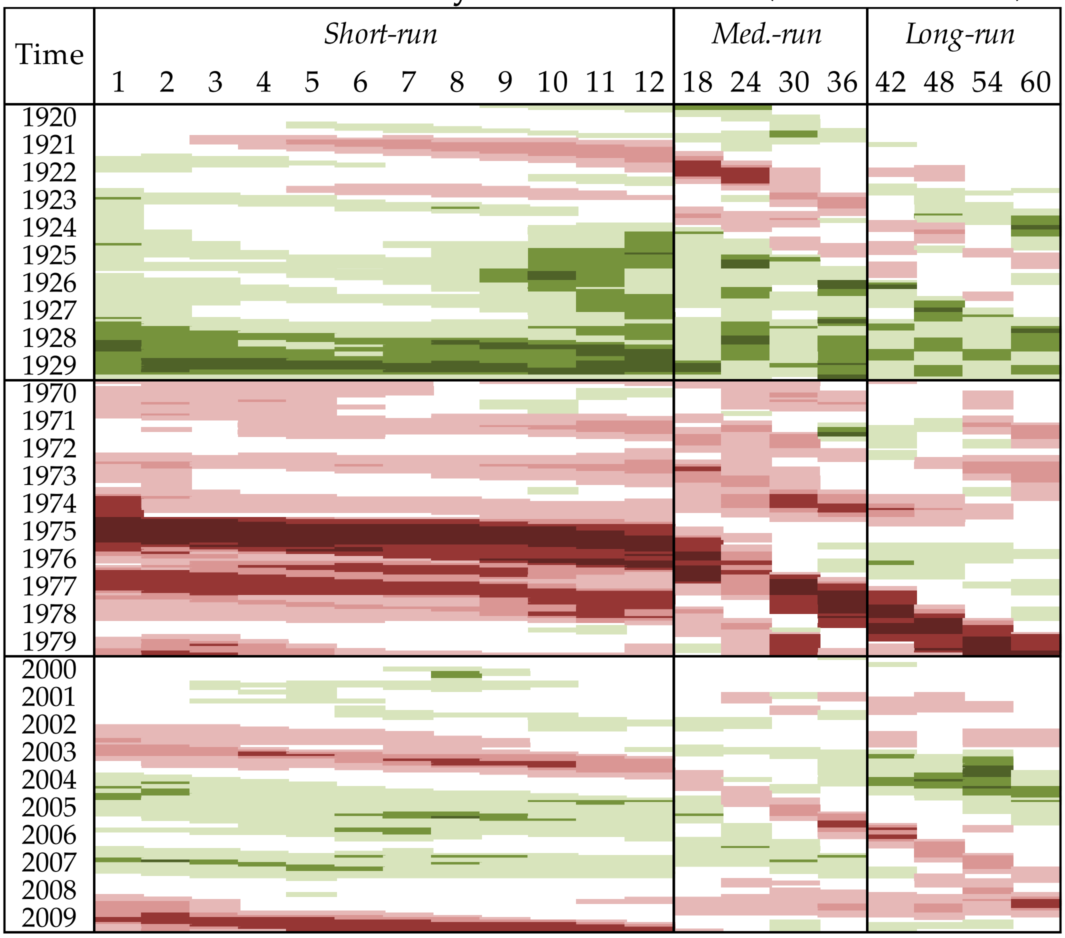
Figure 12: Heat map of R for the UK monthly stock market index (selected decades)



Note: Colouring rule followed a vector-by-vector basis using the full sample. Only selected results presented for the 1920s, 1970s, and 2000s. Each coloured cell represents a month. Short-run panel shows return vectors for n=1, 2, 3,…, 11, 12. Medium-run panels shows return vectors for n=18, 24, 30, and 36. Long-run panel shows return vectors for n=42, 48, 54, and 60. Darker shades of red (green) represent returns that are farther to the left (right) of the distribution. Only returns falling in percentiles 1 (99), 5 (95), 10 (90), and 25 (75), are shaded red (green).

We can go further in our characterisation of **R** by calculating rolling twelve-month standard deviations for each vector $\mathbf{r_n}$ in the matrix of returns for the monthly UK stock market index. We build a similar heat map where the coloring rule is reversed such that periods of high volatility are shown in red and periods of low volatility are shaded in green.

Figure 13: Heat map of 12-month rolling standard deviations of the vectors in R for the UK monthly stock market index (selected decades)



Note: Colouring rule followed a vector-by-vector basis using the full sample. Only selected results presented for the 1920s, 1970s, and 2000s. Each coloured cell represents a month. The short-run panel shows rolling sample standard deviation vectors for *n*=1, 2, 3,…, 11, 12. The medium-run panel shows rolling sample standard deviation vectors for *n*=18, 24, 30, and 36. The long-run panel shows rolling sample standard deviation vectors for *n*=42, 48, 54, and 60. Darker shades of green (red) represent lower (higher) standard deviations. Only standard deviations falling in percentiles 1 (99), 5 (95), 10 (90), and 25 (75), are shaded green (red).

Figure 13 shows two relevant characteristics of financial time series which are well known in the literature: first, volatility is time-varying; second, there is volatility clustering both from time series and crossectional perspectives (Cambell, Lo & MacLinlay, 1997). For example, there is a period of protracted stability in returns during the second half of the 1920s that affects returns to all time horizons. This period, however, does not coincide with any relevant expansion or contraction in the stock market, as attested in Figure 12. Similarly, there is a period of pervasively high volatility during the second half of the 1970s which coincides with both bulls and bears in Figure 12. Finally, a period of low volatility in 2004-7, coincides with a tenuous stock market expansion during the same period.

All these features are worth mentioning to indicate that not all bulls and bears are created equal and that the immense amount of underlying information in a time series, particularly their persistence in time, is not fully reflected in any of the methodologies discussed in section 2.4.

The goal of the BBI methodology is to exploit the empirical distributions of the data and condense as much of this breadth of information as possible in a few readily-interpretable and intuitive variables. Thus, we construct Bull–Bear Indicators (BBIs) for the short-run, medium-run, and long-run both from global and local perspectives.[136] The intuition behind the measures is that if growth rates to different time horizons move farther to the right (left) of the distribution the indicators, measured in standard deviations, take larger positive (negative) values.

As a thought experiment one can think of the data generating process behind the evolution of a time series as throwing a stone in the centre of a pond, producing waves that move outward towards the shore. The turning point algorithm identifies the peaks and troughs of the waves. The severity index identifies waves with high amplitude (substantial differences in height between peaks and troughs) and low frequency (vast distances between peaks and troughs) and omits weaker or higher

[136] The global version of the Bull Bear Indicator will work under the assumption of constant full sample mean and standard deviation. The local version of the BBI will account for time-varying mean and volatility.

frequency ripples. The HP filter, as indicated in section 2.7.1, compares the observed wave to a recursive prediction of how it should behave and highlights only significant deviations. The band-pass filter decomposes the ripples and observes only those that conform to specific preset frequencies. It presumes that the various components of the wave are driven by different phenomena (orthogonality assumption) omitting the fact that only one stone caused the ripples. However, none of the methodologies up to now care whether the ripple is close to or far away from the centre of the lake. The BBIs look at the waves differently, distinguishing those that disappear closer to the centre from those that move farther away and from those that reach the shore. Thus the BBIs discriminate between expansions or contractions that only affect short-run returns from those that affect the medium or long-run. In a sense, all these techniques are complementary and allow for a better, fuller understanding of the process that occurs when a stone drops in the centre of a lake.

2.5.1. The Global Bull Bear Indicators (GBBIs)

As indicated above, by construction, vectors $\mathbf{r_n}$ and $\mathbf{r_m}$ in **R** have different measures since they express n and m period returns respectively. A solution to keep comparability and thus desirable properties such as additivity across vectors with different values of n, is to standardize matrix **R**. By doing so we generate a new matrix **Z** such that:

$$z_{t,n} = \frac{(r_{t,n} - \mu_n)}{\sigma_n} \qquad (2)$$

The values obtained from (2) refer to the number of sample standard deviations σ_n that a given observation $r_{t,n}$ is away from the sample mean μ_n of vector $\mathbf{r_n}$. This idea is similar to the one presented in Le Bris (2018) where he proposes analyzing crashes in the context of market volatility at the time.[137] Instead of performing a standarization using the

[137] The paper by Le Bris appeared in the first number of 2018 of the Economic History Review. An early version of the BBI, which we called Boom-Bust Indicators at the time, appeared as a working paper from Universidad de Barcelona in May 2016. The current version of the Local Bull-Bear appeared as a working paper from the European Historical

full sample mean and standard deviations as in the GBBI he employs a "rolling standarization" using time-varying first and second moments as in the Local BBI presented in 2.5.2. We will highlight the differences between BBIs and the measure offered by Le Bris (2018) in section 2.5.4.

Since the unit of measurement of all observations $z_{t,n}$ is the same, vectors $\mathbf{z_n}$ and $\mathbf{z_m}$ are comparable within $\mathbf{Z}$. We find all vectors in $\mathbf{R}$ and $\mathbf{Z}$ are stationary and have no linear trend according to a battery of tests. We can rewrite (2) as:

$$z_{t,n} = \frac{r_{t,n}}{\sigma_n} - \frac{\mu_n}{\sigma_n} \tag{3}$$

The expression in (3) allows for an interpretation of $z_{t,n}$ as the risk-adjusted above-trend return for vector *n* at time *t*. Allthough an in-depth interpretation will be provided in section 2.6, it is important to highlight that BBIs in all of their forms integrate not only measures of return but also of risk into the characterization of expansions and contractions. This will be of paramount importance when we link the different solutions to the macroeconomic trilemma with financial stability and when we analyze the role of the global financial cycle.

Since matrix $\mathbf{Z}$, in the case of a monthly time series, consists of 20 different vectors a natural next step is to try to aggregate that information into simple indicators. Thus, we will define Global BBIs (GBBIs) as,

$$\text{GBBI} = \omega'\mathbf{Z} \tag{4}$$

Where ω is a vector of weights that add to 1.

Even though the different vectors in $\mathbf{Z}$ have all the same unit of measurement, and thus their linear combinations are interpretable, combining short-run and long-run returns may smooth-out relevant information. To avoid this issue, we construct a short-run GBBI (GBBIS) with the returns from one month up to one year, a medium-run GBBI (GBBIM) with the four vectors from 18 months up to three years, and a long-run GBBI (GBBIL) with the four vectors from 42 months up to five

Economics Society (EHES). Both are included in the references at the end of this dissertation.

years. To do so, we need to divide $\mathbf{Z}$ into three corresponding matrices: $\mathbf{Z_{short}}$ contains vectors from $\mathbf{z_1}$ to $\mathbf{z_{12}}$, $\mathbf{Z_{medium}}$ contains vectors from $\mathbf{z_{18}}$ to $\mathbf{z_{36}}$, and $\mathbf{Z_{long}}$ contains vectors from $\mathbf{z_{42}}$ to $\mathbf{z_{60}}$.

The corresponding vectors of weights ω for each $\mathbf{Z}$ are obtained through factor analysis, a technique designed to reduce the dimension of a dataset which includes a large number of variables n into a smaller number m of unobserved factors.[138] The orthogonal factor model takes the following form (Tsay, 2002):

$$\mathbf{Z} - \boldsymbol{\mu} = \mathbf{F}\boldsymbol{\Lambda}' + \boldsymbol{\epsilon} \qquad (5)$$

Where $\boldsymbol{\mu}$ refers to the mean of vectors in $\mathbf{Z}$, $\mathbf{F}$ is a matrix of orthogonal unobserved factors of dimension txm, $\boldsymbol{\Lambda}$ is a matrix of factor loadings of dimensions nxm, and $\boldsymbol{\epsilon}$ is a txn matrix of error terms. Since the n vectors in $\mathbf{Z}$, of dimensions txn, are standardized, we know that $\boldsymbol{\mu}$ is a matrix of dimensions txn populated with zeros. Given that we wish to obtain a single GBBI for each specification of $\mathbf{Z}$, in this particular case m=1, $\boldsymbol{\Lambda}$ is a column vector $\boldsymbol{\lambda}$ of length n and $\mathbf{F}$ a column vector $\mathbf{f}$ of length t. We can rewrite (5) as:

$$\mathbf{Z} = \mathbf{f}\,\boldsymbol{\lambda}' + \boldsymbol{\epsilon} \qquad (6)$$

Each scalar λ_n is the optimal value used to multiply the unobserved factor $\mathbf{f}$ in order to obtain the corresponding vector $\mathbf{z_n}$. Written in a linear form:

$$z_{t,n}=\lambda_n f_t + \epsilon_{t,n};\, n = 1, \ldots, N \qquad (7)$$

Thus, to estimate the optimal weight assigned to each vector $\mathbf{z_n}$ to obtain GBBIs, we can solve for f_t in (7):

$$\frac{z_{t,n}}{\lambda_n} - \frac{\epsilon_{t,n}}{\lambda_n} = f_t;\, n = 1,2, \ldots, N \qquad (8)$$

[138] To tend to the "curse of dimensionality", factor analysis searches for common underlying factors hidden in the data that explain most of the variations in the covariance or correlation matrix. The orthogonal factor model requires the data to be weakly stationary, which we know to be true for all the vectors in $\mathbf{R}$ and $\mathbf{Z}$. An in-depth description of the method can be found in Tsay (2002).

In this formulation, the error term contains the part of **Z** that cannot be explained by the single vector **f** and is directly related to its explanatory power. From here onward, we will deal with the estimators of the factor loadings ($\widehat{\lambda_n}$) and of the factor ($\widehat{f_t}$) allowing us to rewrite (8) as:

$$\frac{z_{t,n}}{\widehat{\lambda_n}} = \widehat{f_t}; n = 1,2, \dots, N \tag{9}$$

The factor loadings do not necessarily add up to 1, so to transform them into weights we perform the following calculation:

$$\omega_n = \frac{1/\widehat{\lambda_n}}{\sum_{i=1}^{n}\left(1/\widehat{\lambda_n}\right)} \tag{10}$$

The construction of ω in (10) guarantees that GBBIs mimic the factor with the most significant explanatory power over the original matrix **Z** while still being interpretable as standard deviations. We can rewrite (4) using (9) and (10) as follows:

$$\text{GBBI}_t = \frac{z_{t,n}/\widehat{\lambda_n}}{\sum_{i=1}^{n}\left(1/\widehat{\lambda_n}\right)} = \frac{\widehat{f_t}}{\sum_{i=1}^{n}\left(1/\widehat{\lambda_n}\right)}; \; n = \begin{Bmatrix} 1,2,\dots,12 \text{ if } \text{GBBI}_{\text{short}} \\ 18, 24, 30, 36 \text{ if } \text{GBBI}_{\text{medium}} \\ 42,48,54,60 \text{ if } \text{GBBI}_{\text{long}} \end{Bmatrix} \tag{11}$$

From (11) we can see that the short, medium and long-run GBBIs correspond to a rescaled version of the factor that bears the highest explanatory power over the variance-covariance matrices of $\mathbf{Z_{short}}$, $\mathbf{Z_{medium}}$, and $\mathbf{Z_{long}}$.

The issue with resolving (11) in an empirical setting is estimating factor loadings $\widehat{\lambda_n}$. There are two alternative techniques to perform this task: Principal Component Analysis (PCA) and maximum likelihood estimation (MLE).

2.5.1.1. Principal Component Analysis

Given a collection of random variables $\mathbf{y_n}$, with variance-covariance matrix $\mathbf{\Sigma_y}$, PCA will find a small set of vectors $\mathbf{c_m}$, defined as linear combinations of $\mathbf{y_n}$ that explain the underlying structure of $\mathbf{\Sigma_y}$. Dimensionality reduction occurs since *m* is smaller than *n*. This process requires any two components $\mathbf{c_j}$ and $\mathbf{c_k}$ to be orthogonal which is similar to the orthogonality assumption in the Band-Pass filter in Section 2.4.3.2. Additionally, if the variance-covariance matrix $\mathbf{\Sigma_y}$ is positive definite, then it has a spectral decomposition, and principal components $\mathbf{c_m}$ of $\mathbf{\Sigma_y}$ are its eigenvectors.[139] The associated eigenvalues are directly related to the proportion of variance within the variance-covariance matrix that component $\mathbf{c_m}$ explains.[140] Factor loadings are then a function of each eigenvalue and its associated eigenvector.[141] The intuition and benefits of employing PCA to reduce the dimension of a dataset are discussed in detail in Henning et. al. (2011).

The issues with estimating factor loadings through principal component decomposition are twofold. First, even if the first principal component is defined as the one that best explains the variance-covariance matrix of $\mathbf{Z}$, the process through which we obtain it has no tractability, and the result has no readily-interpretable unit of measurement or economic meaning. Second, the process is subject to measurement error from the numerical methods employed in calculating the eigenvalues and eigenvectors of a large matrix.[142]

2.5.1.2. Maximum Likelihood

Following Jöreskog (1967, 1969), if in addition to the model in (6) we assume that $\mathbb{E}(\mathbf{f}) = 0$, $\mathbb{E}(\boldsymbol{\epsilon}) = 0$, $\mathbb{E}(\mathbf{ff'}) = \mathbf{\Phi}$, and $\mathbb{E}(\boldsymbol{\epsilon\epsilon'}) = \mathbf{\Psi}$, where $\mathbb{E}$ is the expectations operator, then

$$\mathbf{\Sigma} = \mathbb{E}(\mathbf{ZZ'}) = \boldsymbol{\lambda}\mathbf{\Phi}\boldsymbol{\lambda}' + \mathbf{\Psi} \qquad (12)$$

The elements $\boldsymbol{\lambda}$, $\mathbf{\Phi}$, and $\mathbf{\Psi}$ are parameters to be estimated from the data. Johnson & Wichern (2015), indicate that $\mathbf{\Phi}$ represents the common

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139 For matrix $\mathbf{\Sigma_y}$ to be positive definite, it has to fulfill that the scalar $v = \boldsymbol{\theta}'\mathbf{\Sigma_y}\boldsymbol{\theta}$ is always positive for every non-zero column vector $\boldsymbol{\theta}$. From the standard financial literature, we know that v can be thought of as the variance of a portfolio with weights $\boldsymbol{\theta}$ which is positive by definition.

140 In order to obtain the proportion of the variance of $\mathbf{\Sigma_y}$ explained by component $\mathbf{c_1}$, one needs to calculate the ratio between the associated eigenvalue e_1 and the sum of all eigenvalues E.

141 For the interested reader, a proof can be found in Tsay (2002).

142 For GBBIs, measurement error in factor loadings calculated via PCA will be associated with the variance explained by all but the first principal components.

variance to all vectors in $\mathbf{Z}$ that is contained in factor $\mathbf{f}$, while $\boldsymbol{\Psi}$ can be interpreted as the specific variance not contained in the factor model. Once we have a matrix $\mathbf{S}$, whose elements are the sample variances and covariances estimated from n+1 observations in the data for $\mathbf{Z}$, Jöreskog (1967) finds that the loglikelihood function of the model in (12), assuming normality is proportional to:

$$\log \mathrm{L} = -\frac{1}{2}n\left[\log|\boldsymbol{\Sigma}| + \mathrm{tr}\left(\mathbf{S}\boldsymbol{\Sigma}^{-1}\right)\right] \quad (13)$$

The different parameters are calculated by maximising Log L.[143] This maximum likelihood estimation method for the factor loadings offers more tractability than principal components. While this method also maximises the variance explained by $\mathbf{f}$, the resulting factor loadings, transformed into weights in (10), allow GBBIs to have both readily-interpretable units of measurement —standard deviations— and economic meaning —risk-adjusted above-average returns.

A final issue to discuss in the construction of GBBIs has to do with the treatment of data to lower frequencies since the credit series we have discussed in Section 2.1.2 have an annual frequency. Therefore, their corresponding $\mathbf{Z}$ matrices will be composed of five vectors of returns, $\mathbf{Z_{short}}$ will be the one-year return vector, $\mathbf{Z_{medium}}$ will contain the vectors for two and three-year returns, and $\mathbf{Z_{long}}$ will contain the vectors for four and five-year returns. Consequently, using dimensionality reduction techniques to calculate factor loadings is unnecesary. For these series, the short-run GBBI will be the same vector $\mathbf{z_1}$ and the medium and long-run GBBIs will we simple averages of the vectors associated to $\mathbf{Z_{medium}}$ and $\mathbf{Z_{long}}$ respectively.

143 The code implemented in MATLAB® has a more sophisticated approach than the one presented in (13) which we do not elaborate upon as the intuition is clear from the text. For the interested reader, the approach employed follows the factor rotation to maximise the *varimax* criterion presented by Kaiser (1958) and discussed in depth in Johnson & Wichern (2015).

2.5.2. The Local Bull Bear Indicators (LBBIs)

One of the caveats in the calculation of the GBBI has to do with using the full sample mean and standard deviation in the standardisation process in (2). This implies that all expansions and contractions are measured relative to the full sample risk-adjusted average return, the second term in (3). While the Global Bull Bear Indicator will allow us to identify the largest above average expansions and contractions for the full sample, it assumes that the series in **Z** have constant means and standard deviations. We know from Figure 12 that there are clusters of very positive or negative returns. When speaking about heteroskedasticity in financial time series, there is evidence that some periods are riskier than others, and that these riskier times are not randomly scattered throughout the series but that they cluster during periods of high and low volatility as seen in Figure 13 (Engle, 2001).

Using the GBBIs to compare expansions and contractions during different time periods may be an anachronistic endeavour that omits contextual characteristics. An expansion of two standard deviations when the annual standard deviation is 10% is different from an expansion that occurs when the annual standard deviation is 30%. One way to think about this issue of comparability through time is a sports metaphor.

The winner of the 2012 Olympic marathon ran two hours and eight minutes while the winner of the 1904 version ran for three hours and twenty-eight minutes. This does not necessarily imply that the former was 1.6 times faster than the latter. Since they were not running under the same conditions, they had different training regimens, diets, equipment, and genetic characteristics; the two are incomparable.[144] A similar case can be made for bull and bear phases in financial and economic time series. One of the benefits of designing a measure that associates both risk and return is that we can perform adjustments to the indicator to include time-

[144] We thank John Landon-Lane for this idea. The data in this example, as well as many other interesting facts to explain the differences in athletic performance through time, can be found in David Epstein's TEDTalk "Are athletes really getting faster, better, stronger?". April 29, 2014. Available at https://www.ted.com/talks/david_epstein_are_athletes_really_getting_faster_better_stronger

varying means and measures of dispersion in the standardisation process. To do so, we will rewrite (2) as:

$$d_{t,n} = \frac{\left(r_{t,n} - \mu_{t,n}\right)}{\sigma_{t,n}} \tag{14}$$

Where now μ and σ have time subscripts. We have changed the notation of variable $z_{t,n}$ to $d_{t,n}$ as we are no longer dealing with a z-score as in section 2.5.1, but the variable still measures a distance expresed in standard deviations with respect to a (time-varying) measure of central tendency. In the local specification, we obtain a matrix **D** by standardizing the vectors in **R** using (14)

To obtain a time-varying mean, we use an exponentially weighted five-year moving average (EWMA) such as:

$$\mu_{t,n} = \frac{\sum_{t=0}^{59} \alpha(1-\alpha)^t r_{t,n}}{\sum_{t=0}^{59} \alpha(1-\alpha)^t} \tag{15}$$

This measure gives more weight to the more recent observations while, as we go back in time, they are assigned decreasing weights. This is a way of accounting for the clustering of returns evidenced in the heat map in Figure 12. The weight of the initial observation α is calculated as

$$\alpha = \frac{2}{\text{obs} + 1} \tag{16}$$

Such that, if for a monthly return vector $\mathbf{r_n}$ we wish to calculate the 60-observation moving average, the weight for the first observation will be 3.28%.

For the time-varying measure of dispersion, we will use a Generalized Autoregressive Conditional Heteroskedasticity model (GARCH) which has been explicitly designed to tend to the issues of time-varying volatility and volatility clustering (Bollerslev, 1986; Engle &

Bollerslev, 1986).[145] The usual GARCH (p,q) model for conditional volatility at time t (h_t) takes the form:

$$h_t = \gamma + \sum_{i=1}^{q} \alpha_i (r_{t-i} - \mu_{t-1})^2 + \sum_{i=1}^{p} \beta_i h_{t-i} \qquad (17)$$

Where parameter p indicates the number of autoregressive lags and parameter q the number of moving average lags that are specified. We specify a GARCH (1,1) conditional volatility model for each vector $\mathbf{r_n}$. This specification

> *"asserts that the best predictor of the variance in the next period is a weighted average of the long-run average variance, the variance predicted for this period, and the new information in this period that is captured by the most recent squared residual".* (Engle, 2001, pp. 159-160)

The model we implement takes the form:

$$h_t = \gamma + \alpha (r_{t-1} - \mu_{t-1})^2 + \beta h_{t-1} \qquad (18)$$

Where parameter γ is stricty positive and α, and β should move between 0 and 1. It is expected that $\alpha + \beta < 1$ in order for the shocks to have a decaying impact on volatility. The weights assigned to the long-run variance, the moving average component and the aurtoregressive component are $1 - \alpha - \beta$, α, and β respectively. It is also known that the long-run average variance is obtained from $\sqrt{\gamma/(1 - \alpha - \beta)}$ (Engle, 2001).

When using a GARCH (p,q) model to estimate volatility in the return series, there are two issues worth discussing. The first one has to do with keeping the parameters, p and q, constant and equal to 1 for all return series. The second issue is related to fitting the process to the full vector of returns $\mathbf{r_n}$ directly or fitting it in a recursive fashion using a moving window. In that sense, we follow Hansen & Lunde (2005), who indicate

[145] An alternative would have been to include a simple rolling standard deviation as in Figure 13. However, this measure gives equal weights to all observations and thus does not control for volatility clustering.

that choosing parameters that maximize goodness-of-fit adds little value with respect to the GARCH(1,1) specification.[146]

On the other hand, with regards to the issue of whether to fit the GARCH(1,1) model to the full sample or to employ a recursive calculation using a moving window, we have calculated the Local BBIs for the UK stock market series using both a GARCH (1,1) model fitted to the full sample and a recursive GARCH(1,1) for a moving window of 60 observations. We present and discuss the results in Annex 4. We find no added-value in moving from fitting the GARCH(1,1) directly to the full sample, towards its recursive application. The latter increases the computation burden, and the number of parameters to estimate. Additionally, first results indicate that there may be model over-specification in the recursive fitting of the model. Finally, since the goal of the indicator is not to forecast the future behaviour of the stock market or credit aggregates, we find no issue with using the full sample of available data rather than the moving window which would represent the information investors had available at a given point in time.

Further research may wish to delve into the forecasting capacity of the indicator, in which case we advise the use of only *ex-ante* information to perform out of sample forecasts and goodness-of-fit tests. For the rest of the dissertation, whenever we discuss LBBIs, the time-varying volatility will be calculated fitting a GARCH(1,1) to the full sample directly.

To obtain Local BBIs, we rewrite (11) using (14) as follows:

$$\mathrm{LBBI_t} = \frac{d_{t,n}/\widehat{\lambda_n}}{\sum_{\mathrm{i=1}}^{\mathrm{n}}\left(1/\widehat{\lambda_n}\right)} = \frac{\widehat{f_t}}{\sum_{\mathrm{i=1}}^{\mathrm{n}}\left(1/\widehat{\lambda_n}\right)};\ n = \left\{\begin{matrix} 1,2,\ldots,12 \text{ if } \mathrm{LBBI_{short}} \\ 18, 24, 30, 36 \text{ if } \mathrm{LBBI_{medium}} \\ 42,48,54,60 \text{ if } \mathrm{LBBI_{long}} \end{matrix}\right\} \quad (19)$$

Using the factor analysis described previously, we calculate the weights assigned to each vector $\mathbf{d_n}$. In that sense, LBBIs correspond to the rescaled factor that best explains the variance in the variance-covariance matrix of matrices $\mathbf{D_{short}}$, $\mathbf{D_{medium}}$, and $\mathbf{D_{long}}$.

[146] Further research may contrast whether using conditional volatility with optimal parameters *p* and *q* for each vector $\mathbf{r_n}$ alters results in a significant way.

Whenever we deal with annual rather than monthly data, the EWMA will be calculated using a five observation window. As we indicated for the Global BBIs, instead of using factor weights, the short-run LBBI will correspond to vector $\mathbf{d_1}$ moreover, the medium and long-run LBBIs will correspond to the simple averages of $\mathbf{d_2}$ and $\mathbf{d_3}$, and $\mathbf{d_4}$ and $\mathbf{d_5}$ respectively. The calculations are presented in (20)

$$\begin{gathered} \text{LBBIS} = \mathbf{d_1} \\ \text{LBBIM} = 0.5(\mathbf{d_2} + \mathbf{d_3}) \\ \text{LBBIL} = 0.5(\mathbf{d_4} + \mathbf{d_5}) \end{gathered} \tag{20}$$

2.5.3. Comparing GBBIs and LBBIs

GBBIs are obtained from the standardised vectors of returns using the full sample mean and the full sample standard deviation. This implies that they shall be understood as the upward or downward deviations of returns from their long-run risk-adjusted average. Their economic interpretation is straightforward: the most significant expansions and contractions represent the best and worst returns for the whole sample without correction for time-varying means or volatility. Consequently, they show the most significant accelerations in the growth or decline of asset prices and credit aggregates. This allows for comparing bull and bear phases in absolute terms. Since GBBIs originate from the linear transformation of returns using constants, they perfectly track the structure of returns.[147] We show this in time series plots of different selected GBBIs and selected return vectors for each time series in Annex 5. The added value of GBBIs vis-à-vis period returns has to do with its unit of measurement —standard deviations rather than 1, 3, or 5 year returns— and with its interpretation as excess risk-adjusted returns as discussed in equation (3).

Conversely, LBBIs originate from the standardised vectors of returns using time-varying means and standard deviations, as discussed in section 2.5.2. In that sense, LBBIs measure the deviation of returns from a short-run mean and volatility. They can be thought of as measures that take into account the historical conditions of a given period answering the

[147] We thank Oscar Jordà for bringing this to our attention.

question: How large, or small is a given return when compared to current market conditions of risk and reward?

A relevant feature of LBBIs is related to the risk-taking channel discussed in Chapter 1. As LBBIs are measures where the risk adjustment occurs in a time-varying fashion, for a set value of the real period return and the real average return, a lower risk perception (time-varying volatility), will result in a higher value of the risk-adjusted return. This, if investors and banks have constant risk aversion, would explain the self-reinforcing nature of stock-market and credit booms. A decrease in the perceived risk of a given stock market index increases the value of its risk-adjusted returns which in turn makes the investment more attractive for a fixed set of investors.[148] Increased demand for a good with fixed supply will lead to self-reinforcing price increases as in the Kindleberger-Minsky framework. Further research may include trading volume as an explanatory variable to confirm whether the predicted relationship between increasing risk-adjusted returns and increasing traded volume does exist and if it is more robust than the correlation between traded volume and simple period returns.

Results using GBBIs or LBBIs may differ depending on whether local means and standard deviations are higher or lower than global means and standard deviations. Let $z_{t,n}$ be the standardized returns $r_{t,n}$ using the full sample mean μ_n and full sample standard deviation σ_n, and $d_{t,n}$ be the standardized returns $r_{t,n}$ using the local mean $\mu_{t,n}$ and local standard deviation $\sigma_{t,n}$. Then, the following holds:

$$\begin{aligned} |d_{t,n}| < |z_{t,n}| \rightarrow \frac{\sigma_n}{\sigma_{tn}} < \frac{|r_{t,n} - \mu_n|}{|r_{t,n} - \mu_{t,n}|} \\ |d_{t,n}| > |z_{t,n}| \rightarrow \frac{\sigma_n}{\sigma_{tn}} > \frac{|r_{t,n} - \mu_n|}{|r_{t,n} - \mu_{t,n}|} \end{aligned} \tag{21}$$

From these inequalities, we know that if markets are facing a period of instability, where local volatility is well above its long-run level ($\sigma_{tn} > \sigma_n$), then a necessary condition for the local indicator to be below the

[148] It may even entice new investors to come to the market.

global indicator is $|r_{t,n} - \mu_n| < |r_{t,n} - \mu_{t,n}|$; that is, the current return must be farther from the local mean than from the corresponding global mean. Conversely, in periods of local stability in the series of returns ($\sigma_{tn} < \sigma_n$), a necessary condition for the local indicator to be below the global BBI is that the 'abnormality' of the current return be stronger in the global approach (or what is the same, $|r_{t,n} - \mu_n| > |r_{t,n} - \mu_{t,n}|$).

Since GBBIs track short, medium and long-run returns reasonably accurately, being that they arise from a monotonic transformation of the return series, we find no added value in their continued use. Thus, for the remainder of this dissertation, we will only use the LBBIs, which constitute the main methodological contribution of this thesis. Further research may focus on findings that may arise from using GBBIs and which may provide further insight into the long-run behaviour of stock markets and credit aggregates and their relation to the trilemma. We believe the findings from this natural extension will be close to what has already been found in the literature, at least concerning the short-run GBBI.

2.5.4. The BBI Methodology Vis-a-vis Le Bris (2017)

In the paper "*What is a Market Crash*?" Le Bris (2018) proposes a new measure that relates price changes in different asset price series with a time-varying measure of volatility:

> "*Crashes, measured as strong price decreases, are sometimes difficult to reconcile with historical events. This can be explained by the fact that a price variation will have a greater negative impact in a stable financial context than a similar variation during a highly volatile period. (…) To control for the instability of the volatility, a new method for identifying crashes is proposed. Each price variation is measured in numbers of standard deviations of the preceding period. These adjusted variations can then be ranked to identify the worst market crashes*" (p. 480).

Even if this summary of the method is reminiscent of our description of LBBIS, there are several differences worth highlighting since they motivate the BBI methodology as a relevant, innovative methodological contribution of this dissertation to the literature:

1. Le Bris (2018), employs his measure solely to identify the most significant market crashes with respect to the contextual volatility at the time in an aim to resolve the "the puzzle of 'big news without big moves, and big moves without big news'" (p. 480). Contrarily, we employ the methodology to construct time series, for both expansions and contractions, which will be later used as dependent variables in econometric analyses. We employ this time series to tell a story about the evolution of asset prices and credit aggregates and relate them to a broader institutional framework. Additionally, we provide a meaningful interpretation of LBBIs as time-varying risk-adjusted excess returns.
2. The argument by Le Bris (2018) requires investors to have constant relative risk aversion (CRRA) which implies that for a fixed level of wealth, they target a constant risk level in their portfolio. As such, investors are compelled to increase their leverage, which cannot be observed, when volatility in the market decreases. We make no such assumptions about the preferences of investors, borrowers or lenders in the specification of our variable.
3. The measure by Le Bris (2018) is applied to single-period returns. If the series is of monthly frequency, then he observes monthly price changes and monthly volatilities. If the series is of daily frequency, the first and second order moments employed in his measure are also of daily frequency. This specification does not allow for an analysis of the persistence of booms and busts across time. Conversely, the BBI methodology aggregates returns to different time horizons, standardised as to make them comparable. The method reflects an effort to observe the effect of expansions an contractions in the short-run (up to 1 year), medium-run (between 18 months and three years), and long-run (between 42 months and five years). This makes for a more thorough characterisation of the evolution of the boom-bust cycle in a given time series.

4. Le Bris (2018), chooses the window size for calculating the time-varying measure of dispersion as the one that minimises the standard deviation in the standardised series. This is not without caveats, as using a different moving window for different series would imply that the investment horizon for investors in different assets is different. Even if this may be true, the criterion investors follow in their choice of the investment period is hardly related to minimising the volatility of standardised returns. A natural counterexample would be the target of a speculative investor, as in a Kindleberger-Minsky framework, whose target may be the complete opposite.
5. To perform the rolling standardisation, Le Bris (2018) uses the sample average and standard deviation as proxies for the first and second moments. The main issue with these measures, as indicated above, is that they give each observation in the window equal weights. This process does not account for the return, and volatility clustering that we have shown exists for financial time series in Figure 12 and Figure 13, and that has also been documented extensively by Campbell et al., (1997).
6. Le Bris (2018) uses the measure just as an indication of the size of a given crash, to confirm whether these newly identified crashes are more in line with the historical narrative. In what follows, we will perform an exhaustive work on the time series, characterising expansions and contractions for all countries and time series regarding their amplitude, duration, and severity. We will also contrast our results with those obtained using the current methodological toolkit described in Section 2.4.

2.5.5. The BBI Methodology Vis-à-vis the Band Pass and Hodrick Prescott filters.

At this point, it is pertinent to clarify the similarities and differences between the BBI methodology and the HP and BP filters described in Section 2.4.3. First, BBIs are similar in that they include a relevant smoothing of the price series as it is transformed into growth rates to different time horizons. Secondly, in both the global and local specifications there is detrending of the series either by subtracting the full sample mean or the EWMA. However, three salient differences represented the added value of LBBIs when compared to other filters.

First, regarding the Band-Pass filter, BBIs do not require the underlying orthogonality assumption: short, medium and long-run indicators are not presumed to be independent. Second, each of the indicators shows expansions and contractions to different time horizons, and in that sense, they reflect persistence in the shocks, which cannot be observed in the series extracted through the HP or BP filters. Finally, BBIs are indicators that include measures of return and risk while in the literature, the trend and cycle components extracted through the HP and BP filters, insofar as they are extracted from prices, do not include the variability of the series explicitly.

2.6. Empirical Results: What LBBIs Tell Us About the Database

We construct local BBIs to different time horizons for all the time series presented in section 2.1. For the sake of brevity, we will only present an overview of the more salient characteristics of LBBIs in Section 2.6.1. For the interested reader include in-depth statistical tables and graphs for the different LBBIs in Annex 6. In section 2.6.2 we discuss the explanatory power of LBBIs over the variance-covariance matrix from **D**. In Section 2.6.3 we present the framework for dating expansions and contractions in the different series and offer a new severity measure to identify booms and busts. A detailed characterisation of expansions and contractions for stock markets and real credit is presented in Annex 7.

2.6.1. A General Overview of LBBIs

In this section, we will present the local BBIs for the stock market and real credit to three different time horizons: short, medium and long-run. For the stock market, where we use monthly data, we employ factor loadings to estimate the weights of the different vectors as discussed in section 2.5. For the real credit series, where we have only annual data, the short-run LBBI corresponds to the first vector in matrix **D**, the medium-run LBBI is the simple average of the second and third vectors, and the long-run LBBI is the simple average of the fourth and fifth vectors.

In the following tables, we present the most salient characteristics of the LBBIs for the stock market and credit. We analyse the changes in the IQR as the time horizon increases, whether the series are negatively skewed, whether they have excess kurtosis, whether we find a trend or structural breaks, and whether the series are stationary according to a standard battery of tests.

Regarding the stock market (Table 6) and real credit (Table 7), we find that none of the 78 series present structural breaks and that they are all stationary according to the standard tests in the literature. This will be useful in designing the econometric specifications throughout the rest of the dissertation.

Concerning the stock market, we find that for all countries, except for Japan, Switzerland, and the United States, the interquartile range increases from the short-run to the medium-run LBBI and from the latter to the long-run LBBI. Since the interquartile range measures the difference between the 75th and 25th percentiles it is a measure of the dispersion in the series that is less driven by outliers than the difference between the minimum and the maximum.

An increase in the spread of the series from the short-run to the long-run indicator requires both booms and busts to be persistent in time, thus suggesting the momentum anomaly typical of explosive processes, as described in footnote 135. If, on the other hand, the spreads of the series were decreasing in the time horizon, this would indicate that the process is mean-reverting such that an above average growth is more likely to be followed by a below average growth and thus the effect would hardly transfer from the long to the medium or long-run indicators. The idea of explosive processes is consistent with the description of periods of euphoria and panic in the Minsky model of financial instability presented in Section 1.1.2.2.

Regarding asymmetry, except for France and Italy, all countries present negative skewness in at least one of the LBBIs.[149] This result is consistent with the asymmetry coefficient for the growth rate of the stock

[149] In the statistical tables in Annex 2, it shows that the series for the growth rate of the French and Italian stock market indices have a positive skew.

market index presented in Annex 2.[150] With regards to extreme values, we find that the LBBIs for the thirteen countries follow a leptokurtic (fat-tailed) distribution.[151] In terms of expansions and contractions, this indicates that all series are prone to having extreme values both to the right and the left of the mean. This result is consistent with the usual characterisation of financial series in general and stock market series in particular (Campbell et al., 1997; Jorion & Goeztmann, 1997; Jorion, 2007). Finally, we have identified a trend component for some of the LBBI series which suggests that in all future econometric specifications we will need to include a linear trend in the dependent variables.

Table 6: Summary of the statistical analysis for stock market LBBIs

Country	Stock Market LBBIs					
	Inc. IQ Range	*Neg. Skew.*	*Excess Kurt.*	*Trend*	*Struct. Break*	*Stationarity*
Australia	Yes	3 / 3	3 / 3	0 / 3	No	Yes
Canada	Yes	3 / 3	3 / 3	0 / 3	No	Yes
Denmark	Yes	3 / 3	3 / 3	2 / 3	No	Yes
France	Yes	0 / 3	3 / 3	0 / 3	No	Yes
Germany	Yes	2 / 3	2 / 3	3 / 3	No	Yes
Italy	Yes	0 / 3	1 / 3	0 / 3	No	Yes
Japan	No	3 / 3	3 / 3	1 / 3	No	Yes
Netherlands	Yes	1 / 3	1 / 3	1 / 3	No	Yes
Norway	Yes	3 / 3	3 / 3	3 / 3	No	Yes
Sweden	Yes	2 / 3	1 / 3	1 / 3	No	Yes
Switzerland	No	3 / 3	3 / 3	1 / 3	No	Yes
United Kingdom	Yes	1 / 3	1 / 3	0 / 3	No	Yes
United States	No	3 / 3	3 / 3	0 / 3	No	Yes

Note: In each column, we summarise results for the three different LBBIs for each original series. Inc. IQ Range refers to whether the interquartile range increases from the short-run to the medium and long-run specifications. For it to be labelled "Yes" there has to be a monotonic increase of the IQR as the time horizon increases. Neg. Skew. indicates the number of LBBIs with negative skewness, indicating a long left tail. Excess Kurt. indicates the number of LBBIs with kurtosis above three, indicating fatter tails than those predicted by a normal distribution. Trend indicates the number of LBBIs for which we accept the null hypothesis of a trend according to Daniels' (1950) trend test. Struct. Break indicates if there is evidence of a structural break in any of the series according to the test by Bai & Perron (2000, 2003). Stationarity summarises the results for a battery of stationarity tests.

[150] If skewness in the growth rate series is positive and close to zero, as is the case for the UK (0.49), some LBBIs can show a negative skew because we detrend the growth rate by subtracting an EWMA which can turn small positive values into negative excess returns.

[151] In the case of Italy, the Netherlands, Sweden, and the United Kingdom, only the short-run LBBI is leptokurtic while the medium and long-run LBBIs are platykurtic.

Concerning real credit (Table 7), there is no evidence of a linear trend in any of the LBBI series. Interestingly, the interquartile range does not increase with the time horizon in most cases. Only the series for Italy, the Netherlands, Sweden, and the UK have increasing IQRs. This suggests that for some countries in the database credit behaves as an explosive process, where credit growth in previous periods is associated with additional growth in the current period. If this occurs concurrently with an explosive behaviour in the stock market, it may provide a first indication of the feedback between credit and stock markets in which excessive asset price growth fuels credit growth, which subsequently increases the demand for assets.[152]

Table 7: Summary of the statistical analysis for real credit LBBIs

Country	**Real Credit LBBIs**					
	Inc. IQ Range	*Neg. Skew.*	*Excess Kurt.*	*Trend*	*Struct. Break*	*Stationarity*
Australia	No	0 / 3	3 / 3	0 / 3	No	Yes
Canada	No	1 / 3	3 / 3	0 / 3	No	Yes
Denmark	No	3 / 3	3 / 3	0 / 3	No	Yes
France	No	3 / 3	3 / 3	0 / 3	No	Yes
Germany	No	0 / 3	0 / 3	0 / 3	No	Yes
Italy	Yes	0 / 3	0 / 3	0 / 3	No	Yes
Japan	No	1 / 3	3 / 3	0 / 3	No	Yes
Netherlands	Yes	0 / 3	0 / 3	0 / 3	No	Yes
Norway	No	0 / 3	3 / 3	0 / 3	No	Yes
Sweden	Yes	3 / 3	0 / 3	0 / 3	No	Yes
Switzerland	No	2 / 3	3 / 3	0 / 3	No	Yes
United Kingdom	Yes	3 / 3	0 / 3	0 / 3	No	Yes
United States	No	1 / 3	3 / 3	0 / 3	No	Yes

Note: In each column, we summarise results for the three different LBBIs for each original series. Inc. IQ Range refers to whether the interquartile range increases from the short-run to the medium and long-run specifications. For it to be labelled "Yes" there has to be a monotonic increase of the IQR as the time horizon increases. Neg. Skew. indicates the number of LBBIs with negative skewness, indicating a long left tail. Excess Kurt. indicates the number of LBBIs with kurtosis above three, indicating fatter tails than those predicted by a normal distribution. Trend indicates the number of LBBIs for which we accept the null hypothesis of a trend according to Daniels' (1950) trend test. Struct. Break indicates if there is evidence of a structural break in any of the series according to the test by Bai & Perron (2000, 2003). Stationarity summarises the results for a battery of stationarity tests.

If, on the other hand, the spread decreases from the short-run indicator to the medium-run indicator and then to the long-run indicator,

[152] This would be the case for Italy, the Netherlands, Sweden, and the United Kingdom.

credit would behave as mean reverting process. This behaviour is consistent with the theory since credit growth in t_0 increases the stock of debt in t_1 and, under normal conditions, a higher stock of debt should discourage future credit growth.[153]

Regarding asymmetry, the series for Australia, Germany, Italy, the Netherlands, and Norway have positive skewness, indicating that credit booms are more probable than credit busts. The other countries present a long left tail in at least one of the indicators suggesting that contractions took place during more months than expansions. On the other hand, when extreme values are concerned, the distribution for LBBIs for Germany, Italy, the Netherlands, Sweden, and the United Kingdom are platykurtic, suggesting that extreme observations either in the right or the left tail are rare. Conversely, LBBIs for the remaining countries are leptokurtic, suggesting that rare events —extreme above or below average observations— are more frequent than what would be predicted by a normal distribution.

These preliminary results for credit suggest two lines for further research. On the one hand, a study can be aimed at understanding why, for a particular subset of countries, real credit growth appears to behave as an explosive process over such a long period while for others it behaves as mean reverting. On the other hand, we leave an open question regarding why some countries appear to be more prone to booms and busts (extreme events) than others. Tending to this issues exceeds the scope of this dissertation since the goal of Chapter 3 and Chapter 4 is to address the possible links between trilemma regimes and financial cycle variables in a panel setting.

2.6.2. The Explanatory Power of LBBIs

In this section, we discuss two different and related issues about the explanatory power of LBBIs. First, we will argue that the *ad hoc* choice of vectors from which we extract the short, medium, and long-run LBBIs is sufficiently representative of the whole structure of period returns from 1

[153] We think of normal conditions as those under which the process of euphoria and panic described by Minsky (1986, 1992) and Kindleberger & Aliber (2005) does not take place.

to 60 months. Secondly, we will use the principal component approach to show that each LBBI has a large explanatory power over its source matrix **D**. We conclude the section by arguing for the use of LBBIs and not principal components in our analysis.

It is noteworthy that the information in this section only applies to the use of monthly data as we summarise the 60 available vectors in matrix **R** into a selection of 20 vectors (12 for the short-run, 4 for the medium-run, and 4 for the long-run). In the case of annual data, we only have access to five vectors of period growth rates, and we use them all in the construction of the three LBBIs.

2.6.2.1. The choice of vectors and the structure of returns

Let matrix **R** be defined as in Section 2.5 where n takes all integer values between 1 and 60. We can break down **R** into three different matrices such that:

$$\begin{aligned} \mathbf{R}^{\mathbf{F}}_{\mathbf{short}} &= \mathbf{R} \text{ for } 1 \leq n \leq 12 \\ \mathbf{R}^{\mathbf{F}}_{\mathbf{short}} &= \mathbf{R} \text{ for } 13 \leq n \leq 36 \\ \mathbf{R}^{\mathbf{F}}_{\mathbf{short}} &= \mathbf{R} \text{ for } 37 \leq n \leq 60 \end{aligned} \tag{22}$$

Where F indicates that n spans all possible integer values between the lower and upper limits. Similarly, we define the matrices that contain only the selected vectors for the LBBIs.

$$\begin{aligned} \mathbf{R}^{\mathbf{S}}_{\mathbf{short}} &= \mathbf{R} \text{ for } 1 \leq n \leq 12 = \mathbf{R}^{\mathbf{F}}_{\mathbf{short}} \\ \mathbf{R}^{\mathbf{S}}_{\mathbf{medium}} &= \mathbf{R} \text{ for } n = 18, 24, 30, 36 \\ \mathbf{R}^{\mathbf{S}}_{\mathbf{long}} &= \mathbf{R} \text{ for } n = 42, 48, 54, 60 \end{aligned} \tag{23}$$

Where S indicates that only a select number of vectors are included in each matrix. We then follow the rolling-standardisation process as in (14) and obtain $\mathbf{D}^{\mathbf{F}}_{\mathbf{short}}$, $\mathbf{D}^{\mathbf{F}}_{\mathbf{medium}}$, $\mathbf{D}^{\mathbf{F}}_{\mathbf{long}}$, $\mathbf{D}^{\mathbf{S}}_{\mathbf{short}}$, $\mathbf{D}^{\mathbf{S}}_{\mathbf{medium}}$, and $\mathbf{D}^{\mathbf{S}}_{\mathbf{long}}$. We use the principal component approach discussed in Section 2.5.1.1 to extract the first principal component **PC** of each of the **D** matrices. To confirm that each pair of principal components ($\mathbf{PC}^{\mathbf{F}}_{\mathbf{medium}}$, $\mathbf{PC}^{\mathbf{S}}_{\mathbf{medium}}$), ($\mathbf{PC}^{\mathbf{F}}_{\mathbf{long}}$, $\mathbf{PC}^{\mathbf{S}}_{\mathbf{long}}$) are statistically identical we perform linear regressions where the first component of each pair is the dependent variable and the second component of each pair is the independent variable. Note that since $\mathbf{R}^{\mathbf{S}}_{\mathbf{short}} = \mathbf{R}^{\mathbf{F}}_{\mathbf{short}}$ we do not perform the test for ($\mathbf{PC}^{\mathbf{F}}_{\mathbf{short}}, \mathbf{PC}^{\mathbf{S}}_{\mathbf{short}}$). In Table 8 we present the coefficients for the constant and the regression coefficient by country as well as the R^2 for each regression. Since there is evidence of serial correlation in the error we use Newey-West (1987) standard errors where the optimal number of lags is obtained from fitting an AR(p) process to the error term such that the residual behaves as white noise. We also present a test for whether the regression coefficient is statistically equal to 1 with 95% confidence.

The main takeaway from Table 8 is that since coefficients are in most cases statistically equal to 1, the constant is statistically equal to 0 in all cases, and the R^2 is always above 0.94; we can safely say that both series are statistically the same. Consequently, our choice of four vectors for each of the medium and long-run horizons, albeit *ad hoc*, sufficiently summarises the behaviour of the full structure of returns.

Table 8: Comparison of principal components for full matrices and selected vectors

	Medium-run					Long-run				
	Lags	β_0	β_1	$\lvert\beta_1\rvert=1$	R^2 (OLS)	Lags	β_0	β_1	$\lvert\beta_1\rvert=1$	R^2 (OLS)
Australia	1	-0.0002	0.9802***	No	0.9575	1	-0.0001	0.9862***	Yes	0.9697
Canada	2	0.0000	0.9817***	Yes	0.9622	3	0.0001	-0.9854***	Yes	0.9661
Denmark	2	0.0000	-0.9787***	Yes	0.9570	1	0.0002	-0.9788***	Yes	0.9595
France	2	-0.0001	-0.9829***	Yes	0.9658	5	0.0000	-0.9867***	Yes	0.9702
Germany	2	0.0000	-0.9849***	Yes	0.9642	4	0.0003	-0.9823***	Yes	0.9688
Italy	2	-0.0001	-0.9796***	Yes	0.9583	2	0.0006	-0.9725***	Yes	0.9489
Japan	2	-0.0002	-0.9745***	Yes	0.9504	1	0.0000	-0.9873***	Yes	0.9732
Netherlands	2	0.0001	-0.9785***	Yes	0.9550	3	-0.0002	0.9819***	Yes	0.9659
Norway	3	-0.0001	0.9835***	No	0.9661	2	0.0000	0.9831***	Yes	0.9635
Sweden	2	0.0000	0.9807***	Yes	0.9604	3	0.0002	0.9840***	Yes	0.9615
Switzerland	4	0.0000	0.9794***	Yes	0.9580	5	-0.0004	0.9777***	Yes	0.9588
United Kingdom	4	0.0003	0.9738***	Yes	0.9488	5	0.0004	0.9769***	Yes	0.9597
United States	1	0.0000	-0.9787***	Yes	0.9571	5	0.0001	-0.9828***	Yes	0.9658

Note: The number of lags for the Newey-West (1987) standard errors is obtained by fitting an AR(*p*) process to the error of the regression such that the residual behaves as white noise. R^2 is obtained from the OLS regression. The test for the unity of the absolute value of the coefficient has a confidence level of 95%. Significance levels * 10%, ** 95%, *** 99%.

2.6.2.2. PCs, LBBIs and explanatory power

As we have discussed in footnote 140, we can calculate the explanatory power of each principal component over the variance of the underlying matrix. Table 9 presents the explanatory power for all the PCs as calculated in the previous section.

Table 9: The explanatory power of principal components by source matrix, time horizon, and country

	PCs full matrix			PCs selected vectors		
	Short	*Medium*	*Long*	*Short*	*Medium*	*Long*
Australia	69.1%	69.9%	77.4%	69.1%	72.2%	80.3%
Canada	69.4%	72.2%	76.9%	69.4%	75.1%	78.7%
Denmark	72.7%	66.0%	73.1%	72.7%	68.9%	75.4%
France	71.3%	75.5%	73.8%	71.3%	78.4%	73.3%
Germany	75.5%	74.6%	76.5%	75.5%	76.4%	77.4%
Italy	69.9%	69.4%	69.6%	69.9%	73.3%	73.1%
Japan	71.2%	67.3%	75.8%	71.2%	69.5%	76.6%
Netherlands	69.1%	73.2%	74.5%	69.1%	77.3%	77.5%
Norway	70.2%	70.9%	74.4%	70.2%	72.9%	76.1%
Sweden	70.5%	70.3%	77.2%	70.5%	73.2%	78.1%
Switzerland	70.3%	72.1%	74.8%	70.3%	73.8%	77.5%
United Kingdom	67.8%	69.4%	74.9%	67.8%	71.6%	78.7%
United States	68.6%	69.6%	74.3%	68.6%	73.1%	76.6%

Note: The explanatory power of each principal component is calculated as the ratio between the largest eigenvalue and the total sum of eigenvalues in the decomposition of the variance-covariance matrix of each matrix **D**.

As Table 9 shows, the explanatory power fluctuates between 66% and 80.3%. We take this as evidence that a very significant portion of the information in the structure of returns can be summarised in a single variable. To confirm that this explanatory power is also contained in LBBIs, we regress them by country on their associated principal component for the selected vectors ($\mathbf{PC}^{\mathbf{S}}_{\mathbf{short}}$, $\mathbf{PC}^{\mathbf{S}}_{\mathbf{medium}}$, and $\mathbf{PC}^{\mathbf{S}}_{\mathbf{long}}$). Results for the regression are presented in Table 10.

Table 10: Results for regressions of LBBIs on PCs for selected vectors by country and time horizon

	Short-run				Medium-run				Long-run			
	Lags	β_0	β_1	R^2 (OLS)	Lags	β_0	β_1	R^2 (OLS)	Lags	β_0	β_1	R^2 (OLS)
Australia	1	0.0001	-0.0353***	0.9923	2	0.0001	-0.0267***	0.9926	1	0.0001*	-0.0205***	0.9987
Canada	2	0.0002*	-0.0365***	0.9913	1	0.0001	-0.0267***	0.9936	1	0.0000	-0.0212***	0.9977
Denmark	1	0.0002*	-0.0337***	0.9898	1	0.0001	0.0250***	0.9922	1	-0.0001	0.0191***	0.9963
France	2	0.0004***	-0.0351***	0.9887	2	0.0001*	-0.0237***	0.9975	1	0.0001**	0.0187***	0.9948
Germany	3	0.0006***	-.0339***	0.9916	2	0.0001	-0.0230***	0.9861	2	0.0000	0.0200***	0.9975
Italy	2	0.0002*	-0.0340***	0.9908	2	-0.0001	0.0250***	0.9877	2	0.0001*	0.0245***	0.9978
Japan	1	0.0002**	-0.0353***	0.9921	1	-0.0001**	-0.0243***	0.9958	1	0.0000	0.0202***	0.9981
Netherlands	2	0.0001	-0.0355***	0.9874	2	0.0001	-0.0234***	0.9929	1	0.0000	0.0231***	0.9962
Norway	1	0.0001	-0.0349***	0.9913	2	0.0001	-0.0278***	0.9947	1	0.0001*	-0.0202***	0.9967
Sweden	1	0.0003**	-0.0339***	0.9885	3	0.0000	-0.0248***	0.9941	3	-0.0002**	0.0180***	0.9941
Switzerland	2	0.0003**	-.0348***	0.9887	1	0.0001	-0.0240***	0.9942	1	0.0000	0.0218***	0.9978
United Kingdom	1	0.0006***	-0.0360***	0.9828	2	0.0000	-0.0230***	0.9831	1	0.0000	-0.0185***	0.9949
United States	1	0.0002	-0.0365***	0.9908	2	0.0000	-0.0269***	0.9822	1	0.0000	0.0253***	0.9956

Note: The number of lags for the Newey-West (1987) standard errors is obtained by fitting an AR(*p*) process to the error of the regression such that the residual behaves as white noise. R^2 is obtained from the OLS regression. Significance levels * 10%, ** 95%, *** 99%.

Table 10 presents the coefficients for the constant and the independent variable by country and time horizon as well as the R^2 for each regression. To account for serial correlation in the error, we use Newey-West (1987) standard errors where the optimal number of lags is obtained from fitting an AR(p) process to the error term such that the residual behaves as white noise.

In Table 10 we find that the R^2 of the regressions is always above 0.98 and that the coefficient for the independent variable is always statistically significant with confidence beyond 99%. We take this as evidence that LBBIs and the PCs of the selected vectors bear a robust linear relation. Since the PCs explain a significant portion of the variance-covariance matrix in **D** then, by transitivity, LBBIs should also contain such explanatory power.

2.6.2.3. Why Use LBBIs Instead of Principal Components?

A natural question that arises is, why then resort to the use of LBBIs at all, and not merely use the first principal component of each matrix **D**. As shown in Table 10, the coefficient estimated for the independent variable is not always positive. Thus, while by construction LBBIs take on positive values in the case of expansions and negative values when contractions occur, the principal component has no such association with phases.

A second reason to employ LBBIs rather than principal components has to do with tractability and interpretability. From Section 2.5.1 and Section 2.5.2 we know where the indicator comes from, its reasonable interpretation as an above or below trend expansion, and its unit of measurement in standard deviations. All these elements are unknown in the case of principal components which arise only as statistical artefacts, with the caveats we have discussed in Section 2.5.1.1

A final issue has to do with the cross-sectional differences in the coefficients for each time horizon. The fact that coefficients are different for both the constant and the independent variable indicates that there are differences in level and scale across principal components, which renders them incomparable across countries. This is worrisome as it would be impossible to include the principal components as the dependent variable in panel regressions, as we will do with LBBIs in the following chapters.

2.6.3. Dating Bears and Bulls: Duration, Amplitude, and Severity

After constructing the different LBBI series that originate from the database discussed in section 2.1, we face the issue of characterising them according to phases of expansion and contraction. To define such phases, we follow a simple approach. If the indicator takes a value above a certain threshold of X standard deviations, we consider the observation to make part of a bull period, and if it has a value below a threshold -X, we consider the observation to make part of a bear period. Table 11 shows the information content of the different bins for a lax threshold of X=0.5 in panel A and for a restrictive threshold of X=1.0 in panel B. For each series and indicator we take the simple average of the percentage of observations in each bin by country, and highlight the value for bulls in green and for bears in red.

Table 11: Information contained in expansions and contractions by series, indicator, and threshold

Panel A: Average percentage of observations contained below, between and above lax thresholds						
	Stocks			**Real credit**		
	LBBIS	*LBBIM*	*LBBIL*	*LBBIS*	*LBBIM*	*LBBIL*
< -0.5σ	26.7%	34.6%	40.1%	37.3%	41.4%	40.7%
-0.5σ < X < 0.5σ	44.9%	29.5%	20.6%	28.2%	22.1%	19.6%
> 0.5σ	28.4%	35.8%	39.4%	34.5%	36.5%	39.7%

Panel B: Average percentage of observations contained below, between and above restrictive thresholds						
	Stocks			**Real credit**		
	Short	*Med.*	*Long*	*Short*	*Med.*	*Long*
< -1.0σ	12.5%	20.4%	23.1%	20.9%	23.7%	26.4%
-1.0σ < X < 1.0σ	75.5%	56.3%	47.7%	62.1%	53.1%	48.3%
> 1.0σ	12.1%	23.4%	29.2%	17.0%	23.2%	25.3%

Note: Each cell contains the country-average percentage of observations either below -X standard deviations, above X standard deviations, or between -X and X standard deviations for a given LBBI. Panel A presents the results for a lax threshold where X is 0.5 standard deviations. Panel B presents the results for a restrictive threshold where X is 1.0 standard deviations. Shaded in red (green) is the percentage of observations deemed as bears (bulls).

In the table we find that for short-run LBBIs a significant amount of information falls within the thresholds; more so than for medium and long-run LBBIs in all cases. The most relevant difference across panels is the amount of information that is omitted from classification. While in the lax specification (top panel), in most cases less than 30% of the information falls between the two thresholds, in the restrictive specification (bottom panel) over 50% of the information, in most cases, falls in the aforementioned bin.

Since our goal, at this point, is to characterise expansions and contractions over the series, rather than paying particular attention to the more extreme situations, we choose to work with the less restrictive threshold of 0.5 standard deviations. However, for alternate research goals such as an in-depth study of particular financial crises or manias, a researcher may choose to focus on the more restrictive threshold

To date expansions and contractions, we follow a simple rule. An expansion (contraction) will begin the first time, and LBBI takes a value above (below) (-)0.5, and the phase will end the first time that the indicator takes a value below (above) (-)0.5. We will not enforce alternation between expansions and contractions, contrary to what is done by Pagan & Sossounov (2003). However, if two expansions (contractions) are separated by less than three months and the indicator never changes sign, we will treat it as a single phase.[154] Additionally, we will not allow expansions or contractions that last for a single month (or year in the case of annual series), unless the indicator takes an absolute value of at least 1.0 standard deviations.

After dating the beginning and end of each phase, we will calculate several descriptive measures to cover aspects of duration, amplitude, and severity.

2.6.3.1. Duration

Duration is measured as the number of months or years between the start and end date. The starting date of a phase refers to the first date of the month or year while the ending date of a phase refers to the last date of the month or year.

[154] We will not enforce this rule for yearly data.

2.6.3.2. Amplitude

In the case of amplitude, we propose two different measures. On the one hand, following the extensive literature on booms and busts, we use the CAGR in the level of the variable from the starting to the ending dates of a phase; this is the traditional growth rate expressed in annual terms for comparability across phases.

On the other hand, since the different specifications of LBBIs use returns to different time horizons, we build three distinct series of the 1, 3, and 5-year growth rates. They correspond to the short, medium and long-run LBBIs respectively (LBBIS, LBBIM, and LBBIL).

The amplitude of a phase identified by LBBIS (LBBIM, LBBIL) will be the difference between the value of the 1-year (3-year, 5-year) growth rate at the starting and ending date of a phase.[155] To exemplify, in the case of stocks, the measure of amplitude for the LBBIM will be the change in the 3-year return of a stock portfolio fully invested in the index between the beginning and end of a phase. In the case of real credit, the measure of amplitude for the LBBIL, for example, will be the change in the 5-year average growth rate in real credit between the beginning and the end of the phase

2.6.3.3. Severity

We include a severity measure which goes well beyond the one proposed by Harding & Pagan (2002b) and Agnello & Schuknecht (2011) presented in equation (1). Rather than approximating the shape of an expansion or a contraction through a right triangle, we will define severity as the accumulated value of the indicator between the starting and ending date of a bull or bear phase. The severity of booms will be positive, and the severity of contractions will be negative. This is a useful measure as it resembles the discrete approximation to the Riemann integral of the LBBI

[155] The reason for using two different measures of amplitude has to do with the fact that the medium and long-run LBBIS can show an expansion (contraction) affecting 3 and 5 year returns, well after the stock market index or credit aggregate has begun to decrease (increase). The second measure, which uses a rolling CAGR for 1, 3 and 5 years better reflects the dynamics of growth rates and returns to different time horizons. However, we include the CAGR between starting and ending date because it is the traditional measure employed in the literature.

function between two dates. In other words, we define the indicator for the severity of expansions and contractions as the area between the LBBI and the horizontal axis for a set period.

In Annex 7 we present a detailed characterisation of bull and bear phases for the stock market variable for some countries. In each table, we present three panels, one for each LBBI, which contain the type of phase, their starting and ending dates, their duration, the two measures of amplitude, and the severity measure. Even though in the following section we only discuss the results for the UK stock market, we firmly believe the additional information contained in the annex is of interest for researchers, a valuable contribution of this dissertation, and a rich resource for further research.

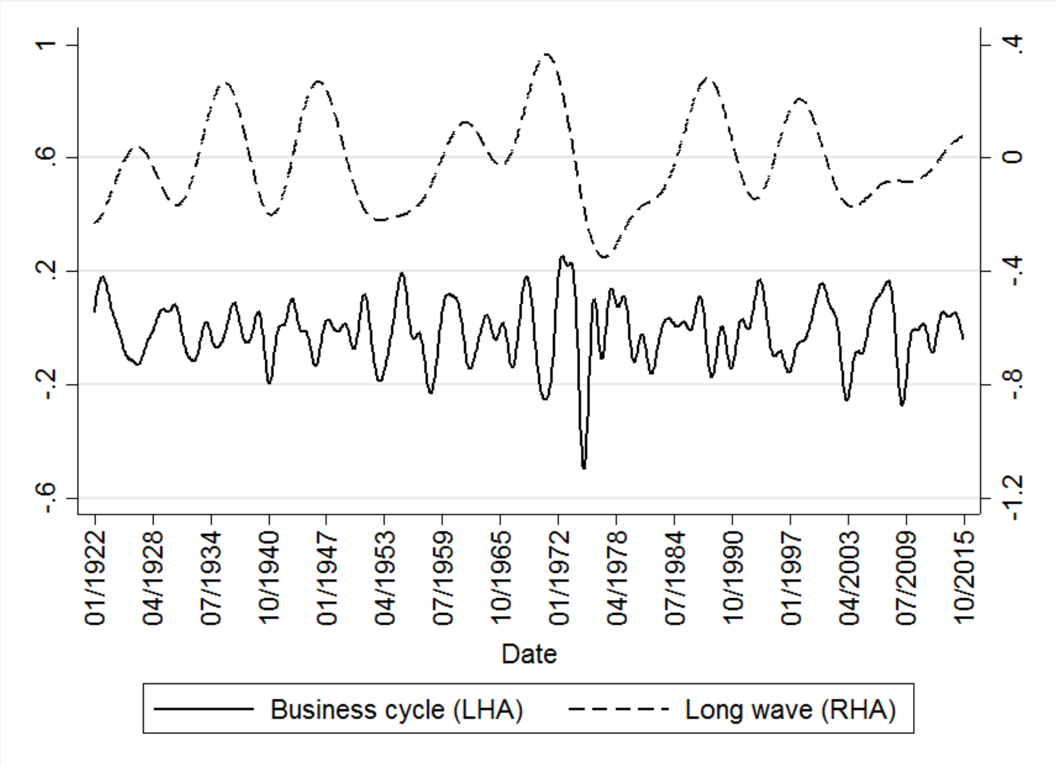
2.7. How BBIs Measure Up? Comparing the Different Methodologies for the UK Stock Market since 1922

We apply the different methodologies discussed in Section 2.4 to the real stock market data for the United Kingdom. For the turning point algorithm, we perform two specifications to obtain starting and ending dates for expansion and contraction phases. First, one for the short-run with an observation window of 8 months, a minimum cycle length of 16 months and minimum phase duration of 4 months as in Pagan & Sossounov (2003). An alternative long-run specification uses an observation window of 12 months, a minimum cycle length of 24 months and minimum phase duration of 6 months as in Bordo & Wheelock (2009).

Subsequently, we follow Drehmann et al. (2012) and use the band-pass filter as in Christiano & Fitzgerald (2003) to extract a business cycle with a duration between 18 and 96 months and a medium-term cycle with a duration between 8 and 30 years (or 96 to 360 months) from the logarithmic transformation of the index. These two components, independent by construction, are presented in Figure 14.

Authors like Bordo et al. (2001) use the business cycle series extracted through the band-pass filter to date booms and busts. By using a centred moving window of 25 observations, we find local maxima and minima in both filtered frequencies in a process reminiscent of the turning point algorithm.

Figure 14: Business and long-run cycles extracted using the band-pass filter

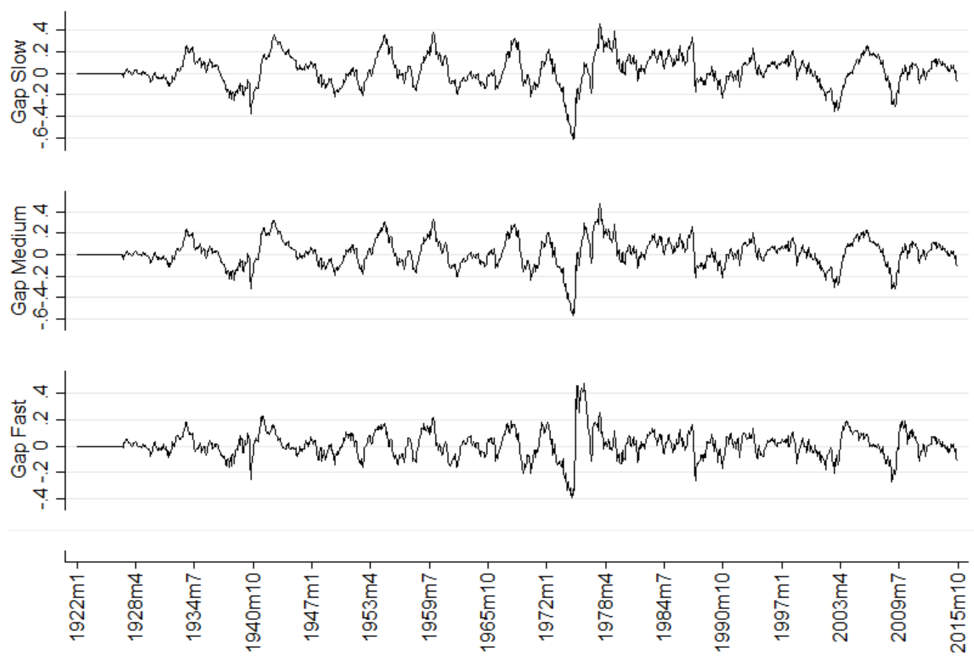


Note: The figure presents the cyclical components extracted from the logarithmic transformation of the stock market index for the United Kingdom. We employ the band-pass filter as in Christiano & Fitzgerald (2003). The business cycle component (solid line) contains frequencies between 18 and 96 months. The long-run cycle component (broken line) contains frequencies between 96 and 360 months. This parametrisation follows Drehmann et al. (2012)

An issue that arises from the decomposition of time series into orthogonal components is that, as Cendejas et al. (2017) indicate, there may be no overlap between waves of different frequency. In that sense, using the various components (business cycle and long wave) to date booms and busts may yield turning points that do not coincide with maxima and minima in the original series. Due to this caveat, we choose to only present the results from the business cycle component which is the standard approach in the literature and thus our benchmark for comparison.

A third approach we follow uses the Hodrick & Prescott (1997) filter to identify bulls and bears. Following what has been done traditionally in the literature we tested three different specifications of the filter by changing the values for the parameter λ. Hodrick and Prescott (1997) find that for quarterly data the optimal λ is 1,600 based on a 5% cyclical component and a quarterly change of 0.125% every quarter. Converting the quarterly growth rate change to a monthly frequency yields a λ of 14,411 which we round to 14,400 and use as the fast adapting λ. Secondly, we follow Ravn & Uhlig (2002) and use a medium speed λ of 129,600. Finally, we follow Borio & Lowe (2004) and use a slow adapting λ of 400,000. The filter is applied to the stock market indices directly, extracting the last observation for the trend on a rolling window of 120 observations (10 years). We then calculate the stock market growth gap as the percentage difference between the expected value of the series and the observed value for a given date. We present the resulting series Figure 15.

Figure 15: HP filter gaps for three different specifications



Note: Results obtained from the recursive application of the HP filter on the stock market indices directly. We store the prediction of the trend component for the last observation of each window and calculate the gap as the difference in percentage between the expected and observed values at a given time. The bottom specification uses a λ of 14,400, following Hodrick and Prescott (1997). The middle panel uses a λ of 129,600 following Ravn & Uhlig. The top panel uses a λ of 400,000 following Borio & Lowe (2004)

We find that neither the predicted trend or the growth gap differ significantly between different values of lambda. Consequently, we only discuss results for the intermediate lambda of 129,600.[156] A remarkable result from Figure 15 is that any of the gap series can identify boom and bust periods, defined as above or below trend growth. However, the series mimic each other substantially, with a minimum correlation coefficient of 0.6, and thus they reflect roughly the same booms and busts.

To compare the results from these three different approaches, we establish starting and ending dates for booms and busts. Both specifications of the turning point algorithm and the band-pass filter produce, as output, such a series. Since their results are quite similar, we summarise them in a single series by stating that any given month is a boom month if at least two out of the three coincide. Busts were defined similarly. We will refer to this series of dates as the Turning Point and Business Cycle consensus (TPBC).

However, to extract dates from the HP filter we needed to establish thresholds for what constitutes a bull or a bear. The choice of a given threshold, however arbitrary, does not imply a loss of information from the gap but rather a means of summarising the data. Recall from 2.6.2.1, that for LBBIs, we determined that expansions or contractions occur when the absolute value of the indicator is above 0.5 standard deviations. In the case of the HP filter gap, and to keep comparability between thresholds, we found that the standard deviation for the HP gap series was 12.95%, thus as a threshold, we chose a value of 6.5%. When the value of the gap exceeds 6.5% upward, it indicates a boom and when it exceeds -6.5% downward it indicates a bust.

As in the case of LBBIs, if two booms (busts) were three or fewer months apart and the value of the gap never turned negative (positive), we treated it as a single boom (bust). Additionally, booms (busts) that

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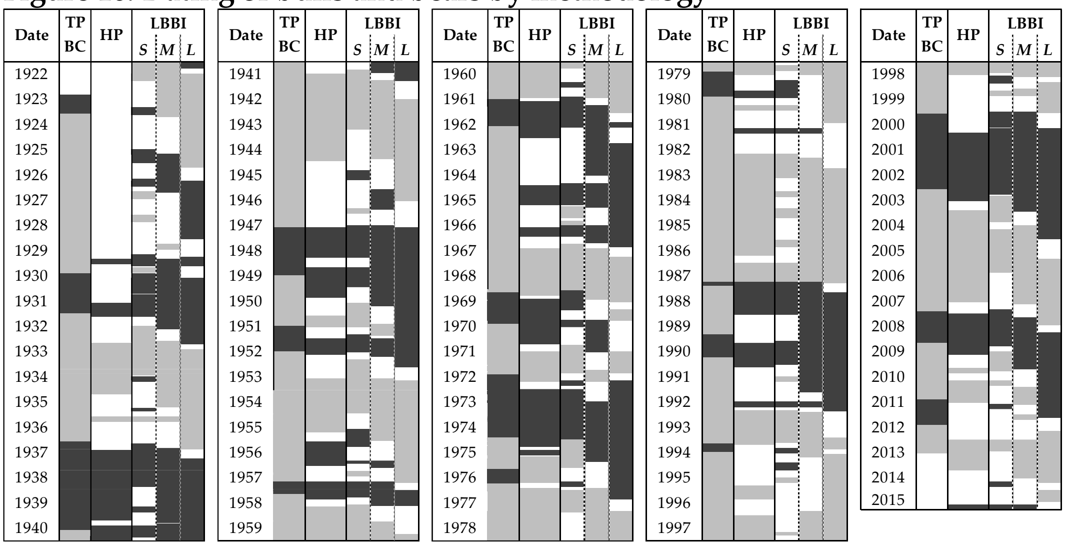
[156] In their paper, Ravn & Uhlig (2002) search for the optimal values of lambda when the frequency of data varies. Their criterion for optimality is that the main properties for the results to one frequency are transferred to other frequencies so that results are not an artifice of the frequency of data used. The monthly equivalent of the optimal quarterly lambda of 1600 found by Hodrick & Prescott (1997) is precisely 129,600.

lasted only one month were kept only if the value of the HP gap was at least (-)13%.

In Figure 16, we summarise the results graphically by identifying the differences in dating across methodologies. Expansion periods are shaded in light grey, and contraction phases are shaded in dark grey according to each methodology for the period between January 1922 and September 2015. For the interested reader, an in-depth analysis of booms and busts in their historical context is presented in Annex 10 and is meant to be read while looking at the results in the figure. In the annex we describe the dynamic across indicators, the build-up of shocks from LBBIS to LBBIL. It has the added benefit of describing how our findings coincide and nuance what has been identified in seminal references We do not include it in the corpus of the dissertation for readability and to avoid repetition with the historical context in Chapter 5 and Chapter 6.

Figure 16: Dating of bulls and bears by methodology



Note: Each of the five panels contains six columns. The first one corresponds to the year. The second column refers to the consensus reached between the turning point specifications and the business cycle component (TPBC). The third column corresponds to the booms and busts detected using the HP filter with a lambda of 129,600 (HP). The last three columns correspond to the bulls and bears reported using the short-run (LBBIS), medium-run (LBBIM), and long-run (LBBIL) local indicators respectively.

As in section 2.6.2.1, we employed the starting and ending dates from each methodology (TPBC and HP) to calculate measures of duration, amplitude, and severity. For duration, we calculated the number of months between the beginning and end of each phase. For amplitude, we calculated both the percentage change in the series in levels (as a CAGR), for each phase, and the difference in the one-year average CAGR between the starting and ending date. As measures of severity, we calculated the severity index presented in (1). It is important to note that in calculating severity we define the amplitude A_i as the period price change in percentage, rather than the CAGR. Annex 8 presents a table with the dating for expansions and contractions, and their associated measures using these different approaches. In what follows we present the most salient differences when using the different methodologies in characterizing bulls and bears for the UK stock market.

2.7.1. Differences in Dating

In Figure 16 we can observe there is a substantial coincidence across methodologies in the broad classification of bull and bear phases. This is particularly clear in the dating offered by the HP and LBBIS methodologies. While we will delve into the details in the next subsections, it is important to highlight several noteworthy differences across methodologies:

Coincidence in dating: Several phases are only reported by one or two of the methodologies (i.e., two bear phases in the 1940s, a bear phase in the early 1980s, or a short bull phase in the early-2010s). At least one of the methodologies is always one of the LBBIs.

Nuance of results from classic methods: While according to TPBC or HP a phase may cover an extended period, LBBIs nuance this result by breaking it into different shorter waves (i.e., the long bull phase in the early 1980s).

Identification of persistence: While the dating from the short-run LBBI coincides roughly with the HP filter, the medium and long-run datings show that expansions and contractions are usually persistent events that affect long-run returns well beyond a shock. (i.e., the shock in the early 1970s seems to run until 1974-75 according to TPBC, HP, and the short-run LBBI, while the medium and long-run indicators show that its effects lasted until 1977).

Different contemporaneous phases: Interestingly, different LBBIs can show both an expansion and a contraction for the same period (i.e., 1965-66 and 1974-77). This apparent contradiction denotes that while the variable may be suffering a long-run contraction, short-run expansions may also take place which does not necessarily cause the long-run trend to revert. An excellent example of this has to do with the stock exchange after the oil shock of 1973, where it started a long-run contraction process. During 1975, there was a short-run expansion which, however, was not strong enough to cause a reversal of the long-run trend.

Additionally, the number of bull and bear phases changes significantly depending on the methodology as shown in Table 12. In most cases, the number of bull or bear phases by methodology is below 30, which makes them subject to small sample issues. This occurrence is usual in empirical applications in economic history, and the only alternative would be to prolong our study in time to allow for the inclusion of more phases. As this is impractical in the current context, we choose only to mention the caveat.

Table 12: Number of phases by methodology

	TPBC	*HP*	*LBBIS*	*LBBIM*	*LBBIL*
Bull	17	20	36	19	16
Bear	17	23	41	20	13

Note: The table presents the number of bull and bear phases identified using the different methodologies following the procedure described in sections 2.6.2.1 and 2.7.

To establish differences in the characterisation of bull and bear phases across methodologies, we followed several approaches. First, we produced boxplots as a graphical representation of the descriptive statistics for the four measures by type of phase across the different methodologies. These figures, included in Annex 9, show that measures such as duration and severity are quite dispersed for both bull and bear phases; an indication that both types of phases are each a distinct event and that making generalisations about their behaviour is not an easy task. Of course, this is an argument in favour of extending the analysis of expansions and contractions beyond simple binary sequences and using the LBBIs proposed here as an additional measure for their identification and characterisation.

Second, we performed pairwise mean comparison tests by measure for the five different methods discussed (TPBC, HP, LBBIS, LBBIM, and LBBIL). We ran ten different mean equality tests and tested the null of equal means for different confidence levels: 75%, 90%, and 95%. A summary of the percentage of statistically significant differences by measure, phase and confidence level is presented in Table 13. For readability purposes, the full tables presenting the results for the pairwise comparisons are presented in Annex 9.

Table 13: Percentage of statistically significant differences in means by measure, confidence level, and type of phase

		Bear phases			Bull phases		
Confidence level		*75%*	*90%*	*95%*	*75%*	*90%*	*95%*
Duration		90%	70%	70%	90%	90%	80%
Amplitude	*Period CAGR*	80%	70%	70%	60%	40%	40%
	Difference in return	80%	60%	60%	70%	70%	70%
Severity		100%	100%	100%	100%	100%	100%

Note: The total number of comparisons is ten arising from $((n(n-1))/2)$ where n is the number of methods compared, n=5 in our case. The table presents the percentage of tests where we fail to accept the null of equal means for different confidence levels. The case of the severity measure is particular since the measures for TPBC and HP are calculated differently than for LBBIs. Thus the number of pairwise comparisons falls to 4 (TPBC against HP and the 3 LBBIs amongst themselves).

The table shows that even to the stricter confidence level there are essential differences across methodologies. The most differences, as expected, are found for the severity measures, while the least differences are apparent in the measures of amplitudes. These results hold for both bull and bear phases. We expect the number of differences to increase even more with a significant increase in sample size, but prefer to leave this extension for further research. In what follows, we will present a summary of results by measure, leaving all supporting figures and tables in Annex 9.

2.7.2. Duration

We can identify that bear phases are shortest when measured by HP followed in ascending order by LBBIS, LBBIM, and LBBIL. Additionally, the duration of bear phases is similar when using TPBC or the LBBIM. Regarding bull phases, we find that they are shortest when measured by LBBIS, followed in ascending order by LBBIM, LBBIL, and TPBC. Additionally, it is indifferent to measure duration by HP or LBBIM.

The relevant takeaway with regards to the LBBI methodology is that as the time horizon increases the median duration of bull and bear phases also increases. This is indicative of persistence in expansions and contractions which this indicator, under its three distinct specifications, makes evident for researchers.

2.7.3. Amplitude

With regards to amplitude, we perform a similar analysis as in the previous section using the two different measures of amplitude discussed in section 2.6.2.1. The first is the CAGR percentage change in levels between the starting and ending dates of each phase. The second amplitude measure is the difference between the 1, 3 and 5-year CAGR between starting and ending date. For TPBC, HP, and LBBIS we employ the one-year CAGR as this measure arises from the short-run evolution of the underlying series. For LBBIM we use the three-year CAGR, and for LBBIL we use the five-year CAGR, keeping consistency with the vectors in **D** from which the indicators originate.

For the first measure, we find that bear phases have similar negative amplitudes when identified through TPBC, HP, and LBBIS. The amplitude measures increase towards zero when measured by LBBIM and then by LBBIL. Regarding bull phases, the strongest gains are evidenced in the phases measured by LBBIS. Amplitude is closer to zero when measured by either TPBC or HP. According to LBBIM and LBBIL, amplitude is both closest to zero and statistically indifferent across both methodologies.

The second amplitude measure employed, indicates that the most negative bear phases are those identified by TPBC, followed by LBBIS, and HP. Measures of amplitude according to LBBIM and LBBIL are closest to zero and indistinguishable from each other. For bull phases, TPBC has the highest mean amplitude, followed by HP and LBBIS. As is the case for bear phases, amplitude according to LBBIM and LBBIL are closest to zero and indistinguishable from each other.

It is interesting that both measures of amplitude yield similar results and that the amplitude of bulls and bears as dated by both medium and long-run indicators is closer to zero than when identified by other methodologies. This may happen because the way in which medium or long-run expansions and contractions are dated may include the beginning of short-term recoveries. However, these results should not be discouraging: a very negative or positive CAGR that occurs for one or two months, which shows up in the LBBIS, may affect investors and even general economic conditions far less than a small but persistent negative or positive trend in medium or long-run CAGRs, which shows up in the LBBIM or LBBIL.

2.7.4. Severity

As measures of severity, on the one hand, we employ the triangular approximation of Harding & Pagan (2002b) shown in equation (1) for bull and bear phases identified by TPBC and HP. On the other hand, the severity of phases identified by LBBIs is measured as the accumulated value of the indicator between the starting and ending date of the phase. Since these measures are not expressed in the same units, we perform comparisons between HP and TPBC and among the different LBBIs separately. This will reflect both in the boxplots and statistical tables in Annex 9.

According to the triangular approximation, both bear and bull phases are more severe when using the TPBC dating than through the HP filter. When comparing the LBBIs, we find that both bull and bear phases are most severe when identified using the LBBIL, they are least severe when identified by LBBIS, with results for LBBIM being in-between. The mean for the three measures of severity are statistically different between them. The results for LBBIs are, as expected, consistent with the results for the measure of duration. Concurrently, we indicate that these two measures reflect well on the persistence of booms or busts in time, where a single shock can affect medium and long-run returns well after the short-term event has diluted.

2.7.5. Are Bulls and Bears Different?

We performed additional pairwise comparisons of means between phases by measure and methodology. This is relevant since Roubini (2006) and Dell'Ariccia et al., (2013) have argued about the asymmetric response of authorities regarding booms and busts. Consequently, we find it is an interesting question to determine if these differential responses are associated with different structures in expansions and contractions. For readability purposes we only present a summary of the statistically significant differences between bull and bear phases by methodology:

Duration: Bull phases are more prolonged than bear phases with 99% confidence according to TPBC and with 90% confidence according to HP.

Amplitude: Using the CAGR phase return as a measure of amplitude, we find that in absolute value, bull phases present a higher return than bear phases with 99% confidence according to LBBIS.

Severity: According to TPBC and HP bull phases are more severe than bear phases with 99% confidence. This may be because the amplitude measure in equation (1) has a lower bound of -100% as stock indices may never turn negative.

Beyond these findings, bull and bear phases seem to be statistically symmetrical under the Local Bull Bear Indicator. Although this is surprising, given that the literature has identified that regulators and policymakers have fewer incentives to hinder an expansion than a contraction (Dell'Ariccia, 2013), we offer two possible explanations for this result.

First, the choice of a ±0.5 may not be restrictive enough and may include too many "business-as-usual" months which result in a symmetrical behaviour of the phases given the symmetrical nature of the underlying series.[157] A second possibility is that this lack of statistical significance in the t-statistics may be due to the dispersion evidenced in each indicator. Regarding the boxplots presented in Annex 9, it may be just that the height of the boxes is such that it does not allow for sufficiently conclusive statistical tests. This, however, is a valuable indication: it is not only that not all bulls or bears are created equal but, rather, that each expansion or contraction has characteristics that make it unique, and thus makes both predicting them and acting upon them very challenging tasks.

A takeaway from this section is that no single indicator strictly dominates the others when identifying bull and bear phases. In that sense, the dating and characteristics of each phase are strongly contingent on the methodology employed. We have found that a subset of the indicators presented here coincides from a broad perspective, in the different measures assigned to each phase. Within said subset one of the specifications of the LBBIs is always included.

It follows that using the three specifications of LBBIs jointly contains all the breadth of information reflected by TPBC and HP. Additionally, as discussed in section 2.5, the origin of LBBIs is more tractable and its interpretation more economically significant than that of the alternative methodologies. While TPBC focuses solely on local maxima and minima, and HP focuses in a measure of deviation from the trend component in the series which arises from a statistical artefact, LBBIs result from analysing the deviations in the data from the risk-adjusted rolling return expressed in standard deviations. This motivates our continued use solely of the LBBIs results for the remainder of the dissertation.

2.8. Summary of Results and Concluding Remarks

The purpose of this chapter was threefold. First, we presented the main time series from which we will construct the dependent variables for the

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[157] Recall that that the one-year return series for the UK stock market index was both symmetrical and leptokurtic. We expected that broadening the threshold to ±1.0 standard deviations would make asymmetries in tail events evident. However, we perform such a test in Chapter 5 and find that results do not appear to be contingent on the threshold.

rest of the dissertation. In this presentation, we took care to represent both critical elements of the financial cycle discussed in Chapter 1: asset prices and credit aggregates. We provided a thorough characterisation of the series in section 2.1 and in-depth statistical analysis in Annex 2.

The second goal of the chapter was to present a new measure of the boom and bust cycle in financial an economic time series. To do so, in section 2.4 we highlighted the strengths and caveats of the current methodological toolbox and, in section 2.5, presented the Global and Local Bull-Bear Indicators as complementary measures that tend to these issues. In section 2.6 we applied the algorithm for the Local Bull Bear Indicator to the different series for stock markets and real credit and offered a statistical description of the series. An alternative calculation of LBBIs is offered in Annex 3, while in-depth discussion of the information contained in GBBIs is offered in Annex 5. We also offered an in-depth analysis of all Local Bull Bear Indicators in Annex 6.

The final goal of this chapter was to compare and contrast the results offered by the new methodology vis-à-vis the available methodological toolkit with regards to the amplitude, duration, and severity of bull and bear phases. In that sense, sections 2.6.2.1 and 2.7 offer a dating algorithm for expansion and contraction phases in the LBBI series and discuss the case of the stock market in the United Kingdom during the period 1922-2015. As a very relevant contribution for further research using these indicators, in Annex 7 we offer a full dating of bulls and bears for stock market indices and real credit for the twelve countries in the database. As a further development of the case study, in Annex 8 we offer the full dating of booms and busts in the UK stock market using the Turning Point and Business Cycle consensus and the HP filter.

From a methodological perspective, we contribute to the literature on the identification of trends and cycles in financial and economic time series. We have shown that the LBBI indicator, in its short, medium and long-run specifications provides as much information as alternative methodologies and allows for further nuance and detail in the analysis of amplitude, duration, and severity. These indicators are valuable as they aggregate in three measures sufficient information about the returns structure of the series to different time horizons. Finally, since LBBIs are continuous time series that adequately reflect the empirical distribution of the underlying data, they exceed by far the informational content of the binary sequences that are usually employed in the financial crises literature.

For researchers in economics and finance, the Local Bull-Bear Indicators offer a measure that is tractable and readily interpretable: the risk-adjusted deviation from average expressed in standard deviations. The fact that it can be constructed to different time horizons is of added interest as it captures the persistence of phases in the series well beyond what is contained in the usual methodologies. Moreover, the measure of severity that can be derived by LBBIs resolves the issues of interpretation and bias in the triangular methodology discussed above.

Finally, the fact that the formula for LBBIs uses both time-varying means and volatilities serves the purpose of analysing events in their respective historical context rather than observing them with respect to very (maybe excessively) long-run measures of central tendency and dispersion.

The spread in the measures of amplitude, duration, and severity, which in part causes the difficulty of establishing statistically significant differences between them, indicates that not all booms or busts are created equal. On the contrary, they show that each phase is a unique event, with specific characteristics that need not be shared with other phases. In this sense, an added value of the measure we propose is that it allows researchers to identify and work with a higher level of granularity.

A final noteworthy issue has to do with the relationship among the different specifications of LBBIs. On the one hand, while the short-run indicator may be denoting a bull phase, the long-run indicator may signal a contraction. This apparent contradiction is moot since it merely reflects that while the variable may be suffering a long-run contraction, short-run expansions that do not cause the long-run trend to revert may also take place. On the other hand, it is noteworthy that according to both measures of amplitude, both bull and bears are ampler when identified by the short-run indicator, than under the medium or long-run specification. This may happen because the dating of medium or long-run expansions and contractions may include the beginning of short-term recoveries. However, these results should not be discouraging: a very negative or positive amplitude that affects short-run returns for just a few months may affect investors and even general economic conditions far less than a small but persistent negative or positive trend in medium or long-run returns, which shows up in the medium or long-run indicators.

There are several avenues for further research. First, researchers can exploit the datings of bull and bear phases for the different series offered in Annex 7. Second, an inquiry can be made into the nature of the more extreme events by restricting the ±0.5 standard deviation threshold to more stringent values. Third, as we will do in Chapter 5, further research can explore the determinants of the anatomical differences between bull and bear phases through time. Finally, we believe that this new indicator will be useful for an ample set of research questions related to financial crises, international macroeconomics, long-run economic growth and development, and international trade cycles and globalisation.

PART II: Panel Data Evidence

Chapter 3. Do the Rules of the Game Matter for Asset Prices? Trilemma Regimes and the Stock Market

In this chapter, we explore the determinants of stock market behaviour under the different trilemma regimes discussed in Section 2.2. We will build on the approaches by Obstfeld, Shambaugh & Taylor (2004) and Klein & Shambaugh (2015) where they interact capital control and exchange regime dummies to build the four different states of the world we have called trilemma regimes (TRs): Fixed exchange rates with either closed or open capital accounts (TR I and TR II respectively), and flexible exchange rates with either closed or open capital accounts (TR III and TR IV respectively).

The question we aim to answer in this chapter is whether the determinants for the accumulation and unwinding of imbalances in stock markets are contingent on the trilemma regime in place. To address this question, we establish a workhorse model for the determination of stock prices which includes exchange rate determinants, capital flows, and a proxy for the global financial cycle. In the model, we also include relevant control variables for economic structure and macroeconomic conditions. To identify the contingency of the determinants, we test for structural breaks in the coefficients by trilemma regime. To analyse the implications of our findings for financial stability, in a second stage, we analyse whether there is an additional structural break in the coefficients driven by the difference between expansions and contractions in the stock market.

Several initial caveats are relevant. As we have argued in Chapter 1, the literature has shown that the trilemma is binding and that different combinations of exchange rate and capital control regimes bear an effect on the level of monetary autonomy a given country can exercise. Consequently, throughout this chapter, we assume that the level of monetary autonomy is time-invariant during each trilemma regime.[158]

[158] As discussed earlier, when the exchange rate is fixed, and the current account is open, as in the gold exchange standard, movements in the interest rate result from the interaction between inflows and outflows of capital such that the price of gold remains constant. The same is true for small open economies, particularly developing countries

This allows us to tackle the issue of having too many moving parts in our analysis. However, we believe that the issue of the role monetary policy plays under each trilemma regime is a fascinating subject for further research.

Second, this research is not aimed at analysing the full breadth of implications that a given trilemma regime may have on the broad economy and in that sense, we refrain from touching on the extensive literature that covers the possible feedbacks (either positive or negative) between a given regime and the business cycle. This also implies that even if we control for real economic conditions, we will not try to interpret the coefficients of control variables throughout the text. Further research could be aimed at tackling these changes which, as the tables in the text and annexes show, are relevant in some cases.

Third, as mentioned in the introduction to this dissertation, we understand that both the exchange rate regime and the position on capital controls are endogenous to the system and there may very well be a two-way causality between the choice of a regime and financial stability. In that sense, we make no claims about causation in the relationship. We believe that, in further research, an empirical strategy that may serve to argue for causal mechanisms needs to address case studies for each regime. Since our analysis is of an aggregate nature and is aimed at observing big-picture stylized facts, the analysis of individual country histories exceeds the scope of what we aim to achieve.

As dependent variables, we will only employ the Local Bull Bear Indicators for the stock market of the twelve countries discussed in Chapter 2 excluding data for the United States. As we discussed in the introduction, we will use the data for the US to proxy for the global financial cycle proposed by Rey (2015). We prefer the LBBI series above the traditional dummy sequences in the financial crisis literature because, as we have shown, they better reflect the empirical distribution of the

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which fixed their exchange rates during the 1980s and 1990s. These cases are addressed first by Diaz-Alejandro (1985) and the large literature that followed. In all other trilemma regimes we assume that some level of monetary autonomy is warranted, and unchanging.

underlying data. Additionally, since LBBIs are more volatile than dummy sequences, they allow for better identification of the links we expect to find.

Our choice of countries can be challenged as there may be low variability in the exchange rate and capital control regimes, our independent variables when studying only twelve countries with similar development paths. To address this issue, we wish to highlight three characteristics of the exchange rate, capital control and trilemma regimes presented in Section 2.2.

First, out of the twelve countries in the database, only four belong to the eurozone, while the remaining countries have experienced a combination of soft pegs and floating exchange rates since 1999 as we showed in Figure 8.[159] Second, ten out of the twelve countries (except Canada and Switzerland) went through two distinct waves of financial repression via capital controls as shown in Figure 9. The first occurred during the interwar years, as described in Section 1.4.1, and the second during the Bretton Woods period, as described in Section 1.4.2. Finally, as shown in Table 5, out of a total of 1,104 country-year observations in our database, the trilemma regime with the least observations (94 or 8.5%) is the one with flexible exchange rates and closed capital accounts. The regime with the most observations (412 or 37%) is the one with fixed exchange rates and open capital account. The number of observations by regime appears to be sufficient for us to explore their nexus with financial imbalances.

From a methodological perspective, after several tests, we run panel corrected standard error (PCSE) regressions of the workhorse model to identify the existence of a global cycle as proxied by the US LBBIs. In a second stage, we perform Chow (1960) tests to identify breaks by trilemma regime, by type of phase (expansion or contraction), and between bank-based and market-based systems. Based on the conclusions of those tests we present regression results by trilemma regime and type of phase.

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[159] Recall the discussion of the exchange rate regime for the eurozone countries after 1999 in Section 2.2.

This chapter makes several contributions to the literature. First, few papers discuss the different solutions countries implement for the trilemma in a long run perspective. Most studies use wide panels of countries covering recent time periods, usually since the fall of Bretton Woods. Our choice is the opposite. We choose a thin but long panel, starting in 1922 and running until 2013, to avoid generalising conclusions for a set of countries that may be naturally incomparable.

Second, research on the joint effect of exchange rate regimes and capital controls, beyond the effects of it on monetary policy autonomy, is relatively recent. Consequently, this study is a necessary step forward in establishing a link between trilemma regimes and financial stability.

Finally, even though we understand that correlation is not causation, we expect the findings discussed here to motivate further research that may serve to develop policy recommendations and actions; after all financial stability is the new holy grail of international macroeconomics.

A first relevant finding is that the LBBIs serve as a reasonable proxy for the VIX index which measures market fear, and thus allows for exploring the idea of a global financial cycle in the long run. We argue throughout the chapter that co-movement across stock markets is relevant regardless of the exchange rate and capital control regime in place, in a similar fashion as Rey (2015). Moreover, we find that the drivers for the evolution of stock market prices do change by trilemma regime in ways that are consistent with the macroeconomic literature. This also applies to the main drivers of expansions and contractions, and thus highlight the difficulty in addressing the issue from a policy perspective since diverse institutional setups and macroeconomic conditions allow financial imbalances to accumulate or unwind through different channels.

The rest of the chapter is structured as follows: Section 3.1 discusses the theoretical approach to the problem by presenting basic models for the determination of stock prices and exchange rates. After presenting a set of country-specific independent variables, we perform preliminary specification tests and argue for the inclusion of a variable that proxies for the global financial cycle. Section 3.2 builds on the literature review in

Chapter 1 and presents a summary of expected results. Section 3.3 presents the unconditional model and first evidence in favour of the global financial cycle. Section 3.4 features structural break tests described above and discusses our empirical results by trilemma regime. Section 3.5 presents several robustness checks. Section 3.6 offers further lines of research and concluding remarks.

3.1. Theoretical Framework and Database

To understand the possible sources of variation in stock prices and their links to the macroeconomic trilemma, we resort to Gordon's dividend discount model as in Stuart (2017), which we present in the following equation:

$$P_0 = \sum_{t}^{T} \frac{D_t}{(1 + r_t)^t} \quad (24)$$

According to the model, the price of a stock at time 0 (P_0) is the present value of the expected payout D_t stockholders will receive in the future. The discount factor is associated with an interest rate r_t which accounts for the time-value of money and the riskiness of the investment. It can be thought of as the hurdle rate that makes the net present value of a correctly priced investment 0 in equilibrium (Damodaran, 2011).

To proxy for the possible effects of the trilemma regimes, we will include variables of interest related to capital flows and exchange rates. First, we include the overall current balance to GDP as increases in this variable indicate a more robust economic activity and more income for export-oriented firms.[160] To account for international capital flows, we include the evolution of the net capital account as a proportion of GDP.[161]

To account for the effect of exchange rates we resort to two distinct equilibrium conditions: the purchasing power parity (PPP) and the covered interest rate parity (CIRP). PPP establishes that in the absence of

[160] Data for the net current account to GDP comes from Mitchel's (2013) International Historic Statistics 1750-2010.

[161] Data for the net capital account to GDP comes from Mitchel's (2013) International Historic Statistics 1750-2010. We obtain the net capital account from the identity: net capital account + net current account + net changes in reserves = 0. We thank Barry Eichengreen for this suggestion.

transaction costs and trade barriers, two identical goods in two distinct markets should cost the same amount of money when expressed in the same currency. In that sense, the critical determinant of the exchange rate in this model is the differential of inflation rates between the domestic and foreign economies.

On the other hand, CIRP establishes that under free capital flows and no transaction costs (0 bid-offer spread), the nominal exchange rate, the domestic and foreign interest rates are jointly set to eliminate arbitrage opportunities. The nominal exchange rate is such that no risk-free profit can be obtained by borrowing abroad (domestically), selling (buying) the foreign currency domestically, investing at the local (foreign) interest rate and using the proceeds to pay the loan in foreign (domestic) currency. Under this model, the critical determinant of the nominal exchange rate is the differential of interest rates. We summarise these relationships in the following equation:[162]

$$FX_{Nominal} = f[(r_{\mathrm{d}} - r_{\mathrm{f}}), (\pi_{\mathrm{d}} - \pi_{\mathrm{f}})] \quad (25)$$

Where r_{d} is the domestic interest rate, r_{f} is the foreign interest rate, π_{d} is the domestic inflation rate, π_{f} is the foreign inflation rate.

A first issue has to do with the underlying assumptions in (25). Both PPP and CIRP require the law of one price to function correctly, which optimally occurs when there are no transaction costs and in the presence of free capital flows. This does not mean, however, that permanent deviations from these two equilibria are sustainable in time if capital controls are established. If the exchange rate is fixed, and the capital account is closed, as was the case during Bretton Woods, a large inflation differential would make imports cheap and exporters loose competitiveness. When this happened, persistent deficits in the current would motivate a one-time change in the value of the peg, as was the case for France, or the UK as noted in Section 1.4.2.2.

[162] Data for the interest rate and inflation differentials is obtained from Jordà, Schularick & Taylor Macrohistory database (2017). We always define the foreign rate to be the one from the United States which is the largest developed economy not included in our dependent variables.

By the same token, a sustained increase in the interest rate differential, could hinder domestic economic activity, reduce the number of viable investment projects for domestic companies, restrict access to credit and aggregate demand, and drive down the competitiveness of the export sector. Persistent long-run deviations in the differentials would bring forth a permanent payment imbalance via the current account which, under the Articles of the Agreement, would have been grounds for a change in the level of the peg (one-time devaluation). In that sense, we expect the determinants of the nominal exchange rate to affect the stock price under all trilemma regimes.

Additionally, from the literature review in Chapter 1, we know that there are several other effects that we need to control for. Following Jorion (1990), companies with sizeable international presence will benefit from openness to the international trade system while domestic companies may suffer from competition from abroad. We include changes in openness to trade, defined as the first difference of the sum of imports and exports to GDP, to control for this situation.[163]

The level of financial development will be critical in determining the liquidity in the stock market as well as its overall size. To measure this, we include the changes in M2, a measure of broad money, to GDP. This is a measure of the overall size of the financial system which, according to the finance and growth literature reviewed earlier, bears a strong relationship with the general economy and consequently should have a strong positive correlation with the stock market. This variable will affect both the numerator and denominator in (24) as it relates both to economic activity and to the discount rate employed in valuation.[164]

Finally, economic growth is critical as it alters expectations about future cash flows and alters the investment opportunity set for companies. Consequently, we include the percentage change in real GDP per capita

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[163] Data for imports, exports and nominal GDP is obtained from Jordà, Schularick & Taylor Macrohistory database (2017).

[164] Data for M2 comes from the broad money variable in the Jordà, Schularick & Taylor Macrohistory database (2017)

among our covariates.[165] We can summarise the variables of interest and their relationship to the model in the following two equations:

$$\mathrm{D}_t = f\left[\frac{NKA}{GDP}, (r_\mathrm{d} - r_\mathrm{f}), (\pi_\mathrm{d} - \pi_\mathrm{f}), \frac{\mathrm{OCB}}{\mathrm{GDP}}, \frac{(\mathrm{M}+\mathrm{X})}{\mathrm{GDP}}, \frac{\mathrm{M2}}{\mathrm{GDP}}, \left(\frac{\mathrm{RGDPpc_t}}{\mathrm{RGDPpc_{t-1}}} - 1\right)\right] \quad (26)$$

$$\mathrm{r}_t = f\left[\frac{\mathrm{NKA}}{\mathrm{GDP}}, (\mathrm{r_d} - \mathrm{r_f}), \frac{\mathrm{M2}}{\mathrm{GDP}}\right] \quad (27)$$

Where NKA is the net capital account, OCB is the overall current balance, M is the total value of imports, X is the total value of exports, M2 is a measure of broad money, and RGDPpc represents real GDP per capita.

We run a first panel regression of LBBIs to each time horizon as the dependent variable, a linear time trend, and the different correlates in (26) and (27) as explanatory variables. We perform the F test for the significance of country fixed effects and time fixed effects where the null is that the effects are not significant. We also run the Breusch & Pagan (1979) test for the significance of random effects. Results are presented in Table 14.

According to Table 14, there is insufficient heterogeneity across countries to warrant the use of country fixed effects (Panel A). Similarly, in Panel C the results for the Breusch & Pagan (1979) tests suggest that the use of a random effects model is unnecessary and that pooling the data is a sufficient alternative. However, Panel B shows that there seems to be a role for time fixed effects, which indicates that there are shocks, over time, that are common to all countries in the database. This is precisely the idea behind the "global financial cycle hypothesis" argued by Rey (2015) and Passari & Rey (2015) among many others. In what follows we discuss the introduction of a variable that proxies for the global cycle and whether it performs better than time fixed effects.

[165] Data for real GDP per capita corresponds to the *rgdppc* series in the Jordà, Schularick & Taylor Macrohistory database (2017)

Table 14: Panel specification tests for the use of fixed or random effects

Panel specification tests for the primary application			
Horizon	**Short-run**	**Medium-run**	**Long-run**
Panel A: Joint significance of country fixed effects			
Statistic (F)	0.22	1.00	1.21
Prob > F	1.00	0.44	0.28
Conclusion	Pool	Pool	Pool
Panel B: Joint significance of time fixed effects			
Statistic (F)	12.89	10.90	5.05
Prob > F	0.00	0.00	0.00
Conclusion	FE	FE	FE
Panel C: Breusch & Pagan (1979) test for the use of random effects			
Statistic (Chi 1 DoF)	0.00	0.00	0.00
Prob > CHI2	1.00	1.00	1.00
Conclusion	Pool	Pool	Pool

Note: Panel A tests for the joint significance of country fixed effects, under the null that they are jointly insignificant. Panel B tests for the joint significance of time fixed effects, under the null that they are jointly insignificant. Panel C performs the Breusch & Pagan (1979) test for a random effects model under the null that random effects are unnecessary.

3.1.1. The Global Financial Cycle

Passari & Rey (2015), in a study covering 1990-2012, indicate that 'risky asset prices (equities, corporate bonds) around the world are largely driven by one global factor. This global factor is tightly negatively related to the [Chicago Board Options Exchange Volatility Index] VIX' (p. 681). This result is not unique to this paper as Miranda-Agrippino & Rey (2015), Adrian & Shin (2014), and Rey (2015, 2016) also find an inverse relationship between measures of market fear and the evolution of asset prices. For example, Passari & Rey (2015), argue that the link can be established using the VIX which is extracted from the S&P 500 index, the VSTOXX which is the European equivalent, the VFTSE extracted from the London Stock Exchange FTSE index, and the VNKY which reflects market fear in the Japanese stock market. In choosing to restrict the analysis to the VIX to the detriment of all other market-fear indices, Rey (2016) argues that:

> *"Given the prevalence of dollar funding and of dollar assets in world balance sheets and the reliance on some type of collateral constraints*

or value-at-risk constraints in many parts of the financial system, assessing the effect of U.S. monetary policy on the dynamics of this global component is of interest to test for the existence of an international credit or risk-taking channel" (p.14).

As we have shown clearly in 1.4, the role of the US as a creditor to the rest of the world was well underway after the First World War and, willingly or unwillingly, they have remained as such ever since. Consequently, it is a possibility that, if there exists a global financial cycle, it is well represented by the evolution of the VIX index.

A final argument for using US stock market information to measure the global cycle is that, in terms of market capitalization, the US has held over 40% of global equity value since the 1930s, with only a short-lived drop at the end of the 1980s and early 1990s, as shown in Figure 17 (Kuvshinov & Zimmermann, 2018, p. 12)[166]. The mechanism at work for the transmission of financial conditions across markets runs through international investors participating in the US market and through the international flow of information as we will discuss ahead. For example, French & Poterba (1991) show that, even though there is a significant home bias in their construction, there is evidence of international diversification in stock market portfolios.

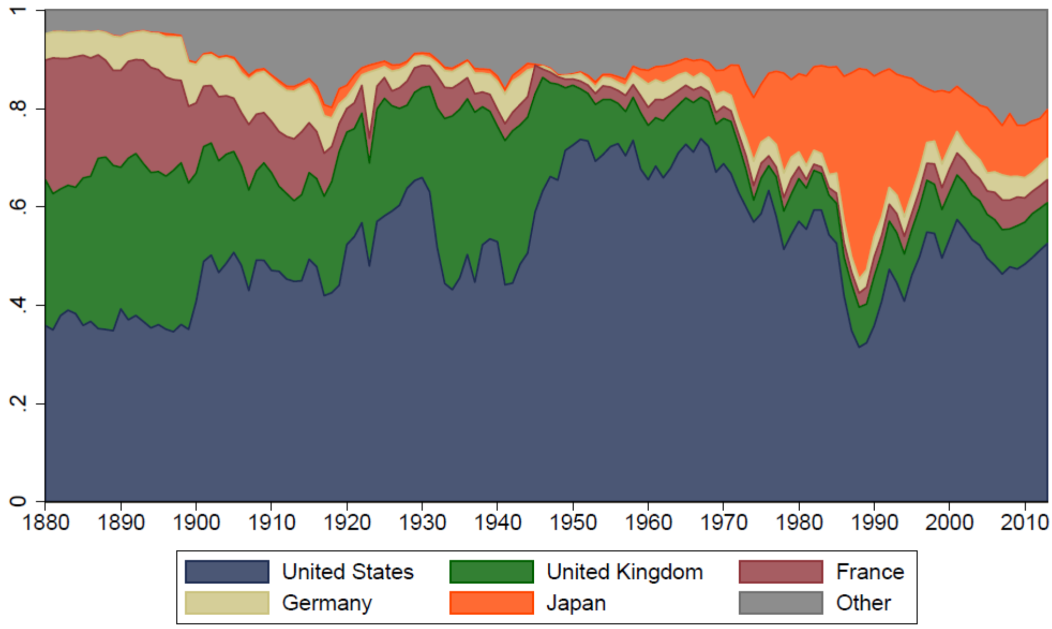
In the ideal experiment to test for the existence of the global cycle since 1922, we would need to obtain data for the VIX index since the interwar years. However, the VIX series is only available from the Chicago Board Options Exchange (CBOE) since 1990 because it originates from the implied volatility of plain vanilla call and put options on the S&P500 index to different time horizons. These financial products have only been traded for a few decades, which makes constructing the series for earlier periods impossible (CBOE, 2014).

As we show in Annex 11, the VIX index is a function of, among other things, the expected dividend growth rate and the volatility of the stock market index, where it covaries negatively with the former and positively with the latter. The relationship between the expected growth

[166] We thank Dmitri Kuvshinov for authorizing the use of this figure.

rate in dividends, volatility and LBBIs, mirrors the one with the VIX. On the one hand, LBBIs increase with the expected dividend growth rate, as it affects the numerator in (24) and increases the current level of the index. On the other hand, LBBIs decrease with increases in volatility as they affect the numerator in the construction of matrix **D**. Consequently, we expect the correlation between the VIX index and LBBIs to be negative and the correlation between the global cycle and LBBIs to be positive. A statistical characterisation of the LBBIs for the US stock market index (S&P500) is included in Annex 6. Information on the series and data sources is available in Section 2.1.1.

Figure 17: World market capitalisation shares (Figure 6)



Note: "Shares of individual countries' capitalisation in world total. Capitalization shares are computed by transforming domestic stock market capitalisation into US dollars using historical exchange rates and dividing it by the sum of capitalisations of all 17 countries. Shares of the United States, the United Kingdom, France, Germany and Japan are shown separately. All other countries are combined together into one joint item" Kuvshinov & Zimmermann (2018, p.12).

A natural question that arises is whether the US data is proxying for the global cycle, or if the potential correlation between the US LBBIs and those for developed economies is spurious. If the former is correct, the US LBBI should bear a strong correlation with the variation that is common across the twelve stock markets, and a low correlation with market-specific variation.[167] To test this, we built three different variance-covariance matrices for the short, medium and long-run LBBIs of the twelve stock markets and extracted the first principal component (PC) of each matrix. These PCs explain about half of the variance of the underlying LBBIs.[168] In Table 15 we present the results of regressing the LBBIs for the US stock market on the corresponding PCs. In Annex 12 we offer stationarity tests for both series and scatter plots to the different time horizons.

Table 15: Regressions of LBBIs for the US stock market on the common component of the twelve countries' stock market LBBIs

Dependent Variable	Short-run PC	Medium-run PC	Long-run PC
LBBIS USA	.0992***		
LBBIM USA		0.1238***	
LBBIL USA			0.1337***
Trend	-0.0001	-0.0001	-0.0002
Constant	0.0054	0.0055	0.0067
Estimation	OLS	Newey 2 lags	Newey 1 lag
N	92	92	92
Adj. R-squared (OLS)	0.4633	0.477	0.5823

Note: Residuals of the three regressions are homoscedastic. The errors for the medium and long-run specifications have an autoregressive component, so the regressions are run using Newey-West standard errors. The optimal number of lags is estimated by fitting an AR(p) model on the residual. Significance: * 10%, ** 5%, *** 1%.

As an additional test, we perform a panel regression, with country fixed effects of the short, medium, and long-run LBBIs of the stock market on their corresponding principal component. We find that the US LBBIs are uncorrelated with the residual and thus bear no explanatory power on

[167] Following Jordà, Schularick, Taylor & Ward (2018) what the test in Table 15 and Annex 12 shows is that there is co-movement between the US stock market and the stock market of the remaining twelve economies. This, however does not allow us to indicate that the US stock market is *driving* the other twelve markets. Although the causes for this relationship exceed the scope of our research, the interested reader may find in their paper several possible explanations for the increasing co-movement of stock and credit markets.

[168] The short-run PC explains 50.9%, the medium-run PC explains 51.2%, and the long-run PC explains 53.8%. These values correspond to the first eigenvalue divided by the sum of all eigenvalues in the decomposition of the VCV matrix.

the country-specific movements of the advanced economies' stock markets.

Since we can now argue that the US LBBI is a sufficient proxy for the global cycle, or at least for the common driver of the twelve different stock markets, we run the pooled OLS regression of LBBIs on the dependent variables in (26) and (27) under two alternative specifications. In the first one, we include time fixed effects, while in the second one we only include the US stock market LBBI. The underlying idea is that both these specifications offer the inclusion of common shocks to all stock markets while the second specification has the added benefit of offering an underlying economic and historical interpretation. In their respective specifications, time fixed effects are jointly significant, and the coefficient for the US LBBI is statistically significant with 99% confidence. For the sake of brevity, in Table 16 we only present the BIC measure for goodness-of-fit in each regression.

Table 16: Goodness-of-fit for time fixed-effects model VS global cycle model

	Short-run		**Medium-run**		**Long-run**	
	Time FE	US LBBI	Time FE	US LBBI	Time FE	US LBBI
BIC	1908	1780	1712	1503	1653	1461

Note: Goodness-of-fit measured by the Bayesian Information Criterion for two regressions of the independent variables in (26) and (27) on the LBBIs for the stock market of the twelve countries in the database. Time FE refers to the inclusion of 91 time-related dummy variables. US LBBI substitutes the time fixed effects for the US LBBI as a proxy for the global financial cycle. Lower values of the measure indicate a better fit of the data.

3.2. Expected Results

In this section, we present a summary of the expected results. In Section 3.2.1 we account for the expected sign of the coefficients of the variables of interest which should be affected by the trilemma regime in place: net current account, net capital account, global financial cycle, and changes in the exchange rate driven by inflation and interest rate differentials. We conclude the section with a summary table for ease of reference. In Section 3.2.2 we present the expected implications for financial stability by trilemma regime, as extracted from the literature review presented in Chapter 1.

3.2.1. Expected Signs for the Coefficients of Trilemma Variables

Regarding the coefficient for the net current account, we do not expect it to change by exchange rate or capital control regime.[169] However, echoing the findings by Bahmani-Oskooee & Saha (2016), we expect the coefficients to be contingent on whether the stock market index contains more export-oriented or import-dependent firms. Since we are dealing with developed economies where imports usually cover raw materials used in production and exports include high value-added products, we expect that an increase in surplus (more exports than imports) will be a signal of positive future cash flows for firms and result in higher values of the stock market index.

The coefficient for the net capital account should be statistically insignificant under those regimes where there are capital controls in place if they are both credible and adequately enforced. Under regimes where the capital account is open, the coefficient should be positive and statistically significant. There are two possible channels through which capital flows can affect the stock market. The first is contemporaneous and is related to direct portfolio investment in domestic equities by foreign agents. The second should operate with a lag and is related to increasing Foreign Direct Investment (FDI) where foreign agents invest in the domestic economy by constituting new firms. Once these new firms go public the effect on the stock market index should also be positive and statistically significant.

The effect of the global financial cycle on domestic stock markets can operate through three distinct channels. First, changing global financial conditions and global risk aversion may affect the way in which investors construct their portfolios. This may produce interdependence across stock markets as global increases in risk aversion may induce shifts from stocks to safer securities, such as government bonds, which would

[169] Recall that in our definition of capital controls we only include open or closed capital accounts but make no reference to restrictions on the current account.

put downward pressure on stock prices and augment their volatility.[170] Interestingly, this channel does not require open capital accounts to function since expectations can be altered by the free flow of information and not only capital.[171] Second, stronger integration of capital markets may produce a "communicating vessels" effect in the face of ever-increasing international capital flows. Under open capital accounts, global investors may want to invest in developed economies without concentrating their portfolio in any one country. This preference would cause a tandem movement of developed countries' stock markets as they receive funds from abroad.[172] Third, from a market microstructure perspective, if multinational companies trade their stock in two or more markets at the same time, no-arbitrage conditions may cause parallel movement in their returns and convergence in their price-to-earnings ratios.[173] Consequently, we expect the coefficient for the global financial cycle to be positive and statistically significant regardless of the trilemma regime in place.

Regarding the differential between domestic and foreign interest rates, we expect that increases in the differential will always drive stock prices down. However, the predicted channel of operation should be contingent on the trilemma regime in place. If the exchange rate is fixed and the capital account is open, short-term interest rate differentials should converge to reflect only the risk premium between countries. If this risk premium increases, the discount rate applied by investors to future projects and cash flows should increase as well pushing the value of the stock market down.

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[170] We use the word interdependence rather than contagion because the financial stability implications are completely different. Two markets may move together because of common investor expectations without the causal implication that a shock in country A caused a market disturbance in country B. An in-depth analysis of the difference between these two effects is presented in Forbes & Rigobon (2002).

[171] This idea has been put forward in several studies. For the interested reader we suggest Hoag (2006) and Jacks (2006) who deal with the effect of stock market integration after the culmination of the undersea Atlantic telegraph cable in 1866. Additionally, Tetlock (2007) discussed the role of modern media on the evolution of the stock market.

[172] This is also true for developing countries and is reminiscent of the description Kindleberger & Aliber make of the build-up of imbalances prior to the Latin American debt crisis of the 1980s.

[173] We thank Lluis Castañeda for bringing this to our attention.

Under every other regime, increases in the differential may be driven by a tighter domestic monetary policy or a laxer foreign monetary policy. If the former is correct and the capital account is closed, stock prices should come down as the financing costs for firms and investors increase, and more of their future income will be directed to debt payments and not to dividends or reinvestment. If the capital account is open, the effect is uncertain because even though domestic investors may find it costlier to invest, foreign capital may be attracted by the higher rates of return. In the case where the increase in the differential driven by a laxer monetary policy abroad and the capital account is closed, there should be no effect on the domestic stock market. Conversely, if the capital account is open, the domestic stock market index should increase as foreign investors search for yield elsewhere.

Finally, the differential between domestic and foreign inflation rates should matter in every regime but through different channels. First, regardless of the exchange rate regime, an increase in domestic inflation should reduce the expected future cash flows for companies as inflation forces companies to try cut costs and compress margins to avoid price increases that may hinder sales and market share both in local and foreign markets. This channel may be partially mitigated when the exchange rate is flexible as export-oriented firms will receive more domestic currency per unit of foreign currency as the differential in inflation increases. Second, when the exchange rate is fixed, a widening inflation differential is an indication of the pressure put on the peg. Since large inflation differentials imply that the peg probably overvalues the domestic currency and, if the peg falls the exchange rate will probably slide, we expect large differentials in inflation should be associated with decreasing stock prices. Table 17 presents a summary of our expected results by trilemma regime.

Table 17: Expected signs for the coefficients of trilemma variables

Regime	TR I: Fixed & closed	TR II: Fixed & open	TR III: Flexible & closed	TR IV: Flexible & open
Net current account	+	+	+	+
Net capital account		+		+
Global financial cycle	+	+	+	+
Short term rate diferential (domestic-foreign)	-	-	-	-
Inflation differential (domestic-foreign)	-	-	-	-

Note: The table summarises the argument offered in this section. We only show the sign for the coefficients we expect to be statistically significant. In each title, the first adjective refers to the exchange rate and the second one to the capital account.

3.2.2. Financial Stability by Trilemma Regime

In the following subsections, we summarise the findings in the literature from Chapter 1 in what concerns the relationship between exchange rate and capital control regimes and financial stability. Since this is the first long-run study we know of that tries to establish a nexus between the macroeconomic trilemma and financial stability directly, these expected results are a piecemeal construction from different literatures. In that sense they are somewhat speculative in nature. For readability purposes, we include references as footnotes.

3.2.2.1. TR I: Fixed Exchange Rate and Closed Capital Account

Under this regime, financial instability in asset prices should be mitigated via gains in monetary autonomy.[174] Additionally, capital controls in the context of a fixed exchange rate should mitigate the exposure to foreign currency denominated debt.[175] Consequently, we expect this regime to be the most stable of all and will use it as the benchmark.

[174] Bernanke & Gertler (1999) and Bernanke, Gertler & Gilchrist (1999).

[175] Brunnermeir & Sannikov (2015).

3.2.2.2. TR II: Fixed Exchange Rate and Open Capital Account

This regime should be related to broader financial instability than TR I.[176] There should be less pronounced booms and busts, and slower recoveries than in the trilemma regime with flexible exchange rates and open capital accounts (TR IV).[177] A mitigating effect for financial instability under this regime is the disciplining role that fixed exchange rates, and open capital accounts play on policymakers' decision-making process.[178]

3.2.2.3. TR III: Flexible Exchange Rate and Closed Capital Account

Generally, regimes with closed capital accounts are expected to have lower financial instability as liberalisation seems to be one of the causes of increased systemic risk.[179] While in some research, flexible exchange rates appear to offer the least crises-prone regimes,[180] we expect this regime to be less stable. As we have shown in Figure 10, most of the observations that coincide with it occur during the beginning of the interwar years and the 1970s, which were characterised by very high inflation and generally unstable stock markets.

3.2.2.4. TR IV: Flexible Exchange Rate and Open Capital Account

The effect of this regime on the dependent variable and financial instability is uncertain. On the one hand, the heightened reaction capacity from the central bank and the self-stabilising role of flexible exchange rates on capital flows may lead to heightened financial stability.[181] On the other hand, the bail-out clause implicit in the central bank's reaction to shocks may foster stock market booms.[182] Regarding the stock market, the effect of exchange rates is contingent on whether the index is more heavily weighted toward import or export firms.[183] However, we do expect to find

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[176] Diaz-Alejandro (1985), Bernanke & Gertler (1999), and Bernanke, Gertler & Gilchrist (1999).
[177] Martin, Schuknecht & Vansteenkiste (2007).
[178] Eichengreen and Rose (2004).
[179] Freixas, Laeven & Peydro (2015).
[180] Ghosh, Ostry & Qureshi (2015).
[181] Bordo & James (2015) and Almunia et al. (2010).
[182] Domac & Martinez (2003) and Eichengreen & Hausmann (1999).
[183] Bahmani-Oskooee & Saha (2016).

abnormal increases in the index under open capital accounts.[184] Finally, we expect the link to be stronger for Netherlands, Sweden and the UK (market-based systems) than for France, Germany and Italy (bank-based systems).[185] To conclude, we expect to find that the strongest link between stocks and the global financial cycle is present under this regime.[186]

3.3. The Unconditional Model: Evidence of a Global Financial Cycle

As we have discussed throughout Section 3.1, the optimal regression model, according to the preliminary tests in Table 14, requires running OLS regressions without country fixed effects and merits the inclusion of time fixed effects that account for common contemporaneous shocks across all countries. As we argued extensively, the role of a common shock to all countries will be proxied by the inclusion of LBBIs for the US stock market to the different time horizons among the independent variables. However, from an economic perspective, even if the twelve countries in the database can be characterised as advanced economies, there are country-specific criteria that remain unobserved and that we may wish to control for. For example, the difference between common or civil law judicial systems, the existence of parliamentary or presidential executive branches, as well as variations in religious preferences, language, government institutions, and several other characteristics that may render, for example, Canada and Japan to be incomparable.

Including country fixed effects, however, would lead to an over-specified model according to the contrasts we have performed. We know that the inclusion of these variables has no effects on the unbiasedness of the estimators for the other variables although it may increase the standard errors. In that sense, including fixed effects acts as a litmus test against our testable hypothesis and suggests that statistically significant coefficients would be even more significant if the "true model" were used (Wooldridge, 2002).

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[184] Henry (2000a, 2000b).

[185] Morley (2002).

[186] Phylaktis & Ravazzolo (2005), Pavlova & Rigobon (2007), Ning (2010), Rey (2015), Aizenman, Chinn & Ito (2015), and Menna & Tobal (2018).

Since we run a panel regression with country fixed effects, we need to perform tests to confirm the OLS estimations are appropriate. The three primary assumptions underlying the ordinary least squares estimation for the panel fixed effects model is that there is group-wise homoskedasticity of the errors, that each error series is not autocorrelated, and that there is no contemporaneous correlation in the error terms for the different countries. We perform regressions where the dependent variables are the LBBIs for the twelve stock markets to the different time horizons, and the regressors are the dependent variables in (26) and (27), and the LBBI for the US stock market as a proxy for the global cycle. In Annex 13 we perform panel unit root tests for all the independent variables and find they are all panel-stationary. We do not include the LBBIs for the US Stock market since stationarity has been shown through a battery of tests in the tables in Annex 6.

We then perform the modified Wald test for group-wise heteroskedasticity (Greene, 2017), Wooldridge's (2002) test for first-order autocorrelation in panel data, and Pesaran's (2004) test for the contemporaneous cross-correlation of error terms. We present results in Table 18.

Panel A of Table 18 shows that there is evidence of heteroskedasticity for the short and long-run regression. Although the result for the medium-run regression allows us to accept the null of homoskedasticity, the critical value and P-value are so close to rejection that it does not warrant running a separate specification for the medium-run. Panel B in the table, indicates that there is evidence of first-order autocorrelation in all specifications. Finally, Panel C indicates the presence of contemporaneous cross-correlation of the error terms for the different countries.

Table 18: Panel specification tests for structure in the residuals

Panel A: Modified Wald statistic for group-wise heteroskedasticity in fixed effect model (Greene, 2017)			
Statistic (chi 12 DoF)	26.82	20.58	24.26
Prob > CHI2	0.01	0.06	0.02
Conclusion	Heteroskedastic	Homoskedastic	Heteroskedastic
Panel B: Wooldridge (2002) test for autocorrelation in panel data			
Statistic (F 1,11)	10.79	136.55	103.91
Prob > F	0.01	0.00	0.00
Conclusion	Autocorrelation	Autocorrelation	Autocorrelation
Panel C: Test for cross-correlation of errors Pesaran (2004)			
Statistic N(0, sigma)	23.06	18.15	17.79
Prob > N	0.00	0.00	0.00
Conclusion	Cross-correlation	Cross-correlation	Cross-correlation

Note: Panel A shows the modified Wald test statistic for group-wise heteroskedasticity in the error under the null of homoskedasticity (Greene, 2017). Panel B shows Wooldridge's (2002) test for autocorrelations in the errors in a panel data framework under the null that there is no first-order correlation. Panel C contains the test for cross-correlation of errors as in Pesaran (2004) under the null of no cross-correlation between groups.

Consequently, in the panel regressions that follow we will present panel corrected standard errors (PCSE) estimates obtained through Prais-Winsten (1954) regressions. This estimation methodology, when in a panel data framework, corrects for the three situations discussed above: heteroskedasticity and autocorrelation in the individual error terms, and accounts for cross-correlation of the errors between countries. While this regression methodology belongs to the family of feasible generalised least squares (FGLS) estimations, it is preferred over standard GLS estimation procedures as it allows for unbalanced panels, as is our case.[187] Given this feature in our data, our specifications allow for the inclusion of all available observations with non-missing pairs rather than those where we only have full cases.

[187] Our panel is unbalanced due to some gaps in the independent variables, particularly during the Second World War or during the interwar years. Gaps are not common to all countries.

In Table 19 we present the unconditional regressions of LBBIs the twelve countries' stock markets on the independent variables described in Section 3.1.[188]

Table 19: Unconditional regressions for the stock market model

		Short-run	Medium-run	Long-run
Control variables	Constant	0.0716	0.1271	0.1795
	Trend	-0.0012	-0.002	-0.0023
	Change in real GDP per capita	0.4357	**2.004*** **	**1.261** **
	Change in trade openness	0.1064	**1.158** **	-0.2195
	Change in financial development	0.8194	0.5373	0.6028
Variables of interest	Overall current balance to GDP	**2.029** **	**2.633*** **	**2.872*** **
	Capital account to GDP	**1.113** **	**1.037** **	**.8175***
	Short term rate differential (domestic-foreign)	-0.0149	**-.0524*** **	**-.0498*** **
	Inflation differential (domestic-foreign)	**-.598*** **	**-.4306*** **	**-.3072** **
	Global cycle (US LBBI to time horizon)	**.5097*** **	**.5842*** **	**.5429*** **
	N	938	938	938
	R squared	0.2955	0.3718	0.3345

Note: Dependent variables are short-run, medium-run and long-run stock market LBBIs. The regressions were run using Panel Corrected Standard Errors (PCSE). Statistically significant coefficients in bold. Significance levels * 10%, ** 5%, *** 1%.

A first element that is worth highlighting from Table 19 is the little relevance that control variables have in explaining the evolution of the stock market. The only exception is the role played by real GDP growth, which for the medium and long-run regressions has a positive and statistically significant sign as indicated in the literature. In line with what is expected, the positive coefficient of trade openness may be related to the

[188] To tend to the issue of collinearity, following Greene (2017) we calculated the condition numbers for the three sets of variables used in the regressions. A condition number is the square root of the ratio between the largest and smaller eigenvalues of the correlation matrix of variables. We obtained the following values for the short, medium and long-run specifications: 2.489, 2.489, and 2.492. As a rule of thumb values above 20 should be worrisome as they indicate the presence of a single factor with large explanatory power over all explanatory variables which may be driving colinear relationships between them.

effect over the second and third year (a lagged effect) of increased activity in the import-export sector. Given these results, in what follows we will only discuss the coefficients for the variables grouped under the category "variables of interest". We will offer the complete regression results by regime and type of phase in Annex 14.

Regarding the results for the variables of interest in the bottom half of the table, we find that in all cases, except for the interest rate differential in the short-run regressions, the coefficients are statistically significant with at least 95% confidence. In all cases, the sign is consistent with the expectations proposed in Table 17. As indicated in Annex 11, the association between the global financial cycle and the LBBIs for the stock market in each of the countries is positive. In the following section, we verify if these relationships are stable across trilemma regimes, expansions and contractions, and between bank-based and market-based financial systems.

A final noteworthy finding in Table 19 is the high value of the R^2 statistic. Each of the unconditional regressions is able to explain over 30% of the variance in the stock market of the twelve countries, which is substantially better than what is usually achieved by standard models such as the CAPM model (Markowitz, 1952; Lintner, 1965; Sharpe, 1966) or the Fama & French (1993) three-factor model and its extensions.[189] The goodness-of-fit we achieve is similar to the one obtained by Passari & Rey (2015).

A possible criticism to this result arises from the "bottles of ketchup" analogy by Summers (1985) discussed in the prologue in that we may be just observing no-arbitrage conditions that allow for the synchronization of markets. However, we have built a stock pricing model from Gordon's dividend discount model that includes the interest rate differential in the denominator and several fundamental variables that can affect the dividend stream both as control variables and variables of interest The aim of including so many variables is to allow us to shift from

[189] As an example, Fama & French (2008) use an 11-factor model, an extension of their 1993 seminal paper, to explain the monthly cross-sectional returns of the US stock market from 1963 until 2005. The highest R^2 in their paper is 0.08

a no-arbitrage scenario to a more fundamental valuation. Additionally, it worthwhile to recall that we are not asking whether the changes in stock prices are fundamental or bubbly in nature but rather if they can be thought of as imbalances: excessive above or below trend growth.[190]

3.4. Empirical Results: Structural Breaks and Conditional Models

To test whether the findings in Table 19 are contingent on the trilemma regime in place, the type of phase in the cycle or the structure of the financial system we perform the Chow (1960) test for structural breaks in the coefficients under five different hypotheses. First, we test whether there is a break by trilemma regime. Second, we test for the presence of a break in the coefficients for expansions and contractions.[191] Third, we jointly test for a break by trilemma regime and by expansions and contractions. Fourth, we test whether there is a break in the coefficients between bank-based and market-based systems as defined in Table 2 in the introduction. Finally, we test the joint hypothesis of a break by trilemma regime and between bank-based and market based-systems.

To perform the second and third hypothesis tests, we need to define what we understand as an expansion or contraction. We will follow a threshold rule similar to the one employed in Chapter 2: if the value of the indicator is above (below) a certain threshold (-)X we indicate that observation to have occurred during a boom (bust) year. However, the choice of a threshold, in this case, will be mostly data-driven as we need sufficient observations by regime to make inference possible. In Table 20 we present the number of observations above and below different thresholds in the full sample (applies to the second hypothesis) and by trilemma regime (applies to the third hypothesis).

[190] We thank an anonymous referee for bringing this to our attention.
[191] This test is inspired on the findings by Bahmani-Oskooee & Saha (2016) and Ning (2010) about the asymmetric behaviour of stock markets as discussed in Section 1.3.3.1.

Table 20: Number of observations above or below a given threshold

		Short-run					Medium-run					Long-run				
		Total	*TR I*	*TR II*	*TR III*	*TR IV*	*Total*	*TR I*	*TR II*	*TR III*	*TR IV*	*Total*	*TR I*	*TR II*	*TR III*	*TR IV*
Bear	x<-1.0	73	21	27	5	20	61	14	23	4	20	53	10	24	5	14
	x<-0.5	247	80	97	20	50	225	69	84	22	50	220	69	72	22	57
	x<0	542	193	194	52	103	551	204	199	49	99	573	201	197	51	124
Bull	x>0	552	195	213	37	107	543	184	208	40	111	521	187	210	38	86
	x>0.5	253	86	94	24	49	211	80	84	14	33	209	65	87	18	39
	x>1.0	88	34	26	10	18	72	29	26	7	10	67	20	26	7	14

Note: Each LBBI series contains 1,094 observations. The trilemma regime with the fewest observations is TR III (89 total observations).

Ex-ante, it would be optimal to have a threshold far enough from the centre of the distribution that would allow us to observe extreme events (booms and busts). The tradeoff is that as the threshold increases the number of observations decreases more than proportionally given the bell-curve shape of the distribution. As it can be seen in Table 20, even a low threshold of ±0.5 standard deviations more than halves the available observations with respect to those available for LBBIs above or below zero. The critical cases are usually TR III and TR IV where the number of observations by time horizon drops below 30 and 60 respectively. Since we prefer to present results as robust as possible, we will establish a single threshold where expansions (bull markets) occur whenever the LBBI is positive, and contractions (bear markets) occur whenever LBBI values are negative.[192]

In Table 21 we present the results for the Chow (1960) structural break tests for the five different hypotheses discussed above. In all cases, the null hypothesis is the equality of coefficients by group.

[192] Future research is aimed at increasing the total number of observations by broadening the database to include additional countries. Candidate countries include: Austria, Belgium, Brazil, Chile, Czech Republic, Finland, Greece, Mexico, New Zealand, Poland, Portugal, Spain, and Turkey. From this list, we have not included the eurozone countries because we believe this would unnecessarily skew the results. The other countries have not been included because of comparability issues, and data availability particularly for the first decades of the sample.

Table 21: Chow test for structural breaks in coefficients by group

Hypothesis I: There is no break by trilemma regime						
Horizon	*Short*		*Medium*		*Long*	
Statistic	**1.83**		**1.66**		**1.47**	
P-value	**0.00**		**0.00**		**0.01**	
Hypothesis II: There is no break between expansions and contractions						
Horizon	*Short*		*Medium*		*Long*	
Statistic	**56.04**		**25.30**		**19.12**	
P-value	**0.00**		**0.00**		**0.00**	
Hypothesis III: There is no joint break between expansions and contractions by trilemma regime						
Phase	*Contractions*			*Expansions*		
Horizon	*Short*	*Medium*	*Long*	*Short*	*Medium*	*Long*
Statistic	**3.22**	**2.23**	**1.54**	**1.70**	**1.89**	**1.89**
P-value	**0.00**	**0.00**	**0.01**	**0.00**	**0.00**	**0.00**
Hypothesis IV: There is no break between market based and bank based systems						
Horizon	*Short-run*		*Medium-run*		*Long-run*	
Statistic	0.90		1.08		0.54	
P-value	0.60		0.37		0.95	
Hypothesis V: There is no joint break between bank based and market-based systems by trilemma regime						
System	*Bank-based*			*Market-based*		
Horizon	*Short*	*Medium*	*Long*	*Short*	*Medium*	*Long*
Statistic	1.03	0.95	0.79	0.98	0.65	1.05
P-value	0.42	0.59	0.87	0.53	0.97	0.40

Note: Each panel contains a Chow test for structural breaks in the coefficient of the regressions in Table 19 by different groups. The null hypothesis is there is no break. Hypothesis I breaks the sample into four trilemma subsamples. Hypothesis II breaks the sample into two samples according to the phases. Hypothesis IV breaks the sample into two groups by bank-based or market-based financial systems. Hypothesis III combines the groups of hypotheses I and II. Hypothesis V combines the groups of Hypotheses I and IV. Significant statistics and P values in bold.

Results from Table 21 indicate that, as expected, there is evidence of a distinct behaviour of the drivers of the stock market in each trilemma regime. Additionally, there is evidence of a different behaviour of the determinants during expansions and contractions, which suggests that the drivers of booms and busts are different. Moreover, as drivers of booms and busts are different by trilemma regime, this is the first reliable indication that each regime is endowed with a different elasticity, as suggested by Borio & Lowe (2002, 2004) and Borio (2014a, 2014b, 2014c). Finally, in line with the finance and growth literature discussed in the introduction to this dissertation, there is scant evidence of a varying behaviour in the drivers of booms and busts as a function of the structure in the financial system.

An important point to make with regards of our findings is that since there is evidence of a break the specification that best approaches a "true" model is the one that accounts for the breaks. This comes with a tradeoff since breaking down the sample brings us ever closer to small sample issues. In our presentation of results, we try to balance these two elements.

Before presenting the results by trilemma regime and type of phase, we want to issue a note of caution with regards to the results under trilemma regime III, where exchange rates are flexible, and the capital account is closed. Given the definition of the trilemma discussed in Chapter 1, out of the three desirable goals authorities under this regime would be sacrificing two and only keeping monetary autonomy. This solution, which is sub-optimal from a rational perspective, is the least frequent of the combinations. Still, the question of why a country would choose this policy stance at any point in time remains a valid one.

A likely explanation is that, as we discussed at length in Section 2.2, we are using a measure of *de jure* capital controls from several sources which reflect what countries said rather than what they did. In that sense, we need to refer to Figure 10, where the country/year observations for this regime are highlighted in orange. Most of the occurrences of TR III take place during the interwar period (Denmark, France, Germany, Japan, and Norway) and between 1970 and 1980 (Australia, France, Italy, Japan, Norway, Sweden, and the United Kingdom). This is important because, during the interwar years, the establishment of capital controls was not equally rigid for all countries and some were quite porous (Urban & Straumann, 2012). Øksendal (2006), for example, indicates that Norwegian capital controls resembled gates rather than walls and that certain regulatory forbearance took place.

For the more recent period, the effectiveness of capital controls is decreasing as they remain in place for more extended periods of time, as investors learn how to exploit loopholes in the regulation. An assortment of techniques was available to bypass regulations as indicated by Grilli & Milesi-Ferreti (1995). They indicate that "current account transactions can be used to (partially) evade restrictions on capital transactions through practices such as leads and lags in export billing, over-invoicing of imports, and under-invoicing of exports" (p. 525). Consequently, we are less confident about the validity of the results for this regime and take them with a grain of salt.

In what follows we present and discuss our empirical findings by trilemma regime. In each subsection, we include the coefficients and goodness of fit measures for the regressions by trilemma regime. To avoid making the text excessively cumbersome we include a reduced form version of the regressions by phase and regime in which we only present the sign and statistical significance of coefficients by phase and trilemma regime. Although all regressions include the control variables discussed earlier, time trend, growth in real GDP per capita, change in trade openness, and change in financial development, we omit the discussion of the coefficients as we do not expect them to be contingent on the trilemma regime in place. For the interested reader, the full tables of results are presented in Annex 14.

3.4.1. TR I: Fixed Exchange Rates and Closed Capital Account

The trilemma regime where fixed exchange rates and closed capital accounts overlap, as seen in Figure 10, occurs historically, during the postwar era and coincides with the Bretton Woods period described in Section 1.4.2. We present regression results for each of the LBBIs in Table 22.

In this regime, as expected, there is no significant effect of the net capital account precisely because of the capital controls in place. We do find, however, a long-run effect of the net current account on the evolution of the stock market. This is reasonable since, once currency convertibility was achieved in 1958, trade relations between countries blossomed fostered by exchange rate stability and the growth dynamics of the Golden Age.

Table 22: Regressions for trilemma regime I

Variable		Fixed FX Closed KA		
		Short	*Medium*	*Long*
Variables of interest	Overall current balance to GDP	1.3290	1.0200	**2.599*****
	Capital account to GDP	0.3642	0.6706	0.3885
	Short term rate diferential (domestic-foreign)	-0.0134	**-.0703*****	-0.0260
	Inflation differential (domestic-foreign)	**-.4626****	**-.4441*****	**-.3555****
	Global cycle (US LBBI to time horizon)	**.3287*****	**.4605*****	**.4112*****
	N	337		
	R squared	0.1711	0.2837	0.2145

Note: Results from PCSE regressions with country fixed effects and control variables as in Table 19 (coefficients for control variables not shown). Significance: * 10%, ** 5%, *** 1%. Significant coefficients are highlighted in bold.

It is useful to recall that in Chapter 2 and Annex 6 we established that the short and medium-run LBBIs are noisier than the long-run indicator (recall Figure 11) and that the latter only reflects shocks that have persisted in time. Consequently, when a variable such as the net current account seems to bear an effect only in the long-run indicator, it suggests that its effect occurs through the long-run expectations of investors. In some sense, temporary current account imbalances bear no effect on the stock market, but long run increases (declines) do explain bull (bear) markets as they reflect underlying economic activity and condition the expectations formed around the future cash flows of export-oriented firms.

Under this regime, countries gain monetary autonomy by sacrificing free flows of capital. In that sense, there is no mechanism through which short-run deviations between the local and foreign interest rate could put pressure on the exchange rate peg. On the other hand, sustained deviations from the centre’s interest rate may hinder the pegs credibility and cause both domestic investors to bet against it by adjusting their expectations to a higher exchange rate in the future.[193]

Additionally, if the increase in the interest rate differential happens because of a tightening of the domestic monetary policy stance, then the usual transmission mechanism takes place: the cost of credit increases, the investment opportunity set for firms is curtailed, a more substantial proportion of income is directed towards debt payments, and thus expected future cash flows decrease putting downward pressure on the stock price.

We argue that the coefficient is significant only for the medium-run regression because while a short-run deviation in the differential may not affect investors' expectations if it corrects sufficiently quickly, a long-run deviation is, as argued above, unsustainable and could not last long enough (before a one-time adjustment) so as to affect the long-run indicator.

Regarding the price level, results show that the inflation differential has a negative and statistically significant coefficient for all time horizons. This result is in line with our expectations, as discussed in Section 3.2. Higher domestic inflation will force companies to reduce margins and cut costs as they try to avoid increasing prices and keep their market share. As profits decrease expected future cash flows fall, which will push stock prices down. Additionally, higher domestic inflation and a

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[193] To better understand the dynamics in play we propose a thought experiment. Suppose country A has a fixed exchange rate against the currency of country B, it has a closed capital accounts but an open current account insofar as it exports and imports to and from the rest of the world. If the interest rate differential $(r_A - r_B)$ increases, on the one hand, the cost of credit will increase, investment opportunities for firms will decrease and the value of exported goods decreases. On the other hand, to pay for the increasing interest expense, companies must increase the price of their products reducing international competitiveness since prices in the foreign currency increase proportionally. This causes stock prices to decrease as expected future cash flows wane, and the stock of foreign currency to decrease as the positive balance of the net capital account shrinks or even changes sign. This sustained current account imbalance was, under the Articles of the IMF Agreement, the only reason that would allow for a one time change in the value of the peg (Kindleberger & Aliber, 2005). In Section 1.4.2 we have mentioned several examples where this occurred.

fixed exchange rate will foster imports which may bring adverse effects on the local industry as well as additional pressure on the peg.

Finally, the global financial cycle, as proxied by the LBBIs for the US stock market bares a positive and statistically significant relationship with domestic stock markets in the three regressions. This concurs with our expectations and denotes that the transmission mechanism for global financial conditions is not restricted to the role played by foreign investors in domestic markets, as anticipated in Section 3.2.1. Apparently, under closed capital accounts, the interdependence across markets exists, and a candidate driver would be that of a global risk aversion cycle that does not operate through capital flows but through information flows between developed economies. This would be in line with the results in Jorda, Schularick, Taylor & Ward (2018) and with the asset substitution and risk-preference channels discussed in Section 1.1.2.

With regards to financial stability, we break the sample between expansions (LBBIs>0) and contractions (LBBIs<0) and run separate regressions for each subsample. In Table 23 we present a summary of results where only the signs of statistically significant coefficients (P value below 0.05) are indicated.

Table 23: Regressions by phase for trilemma regime I

Variable		**Fixed FX Closed KA**					
		Short		*Medium*		*Long*	
		Bear	*Bull*	*Bear*	*Bull*	*Bear*	*Bull*
Variables of interest	Overall current balance to GDP						
	Capital account to GDP						
	Short term rate diferential (domestic-foreign)			- - -			
	Inflation differential (domestic-foreign)	- - -		- -			
	Global cycle (US LBBI to time horizon)	+ + +	+ +	+ + +	+ + +	+ + +	+ + +
	N	159	178	159	178	159	178
	R squared	0.51	0.14	0.34	0.12	0.14	0.09

Note: The table contains summary results for the PCSE regression distinguishing between expansions and contractions. Only statistically significant coefficients are indicated by + (positive) or – (negative) signs. Significance: + +/- - 5%, + + + /- - - 1%.

Findings from Table 23 can be broken down into three relevant ideas. First, once the sample is broken down, there is no significant effect of the net current account on the stock market. Additionally, the effect of inflation differentials on the long-run behaviour of the stock market disappears as the sample is broken. This result indicates that something in the nature of the variables for the net current account and for the inflation differential was proxying for the underlying cause of the breaks, such that when they are accounted for the explanatory power of the variables disappears.[194]

Second, the effect of short-term interest rate and inflation differentials seems to occur mostly during bust phases. This is to say that large differentials coincide with deeper contractions in the stock market but have no discernible link with expansions. Regarding inflation, this amounts to saying that price stability is a necessary, albeit not a sufficient condition for stability in the stock market. Finally, the role played by the global cycle is consistent and significant across phases and time-horizons. Larger expansions and deeper contractions seem to occur simultaneously across the 13 markets.

What these results suggest is that while the determinants of the exchange rate seem to be associated to the unwinding of imbalances, in the form of busts, the culprits for the accumulation of imbalances need to be found elsewhere. In Table 146, Table 147, and Table 148 (Annex 14), we find that apart from the global cycle the only statistically significant driver for expansions is the change in real GDP growth which would suggest that most of the drivers of bull markets are of a fundamental nature, rooted in investors' expectations on the behaviour of the economy.

3.4.2. TR II: Fixed Exchange Rates and Open Capital Account

In this regime, when compared to TR I, countries choose to sacrifice monetary autonomy to gain free capital mobility. This corresponds to the periods signalled in blue in Figure 10 which occurs mostly during the

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[194] This kind of effect will occur throughout the remainder of this chapter and in the results for Chapter 4. We highlight that the model closest to the true model for the stock market and real credit is the model that accounts for the breaks that have been evidenced in the Chow tests in each chapter.

interwar years and though out most of the recent history for Canada, Denmark, and Switzerland.[195] Table 24 presents the regression results for the full sample regression under this regime.

Table 24: Regressions for trilemma regime II

Variable		**Fixed FX Open KA**		
		Short	*Medium*	*Long*
Variables of interest	Overall current balance to GDP	**3.571*** **	**4.145*** **	**3.05** **
	Capital account to GDP	**1.999** **	**2.077*** **	0.8893
	Short term rate diferential (domestic-foreign)	0.0067	-0.0270	**-.0438*** **
	Inflation differential (domestic-foreign)	-1.2510	-1.2170	**-1.963* **
	Global cycle (US LBBI to time horizon)	**.5721*** **	**.6312*** **	**.6121*** **
	N	336		
	R squared	0.3929	0.4707	0.4336

Note: Results from PCSE regressions with country fixed effects and control variables as in Table 19 (coefficients for control variables not shown). Significance: * 10%, ** 5%, *** 1%. Significant coefficients are highlighted in bold.

The first relevant finding is that, as expected, under this regime both the net current account and the net capital account have a positive and statistically significant relationship with the evolution of the stock market. While the former affects every time horizon, which may be strongly linked to the positive effect of growing export-oriented sectors on economic activity, the latter seems to affect only in the short and medium-run indicators. As argued in the section on expected results, the role played by capital flows may run either contemporaneously through the portfolio investment channel or with a lag through the FDI channel. The fact that we do not observe a long-run effect of capital flows may serve as

[195] As we have noted earlier in the text, we use a *de facto* measure of exchange rate regimes. This means that it is not necessary that a country has set up an explicit policy to fix its exchange rate, but only that the logarithmic difference of the maximum and minimum monthly exchange rate during a given year is below 0.1, or what is equivalent, that it keeps within a ±5% band for two consecutive years. This denotes that even if a country had the possibility of establishing a monetary policy that deviated from that of the centre, they did not do it.

a first indication that investors enter or exit an open economy through the portfolio investment channel and that their participation in the stock market rather than being a persistent event is highly exposed to reversals.

An important caveat in the analysis of this coefficient is that in using the net value of the capital account, we do not observe who are the originators of inflows and who are the receivers of outflows. Consequently, it may be true that large FDI inflows are being offset by large portfolio outflows, and we would be unable to trace these effects in our regressions. As suggested by Borio, James & Shin (2014) and Borio (2016), further research should be directed at analysing the role of gross capital flows on the evolution of financial stability.

Secondly, the effect of interest rate and inflation differentials is negative and statistically significant only in the long-run regression. This means that short or medium-run shocks may be driven by other factors but, the fact that they reach the long-run indicator, that they become persistent and affect the 3-5 year returns of investor portfolios, is associated to sustained spreads in interest rates and price levels. This may have to do with the fact that in an open economy with fixed exchange rates, long-run deviations from PPP or CIRP threaten the credibility of the peg.

Finally, as in the previous regime, the global cycle has a positive and statistically significant association with the evolution of the domestic stock markets to every time horizon. In this case, since the capital account is open, it is possible that, besides the assets-substitution and risk-taking channels described for TR I, the communicating-vessels channel mentioned in Section 3.2.1 may be at work.

In Table 25 we present the summary of the results for the regressions by type of phase. The first finding in these new set of regressions is that the current account seems to correlate significantly with short-run bear phases (more substantial surpluses coincide with shallower busts), and with long-run expansions (more substantial surpluses coincide with larger booms). The net capital account, on the other hand, is positively correlated only with long-run expansions indicating that, under this regime, foreign flows play a role in the more persistent kind of booms.

Table 25: Regressions by phase for trilemma regime II

Variable		Fixed FX Open KA					
		Short		*Medium*		*Long*	
		Bear	*Bull*	*Bear*	*Bull*	*Bear*	*Bull*
Variables of interest	Overall current balance to GDP	+ + +					+ + +
	Capital account to GDP						+ +
	Short term rate diferential (domestic-foreign)						
	Inflation differential (domestic-foreign)	- -		- - -			
	Global cycle (US LBBI to time horizon)	+ + +		+ + +	+ +	+ + +	+ + +
	N	170	166	170	166	170	166
	R squared	0.50	0.24	0.50	0.35	0.43	0.39

Note: The table contains summary results for the PCSE regression distinguishing between expansions and contractions. Only statistically significant coefficients are indicated by + (positive) or – (negative) signs. Significance: + +/- - 5%, + + + /- - - 1%.

Additionally, inflation differentials appear to be negatively correlated with short and medium-run contractions. As the differential grows larger, putting pressure on the credibility of the peg and the profit of companies, the stock price decreases and returns from 1 month up to 3 years may be depressed.

Finally, the global financial cycle variable appears to be positively and significantly correlated with the evolution of the stock market for all phases except for short-run bull markets. In general, these relationships are consistent with what we expected.

3.4.3. TR III: Flexible Exchange Rates and Closed Capital Account

Bearing in mind the caveats presented at the beginning of this section, Table 26 shows the results of the regressions when the exchange rate is flexible, and the capital account is closed.

Table 26: Regressions for trilemma regime III

Variable		Flexible FX Closed KA		
		Short	*Medium*	*Long*
Variables of interest	Overall current balance to GDP	**14.32*** **	**7.855** **	**6.645***
	Capital account to GDP	**17.75*** **	**5.065***	3.1290
	Short term rate diferential (domestic-foreign)	**-.05***	-0.0163	0.0227
	Inflation differential (domestic-foreign)	-1.5730	0.2790	-1.1330
	Global cycle (US LBBI to time horizon)	**.4929*** **	**.5302*** **	**.4277*** **
	N	83		
	R squared	0.5012	0.5120	0.6309

Note: Results from PCSE regressions with country fixed effects and control variables as in Table 19 (coefficients for control variables not shown). Significance: * 10%, ** 5%, *** 1%. Significant coefficients are highlighted in bold.

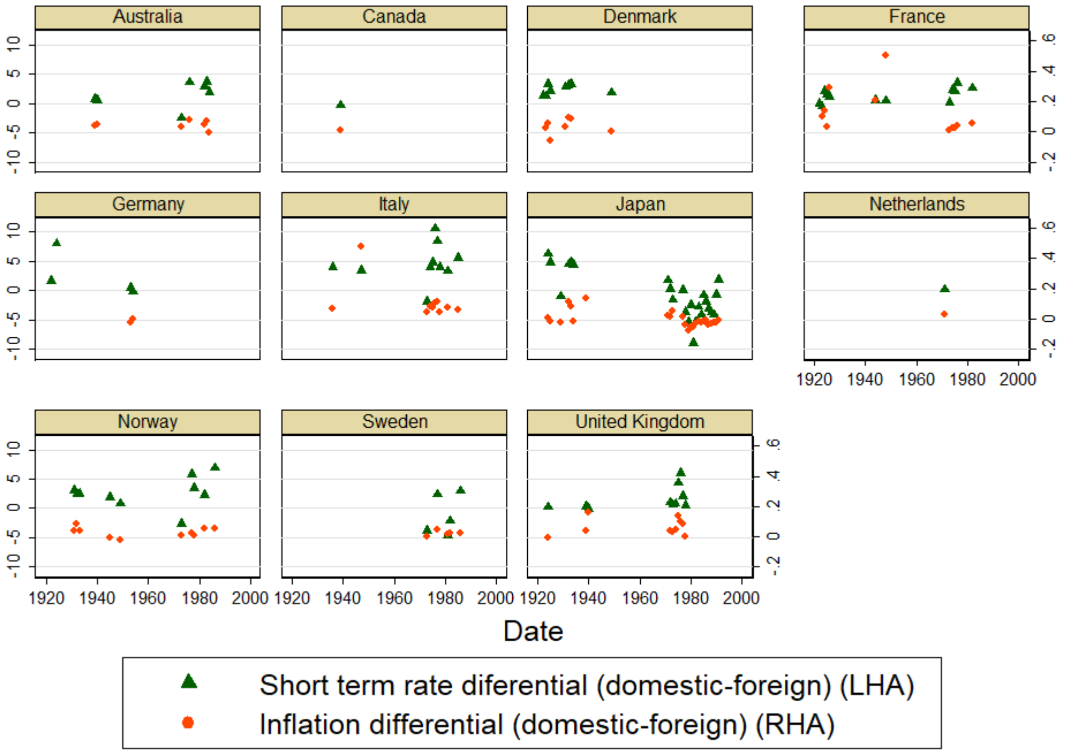
The first relevant finding is that the coefficient for the inflation and interest rate differentials are either statistically insignificant or very close to insignificance. This is a surprising finding since the hallmark event of the period covered by this regime is the second oil shock and the Volcker shock of the late 1970s. However, upon further inspection of the independent variables, we note that their variability is very low, probably because both inflation rates and interest rates moved in tandem with the US, the former because of the external shock and the latter as part of the reaction to the shock.[196] We present the figures for both the interest rate and inflation differentials under trilemma regime III by country in Figure 18.

Concerning the net current account and the global cycle, both coefficients are positive and statistically significant to every time horizon. The mechanisms at work for the current account relate to strengthening trade relations: as exports increase, indicating a more robust productive sector, the expected future cash flows for firms increase, and this puts upward pressure on stock prices. It is noteworthy that the significance of

[196] Recall from Section 1.4.2.2 that the dollar glut fostered by the US since the mid-1960s initiated a period of global inflation that peaked twice during the 1970s, in 1973 and 1979, concurrent with the two oil shocks.

this relationship decreases with the time horizon (99% for the short-run, 95% for the medium-run and only 90% for the long-run).

Figure 18: Inflation (RHA) and interest rate (LHA) differentials during TR III



Note: Inflation and interest rate differentials between domestic economies and the United States during the trilemma regime where exchange rates are flexible, and capital accounts are closed. Data from JST (2017). We highlight the low variability in most cases, except for Japan, Italy and the UK.

Lastly, regarding the role of the net capital account, we find the coefficients to be positive and statistically significant for the short and medium run regressions. As we advanced in the preliminary caveats to this section, we argue that the significance of the coefficients may occur because since the final years of Bretton Woods and up to the deregulation wave of the late 1970s, even though capital controls were in place *de jure*, economic agents found strategies to circumvent them. Additionally, there were known cases of regulatory forbearance at the time which may have made the controls more porous during the years leading up to their elimination.

Regarding financial stability, Table 27 summarises the statistically significant results for the regressions by type of phase under trilemma regime III. A first element that is worth highlighting is the small number of observations in each sample. For that reason, we are particularly cautious in the interpretation of results.

Table 27: Regressions by phase for trilemma regime III

Variable		Flexible FX Closed KA					
		Short		*Medium*		*Long*	
		Bear	*Bull*	*Bear*	*Bull*	*Bear*	*Bull*
Variables of interest	Overall current balance to GDP						
	Capital account to GDP						
	Short term rate diferential (domestic-foreign)	- - -					
	Inflation differential (domestic-foreign)			- - -			
	Global cycle (US LBBI to time horizon)	+ + +					
	N	49	34	49	34	49	34
	R squared	0.57	0.25	0.35	0.41	0.52	0.57

Note: The table contains summary results for the PCSE regression distinguishing between expansions and contractions. Only statistically significant coefficients are indicated by + (positive) or – (negative) signs. Significance: + +/- - 5%, + + + /- - - 1%.

We find that increases in the interest rate differential have a negative correlation with the stock market during bust phases, indicating that larger differentials coincide with deeper busts. Tighter domestic monetary policy could drive this during stock market contractions which would put further downward pressure on the indices.

Regarding the inflation differential, it appears as a significant explanatory factor for medium-run contractions, which may be related with a compression of profits in the domestic market and with a loss of competitiveness in the international market, especially if the exchange rate does not adjust at sufficient speed.

Finally, the global cycle, in this case, is only statistically significant when explaining short-run contractions in the stock market. What we find particularly challenging in this result is the fact that when we do not break the sample, the coefficient for the global cycle is highly significant to every time horizon. Consequently, we argue that the poor quality of the results in Table 27 is due mostly to the low number of observations by phase.

3.4.4. TR IV: Flexible Exchange Rates and Open Capital Account

In this trilemma regime, which coincides with most countries stance in the more recent period, exchange rates are flexible, and the capital account is open. We present regression results to the three different time horizons in Table 28.

Table 28: Regressions for trilemma regime IV

Variable		Flexible FX Open KA		
		Short	*Medium*	*Long*
Variables of interest	Overall current balance to GDP	2.0710	1.9540	**3.467****
	Capital account to GDP	0.4001	0.6053	**2.001*****
	Short term rate diferential (domestic-foreign)	-0.0069	**-.0405****	**-.0529*****
	Inflation differential (domestic-foreign)	**-2.874****	0.7774	0.6371
	Global cycle (US LBBI to time horizon)	**.6509*****	**.7151*****	**.5883*****
	N	182		
	R squared	0.5994	0.6379	0.5778

Note: Results from PCSE regressions with country fixed effects and control variables as in Table 19 (coefficients for control variables not shown). Significance: * 10%, ** 5%, *** 1%. Significant coefficients are highlighted in bold.

A first element worth highlighting is that of all the trilemma specific regressions, this is the one that presents the higher values for the R^2 and the highest estimators for the global financial cycle (closely followed in both regards by the regressions for trilemma regime II). Although we will delve deeper into this issue in Chapter 5, this evidence suggests that, in line with Obstfeld & Taylor (2004), after a trough during the Bretton Woods period, international financial integration has increased significantly in the last three decades. The fact that there are over 180 observations in each regression gives us confidence in that the significance of the results is not driven by small sample size (as might be the case for TR III). In this case, the three channels discussed above, global risk aversion, communicating vessels, and companies trading in several stock markets simultaneously, could be at play and serve to explain why the cycle's significance peaks, at least in terms of the estimators, during this period.

A second interesting result is that while the inflation differential covaries negatively with the short-run evolution of the stock market, the interest rate differential covaries negatively with the medium and long-run indicators. It is possible that increases in inflation alter short-term expectations of agents, however, during most of this regime, inflation targets have been part of the policy mandate of central banks. Consequently, inflation is not usually out of control for sustained periods of time, particularly in advanced economies. This has been one of the critical characteristics of the great moderation described in Section 1.4.4. However, interest rates can have a more persistent effect on the evolution of stock prices. An excellent example of this is the criticism of central banks, particularly the Federal Reserve after the dot.com crash, in which several researchers and analysts argued that the FOMC under Greenspan had kept interest rates too low for too long which had fostered the asset price bubble that led to the GFC (Taylor, 2007). In this, which was described in more detail in Section 1.4.4, we find a clear example of how the effect of interest rate policy may have a substantial effect on the medium and long-run behaviour of stock markets.

With regards to financial stability, in Table 29 we present the regression by type of phase, highlighting only the statistically significant results. As in the previous trilemma regimes (except TR III), the global cycle appears as a critical driver for both expansions and contractions to every time horizon, which goes in line with the proposition of increasing financial integration over the last two decades. Interestingly, we find that positive current account balances are strongly correlated with expansions in both the medium and long-run which is consistent with the idea of more robust trade relationships as well as stronger export-oriented companies.

The role of net capital flows is also worthy of mention. In the short run, capital flows are strongly associated with bear phases in the stock market, suggesting some sort of fly-to-quality dynamic. Since we are dealing with developed economies, the idea of a sudden stop may seem counter-intuitive, but if the recent European debt crisis is any indication, even developed countries are subject to capital flight towards the United States (De Grauwe, 2010). Further research may confirm whether this effect is driven by a particular subset of countries (Japan during the Asian crises and Italy during the 2010s come to mind), or whether it is robust to the inclusion of the United States in the dependent variables.

Table 29: Regressions by phase for trilemma regime IV

	Variable	Flexible FX Open KA					
		Short		*Medium*		*Long*	
		Bear	*Bull*	*Bear*	*Bull*	*Bear*	*Bull*
Variables of interest	Overall current balance to GDP				+ +		+ + +
	Capital account to GDP	+ +					+ + +
	Short term rate diferential (domestic-foreign)					- -	
	Inflation differential (domestic-foreign)						
	Global cycle (US LBBI to time horizon)	+ + +	+ + +	+ + +	+ + +	+ + +	+ + +
	N	88	94	88	94	88	94
	R squared	0.73	0.51	0.67	0.59	0.57	0.74

Note: The table contains summary results for the PCSE regression distinguishing between expansions and contractions. Only statistically significant coefficients are indicated by + (positive) or – (negative) signs. Significance: + +/- - 5%, + + + /- - - 1%.

On the other hand, capital flows are positively related to long-run expansions. This finding falls in line with Kindleberger & Aliber's (2005) view of capital flows from abroad as a form of foreign credit, an expansion of the available resources to invest that can fuel an asset price boom. This phenomenon is only observable under regimes with open capital accounts and may be a trademark of deregulation. We will delve deeper into this issue in Chapter 6.

Finally, the interest rate differential is negatively correlated with long-run bear phases. This is a sensible result since leveraged investors will choose to finance and invest in countries where funds are readily available at a low price. When interest rates increase domestically, and the monetary mechanism kicks-in, the natural reaction is for asset prices to decrease, pushing out both domestic and foreign investors who, in a search for yield will rebalance their portfolio towards countries where the stock market is booming, and borrowing is less expensive. This is one of the consequences of international capital integration amidst deregulation: the market for investments, as it becomes more and more complete in an Arrow & Debreu (1954) sense, has become one of global competition where world-wide risk-adjusted-returns seem to be subject to the law of one price.

3.5. Robustness Tests

To confirm the robustness of our results, we first control for the years where the Second World War took place and include a dummy that takes a value of 1 for the years 1939-46. We include 1946 as the return to normalcy may not have occurred immediately after the end of the conflict in May (Europe) and August (Asia), 1945. In Annex 15 we present a table with the unconditional regressions presented in Section 3.3 and the dummy variable whose coefficients are statistically equal to zero in all cases, suggesting that the war did not cause a break in the level of the regressions.

A second event whose inclusion in the robustness tests is relevant has to do with the creation of the euro in 1999, as discussed in Chapter 2. In understanding the eurozone from the perspective of the macroeconomic trilemma, one must draw a distinction between the relationship of countries within the eurozone, which would be in TR II as they have fixed exchange rates, no autonomous monetary policy and open capital accounts, and eurozone countries vis-à-vis the rest of the world, which would be in trilemma regime IV, with flexible exchange rates, open capital accounts and autonomous monetary policy. While in this dissertation we follow the second approach, it is relevant to confirm whether our results are robust when we control both for a break in 1999 for all countries and a break in the individual eurozone countries.

Consequently, in Annex 15 we include two tests. In the first test we run the unconditional regressions presented in Section 3.3, while including a post-1999 dummy variable that takes the value of 1 for every country-year observation starting in 1999 to test whether the implementation of the euro has some explanatory power on the evolution of stock markets beyond the exchange rate drivers we included in the model. We find this dummy to be statistically insignificant in all cases. In the second test, we include a eurozone dummy that takes the value of 1 for every country-year observation since 1999 if the country uses the euro as a currency. We then run the unconditional regressions as in the previous test, and the regressions only for the fourth trilemma regime where these countries partake. In no case is the dummy statistically significant, providing evidence that the inclusion of the euro is in no way driving the conclusions of this study.

3.6. Concluding Remarks and Further Research

The question that guided this chapter was whether the determinants of the evolution of the stock market were contingent on the trilemma regimes in place. We provide an answer by testing for structural breaks in the coefficients of the explanatory variables by trilemma regimes. Additionally, to address the issue of financial stability, we tested for additional breaks depending on whether the market was expanding or contracting.

A first relevant finding is that the variables that affect LBBIs, namely the expected dividend growth rate and the stock market volatility, also affect the VIX index which has been traditionally used to proxy for the global financial cycle. However, while LBBIs increase with the dividend growth rate and decrease with volatility, the VIX decreases in the dividend growth rate and increases with volatility. Consequently, there is an inverse relationship between both variables. In the tests we performed to find the most appropriate econometric specification, we found evidence of a common contemporaneous shock that affected all variables, and that would have required the use of time fixed effects. We replaced the time fixed effects with the LBBIs for the US to proxy for the global cycle and, in so doing, built a more parsimonious model as indicated by the Bayesian information criteria (BIC). We find this global cycle to be positively related to stock market LBBIs and statistically significant in all specifications, regardless of the exchange rate regime, as in Rey (2015), and of the capital control regime. We suggest three possible mechanisms for this to occur. First, even under closed capital accounts, there is an efficient flow of information in stock markets which may cause the risk-taking channel and the asset substitution channel to come into play. Second, under international financial integration, there may be a communicating-vessel effect as capital flows increase. Third, if a sufficient number of companies trade in different markets, no-arbitrage conditions may cause them to move in tandem.

Second, we use a standard asset pricing model and an exchange rate determination model to establish a functional relationship between stock market LBBIS and variables associated to the trilemma regimes: net current and capital account to GDP, inflation and interest rate differentials and the global financial cycle. We test this model for structural breaks in the coefficients by trilemma regime, by type of phase (expansions and contractions), and by financial system structure (bank-based or market-based). We find evidence for breaks in the first two cases. Consequently, we evaluate the significance of the coefficients of the explanatory variables under each institutional setup. To provide more in-depth analysis, we contrast if our results are contingent on whether the market is expanding or contracting. We address the findings by trilemma regime in turn.

Under fixed exchange rates and closed capital accounts, as in Bretton Woods, the differential in inflation is a critical variable to all time horizons. The link between the price level and the stock market runs probably through the credibility of the peg on the one hand, and the reduction in corporate profits and loss of market share to foreign competitors on the other hand. Differentials in interest rates play a more muted role, affecting only the medium-run indicator as they affect the funding cost for firms and curtail expected cash flow growth. We argue that the effect does not show either in the long run or the short run because in the first case, a very persistent differential could cause a devaluation under the Articles of the Agreement, and in the second case investor expectations do not necessarily adjust to short-term shocks.

Under this regime, capital flows are not significant, suggesting that capital controls were sufficiently enforced.

Under fixed exchange rates with open capital accounts, a regime that was pervasive during the gold exchange standard and, more recently since the 1990s, the net current account has a positive and statistically significant coefficient to every time horizon, which highlights the importance of international trade for advanced economies as a source of corporate income. The net capital account surpluses are also relevant in explaining short and medium-run expansions in the stock market but do not seem to have a long-run effect. This is probably due to the fickle nature of capital flows, particularly in what relates to portfolio investment (Eichengreen, Gupta & Masetti, 2017). Finally, interest rate and inflation rate differential have a negative and significant effect only in the long-run indicating that it is persistent deviations in these variables what causes distortions in asset prices.

The third trilemma regime, with flexible exchange rates and closed capital accounts, is subject to several caveats as mentioned in the text. However, we find that, as in the previous regime, the net current account has a positive and significant coefficient to all time horizons. While we do find a role for the net capital account, we argue that this may indicate the failing nature of capital controls at the time, as investors had found several ways in which to circumvent them. Finally, both interest rate and inflation differentials lose their explanatory power under this regime, probably because during the oil shocks and the Volcker shock that followed, both variables move in tandem between the advanced economies in the left side of the regression equation and the US.

The last regime we cover has flexible exchange rates and open capital accounts and coincides mostly with the current period and the depression years in the 1930s. Under this regime, the primary driver seems to be the global financial cycle which presents the highest estimators among all the cases covered. However, several phenomena that we are not controlling for such as financial innovation, the development of a shadow banking sector, and deregulation in the financial system may be driving this result.

Additionally, both current and capital accounts explain the long-run evolution in the stock market, while short and medium run phenomena appear to be driven by inflation rate and interest rate differentials respectively. The case of inflation differentials only affecting the short-run behaviour of stock markets may result from the positive effect that inflation targeting regimes have had in anchoring investors' expectations in so far as they know that short-run bouts of inflation will be met with corrective monetary policy. Interest rates, on the other hand, seem to have a more pervasive effect since interest rates may remain too low for too long if they do not put pressure on the price level.

Third, regarding the elasticity of trilemma regimes, understood as the ways in which they allow for the accumulation and unwinding of financial imbalances, we find a role for the global cycle both in expansions and contractions.[197] In the case of fixed exchange rates, we find in the inflation differential an important driver for short and medium-run bear phases. This provides a solid argument in favour of the price stability mandate given to central banks and is probably why under the inflation targeting regime inflation does not seem to drive either bull or bear phases. During Bretton Woods, and the more recent period, interest rate differentials seem to drive medium and long-run contractions respectively, a sensible result since under both regimes there is some measure of monetary policy autonomy in which the domestic rate may deviate from the reference interest rate for sustained periods. Finally, net capital and current accounts appear to be relevant in regimes where capital controls are absent. These variables explain short-run bear markets in what can be thought of as a sudden reversal of flows, and long-run expansions suggesting that foreign flows fuel domestic stock market booms. The main conclusion of our findings regarding financial stability is that there is enormous difficulty in addressing the issue from a policy perspective since different institutional setups and macroeconomic conditions allow financial imbalances to accumulate or unwind through different channels.

[197] In this part of the conclusion we do not discuss results for TR III due to the low sample size which undermines our confidence in the results.

Regarding further research that arises from our findings, the first line of inquiry has to do with the role of changing monetary policy by regime. For example, an interesting question concerns what happens when, under an autonomous monetary policy, countries have a lax or tight policy stance. It is possible that the dynamic of expansions and contractions, and consequently of financial stability changes when the domestic policy stance is different from that in centre countries such as the United States.

A second issue that may be relevant is whether the differences in the coefficients we have found by regime are driven by some underlying dynamic in control variables. As argued in the introduction, we have not discussed the general equilibrium conditions under each regime, and it is possible that the evolution of macroeconomic aggregates may hold part of the explanation for the variability we find in the coefficients.

Additionally, in Section 3.2 we offered expected results and, in so doing suggested several mechanisms that may be in play. However, since the goal of this chapter was not to find causal relationships, further research needs to be aimed at identifying causality either from a modelling perspective, similar to the one we will present in Chapter 6, or through in-depth case studies that evaluate country-specific experiences that may shed a light on the mechanisms through which our findings take place as we do in Chapter 5.

Finally, improving the robustness of the results requires broadening the database. Even though we have suggested candidate countries in footnote 192, this is challenging because gathering long-run data for most of these countries is difficult, particularly since all series need to be equivalent and thus should be gathered using the same methodology and primary and secondary sources of comparable quality.

Chapter 4. Do the Rules of the Game Matter for Credit Growth? Trilemma Regimes and Real Credit

This chapter aims to explore the determinants of real domestic credit to the non-financial sector (households and firms) under the different trilemma regimes we have identified in Chapter 2. This chapter is complementary to Chapter 3 in the sense that jointly they serve as a study of the two components of the financial cycle that we presented in Section. 1.1. Consequently, both chapters follow a parallel structure and deal with a similar research question.

Specifically, we will test whether the determinants for the accumulation and unwinding of financial imbalances in real credit to the non-financial sector are contingent on the trilemma regime in place. Additionally, to link our results with issues of financial stability, we will test if the determinants change depending on the type of phase (expansion and contraction). Finally, with regards to the possible relevance of the structure of the financial system, we will identify if our general results change if we focus either on bank-based or market-based financial systems, as suggested in the introduction to this dissertation.

One of the first challenges in addressing this question was finding a model for the determination of the growth in the stock of domestic credit. A first possible approach was to use a DSGE model to identify the possible underlying dynamics of credit growth. However, as we have indicated in footnote 9, this family of models are subject to several caveats, among which the difficulty in including financial frictions and in modelling endogenous money creation become paramount. Consequently, we chose to turn to the literature and gather a collection of variables that have been identified as significant determinants for the level of credit and its evolution in time.

Most of the additional variables we include in this chapter are meant only to control for effects that are specific to credit. The variables of interest, which are directly related to the channels of operation of the trilemma regime, remain unchanged from the previous chapter. This has the added benefit of allowing for a comparison of results across chapters, as we will show in the general concluding remarks to this dissertation in Chapter 7.

A second issue that will be relevant throughout this chapter is that the credit series we employ does not contain credit from abroad, nor includes the financial system as a creditor. In Chapter 2 we showed that using alternative series such as real credit from the World Bank is not feasible as it includes a public debt component which would force us to broaden the scope of this research to include fiscal policy components. As we argued in the introduction, this is a path that we will explore in future research endeavours. However, the real credit series we employ is sufficiently broad to reflect the evolution of household and firm financing in the economy and to reflect the capacity for endogenous money creation of the financial system (Assenmacher-Wesche & Gerlach, 2010).

A third caveat that is relevant in the development of this chapter has to do with the changing nature of credit contracts throughout the period. As argued by Jordà, Schularick & Taylor (2013, 2015), during the postwar era the role of mortgage financing as a component of credit increased substantially, particularly in a context where household wealth was majorly represented by home ownership. Additionally, following Offer (2017) and Neal (2015), the period after the fall of Bretton Woods has been characterised by an ever-increasing array of financing vehicles and opportunities which may have altered the nature of the relationship between the trilemma variables and credit. Consequently, as a robustness check, we will test the validity of our full sample results for a subsample that covers the period 1971-2013. Finally, the caveats concerning monetary policy, general equilibrium effects, and causality discussed in the introduction to Chapter 3 apply similarly to our discussion of credit aggregates.

From a methodological perspective, as in Chapter 3, we employ the LBBIs for real credit for the twelve countries as dependent variables. Apart from the control and trilemma variables, we employ the LBBIs for the evolution of real credit in the US as proxies for the global financial cycle. As in the previous chapter, this is not to say that the evolution of the domestic credit market in the US is driving credit conditions elsewhere.

Rather, following Jordà, Schularick, Taylor & Ward (2018), we employ the data for the US as a proxy for the co-movement across credit markets in developed economies in general. First, we will run an unconditional PCSE regression to confirm the existence of a global financial cycle that affects the domestic evolution of real credit aggregates. Subsequently, we perform structural break tests and present empirical results by trilemma regime, type of phase, and structure of the financial system.

As we have stated in Chapter 3, we offer three main contributions to the literature. First, we offer a long run study that links the macroeconomic trilemma to the evolution of credit. Most of the literature surveyed has covered the post-Bretton Woods period but refrains from looking further back. Secondly, this chapter follows the literature on the financial cycle and tackles the link between the trilemma and financial stability considering the relevance that endogenous money creation by the financial system has on the accumulation and unwinding of imbalances. Finally, we suggest stimulating avenues for further research to continue in this exploration of the link between institutions and financial stability.

A first relevant finding is that there is a co-movement across domestic credit markets, a global financial cycle, that is sufficiently proxied by the real credit LBBIs for the United States. Secondly, we find that the drivers for real credit growth, including the global cycle, are contingent both on the trilemma regime in place and on whether credit is facing an expansion or a contraction. Our findings, however state-contingent, are consistent with the macroeconomic literature surveyed. This serves to highlight the challenges in addressing the financial stability question: changes in the institutions in place and general economic conditions will alter the channels and drivers of financial stability.

The rest of this chapter is structured as follows. Section 4.1 argues for the inclusion of several relevant variables for the analysis of domestic credit markets. After presenting the country-specific independent variables, we perform preliminary specification tests and argue for the inclusion of the US LBBIs to proxy for global credit conditions. Section 4.2 builds on the literature review in Chapter 1 and presents a summary of expected results. Section 4.3 presents the unconditional model and first evidence in favour of the global financial cycle. Section 4.4 features structural break tests described above and discusses our empirical results by trilemma regime, by type of phase and by structure of the domestic financial system. Section 4.5 presents several robustness checks. Section 4.6 offers concluding remarks and questions for further research.

4.1. Database: Control and Trilemma Variables

Based on the wide literature on the subject, we have constructed a database that is designed to include variables that capture as much of the dynamic driving the real stock of credit as possible.

First, regarding the variables to proxy for the macroeconomic trilemma, we will employ the same variables and sources as we did in the previous chapter. Regarding the net current account to GDP, Mendoza & Terrones (2008), in a sample combining developed and developing countries, found that increasing current account deficits were associated with credit booms. Bordo & Meissner (2012), using a sample of only developed economies, found no statistical significance in the coefficient.[198]

Regarding the capital account balance, Magud & Vesperoni (2015) use it as an explanatory variable for the evolution of real credit growth and find that it has a positive and statistically significant coefficient under several specifications (90% confidence). In the same paper, they include a measure of the real effective exchange rate and find it has a positive and statistically significant coefficient under several specifications (99% confidence). We choose not to include the exchange rate directly, but rather follow the exchange rate determination model presented in (25) and include the differential in inflation and short-term interest rates.[199]

Concerning control variables, we will include a broadened set of variables when compared to Chapter 3.[200] Some of the variables, such as

[198] Two issues in relation to the Bordo & Meissner (2012) paper are relevant. First, they include the variable in first differences rather than in levels as we include it in our specification. Secondly, they include it as a robustness test in a subsample that only covers the post-Bretton Woods period.

[199] Recall that the differential is calculated as the difference between the domestic variable and the contemporaneous value of the variable for the United States (foreign).

[200] The sources for real GDP growth, change in trade openness, and change in financial development are the same as the ones described in Chapter 3.

the linear trend, coincide with those we used in the previous chapter. Among the other coincident variables across chapters, we follow Bordo & Meissner (2012), Meissner (2013), Magud, Reinhart & Vesperoni (2014) and Magud & Vesperoni (2015) and include the change in real GDP per capita as a measure of economic growth. In these papers, the authors find a positive and statistically significant coefficient for the variable.

Additionally, we follow Magud, Reinhart & Vesperoni (2014) and Boudias (2015) and include a measure of openness to trade as de percentage change in imports plus exports as a ratio to GDP. This measure is aimed at controlling for the growth in credit due to increases in international trade. To control for the size of the financial system, we include the change in broad money (M2) to GDP as a measure of financial development.[201]

However, some other control variables are included exclusively for this specification as we expect them to be relevant for the evolution of credit aggregates but not for the level of stock market indices. A first additional control variable is the first lag in the level of credit as a proportion to GDP as in Magud & Vesperoni (2015).[202] The goal of including this variable is to account for the current leverage level in the economy as highly leveraged countries should be less prone to substantial YOY credit growth. Secondly, we follow Magud, Reinhart & Vesperoni (2014), and Boudias (2015) and include the first lag of the inflation rate.[203] The aim of including this variable is to control for the money illusion as in Fisher (1933). Higher inflation rates reduce the real burden of the stock of debt and are expected to encourage credit growth.[204]

Finally, as in Bordo & Meissner (2012), we include the percentage change in investment as a proportion of GDP since we expect that increasing capital expenditures and investment projects by firms will be

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[201] Magud, Reinhart & Vesperoni (2014) refer to this as financial deepness.

[202] We calculate it as the nominal value of credit divided by the nominal GDP. Both series come from Jordà, Schularick & Taylor (2017) Macrohistory database.

[203] Data taken from Jordà, Schularick & Taylor (2017) Macrohistory database.

[204] We include lagged values of variables to control for collinearity. The current level of credit to GDP is directly related to the construction of LBBIs, and the inflation level is directly related to the inflation rate differentials.

financed, at least partly, with new debt issues.[205] According to the pecking order theory in Myers and Majluf (1984), when firms need to fund investment projects, they access funds in a given order that accounts for their cost and the dilution of property. First, they use internally generated funds (cash flows and accumulated profits), then they resort to short-term debt, then long-term debt, and finally to new equity issues. Consequently, growth in investment to GDP should have a positive relation to real credit growth.

After deciding on the set of independent variables we run a first panel regression using real credit LBBIs to each time horizon as the dependent variables. We perform the F test for the significance of country fixed effects and time fixed effects where the null is that the effects are not significant. We also run the Breusch & Pagan (1979) test for the significance of random effects and the Hausman (1978) test to select between random and fixed effects models. Results are presented in Table 30.

According to Table 30, the use of both country and time fixed effects is necessary in the specification as there is sufficient heterogeneity across groups (Panel A) and there seems to be evidence for common shocks across countries (Panel B). We find, however, that there is no need to use random effects in the model, and that given the alternative pooling the data would suffice (Panel C). The Hausman (1978) test in Panel D, confirms these findings. As in the previous chapter, we argue that the suggestion of a common shock to all countries in Panel B is evidence of the need to include a measure of a global financial cycle as in Passari & Rey (2015). In what follows we argue for the inclusion of the LBBIs for real credit in the United States as such a measure.

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[205] Data taken from Jordà, Schularick & Taylor (2017) Macrohistory database.

Table 30: Panel specification tests for the use of fixed or random effects

Horizon	Short-run	Medium-run	Long-run
Panel A: Joint significance of country fixed effects			
Statistic (F)	4.05	4.47	2.69
Prob > F	0.00	0.00	0.00
Conclusion	FE	FE	FE
Panel B: Joint significance of time fixed effects			
Statistic (F)	3.14	3.71	4.27
Prob > F	0.00	0.00	0.00
Conclusion	FE	FE	FE
Panel C: Breusch Pagan (1979) test for the use of random effects			
Statistic (Chi 1 DoF)	0.00	0.00	0.00
Prob > CHI2	1.00	1.00	1.00
Conclusion	Pool	Pool	Pool
Panel D: Hausman (1978) test for the choice of random or fixed effects			
Statistic (chi 8 or 9 DoF)	42.89	47.17	28.94
Prob > CHI2	0.00	0.00	0.00
Conclusion	FE	FE	FE

Note: Panel A tests for the joint significance of country fixed effects, under the null that they are jointly insignificant. Panel B tests for the joint significance of time fixed effects, under the null that they are jointly insignificant. Panel C performs the Breusch & Pagan (1979) test for a random effects model under the null that random effects are unnecessary. Panel D performs the Hausman (1978) test for the choice between random and fixed effects models where the null is that random effects are pertinent.

4.1.1. The Global Financial Cycle

In section 3.1.1 we discussed in-depth the underlying idea of the global financial cycle. In the case of the stock market, it was sensible to assume that since the VIX was extracted from the S&P500 index, using the LBBIs for that same index would sufficiently proxy for the global cycle for the period 1922-2013.

The case for real credit is somewhat different. To argue for the inclusion of the LBBIs for the US real credit variable we follow Jordà, Schularick, Taylor & Ward (2018) who in discussing the global financial cycle consistently use words as synchronisation or co-movement across markets. They argue that “financial cycles are associated with the synchronized ebb and flow in credit aggregates, house prices, and equity prices across countries” (p. 3).

To show that the LBBIs for the US proxy for the underlying common driver to the twelve domestic credit markets, we build three matrices that contain the 12 short, medium, and long-run LBBIs for real credit of the countries in the database. We then extract the first principal component of the variance-covariance matrix in each. This first principal component behaves as the common driver to all domestic credit markets and is the one that bears the highest explanatory power over the variance-covariance matrix of the short, medium and long-run LBBIs.[206] Subsequently, we regress each principal component (PC) against the corresponding LBBI for the US credit market. We present the results in Table 31. In Annex 16 we offer stationarity tests for both series and scatter plots to the different time horizons.

Table 31: Regressions of LBBIs for US real credit on the common component of the twelve countries' real credit LBBIs

Dependent Variable	Short-run PC	Medium-run PC	Long-run PC
LBBIS USA	-0.0681**		
LBBIM USA		-0.0826***	
LBBIL USA			-0.0869***
Trend	0.0001	0.0002	0.0002
Constant	-0.0020	0.0025	0.0076
Estimation	Newey 1 lag	Newey 2 lags	Newey 2 lags
N	92	92	92
Adj. R-squared (OLS)	0.1486	0.1973	0.2459

Note: Residuals of the three regressions are homoscedastic. The errors for all specifications have an autoregressive component, so the regressions are run using Newey-West standard errors. The optimal number of lags is estimated by fitting an AR(p) model on the residual. Significance: * 10%, ** 5%, *** 1%.

The case for real credit is substantially different from the case for stock markets. Principal components explain only a third of the joint movement across markets (for stock markets it was over half of the variability in the variance-covariance matrix), and the goodness-of-fit

[206] The short, medium and long-run principal components explain 30.6%, 36.8%, and 37.2% of the variance in the original variance-covariance matrices. The explanatory power is calculated as the ratio between the largest eigenvalue (associated to the first eigenvector) and the sum of all eigenvalues in the decomposition of each matrix (Tsay, 2002).

measures in Table 31 are but a third of those in Table 15 which corresponds to the stock market case. These results are consistent with the findings by Jordà, Schularick, Taylor & Ward (2018) who find a stronger co-movement in the stock market than in housing prices or credit markets. Still, these results are notable, especially since the real credit variables only include lending from domestic sources to domestic borrowers. It is natural that, because of the definition of the variables, co-movement across markets is weaker for credit than for stock markets. Further research should try to broaden the definition of credit to include foreign lending, and we expect that the link between credit markets would increase using this ampler definition.

Still, the results from Table 31 and Annex 16 do provide evidence in favour of a common shock to all credit markets that may be proxied by the US LBBIs. Consequently, we run a first regression of all the control and trilemma variables on the short, medium and long-run LBBIs for each of the twelve countries as dependent variables. We perform two specifications for each of the three regressions. In the first one, we include time fixed effects. In the second one, we replace the 91 dummy variables with the LBBI for the US stock market to the corresponding time horizon. As discussed in Section 3.1.1, we will use the Bayesian information criterion (BIC) as a measure of goodness-of-fit for the different specification. We present the results in Table 32.

Table 32: Goodness-of-fit for time fixed-effects model VS global cycle model

	Short-run		**Medium-run**		**Long-run**	
	Time FE	US LBBI	Time FE	US LBBI	Time FE	US LBBI
BIC	1621	1276	1621	1315	1729	1450

Note: Goodness-of-fit measured by the Bayesian Information Criterion for two regressions of the independent variables on the LBBIs for real credit of the twelve countries in the database. Time FE refers to the inclusion of 91 time-related dummy variables. US LBBI substitutes the time fixed effects for the US LBBI as a proxy for the global financial cycle. Lower values of the measure indicate a better fit of the data.

As is clear from Table 32, the model with the best fit in every case is the one that includes the global cycle variable rather than the time fixed effect dummies. In the next section, we will present the expected results.

4.2. Expected Results

In this section, we present a summary of the expected results. In Section 4.2.1 we account for the expected sign of the coefficients of the variables of interest which should be affected by the trilemma regime in place: net current account, net capital account, global financial cycle, and changes in the exchange rate driven by inflation and interest rate differentials. [207] We conclude the section with a summary table for ease of reference. In Section 4.2.2 we present the expected implications for financial stability by trilemma regime, as extracted from the literature review presented in Chapter 1.

4.2.1. Expected Signs for the Coefficients of Trilemma Variables

Regarding the coefficient for the net current account, a first issue we face is that in most of the literature the functional relationship of the variables is assumed to be the opposite: the usual question is what effect do changes in real credit have on the current account. Following Unger (2017), the usual finding is that increases in the available amount of credit lead to deficit current accounts when the newly created funds are used for the purchase of imports. Still, there is no clear-cut evidence of causality running in only one direction. In what follows we motivate including the current account as an independent variable, argue for the mechanisms in play, and suggest an expected sign for the coefficient.

As a starting point, the expected behaviour of the coefficient will vary depending on the trilemma regime in place. First, under closed capital accounts, a large surplus or deficit is not offset by a corresponding capital outflow or inflow.[208] Consequently, surpluses (deficits) will either increase (deplete) foreign reserves if the exchange rate is pegged or put downward (upward) pressure on the exchange rate if it is floating. Under fixed exchange rates and closed capital accounts as in Bretton Woods, surpluses in the current account should be sterilised by the central bank to

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[207] The discussion about the determinants of the exchange rate under the PPP and CIRP models is included in section 3.1.

[208] It is usual in the literature that deals with currency and banking crises in the post-Bretton Woods period, to assume a perfect negative correlation between the net current and capital accounts (Kaminsky & Reinhart, 1999; Bordo et al. 2001, among others).

avoid inflationary pressure, but as highlighted by Magud, Reinhart & Vesperoni (2014) this process is usually incomplete and leaves way for the bank-intermediation channel of those flows. However, if sterilisation were complete through the standard mechanism of open market operations (OMOs), interest rates may increase thus hindering domestic credit expansion. Additionally, increasing exports will produce larger cashflows for domestic firms which would mitigate their need for additional credit according to the pecking order theory.

Under flexible exchange rates and closed capital accounts, the effect of the net current account on domestic credit is uncertain. To exemplify, during an export boom that brings about a surplus in the current account, firms' income increases and their need for external funds decreases. However, the fall in the exchange rate may make those same firms less competitive internationally and thus more reliant on domestic credit to finance their operations.

When the capital account is open, and the exchange rate is fixed, a positive net current balance indicates a larger availability of foreign currency which, compounded with the stability of the peg may encourage investors to substitute domestic for foreign debt depending on the interest rate differential. Under open capital accounts and flexible exchange rate, the underlying assumption in footnote 208 operates and thus the effect of the current account and capital account should offset each other and only alter the level of the exchange rate. Consequently, as suggested in Section 1.3.3, there should be no effect of the current account on domestic credit.

The effect of net capital flows on domestic credit should only be statistically significant in the absence of capital controls. We expect that, under stable credit demand, as capitals are allowed to flow into a country, agents will be able to substitute domestic credit with foreign loans if conditions are more favourable. Consequently, positive capital flows into a country should have a negative and significant coefficient under trilemma regimes II and IV.

With regards to the global financial cycle, we expect that, since there is evidence of synchronisation across credit markets, the sign should be positive and statistically significant under all regimes. We argue that there are two possible channels for this joint movement across markets. On the one hand, there is a transmission of global financial conditions through the risk-aversion channel as tightening conditions can passthrough markets by altering investors' expectations. An important feature of this channel is that it can function correctly even under restricted international capital movements as was the case during the Bretton Woods period. On the other hand, growing international financial integration —as evidenced by increasing outstanding debt issues in foreign markets, issuance of debt obligations denominated in foreign currency, and the increasing share of foreign assets in domestic bank's balance sheets— may help explain this co-movement by linking the behavior of profitability, net worth, and leverage across financial systems.[209,210] Still, we expect the coefficients to be smaller for the global cycle in this chapter than in the case of stock markets discussed in Chapter 3.

With regards to the short-term interest rate differential, large positive values will imply that credit is cheap abroad and expensive domestically. However, we expect the coefficient to be significant only when the capital account is open since the switch from domestic to foreign creditors can only occur in the absence of capital controls. On the other hand, concerning the differential in inflation rates, we expect the coefficient to be negative and statistically significant under all regimes. However, the channels through which the relationship occurs should be

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[209] The Bank for International Settlements (BIS) publishes since August 1996, the BIS Quarterly Review (https://www.bis.org/quarterlyreviews/index.htm?m=5%7C25) in which they discuss the configuration and recent trends of the global financial system. The usual data that they feature includes cross-border claims between financial institutions, data on global debt securities markets, information on the global derivatives markets, global liquidity indicators, and statistics on credit to the private non-financial sector.

[210] An early example of growing links across financial systems is the advent of Eurodollar market described in Section 1.4.2 which allowed for dollar deposits to be created by commercial banks outside of the US or foreign branches of US banks. This may have allowed for the transmission of monetary conditions from the credit market in the US to credit markets abroad. However, the stronger co-movement across credit markets need not be driven by the US. The fact that European banks may issue debt in the US or that Japanese banks can finance themselves with funds from the European financial market are also examples of ways in which credit markets across countries become linked.

contingent on the regime in place. When the capital account is closed, a higher differential will compress the profit margin for companies, restrict their available cash flow to cover any additional obligations, and consequently translate into hindered domestic credit growth.[211] When the capital account is open, increasing inflation differentials may encourage investors to incur in debt from foreign creditors as they expect either domestic interest rates to increase or the domestic currency to depreciate to correct or account for the increasing differential. Table 33 presents a summary of our expected results by trilemma regime.

Table 33: Expected signs for the coefficients of trilemma variables

Regime	TR I: Fixed & closed	TR II: Fixed & open	TR III: Flexible & closed	TR IV: Flexible & open
Net current account	-	-	±	
Net capital account		-		-
Global financial cycle	+	+	+	+
Short term rate diferential (domestic-foreign)		-		-
Inflation differential (domestic-foreign)	-	-	-	-

Note: The table summarises the argument offered in this section. We only show the sign for the coefficients we expect to be statistically significant. In each title, the first adjective refers to the exchange rate regime and the second one to the capital account regime.

4.2.2. Financial Stability by Trilemma Regime

In the following subsections, we summarise the findings in the literature from Chapter 1 in what concerns the relationship between exchange rate and capital control regimes and financial stability. Since this is the first long-run study we know of that tries to establish a nexus between the macroeconomic trilemma and financial stability directly, these expected results are a piecemeal construction from different literatures. In that sense they are somewhat speculative in nature. For readability purposes, we include references as footnotes.

[211] Here it is important to recall that we are controlling for the money illusion effect by using lagged inflation as a control variable.

4.2.2.1. TR I: Fixed Exchange Rate and Closed Capital Account

Under this trilemma regime, credit booms occur with higher frequency because monetary policy is aimed at maintaining the peg rather than at curtailing the boom.[212] In that same direction, the implicit guarantee behind the peg may allow for the credit multiplier to be more significant than when the exchange rate is flexible.[213] However, while banking crises are less frequent, the cost, once they happen, seems to be higher given the slow adjustment speed brought upon the system by the fixed exchange rate.[214] Additionally, exchange rate fixity has been found to make bank lending more sensitive to the global financial cycle.[215] This regime, however, should be less volatile than those where capital accounts are open since in this case there is no credit coming into the economy from abroad. Consequently, the only form of expansion for a credit boom is through financial innovation and endogenous money creation.

4.2.2.2. TR II: Fixed Exchange Rate and Open Capital Account

As in the previous case, fixed exchange rates may foster booms both by the inattentiveness of monetary authorities and the strengthening of the credit multiplier. Similarly, crises although less frequent may be costlier. Additionally, under this regime, the stability of the exchange rate may translate into a bout of foreign borrowing as in the original sin hypothesis.[216] In this direction, it has been suggested that gross capital flows can also alter the financing conditions of banks and relax the credit constraint for agents in the economy.[217] The main issue is that capital account openness allows the boom-bust cycle to be ampler, as expansions are fueled by both endogenous domestic credit, and foreign lending and, credit crunches can be deepened by massive contemporaneous capital outflows.[218] Finally, under open capital accounts global financial

[212] Dell'Ariccia et al. (2013).
[213] Magud, Reinhart & Vesperoni (2014)
[214] Domac & Martinez (2003).
[215] Obstfled et al. (2018b)
[216] Bordo, Meissner & Stuckler (2010) and Claessens and Kose (2013)
[217] Dell'Ariccia et al. (2013), James & Shin (2014), and Borio (2016)
[218] Magud, Reinhart & Vesperoni (2014), Magud & Vesperoni (2015) and Boudias (2015).

conditions are more easily transmitted between countries through the global cycle.[219]

4.2.2.3. TR III: Flexible Exchange Rate and Closed Capital Account

In the surveyed literature, we found no studies that cover this trilemma regime and its relationship with domestic credit. Consequently, this is a piecemeal approach from the findings on flexible exchange rates and closed capital accounts. When exchange rates are flexible, and the capital account is closed, borrowers cannot incur in the original sin, and credit booms can only be financed by domestic sources, which should make them, *ceteris paribus*, less ample. Under this regime, we expect that the effect the of the global cycle is minimal as the transmission channel of capital flows is not in play. In summary, under this regime, we expect most of the sources of instability discussed in this section will be curtailed.

4.2.2.4. TR IV: Flexible Exchange Rate and Open Capital Account

Under flexible exchange rates, borrowers are less prone to fall into the original sin by borrowing abroad as currency depreciations may translate into debt overhang problems. Additionally, in the presence of open capital accounts, booms are less ample when the exchange rate is flexible.[220] In particular, under open capital accounts, countries with flexible exchange rate have consistently lower levels of credit to GDP than those with fixed exchange rates.[221] However, regardless of the exchange rate regime, open capital accounts are associated with more flexible lending standards across the board.[222] The effect of the global financial cycle is heightened by the openness of capital accounts regardless of the exchange rate regime, and consequently, we expect it will have an effect in amplifying the cycle.[223]

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[219] Rey (2015), Passari & Rey (2015), and Menna & Tobal (2018).
[220] Boudias (2015).
[221] Magud, Reinhart & Vesperoni (2014)
[222] James & Shin (2014)
[223] Rey (2015), Passari & Rey (2015), and Menna & Tobal (2018).

4.3. The Unconditional Model: Evidence of a Global Financial Cycle

As we showed in Table 30, the optimal specification we need to run should include time and country fixed effects. In Section 4.1.1 we argue further that instead of including 91 different dummy variables as in the traditional time fixed effects model, we would include the real credit LBBIs for the US as they proxy for the comovement across markets (see Table 31 and Annex 16) and this specification provides a more parsimonious specification (see Table 32).

In what follows we aim to identify if the use of OLS is appropriate. To do so we will test the error term in a first unconditional regression to confirm that it is homoscedastic, that there is no evidence of serial correlation, and that there is no pairwise contemporaneous correlation of the errors across countries. We will run a panel regression under an OLS specification where the dependent variables are the real credit LBBIs of the twelve countries, and the regressors are on the variables discussed throughout Section 4.1. In Annex 17, which is complementary to Annex 13, we present a battery of panel stationarity tests for the variables that have been included in this chapter. We find all series are panel-stationary and consequently discard any cointegration relationships. We do not include the LBBIs for the US real credit since stationarity has been shown through a battery of tests in the tables in Annex 6.

To confirm the validity of the OLS specification, we perform the modified Wald test for group-wise heteroskedasticity as in Greene (2017), Wooldridge's (2002) test for first-order autocorrelation in panel data, and Pesaran's (2004) test for the contemporaneous cross-correlation of error terms. Since the inflation rate and the ratio of credit to GDP are included with one lag in the model, we perform the autocorrelation test with all variables in a contemporaneous form and, alternatively, we include the two variables with a lag. We present results in Table 34.

Panel A of Table 34 shows that there is only evidence of heteroskedasticity for the long-run regression. For the short- and medium-run regressions we cannot reject the null hypothesis of homoskedasticity with P-values substantially away from the rejection area. Conversely, panels B1 and B2 show that there is substantial evidence of first-order autocorrelation in the error term regardless of whether we use the variables contemporaneously or with a lag. Finally, panel C indicates there is solid evidence of cross-correlation in the error across countries. Consequently, we will use the same PCSE method described in Chapter 3.

Table 34: Panel specification tests for structure in the residuals

Panel A: Modified Wald statistic for groupwise heteroskedasticity in fixed effect model (Greene, 2017)			
Statistic (chi 12 DoF)	11.39	13.06	80.68
Prob > CHI2	0.50	0.36	0.00
Conclusion	Homoskedastic	Homoskedastic	Heteroskedastic
Panel B1: Wooldridge (2002) test for autocorrelation in panel data (all variables contemporaneoulsy)			
Statistic (F 1,11)	13.88	215.82	187.40
Prob > F	0.00	0.00	0.00
Conclusion	Autocorrelation	Autocorrelation	Autocorrelation
Panel B2: Wooldridge (2002) test for autocorrelation in panel data (includes variables with a lag)			
Statistic (F 1,11)	7.91	387.46	434.82
Prob > F	0.02	0.00	0.00
Conclusion	Autocorrelation	Autocorrelation	Autocorrelation
Panel C: Test for cross-correlation of errors Pesaran (2004)			
Statistic N(0, sigma)	8.74	11.22	12.45
Prob > N	0.00	0.00	0.00
Conclusion	Cross-correlation	Cross-correlation	Cross-correlation

Note: Panel A shows the modified Wald test statistic for group-wise heteroskedasticity in the error under the null of homoskedasticity. Panel B1 and B2 show Wooldridge's (2002) test for autocorrelations in the errors in a panel data framework under the null that there is no first-order correlation. In the first panel all variables are included contemporaneously and in the second panel two variables are included with a lag as in the specification (inflation rate and domestic credit to the non-financial sector to GDP). Panel C contains the test for cross-correlation of errors as in Pesaran (2004) under the null of no cross-correlation between groups.

In Table 35 we present the results for the unconditional regression of the real credit LBBIs for the countries in the database on the covariates described in section 4.1.[224]

[224] To tend to the issue of collinearity, following Greene (2017) we calculated the condition numbers for the three sets of variables used in the regressions. We obtained the following

Table 35: Unconditional regressions for the real credit model

		Short-run	Medium-run	Long-run
Control variables	Constant	-0.0649	-0.021	-0.0435
	Trend	.0033***	.0046**	0.0036
	Loans to GDP (lag 1)	**-.5288*** **	**-.711*** **	**-.491** **
	Domestic inflation (lag 1)	**.56*** **	**-.2219* **	-0.0128
	% Change in real GDP per capita	**3.906*** **	**1.197** **	0.5375
	% Change in investment to GDP	**2.857*** **	0.9722	**1.82** **
	Change in Trade Openness	-0.0481	.722*	0.2444
	Change in Financial Development	**3.491*** **	**1.266*** **	**.6982* **
Variables of interest	Overall current balance to GDP	**-1.263** **	**-2.412*** **	**-2.028*** **
	Capital account to GDP	**-1.302*** **	**-1.244*** **	**-.7671** **
	Short term rate diferential (domestic-foreign)	**-.0192** **	-0.0121	0.0056
	Inflation differential (domestic-foreign)	**-.5595*** **	**-.5069*** **	**-.5884*** **
	Global cycle (US LBBI to time horizon)	**.1615*** **	**.1686*** **	**.1959*** **
	N	894	894	894
	R squared	0.244	0.1663	0.1258

Note: Dependent variables are short-run, medium-run and long-run real credit LBBIs. The regressions were run using Panel Corrected Standard Errors (PCSE). Statistically significant coefficients in bold. Significance: * 10%, ** 5%, *** 1%.

In stark contrast with the results for the unconditional stock market model in Table 19, control variables in the real credit model bear explanatory power on the evolution of the dependent variable. From a birds-eye perspective, the accumulated stock of debt proxied by loans to GDP has the expected sign as increasing amounts of debt would generally discourage future growth in credit. Similarly, the two measures that proxy for economic development, changes in real GDP per capita and change in investment to GDP also have a positive sign, and at least one of them is

values for the short, medium and long-run specifications: 2.830, 2.829, and 2.823. As a rule of thumb values above 20 should be worrisome as they indicate the presence of a single factor with large explanatory power over all explanatory variables which may be driving colinear relationships between them.

statistically significant in each specification. Finally, it is relevant to note that change in financial development, measured as broad money as a proportion of GDP, is always relevant, indicating that large financial systems can support higher credit growth and consequently more risk as anticipated by Beck (2012).

Regarding the trilemma variables, labelled variables of interest in the bottom half of the table, we find that in general terms they present the expected signs as indicated in Table 33. The only anomaly we find is that the short-term interest rate appears to be significant only in the short-run specification. In all remaining cases, coefficients are statistically significant with, at least, 95% confidence. Of interest is the positive relation between domestic real credit growth and the global financial cycled proxied by the real credit LBBIs for the United States. As expected, the coefficient is positive and significant although just a third of its counterpart in the stock market regressions.[225]

Finally, the goodness-of-fit measures indicate that our model can explain, at most, 24% of the variability in the short-run evolution of real credit.[226] The small values of the R^2 in our regressions are indicative of the complexities that underlie explaining such a phenomenon. Further research may be aimed at improving these measures by, for example, including a dynamic panel data (DPD) structure through the inclusion of the lagged dependent variable as a covariate.

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[225] It is important to recall that by construction, since LBBIs are expressed as standard deviations, a coefficient of 0.5 indicates that an increase of 1 standard deviation in the independent LBBI (the global cycle) is met with a 0.5 standard deviation increase in the dependent LBBI (real credit or stock market index for the countries in the database). Consequently, the dimension of the estimators is comparable across different regressions. Further research may be aimed at testing formally the differences in estimators across regressions.

[226] Usually, real credit regressions using large panels of countries and economically relevant variables reach values for the R^2 closer to 0.35 or 0.4. See for example results by Bordo & Meissner (2012) and Magud & Vesperoni (2015).

4.4. Empirical Results: Structural Breaks and Conditional Models

This section aims to test whether the findings in Table 35 are contingent on the trilemma regime in place, the type of phase, and the structure of the financial system. To do so, we perform Chow (1960) tests under five different hypothesis. First, we test whether there is a break in the coefficients when we break the sample into the four trilemma regimes. Second, we test for the presence of a break in the coefficients for expansions and contractions as defined in Chapter 3. Third, we jointly test for a break by trilemma regime and by expansions and contractions. Fourth, we test whether there is a break in the coefficients between bank-based and market-based systems as defined in Table 2 in the introduction. Finally, we test the joint hypothesis of a break by trilemma regime and between bank-based and market based-systems. In Table 36 we present the results for the Chow tests for these hypotheses where the null hypothesis is always for the equality of coefficients across groups.

We find that there is evidence of a structural break in the coefficients to every time horizon when we break the sample both jointly and separately into trilemma regimes and types of phase. The evidence is not as clear-cut when we break the sample by type of financial system, where we only find evidence of the break for the short and medium-run regressions. When we perform the tests to check for a joint break by structure of the financial system and trilemma regime, we find statistically significant breaks to all time horizons for the bank-based system and only for the short and medium-run for market-based systems.

Table 36: Chow test for structural breaks in coefficients by group

Hypothesis I: There is no break by trilemma regime						
Horizon	*Short*		*Medium*		*Long*	
Statistic	**6.68**		**6.64**		**3.93**	
P-value	**0.00**		**0.00**		**0.00**	
Hypothesis II: There is no break between expansions and contractions						
Horizon	*Short*		*Medium*		*Long*	
Statistic	**108.36**		**35.68**		**20.54**	
P-value	**0.00**		**0.00**		**0.00**	
Hypothesis III: There is no joint break between expansions and contractions by trilemma regime						
Phase	*Contractions*			*Expansions*		
Horizon	*Short*	*Medium*	*Long*	*Short**	*Medium**	*Long*
Statistic	**4.94**	**3.59**	**2.61**	**3.12**	**3.01**	**1.62**
P-value	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Hypothesis IV: There is no break between market based and bank based systems						
Horizon	*Short-run*		*Medium-run*		*Long-run*	
Statistic	**2.59**		**2.57**		0.62	
P-value	**0.00**		**0.00**		0.92	
Hypothesis V: There is no joint break between bank based and market-based systems by trilemma regime						
System	*Bank-based*			*Market-based*		
Horizon	*Short*	*Medium*	*Long*	*Short**	*Medium*	*Long*
Statistic	**3.04**	**2.55**	**1.86**	**1.73**	**1.33**	0.74
P-value	**0.00**	**0.00**	**0.00**	**0.00**	**0.07**	0.93

Note: Each panel contains a Chow test for structural breaks in the coefficient of the regressions in Table 35 by different groups. The null hypothesis is there is no break. Hypothesis I breaks the sample into four trilemma subsamples. Hypothesis II breaks the sample into two samples according to the phases. Hypothesis IV breaks the sample into two groups by bank-based or market-based financial systems. Hypothesis III combines the groups of hypotheses I and II. Hypothesis V combines the groups of Hypotheses I and IV. Significant statistics and P values in bold.

In what follows we present and discuss our empirical findings by trilemma regime. In this case, as in Section 3.4, the caveat about the validity of results for TR III applies as sample size remains small.

In the first four subsections, we include the coefficients and goodness of fit measures for the regressions by trilemma regime. To avoid making the text excessively cumbersome we include a reduced form version of the regressions by phase and regime in which we only present the sign and statistical significance of coefficients by phase and trilemma regime. In a final subsection, we discuss the results by the structure of the financial system. Although all regressions include the control variables discussed earlier, time trend, growth in real GDP per capita, change in investment to GDP, lagged inflation rate, lagged credit to GDP, change in trade openness, and change in financial development, we omit the discussion of the coefficients. For the interested reader, the tables with the complete results summarised in the next subsections are included in Annex 18.

4.4.1. TR I: Fixed Exchange Rates and Closed Capital Account

This regime, which historically coincides with the Bretton Woods period, as shown in Figure 7, is characterised by gaining monetary autonomy in exchange for curtailing international capital flows. Results for the short, medium and long-run LBBIs are presented in Table 37.

Table 37: Regressions for trilemma regime I

		Fixed FX Closed KA		
		Short	*Medium*	*Long*
Variables of interest	Overall current balance to GDP	**-3.283*** **	**-1.992***	**-1.855** **
	Capital account to GDP	-1.2670	-1.3140	-0.8483
	Short term rate diferential (domestic-foreign)	0.0223	0.0163	0.0038
	Inflation differential (domestic-foreign)	**-.529*** **	**-.4785*** **	**-.5521*** **
	Global cycle (US LBBI to time horizon)	**.2739*** **	**.1636** **	**.4453*** **
	N	284		
	R squared	0.3878	0.3275	0.3478

Note: Results from PCSE regressions with country fixed effects and control variables as in Table 35 (coefficients for control variables not shown). Significance: * 10%, ** 5%, *** 1%. Significant coefficients are highlighted in bold.

A first relevant finding in Table 37 is that, as expected since the capital account is closed during this regime, the coefficient for net capital flows to GDP is statistically insignificant. This indicates that under this regime it is possible to assume that capital controls were sufficiently well implemented and that credit from foreign sources was not a relevant source of finance for firms or households. This also motivates that the coefficient for the interest rate differential is insignificant. Since there is no access to credit from abroad, it is irrelevant whether it is cheap or expensive vis-à-vis domestic credit.

Concerning the results for the net current account, a first possibility we need to account for, as indicated in Section 4.2.1, is that of reverse causality. It is possible that increases in credit would finance growing imports which would, in turn, pressure the current account into a deficit. As we indicated in Section 1.4.2, before the achievement of currency convertibility in 1958 European and Commonwealth countries, which account for the lion's share of the database, aimed at keeping balanced external accounts due to the dollar glut that plagued the system. The paramount manifestation of this was the establishment of the EPU in 1950, which established a bilateral liquidation scheme for international trade between signatories. Consequently, it would have defeated the purpose that domestic credit fuelled an import bout as it would have put pressure on the already meagre foreign currency reserves.

The alternative would be that increases in export income would be sterilised by the central bank through an increase of the stock of reserves to avoid currency appreciation and protect the peg. As a consequence, to eliminate the inflationary impact OMOs would come into play, decreasing the price (increasing the returns) of bonds and thus raising the nominal interest rate which would, in turn, discourage credit. Regardless of the direction of causality, the sign is negative and statistically significant. Still, further research is needed to disentangle these effects.

Regarding the coefficients for the inflation differential, we find the expected negative sign. As inflation increases in the domestic economy, even under closed capital accounts, firms are forced to compress their profit margins to avoid increasing prices since this may produce a loss of their market share. With a decrease in margins, the free cash flow to invest wanes and so does the company's capacity to service any future additional debt. In this fashion, the demand for domestic credit may curtail in inflationary environments (Bose, 2002). From the supply side, the argument is that as inflation mounts, central banks have a motivation to tighten their monetary policy stance and increase the cost of credit to placate inflationary pressure. This mechanism would also produce the negative and statistically significant signs in Table 37.

Finally, regarding the global financial cycle, we find the expected positive signs to every time horizon. This is an indication that the co-movement across domestic credit markets is not only driven by an international capital flows argument but rather, that information flows may also alter investors' expectations and risk appetites in apparently disconnected markets.

With regards to financial stability, we break the sample in expansions and contractions and run separate regressions for each subsample. Table 38 presents a summary of results where only the signs of statistically significant coefficients (P value below 0.05) are indicated.

Table 38: Regressions by phase for trilemma regime I

Variable		**Fixed FX Closed KA**					
		Short		*Medium*		*Long*	
		Bear	*Bull*	*Bear*	*Bull*	*Bear*	*Bull*
Variables of interest	Overall current balance to GDP						
	Capital account to GDP	+ +				+ +	+ + +
	Short term rate diferential (domestic-foreign)	+ + +				+ +	
	Inflation differential (domestic-foreign)			- - -	- - -	- - -	- -
	Global cycle (US LBBI to time horizon)		+ +				+ + +
	N	83	84	111	101	118	103
	R squared	0.74	0.69	0.54	0.62	0.59	0.59

Note: The table contains summary results for the PCSE regression distinguishing between expansions and contractions. Only statistically significant coefficients are indicated by + (positive) or – (negative) signs. Significance: + +/- - 5%, + + + /- - - 1%.

A first finding from Table 38 is that, as was the case for the stock market regressions by phase for TR I in Section 3.4.1, the net current account loses statistical significance to every time horizon. This is an indication that while in the full sample regression the net current account might have been proxying for the effect of the structural break, once we account for it the significance of the variable disappears. This could happen, for example, if current account surpluses (deficits) consistently coincide with busts (booms), but the variability within deficits or surpluses is low.

Secondly, for the global financial cycle, we find evidence that synchronisation across domestic credit markets is most significant in expansionary phases. This result indicates that throughout Bretton Woods, during credit booms all domestic markets seem to go hand in hand, while credit crunches seem to be country-specific events. A possible explanation is that while optimism about the Golden Age of capitalism spread as economic conditions improved for most countries, it was only country-specific events that would cause temporary contractions in the credit indicator.

The results for the net capital account contradict the findings in Table 38 since there appears to be a role for capital flows in explaining short-run bear markets and long-run expansions and contractions. This effect could not be possible if the capital controls in place under this regime were fully enforced and, consequently, suggest that there may be some differences between our *de jure* measures and what was *de facto* happening in each economy. Furthermore, an interesting nuance to this finding is that the effect of foreign flows on credit seems to be persistent as it affects the long-run behaviour of expansions and contractions rather than just concentrating in the short-run as it would be in the case of speculative "hot" capital flows. A hypothesis that warrants further research is that, possibly, while capital controls were not fully efficient curtailing the entrance of foreign investors, they did minimise the short-run volatility of capital flows and thus we only see their long-run effect on the evolution of credit.[227]

When we run the regressions by subsample, the coefficient for the interest rate differential becomes positive and statistically significant for short and long-run bear phases. This suggests that, under closed capital

[227] The way in which foreign flows show up in the domestic credit variable is related to the bank intermediation channel described by Magud, Reinhart & Vesperoni (2014).

accounts, when the domestic interest rate increases (or the foreign rate decreases) contractions in domestic credit are shallower than when the interest rate differential decreases. This relationship, while counterintuitive in principle, makes sense when analysed jointly with the behaviour of the net capital account. As the domestic interest rate increases, investment in the domestic economy becomes more attractive for foreign investors who will mask their investment as current account operations to reap a profit. The foreign investment enters the domestic banking system and is then multiplied through the credit channel showing up as an increase in credit.

Finally, the inflation differential is the only variable whose coefficient does not change either in sign or significance once the sample is broken and thus our interpretation above holds.

4.4.2. TR II: Fixed Exchange Rates and Open Capital Account

Under this regime, countries sacrifice monetary autonomy in order to gain capital mobility. In Table 39 we offer the regression results.

Table 39: Regressions for trilemma regime II

		Fixed FX Open KA		
		Short	*Medium*	*Long*
Variables of interest	Overall current balance to GDP	-0.9693	**-2.292*****	**-3.207*****
	Capital account to GDP	**-1.089***	**-1.242****	**-3.386*****
	Short term rate diferential (domestic-foreign)	**-.0317*****	**-.0239***	-0.0166
	Inflation differential (domestic-foreign)	**-7.28*****	**-3.689*****	-1.2220
	Global cycle (US LBBI to time horizon)	**.1599*****	**.1062***	0.1572
	N	284		
	R squared	0.4184	0.3360	0.2089

Note: Results from PCSE regressions with country fixed effects and control variables as in Table 35 (coefficients for control variables not shown). Significance: * 10%, ** 5%, *** 1%. Significant coefficients are highlighted in bold.

As we indicated in Table 33, all the coefficients bear the expected sign and significance level. First, as argued when discussing the regressions under TR I, decreases in credit in the presence of surplus current account may be due to the sterilisation process of foreign currency or gold that flows into the domestic economy to avoid pressure on the peg.

Additionally, in this case, the absence of capital controls has made the coefficient for the net capital account negative and significant to every time horizon. This is expected since borrowers under this regime can access the foreign credit market. Consequently, assuming a constant total demand for credit, some investors will have an incentive to trade their domestic debt for obligations abroad. This shift may be further encouraged by the fixed exchange rate which mitigates the risk of cross-currency losses and fosters "original sin" lending as discussed in Section 4.2.

A similar dynamic is reflected by the negative and significant coefficient of the interest rate differential. As borrowing abroad becomes cheaper or domestic interest rates increase, borrowers have an incentive to shift their sources of funds outside the borders of the country.

Regarding inflation differential, we find the expected negative and statistically significant coefficient. The demand-side mechanism for the operation of this effect is the same as the one discussed for TRI: firms' cash flows decrease in their attempt to protect their market share, and consequently, their payment capacity and credit demand are curtailed. The supply-side argument provided for TR I does not work in this case since there is no autonomous monetary policy that may try to tackle the price level.

Finally, under this regime, we find evidence of synchronisation of the domestic credit markets only in the short and medium-run (99% and 90% confidence respectively). This decrease in synchronisation probably has to do with the domestic nature of our credit series. Since capital accounts are open and debtors can access foreign credit markets, it is possible that if there were synchronisation, it would be evidenced in a variable that tackled private debt from foreign creditors as we expect firms to shift their obligations abroad. This idea is consistent with the period we are covering since during the gold exchange standard the two main debt and credit markets, as discussed by Neal (2015) were the United States and the United Kingdom, with France being a close third. We do not expect households to search for loans abroad, but, during this period the credit series mostly covers firm lending with household borrowing becoming relevant only in the post-war period (Jordà et al., 2015).

In Table 40 we present a summary of the statistically significant coefficients in the regressions for the expansion and contraction subsamples. In these new regressions, we find that the net current account only seems to affect long-run bull markets, where a surplus of exports coincides with curtailed booms in credit.

Table 40: Regressions by phase for trilemma regime II

Variable		**Fixed FX Open KA**					
		Short		*Medium*		*Long*	
		Bear	*Bull*	*Bear*	*Bull*	*Bear*	*Bull*
Variables of interest	Overall current balance to GDP						- -
	Capital account to GDP	+ +				- - -	
	Short term rate diferential (domestic-foreign)	- -					
	Inflation differential (domestic-foreign)				- - -		- - -
	Global cycle (US LBBI to time horizon)				+ +		+ + +
	N	98	79	118	91	124	108
	R squared	0.69	0.70	0.52	0.64	0.48	0.54

Note: The table contains summary results for the PCSE regression distinguishing between expansions and contractions. Only statistically significant coefficients are indicated by + (positive) or – (negative) signs. Significance: + +/- - 5%, + + + /- - - 1%.

Results for the net capital account are noteworthy because they appear to curtail domestic credit contraction in the short-run but to accentuate them in the long-run. Probably as domestic investors see foreign agents coming into the economy, they suffer a catch-up effect and contract increasing volumes of domestic credit to enter into investment projects or purchase assets. However, as domestic credit sources become exhausted or too expensive, long-run investors shift their loans from domestic to foreign sources shielded by the stable exchange rate.[228]

Regarding interest rate differentials, they only seem to affect short-run credit contractions so that high domestic rates determine whether investors will acquire new debt obligations or roll-over previous debt in the local financial system only if interest rates are attractive. If the differential increases, there is an incentive to shift from domestic to foreign debt.

Both the coefficients for the inflation differential and the global cycle keep the signs they had under the full sample specification although they only have a significant effect on the medium and long-run expansions of domestic credit. On the one hand, according to our results, rising prices seem to curtail credit expansions but do not bear an effect on credit contractions, which suggests that while firms compress their profits and stall future investment and new issues of debt, they do not go so far as to deleverage. On the other hand, as discussed in the case of TR I the results for the global cycle indicate that synchronisation occurs in the context of credit expansion but that domestic credit contractions remain country-specific events.

4.4.3. TR III: Flexible Exchange Rates and Closed Capital Account

In our discussion of this regime, we need to bear in mind the usual caveat about the quality of our *de jure* measure for capital controls. Additionally, the sample is small for the full sample regression (only 45 observations), and it decreased even further as we ran the regressions by type of phase. Consequently, we do not present regressions for the subsamples and will be prudent in our analysis of results. Table 41 presents the results for the full sample regressions under this regime.

Regarding the results, first, we find that both the net capital account and the interest rate differential do not have an effect on the evolution of real credit under TR III. This is not surprising since under this

[228] It is important to note that a negative sign in the coefficient only speaks to the amount of domestic credit but says nothing about the overall level of investment in the economy (for which we control elsewhere) or about the level of asset prices, which we have discussed in Chapter 3.

regime capital accounts are closed. However, these results contrast starkly with those in Chapter 3 since, under this regime, the net capital account had a positive and statistically significant correlation with the evolution of the stock market.

Secondly, the coefficient for the net current account is positive and statistically significant to the short and medium-run horizons, which contrasts with our findings for the previous two regimes. This result is puzzling, but rather than suggesting possible alternative explanations we suggest that further research tends focuses on whether these results hold when the sample size is increased, and the capital control series are corrected to reflect better *de jure* measures implemented.

Regarding the global cycle, we find a positive and significant coefficient to every time horizon, in line with our discussion in Section 4.2.

Table 41: Regressions for trilemma regime III

		Flexible FX Closed KA		
		Short	*Medium*	*Long*
Variables of interest	Overall current balance to GDP	**13.48***	**12.89***	5.7950
	Capital account to GDP	2.4360	-2.6220	-5.8370
	Short term rate diferential (domestic-foreign)	0.0214	-0.0254	0.0002
	Inflation differential (domestic-foreign)	**-6.444***	-0.0577	**4.44**
	Global cycle (US LBBI to time horizon)	**.198***	**.2321***	**.3063***
	N	45		
	R squared	0.7749	0.6796	0.6063

Note: Results from PCSE regressions with country fixed effects and control variables as in Table 35 (coefficients for control variables not shown). Significance: * 10%, ** 5%, *** 1%. Significant coefficients are highlighted in bold.

Finally, under this regime, the differential in inflation has a negative coefficient in the short-run regression, but a positive coefficient in the long run regression and both are statistically significant with over 95% confidence. While the short-run coefficient falls in line with our expectations and the mechanisms we have discussed throughout this section, the long run coefficient results counterintuitive as we already include the lagged level of inflation to control for the money-illusion effect. We argue that analysing this result is challenging as it may be driven by Japanese data (30% of total observations) from the late 1970s to the early 1990s.[229] Further research should expand the database to verify if this result holds to increasing sample sizes.

4.4.4. TR IV: Flexible Exchange Rates and Open Capital Account

Under this regime, countries sacrifice exchange rate stability to obtain the benefits of an autonomous monetary policy and an open capital account. We present results for the full sample regression under this regime in Table 42.

Table 42: Regressions for trilemma regime IV

		Flexible FX Open KA		
		Short	*Medium*	*Long*
Variables of interest	Overall current balance to GDP	**3.047***	1.6160	-0.2582
	Capital account to GDP	1.9270	2.7660	5.0720
	Short term rate diferential (domestic-foreign)	0.0099	0.0036	-0.0203
	Inflation differential (domestic-foreign)	**-4.447*****	**-4.763*****	-1.7070
	Global cycle (US LBBI to time horizon)	0.0228	**.1729***	0.0675

N	141	141	141
R squared	0.4682	0.4501	0.4125

Note: Results from PCSE regressions with country fixed effects and control variables as in Table 35 (coefficients for control variables not shown). Significance: * 10%, ** 5%, *** 1%. Significant coefficients are highlighted in bold.

A first finding is that the only coefficients that are statistically significant beyond 95% confidence are those for the inflation differential under the short and medium-run specification. These negative coefficients coincide with our expectation and with the transmission mechanisms that we discussed throughout this section. What results puzzling is that the

[229] According to Acemoglu & Robinson (2012, Kindle version), "the Nobel Prize–winning economist Simon Kuznets once famously remarked that there were four sorts of countries: developed, underdeveloped, Japan, and Argentina".

coefficients for all other variables of interest are either statistically equal to zero or barely significant at all.

To confirm whether this is an issue related to the specification in the regressions, in Table 43 we present the results for the regressions when we break the sample further into expansions and contractions. In these more granular regressions, we find no role for the interest rate differential, which may be related to the convergence of interest rates in developed economies that has characterised the more recent period.[230] A similar argument can be made for the Great Moderation in inflation that has occurred since the mid-1980s as discussed in Section 1.4.4. As the interest rate and inflation differentials converge to zero, their variability decreases as well, making identification challenging.

Table 43: Regressions by phase for trilemma regime IV

Variable		**Flexible FX Open KA**					
		Short		*Medium*		*Long*	
		Bear	*Bull*	*Bear*	*Bull*	*Bear*	*Bull*
Variables of interest	Overall current balance to GDP		+ + +				- - -
	Capital account to GDP	+ +	+ + +				- - -
	Short term rate diferential (domestic-foreign)						
	Inflation differential (domestic-foreign)	+ + +					
	Global cycle (US LBBI to time horizon)			+ +	- - -		
	N	49	42	55	46	54	59
	R squared	0.84	0.85	0.51	0.91	0.61	0.80

Note: The table contains summary results for the PCSE regression distinguishing between expansions and contractions. Only statistically significant coefficients are indicated by + (positive) or – (negative) signs. Significance: + +/- - 5%, + + + /- - - 1%.

Regarding the net current and capital accounts, we find they have a positive correlation with short-run expansions and a negative correlation with long-run expansions in real credit. This suggests that large inflows of

[230] As an example, one of the Maastricht convergence criteria for the adoption of the euro, as discussed in Section 1.4.4, was that the long-term interest rate of any given country could not be over 2% above the average rate in the countries with lowest inflation in the eurozone.

foreign currency, either in the form of payments for exports or capital inflows increases domestic credit in the short-run probably through the bank intermediation channel as in Magud, Reinhart & Vesperoni (2014). In the long-run, however, as the flow of foreign currency towards the domestic economy persists, domestic credit starts shrinking. We expect that this occurs as firms substitute their debt denominated in domestic currency with foreign currency long-run debt. While it is true that under flexible exchange rate foreign borrowing may be discouraged initially, financial innovation has been the hallmark of the financial systems in developed economies since the 1980s. Ever growing derivatives markets may allow investors and borrowers to hedge this currency risks. This process may be fostered further by global financial integration as evidenced by increasing capital flows and the transnational nature of systemically important financial institutions (SIFIs) (Freixas et al., 2015).

A final issue we find in these regressions is the lack of explanatory power of the synchronisation across domestic debt markets. First, except for the medium-run specification, the coefficients are statistically insignificant. Second, as we delve in the results by phase, we find that the global cycle has a positive coefficient during contractions (making them deeper) and a negative coefficient during expansions (making them less intense).

A possible explanation for the general weakness of the results under this trilemma regime relates to the credit series we are using as a dependent variable. Since the deregulation wave of the late 1970s and 1980s financial integration has exploded and the openness of capital accounts has made it easier for firms to contract debt obligations outside of their domestic markets. Consequently, we suggest that further research should be oriented at broadening the definition of credit from a domestic perspective to include credit from foreign sources. Additionally, including credit from the shadow banking sector and from sophisticated financial assets may aid us in the task of identification.

4.4.5. Structure of the Financial System

The final structural break identified by the Chow (1960) test in Table 36 is between bank-based and market based financial systems. In Table 44 we present the results for the standard regression in this chapter when we break down the sample between countries with bank-based or market-based financial systems. In the table, we highlight in grey pairs of coefficients when they are statistically different from one another with 95% confidence.[231]

A first result is that in most cases when a coefficient is statistically significant (in bold), the sign coincides with our expectations as described in Table 33. The only exception is for the net capital account to GDP in bank-based systems, but since the coefficient is only significant with 90% confidence, we do not discuss it further.

Table 44: Regressions by structure of the financial system

Variable		Short-run		Medium-run		Long-run	
		Bank	*Market*	*Bank*	*Market*	*Bank*	*Market*
Variables of interest	Overall current balance to GDP	3.0150	-2.5960	-0.1613	**-3.159****	-0.7352	-1.7730
	Capital account to GDP	**3.162***	**-2.738***	1.6000	**-3.145*****	0.8981	-0.6181
	Short term rate diferential (domestic-foreign)	-.023*	-0.0024	-0.0160	0.0113	0.0014	0.0178
	Inflation differential (domestic-foreign)	**-.4659*****	**-6.195*****	**-.5172*****	**-3.168*****	**-.5622*****	**-1.356***
	Global cycle (US LBBI to time horizon)	**.1888*****	**.1407*****	**.2184*****	**.1427****	**.1855*****	**.253*****
	N	347	246	347	246	347	246
	R squared	0.2336	0.3865	0.1914	0.3579	0.1636	0.1949

Note: Results from PCSE regressions with country fixed effects and control variables as in Table 35 (coefficients for control variables not shown). Market-based systems include Australia, Canada and the United Kingdom. Bank-based systems include France, Germany, Italy, Japan, and the Netherlands. For further details refer to the introduction of this dissertation and Table 2. Significance: * 10%, ** 5%, *** 1%. Significant coefficients are highlighted in bold. When highlighted in grey, bank-based and market-based coefficients are statistically different from each other with 95% confidence.

The two main distinctions between the determinants of real credit LBBIs for bank-based and market-based economies can be found in the balance-of-payments (BoP) variables and in the size of the effect of the inflation differential. Regarding the inflation differential, the coefficient is significantly more negative for market-based systems than for bank-based

[231] We test this by comparing the 95% confidence intervals around each estimator. When they do not intersect we can state that the two coefficients are different from one another.

systems. This difference probably reflects that, on the one hand, the stock market reacts faster to changing expectations about inflation and the reaction of policymakers, and, on the other hand, equity markets are known to overreact to innovations in information (Chen, Roll & Ross, 1986; De Bondt & Thaler, 1985). This changes in expectations, although affecting the stock market first, will transfer to the rest of the economy through the risk-taking and asset-substitution channels discussed in 1.1.2.2, and may lead up to an effect on the domestic credit market.

Similarly, balance-of-payments variables such as the net current account or the net capital account only matter for market-based systems in the medium run, but they do not matter for bank-based systems under any specification.[232]

On the one hand, the result for the net current account is consistent with our hypothesis that the effect of current account surpluses or deficits affects the credit market through the behaviour of firms as debtors. In bank-based systems, where agents do not have a stable, frequent and generalised source of funding in the securities market, the behaviour of a subset of firms is unlikely to drive the behaviour of the stock of debt. Contrarily, in a market-based system, where the banking sector is less robust and not as diversified, the stock of debt may be more sensitive to innovations in the export sector. On the other hand, the result for the net capital account indicates that it is probably in market-based systems where the shift from the domestic to the foreign credit market happens first precisely because of the larger pool of resources that can be found abroad.

Further research may be aimed at confirming this hypothesis by including more countries in the database so that inference can produce more clear-cut results. Additionally, understanding and testing the mechanisms that operate differently in each of the systems, while

[232] We show in Annex 17, this effect is not persistent by trilemma regime. However, the small sample size of those regressions invites us to remain cautious about presenting the results in the corpus of the dissertation and are left in the annexes to tickle the interest of future researchers.

exceeding by far the scope of this research, appears as an interesting topic that may have consequential ramifications on policymaking.

4.5. Robustness Tests

To confirm the robustness of our results, we first control for the years where the Second World War took place and, as we did in Section 3.5, include a dummy that takes a value of 1 for the years 1939-46. In Annex 19 we present a table with the unconditional regressions presented in Section 4.3 and the dummy variable whose coefficients are statistically equal to zero in all cases, suggesting that the war did not cause a break in the level of the regressions.

A second event whose inclusion in the robustness tests is relevant has to do with the creation of the euro in 1999. Consequently, we will control both for a break in 1999 for all countries and for a break in the individual eurozone countries.[233] As a result, in Annex 19 we include two tests. In the first test, we run the unconditional regressions presented in Table 35 while including a post-1999 dummy variable that takes the value of 1 for every country-year observation starting in 1999 to test whether the implementation of the euro has some explanatory power on the evolution of real credit beyond the drivers for the exchange rate. We find this dummy to be statistically insignificant with 95% confidence for all specifications. In the second test, we include a eurozone dummy that takes the value of 1 for every country-year observation since 1999 if the country uses the euro as a currency. We then run the unconditional regressions as in the previous test. In no case is the dummy statistically significant, providing evidence that the inclusion of the euro is in no way driving the conclusions of this study.

A final issue we need to address is whether our results are robust if our sample begins after Bretton Woods. This question is relevant on three accounts. First, the composition of the credit variable since the end of Bretton Woods has shifted, with the share of mortgage lending increasing when compared to firm borrowing. Second, since the mid-1970s a long

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[233] The underlying argument for the inclusion of this test has been presented at length in Section 3.5.

wave of deregulation and financial innovation has washed over the IMFS, and this process may have changed the internal dynamics of credit growth. Finally, since most of the literature uses databases that begin between 1971 and 1973, and we wish our results to be comparable, we need to confirm that results for each of the trilemma regimes are not driven either by the interwar experience, the Second World War, or the Bretton Woods period.

The main caveat in the implementation of this test is the reduction in sample size, particularly for TR I and TR III. In Annex 19 we present the unconditional regression, as in Table 35, and the same set of complete regressions as in Annex 18. The only significant change from the full sample to the post-Bretton Woods sample is that in the regressions by trilemma regime the net current account loses all its statistical significance, while in the regressions by type of phase it becomes consistently relevant in explaining the behaviour of credit during contractions. This is a clear invitation for further research in the direction of including possible transformations of the current account variable, either as first differences or rates of growth, to test for a different functional relationship between variables.

4.6. Concluding Remarks and Further Research

In this chapter, we have discussed whether the determinants for the expansions and contractions in real credit for developed economies are contingent on the different trilemma regimes that have operated from 1922 until 2013. Our identification strategy was to test for structural breaks in the coefficients of the independent variables after slicing the database according to the exchange rate and capital control regimes that each country implemented. Furthermore, we tended to the issue of financial stability by contrasting whether these relationships were further driven by whether the market was expanding or contracting, and whether the countries' financial system was market-based or bank-based.

In constructing the econometric specification that adjusted best to our data, we found evidence that pointed toward the use of both country and time fixed effects. For the latter, we argue that instead of using year specific dummies, we would include a single variable, the real credit

LBBIs for the United States, as we showed that it covaries significantly with the common driver of the domestic credit markets for the twelve economies in our database. Our main argument in doing so is not that the US LBBIs are driving the phenomenon but instead that they are representative of the global financial cycle, the joint movement of credit across markets.

A first relevant finding, with regards to the global financial cycle, is that while there is evidence of co-movement between domestic credit markets, it is weaker than in the case for stock markets. This is consistent with findings by Jordà, Schularick, Taylor & Ward (2018). Additionally, we find that in the unconditional regression, the coefficient is positive and statistically significant to every time horizon. We posit two distinct mechanisms for this relationship to occur. On the one hand, when the capital account is open, we argue that the co-movement across domestic credit markets can be driven by international capital flows which, through the bank intermediation channel, alter the stock of domestic credit. On the other hand, when the capital account is closed, we expect that information flows may also alter investors' expectations and risk appetites across apparently disconnected and insulated domestic markets.

Once we break the sample by trilemma regime, we find our variable for the global financial cycle loses significance when the exchange rate is flexible, and the capital account is open. We argue that this is the case because that particular regime coincides with an era of financial globalisation, deregulation and innovation that began in the late 1970s. Consequently, it is difficult to observe synchronisation in domestic credit markets and it will be more easily identified if we can account for credit to all economic agents, in every available financial product, and from both domestic and foreign sources.

A relevant issue we faced in the construction of the econometric specification was the choice between implemented a sophisticated DSGE model that would allow us to find, in equilibrium, the determinants for credit growth, and turning to the literature to use variables that have been found to be critical drivers of the evolution of credit. We follow the latter approach since DSGE models usually fail in the inclusion of financial frictions or the modelling of the endogenous process of credit creation (Freixas et al., 2015). From our review we found that, in addition to the variables in Chapter 3, we needed to include the lagged level of credit as a proportion of GDP, the lagged rate of inflation, and the first difference of investment as a proportion of GDP to control for the overall leverage in the economy, the money illusion, and the change in the demand for credit by firms respectively. One of the windfalls of using the same variables of interest for Chapter 3 and Chapter 4, is that results are comparable, a feature we will exploit in the concluding remarks to this dissertation.

A second finding that arises from our specification is that we found structural breaks in the coefficients of the variables of interest associated with three different partitions of the sample. First, coefficients vary by trilemma regime; second, they vary depending on whether real credit is expanding or contracting and, finally, they change depending on whether the financial system is bank-based or market-based. We tackle each of these results in terms.

Under fixed exchange rates and closed capital accounts, we find that the net current account has the expected negative and significant coefficient. However, this significance disappears once the sample is broken by expansions and contractions, which indicates that the current account balance may be proxying for the direction of credit growth. This may happen if expansions (contractions) coincide with deficits (surpluses) but the variability within deficit and surpluses groups is not high. Since under this regime, the capital account is closed, both the interest rate differential and the net capital account have statistically insignificant coefficients indicating that capital controls may have been effectively implemented. However, once we break the sample into expansions and contractions we find that both variables have positive and significant correlation with short and long-run bear phases, nuancing our previous results and suggesting, in line with Grilli & Milesi-Ferreti (1995), that investors found loopholes to make capital account operations look like current account operations in order to circumvent capital controls. Furthermore, we find a negative relationship between the differential in inflation and credit growth and offer both supply and demand side mechanisms for this to happen. The former runs through monetary policy in attempting to control the price level, and the latter runs through a compression in corporate profits and free cash flows that hinders the possibility of contracting new debt obligations.

Under fixed exchange rates and open capital accounts, we find that the net current account keeps its negative and significant coefficient as in the previous regime. Conversely, however, as the current account is liberalised, both the net capital account and the interest rate differential feature a negative and statistically significant coefficient. In this case, we argue that increasing interest rate differentials encourage borrowers to shift their source of funds from the domestic economy to less expensive financial systems. This process can be fostered further by the stability of the exchange rate. As in the previous regime, the inflation differential remains negative and significant but, since monetary autonomy is curtailed under this regime, we only expect the demand side mechanism to come into play.

Under flexible exchange rates and closed capital accounts, we find that similarly to TR I, both the net capital account and the interest rate differential loose explanatory power, probably because of the influence of capital controls. This result contrasts with the case for stock markets, where the weakness of capital controls allowed for the two variables to have significant coefficients. However, due to sample size issues we are not able to break the sample further into expansions and contractions to contrast these findings. Another two results are puzzling. First, the net current account shows a positive and significant coefficient to the short and medium-run. Secondly, the differential in inflation rates has the expected negative coefficient for the short-run but a positive and significant coefficient for the long run. To confirm whether these results merit further exploration, future research should both broaden the database and revise the series of capital controls to approximate de jure measures.

Under flexible exchange rates and open capital accounts, our findings appear to be somewhat weak. We find no relationship between the balance-of-payments variables, the interest rate differential, or the global cycle with 95% confidence. The only negative and significant coefficients are those associated with the differential in inflation. Once we break the sample between expansions and contractions, we do find that BoP variables foster short-run booms and hinder long-run expansions. We argue that the overall tepidness of these results is because in the real credit series we are employing we are omitting elements of the IMFS that have become relevant since the late 1970s: loans from abroad, the role of the financial system as a debtor, and innovation of financial products.

Regarding the elasticity of trilemma regimes, understood as the ways in which they allow for the accumulation and unwinding of financial imbalances, we find that when the exchange rate is fixed, the global financial cycle seems to operate during credit expansions.[234] Conversely, during contractions, the coefficient is statistically insignificant. We interpret this result as an indication that booms occur synchronised across domestic credit markets, but contractions seem to be driven by country-specific events. Concerning the net current account, we find that once the capital account is open, it varies negatively with long-run booms. Contrarily, the net capital account appears as important regardless of the capital control regime, particularly as it affects short-run contractions and long-run expansions. Concerning the differentials, on the one hand, we find that interest rates are associated, either positively or negatively contingent on the regime, with short-run bear phases. On the other hand, we find that the differential in inflation rates has a consistently negative effect on credit growth across specifications and regimes. We suggest this is a relevant argument in favour of the price stability mandate that has been given to central banks all around the world.

The final result concerns the structure of the financial system. On the one hand, we find that there are differences in the coefficients for inflation differentials in the short and medium run specifications, where the coefficient is consistently more negative for market-based systems. We argue that this may happen because stock markets are known to react faster, and sometimes excessively, to innovations in information. This

[234] In this part of the conclusion we do not discuss results for TR III due to the low sample size which undermines our confidence in the results.

reaction will transfer from the stock market to the rest of the economy, including the domestic credit market, through the asset-substitution and risk-taking channels. On the other hand, we find that BoP variables only affect market-based economies in the medium-run specification while bank-based economies remain unaffected. We suggest that this may be related to the size of the credit market. Since market-based economies have smaller banking sectors relative to their stock markets, it is possible that changes in the expectations for export-oriented firms may more easily alter the stock of debt. On that same direction, since market-based economies have smaller pools of lendable resources than bank-based economies, relative to the size of the stock market, it is more likely that domestic firms will try to contract debt abroad where resources are more abundant and probably cheaper.

Further research is needed in three distinct directions. First, the credit series employed should be broadened to include credit from abroad to account for the more relevant trends of the IMFS since the end of Bretton Woods. This includes broadening the definition of borrowers to include the financial sector as part of the growth in global loans is interbank credit, including new financial products and innovations, and the role of the shadow banking sector. Moreover, it would be useful to separate credit by destination distinguishing between households and firms as the former may be less exposed to the trilemma regime in place. Furthermore, it would be useful to correct the series for capital controls to account for what was really happening in the different advanced economies. This will allow answering questions about their efficiency in stopping capital flows or at least in mitigating their volatility. In that same direction, a broadening of the database to include more bank-based and market-based systems will be useful in identifying whether the effect of the net current account is more prevalent in one system than the other.

Secondly, results about the role played by the net current account seem to be inconclusive. An alternative approach to the problem would include transformations of the net current account series such as first differences to identify whether the results presented in this chapter hold.

In third place, the issue of causality needs to be addressed through two possible channels. On the one hand, the use of different econometric techniques such as DPD or VAR models may serve to identify the causal mechanisms through which the trilemma regime may impinge on the evolution of credit. On the other hand, the use of case studies may serve to present at least circumstantial evidence the direction and mechanism of causation. While throughout this chapter we have made an effort to suggest possible channels of operation, offering clear-cut evidence of the way impulses run from the institutions to the credit market falls well beyond the scope of our project.

PART III: Time Series Evidence

Chapter 5. What Role do Trilemma and Domestic Policy Regimes Play in the Boom-Bust Cycle of the UK Stock Market (1922-2015)?

As part of the post-mortem for the Great Financial Crisis (GFC) (2007-8), research on the boom-bust cycle of asset prices and its implication for broader financial stability has grown exponentially. This strand of literature is motivated by the studies of Bernanke & Gertler (1999, 2001) who indicate that the evolution of asset prices has real effects on economic activity. Nevertheless, this finding is not new; rather it is the nod given by mainstream economists, to the works of economic historians such as Bagehot, Minsky or Kindleberger. Most of these studies focus either on the joint evolution of equity and housing markets or solely on the latter which is to be expected as research agendas usually veer towards more impactful events. The GFC passes the litmus test of pertinence with flying colours. [235]

Regarding historical accounts of boom-bust cycles in asset prices, Borio & Lowe (2002) find that prevalence is given to housing prices, while mainstream macroeconomics focuses mostly on equity prices. Consequently, a historical analysis of bull and bear phases in stock markets may serve to bridge the gap between the two kinds of literature.

Additionally, stock markets are interesting as stand-alone objects of study because of their high liquidity, particularly in market-based developed financial systems (Levine, 2002). This characteristic allows them to quickly reflect changes in impending economic conditions and agents' expectations (Chen et al., 1986). In that sense, they offer researchers more variability than housing or commercial property prices (Borio & Lowe, 2002).

Moreover, available studies on the long run history of bull and bear stock markets arrive at insights that further motivate them as an exciting

[235] Relevant works on joint equity and housing price booms are, among others, Bordo & Jeanne (2002), Borio & Lowe (2002, 2004), Helbling & Terrones (2003), Borio & White (2004), Kindleberger & Aliber (2005), Adalid & Detken (2007), Borio & Drehman (2009), Fatas et al. (2009) Claessens & Kose (2013), Bordo & Landon-Lane (2013), Freixas, Laeven & Valencia (2015), Jorda, Schularick & Taylor (2015). A few works focusing on housing markets include Taylor (2007), Agnello & Schuknecht (2011), Crowe et al. (2013), Lambertini et al. (2013), Turk (2015).

subject. Kindleberger & Aliber (2005) note that stock prices vary inversely with a firm's cost of capital. Consequently, during a boom period, the reduction of the cost of equity leads to a broadening of the profitable investment opportunity set, and thus to increased investment while busts lead to debt overhang, reduced profits and may impact the financial sector via loan defaults. Mishkin & White (2002) argue that if a crash affects ex-ante weak balance-sheets, then adverse selection issues ensue in the creditor-borrower relationship, while if the weakness occurs ex-post, topics such as moral hazard and reluctance to liquidate become more relevant. Helbling & Terrones (2003) find that stock market bubbles are more frequent albeit less impactful than housing bubbles. However, about half the stock market crashes in their database are associated with economy-wide recessions. These results are in line with findings by Barro & Ursúa (2017). Claessens et al. (2013) find that market-based financial systems suffer more substantial output losses in the face of equity price crashes than under similar events in housing markets.

Although the literature on drivers of stock returns is immense, some relevant findings from studies on the determinants of stock market movements in the long-run are of interest. From a theoretical perspective, we follow Stuart (2017), who uses Gordon's dividend discount model to indicate that variations in stock market prices are a function of the risk-free rate, the risk premium, and the growth rate of dividends. Concurrently, Assenmacher-Wesche & Gerlach (2010) highlight the possibility of using the changes in the dividend yield as indications of the presence of bubbles. Greenwald et al., (2015), found that 75 per cent of the quarterly variation of US stock returns since 1952 can be explained by risk aversion shocks. Finally, Bordo & Wheelock (2009) in a study for ten developed stock markets between 1924 and 2000, find that booms arise during periods of above-average growth and below average inflation, moving procyclically with the business cycle. They indicate that busts usually happen after a period of rising inflation, monetary policy tightening and tend to be followed by declining economic activity. They conclude by suggesting that the evolution of asset prices is likely to be influenced by both international and domestic economic policies and that their interaction should be taken into account in further studies. Borio (2014b) concurs with this result by indicating that the duration and amplitude of the financial cycle depend on the different policy regimes in place.

Following their advice, this chapter investigates the evolution of the boom-bust cycle in the UK stock market under different international and domestic economic policy regimes. In that sense, our period of choice (1922-2015) is pertinent as it allows us to encompass international regimes since the gold exchange standard until the post-Bretton Woods period, and domestic policy regimes that begin with the minimum balanced budget rule (MBBR) and run until the current inflation targeting scheme (Middleton, 2014).

Moreover, the British stock market is of interest for several reasons. First, Van Nieuwerburgh et al. (2006) highlight the relevance of a well-functioning stock market both in the expansion of the industrial revolution since the mid-eighteenth century and for finance-led growth in Britain. Moreover, London became the foremost financial centre during the nineteenth century since it aided in the financing of railway companies among other endeavours that transformed the British economy (Campbell et al., 2018). However, our study begins at the time that New York was about to surpass London as the wealthiest stock market in the world. According to Campbell et al., (2017) while in 1925 the London Stock Exchange (LSE) had a market capitalisation of 5.3 billion pounds spread across over 2,381 stocks, the New York Stock Exchange (NYSE) was a close second with a market capitalisation of 4.7 billion pounds and 548 listed stocks. Additionally, since the end of World War I, equity issues in the LSE increased until they became the financing vehicle of choice for firms, surpassing debentures by the 1950s (Chambers, 2009). This occurred in a scenario where the "weakly protected, retail investor, bond-centric world of pre-1913 was giving way to the more tightly regulated, institutional investor, equity-centric financial system characteristic of the second half of the twentieth century" (Chambers, 2010, p.51).

Finally, recent research has brought to the fore an apparent puzzle about the drivers of the UK stock market during this period. On the one hand, Campbell et al. (2018), "find that economic fundamentals, such as dividends, interest rates, exchange rates, gold prices, and wheat prices, explain (…) up to 34 per cent of monthly movement" in the LSE during the nineteenth century (p. 157). They list, among other culprits, wars, revolutions, monetary policy, railway sector news, and financial crises. In another study about integration between the LSE and the NYSE from 1825 until 1925, Campbell & Rogers (2017) find little evidence of co-movement between the two markets. They indicate that 'the existence of the gold standard and almost instantaneous communication did not lead to highly integrated markets' (p. 1214). This contradicts previous findings by Goetzmann et al. (2005) and Obstfeld & Taylor (2004) who find that financial markets were highly integrated by the end of the nineteenth century.

On the other hand, Miranda-Agrippino & Rey (2015) built a database that spans the period 1990-2012 and contains a cross-section with prices for 858 risky assets spread worldwide. They find that a single global factor explains up to 25% of the variance-covariance matrix of risky returns. Moreover, Rey (2015), finds that the correlation between the global factor and the VIX index of risk aversion is negative and significant, indicating that as risk aversion and realised risk decrease, asset prices around the world increase. Finally, Passari & Rey (2015), find that correlations between the global cycle and stock markets do not seem to vary systematically with the exchange rate regime.

These conflicting pieces of evidence beg two different and related questions that will drive the rest of this chapter. First, following Bordo & Wheelock (2009), we tend to the issue of whether the evolution of the boom-bust cycle in the stock market is contingent on domestic and international economic policies. Second, we test whether the co-movement between the stock market and the global cycle has a time-varying nature that depends on these same policy stances. Since Obstfeld & Taylor (2004) have shown that the level of integration in international markets follows a U-shaped pattern with peaks during the classical gold standard and in the current post-Bretton Woods period, we will account for the effect of the global factor on the UK stock market during different international and domestic policy regimes.

We find that expansions and contractions are symmetrical and that only medium-run amplitude seems to vary across international economic policy regimes. We provide evidence for the global financial cycle as a driver of the UK stock market and show that such a relationship changes in time. Furthermore, we argue that the agreed-upon story about international capital integration following a U-shaped pattern with peaks during the gold standard and the present-day regime is consistent with our findings using a short-run indicator. We nuance this narrative in two ways. From a medium-run perspective, integration stagnated since the fall of Bretton Woods. The long-run story shows peaks in integration during the Second World War and the 1970s, probably driven by global financial conditions. Finally, we find that the interaction between domestic and international policy regimes seems to matter only for the long-run behaviour of the cycle, while the macroeconomic trilemma sufficiently explains short and medium-run changes.

The rest of this chapter is structured as follows. Section 5.1 characterises the different international and domestic economic policy regimes in the UK. Section 5.2 identifies and describes bull and bear phases in stock prices and tests for differences in duration, amplitude, and severity of bull and bear phases contingent on the institutional setting. Section 5.3 explores the time-varying nature of the co-movement of the UK stock market and a global cycle. Section 5.4 highlights our contributions and offers concluding remarks.

5.1. Characterising the Regimes

This section presents a streamlined characterisation of the international and domestic economic policies in the UK since the end of the First World War. A caveat to the following description is that the distinction between the two types of regimes is a useful theoretical construct and not an empirical reality. From a macroeconomic perspective, they are both intertwined and must bear some internal consistency. We will tend to this interaction in the econometric specification presented in section 5.3.

To portray the evolution of international economic policy, we will use the framework of the impossible trinity first presented formally in Obstfeld & Taylor (1997). This macroeconomic trilemma shows that fixed exchange rates, open capital accounts and independent monetary policies are incompatible, and thus policymakers are forced to choose two out of the three desirable goals (Obstfeld, Shambaugh & Taylor, 2005). Bordo & James (2015) show that rarely a country will choose one of the corners (the pure trilemma solutions), and instead will try to locate somewhere between the corner positions. Moreover, Aizenman, Chinn & Ito (2010, 2013) find that this framework is not only a theoretical construction but a tie that binds both developed and developing economies since the end of the Second World War. Obstfeld, Shambaugh & Taylor (2004) find similar results for the interwar period. In what remains of the chapter we will refer to the different ways in which countries resolve this impossible trinity as a trilemma regime.

Following the usual portrayal in the literature, we will define five broad trilemma regimes for the UK: gold exchange standard (1925-38) (GES), pre-convertible Bretton Woods (1944-58) (PCBW), convertible Bretton Woods (1959-71) (CBW), inflationary post-Bretton Woods (1972-82), and the Great Moderation (1983-2015).[236]

The prevailing view of the gold exchange standard in Britain dates it between April 1925 and September 1931, after a period of floating exchange rates that began in 1914 (Bordo & Schwartz, 1999). This was the period where, following the recommendations of the Genoa Conference in 1922, convertibility to gold was established under the condition that reserves could be held either in gold or convertible currencies such as US dollars or UK pounds (Kindleberger & Aliber, 2005). From the perspective of the trilemma, fixed exchange rates allowed for free capital flows and independent monetary policy during the period. However, the exchange rate was set at an overvalued pre-war parity of $4.86 per pound to return to the *antebellum* order (Bordo & Schwartz, 1999). This caused the UK to

[236] In this periodisation we follow the works of Bordo & Schwartz (1999), Obstfeld & Taylor (2004), Obstfeld, Shambaugh & Taylor (2005), Fatas et al. (2009), Urban & Straumann (2012), and Neal (2015).

suffer from anaemic growth, significant gold outflows and modest real stock price increases (Bordo & Wheelock, 2009).

During the interwar period, the frequency of crises reached an all-time high, with the Great depression of 1929-33 playing the leading role (Taylor, 2013). Weary economic conditions and constant capital outflows forced Britain out of the gold standard in 1931. Another consequence was the return to protectionism in 1931-2 when the government implemented a new tariff system aimed at protecting British industrial recovery (Middleton, 2014). According to Bordo & Wheelock (2009), British economic and stock market growth resumed in mid-1932 and found headwinds with the increase in defence spending before the Second World War. This expenditure, according to Eichengreen (1996) would have been impossible under the fetters imposed by the gold exchange standard.

Urban & Straumann (2012) convincingly challenge this view on three different fronts. First, they find that following a methodology like Shambaugh (2004) for identifying de facto exchange rate regimes, Britain was pegged to gold uninterruptedly from 1930 until 1939, even in the absence of convertibility. 'They had broken their golden fetters to devalue their currencies, not to abandon the gold standard altogether' (Urban & Straumann, 2012, p. 22). Second, they indicate that the capital controls imposed in 1931 were mild when compared to those in Germany or Japan. In supporting this view, Britain kept commercial ties and trade with the whole Commonwealth under the figure of imperial preference (Eichengreen & Sussman, 2000). Third, they indicate that the rearmament programme was consistent with gold standard rules as in 1938 defence expenditure represented only 7 per cent of GDP. At the time, the current account deficit increased in only £8 million (to £55 million). Concurrently, the UK's reserves during 1937 were almost six times those in 1931 while notes in circulation increased only threefold in the same period. Given these arguments, we date the end of the gold exchange standard trilemma regime in 1938 just before the imbalances caused by the Second World War came into play. We will test the robustness of our results to the prevailing view throughout the chapter.

According to Roberts (2013), the post-war period was characterised by an attempt to foster trade through stable exchange rates. In that sense, the pact signed between 44 nations in July of 1944 at Bretton Woods, New Hampshire was a critical development. The agreement proposed a system of fixed but adjustable exchange rates between member nations, while the US kept the price of gold at $35 an ounce, as it had since 1934 (Eichengreen and Sussman, 2000; Neal, 2015). In 1946 the IMF was created to aid countries with balance of payments imbalances, and in 1947 the General Agreement on Tariffs and Trade (GATT) was established to foster commerce under a set of standard rules (Roberts, 2013). Cendejas et al. (2017), find that the post-war period sees convergence across Western European and Anglo-Saxon economies coinciding with the organisations mentioned above as well as the Marshall Plan (1948-52) and the Treaty of Rome (1957). During this period, the evolution of labour parties and the stronger demands from workers in democratic countries forced policymakers to aim at keeping monetary policy autonomy to tend to domestic issues (Eichengreen, 2008). Consequently, from the perspective of the trilemma, the way to achieve these competing objectives was to curtail free capital flows via 'exchange controls' (OECD, 1993). Taylor (2013) confirms this and characterises the period as the one with the most restrictive era for capital flows.

The Bretton Woods system went through a phase of inconvertible currencies (1944-57) and a convertible period (1958-71). The first one was characterised by a shortage of US dollars in the international monetary system. Hindered dollar reserves led to restrictions on current account transactions and bilateral, rather than multilateral, trade agreements (Bordo & Schwartz, 1999; Eichengreen & Sussman, 2000). The funds from the Marshall Plan (1948-52), the British devaluation of the pound by 30% in 1949, and the establishment of the European Payments Union in 1950 went a long way to solve the dollar glut, and full convertibility was achieved in 1958 (Neal, 2015).

For Britain, the convertible phase of Bretton Woods was one where capital controls remained of the utmost importance to guard dollar reserves (Eichengreen & Sussman, 2000). This is evidenced by the fact that the UK temporarily derogated the OECD codes of liberalisation of capital movements proposed in 1961 from 1966-71 (OECD, 1993). The main arguments to do this were the issues related to both balance-of-payments and exchange rates that led to a second one-time devaluation of the pound in November 1967 (Roberts, 2013). As the period progressed, capital controls became more permeable as investors found loopholes, like over-invoicing and leads-and-lags, to make capital investment pass for current account transactions (Borio, James & Shin, 2014).

The fall of Bretton Woods was precipitated by monetary expansion and war-time fiscal deficit in the US coupled with high interest rates in Germany which made investors expect a revaluation of the mark and hence increased the flow of funds from the US to Europe (Kindleberger & Aliber, 2005). On 15 August 1971, President Nixon took three measures. First, he suspended convertibility causing the dollar to become a fiat currency with the stroke of a pen (Neal, 2015). The other two measures were wage and price freezes and the implementation of an import surcharge to avoid the bleeding of reserves (Roberts, 2013). These measures inaugurated a period of floating exchange rates and fiat currencies that lasts until today.

As mentioned above, the present period can be broken down into a period of high inflation (1971-1982) and a period of low inflation, also deemed the 'Great Moderation' (Bordo & Schwartz, 1999; Fatas et al., 2009). From the perspective of the trilemma, under the current paradigm, policymakers have sacrificed the stability in exchange rates to reap the benefits of capital flows and independent monetary policies. The absence of a nominal anchor to the currency, the oil shocks in 1973 and 1979 and the budget deficits to tackle unemployment induced a global inflationary process (Eichengreen & Sussman, 2000). Since Britain chose not to participate in the European Monetary System, inflation led to an overvalued currency, and under this scenario of uncertainty, investors shifted their investments towards Germany. Massive interventions by the Bank of England did nothing to solve the issue, and in 1976, the IMF offered a £2.3 billion loan to the UK. However, Britain never used it because of the clauses of conditionality that came attached to its disbursement (Neal, 2015). The fight against inflation took a turn for the better in the watershed year of 1979. Paul Volcker, at the Federal Reserve, went to great lengths, targeting monetary aggregates to reduce the growth in consumer prices to reasonable levels. A third oil shock, where prices halved in 1985, favoured, even more, the reduction of worldwide inflation.[237]

To end our discussion of this period, in 1979 Britain eliminated all capital controls which, as suggested by Bellringer & Michie (2014), exposed the City to international competition for investments. Quinn & Inclan (1997) indicate that this liberalisation measure was fostered by a context of favourable economic growth that reduced the needs and demands for protection by the industry.

The period from 1982 until the present day has been characterised by moderated inflation compounded with international financial crises that have spanned Latin America (1980s), Asia and the emerging markets (1990s), and the North Atlantic (2000s). Kindleberger and Aliber (2005) suggest that this process has been aided by a mix of capital flows and deregulation. Concurrently, Aizenman, Chinn, and Ito (2008) find that financial openness in industrialised countries has increased dramatically since the 1990s. Even if from the perspective of the trilemma both periods (1971-82 and 1983-2015) are similar, changes in inflation and the advent of deregulation may render them incomparable.

In terms of domestic economic policy regimes we follow Middleton (2014) who identifies four main periods: 1) a period of stable *laissez-faire* from 1870 until the First World War; 2) a period of initial demand management followed by strong dirigisme, from 1922 until the post-war reconstruction; 3) a period of 'big government' and crystallized economic management that coincides with the Golden Age from 1950 until 1973; and 4) the current period, characterized by a more neo-liberal agenda in a context of renewed globalization. This broad characterisation has the issue

[237] For a detailed view of the pass-through from oil prices to inflation see Segal (2011).

that it roughly coincides with the trilemma regimes discussed above and thus will make identification difficult.[238]

Thus, we have chosen to exploit the broad literature on the variability in the evolution of UK economic policy and management to break down the period in a more granular way: an era characterized by the Minimal Balanced Budget Rule (1922-38) (MBBR); a period of war-time demand management (1939-50) (WDM); the period of Stop-Go policy (1951-65) (SGP); a phase of expanded Keynesianism (1966-78) (KePl); the Thatcher-Monetarist era (1979-92) (ThM); and the current inflation targeting consensus (1993-2015) (IT).

Since the mid-nineteenth century, the classic liberal economic policy that in Britain was focused on three pillars: the gold standard, the minimal balanced budget rule (MBBR), and free trade. The underlying idea behind the MBBR is to keep a small state, internal and external balance and allow market forces to operate. Extending this period until 1938 wishes to convey that this was the model to which policymakers wanted to return after WWI and explains their assistance in returning to the gold standard at pre-war parity as soon as possible (Checkland, 1983). Additionally, it was a period where international political an economic cooperation was essential as highlighted by institutions and accords such as the Bank for International or the British Economic Conference of 1932 (Cendejas et al., 2017)

With the advent of the Second World War, Britain entered an era of war-time demand management (WDM) and industrial protectionism. The elements of demand management were in place not to foster employment but to avoid excess demand in the face of rearmament. Investment in war-focused sectors such as heavy industry was undertaken at the expense of agriculture and light industry (Cendejas et al., 2017). As fiscal leverage and unemployment policies were implemented, the government came to have a stabilisation function. During the war, economic controls resurfaced: demand was rationed, while labour, capital and product

[238] The literature on British economic policy during the twentieth century is abundant. Relevant long-run studies are, for example, Crafts & Woodward (1991), Bean & Crafts (1996), Card, Blundell & Freeman (2004), and Floud, Humphries & Johnson (2014),

markets were subject to direct controls (Middleton, 2014). In the middle of this period, we find the 1944 White Paper on Employment Policy which has been the traditional milestone for the beginning of Keynesianism (Booth, 1983). However, research has found that deficit-finance did not become popular until the early 1950s because there was fear that expenditure would explode once the fiscal discipline imposed by a balanced budget was relaxed (Middleton, 1989).

After the end of the war, during the inconvertible phase of Bretton Woods, the main issues were maintaining the stability of the pound in international currency markets and facilitating the government's debt rollover process by re-establishing the City as a major financial centre (Scott & Walker, 2017). Another relevant talking point was the low rate of economic growth relative to other developed countries (Allen, 2016).[239] A financial approach to tackle these issues was to implement quantity restrictions on credit to increase the available funds for public debt rollovers and reduce credit-driven import growth that would hurt balance-of-payments equilibrium (Offer, 2017). From a macroeconomic perspective, whenever growth accelerated, and unemployment decreased, prices and wages increase leading to balance-of-payments deficits as retailers would shift their sales from foreign to domestic markets (Middleton, 1989). Since according to Scott & Walker (2017) the Conservatives had won the 1951 elections by promising an end to the rationing, their tools to prevent foreign account imbalances were reducing expenditure and increasing taxes to curtail aggregate demand and economic growth (stop phase). As the economy cooled down and the balance of payments returned to equilibrium, domestic pressure for stronger growth and higher employment would increase thus causing a reversion in the process via lower taxes and expanded government expenditure (go phase) (Middleton, 1989, 2014).

Regarding policies, since 1952, some of the go-to measures were hire-purchase restrictions and purchase taxes that would increase the

[239] An extensive literature on this subject is available. Relevant references are Broadberry & Crafts (1996), Broadberry & Crafts (2003), and Crafts (2012). A long-run international comparison is Broadberry & O'Mahony (2007).

upfront price on credit purchases (Scott & Walker, 2017). The Conservative's actions did not seem to work, and the Labor government of Harold Wilson's (1964-70) inherited a balance of payments deficit close to £800 million. The dire situation led him to impose a 15 per cent import surcharge on all imports. While the measure was deemed useless and lifted in November 1966, Roberts (2013) finds that it did aid in the improvement of the external deficit.

Subsequently, during the expanded Keynesianism or Keynesianism plus (KePl) period the trade-off faced by policymakers was one between low unemployment and price stability. This period is characterised by the mounting dissatisfaction with the stop-go policies of the previous period and the looming inflation pressures after the oil shock of 1973. Consequently, this is a phase of economic experimentation which included enhanced demand management, incomes policy, and strategic planning (Pemberton, 2000). Both the Heath and Labor governments implemented monetary and fiscal latitude that led to increases in inflation which peaked at 25 per cent in 1975 (Minford, 2015). Bordo & Landon-Lane (2009) indicate that the passage of the Competition and Credit Control (CCC) Bill in 1971 which liberalised the financial system and ended the price-setting bank cartel, increased M4 and propelled credit, housing and equity booms. In 1973, the Heath government had to reign back credit, but it was too-little-too-late, and the effects of the first oil shock pushed the banks that had financed the housing boom close to bankruptcy. It was at that time that the Bank of England rescued the financial system through a 'lifeboat' operation (Offer, 2017).

By the end of the decade, the situation was ominous. The excessive inflation of the 1970s and the failure to honour the post-war agreement of growth and employment led to a resurgence of conservatism that materialised with the ascent of Margaret Thatcher to the government. This period is characterised by a systematic reduction both in government size and the scope of its intervention (Middleton, 2014).[240] In her first year in office, Thatcher got a windfall as oil deposits were found in the North Sea.

[240] Further references for this period are Allsopp, Jenkinson & Morris (1991) and Crafts (1991).

This additional income stabilised the pound and allowed for the elimination of credit restrictions (Offer, 2017). The rest of the Thatcher revolution included tax cuts on capital income, widespread deregulation of industries and a monetary policy *á la* Volcker, designed to bring inflation back from the wilderness (Bordo & Landon-Lane, 2009). Even if by 1983 the economy was thriving, an unintended consequence was increasing unemployment (Minford, 2015).

In 1983 an agreement was struck between the government and the LSE to eliminate fixed commissions for trades at the latest three years in the future. This, according to Bellringer and Michie (2014) was the *causa proxima* for the 'Big Bang' of 1986. On 27 October 1986, the trading system changed from a floor-based to a screen-based trading system linking market makers in different bank offices. Concurring with these two events, the existence of common-law courts, supervision of the markets by the Bank of England and an environment of open competition favoured that the City becoming arguably the most significant financial centre in the world (Minford, 2015).

However, according to Bellringer & Michie (2014), the policies of this monetarist period offered mixed results: while there were gains in productivity and competitiveness, major industries were destroyed, and unemployment increased in some geographical regions. By the end of the Thatcher government (November 1990) the economy had slid in what would be the most prolonged recession since the Great Depression (1990-93) (Minford, 2015). During this period the UK entered the Exchange Rate Mechanism within the European Monetary System in 1990 but was forced to leave in 1992 after a severe speculative attack against the pound sterling and other currencies. This caused the ERM to enter a crisis (Eichengreen, 2008).[241]

The final period in our characterisation of domestic economic policy is the current inflation targeting (IT) regime. Mishkin (2008) identifies five components of an IT regime. First, public announcements of a medium-run target for inflation. Second, price stability as the primary

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[241] A comprehensive presentation of the evolution of the ERM crisis is available in Buiter, Corsetti & Pesenti (2001)

mandate for monetary policy. Third, data-driven use of policy instruments. Fourth, a transparent policy-making strategy. Finally, accountability for the central bank in meeting inflation goals. Rose (2007) highlights that the IT regime is different from the previous periods as there is no required coordination between countries, there is no role for a centre country, the IMF or gold. Freixas et al. (2015), contradict these arguments and indicate that after the GFC there is a role for both international coordination and agreement between monetary and macroprudential authorities in preventing inflation and fostering financial stability at the same time.

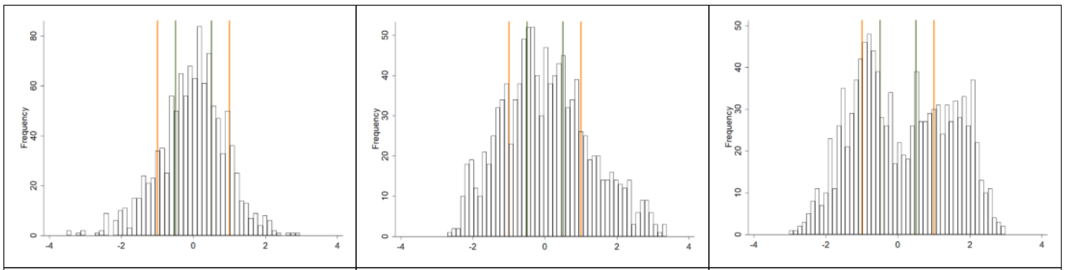
This period in the UK denotes a return to the post-war consensus of economic growth, stability in prices and low unemployment, particularly during the conservative government of John Major and the first Labor government of Tony Blair. Importantly, on 8 October 1992, the Chancellor of the Exchequer, Norman Lamont, set an inflation target of 1-4 per cent for the first time in UK history (Benati, 2008). Subsequently, in February 1993 the Bank of England produced its first inflation report, and in 1997, the Gordon Brown government declared the central bank to be independent (Minford, 2015). This period also coincides with major international crises such as the Asian crises, the Russian default, the Latin American crises (Brazil and Argentina) the dot.com bubble and the Great Financial Crisis (Kindleberger & Aliber, 2005). This was a period of financial innovation coupled with capital flight to Europe and the US, where investors were looking for a haven (James, 2014).

5.2. Identifying Bulls and Bears and Testing Differences by Regimes

Throughout the rest of this chapter, we will employ the monthly LBBIs for the UK stock market as identified in section 2.1.1. We follow the same rule for identifying bull and bear periods in the UK stock market as in section 2.6.2.1. However, as suggested in footnote 157, we will choose a boundary of ±1 standard deviation to observe the more extreme booms and busts in the series. The following figure contains the empirical distribution of

LBBIs as well as a homologue to Table 11, with information only for UK stock market series.

Figure 19: Empirical distribution and data in the tails contingent on threshold choice



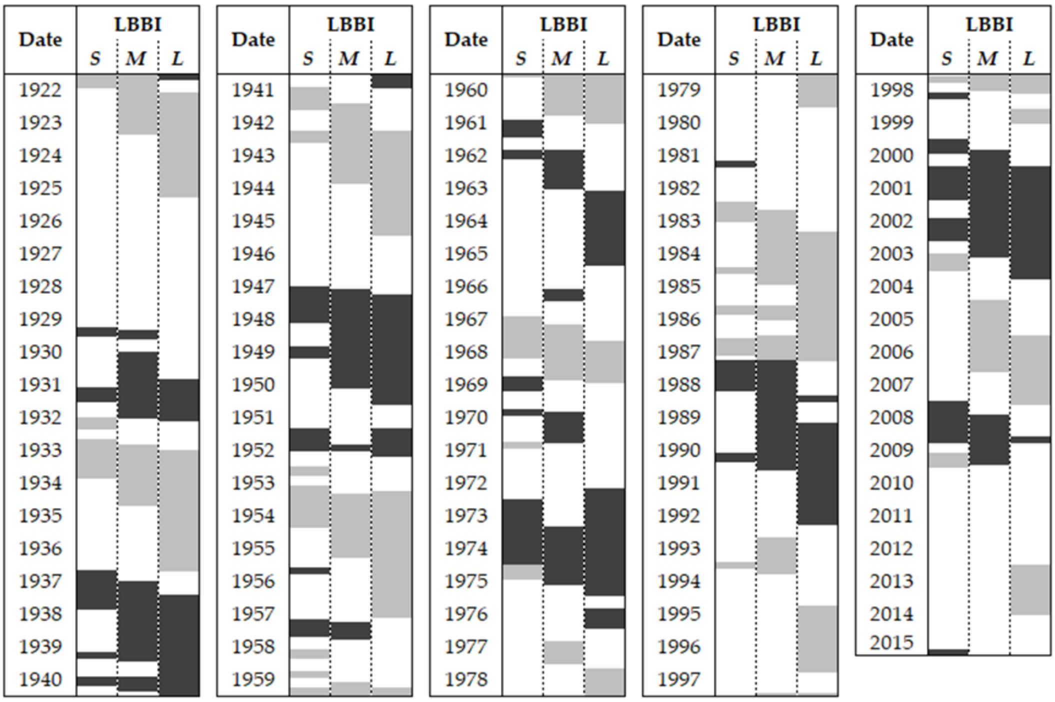
Short-run LBBI			Medium-run LBBI			Long-run LBBI		
<−0.5σ	−0.5σ< X <0.5σ	> 0.5σ	<−0.5σ	−0.5σ< X <0.5σ	> 0.5σ	<−0.5σ	−0.5σ< X <0.5σ	> 0.5σ
27.10%	45.40%	27.50%	34.70%	31.40%	33.90%	39.50%	18.70%	41.80%
<−1σ	−1σ< X <1σ	> 1σ	<−1σ	−1σ< X <1σ	> 1σ	<−1σ	−1σ< X <1σ	> 1σ
14.20%	73.80%	12.00%	21.50%	57.60%	20.90%	23.50%	45.30%	31.20%

Note: The histograms present the empirical distribution of each of the LBBIs. The green vertical lines show the less restrictive threshold (X=0.5) while the vertical orange lines show, the more restrictive threshold (X=1). In the table, each cell contains the percentage of observations below -X standard deviations, above X standard deviations, or between -X and X standard deviations for a given LBBI. The first two rows present the results for a lax threshold where X is 0.5 standard deviations. The third and fourth rows present the results for a restrictive threshold where X is 1.0 standard deviations. Shaded in red (green) is the percentage of observations deemed as bears (bulls).

According to Figure 19, shifting from the lower to the higher threshold excludes 28.4% of the observations in LBBIS, 26.2% of the observations in LBBIM, and 26.6% of the observations in LBBIL.

To date the different phases, a boom (bust) will begin on the first day of the month the indicator breaks the (-)1 standard deviation threshold upward (downward). The stage will come to an end on the last day of the month that the indicator breaks the (-)1 standard deviation threshold downward (upward). If two expansions or contractions are separated by three months or less, we will treat them as a single event. If a boom or bust occurs for a single month, we will require that the value of the indicator is at least two standard deviations to avoid including spurious results. No such cases occur. We now present a figure constructed in the same manner as Figure 16, presenting booms (light grey) and busts (dark grey) according to each of the Local Bull-Bear Indicators.

Figure 20: Dating of bulls and bears in the UK stock market with a restrictive threshold



Note: Each of the five panels contains four columns. The first one corresponds to the year. The second, third and fourth columns correspond to the bulls and bears reported using the short-run (LBBIS), medium-run (LBBIM), and long-run (LBBIL) local indicators respectively. Booms (busts) are highlighted in light (dark) grey. We use a threshold of ±1 standard deviation.

We now calculate three distinct measures to characterise each of the phases in Figure 20. We measure duration as the number of months between the start and end date of the period. We measure amplitude as the difference between the one, three and five-year CAGR for the short, medium and long-run LBBIs respectively between starting and ending date. This is the change in the profitability of the index to different time horizons during the phase. Severity is measured as the accumulated value of the indicator during each phase. The value of amplitude and severity is positive for expansions and negative for contractions. A full characterisation of phases by each indicator is presented in Annex 21. This in-depth characterisation is a valuable contribution, as it opens the door for research on the issue using new time series. Further research may be aimed at comparing results in Figure 16 and Figure 20.

In the following table, we present summary statistics for the three measures by phase (bull or bear) and by indicator.

Table 45: Summary statistics for the three measures by type of phase and indicator

		Obs	Mean	Std. Dev.	Min	Max
Bear Phases						
LBBIS	*Duration*	24	6.96	6.38	2	29
	Amplitude		-19.14%	17.02%	-77.99%	1.84%
	Severity		-9.72	7.70	-29.98	-2.32
LBBIM	*Duration*	14	17.92	13.86	2	40
	Amplitude		-11.63%	9.91%	-30.52%	1.03%
	Severity		-27.30	22.89	-68.86	-2.44
LBBIL	*Duration*	12	22.00	17.17	2	42
	Amplitude		-9.26%	7.03%	-18.77%	-0.94%
	Severity		-34.28	27.89	-76.86	-2.09

		Obs	Mean	Std. Dev.	Min	Max
Bull Phases						
LBBIS	*Duration*	20	5.61	4.28	2	15
	Amplitude		24.39%	13.65%	0.81%	52.43%
	Severity		8.11	6.78	2.12	23.73
LBBIM	*Duration*	13	17.77	8.29	5	29
	Amplitude		14.60%	8.85%	0.75%	32.85%
	Severity		32.46	17.77	5.88	55.57
LBBIL	*Duration*	13	27.00	14.23	5	47
	Amplitude		11.08%	6.96%	1.06%	25.83%
	Severity		46.68	25.75	6.45	83.31

An interesting question is whether bull and bear phases are symmetric. To test this, we perform t-tests comparing the means of each measure by phase for each indicator. Since this is a test for symmetry, we will use the absolute value of amplitude and severity to perform the contrasts. A caveat for performing any tests on this series is the small sample issue as the number of phases under any indicator is below 30. However, since the alternative is to extend the study back in time, raising comparability problems due to substantial changes in the institutional and industrial setup of the British economy, we only choose to mention it.

We find that we cannot reject the null hypothesis of equality of means in any case with 95 per cent confidence, which indicates that bull and bear phases are statistically symmetrical during the period. This is a puzzling result since Dell'Ariccia et al. (2013) indicate that policymakers are more inclined to react quickly in the phase of busts than in the case of booms because the hindering the former will safeguard the economy while hampering the latter mitigates unobservable risks to the detriment of observable measures such as growth and employment.

As a next step, we test whether the evolution of the boom-bust cycle in the stock market is contingent on domestic and international economic policies. We break down the different phases by trilemma or economic policy regime, following a stringent rule: if a given phase takes place during two different regimes, we exclude it from the analysis. We perform pairwise comparisons of the means in duration, amplitude, and severity by regime and indicator, separating domestic policy from trilemma regimes. The following table presents a summary of the percentages of pairwise mean comparison tests that reject the null hypothesis of equality, by measure, for three LBBIs. Auxiliary boxplots and the full statistical tables from which we derive Table 46 can be found in Annex 20. We also advance speculative hypothesis as to the nature of the differences we find. Since most differences are only significant with 75% confidence we chose to omit them from the corpus of the dissertation.

Results from these tests indicate that, with few exceptions, there are no statistically significant differences in the anatomy of expansions and contractions contingent on the trilemma or domestic policy regimes that exceed 95% confidence. This is especially true in the case of the short-run indicator and holds for the measure of duration across most specifications of the test. Differences in the amplitude of bear phases and the severity of bull phases are evident across both types of regimes, but they disappear in the long-run indicator.

To confirm whether the results in this section are affected by the small sample size, we suggest further research should be directed at including more countries in the database to increase the number of phases. The main challenge in this extension is to find a way to make domestic policy regimes comparable across countries. If our results hold to more robust specifications, a possible explanation would be that phenomena not contained in domestic or international economic policy are driving the anatomical differences across phases. Possible candidate drivers we suggest are changes in industrial organization (Roe, 2001; Hou & Robinson, 2006), the monetary policy stance (Ioannidis & Kontonikas, 2008), the evolution of the business cycle (Hamilton & Lin, 1996), and information innovations on the economy (McQueen & Roley, 1993).

Table 46: Percentage of statistically significant differences pairwise comparisons of means

		Bear phases		Bull phases	
		TR	DPR	TR	DPR
Duration	*Short-run*	0%	0%	0%	0%
	Medium-run	0%	0%	0%	0%
	Long-run	0%	0%	0%	13%
Amplitude	*Short-run*	0%	0%	0%	7%
	Medium-run	60%*	13%	20%	0%
	Long-run	0%	0%	30%	13%
Severity	*Short-run*	0%	0%	0%	0%
	Medium-run	0%	0%	0%	0%
	Long-run	0%	0%	0%	13%

Note: Percentage is calculated out of ten comparisons in the case of trilemma regimes (TR) and 15 comparisons in the case of domestic economic policy (DPR). All tests calculated with 95% confidence. The * indicates that the percentage is reduced to 50% when we change the Urban & Straumann dating of the gold standard to the conventional view (April 1925 – September 1931).

5.3. Co-movement Between the UK Stock Market and the Global Cycle

The second aim of this chapter is to test whether the co-movement between the stock market and the global cycle has a time-varying nature that depends on trilemma or domestic economic policy regimes. Passari & Rey (2015), in a study covering 1990-2012, indicate that 'risky asset prices (equities, corporate bonds) around the world are largely driven by one global factor. This global factor is tightly negatively related to the [Chicago

Board Options Exchange Volatility Index] VIX' (p. 681). To test whether this has been the case since 1922, it would be ideal to obtain data for the VIX index since the interwar years. As we argued in Chapter 3 and Annex 11, we will use the LBBIs for the US stock market to proxy for the global financial cycle. In Annex 11 we have established that these series covary negatively with the VIX and are a function of similar variables. A statistical characterization of the LBBIs for the US S&P500 index is presented in Annex 6.

To identify whether there is a global financial cycle proxied by the US stock market, we regress yearly LBBIs for the US and a variety of controls on yearly LBBIs for the UK. As the annual value of each LBBI, we take the datum for December of each year. Following the drivers discussed in the introduction, we use as controls yearly data for the dividend yield, the short-term interest rate, the level of domestic credit to the private non-financial sector as a percentage of nominal GDP, and the logarithm of GDP. All series, except for the dividend yield, are obtained from Jordà, Schularick and Taylor's Macrohistory Database (2017). The dividend yield series has been obtained from GFD. We use the series' first differences to guarantee stationarity. All regressions are run with robust standard errors.

Since the LBBI series inherit strong autoregressive properties from the original returns in matrix **R**, we include the first lag of the UK LBBI for all specifications and the second lag for the regressions that use the long-run indicators. Lags are chosen such that the error term of the regression behaves as white noise according to Bartlett's test (1955). Results for the regression are presented in Table 47.

Table 47: Drivers of the boom-bust cycle in the UK stock market to different time horizons

Dependent Variable	Short-run LBBI UK		Medium-run LBBI UK		Long-run LBBI UK	
First difference dividend yield	-30.3100***	-23.4100**	-38.2400**	-30.2900**	-25.0300**	-18.1600**
First difference short-term interest rate	-8.3380	-10.1600**	-9.4770	-13.1700**	-9.5780	-13.3100**
First difference loans to GDP	-3.4490*	-2.2440	-5.0970**	-3.8240**	-1.1580	-0.2565
First difference log GDP	0.5047	1.0450	0.8091	0.4184	-0.1830	-1.0960
First lag short-run UK LBBI	0.1210	0.1352				
First lag medium-run UK LBBI			.5807***	.5064***		
First lag long-run UK LBBI					.9815***	.8828***
Second lag long-run UK LBBI					-.4392***	-.4614***
Short-run US LBBI		**.4811*** **				
Medium-run US LBBI				**.3476*** **		
Long-run US LBBI						**.368*** **
Constant	-0.0253	-0.1189	-0.0205	0.0693	0.0731	.2505*
N	90	90	90	90	90	90
AIC	199.6	179.2	240.7	224.5	234.3	212.8
Adjusted R^2	0.2926	0.4417	0.4823	0.5722	0.6017	0.6894

Note: Significance levels: * p<0.1; ** p<0.05; *** p<0.01 We used robust standard errors to estimate the significance of coefficients. Additional results are available upon request. Coefficients of interest highlighted in bold. AIC corresponds to the Akaike Information Criteria.

Results in Table 47 indicate that the autoregressive component in the LBBI series is relevant for the medium and long-run specifications. In the short-run, up to one year, the first lag bears no significance. Additionally, according to the different goodness-of-fit measures (AIC and adjusted R^2), the models including the LBBI series for the US stock market explain better the behaviour the UK stock market to the three time-horizons (coefficients in bold). It is noteworthy that for the three models that include the global cycle variable, the adjusted R^2 is above 40%. Moreover, in those models, both the dividend yield and the short-term interest rate seem to matter, with the expected negative coefficients. Increases in the short-term risk-free rate will coincide with decreased stock values, as indicated by Stuart (2017) using Gordon's dividend discount model. Also, increases in the dividend yield correlate with decreases in the stock market index as it is directly related to the denominator of the ratio. To correct for the autocorrelation structure in the errors, we ran the regressions with Newey-West (1987) standard errors and found results to be robust. Additional results are available upon request.

We firmly believe that the results presented above offer sufficient evidence of the co-movement between the UK stock market and a global cycle, as proxied by the US stock market to different time horizons. In all cases, the coefficient is positive, although its dimension decreases as the time horizon increases. An argument could be made for reverse causality between British LBBIs and the explanatory variables. However, historical evidence gives us arguments in favour of using the US stock market as an explanatory variable rather than the reverse. For example, Obstfeld, Shambaugh & Taylor (2004) show that by the end of the First World War, it was clear that the City was no longer the financial centre of the world. If, as Campbell & Rogers (2017) indicate, one of the mechanisms for the integration of capital markets is foreign investment, by the end of the First World War, the US had replaced Britain as the world's leading creditor (Eichengreen & Portes, 1987). Kindleberger & Aliber (2005) concur, indicating that during the interwar years, the City lost its pre-eminence in global financial markets.

However, the question remains if this relationship is stable in time or, if it is contingent either on the domestic policy or trilemma regimes in place. For example, Bordo & Murshid (2001), find that the tendency of markets to move together in times of crises has been decreasing in the recent years (not accounting for the GFC). Mauro, Sussman & Yafeh (2002), on the other hand, find that global financial conditions seem to matter more, recently than at any previous time. Borio, James & Shin (2014), indicate that the recent process of financial integration is a probable culprit for the existence of Rey's (2013) global financial cycle. Obstfeld & Taylor (2004) indicate that capital market integration has followed a U-shaped process with peaks during the gold standard and in present day and a trough during the pre-convertible period of Bretton Woods, at the height of capital controls and bilateral trade agreements.

We present four different models. Model I is a base case where we regress monthly LBBIs for the US on the corresponding monthly LBBI for the UK. Model II includes dummy variables for the trilemma regimes and their interactions with the corresponding LBBI for the US stock market. In this case, the omitted dummy marking the benchmark case is the one for the pre-convertible Bretton Woods period (1944-57). Version A of the model uses the Urban & Straumann dating for the British gold standard. Version B of the model uses the conventional dating. Model III is defined similarly, but we change the trilemma dummies for those corresponding to the domestic policy regime. In this model, the benchmark case corresponds to the stop-go policy period (1950-65). As anticipated in section 5.1, Model IV includes the interaction of international and domestic policy regimes, following Bordo & Wheelock's (2009) recommendation for future studies. The benchmark case will be the period where the pre-convertible Bretton Woods and stop-go policy overlap, from 1950 until 1957. Version A of the model uses the Urban & Straumann dating for the British gold standard. Version B of the model uses the conventional dating. We present the results using robust standard errors in Table 48.

The table shows the regression results for the different models described. In the bottom panel, we present goodness of fit measures. We can see that models for both the short-run and long-run indicators have a high adjusted R^2 while, surprisingly, the measure decreases for the medium run indicator.

Table 48: Regression results for LBBIs for the UK to different time horizons - Various specifications

	Short-run LBBI UK						Medium-run LBBI UK						Long-run LBBI UK					
	M. I	***M. II.A.***	*M. II.B*	*M. III*	*M. IV.A*	*M. IV.B*	*M. I*	*M. II.A.*	***M. II.B***	*M. III*	*M. IV.A*	*M. IV.B*	*M. I*	*M. II.A.*	*M. II.B*	*M. III*	*M. IV.A*	***M. IV.B***
Lag LBBI UK	.7264***	**.6993*****	.7023***	.6998***	.6881***	.6875***	.9506***	.9397***	**.9408*****	.9435***	.9308***	.9310***	.9631***	.9529***	.9516***	.9614***	.9433***	**.9405*****
LBBI US	.2516***	**.0794***	.1353***	.1600***	.1515**	.2032***	.0466***	0.0064	**0.016**	0.0042	0.0037	0.0309	.0355***	.0305**	0.0203	0.0036	-0.0088	**0.0184**
Interactions with LBBI US																		
Float (1922-25)		**0.0578**	0.0007					.1343***	**.1235*****					-0.1824	-0.1710			
Gold standard (1925-38)		**.1390****						.0417**						0.0005				
Gold standard (1925-31)			0.0612						**0.0338**						.0527**			
Convertible BW (1959-71)		**.1387***	0.0820					0.0096	**-0.0003**					-0.0261	-0.0168			
Post-BW high inflation (1972-82)		**.1577****	0.1003					.0931***	**.0829*****					.0960**	.1080**			
Post-BW great moderation (1983-2015)		**.3966*****	.3387***					.0929***	**.0823*****					0.0201	.0312**			
MBBR (1922-38)				0.0483						.0473**						0.0337		
War-time DM (1939-1950)				-0.1163						0.0040						0.0157		
Keynesianism plus (1966-78)				0.0885						0.0516						.0751*		
Thatcherism (1979-92)				.2388**						.1008***						.0719**		
Inflation targeting (1993-2015)				.3111***						.0819***						0.0368		
MBBR U Float (1922-25)					-0.0095	-0.0610					.1462***	.1189***					-0.1340	**-0.1586**
MBBR U Gold standard (1925-38)					0.0717						0.0501						0.0440	
MBBR U Gold standard (1925-31)						-0.0027						0.0217						**.0573****
War-time DM U Float (1939-44)					-0.1149	-.1665**					-0.0109	-0.0382					0.1104	**.0880****
War-time DM U Pre-convertible BW (1944-50)					-0.0665	-0.1182					0.0266	-0.0007					0.0560	**0.0314**
Stop-go U Convertible BW (1959-65)					0.0255	-0.0261					0.0059	-0.0214					-0.0429	**-.0724***
Keynesianism plus U Convertible BW (1966-71)					0.1332	0.0816					0.0555	0.0282					0.1148	**.0867***
Keynesianism plus U Post-BW high inflation (1972-78)					0.0961	0.0448					.1304***	.1031***					.2592**	**.2367*****
Thatcherism U Post-BW high inflation (1979-82)					0.0813	0.0297					0.0523	0.0251					0.1491	**.1239***
Thatcherism U Post-BW great modederation (1983-92)					.3408**	.2894**					.1340***	.1066***					0.0983	**.0738*****
Inflation targeting U Post-BW (1993-2015)					.3281***	.2767***					.0921***	.0647***					0.0631	**.0380***
Constant	0.0011	**-0.0025**	0.0093	0.0250	0.0434	0.044	0.0082	0.0044	**0.0097**	0.0094	0.0226	0.0254	.0158**	0.0169	.0241*	0.0092	0.0485	**.0432****
Dummies (intercepts)	Yes	**Yes**	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	**Yes**
N	1124	**1124**	1124	1124	1124	1124	1124	1124	**1124**	1124	1124	1124	1124	1124	1124	1124	1124	**1124**
AIC	1672.0	**1628.0**	1631.0	1633.0	1635.0	1633.0	358.6	350.0	**348.7**	356.9	355.9	354.2	181.7	175.9	161.5	190.0	162.1	**145.0**
Adjusted R^2	0.6949	**0.7092**	0.7084	0.7079	0.7100	0.7104	0.2770	0.3586	**0.3624**	0.3266	0.4384	0.4535	0.9614	0.9619	0.9624	0.9615	0.9627	**0.9633**

Note: Significance levels: * p<10%; ** p<5%; *** p<1%. Model with lowest AIC, by LBBI highlighted in bold.

A first interesting finding from Table 48 relates to the dating of the gold exchange standard. Only in the short-run specification, the dating proposed by Urban and Straumann (2012) seems to bear a better explanatory power than the conventional dating. The medium and long-run models, on the other hand, show that the coefficient for the gold standard (1925-31) is positive and statistically significant with 99% confidence. This indicates that, even if the rules of the gold exchange standard were still being followed after 1931, there was something special about the commitment to convertibility that lasted for 77 months starting in April 1925.

Another noteworthy result is that the coefficients associated to the LBBIs for the US loose significance in the medium and long-run models that include trilemma regimes, domestic policy regimes or their interactions. This is a first piece of evidence in favour of the U-shaped process of capital integration in Obstfeld & Taylor (2004). When we set all the dummies to zero the coefficient of the US stock market LBBIs reflects whether the co-movement between the US and UK was significant during the base period. As mentioned above, our excluded dummy corresponds to the period with more stringent capital controls and government control over the British economy: the pre-convertible phase of Bretton Woods and the stop-go policy. Concurrently, for the medium and long-run specification, the coefficient of the first lag of the UK's LBBI approaches one, reflecting the strong autocorrelation structure in the series.

For the sake of brevity, in what follows we will perform further analysis solely of the models that best explain each of the British LBBIs according to the Akaike Information Criteria (AIC) (highlighted in bold). It is telling, that for both the short and medium-run, the models with the best fit are those that contain only trilemma regimes, while the long-run model that fits best contains the interactions of domestic and international economic policy. This indicates that Bordo & Wheelock's (2009) suggestion about the interaction of international and domestic policy regimes may only be pertinent to the evolution of long-run returns.

Since we know that LBBIs feature a strong autoregressive component, we wish to check if this has been captured by including the first lag of the dependent variable or if, on the other hand, the residual still showcases some form of serial-correlation that causes heteroskedasticity. We perform the Bartlett (1955) white noise test on the residuals with 95 per cent confidence and identify that the error in all cases still follows an AR(1) process. Therefore, we rerun the regressions, this time with Newey-West (1987) standard errors.

In Table 49, we present the coefficients from the Newey-West regressions for the models with the best fit in Table 48. The value for each policy regime corresponds to the sum of the coefficient for the base case and the coefficient for the corresponding interaction. In each panel, the period used as a base case is signalled in italics. We perform tests on the coefficients to identify whether they are statistically different from zero.

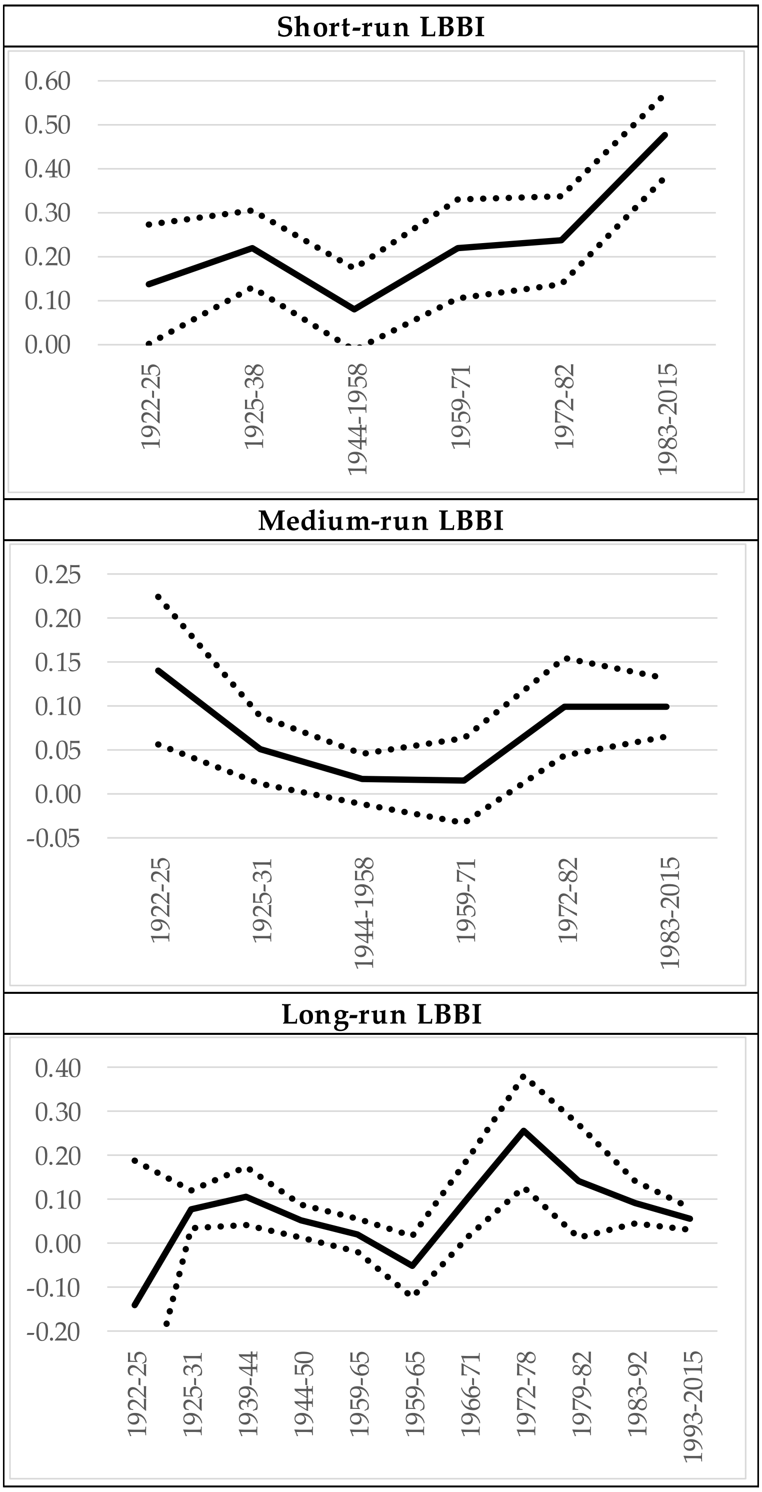
Table 49: Coefficients for the co-movement between the UK stock market and the global cycle to different time horizons

Period	Coefficient
Short-run LBBI	
Float (1922-25)	0.1372**
Gold standard (1925-38)	0.2184***
Pre-convertible BW (1944-1958)	0.0794*
Convertible BW (1959-71)	0.2180***
Post-BW high iInflation (1972-82)	0.2371***
Post-BW great moderation (1983-2015)	0.4760***
Medium-run LBBI	
Float (1922-25)	0.1396***
Gold standard (1925-31)	0.0498**
Pre-convertible BW (1944-1958)	0.0160
Convertible BW (1959-71)	0.0157
Post-BW high iInflation (1972-82)	0.0990***
Post-BW great moderation (1983-2015)	0.0984***
Long-run LBBI	
MBBR U Float (1922-25)	-0.1402
MBBR U Gold standard (1925-31)	0.0757***
War-time DM U Float (1939-44)	0.1064***
War-time DM U Pre-convertible BW (1944-50)	0.0498**
Stop-Go U Pre-convertible BW (1959-65)	0.0184
Stop-Go U Convertible BW (1959-65)	-0.0540
Keynesianism plus U Convertible BW (1966-71)	0.1050**
Keynesianism plus U Post-BW high inflation (1972-78)	0.2551***
Thatcherism U Post-BW high inflation (1979-82)	0.1422**
Thatcherism U Post-BW Great Mododeration (1983-92)	0.0921***
Inflation targeting U Post-BW (1993-2015)	0.0563***

Note: Significance levels: * $p<0.1$; ** $p<0.05$; *** $p<0.01$. In the bottom panel, the letter U indicates the overlap of domestic policy with trilemma regimes. The dates for each regime are presented in parentheses.

We offer graphs for the evolution of the coefficients in Figure 21.

Figure 21: Evolution of the co-movement coefficients by regime for different LBBIs



Note: Continuous line shows the evolution of the coefficients. Dotted lines present 95% confidence intervals around the coefficients.

The story in Table 49 and Figure 21 is one of time-varying association between the global financial cycle, as proxied by the S&P 500 and the UK stock market. All evidence points to a low point in the association between both variables which coincides with the regime we determined would constitute the benchmark. This is consistent with the U-shaped pattern in market integration described by Obstfeld & Taylor (2004), particularly in the short-run indicator where the association is at an all-time high for the most recent period and following an upward trend.

However, we can nuance their dictum in several ways. The medium-run results indicate that co-movement has not yet reached the levels of the interwar years and stagnated after the fall of Bretton Woods, this has been an issue of large debate in the literature since Obstefled & Taylor (2004). This is surprising since several authors since the early works of Kindleberger & Aliber (2005) have indicated that the wave of deregulations of the 1980s favoured co-movement across markets given the increase in 'hot money' moving around the globe. The significant increase in the coefficients occurs in 1972-82, consistent with external shocks such as the one affecting commodity markets or with the elimination of capital controls in 1979. This global-conditions story is consistent with findings by Mauro, Sussman & Yafeh (2002).

Regarding the long-run association between the UK and the global financial cycle, we find that the U-shaped story is inaccurate. There is a first wave of increased co-movement between Britain and the global financial cycle during the Second World War and a second peak during the convertible phase of Bretton Woods that coincides with the Keynesianism plus policies (1972-78) and the oil shocks. Since LBBIs are indicators that aggregate measures of risk and return, both peaks may be associated with increasing correlation between the risk component associated with the measures. The source of risk for the first peak may be the effect of the Second World War, which would resemble the findings of Campbell et al. (2018) for the nineteenth century. The second peak may be related to the risky global financial conditions that coexisted with high inflation and flexible exchange rates after 1972, which would be consistent with findings by Greenwald et al. (2015).

5.4. Concluding Remarks

The goal of this chapter was to determine the role both trilemma and domestic policy regime play in the evolution of the boom-bust cycle in the UK stock market since the interwar years until present day. We have identified that booms and busts do not present significant differences in duration, amplitude or severity under domestic or international economic policy settings. An additional puzzling result is that expansions and contractions seem to be symmetric even though the response of policymakers to bulls and bears is known to be asymmetric (Roubini, 2006). Even though small sample size may drive results, other alternatives are that changes in industrial organisation, market microstructure, the business cycle or monetary policy may be driving anatomical differences across phases.

Secondly, we have found that the agreed-upon story about international capital integration may need an update. The idea of a U-shaped integration across markets with peaks during the gold standard and the present day is consistent with our findings for the short-run indicator. However, when we look at medium or long-run Local Bull Bear Indicators, the story seems to change. Medium-run co-movement between the British stock market and the global financial cycle seems to have stagnated since the fall of Bretton Woods despite the wave of deregulation of the 1980s. Events like the 'Big Bang' in the UK financial market do not have the expected effect of increasing association between the two series.

Regarding the long-run story, we identify peaks in two of the riskiest moments in the series: the Second World War and the inflation-ridden 1970s. We hypothesise that risk is one of the main drivers in the long run association between British and global financial markets. This seems to be a promising field for further research.

Finally, a third finding has to do with whether domestic economic policy, trilemma regimes or their interactions matter more for the evolution of the stock market cycle. We find that changes in the short and medium run association between UK and US LBBIS seem to be contingent on the policies that Britain undertook to resolve the macroeconomic trilemma. Periods with free capital flows coincide with stronger association to world markets. However, as indicated by Bordo & Wheelock (2009), the interaction between domestic and foreign policy seems to be relevant in understanding the changing association between markets. In the absence of free capital flows, fiscal expansion (as during war-time demand management) or the deregulation of credit markets (as in the early 1970s), seems to allow for stronger synchronisation of cycles. This association may be driven not only by the changes in stock market prices but also by common risk drivers as proposed by Greenwald (2015).

Chapter 6. The Financial Cycle and the Regulatory Pendulum in the United Kingdom (1922-2013)

The financial crisis of 2008 confirmed what some researchers, particularly at the Bank for International Settlements (BIS), have been saying from the beginning of this century: central banks and regulators cannot assume a direct correspondence between low inflation and financial stability. This equivalence, which was proposed by Bernanke & Gertler (1999) when presenting the benefits of inflation targeting, has excessive focus on a single target, induces policymakers both to turn a blind eye on the accumulation of financial imbalances —excessive credit and asset price growth— and to privilege non-financial variables such as expected inflation, output gap, and unemployment as inputs for models. This issue is not new, as most of the more sophisticated New Keynesian DSGE models tend to assign to the financial system a basic role in reassigning resources but omit its ability to create purchasing power through the creation of money (Airaudo et al., 2015). Under this view, the link between credit and asset prices runs through a "financial accelerator" channel, in which increases in the price of collateral-worthy assets strengthens balance sheets for firms and households easing their credit restrictions (Bernanke, Gertler & Gilchrist, 1999)

The alternative view hypothesised by the BIS posits that there is a financial cycle, composed of the joint behaviour of assets and credit, which accumulates imbalances during periods of excessive growth resulting in financial crises as they unwind (Borio, 2014b). Recently, a rich set of literature has evolved with the aim of contrasting this hypothesis by explaining the sources of synchronisation/decoupling of the asset and credit cycles, understanding the role monetary policy and capital flows may play in their evolution and deriving implications for both crisis management and prevention. In this view, that arises from the works of Minsky (1986, 1992) and Kindleberger & Aliber (2005), excessive credit growth can fuel asset price booms disconnected from fundamentals and lead to what Jordà, Schularick & Taylor (2015) have termed "leveraged bubbles".

The literature on the interactions between credit and asset prices has reached valuable conclusions for the general evolution of the financial cycle. First, it has shown that asset booms fueled by excessive credit growth have profound long-run consequences when imbalances unwind (Borio, 2014b). Secondly, it has indicated that recessions that are coupled with the unwinding of imbalances tend to be broader than those that happen independently (Jordà, Schularick & Taylor, 2011, 2013, 2015). In third place, it has revealed that credit growth is a sufficient early-warning indicator for the presence of financial instability (Dell'Ariccia et al., 2013). Moreover, it has shown that the effect of the financial cycle on general economic conditions is better observed to a medium run horizon that extends beyond the usual one or two-year forecast period of central banks (Drehmann et al., 2012).

Finally, from the policy perspective, deregulation and liberalisation of financial systems have been found to play a critical role in their evolution. In credit markets, as constraints on both lenders and borrowers are reduced, the number of (apparently) credit-worthy individuals increases, and credit expansions ensue (Diaz-Alejandro, 1985; Borio, 2014b). A similar process is evidenced in capital markets where liberalisation processes increase access to capital markets both by domestic and foreign agents and may foster stock market booms (Henry 2000a, 2000b, 2003). On the side of financial repression, Reinhart & Rogoff (2009a) and Jordà, Schularick & Taylor (2011), using a database for banking crises, indicate that the prevalence of crises was reduced during periods of stringent capital controls such as the Bretton Woods period. Posen (2006) goes even further and indicates that no amount of monetary discipline can substitute sufficient financial regulation and supervision.

This chapter aims to move beyond this panel data setting and explore the British financial cycle, as proxied by stock market prices and the level of real domestic credit to the non-financial sector from 1922 until 2013. The question we wish to answer is whether there is evidence of a financial cycle in the UK in the period of study and, if so, whether the relationship between stock markets and credit aggregates is contingent on the regulatory framework in place. Formally, we will test if changes in regulation affect the causal relationship between stock markets and credit aggregates after controlling for an assortment of variables that may be driving the relationship.

In that sense, the first contribution of this chapter is to offer a study of the financial cycle for a single country, since all stylized facts described above are derived from large panels of countries that assume them to be comparable. From a methodological perspective, our main contribution is to extend the single series analysis of the previous chapters in the dissertation into a bivariate analysis of LBBIs for assets and credit. The final contribution is to integrate Reinhart & Rogoff's (2013) idea of a regulatory pendulum that sways from financial repression to liberalisation into the financial cycle framework.

While the relevance of the British stock market as an object of study has been argued for in Chapter 5, a point must be made about using real credit to the private non-financial sector. First, Sheppard (1971) shows that from 1920 until 1962 the total financial assets of the British financial institutions grew by a factor of eight. Furthermore, according to data from Jordà, Schularick & Taylor (2017), the growth in real credit to the private non-financial has averaged a 4.56% annually since 1922 until 2013, exceeding the growth rate of the US, Switzerland, Norway or Denmark. Additionally, the UK banking system is of interest because since the 1920s and until the 1970s, the Bank of England allowed large clearing banks "to collude in setting interest rates on deposits, loans and in the London money market", while by the late 1970s and early 1980s, greater competition among banks was fostered as monetary policy was liberalized (Saunders & Wilson, 1999, p. 542). At the same time, there was a substantial liberalisation of the stock market particularly with the elimination of capital controls in 1979 (Henry, 2003).

To approach this issue, we will use the annual LBBIs for the real stock market index and the real credit level as described in Chapter 2. We will then use a standard VAR approach as in Charemza & Deadman (1997), with several exogenous variables to identify the direction of causality between both variables through Granger causality tests (Granger, 1969, 1980, 1988). To test for the role of financial repression and deregulation, we test for the existence of a structural break in the relationship occurring in 1979.

We find that there is a consistent, time-varying link between asset prices and the level of domestic credit in the UK for the period under study. This link is weaker between the financial cycle variables and the real economy and is present only during economic expansions. Secondly, we identify a structural break in the relationship between assets and credit in 1979, concurrent with the deregulation process that had started since the Competition and Credit Control Bill of 1971 (Offer, 2017) and that peaked with the ascent of Margaret Thatcher to the government in 1979. Additionally, through a standard VAR approach, we find that causal relationship between stock markets and credit is bidirectional in the short and long-run specifications until 1979. After deregulation, we find that, to every time horizon, changes in credit seem to cause changes in stock prices significantly, but not the other way around.

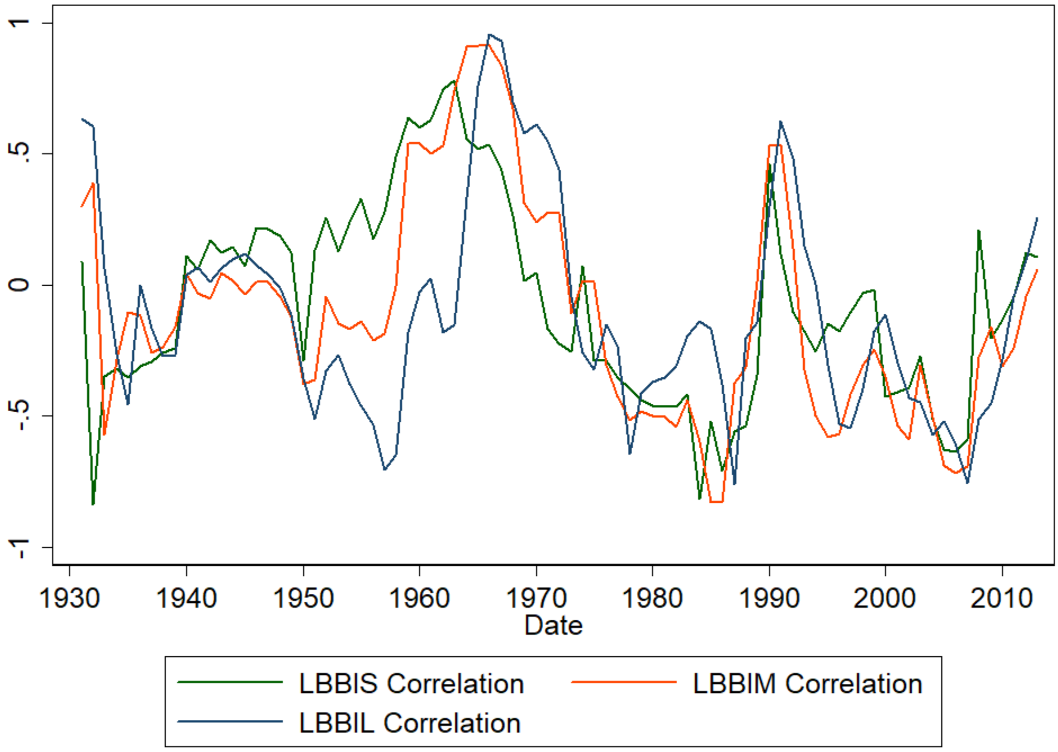
The rest of this chapter is structured as follows. Section 6.1 offers first evidence of the existence of the financial cycle for the UK. In Section 6.2, we describe the historical context of the deregulation process that occurred in the UK financial market in the later part of the 1970s to argue for the existence of a structural break in both credit and stock market institutions. Section 6.3 presents the empirical results from the VAR approach. A final section concludes and offers avenues for further research.

6.1. Some Preliminary Evidence of the British Financial Cycle

A first natural exploration of the relationship between the stock market and real credit LBBIs for the UK is to calculate the ten-year rolling pairwise correlation coefficient between the short, medium and long-run indicators. We present the results in Figure 22.

The main finding in the figure is that the relationship between both variables seems to be unstable in time. Interestingly, peaks in the association occur during the late-1960s, in the early 1990s and during the GFC in the late 2000s. Conversely, correlation troughs in the early 1930s, during the 1950s, in the mid-1980s, and before the GFC. From our study of British economic history in Chapter 5 and Annex 10, we can infer that peaks in correlation seem to be related to periods of economic downturn (like the 1990-93 recession). This is sensible as concurrent divestment in the stock market and a reduction in the demand and supply of credit are common occurrences during recessions (Kindleberger & Aliber, 2005). Conversely, troughs seem to be associated to periods of economic expansions (the recovery from the Great Depression or the golden age of the 1950s).

Figure 22: Ten-year rolling correlation between stock market and real credit LBBIs

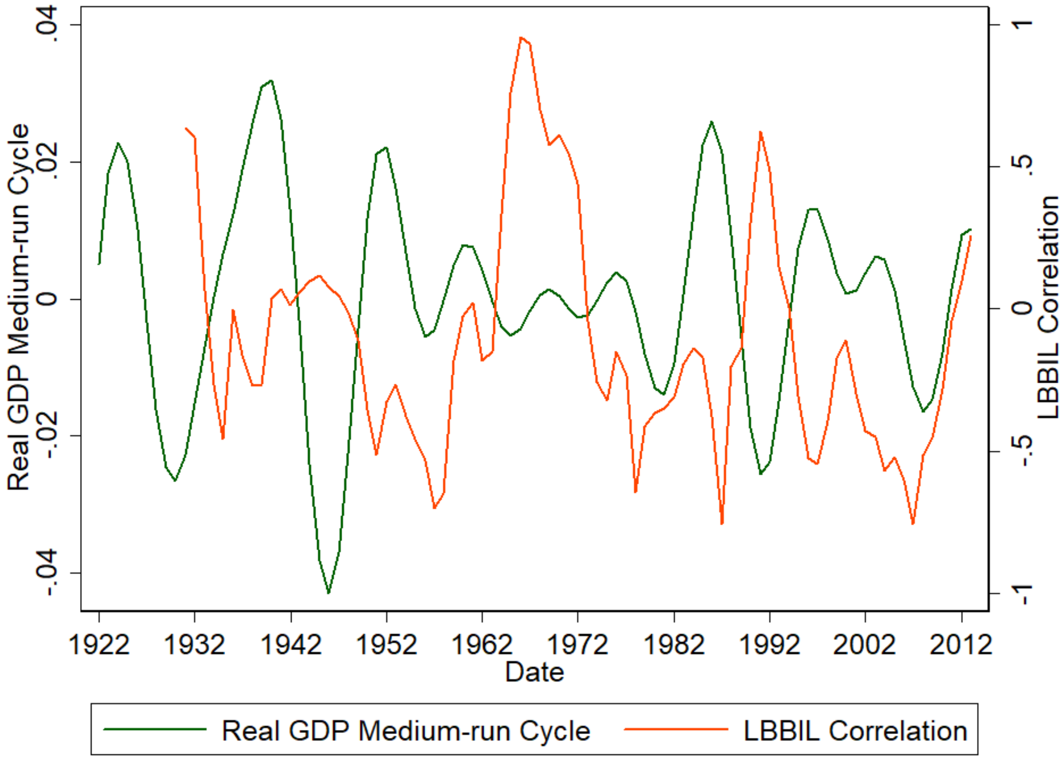


Note: Simple pairwise correlation between real credit and stock market LBBIs by time horizon. Correlation is calculated using a moving window of 10 observations.

To delve deeper into an intuition of a relationship between the correlation described above and the real economy, we follow the seminal work on the financial cycle by Drehmann et al. (2012). In following their characterisation we extract the medium run cyclical component of real GDP growth for the UK using the band-pass filter as in Christiano & Fitzgerald (2003). Figure 23 shows the plots for the cyclical component of

GDP (green line) and the time-varying correlation between the long-run stock market and real credit LBBIs (orange line).[242]

Figure 23: Real GDP growth cycle to the medium run and correlation between real credit and stock market long-run LBBI



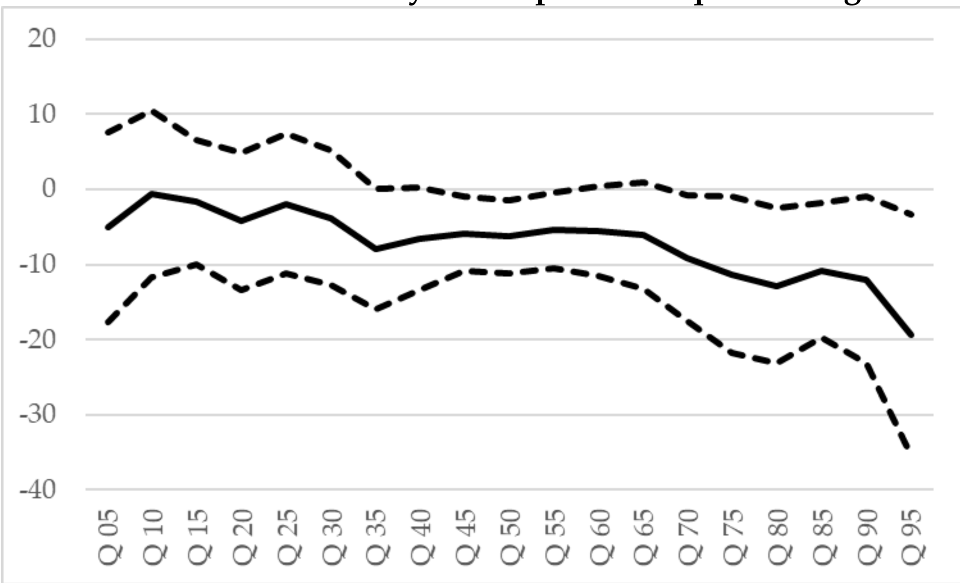
Note: Real GDP growth data taken from the Maddison Project (Bolt et al., 2018). Cyclical component extracted from annual growth rates through the bandpass filter as in Christiano & Fitzgerald (2003) with a bandwidth of 8 to 30 years.

Figure 23 shows that the correlation between long-run LBBIs seems to mirror the cyclical component in GDP growth, which is consistent with our analysis of Figure 22. To provide further evidence about this relationship we perform quantile regressions where the dependent variable is the ten-year rolling correlation between long-run LBBIs and the independent variable is the medium-run cycle extracted through the band-pass filter. We follow Koenker & Hallock (2001) and run simultaneous quantile regressions for each percentile multiple of five. In the following

[242] Since correlations between LBBIs to every time-horizon seem to track each other closely, we choose to present this experiment using only the correlation between long-run indicators for stocks and real credit.

figure, we present the evolution of the coefficient and 95% confidence intervals by quantile.

Figure 24: Coefficients for the cycle component in quantile regression



Note: Quantile regressions using bootstrap standard errors (100 replications). The dependent variable is the rolling correlation between long-run LBBIs for credit and stocks. The independent variable is the cyclical component of real GDP growth extracted through the band-pass filter for frequencies between 8 and 30 years. Continuous line shows the value of the estimator. Dotted lines represent the 95% confidence intervals. The coefficient for the OLS regression is -7.54, significant with 99% confidence, and the confidence interval is [-13.23 -1.85].

The most salient feature from Figure 24 is that the coefficient in the regression is only statistically significant for the higher quantiles in the regression (> Q 70). This is consistent with part of our initial intuition. The relationship between the real economy and the correlation of LBBIs exists only during economic booms. As the economy expands, the correlation between stock markets and credit decreases, usually taking negative values as shown in Figure 22.

To summarise, in this section we have shown, on the one hand, that the association between stock markets and credit aggregates in the UK is time-varying and unstable as indicated in the Minsky's financial instability hypothesis (Minsky, 1986, 1992; Kindleberger & Aliber, 2005). On the other hand, there appears to be an association between the financial cycle and the real economy, which we can only identify robustly during economic booms.

6.2. From Financial Repression to Liberalization: Searching for the Break

Following the works of Diaz-Alejandro (1985), Kamisky & Schmukler (2008), and Reinhart (2012) we argue that changes in the regulatory environment, and particularly shifts from financial repression to financial liberalisation, alter the way in which asset prices and credit aggregates interact. Following Reinhart (2012):

> "*Financial repression includes directed lending to the government by captive domestic audiences (…), explicit or implicit caps on interest rates regulation of cross-border capital movements, and (…) a tighter connection between government and banks, either explicitly through public ownership of some of the banks or through heavy 'moral suasion'. Financial repression is also sometimes associated with (…) securities transaction taxes (…)*" (p. 38)

In the above definition, we have underlined three elements of interest. First, financial repression takes place when there is an explicit or an implicit cap on interest rates which can be extended to quantitative restrictions on credit. Second, it occurs in the presence of controls to cross-border capital movements. Finally, we can speak about financial repression in the presence of transaction taxes in the securities market. Consequently, we present a portrayal of British economic history explicitly from the perspective of the ebb and flow of financial repression.

According to Middleton (2014), the beginning of the extended phase of financial repression in the UK is marked by the return to protectionism through tariffs to protect the British industry in 1931-32. Although in 1931 the first round of capital controls was implemented, Urban & Straumann (2012) indicate that these were milder than those imposed by Germany or Japan. Through most of the 1930s, Britain kept commercial ties and trade with the whole Commonwealth under the figure of imperial preference which indicates that commercial restrictions were partial at best (Eichengreen & Sussman, 2000). However, by 1939 with the advent of the

Second World War, exchange controls were entirely in place (OECD, 1993). During the confrontation economic management was heightened, demand was rationed, while labour, capital and product markets were subject to direct controls (Middleton, 2014).

After the end of the war, during the inconvertible phase of Bretton Woods, the main issues were maintaining the stability of the pound in international currency markets and facilitating the government's debt rollover process (Scott & Walker, 2017). Another relevant point was the low rate of economic growth relative to other developed countries (Allen, 2016). These three features were the key determinants of the stop-go policies that started in 1951 and lasted until 1965 and that we characterise as a period of 'countercyclical financial repression' to stabilise external imbalances.

According to Scott & Walker (2017), the Conservatives had won the 1951 elections by promising an end to the rationing. Consequently, the tools at their disposal to prevent foreign account imbalances were limited to reducing expenditure and increasing taxes to curtail aggregate demand and economic overheating. Some specific measures at the time were hire-purchase restrictions and purchase taxes that would increase the upfront price on credit purchases. As soon as imbalances were resolved, these stalling measures would be rolled back. From a financial perspective, quantity restrictions on credit were implemented to increase the available funds for public debt rollovers and reduce credit-driven import growth that would hurt balance-of-payments equilibrium (Offer, 2017). Finally, while in 1961 Britain signed the OECD codes of liberalisation that were aimed at eliminating capital controls, it opted out of the agreement from 1966-71 (OECD, 1993).

Financial liberalisation was a lengthy process in Britain. Kaminsky & Smuckler (2008) establish a chronology of financial liberalisation for 27 countries in three different areas: capital account, domestic financial sector, and the stock market. For the UK they indicate that partial liberalisation of the capital account began in 1973 with full liberalisation taking place in 1979. Regarding the domestic financial sector, they dated the full liberalisation in January 1981. For the stock market, they indicate that partial liberalisation began in 1973 and full liberalisation was achieved in January 1981. In what remains of this section we argue that this very lengthy process of liberalisation peaked in the watershed year of 1979.

As discussed in the introduction, the first step towards the end of financial repression was the passage of the Competition and Credit Control (CCC) Bill in 1971 which liberalised the financial system, increased M4 and propelled credit, housing and equity booms (Bordo & Landon-Lane, 2009). According to Braggion & Ongena (2015), the CCC bill of 1971 put in motion a process of increasing competition among financial institutions that were no longer bounded by quantity restrictions or interest rate setting schemes and thus had to participate both in the deposit and loan markets. However, in 1973, the Heath government tried to reign back credit, but it was too-little-too-late, and the effects of the first oil shock pushed the banks that had financed the housing boom close to bankruptcy. It was at that time that the Bank of England rescued the financial system through a 'lifeboat' operation (Offer, 2017). According to Lee (1979), the 1973-74 financial crises was a secondary cause for the passage of the Banking Act in 1979, which formalised the supervision of banks and other deposit-taking institutions. However, what Booth (2015) argues was broader and stronger supervision and regulation of the financial industry, was not associated with the establishment of levies or increases in transaction costs to hinder activity, but rather as a solution to increasing competition and expansion of operations.

Coutts and Gudgin (2015) indicate that the natural step after the elimination of fixed exchange rates in 1971 and the beginning of financial deregulation with the CCC Bill was the full elimination of capital, wage and investment controls in 1979 by the recently inaugurated Thatcher government. Booth (2015) coincides and posits that there was substantial deregulation of the foreign exchange markets that drove economic conditions back to the pre-1939 situation when the movement toward financial repression began. Quinn & Inclan (1997) argue that these liberalisation measures were fostered by a context of favourable economic growth that reduced the needs and demands for protection by the industry. Offer (2017) concurs and indicates that finding oil deposits in the North Sea was a necessary windfall for the stabilisation of the pound which allowed all these measures to come to fruition. Bellringer & Michie (2014), also argue that these measures exposed the City to international competition for investments. While according to Bordo & Landon-Lane (2009) the rest of the Thatcher revolution included tax cuts on capital income and widespread deregulation of industries, all the measures discussed above signal 1979 as the watershed year in the institutional setup of the UK financial system. Consequently, in what follows we will test whether this date also marks a structural break in the credit-stock market relationship in Britain.

6.3. Testing the Relationship: VAR results

To characterise the evolution of the financial cycle for Britain since 1922 we need to understand the joint dynamic behaviour of the stock market and real credit LBBIs. To this end, we will employ a vector autoregression (VAR) model that relates endogenous LBBIs and a set of exogenous control variables to control for general economic conditions.[243] Our analysis in this section is structured as follows. In the first part of the section, we describe the VAR model, perform a full sample estimation, and test for the presence of a structural break in the relationship in 1979. In the final part, we re-estimate the VAR model for the pre and post-break samples and use Granger causality tests to identify whether there is evidence of a changing relationship between the variables which may be driven by the regulatory framework.

A note of caution is pertinent about the Granger causality analysis. If we were to find evidence of stock market movements causing shifts in real credit, then the most direct mechanisms would be that investors are using more-valuable stocks as collateral on new loans, or that companies with increasing equity value see their debt to equity ratio plunge and thus access new credit either to invest in new projects. If we were to find evidence of real credit movements causing shifts in the stock market, the

[243] In this section, the references we follow to construct the VAR model are Charemza & Deadman (1997), Lütkepohl & Krätzig (2004), and Pesaran (2015).

most direct mechanism would be investors taking our loans to finance their stock market investments. Results are restricted to the link between stock markets and real credit and should not be extrapolated to other asset classes such as investment in the housing market. We leave this noteworthy issue for further research.

A generalised VAR model including exogenous variables takes the following form:

$$\mathbf{Y_t} = \sum_{j=1}^{P} \mathbf{\Lambda_j Y_{t-j}} + \mathbf{\Phi X_t} + \varepsilon_t \tag{28}$$

Where variables in bold denote matrices or vectors. $\mathbf{Y_t}$ is an nx1 vector of endogenous variables, $\mathbf{\Lambda_j}$ is nx1 vector of the coefficients for the j[th] lag in the endogenous variables $\mathbf{Y_{t-j}}$. $\mathbf{X_t}$ is an mx1 vector of exogenous variables and $\mathbf{\Phi}$ is a parameter matrix. The error term, ε_t, is assumed to behave like white noise so we will perform a test for autocorrelation and normality of the residuals. To establish the order of the VAR model (the number of lags p), we follow Lütkepohl & Krätzig (2004) and establish lag order selection statistics based on different information criteria.[244]

For the choice of exogenous variables in $\mathbf{X_t}$ that may be affecting the behavior of stock price and real credit growth, we include all of the control variables and variables of interest discussed in Chapter 3 and Chapter 4. The following table includes the first estimation of the VAR model including all exogenous variables and the optimal number of lags according to the pre-estimation information criteria described above.

[244] The information criteria used include the final prediction error (FPE) (Akaike, 1969), Akaike's information criterion (Akaike, 1974), Schwarz's Bayesian information criterion (Schwarz, 1978) and the Hannan-Quinn information criterion (Hannan & Quinn, 1979).

Table 50: Full sample estimation of VAR model including all exogenous variables

VAR equations	Short-run		Medium-run		Long-run	
	Stocks	*Credit*	*Stocks*	*Credit*	*Stocks*	*Credit*
Panel A: Endogenous						
LBBI Stocks lag 1	-0.0989	**.1413****	**.5521*****	-0.0168	**.666*****	**.1728****
LBBI Stocks lag 2	**-.1879****	-0.0678	**-.5177*****	-0.025	**-.3832*****	**-.2343****
LBBI Stocks lag 3					-0.0591	**.2241*****
LBBI Real credit lag 1	**-.2098***	0.1067	**-.2655*****	**.7802*****	-0.1697	**.8673*****
LBBI Real credit lag 2	**-.2548****	0.0574	0.0173	**-.298*****	0.1707	-0.1146
LBBI Real credit lag 3					-0.1622	-0.1107
Panel B: Exogenous						
Trend	0.0025	.0099***	0.0036	.0051*	**.0055***	-0.0013
Loans to GDP	-0.4098	**-1.145*****	-1.293	1.163	0.2917	-1.379
Inflation rate	1.469	-0.152	1.052	0.5304	0.4337	**2.516*****
Change in real GDP per capita	-1.582	1.336	**-2.444***	-0.5446	**-3.126****	-1.622
Change in investment to GDP	-4.346	7.324	2.056	**4.136*****	2.044	1.58
Change in openness to trade	-2.24	-0.9191	**3.53***	2.68	**3.187***	1.002
Change in financial development	3.534	**5.337*****	2.757	1.268	2.528	0.6932
Overall current balance to GDP	**7.479****	3.12	-0.0073	-0.0108	**-.0443****	0.0196
Capital account to GDP	**5.171***	2.707	**-2.85***	**-5.1*****	-1.83	**-5.653*****
Short term rate diferential (domestic-foreign)	-0.0118	-0.0212	-0.4468	**-.6716*****	**-.4866***	-0.1031
Inflation differential (domestic-foreign)	-1.807	**-7.317*****	-1.65	4.946	-1.144	**6.929****
Global credit cycle (US LBBI to time horizon)	0.1681	0.1094	-0.0097	**.118****	-0.1004	**.1222****
Global stock market cycle (US LBBI to time horizon)	**.4507*****	0.06	**.3279*****	0.0202	**.2339*****	-0.0103
Constant	0.0604	0.1174	0.0464	0.0662	-0.0173	0.0413
R squared	0.5459	0.657	0.7031	0.8145	0.7257	0.8514
Chi squared	104.6	166.7	206	381.9	227.5	492.6

Note: Lag order selection is optimal for the short-run using the FPE and likelihood ratio criterions, for the medium-run using the LR, FPE, AIC, SBIC and HQ information criteria; for the long-run using the HQ information criteria. Higher lag orders in the long-run specification, as suggested by LR, AIC and SBIC resulted in at least one of the lags being statistically insignificant. We include all exogenous described in Chapter 3 and Chapter 4. Statistically significant results beyond 90% significance are highlighted in bold. Significance * 10%, ** 5%, *** 1%.

We present post-estimation statistics in Table 51.

Table 51: Post-estimation statistics full sample

VAR equations		Short-run		Medium-run		Long-run	
		Stocks	*Credit*	*Stocks*	*Credit*	*Stocks*	*Credit*
Panel A: Wald lag exclusion statistics							
Lag 1	Individual	0.10	**0.04**	**0.00**	**0.00**	**0.00**	**0.00**
	Joint	**0.03**		**0.00**		**0.00**	
Lag 2	Individual	**0.01**	0.41	**0.00**	**0.00**	**0.00**	**0.03**
	Joint	**0.02**		**0.00**		**0.00**	
Lag 3	Individual					0.24	**0.00**
	Joint					**0.00**	
Panel B: Autocorrelation of errors (P values for Lagrange multiplier test)							
Lag 1		0.60		0.57		0.17	
Lag 2		0.91		0.32		0.81	
Lag 3		0.12		0.08		0.39	
Conclusion		**No autocorrelation**		**No autocorrelation**		**No autocorrelation**	
Panel C: Jarque Bera normality test of errors							
Individual		0.33	0.26	0.24	0.89	0.41	0.12
Joint		0.30		0.54		0.19	
Conclusion		**Cannot reject**		**Cannot reject**		**Cannot reject**	
Panel D: Eigenvalue stability condition							
Conclusion		**Satisfied**		**Satisfied**		**Satisfied**	
Panel E: Likelihood ratio test for a structural break in 1979							
Statistic		**92.56**		**123.34**		**176.52**	
P-value		**0.00**		**0.00**		**0.00**	

Note: Panel A presents the Wald Test for lag exclusion where the null is that the lags are statistically equal to zero in each equation individually and then jointly. Panel B applies the Lagrange multiplier test for autocorrelation in the residuals as in Godfrey (1989). We present the p-values first three lags in the test and the conclusion of the test up to six lags. Panel C presents the Jarque & Bera (1980, 1987) test of normality in the residuals both for each equation and jointly for both specifications. The null hypothesis is the error term follows a normal distribution. Panel D presents the eigenvalue stability condition of the VAR that tests that all eigenvalues of the matrix of endogenous coefficients lie within the unit circle (have modulus smaller than 1) as in Glaister (1993). Panel E presents a likelihood ratio test for a known structural break in the VAR model estimated for 1979 following Bai (2000). The null hypothesis is that there is no structural break.

From Table 51 we know that the error is well-behaved and that the VAR structure fulfils the stability condition so that any given shock will not become an explosive process but rather fade out in time. Additionally, as argued in Section 6.2 there is evidence of a structural break in the VAR structure to every time horizon in 1979, indicating that the deregulation process that peaked in that gear changed the dynamic relationship between stocks and credit.

From Table 50 we know that some of the exogenous variables are statistically insignificant for both credit and stock market equations. Consequently, we re-estimate the model to each time horizons including only the exogenous variables that are significant with 90% confidence level in at least one of the two equations. We also confirm that the number of optimal lags does not change in the full sample specification and the structural break in 1979 is still statistically significant with over 99.9% confidence to all time horizons.

To investigate the causal relationships between real credit and stock market LBBIs for the UK, we will estimate the VAR model for two different subsamples: the first one from 1922-79 and the second from 1980-2013 using the exogenous variables in the reduced form specification. With the estimation results for each subsample, we use the lag order selection criteria discussed above to optimise the number of lags. For the sake of brevity in what follows we will only present the coefficients for the lags in the endogenous variables.

Table 52: VAR estimation results and post-estimation statistics 1922-79

Sample I: 1922-79		Short-run		Medium-run		Long-run	
		Stocks	*Credit*	*Stocks*	*Credit*	*Stocks*	*Credit*
Panel A: Endogenous							
LBBI Stocks lag 1		-0.0811	**.2328*****	**.4998*****	-0.053	**.4999*****	**.1698****
LBBI Stocks lag 2		**-.3111*****	-0.0719	**-.514*****	-0.0026		
LBBI Real credit lag 1		-0.1501	0.0057	-0.2053	**.671*****	**-.2818*****	**.7242*****
LBBI Real credit lag 2		**-.2766****	0.0721	-0.0949	**-.3139*****		
R squared		0.5707	0.7156	0.6968	0.84	0.6738	0.8234
Chi squared		74.43	140.9	128.7	293.9	117.8	265.7
Panel B: Wald lag exclusion statistics							
Lag 1	Individual	0.40	**0.01**	**0.00**	**0.00**	**0.00**	**0.00**
	Joint	**0.02**		**0.00**		**0.00**	
Lag 2	Individual	**0.00**	0.44	**0.00**	**0.01**		
	Joint	**0.01**		**0.00**			
Panel C: Autocorrelation of errors (P values for Lagrange multiplier test)							
Lag 1		0.58		0.56		0.34	
Lag 2		0.42		0.63		0.09	
Lag 3		0.34		0.17		0.45	
Conclusion		**No autocorrelation**		**No autocorrelation**		**No autocorrelation**	
Panel D: Jarque Bera normality test of errors							
Individual		0.46	0.72	0.75	0.26	**0.00**	0.37
Joint		0.70		0.51		**0.02**	
Conclusion		**Cannot reject**		**Cannot reject**		**Cannot accept**	
Panel E: Eigenvalue stability condition							
Conclusion		**Satisfied**		**Satisfied**		**Satisfied**	
Panel F: Granger causality tests - P values							
Real credit causes stocks		**0.02**		**0.02**		**0.00**	
Stocks cause real credit		**0.01**		0.74		**0.04**	

Note: Panel A presents the coefficients for the optimal number of lags of the endogenous variables. Panel B presents the Wald Test for lag exclusion where the null is that the lags are statistically equal to zero in each equation individually and then jointly. Panel C applies the Lagrange multiplier test for autocorrelation in the residuals as in Godfrey (1989). We present the p-values first three lags in the test and the conclusion of the test up to six lags. Panel D presents the Jarque & Bera (1980, 1987) test of normality in the residuals both for each equation and jointly for both specifications. The null hypothesis is the error term follows a normal distribution. Panel E presents the eigenvalue stability condition of the VAR that tests that all eigenvalues of the matrix of endogenous coefficients lie within the unit circle (have modulus smaller than 1) as in Glaister (1993). Panel F presents the Granger causality test as in Ganger (1969, 1980, 1988).

Table 52 shows that the error is well behaved and that the VAR specification is stable. In this case, the optimal number of lags remains in two for the short and medium-run specifications while it falls to 1 for the long-run specification. Regarding Granger causality, panel F shows that there is a bidirectional dynamic relationship between the stock market and credit before deregulation.

The first interpretation of these results is that we are facing a chicken-and-the-egg problem in which we can only identify the feedback loop between asset price and credit growth as described by Minsky (1986, 1992) and discussed at length in Section 1.1.2.2. What we know from Granger (1969, 1980) is that the LBBIs for the stock market have some unique information that is useful in predicting the future behaviour of the LBBIs for real credit in the short and long-run specification. The reverse is also true. The causal link from stocks to credit is representative of a fundamental relationship in which increasing asset prices, through the financial accelerator mechanism, allow for a larger availability of credit. The link in the opposite direction indicates that it is possible that part of the loanable funds was directed to speculative investment in the stock market.

This implies that, with the results from panel F in Table 52, if policymakers wished to affect both endogenous variables, in theory, they would only need to affect one as there is bidirectional causation between them. It also indicates that a shock to one of the endogenous will reverberate across the model to affect the other. This confirms the idea posited by Kindleberger & Aliber (2005) of self-fulfilling manias and panics: positive shocks to asset prices fuel credit which concurrently fuels asset prices further. A negative shock to either variable, even a small one, may upend the virtuous cycle into a vicious one ending in a stock market crash or a credit crunch.

These findings, however, should not be taken out of the historical context of financial repression discussed in Section 6.2. Under a scenario of quantity limitations to credit, restrictions on international capital flows, taxes on imports, and high transaction costs for securities trades, the effect of these feedback on financial stability should be muted. Particularly, since expansions in credit are tightly regulated, the amplitude of the feedback loop identified in Table 52 ought to be bounded. By the same token, since both variables share strong causal links, limiting the amplitude in the boom-bust cycle of one of them should impinge on the other variable's range of variation. In Table 53, we present results once financial repression has come to an end. It has the same structure as Table 52, but this time the VAR specification is applied to LBBIs from 1980 until 2013.

Table 53 shows that the error is well behaved and that the VAR specification is stable. In this case, the optimal number of lags falls to 1 for the short-run and remains in two lags for the medium and long-run specification. Regarding Granger causality, we find that with deregulation the link that runs from the stock to the credit market appears to be broken while the opposite nexus remains robust. In this case, as suggested in an extensive review of the literature by Posen (2006), monetary authorities should not aim to affect asset prices insofar as they do not affect expected inflation or the output gap, which they already currently control for under the inflation targeting regime.

However, we do find that shocks to real credit do have a causal effect in movements in the stock market to every time horizon. The implications of this result for current policy-making are substantial. As indicated in the introduction, credit growth seems to be a good predictor of financial instability, and our findings attest to the possible mechanism through which this occurs. If in a scenario of liberalised financial markets credit booms (busts) can reverberate through the economy up to the point when they lead to asset price expansions (crashes), then regulators and policymakers should include credit growth in their target functions. Furthermore, the fact that the relationship holds for returns up to five years (as those reflected in the long-run LBBI) suggests that as Borio (2006) indicates, the current policymaking horizon for monetary authorities is too short and may be leading to myopic decision-making.

Table 53: VAR estimation results and post-estimation statistics 1980-2013

Sample II: 1980-2013		**Short-run**		**Medium-run**		**Long-run**	
		Stocks	*Credit*	*Stocks*	*Credit*	*Stocks*	*Credit*
Panel A: Endogenous							
LBBI Stocks lag 1		0.0204	-0.0904	0.0925	0.1144	**.2478*****	**-.2141***
LBBI Stocks lag 2				0.0015	0.0344	**-.3006*****	0.068
LBBI Real credit lag 1		**-.3936****	**.3077****	**-.8103*****	**1.212*****	-0.0557	**1.222*****
LBBI Real credit lag 2				**.7587*****	**-.5178*****	**.1904****	**-.4832*****
R squared		0.7389	0.8201	0.9175	0.9097	0.9633	0.9402
Chi squared		84.92	136.7	322.3	292.1	762.1	455.8
Panel B: Wald lag exclusion statistics							
Lag 1	Individual	0.12	**0.01**	**0.00**	**0.00**	**0.00**	**0.00**
	Joint	**0.01**		**0.00**		**0.00**	
Lag 2	Individual			**0.00**	**0.00**	**0.00**	**0.00**
	Joint			**0.00**		**0.00**	
Panel C: Autocorrelation of errors (P values for Lagrange multiplier test)							
Lag 1		0.25		0.00		0.17	
Lag 2		0.28		0.14		0.03	
Lag 3		0.75		0.20		0.03	
Conclusion		**No autocorrelation**		**No autocorrelation**		**No autocorrelation**	
Panel D: Jarque Bera normality test of errors							
Individual		0.91	0.10	0.80	**0.02**	0.90	0.71
Joint		0.31		0.07		0.93	
Conclusion		**Cannot reject**		**Cannot reject**		**Cannot reject**	
Panel E: Eigenvalue stability condition							
Conclusion		**Satisfied**		**Satisfied**		**Satisfied**	
Panel F: Granger causality tests - P values							
Real credit causes stocks		**0.05**		**0.00**		**0.00**	
Stocks cause real credit		0.23		0.28		0.13	

Note: Panel A presents the coefficients for the optimal number of lags of the endogenous variables. Panel B presents the Wald Test for lag exclusion where the null is that the lags are statistically equal to zero in each equation individually and then jointly. Panel C applies the Lagrange multiplier test for autocorrelation in the residuals as in Godfrey (1989). We present the p-values first three lags in the test and the conclusion of the test up to six lags. Panel D presents the Jarque & Bera (1980, 1987) test of normality in the residuals both for each equation and jointly for both specifications. The null hypothesis is the error term follows a normal distribution. Panel E presents the eigenvalue stability condition of the VAR that tests that all eigenvalues of the matrix of endogenous coefficients lie within the unit circle (have modulus smaller than 1) as in Glaister (1993). Panel F presents the Granger causality test as in Ganger (1969, 1980, 1988).

6.4. Concluding Remarks

This chapter aimed to explore the financial cycle, characterised by the joint evolution between credit aggregates and stock market prices, in the UK from 1922 until 2013. To further understand its behaviour, we tested for changes in its behaviour under different regulatory frameworks. To do so, we broke down the period of study between a period of financial repression (1922-79) and a period of liberalised financial markets (1980-2013) and tested for a structural break in the relationship.

Our findings indicate that the relationship between stock price and credit growth is contingent on whether the economy is experiencing a period of financial repression or latitude. As a case in point, we extensively discussed the changes in the British regulatory framework that occurred during the 1970s and that peaked in 1979. We found evidence that these changes coincide with a structural break in the VAR model proposed in section 6.3. Before deregulation, the relationship between both variables was of bidirectional causality, particularly in the short and long-run specifications. Contrarily, after deregulation, causality seems to run only from credit to the stock market.

This, for the current context of worldwide deregulation, suggests that we provide evidence in favour of central banks keeping a hands-off approach regarding asset price booms, after all the variable that seems to be leading the developments in the financial cycle is real credit growth. Consequently, we suggest that monetary authorities and regulators should include the behaviour of credit aggregates to different time horizons in their optimisation function as unchecked credit booms may result in increased financial instability. In the words of Kindleberger & Aliber (2005) "A strong case can be made for stricter regulation and supervision of banks to forestall lending in euphoric periods that may end in financial crisis" (p. 224).

An additional finding is that the causal link between stocks and credit appears to be strong in the long-run specification, regardless of the regulatory framework in place. This suggests, in line with what has been proposed by Borio & Lowe (2004) and Borio (2014a, 2014b), that it may be in the interest of central banks to increase the forecast period for their policymaking function. The current foresight of one or two years may be missing part of the picture and causing myopic decision making.

Further research is necessary in several directions. First, it may be useful to broaden the scope of the dependent variables to include housing prices on the asset side and foreign credit on the liability side. Additionally, one of the hallmarks of the deregulation process has been the rise of a shadow banking sector for which we are unable to account with the definition of credit in this paper. It would be interesting to show whether our results hold in the presence of a broader definition of both variables. Finally, this is an experiment that can be extended to other countries and institutional settings. Some suggested subjects of study may be developing countries that have undergone substantial changes either in the regulation of their financial sector (Latin American countries after de the debt crises of the 1980s, for example) or developed countries that have been subject to integration processes such as the members of the Eurozone.

Chapter 7. Summary of Findings: Lessons and Contributions

Financial (in)stability and financial crises have, once more, come to the fore of the research agenda for economic historians and international macroeconomists alike. As Fisher (1933) argued, equilibrium in financial systems and the real economy is a fragile thing. As financial imbalances accumulate through the overextension of firm and household balance sheets, excessive growth in asset prices and credit aggregates, the accumulation of public debt, or deficits in foreign accounts, equilibrium becomes untenable, and a crisis ensues.

The consequences have made the front page of newspapers for the better part of the last decade in the form of increasing unemployment, lukewarm growth in developed and developing economies alike, growing income and wealth inequality and, during the GFC, fears of deflation. In that context, questions that had arguably been answered in the 1990s, have been brought back to life.[245] What causes financial instability? Is it avoidable? What is the policy context that best suits the mitigation of financial imbalances?

At the centre of it all, a decades-old debate has resurfaced after the mainstream consensus proved its inability to shelter developed and developing economies the world over from the possibility of systemic risk events. On the one hand, the Greenspan-Bernanke view, which became mainstream in the 1990s, argues macroeconomic shocks are exogenous, and the financial system, whose ability to create money endogenously goes unacknowledged, operates mainly as an amplifier of those shocks.[246] Those who hold this view, argue for two critical coincidences in macroeconomics. First, the same interest rate that allows for price stability also serves to maximise output at non-inflationary levels. Second, the achievement of price stability is tantamount to financial stability. Naturally, whoever suggests policymakers should deviate from the optimal policy, would have to post incontrovertible proof.

[245] For an example recall Lucas' (2003) dictum about depression in developed economies.
[246] Not surprisingly the main mechanism awarded to the financial system in this view is called the financial accelerator.

On the other hand, the heterodox view argues that those coincidences are spurious, the consequence of historical conditions and that financial stability and price stability should be acknowledged as independent policy goals. In their perspective, the financial system, with its ability to create money endogenously and to innovate beyond the control of monetary authorities, can cause shocks and instability in the system. They argue that the myopic focus on price stability, a standard feature of inflation targeting regimes, has made authorities oblivious to the feedback the arises between asset prices and credit —the financial cycle— and its inherent ability to render the system fragile. Global financial linkages, information flows, and the globalisation of capital have added a further layer of complexity as shifts in the perception and valuation of risk have synchronised and become a transnational force. Naturally, in this view, a role should be assigned to asset prices and credit in the monetary policy reaction function beyond their effect on inflation and growth.

However, the debate is not only related to monetary policy but instead, it encompasses a broader institutional framework. After all, the choices made by different countries, at different times, with regards to exchange rates and capital controls, beyond their effect on macroeconomic fluctuations, have implications for developments in stock and credit markets and, ultimately, on financial stability. On the one hand, the effect of exchange rates on asset prices and credit seems to be very much contingent on market microstructure elements and the identification of causality has proven difficult. On the other hand, concerning capital controls, processes of capital flow deregulation and stock market liberalisation are critical for the development of future financial instability. Additionally, financial integration seems to be a key driver of financial instability, mainly through the global financial cycle. It is in this context that we formulated the guiding question for this research:

> *Is the accumulation and unwinding of financial imbalances in stock markets and private domestic credit, in advanced economies, contingent on the exchange rate and capital control regimes in place*

between 1922 and 2013, and if so, how do the sources of instability change according to the institutional arrangements in place?

We have chosen to address this question by building a database for twelve developed economies: Australia, Canada, Denmark, France, Germany, Italy, Japan, the Netherlands, Norway, Sweden, Switzerland, and the United Kingdom. Data for the behaviour of stock markets and real credit in the United States has been included as a proxy for the global financial cycle posited in the literature. In the choice of our period of study, the database begins with the Genoa Conference, the first real attempt to return to the rules of the gold standard after the First World War and runs as close to the present as the data allows.

To attest to the changes in the institutional setup, we present the first work, to our knowledge, that directly links the framework of the macroeconomic policy trilemma and financial stability in the long-run. To do so, we constructed dummy sequences for exchange rate regimes and capital controls for the twelve countries in our database. The former was built following time-tested methodologies in the literature while the latter was constructed piecemeal from *de jure* classifications available from different sources. From interacting these two sequences, we obtained four different trilemma regimes characterised by their stances on exchange rates (fixed/flexible) and openness in the capital account (open/closed).

To analyse the accumulation and unwinding of financial imbalances in the stock market and credit aggregates we built a novel indicator for expansions and contractions: The Local Bull Bear Indicator (LBBIs). These indicators were our dependent variables for the two central parts of this thesis. In the first part, we present panel data evidence on the evolution of stock markets (Chapter 3) and credit aggregates (Chapter 4) under different trilemma regimes. The second part relates to time series evidence on the interplay between domestic and foreign economic policy (Chapter 5) and the relationship between the financial cycle and regulation (Chapter 6) using the United Kingdom as a case study.

As we answered the guiding research question, we have been able to shed light on some other queries that remain open in the literature: Is there evidence for a financial cycle that arises from the feedback between asset prices and credit aggregates? Is the boom and bust process of asset prices and credit, driven somehow by global financial conditions? Is there a place for asset prices and credit aggregates in the formulation of monetary policy? In what follows we highlight the contributions to those open question and lessons learnt throughout this volume.

Contribution 1: The Local Bull Bear Indicator

In answering the research question, the first hurdle we met was related to the identification of financial instability. The literature usually employs binary sequences for the characterisation of financial crises, where crises periods take a value of one and calm periods a value of zero. Since systemic risk events are rare, to harness sufficient variability, researchers are forced to build wide and long panels of countries in their quest for identification.

This solution, which is standard in research for economic historians and long-run macroeconomists, will operate correctly under two assumptions that we approach with disbelief. First, when pooling together diverse countries, all the subject-specific differences that are not controlled for in the independent variables of a regression, will be summarised (and accounted for) by the country fixed effects. Second, two crises, insofar as they are both marked with a one in the dummy series, are catalogued as qualitatively identical events. Additionally, in creating binary sequences, researchers require a crisis to happen in order to mark a period with a one; they cannot use, for example, a value of 0.5 for a period of high financial instability. This presumes that the switch from calm to crisis is an instantaneous change of state and disregards the idea of accumulating imbalances that underlies our research question.

To overcome this obstacle we developed the Local Bull Bear Indicator, a methodology that reexpresses the growth rates of financial and economic time series, to different time horizons, as standard deviations above or below their time-varying mean. These indicators are our primary contribution to the literature on the identification of trends and cycles in financial and economic time series. The value of these variables lies in that they aggregate sufficient information about the growth rate structure of the series to different time horizons. Finally, since LBBIs are continuous time series that adequately reflect the empirical distribution of the underlying data, they exceed by far the informational content of the traditional binary sequences, and they resolve the identification problem we faced.

For researchers in economics and finance, LBBIs are a valuable contribution since they represent a measure that is tractable and readily interpretable: the risk-adjusted deviation from average expressed in standard deviations. The fact that it can be constructed to different time horizons is of added interest as it captures the persistence of phases in the series well beyond what is contained in the usual methodologies. Moreover, since LBBIs are constructed by using both time-varying means and volatilities, they permit analysing events in their respective historical context

In our presentation of the methodology, we show that LBBIs, in their short, medium and long-run specifications provide as much information as alternative methodologies and allow for further nuance and detail in the analysis of expansion and contraction phases in credit and stock markets. In an application of the LBBIs to the UK stock market from 1922 until 2015 we found that the measures of amplitude, duration, and severity for each of the phases are very dispersed. While the lack of regularities in the data made extracting stylized facts impossible, it revealed a paramount characteristic of bull and bear markets: each phase is unique and summarising it in a binary sequence is not making justice to its underlying complexities. Furthermore, since the indicators allow us to identify persistence, we have found that short run expansions (contractions) can coincide with long-run contractions (expansions). This apparent contradiction is moot since it merely reflects that long-run trends need not be altered by short-run shocks.

Contribution 2: New data series

As a data contribution, in Annex 7 we offer a complete characterisation of expansions and contractions of the stock market and real credit series for the thirteen countries in the database. In each table, we present the start and ending date of each phase, its amplitude, duration, and severity according to the new measures we propose. These tables offer researchers a new characterisation of expansions and contractions that accounts for persistence in time, and that will surely be useful in answering the many open questions that remain on this fascinating subject. We turn our attention to those open questions in the epilogue to this dissertation.

Contribution 3: On the global financial cycle and international integration of markets

For the stock market, we found that LBBIs for the US covary negatively with the VIX, a measure employed in the literature to proxy for the global financial cycle. Similarly, in the case of real credit, we found that the LBBIs for the US are strongly related to the main driver of the co-movement across domestic credit market as measured by the first principal component of the dependent variables. Consequently, and in agreement with the panel specification tests, we included both series as proxies for a global financial cycle in the stock market and credit models, respectively. Our main argument in doing so is not that the US LBBIs are driving the phenomena but instead that they are representative of the joint movement of domestic stock and credit markets. An additional benefit of including this variable is that it allows for a more parsimonious model than the one we would have obtained by including simple time fixed effects.

For the stock market model, we find this global cycle is positively related to stock market LBBIs and statistically significant in all specifications, regardless of the exchange rate and capital control regimes as in Rey (2015). For the real credit specification, we find that the correlation is weaker but still positive and statistically significant to every time horizon in the unconditional model. Once we break the sample by trilemma regime, the global financial cycle loses significance under a flexible exchange rate and an open capital account.

Furthermore, in our study about stock market co-movements between the UK and the global cycle, we have found that the idea of a U-shaped integration across markets with peaks during the gold standard and the present day is consistent with our specification using the short-run indicator. However, when we look at medium or long-run LBBIs, the story seems to change. Medium-run co-movement between the British stock market and the global financial cycle seems to have stagnated since the fall of Bretton Woods despite the wave of deregulation of the 1980s. It seems that country-specific shocks such as domestic recessions or crashes play a role in stalling the effect that integration may have in the medium-run. Regarding the long-run story, we identify that co-movement peaks in two of the riskiest moments in the series: the Second World War and the inflation-ridden 1970s. We hypothesise that while returns drive the short-run integration of markets, changing perceptions and valuations of risk may be the main driver in the long run association between British and global financial markets.

In that same regard, our study of the interplay between domestic economic policy and the trilemma regimes for the UK shows that changes in the short and medium-run estimators fo the role played by the global cycle are contingent on the policies that Britain undertook regarding exchange rates and capital controls. Periods with free capital flows coincide with a stronger association to world markets. However, the interaction between domestic and foreign economic policy seems to be relevant in understanding the changing association between the UK and global markets in the long-run. In the absence of free capital flows, stronger synchronisation of cycles occurs concurrently with periods of fiscal expansion (as during war-time demand management) or in the presence of deregulated credit markets (as in the early 1970s). This association may be driven both by changes in stock market prices and by common risk factors.

Contribution 4: Determinants of the stock market and real credit are contingent on the trilemma regime in place

In both stock market and real credit models, found evidence of structural breaks in the coefficients of the independent variables by trilemma regime which allowed us to conclude that the determinants in both models are contingent on the choice of exchange rate and capital control regimes. In Table 54 we summarise the results of the regressions by trilemma regime in both models highlighting only the sign of the statistically significant coefficients with 95% confidence for the variables of interest.

Table 54: Summary of results for the stock market and credit models - full sample

	TR I: Fixed & closed		**TR II: Fixed & open**		**TR III: Flexible & closed**		**TR III: Flexible & open**	
	Stocks	*Credit*	*Stocks*	*Credit*	*Stocks*	*Credit*	*Stocks*	*Credit*
Overall current balance to GDP	+	-	+	-	+	+	+	
Capital account to GDP			+	-	+		+	
Short term rate diferential (domestic-foreign)	-		-	-	-		-	
Inflation differential (domestic-foreign)	-	-	-	-		-	-	-
Global cycle	+	+	+	+	+	+	+	

Note: Summary of results extracted from Section 3.4 and Section 4.4. We only highlight the sign of statistically significant coefficient with 95% confidence. We require the coefficient to be statistically significant in at least one of the regressions (short, medium or long-run).

There are three main takeaways from Table 54. First, the differential in inflation and the global cycle seem to be a common driver for both stocks and credit regardless of the trilemma regime. On the one hand, the finding for the global market is relevant as it speaks about synchronisation across markets that extends beyond the usual channels of capital flows and exchange rate adjustment. We expect that information flows and the behavioural characteristics of agents should play a role in driving this co-movement. On the other hand, the fact that the inflation differential is consistently significant reaffirms the importance of price stability for financial stability. However, as we will discuss in the following contribution, while price stability is necessary, it is not a sufficient condition for stable markets.

Second, except for TR II, the short-term interest rate differential and the net capital account to GDP only affect the evolution of the stock market. As we have argued, these results may be driven by the definition of real credit that we employ throughout the dissertation. Following Kindleberger & Aliber (2005):

"Monetary expansion is systematic and endogenous rather than random and exogenous. During economic booms, the amount of money defined as means of payments has been continuously expanding and the existing money supply has been used more efficiently to finance both increases in economic activity and the purchases of real estate and securities and commodities in search of capital gains. The efforts of central bankers to limit and control the growth of the money supply have been offset in part by the development of new and very close substitutes for money". (pp. 66-67)

It is possible that, as posited in the quote, the decoupling between interest rates and domestic credit is associated with financial innovation and new sources of credit that we may not be considering. The issue is not only restricted to foreign credit but also to the role of the shadow banking sector, and new financial products, particularly since the 1980s.

Finally, the coefficients for the net current account indicate a stable and straightforward relationship with the stock market but a changing link with regards to credit. As we will discuss in the epilogue, this is one of the more intriguing avenues for further research,

Contribution 5: The drivers of financial instability are contingent on the trilemma regime

In our analysis of financial stability, we tested the stock market and credit models for structural breaks in the coefficients by trilemma regime and type of phase. The Chow test resulted in evidence of a structural break in both cases, providing evidence that the channels through which imbalances accumulate and those through which they unwind are different. We summarise our findings for expansions in Table 55

Table 55: Summary of results for the stock market and credit models - expansions

	TR I: Fixed &		TR II: Fixed &		TR III:		TR III:	
	Stocks	*Credit*	*Stocks*	*Credit*	*Stocks*	*Credit*	*Stocks*	*Credit*
Overall current balance to GDP			+	-			+	±
Capital account to GDP		+	+				+	±
Short term rate diferential (domestic-foreign)								
Inflation differential (domestic-foreign)		-		-				
Global cycle	+	+	+	+			+	-

Note: Summary of results extracted from Section 3.4 and Section 4.4. We only highlight the sign of statistically significant coefficient with 95% confidence. We require the coefficient to be statistically significant in at least one of the regressions (short, medium or long-run). The symbol ± indicates that the coefficient is positive under at least one specification and negative under at least one specification.

We summarise our findings for contractions in Table 56.

Table 56: Summary of results for the stock market and credit models - contractions

	TR I: Fixed &		TR II: Fixed &		TR III:		TR III:	
	Stocks	*Credit*	*Stocks*	*Credit*	*Stocks*	*Credit*	*Stocks*	*Credit*
Overall current balance to GDP			+					
Capital account to GDP		+		±			+	±
Short term rate diferential (domestic-foreign)	-	+		-	-		-	
Inflation differential (domestic-foreign)	-	-	-		-			+
Global cycle	+		+		+		+	+

Note: Summary of results extracted from Section 3.4 and Section 4.4. We only highlight the sign of statistically significant coefficient with 95% confidence. We require the coefficient to be statistically significant in at least one of the regressions (short, medium or long-run). The symbol ± indicates that the coefficient is positive under at least one specification and negative under at least one specification.

The most remarkable result from the tables for expansions and contractions is that there are far fewer statistically significant coefficients in the former than in the latter. In general terms, bull phases seem to be driven by balance-of-payments variables and the global financial cycle. The drivers for the exchange rate, differentials in short-term interest rates and inflation, seem to be far more relevant in explaining bear phases in both stock markets and credit aggregates. Interestingly, while the global financial cycle may explain expansions in stock markets and credit, it is only relevant in explaining contractions in the stock market. This shows that while domestic credit booms seem to coincide across markets, credit busts may be country-specific events.

A major takeaway from this summary of results is that there is no single driver for either the accumulation or unwinding of imbalances, which directly contradicts the price-financial stability coincidence suggested by the pre-GFC consensus. The evolution of financial (in)stability in stock markets and credit aggregates is a complex issue as drivers for expansions and contractions are contingent on both the dependent variable and the institutional arrangement in place. From the tables, it is evident that stylizing our results any further would do an injustice to the underlying complexities of the issue. That has been one of the reasons for us to perform such an in-depth analysis of our findings for both stocks and credit under each trilemma regime within the corpus of the dissertation.

Contribution 6: Implications for regulation and policymaking

In our study of the financial cycle as the joint evolution of stock markets and credit aggregates (Chapter 6), we find that there is a causal relationship between credit and stock markets for the UK. We followed the literature on financial repression which assigns a paramount role to the regulatory framework in place to the expansion of both credit and asset markets, and test whether the relationship changes after deregulation processes. For Britain, we find evidence of a structural break in the VAR model on the year where financial deregulation peaked (1979). Before deregulation, the relationship between both variables was of bidirectional causality, particularly in the short and long-run specifications. While this is evidence of the feedback posited by the heterodox view, we can provide no insight as to the direction in which the impulse is stronger. Contrarily, after deregulation, causality runs only from credit to the stock market.

Consequently, we suggest that this is strong evidence of how the financial system plays a role in both amplifying exogenous shocks and producing shocks endogenously in the system. Furthermore, a critical element that either allows or curtails the elasticity of the financial system seems to be precisely provided by the regulatory framework in place. In systems with less regulation, where credit is unshackled, the role played by asset prices in the financial cycle seems to be comparatively muted, and the story seems to be one of accumulating imbalances through endogenous money creation.

From a policymaking perspective, this suggests that central banks should keep a hands-off approach regarding asset price booms. Regardless of whether the system is regulated or deregulated, the whole causal relationship can be affected by pulling the levers increasing or curtailing credit creation. Consequently, we argue that this is evidence that monetary authorities and regulators should include the behaviour of credit aggregates to different time horizons in their optimisation function as unchecked credit booms may result in increased financial instability.

Epilogue: A Research Agenda for the Future

"There are known knowns; there are things we know we know. We also know there are known unknowns; that is to say we know there are some things we do not know. But there are also unknown unknowns - the ones we don't know we don't know". Donald Rumsfeld. Secretary of Defense in a press conference at the White House on December 2, 2012.

As I gave the finishing touches to the concluding remarks of this dissertation, I could not help feeling I left more questions open than those I actually answered. However, as the quote above indicates, I wanted to leave all the known knowns in the form of lessons to give the reader the sense of a *fait accompli*. The goal of this epilogue is the opposite. I aim at establishing a thread of all the known unknowns that will guide my role as a researcher in the future. This, again, is more a personal statement of purpose than an integral part of the dissertation, and I hope to provide a trove of intriguing questions for researchers and graduate students alike.

The first very relevant issue that we covered only tangentially was the identification of causality in the different relationships we were able to identify. In the future, I propose two different approaches to transform our description of correlations into the full-fledged identification of mechanisms. On the one hand, as we did in Chapter 6, the use of more sophisticated econometric models may provide a means to identify impulse-response relationships. On the other hand, resorting to an in-depth historical description and analysis of case studies for certain countries under specific regimes may show the intuition behind the mechanisms we propose. Hopefully, in selecting these historical examples, I will come across natural experiments that allow for clear-cut identification.

A second element that we did not cover, given that the framework of the trilemma did not require it, was the evolution of the monetary policy regime and its effect on financial stability. I believe that the more substantial variability in LBBIs will provide us with exciting new opportunities to explore how monetary policy regimes affect the evolution of the financial cycle. In particular, I would like to explore issues such as central bank independence, its role as a LOLR, the effects on financial stability of giving the central bank a dual mandate, and whether the behaviour of booms and busts is contingent on domestic policy latitude when compared to that of the centre countries.

A third element that remains puzzling after writing this volume is the role played by the net current account on the evolution of financial stability. In further research I will include several transformations of the net current account variables, to see if our results are robust.

The fourth direction for further research has to do with confirming the robustness of our results to a broader database. In finding new data, there are several critical issues that it would be useful to address. First, I should increase the number of countries to include not only developed but developing countries to contrast whether the effect of the trilemma on financial stability is different for AEs and EMEs. Second, I should include more bank-based and market-based countries since when testing for differences in financial stability by structure of the financial system our results were mostly inconclusive. Third, I should broaden the definition of asset prices to include property prices, corporate bonds and many other asset classes that have been excluded and that serve as investment vehicles. Regarding credit, I should broaden the database to include the financial sector both as a creditor and as a debtor. Additionally, we have not included the shadow banking sector which has gained relevance since the 1980s and was a significant source of instability during the GFC.

Finally, the database on capital flows could be improved in two ways. First, our measures of capital flows could be altered to include gross capital flows and not only the net capital account. Borio, James & Shin (2014) and Borio (2016) have shown that the dimension of gross capital of flows is a significant driver of financial instability. Second, the current definition of capital controls in the database contains de jure measures which may be affecting our classification of trilemma regimes, as we suggested regarding our results for TR III in Chapter 3 and Chapter 4. After all, what matters for economic agents and the evolution of economic and financial variables is what countries do and not necessarily what they say they do.

A final line of inquiry for the future is related to the LBBIs developed for this dissertation. On the one hand, there are several methodological choices that we made throughout the dissertation, such as using the full sample GARCH (1,1) rather than fitting it recursively, which could be revisited to confirm the value of the choices made here or change them for future applications. On the other hand, it is interesting to explore if LBBIs can be used to predict financial instability. This would require revisiting the early-warning literature and perform several out of sample tests using, for example, only *ex-ante* information. In doing so, we would be able to include in our analysis the perspective of policymakers, who do not know the future.

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PhD in Economic History

THE IMPOSSIBLE TRINITY AND FINANCIAL STABILITY

The Incidence of Trilemma Regimes on the (In)stability of Stock Markets and Credit Aggregates (1922-2013)

VOLUME II

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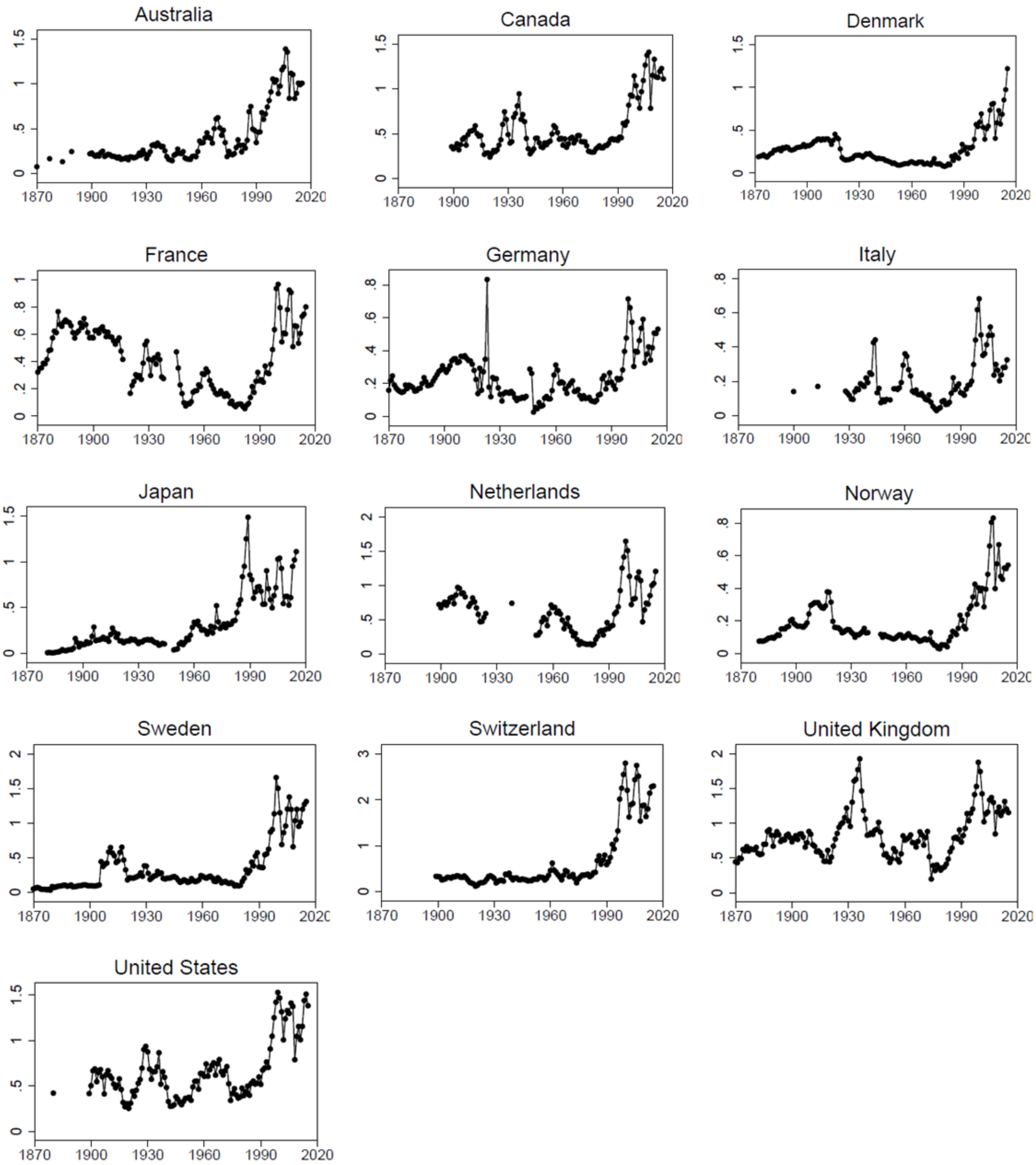
Annex 1. Stock Market Capitalisation by Country

The following plots show the stock market capitalisation for the thirteen countries in the database. Data comes from Figure 3 in Kuvshinov & Zimmermann (2018, p. 8).[247]

Figure 25: Stock market capitalisation to GDP ratio in individual countries



Note: Data depicts stock market capitalisation by country. It only contains shares from domestic companies listed in the domestic market.

[247] We thank Dmitri Kuvshinov for authorizing us to use these figures.

Annex 2. Statistical Characterisation of Stock Market and Credit Variables.

The following tables include a statistical characterisation of the original time series discussed in section 2.1. A first section of the left column describes the different series by type, frequency, country, number of observations, start and end date, and source. Then we include two graphs, one for the logarithmic transformation of the series and another for the first differences in the series. The following panel in the left section includes descriptive statistics for the series in levels, its logarithmic transformation, the first differences of the log or level series, and the one-period growth rate. The bottom panel of the left column includes a Daniels' trend test for the series in logarithms or levels and first differences, using the rank (Spearman) correlation between the series and a linear time trend (Daniels, 1950). For series of monthly frequency, we include a seasonality test, in levels and growth rates, which tests the statistical significance of the coefficient in the autocorrelation function (ACF) to 12 and 24 lags in the series in logarithms and first differences. Statistically insignificant coefficients allow rejection of the seasonality hypothesis.

In the right column, the first section performs structural breaks tests. To test the logarithmic transformation of the series we employ the test in Perron & Yabu (2009) which is specifically designed to be run on a non-stationary time series. To test the first differences in the series in logarithms we follow Bai & Perron (1998, 2003) since this test is designed for I(0) series. We present the statistic for the test where the null hypothesis is the absence of breaks against the alternative of one break. We establish our conclusion based on this test, although we also include the number of sequential breaks suggested following the Akaike Information Criterion (AIC) (Akaike, 1969, 1974).

The second panel in the column includes stationarity tests for the logarithmic transformations of the series and their first differences. We include the Augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1979, 1981) and the ADF-GLS test (Elliot, Rothenberg & Stock, 1996) on the logarithmic transformation of the series and its first differences. The ADF-

GLS tests performs the same ADF test on a series that has been previously detrended using a generalised least squares (GLS) regression. Additionally, we include the Kwiatkowski, Phillips, Schmidt, & Shin (1992) tests (KPSS) which, instead of testing for a unit root, tests for trend stationarity leaving the unit root as the alternative hypothesis.

We also run specific seasonal unit root tests for the series of monthly frequency. The first is the Hylleberg, Engle, Granger & Yoo (HEGY) (1990) test for seasonal integration. Similar to the ADF, the null is that there are some if not all seasonal unit roots in the data. The second seasonal unit root test we include if the one designed by Canova & Hansen (CH) (1995). This test, in the same spirit as KPSS, reverses the hypothesis in HEGY, setting as a null that all seasonal roots are below unity.

Additionally, only for the annual series, we include the Phillips & Perron (1988) test (PP) which runs the ADF test on the first differences of the series rather than on the levels to make it robust to unspecified autocorrelation and heteroskedasticity. We include the Phillips-Perron t-statistic (PP [z(t)]), and the Phillips-Perron normalised bias statistic (PP [z(rho)]). Note that numbers in brackets ([]) represent critical values and not p-values. Whenever the statistic exceeds the critical value, we cannot reject the alternative hypothesis.

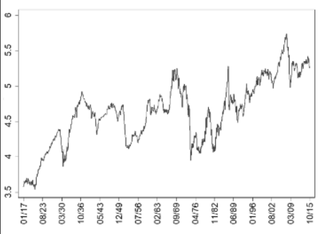
In the third panel, we perform tests to identify the stochastic structure of each time series. We present the statistics of the ARIMA process which best fits the data. Standard errors are included in parenthesis underneath the coefficients. The final panel includes a list of the outliers detected with respect to the best-fitting ARIMA process. These outliers can take three different forms: the additive outlier (AO) which reflects a single jump that immediately reverts to the process; the temporary change (TC) which indicates a jump that reverts slowly towards the identified process; and the level shift (LS) which represents a jump that never reverts to the original process.

Table 57: Australian stock market statistics

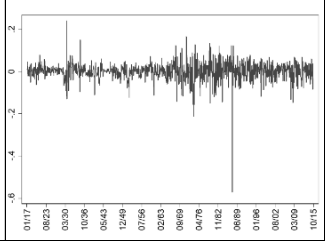
Series:	Stocks	**Frequency:**	Monthly
Country:	Australia	**Observations:**	1185
Period:	Jan/1917 - Sep/2015	**Source:**	GFD

Graphs

Logarithmic transformation



First logarithmic differences



Descriptive Statistics

	Level	*Log*	*Diff Log*	*Gr. Rate*
Mean	112.96	4.63	0.14%	0.23%
Median	105.71	4.66	0.32%	0.32%
Standard. Dev.	51.00	0.46	4.33%	4.19%
Skewness	0.92	-0.17	-2.19	-0.95
Kurtosis	3.75	2.64	30.54	15.69
Minimum	34.33	3.54	-57.07%	-43.49%
Maximum	310.50	5.74	24.23%	27.41%
Range	276.17	2.20	81.30%	70.90%
IQ Range	63.70	0.62	4.19%	4.20%

Trend Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
Daniels test	28.2382	0.0000	Trend	2.9543	0.00313	Trend

Seasonality Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ACF(12)	0.0229	0.9817	No Sea.	0.0258	0.9794	No Sea.
ACF(24)	0.0367	0.9707	No Sea.	0.0614	0.9510	No Sea.

Structural Breaks Tests

	Log		*Diff log*			
	PY test	Date	F(0/1)	Conclusion	AIC	Date
1st break	30.9044	Sep-51	0.9839	No break	0	-
2nd break	99.2885	Aug-72				
3rd break	67.1481	Jan-77				

PY corresponds to the F test in Perron and Yabu (2009), with 5% significance

F(0/1) corresponds to the test in Bai and Perron (2003) of zero breaks againts at least one break

AIC indicates the number of breaks according to the AIC criterion (Bai and Perron, 2003)

Stationarity Tests

	Log			*Diff Log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ADF	-3.1422	0.0965	I(1)	-9.3044	0.0000	I(0)
ADF-GLS	-2.1213	[-2.8900]	I(1)	-7.2174	0.0000	I(0)
KPSS	0.7925	[0.1480]	I(1)	0.0563	[0.4620]	I(0)
HEGY	-3.1400	0.0934	I(1)	-9.3000	0.0000	I(0)
CH	2.8624	0.0191	I(1)	2.6811	0.0378	I(1)

ARIMA process: ARIMA(1.1.0)

Estimates	ϕ_1	ϕ_2	θ_1	θ_2	σ^2	*ll*	AIC
	-0.2244				0.0075	4106.97	-4564.03
	(0.0000)						

Outliers detected in the estimated ARIMA

Type	Date	Estimate	Type	Date	Estimate
TC	Oct-30	0.07	TC	Sep-74	-0.0414
AO	May-35	-0.0267	AO	Dec-74	-0.0215
LS	Sep-68	-0.0281	TC	Mar-80	-0.035
AO	May-70	-0.0198	AO	Jan-83	0.0189
LS	Dec-71	0.0363	TC	May-84	-0.0305
LS	May-74	-0.0309	LS	Oct-87	-0.1192
LS	Jul-74	-0.0427	AO	Sep-97	0.0186

AO means Additive Outlier; TC means Temporary Change; LS means Level Shift

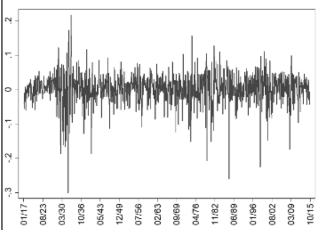
Table 58: Canadian stock market statistics

Series:	Stocks	**Frequency:**	Monthly
Country:	Canada	**Observations:**	1185
Period:	Jan/1917 - Sep/2015	**Source:**	GFD

Graphs

Logarithmic transformation

First logarithmic differences



Descriptive Statistics

	Level	*Log*	*Diff Log*	*Gr. Rate*
Mean	213.95	5.18	0.15%	0.26%
Median	185.38	5.22	0.51%	0.51%
Standard. Dev.	135.07	0.61	4.58%	4.51%
Skewness	1.24	0.08	-0.92	-0.53
Kurtosis	3.80	2.39	7.85	6.85
Minimum	50.36	3.92	-30.11%	-26.00%
Maximum	630.03	6.45	21.77%	24.33%
Range	579.67	2.53	51.88%	50.32%
IQ Range	131.71	0.76	4.89%	4.91%

Trend Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
Daniels test	31.0848	0.0000	Trend	1.1976	0.23107	No trend

Seasonality Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ACF(12)	-0.0081	0.9935	No Sea.	-0.0059	0.9953	No Sea.
ACF(24)	0.0174	0.9861	No Sea.	0.0292	0.9767	No Sea.

Structural Breaks Tests

	Log		*Diff log*			
	PY test	Date	F(0/1)	Conclusion	AIC	Date
1st break	19.1882	Apr-40	0.284	No break	0	-
2nd break	16.4848	Jul-74				
3rd break	10.5046	Oct-96				

PY corresponds to the F test in Perron and Yabu (2009), with 5% significance

F(0/1) corresponds to the test in Bai and Perron (2003) of zero breaks againts at least one break

AIC indicates the number of breaks according to the AIC criterion (Bai and Perron, 2003)

Stationarity Tests

	Log			*Diff Log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ADF	-3.6536	0.0255	I(1)	-23.6030	0.0000	I(0)
ADF-GLS	-3.2137	[-2.8900]	I(1)	-3.3745	0.0000	I(0)
KPSS	0.4938	[0.1480]	I(1)	0.0730	[0.4620]	I(0)
HEGY	-4.1100	0.0064	I(1)	-9.2600	0.0000	I(0)
CH	2.4939	0.0729	I(0)	2.3375	0.1198	I(0)

ARIMA process: ARIMA(0.1.1)

Estimates	ϕ_1	ϕ_2	θ_1	θ_2	σ^2	*ll*	AIC
			0.189		0.0078	3994.62	-4117.48
			(0.0000)				

Outliers detected in the estimated ARIMA

Type	Date	Estimate	Type	Date	Estimate
AO	Sep-30	0.0251	LS	May-33	0.0397
AO	Nov-31	0.0247	LS	May-40	-0.035
TC	May-32	-0.0751	TC	Mar-80	-0.0378
TC	Jun-32	-0.0396	LS	Oct-87	-0.0449
LS	Oct-32	-0.0357	TC	Aug-98	-0.0355

AO means Additive Outlier; TC means Temporary Change; LS means Level Shift

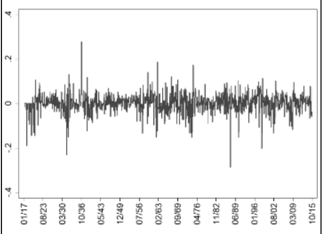
Table 59: Danish stock market statistics

Series:	Stocks	**Frequency:**	Monthly
Country:	Denmark	**Observations:**	1185
Period:	Jan/1917 - Sep/2015	**Source:**	GFD

Graphs

Logarithmic transformation

First logarithmic differences



Descriptive Statistics

	Level	*Log*	*Diff Log*	*Gr. Rate*
Mean	159.36	4.91	0.07%	0.14%
Median	120.49	4.79	0.09%	0.09%
Standard. Dev.	108.34	0.53	3.86%	3.85%
Skewness	2.18	0.80	-0.31	-0.02
Kurtosis	8.25	3.39	6.19	6.10
Minimum	43.37	3.77	-20.32%	-18.39%
Maximum	714.68	6.57	18.15%	19.90%
Range	671.31	2.80	38.47%	38.29%
IQ Range	62.81	0.50	3.61%	3.62%

Trend Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
Daniels test	19.5504	0.0000	Trend	0.5379	0.59065	No trend

Seasonality Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ACF(12)	0.0056	0.9955	No Sea.	0.0664	0.9471	No Sea.
ACF(24)	0.033	0.9737	No Sea.	0.0355	0.9717	No Sea.

Structural Breaks Tests

	Log		*Diff log*			
	PY test	Date	F(0/1)	Conclusion	AIC	Date
1st break	3.7775	Mar-78	0.4865	No break	0	-
2nd break						
3rd break						

PY corresponds to the F test in Perron and Yabu (2009), with 5% significance

F(0/1) corresponds to the test in Bai and Perron (2003) of zero breaks againts at least one break

AIC indicates the number of breaks according to the AIC criterion (Bai and Perron, 2003)

Stationarity Tests

	Log			*Diff Log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ADF	-2.0294	0.5485	I(1)	-10.5676	0.0000	I(0)
ADF-GLS	-0.5064	[-2.8900]	I(1)	-10.3202	0.0000	I(0)
KPSS	2.7267	[0.1480]	I(1)	0.5098	[0.4620]	I(0)
HEGY	-1.8100	0.6932	I(1)	-9.5200	0.0000	I(0)
CH	3.9976	0.0001	I(1)	3.8911	0.0002	I(1)

ARIMA process: ARIMA(3.1.0)

Estimates	ϕ_1	ϕ_2	f_3	σ^2	*ll*	AIC
	-0.231	0.0174	-0.1498	0.0067	-1877.2	-4669.23
	(0.0000)	*(0.5582)*	*(0.0000)*			

Outliers detected in the estimated ARIMA

Type	**Date**	**Estimate**	**Type**	**Date**	**Estimate**
LS	Jan-20	-0.0254	AO	Dec-85	0.0177
LS	Jan-25	0.0385	AO	Jan-87	0.0198
LS	Oct-72	0.0256	AO	Jul-97	0.0169
AO	Jan-73	0.0223	TC	Sep-02	-0.0282
LS	Nov-73	-0.0271	LS	Oct-08	-0.0325
LS	Aug-83	0.0282	LS	Sep-08	-0.0285
AO	Apr-84	0.0202	LS	Apr-09	0.0271

AO means Additive Outlier; TC means Temporary Change; LS means Level Shift

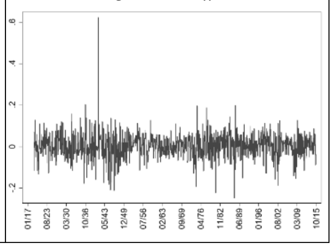
Table 60: French stock market statistics

Series:	Stocks	**Frequency:**	Monthly
Country:	France	**Observations:**	1161
Period:	Jan/1919 - Sep/2015	**Source:**	GFD

Graphs

Logarithmic transformation

First logarithmic differences



Descriptive Statistics	*Level*	*Log*	*Diff Log*	*Gr. Rate*
Mean	1,160.36	6.36	0.31%	0.49%
Median	415.66	6.03	0.42%	0.42%
Standard. Dev.	1,511.76	1.13	5.98%	6.21%
Skewness	1.68	0.64	0.66	2.23
Kurtosis	4.56	2.28	13.62	35.07
Minimum	82.26	4.41	-24.86%	-22.01%
Maximum	6,431.57	8.77	62.47%	86.76%
Range	6,349.31	4.36	87.32%	108.77%
IQ Range	1,105.74	1.68	7.25%	7.28%

Trend Test	*Log*			*Diff log*		
	Statistic	pvalue	Result	Statistic	5% C.V.	Result
Daniels test	25.3488	0.0000	Trend	-0.2639	0.3959	No trend

Seasonality Test	*Log*			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ACF(12)	0.0559	0.9554	No Sea.	0.0279	0.9777	No Sea.
ACF(24)	3.7629	0.0002	No Sea.	1.3562	0.1750	No Sea.

Structural Breaks Tests	*Log*		*Diff log*			
	PY test	Date	F(0/1)	Conclusion	AIC	Date
1st break	47.1000	Apr-29	0.2263	No break	0	-
2nd break	37.3687	Mar-39				
3rd break	53.7903	May-43				
4th break	53.9298	Oct-83				

PY corresponds to the F test in Perron and Yabu (2009), with 5% significance

F(0/1) corresponds to the test in Bai and Perron (2003) of zero breaks againts at least one break

AIC indicates the number of breaks according to the AIC criterion (Bai and Perron, 2003)

Stationarity Tests	*Log*			*Diff Log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ADF	-2.0272	0.5828	I(1)	-13.7549	0.0000	I(0)
ADF-GLS	-1.6223	[-2.8900]	I(1)	-2.2011	0.0267	I(0)
KPSS	2.0704	[0.1480]	I(1)	0.1149	[0.4620]	I(0)
HEGY	-0.6010	0.8730	I(1)	-8.2900	0.0000	I(0)
CH	1.8769	0.3984	I(0)	1.7909	0.4756	I(0)

ARIMA process: ARIMA(1.1.1)							
Estimates	ϕ_1	ϕ_2	θ_1	θ_2	σ^2	*ll*	AIC
	0.3072		0.4572		0.0558	1701.17	-3390.38
	(0.0000)		*(0.0000)*				

Outliers detected in the estimated ARIMA					
Type	**Date**	**Estimate**	**Type**	**Date**	**Estimate**
LS	Mar-41	0.6046	AO	Jan-88	-0.1601

AO means Additive Outlier; TC means Temporary Change; LS means Level Shift

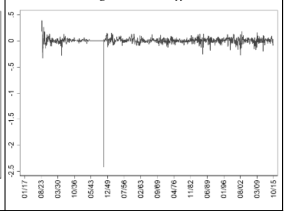
Table 61: German stock market statistics

Series:	Stocks	**Frequency:**	Monthly
Country:	Germany	**Observations:**	1103
Period:	Nov/1923 - Sep/2015	**Source:**	GFD

Graphs

Logarithmic transformation

First logarithmic differences



Descriptive Statistics				
	Level	*Log*	*Diff Log*	*Gr. Rate*
Mean	2,130.40	6.85	0.43%	0.71%
Median	981.64	6.89	0.50%	0.50%
Standard. Dev.	2,614.88	1.37	9.03%	6.01%
Skewness	1.54	-0.01	-17.62	-2.92
Kurtosis	4.44	2.01	474.41	56.92
Minimum	41.69	3.73	-241.93%	-91.10%
Maximum	12,149.17	9.41	39.08%	47.82%
Range	12,107.48	5.67	281.01%	138.92%
IQ Range	2,689.69	2.25	5.07%	5.12%

Trend Test						
	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
Daniels test	19.6164	0.0000	Trend	-6.3103	0.0000	Trend

Seasonality Test						
	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ACF(12)	0.0307	0.9755	No Sea.	0.0403	0.9679	No Sea.
ACF(24)	1.0984	0.2720	No Sea.	1.9594	0.0501	No Sea.

Structural Breaks Tests						
	Log		*Diff log*			
	PY test	Date	F(0/1)	Conclusion	AIC	Date
1st break	7.4132	Sep-23	0.2263	No break	0	-
2nd break	104.2200	Aug-41				
3rd break	9.2525	Jul-55				
4th break	9.2803	Feb-78				
5th break	6.6172	May-90				
6th break	5.8427	Jul-95				

PY corresponds to the F test in Perron and Yabu (2009), with 5% significance
F(0/1) corresponds to the test in Bai and Perron (2003) of zero breaks againts at least one break
AIC indicates the number of breaks according to the AIC criterion (Bai and Perron, 2003)

Stationarity Tests						
	Log			*Diff Log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ADF	-1.8409	0.6848	I(1)	-0.7254	0.0000	I(0)
ADF-GLS	-1.4836	[-2.8900]	I(1)	-13.9421	0.0000	I(0)
KPSS	2.3763	[0.1480]	I(1)	0.0219	[0.4620]	I(0)
HEGY	-1.1100	0.3336	I(1)	-9.3800	0.0000	I(0)
CH	3.0534	0.0085	I(1)	2.5023	0.0695	I(0)

ARIMA process: ARIMA(1.1.0)							
Estimates	ϕ_1	ϕ_2	θ_1	θ_2	σ^2	*ll*	AIC
	0.2553				0.0402	1976.93	11208.11
	(0.0000)						

Outliers detected in the estimated ARIMA					
Type	**Date**	**Estimate**	**Type**	**Date**	**Estimate**
AO	Dec-23	0.1813	LS	Oct-87	-0.2225
TC	Jan-24	0.5764	AO	Jan-88	-0.0978
TC	Feb-24	0.3049	LS	Aug-90	-0.157
LS	Apr-24	-0.1689	AO	Sep-90	-0.1246
LS	Aug-24	0.2583	AO	Jul-97	0.1154
LS	Dec-24	0.1665	LS	Aug-98	-0.1626
TC	Jan-25	0.1658	TC	Sep-01	-0.1506
LS	Sep-31	-0.2976	LS	Jul-02	-0.1493
TC	Dec-31	-0.1301	TC	Sep-02	-0.2813
LS	Jul-48	-24307	LS	Dec-02	-0.1631
AO	Dec-49	0.1184	LS	Apr-03	0.1826
AO	Oct-62	-0.0913	LS	Jan-08	-0.1608
AO	Oct-73	0.0928	TC	Feb-09	-0.1285
TC	Aug-86	0.1501	LS	Aug-11	-0.1804

AO means Additive Outlier; TC means Temporary Change; LS means Level Shift

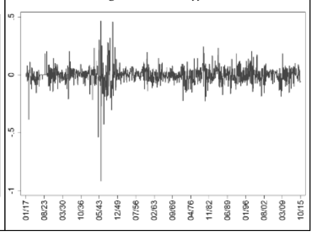
Table 62: Italian stock market statistics

Series:	Stocks	**Frequency:**	Monthly
Country:	Italy	**Observations:**	1185
Period:	Jan/1917 - Sep/2015	**Source:**	GFD

Graphs

Logarithmic transformation

First logarithmic differences



Descriptive Statistics

	Level	*Log*	*Diff Log*	*Gr. Rate*
Mean	229.90	5.13	-0.22%	0.09%
Median	167.69	5.12	0.00%	0.00%
Standard. Dev.	210.49	0.77	7.88%	7.73%
Skewness	2.77	0.21	-1.29	0.61
Kurtosis	13.55	2.57	23.73	14.38
Minimum	33.82	3.52	-91.75%	-60.05%
Maximum	1,481.94	7.30	46.81%	59.70%
Range	1,448.12	3.78	138.56%	119.75%
IQ Range	235.26	1.26	7.36%	7.35%

Trend Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
Daniels test	-22.761	0.0000	Trend	0.9834	0.8373	No trend

Seasonality Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ACF(12)	0.1848	0.8534	No Sea.	0.2119	0.8322	No Sea.
ACF(24)	44.3528	0.0000	No Sea.	57.3888	0.0000	No Sea.

Structural Breaks Tests

	Log		*Diff log*			
	PY test	Date	F(0/1)	Conclusion	AIC	Date
1st break	73.6811	Dec-44	0.2263	No break	0	-
2nd break	7.0812	Jul-59				
3rd break	82.5437	Apr-75				

PY corresponds to the F test in Perro\
F(0/1) corresponds to the test in Bai and Perron (2003) of zero breaks againts at least one break\
AIC indicates the number of breaks according to the AIC criterion (Bai and Perron, 2003)

Stationarity Tests

	Log			*Diff Log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ADF	-5.9131	0.0000	I(1)	-6.2771	0.0000	I(0)
ADF-GLS	-0.9454	[-2.8900]	I(1)	-3.0265	0.0024	I(0)
KPSS	0.9886	[0.1480]	I(1)	0.4573	[0.4620]	I(0)
HEGY	-2.9800	0.0354	I(0)	-7.6200	0.0000	I(0)
CH	2.5506	0.0600	I(0)	2.3915	0.1013	I(0)

ARIMA process: ARIMA(0.1.1)

Estimates	ϕ_1	ϕ_2	θ_1	θ_2	σ^2	*ll*	AIC
			0.172		0.0571	-4364.27	8790.56
			(0.0000)				

Outliers detected in the estimated ARIMA

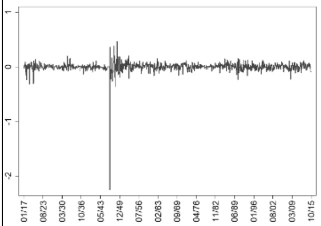
Type	Date	Estimate	Type	Date	Estimate
LS	Jan-43	-0.5271	AO	Aug-46	0.2101
AO	Apr-43	0.2158	TC	Mar-47	0.1975
LS	May-43	0.5131	TC	Apr-47	0.3988
AO	Dec-43	0.9139	TC	May-47	0.2353
LS	Dec-43	-0.4322	LS	Oct-47	-0.2417
TC	Feb-44	-0.2415	LS	Apr-48	0.4773
TC	Apr-44	0.2163	LS	Jan-49	0.2368
TC	May-44	0.2547	TC	Aug-60	0.2072
AO	Oct-44	0.1402	LS	Jul-73	-0.2461
LS	Jan-45	-0.4271	AO	Oct-80	0.1645
TC	Jan-46	-0.1998	LS	Jun-81	-0.2144
TC	Apr-46	-0.2526	AO	Aug-81	0.143
LS	Jul-46	0.2082	AO	Mar-98	0.1468

AO means Additive Outlier; TC means Temporary Change; LS means Level Shift

Table 63: Japanese stock market statistics

Series:	Stocks	**Frequency:**	Monthly
Country:	Japan	**Observations:**	1185
Period:	Jan/1917 - Sep/2015	**Source:**	GFD

Graphs

Logarithmic transformation	*First logarithmic differences*
	

Descriptive Statistics

	Level	*Log*	*Diff Log*	*Gr. Rate*
Mean	1,954.51	7.26	-0.08%	0.22%
Median	1,872.13	7.53	0.12%	0.12%
Standard. Dev.	1,298.11	0.93	9.02%	6.80%
Skewness	0.70	-1.11	-13.17	-1.07
Kurtosis	3.23	3.92	333.78	37.14
Minimum	61.92	4.13	-225.41%	-89.50%
Maximum	7,418.18	8.91	46.82%	59.72%
Range	7,356.27	4.79	272.23%	149.22%
IQ Range	1,836.21	1.13	5.95%	5.97%

Trend Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
Daniels test	-266.14	0.0000	Trend	-8.2116	0.0000	Trend

Seasonality Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ACF(12)	0.0764	0.9391	No Sea.	0.023	0.9817	No Sea.
ACF(24)	-0.0038	0.9970	No Sea.	-0.0471	0.9624	No Sea.

Structural Breaks Tests

	Log		*Diff log*			
	PY test	Date	F(0/1)	Conclusion	AIC	Date
1st break	664.6945	Jun-46	2.8168	No break	0	-
2nd break	18.4539	Jul-86				
3rd break						

PY corresponds to the F test in Perron and Yabu (2009), with 5% significance

F(0/1) corresponds to the test in Bai and Perron (2003) of zero breaks againts at least one break

AIC indicates the number of breaks according to the AIC criterion (Bai and Perron, 2003)

Stationarity Tests

	Log			*Diff Log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ADF	-2.3070	0.4296	I(1)	-7.5026	0.0000	I(0)
ADF-GLS	-1.5432	[-2.8900]	I(1)	-5.5981	0.0000	I(0)
KPSS	1.8693	[0.1480]	I(1)	0.1560	[0.4620]	I(0)
HEGY	-2.3100	0.4199	I(1)	-6.3700	0.0000	I(0)
CH	1.6796	0.5761	I(0)	1.4685	0.7984	I(0)

ARIMA process: ARIMA(0.1.1)

Estimates	ϕ_1	ϕ_2	θ_1	θ_2	σ^2	*ll*	AIC
			0.1646		0.0501	1863.79	-3691.58
			(0.0000)				

Outliers detected in the estimated ARIMA

Type	Date	Estimate	Type	Date	Estimate
LS	Jan-18	0	AO	Mar-48	0.1891
LS	Jan-19	-0.3035	LS	Aug-48	-0.3516
LS	Apr-20	-0.2769	LS	Jan-49	0.4993
TC	Jun-20	-0.2583	AO	May-49	0.1416
LS	Jul-46	-22217	TC	Aug-49	0.2172
TC	Sep-46	0.4125	AO	Jan-50	-0.1833
TC	Apr-47	0.2518	TC	Jan-53	0.2265
LS	Jan-48	0.3575	AO	Sep-90	-0.1955

AO means Additive Outlier; TC means Temporary Change; LS means Level Shift

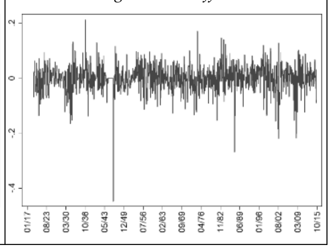
Table 64: Dutch stock market statistics

Series:	Stocks	**Frequency:**	Monthly
Country:	Netherlands	**Observations:**	1161
Period:	Jan/1919 - Sep/2015	**Source:**	GFD

Graphs

Logarithmic transformation

First logarithmic differences



Descriptive Statistics

	Level	*Log*	*Diff Log*	*Gr. Rate*
Mean	226.08	5.20	0.06%	0.18%
Median	166.02	5.11	0.15%	0.15%
Standard. Dev.	171.88	0.63	5.00%	4.90%
Skewness	1.82	0.57	-1.08	-0.55
Kurtosis	5.99	2.67	10.36	7.21
Minimum	46.74	3.84	-44.72%	-36.06%
Maximum	923.51	6.83	21.45%	23.92%
Range	876.77	2.98	66.17%	59.98%
IQ Range	127.76	0.76	5.47%	5.48%

Trend Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
Daniels test	19.2857	0.0000	Trend	0.1503	0.5597	No trend

Seasonality Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ACF(12)	0.0849	0.9323	No Sea.	0.0829	0.9339	No Sea.
ACF(24)	9.4468	0.0000	No Sea.	8.7008	0.0000	No Sea.

Structural Breaks Tests

	Log		*Diff log*			
	PY test	Date	F(0/1)	Conclusion	AIC	Date
1st break	45.2979	Sep-34	0.2263	No break	0	-
2nd break	48.2224	Nov-52				
3rd break	43.1359	Apr-72				
4th break	37.6565	Nov-93				
5th break	3.6055	Aug-99				

PY corresponds to the F test in Perron and Yabu (2009), with 5% significance

F(0/1) corresponds to the test in Bai and Perron (2003) of zero breaks againts at least one break

AIC indicates the number of breaks according to the AIC criterion (Bai and Perron, 2003)

Stationarity Tests

	Log			*Diff Log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ADF	2.6903	0.2406	I(1)	-29.0457	0.0000	I(0)
ADF-GLS	-1.4554	[-2.8900]	I(1)	-5.1953	0.0000	I(0)
KPSS	1.2312	[0.1480]	I(1)	0.1408	[0.4620]	I(0)
HEGY	-1.5900	0.4853	I(1)	-8.1500	0.0000	I(0)
CH	3.9502	0.0001	I(1)	3.7205	0.0004	I(1)

ARIMA process: ARIMA(0.1.1)

Estimates	ϕ_1	ϕ_2	θ_1	θ_2	σ^2	*ll*	AIC
			0.1808		0.0089	3825.84	-3826.7
			(0.0000)				

Outliers detected in the estimated ARIMA

Type	Date	Estimate	Type	Date	Estimate
LS	Oct-36	0.042	LS	Oct-87	-0.0448
LS	May-46	-0.0903	AO	Sep-02	-0.0284

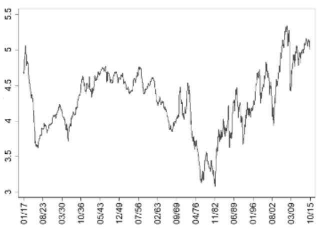
AO means Additive Outlier; TC means Temporary Change; LS means Level Shift

Table 65: Norwegian stock market statistics

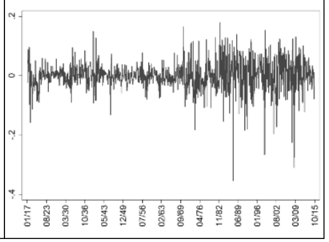
Series:	Stocks	**Frequency:**	Monthly
Country:	Norway	**Observations:**	1185
Period:	Jan/1917 - Sep/2015	**Source:**	GFD

Graphs

Logarithmic transformation



First logarithmic differences



Descriptive Statistics

	Level	*Log*	*Diff Log*	*Gr. Rate*
Mean	80.21	4.29	0.03%	0.15%
Median	76.40	4.34	0.01%	0.01%
Standard. Dev.	35.12	0.45	4.97%	4.89%
Skewness	0.87	-0.27	-0.93	-0.44
Kurtosis	3.79	2.79	9.12	7.08
Minimum	21.70	3.08	-35.55%	-29.92%
Maximum	208.37	5.34	17.91%	19.61%
Range	186.67	2.26	53.46%	49.53%
IQ Range	46.30	0.63	4.50%	4.50%

Trend Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
Daniels test	17.2134	0.0000	Trend	-0.905	0.36547	No trend

Seasonality Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ACF(12)	0.1543	0.8774	No Sea.	-0.0015	0.9988	No Sea.
ACF(24)	0.332	0.7399	No Sea.	0.0548	0.9563	No Sea.

Structural Breaks Tests

	Log		*Diff log*			
	PY test	Date	F(0/1)	Conclusion	AIC	Date
1st break	4.2225	Sep-35	5.3753	No break	0	-
2nd break	21.1919	Dec-74				
3rd break	10.1641	Apr-86				

PY corresponds to the F test in Perron and Yabu (2009), with 5% significance

F(0/1) corresponds to the test in Bai and Perron (2003) of zero breaks againts at least one break

AIC indicates the number of breaks according to the AIC criterion (Bai and Perron, 2003)

Stationarity Tests

	Log			*Diff Log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ADF	-2.8202	0.1898	I(1)	-16.8864	0.0000	I(0)
ADF-GLS	-1.9801	[-2.8900]	I(1)	-5.6330	0.0000	I(0)
KPSS	1.4422	[0.1480]	I(1)	0.1194	[0.4620]	I(0)
HEGY	-2.5200	0.3151	I(1)	-9.2400	0.0000	I(0)
CH	3.1588	0.0057	I(1)	3.0680	0.0083	I(1)

ARIMA process: ARIMA(3.1.1)

Estimates	ϕ_1	ϕ_2	θ_1	θ_2	σ^2	*ll*	AIC
	-0.139	0.0078	-0.1443		0.0102	3688.48	-3949.23
	(0.0000)	*(0.7916)*	*(0.0000)*				

Outliers detected in the estimated ARIMA

Type	**Date**	**Estimate**	**Type**	**Date**	**Estimate**
TC	Sep-39	0.0388	TC	Aug-92	-0.0499
AO	Sep-74	-0.0295	LS	Aug-98	-0.0532
LS	Apr-83	0.0442	TC	Jan-08	-0.0496
AO	Jul-86	-0.0283	LS	Sep-08	-0.0577
LS	Oct-87	-0.0919	LS	Oct-08	-0.0552
LS	Nov-87	-0.0602			

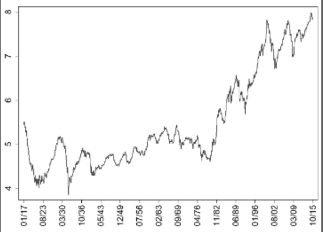
AO means Additive Outlier; TC means Temporary Change; LS means Level Shift

Table 66: Swedish stock market statistics

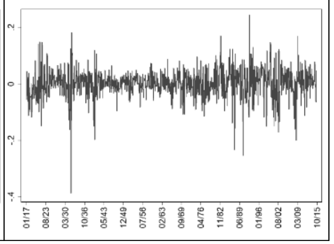
Series:	Stocks	**Frequency:**	Monthly
Country:	Sweden	**Observations:**	1185
Period:	Jan/1917 - Sep/2015	**Source:**	GFD

Graphs

Logarithmic transformation



First logarithmic differences



Descriptive Statistics	*Level*	*Log*	*Diff Log*	*Gr. Rate*
Mean	473.33	5.48	0.20%	0.32%
Median	158.73	5.07	0.33%	0.33%
Standard. Dev.	638.17	1.08	5.09%	5.04%
Skewness	1.83	0.90	-0.66	-0.20
Kurtosis	5.25	2.45	7.94	6.57
Minimum	47.42	3.86	-38.75%	-32.12%
Maximum	2,932.57	7.98	24.65%	27.95%
Range	2,885.15	4.12	63.39%	60.07%
IQ Range	384.56	1.51	5.37%	5.39%

Trend Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
Daniels test	29.6307	0.0000	Trend	3.316	0.0005	No trend

Seasonality Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ACF(12)	0.094	0.9251	No Sea.	0.0468	0.9627	No Sea.
ACF(24)	4.547	0.0000	No Sea.	3.8663	0.0001	No Sea.

Structural Breaks Tests

	Log		*Diff log*			
	PY test	Date	F(0/1)	Conclusion	AIC	Date
1st break	34.8165	Jan-24	0.2263	No break	0	-
2nd break	36.7993	Apr-59				
3rd break	25.6796	Dec-82				
4th break	3.1639	Dec-96				

PY corresponds to the F test in Perron and Yabu (2009), with 5% significance
F(0/1) corresponds to the test in Bai and Perron (2003) of zero breaks againts at least one break
AIC indicates the number of breaks according to the AIC criterion (Bai and Perron, 2003)

Stationarity Tests

	Log			*Diff Log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ADF	-2.8995	0.1642	I(1)	-8.2578	0.0000	I(0)
ADF-GLS	-1.0634	[-2.8900]	I(1)	-2.3927	0.0163	I(0)
KPSS	2.5388	[0.1480]	I(1)	0.3965	[0.4620]	I(0)
HEGY	-0.1900	0.8949	I(1)	-7.8900	0.0000	I(0)
CH	2.3651	0.1130	I(0)	2.2333	0.1630	I(0)

ARIMA process: ARIMA(3.1.1)

Estimates	ϕ_1	ϕ_2	ϕ_3	θ_1	σ^2	*ll*	AIC
	0.7587	0.1206	-0.1179	-0.589	0.0081	4024.68	-4027.14
	(0.0000)	*(0.0032)*	*(0.0002)*	*(0.0000)*			

Outliers detected in the estimated ARIMA

Type	Date	Estimate	Type	Date	Estimate
TC	Jan-21	0.0357	LS	Mar-32	-0.0791
LS	Jul-21	0.0347	LS	Jun-32	0.0480
TC	Feb-22	-0.0402	AO	Mar-40	0.0336
AO	Mar-22	-0.0235	TC	Jan-87	-0.0225
TC	Jun-31	0.0306	LS	Oct-87	-0.0378
TC	Jan-32	0.0396			

AO means Additive Outlier; TC means Temporary Change; LS means Level Shift

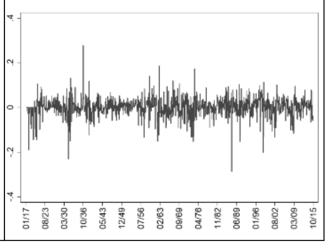
Table 67: Swiss stock market statistics

Series:	Stocks	**Frequency:**	Monthly
Country:	Switzerland	**Observations:**	1185
Period:	Jan/1917 - Sep/2015	**Source:**	GFD

Graphs

Logarithmic transformation

First logarithmic differences



Descriptive Statistics

	Level	*Log*	*Diff Log*	*Gr. Rate*
Mean	197.93	5.05	0.14%	0.24%
Median	133.19	4.89	0.36%	0.36%
Standard. Dev.	150.67	0.67	4.47%	4.43%
Skewness	1.41	0.47	-0.60	-0.17
Kurtosis	3.85	2.41	7.79	7.89
Minimum	34.48	3.54	-28.66%	-24.92%
Maximum	665.87	6.50	27.94%	32.23%
Range	631.40	2.96	56.59%	57.15%
IQ Range	123.60	0.82	4.47%	4.49%

Trend Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
Daniels test	30.0715	0.0000	Trend	1.3658	0.172	No trend

Seasonality Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ACF(12)	0.0874	0.9304	No Sea.	0.0406	0.9676	No Sea.
ACF(24)	0.0483	0.9615	No Sea.	0.074	0.9410	No Sea.

Structural Breaks Tests

	Log		*Diff log*			
	PY test	Date	F(0/1)	Conclusion	AIC	Date
1st break	20.3276	Apr-23	3.1468	No break	0	-
2nd break	15.3428	Jun-59				
3rd break	16.4674	Mar-74				
4rd break	17.3189	Jan-97				

PY corresponds to the F test in Perron and Yabu (2009), with 5% significance

F(0/1) corresponds to the test in Bai and Perron (2003) of zero breaks againts at least one break

AIC indicates the number of breaks according to the AIC criterion (Bai and Perron, 2003)

Stationarity Tests

	Log			*Diff Log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ADF	-3.2794	0.0696	I(1)	-7.7611	0.0000	I(0)
ADF-GLS	-2.4197	[-2.8900]	I(1)	-7.2005	0.0000	I(0)
KPSS	0.8443	[0.1480]	I(1)	0.1156	[0.4620]	I(0)
HEGY	-1.3400	0.6103	I(1)	-7.7600	0.0000	I(0)
CH	2.9041	0.0162	I(1)	2.9122	0.0157	I(1)

ARIMA process: ARIMA(3.1.1)

Estimates	ϕ_1	ϕ_2	ϕ_3	θ_1	σ^2	*ll*	AIC
	-0.9782	0.2124	-0.1206	-0.8111	0.0075	4048.39	-4279.55
	(0.0000)	*(0.7916)*	*(0.0001)*	*(0.0000)*			

Outliers detected in the estimated ARIMA

Type	Date	Estimate	Type	Date	Estimate
LS	Jan-18	-0.0463	LS	Apr-32	-0.0308
LS	Jul-19	-0.0332	LS	Jul-32	0.0294
LS	Oct-19	-0.03	LS	Oct-36	0.0642
LS	Jul-20	-0.0332	AO	Sep-38	-0.0265
TC	Oct-20	-0.0372	AO	Oct-62	-0.0268
LS	Sep-31	-0.0523	LS	Jan-75	0.0381
AO	Dec-31	-0.0178	LS	Oct-87	-0.056

AO means Additive Outlier; TC means Temporary Change; LS means Level Shift

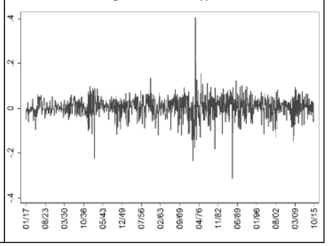
Table 68: British stock market statistics

Series:	Stocks	**Frequency:**	Monthly
Country:	United Kingdom	**Observations:**	1185
Period:	Jan/1917 - Sep/2015	**Source:**	GFD

Graphs

Logarithmic transformation

First logarithmic differences



Descriptive Statistics

	Level	*Log*	*Diff Log*	*Gr. Rate*
Mean	1,197.68	5.86	0.41%	0.52%
Median	342.55	5.84	0.73%	0.73%
Standard. Dev.	1,680.09	1.70	4.58%	4.59%
Skewness	1.42	0.19	-0.35	0.49
Kurtosis	3.58	1.73	11.77	16.75
Minimum	21.60	3.07	-31.29%	-26.87%
Maximum	6,252.60	8.74	40.58%	50.05%
Range	6,230.99	5.67	71.87%	76.91%
IQ Range	1,585.25	3.09	4.74%	4.78%

Trend Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
Daniels test	3.9821	0.0000	Trend	2.0982	0.0179	Trend

Seasonality Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ACF(12)	0.2019	0.8400	No Sea.	0.0604	0.9518	No Sea.
ACF(24)	0.5739	0.5660	No Sea.	4.3225	0.0000	No Sea.

Structural Breaks Tests

	Log		*Diff log*			
	PY test	Date	F(0/1)	Conclusion	AIC	Date
1st break	6.6412	Aug-21	0.2263	No break	0	-
2nd break	15.8401	May-38				
3rd break	38.3128	Feb-59				

PY corresponds to the F test in Perron and Yabu (2009), with 5% significance

F(0/1) corresponds to the test in Bai and Perron (2003) of zero breaks againts at least one break

AIC indicates the number of breaks according to the AIC criterion (Bai and Perron, 2003)

Stationarity Tests

	Log			*Diff Log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ADF	-3.3470	0.0427	I(0)	-15.1034	0.0000	I(0)
ADF-GLS	-1.8609	[-2.8900]	I(1)	-2.3737	0.0172	I(0)
KPSS	0.8929	[0.1480]	I(1)	0.0861	[0.4620]	I(0)
HEGY	-0.3200	0.9733	I(1)	-9.4700	0.0000	I(0)
CH	1.9025	0.3768	I(0)	1.8421	0.4483	I(0)

ARIMA process: ARIMA(1.1.2)

Estimates	ϕ_1	ϕ_2	θ_1	θ_2	σ^2	*ll*	AIC
	-0.8973		-0.7594	-0.0803	0.0069	4208.09	-4298.03
	(0.0000)		*(0.0000)*	*(0.0159)*			

Outliers detected in the estimated ARIMA

Type	**Date**	**Estimate**	**Type**	**Date**	**Estimate**
AO	May-38	0.0226	LS	Jan-75	0.0768
AO	Oct-38	-0.0230	AO	Feb-75	0.0383
LS	Jun-40	-0.0464	TC	Oct-76	-0.0275
TC	Jul-40	-0.0612	TC	Sep-81	-0.0296
LS	Mar-74	-0.0390	LS	Oct-87	-0.0429
TC	Nov-74	-0.0324			

AO means Additive Outlier; TC means Temporary Change; LS means Level Shift

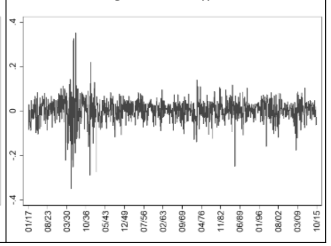
Table 69: United States' stock market statistics

Series:	Stocks	**Frequency:**	Monthly
Country:	United States	**Observations:**	1185
Period:	Jan/1917 - Sep/2015	**Source:**	GFD

Graphs

Logarithmic transformation

First logarithmic differences



Descriptive Statistics

	Level	*Log*	*Diff Log*	*Gr. Rate*
Mean	339.32	5.48	0.19%	0.34%
Median	229.84	5.44	0.62%	0.62%
Standard. Dev.	295.64	0.84	5.38%	5.37%
Skewness	1.33	0.18	-0.41	0.37
Kurtosis	3.72	2.04	10.32	12.15
Minimum	44.93	3.81	-34.96%	-29.51%
Maximum	1,235.77	7.12	35.24%	42.24%
Range	1,190.84	3.31	70.20%	71.75%
IQ Range	283.02	1.25	5.66%	5.69%

Trend Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
Daniels test	32.4435	0.0000	Trend	15.2747	0.0000	Trend

Seasonality Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ACF(12)	0.0189	0.9849	No Sea.	0.0428	0.9659	No Sea.
ACF(24)	0.0302	0.9759	No Sea.	0.0634	0.9494	No Sea.

Structural Breaks Tests

	Log		*Diff log*			
	PY test	Date	F(0/1)	Conclusion	AIC	Date
1st break	21.8248	Oct-96	2.0459	No break	0	-
2nd break	4.8828	Jun-74				
3rd break	9.1628	Nov-54				

PY corresponds to the F test in Perron and Yabu (2009), with 5% significance

F(0/1) corresponds to the test in Bai and Perron (2003) of zero breaks againts at least one break

AIC indicates the number of breaks according to the AIC criterion (Bai and Perron, 2003)

Stationarity Tests

	Log			*Diff Log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ADF	-2.0340	0.5837	I(0)	-13.2608	0.0000	I(0)
ADF-GLS	-1.5990	[-3.150]	I(1)	-3.0930	0.0019	I(0)
KPSS	1.7361	[0.148]	I(1)	0.0284	[0.462]	I(0)
HEGY	1532.7	0.0000	I(1)	88.1200	0.0000	I(0)
CH	2.7052	0.0346	I(1)	2.2390	0.1604	I(0)

ARIMA process: ARIMA(3.1.1)

Estimates	ϕ_1	ϕ_2	ϕ_3	θ_1	σ^2	*ll*	AIC
	0.8744	-0.0741	-0.0768	0.9335	0.04414	2014.43	8981.56
	(0.0000)	*(0.0571)*	*(0.0119)*	*(0.0000)*			

Outliers detected in the estimated ARIMA

Type	**Date**	**Estimate**	**Type**	**Date**	**Estimate**
LS	Oct-29	-0.2177	LS	Apr-33	0.3307
AO	May-31	-0.1551	TC	Mar-38	-0.3035
LS	Sep-31	-0.3462	AO	May-38	-0.1464
LS	Apr-32	-0.2039	TC	May-40	-0.259
LS	May-32	-0.2667	AO	Sep-74	-0.1394
LS	Jul-32	0.3139	LS	Oct-87	-0.2445
TC	Aug-32	0.3221	TC	Sep-98	-0.1693
TC	Feb-33	-0.1825			

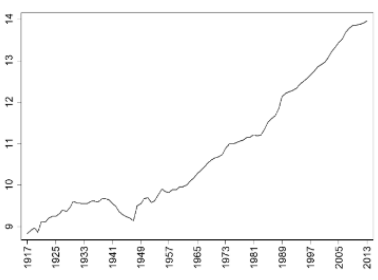
AO means Additive Outlier; TC means Temporary Change; LS means Level Shift

Table 70: Australian real credit statistics

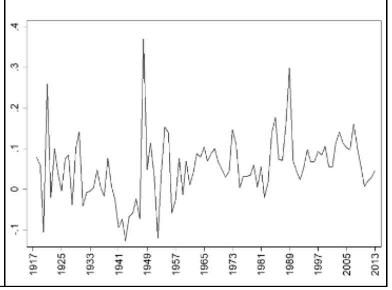
Series:	Real credit	**Frequency:**	Annual
Country:	Australia	**Observations:**	97
Period:	1917 - 2013	**Source:**	JST

Graphs

Logarithmic transformation



First logarithmic differences



Descriptive Statistics

	Level	*Log*	*Diff Log*	*Gr. Rate*
Mean	168,217.85	10.80	5.34%	5.83%
Median	29,141.14	10.28	5.53%	5.68%
Standard. Dev.	289,583.70	1.53	8.02%	8.77%
Skewness	2.22	0.69	0.71	1.23
Kurtosis	4.00	-0.82	2.68	4.43
Minimum	6,833.86	8.83	-12.68%	-11.91%
Maximum	1,151,211.8	13.96	37.05%	44.85%
Range	1,144,377.9	5.13	49.73%	56.76%
IQ Range	172,915.23	2.58	9.21%	9.70%

Trend Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
Daniels test	>10	0.0000	Trend	7.8462	0.0000	Trend

Structural Breaks Tests

	Log		*Diff log*			
	PY test	Date	F(0/1)	Conclusion	AIC	Date
1st break	14.3805	1962	0.0313	No break	1	1947
2nd break	12.6751	1942				
3rd break	6.5713	1982				

PY corresponds to the F test in Perron and Yabu (2009), with 5% significance

F(0/1) corresponds to the test in Bai and Perron (2003) of zero breaks againts at least one break

AIC indicates the number of breaks according to the AIC criterion (Bai and Perron, 2003)

Stationarity Tests

	Log			*Diff Log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ADF	-0.0782	0.9999	I(1)	-7.9933	0.0000	I(0)
ADF-GLS	-0.5418	[-3.0300]	I(1)	-1.8909	0.0556	I(1)
PP [z(rho)]	1.2030	[-13.668]	I(1)	-81.8480	[-13.668]	I(0)
PP [z(t)]	2.0950	[-2.893]	I(1)	-8.0760	[-2.893]	I(0)
KPSS	0.5892	[0.1480]	I(1)	0.0772	[0.462]	I(0)

ARIMA process: ARIMA(0.1.1)

Estimates	ϕ_1	θ_1	σ^2	*ll*	AIC
		0.4851	0.0582	107.103	1654.6
		(0.0000)			

Outliers detected in the estimated ARIMA

Type	**Date**	**Estimate**	**Type**	**Date**	**Estimate**
LS	1921	0,3540	LS	1948	0,3842

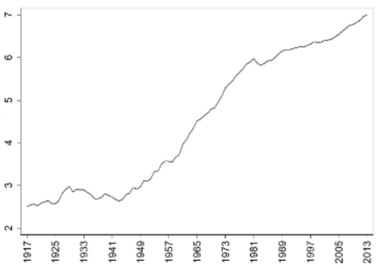
AO means Additive Outlier; TC means Temporary Change; LS means Level Shift

Table 71: Canadian real credit statistics

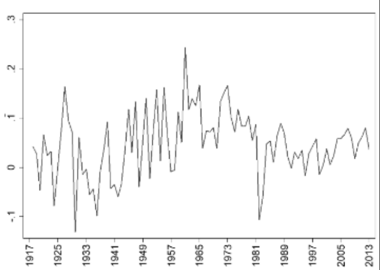
Series:	Real credit	**Frequency:**	Annual
Country:	Canada	**Observations:**	97
Period:	1917 - 2013	**Source:**	JST

Graphs

Logarithmic transformation



First logarithmic differences



Descriptive Statistics

	Level	*Log*	*Diff Log*	*Gr. Rate*
Mean	248.29	4.51	4.68%	5.02%
Median	91.65	4.52	5.04%	5.17%
Standard. Dev.	289.96	1.59	6.65%	6.99%
Skewness	1.12	0.10	-0.04	0.20
Kurtosis	0.30	-1.69	0.41	0.55
Minimum	12.23	2.50	-13.13%	-12.30%
Maximum	1,093.83	7.00	24.43%	27.68%
Range	1,081.60	4.49	37.56%	39.98%
IQ Range	453.96	3.30	7.64%	7.99%

Trend Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
Daniels test	>10	0.0000	Trend	6.6896	0.0000	Trend

Structural Breaks Tests

	Log		*Diff log*			
	PY test	Date	F(0/1)	Conclusion	AIC	Date
1st break	5.6621	1962	2.6832	No break	1	1981
2nd break	3.8155	1942				
3rd break	20.0487	1982				

PY corresponds to the F test in Perron and Yabu (2009), with 5% significance

F(0/1) corresponds to the test in Bai and Perron (2003) of zero breaks againts at least one break

AIC indicates the number of breaks according to the AIC criterion (Bai and Perron, 2003)

Stationarity Tests

	Log			*Diff Log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ADF	-2.2795	0.4446	I(1)	-2.0553	0.2632	I(1)
ADF-GLS	-1.3113	[-3.030]	I(1)	-2.0189	0.0417	I(0)
PP [z(rho)]	0.2950	[-13.668]	I(1)	-66.0950	[-13.668]	I(0)
PP [z(t)]	0.5230	[-2.893]	I(1)	-6.8710	[-2.893]	I(0)
KPSS	0.3185	[0.1480]	I(1)	0.2439	[0.462]	I(0)

ARIMA process: ARIMA(3.1.1)

Estimates	ϕ_1	ϕ_2	ϕ_3	θ_1	σ^2	*ll*	AIC
	0.4245	-0.4949	0.0602	0.9043	0.0536	144	597.22
	(0.0000)	*(0.0000)*	*(0.6011)*	*(0.0000)*			

Outliers detected in the estimated ARIMA

Type	Date	Estimate	Type	Date	Estimate
AO	1950	0,1256			

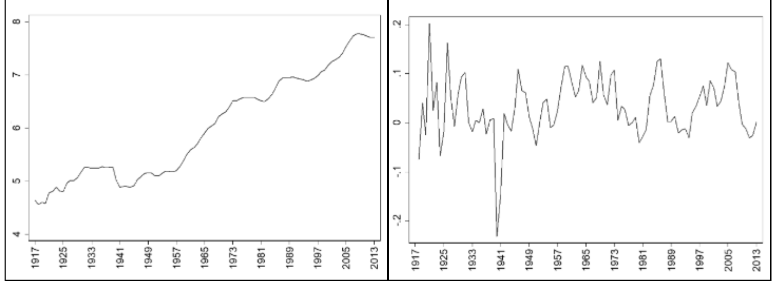
AO means Additive Outlier; TC means Temporary Change; LS means Level Shift

Table 72: Danish real credit statistics

Series:	Real credit	**Frequency:**	Annual
Country:	Denmark	**Observations:**	97
Period:	1917 - 2013	**Source:**	JST

Graphs

Logarithmic transformation — *First logarithmic differences*



Descriptive Statistics

	Level	*Log*	*Diff Log*	*Gr. Rate*
Mean	651.82	6.01	3.19%	3.44%
Median	369.27	5.91	3.16%	3.21%
Standard. Dev.	641.76	0.99	6.20%	6.31%
Skewness	1.37	0.27	-0.64	-0.24
Kurtosis	1.04	-1.34	3.11	2.07
Minimum	95.91	4.56	-23.24%	-20.73%
Maximum	2,379.58	7.77	20.25%	22.44%
Range	2,283.66	3.21	43.48%	43.18%
IQ Range	829.67	1.76	7.88%	8.15%

Trend Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
Daniels test	>10	0.0000	Trend	2.8780	0.0020	Trend

Structural Breaks Tests

	Log		*Diff log*			
	PY test	Date	F(0/1)	Conclusion	AIC	Date
1st break	9.0121	1940	0.0161	No break	0	-
2nd break	31.9476	1931				
3rd break						

PY corresponds to the F test in Perron and Yabu (2009), with 5% significance
F(0/1) corresponds to the test in Bai and Perron (2003) of zero breaks againts at least one break
AIC indicates the number of breaks according to the AIC criterion (Bai and Perron, 2003)

Stationarity Tests

	Log			*Diff Log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ADF	-1.9341	0.6341	I(1)	-4.4911	0.0001	I(0)
ADF-GLS	-1.8668	[-3.030]	I(1)	-2.3254	0.0194	I(0)
PP [z(rho)]	0.1690	[-13.668]	I(1)	-53.6880	[-13.668]	I(0)
PP [z(t)]	0.1930	[-2.893]	I(1)	-6.1170	[-2.893]	I(0)
KPSS	0.3262	[0.1480]	I(1)	0.1337	[0.462]	I(0)

ARIMA process: ARIMA(1.1.2)

Estimates	ϕ_1	θ_1	θ_2	σ^2	*ll*	AIC
	-0.7163	0.0842	-0.435	0.04721	156.47	855.218
	(0.0000)	*(0.7297)*	*(0.0328)*			

Outliers detected in the estimated ARIMA

Type	**Date**	**Estimate**	**Type**	**Date**	**Estimate**
LS	1921	0.27			

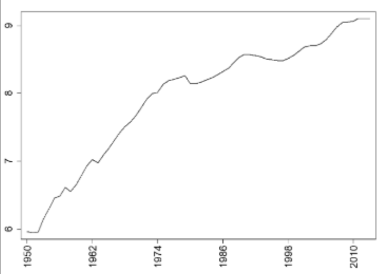
AO means Additive Outlier; TC means Temporary Change; LS means Level Shift

Table 73: French real credit statistics

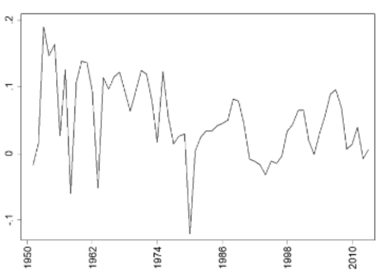
Series:	Real credit	**Frequency:**	Annual
Country:	France	**Observations:**	64
Period:	1950 - 2013	**Source:**	JST

Graphs

Logarithmic transformation



First logarithmic differences



Descriptive Statistics

	Level	*Log*	*Diff Log*	*Gr. Rate*
Mean	3,838.95	7.94	5.00%	5.30%
Median	3,708.60	8.22	4.32%	4.42%
Standard. Dev.	2,524.34	0.91	5.92%	6.23%
Skewness	0.41	-0.78	-0.05	0.12
Kurtosis	-0.64	-0.52	0.12	-0.01
Minimum	381.00	5.94	-12.06%	-11.36%
Maximum	9,026.32	9.11	19.01%	20.94%
Range	8,645.32	3.17	31.08%	32.31%
IQ Range	3,783.38	1.29	8.30%	8.75%

Trend Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
Daniels test	>10	0.0000	Trend	1.192	0.2332	No trend

Structural Breaks Tests

	Log		*Diff log*			
	PY test	Date	F(0/1)	Conclusion	AIC	Date
1st break	6.9239	1945	1.2413	No break	0	-
2nd break						
3rd break						

PY corresponds to the F test in Perron and Yabu (2009), with 5% significance
F(0/1) corresponds to the test in Bai and Perron (2003) of zero breaks againts at least one break
AIC indicates the number of breaks according to the AIC criterion (Bai and Perron, 2003)

Stationarity Tests

	Log			*Diff Log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ADF	-2.0551	0.5703	I(1)	-1.4845	0.5417	I(1)
ADF-GLS	-1.1099	[-3.030]	I(1)	-1.7440	0.0771	I(1)
PP [z(rho)]	-1.7740	[-13.668]	I(1)	-40.4610	[-13.668]	I(0)
PP [z(t)]	-3.1760	[-2.893]	I(1)	-3.5630	[-2.893]	I(0)
KPSS	0.3823	[0.1480]	I(1)	0.1626	[0.462]	I(0)

ARIMA process: ARIMA(1.1.0)

Estimates	ϕ_1	θ_1	σ^2	*ll*	AIC
	-0.6254		131.456	-396.99	801.99
	(0.0000)				

Outliers detected in the estimated ARIMA

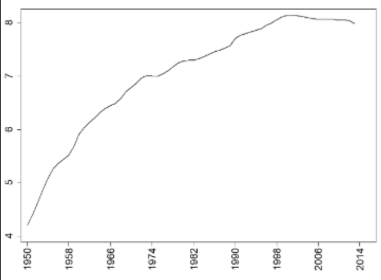
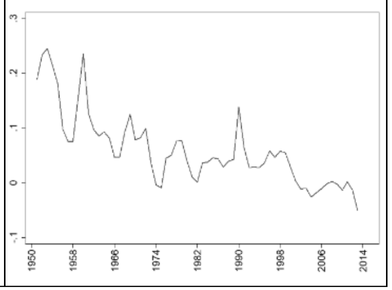
Type	**Date**	**Estimate**	**Type**	**Date**	**Estimate**
LS	1980	-0.5083			

AO means Additive Outlier; TC means Temporary Change; LS means Level Shift

Table 74: German real credit statistics

Series:	Real credit	**Frequency:**	Annual
Country:	Germany	**Observations:**	64
Period:	1950 - 2013	**Source:**	JST

Graphs

Logarithmic transformation	*First logarithmic differences*
	

Descriptive Statistics

	Level	*Log*	*Diff Log*	*Gr. Rate*
Mean	1,675.46	7.03	6.00%	6.42%
Median	1,468.51	7.29	4.58%	4.68%
Standard. Dev.	1,154.01	1.07	6.69%	7.39%
Skewness	0.18	-0.98	1.14	1.31
Kurtosis	1.54	3.09	4.09	4.52
Minimum	67.23	4.21	-5.01%	-4.88%
Maximum	3,429.01	8.14	24.53%	27.80%
Range	3,361.78	3.93	29.54%	32.69%
IQ Range	2,330.78	1.56	7.71%	8.07%

Trend Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
Daniels test	7.713	0.0000	Trend	-6.6261	0.0000	Trend

Structural Breaks Tests

	Log		*Diff log*			
	PY test	Date	F(0/1)	Conclusion	AIC	Date
1st break	13.0598	1997	0.0573	No break	1	1975
2nd break						
3rd break	-					

PY corresponds to the F test in Perron and Yabu (2009), with 5% significance

F(0/1) corresponds to the test in Bai and Perron (2003) of zero breaks againts at least one break

AIC indicates the number of breaks according to the AIC criterion (Bai and Perron, 2003)

Stationarity Tests

	Log			*Diff Log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ADF	-1.0617	0.9337	I(1)	-2.2775	0.01823	I(0)
ADF-GLS	-1.5854	[-3.0300]	I(1)	-2.2555	0.0233	I(0)
PP [z(rho)]	-3.2790	[-20.1060]	I(1)	-14.1110	[-13.9960]	I(0)
PP [z(t)]	-0.9210	[-3.4830]	I(1)	-2.3440	[-2.9200]	I(1)
KPSS	0.1612	[0.1480]	I(1)	0.2358	[0.4620]	I(0)

ARIMA process: ARIMA(0.2.0)

Estimates	ϕ_1	θ_1	σ^2	*ll*	AIC
			0.0272	135.53	48.69

Outliers detected in the estimated ARIMA

Type	Date	Estimate	Type	Date	Estimate
LS	1960	0.0953	LS	1990	0.0848

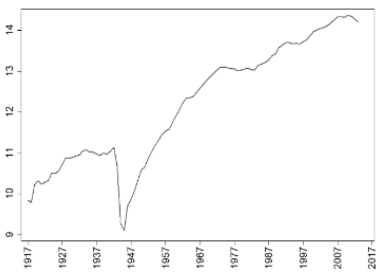
AO means Additive Outlier; TC means Temporary Change; LS means Level Shift

Table 75: Italian real credit statistics

Series:	Real credit	**Frequency:**	Annual
Country:	Italy	**Observations:**	97
Period:	1917 - 2013	**Source:**	JST

Graphs

Logarithmic transformation



First logarithmic differences

Descriptive Statistics

	Level	*Log*	*Diff Log*	*Gr. Rate*
Mean	454,239.27	12.17	4.53%	6.11%
Median	237,968.09	12.38	5.27%	5.41%
Standard. Dev.	508,129.64	1.48	18.98%	15.42%
Skewness	1.18	-0.14	-4.86	-0.25
Kurtosis	3.26	1.69	42.45	16.96
Minimum	8,981.67	9.10	-143.08%	-76.09%
Maximum	1,736,932.0	14.37	59.06%	80.50%
Range	1,727,950.3	5.26	202.14%	156.59%
IQ Range	615,874.55	2.49	10.85%	11.42%

Trend Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
Daniels test	-8.4988	0.0000	Trend	-1.1433	0.8735	No trend

Structural Breaks Tests

	Log		*Diff log*			
	PY test	Date	F(0/1)	Conclusion	AIC	Date
1st break	-	-	0.4398	No break	1	1978
2nd break						
3rd break	-					

PY corresponds to the F test in Perron and Yabu (2009), with 5% significance

F(0/1) corresponds to the test in Bai and Perron (2003) of zero breaks againts at least one break

AIC indicates the number of breaks according to the AIC criterion (Bai and Perron, 2003)

Stationarity Tests

	Log			*Diff Log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ADF	-2.1394	0.5231	I(1)	-2.6118	0.0004	I(0)
ADF-GLS	-1.7461	[-3.0300]	I(1)	-3.5629	0.0004	I(0)
PP [z(rho)]	-3.0690	[-20.1060]	I(1)	-32.3420	[-13.9960]	I(0)
PP [z(t)]	-1.3940	[-3.4540]	I(1)	-3.7800	[-2.9200]	I(0)
KPSS	0.5408	[0.1480]	I(1)	0.4578	[0.4620]	I(0)

ARIMA process: ARIMA(1.1.0)

Estimates	ϕ_1	θ_1	σ^2	ll	AIC
	-0.5593		0.0637	127.89	48.36
	(0.0000)				

Outliers detected in the estimated ARIMA

Type	Date	Estimate	Type	Date	Estimate
LS	1919	0	LS	1944	-13837
LS	1943	-0.4775	LS	1946	0.5771

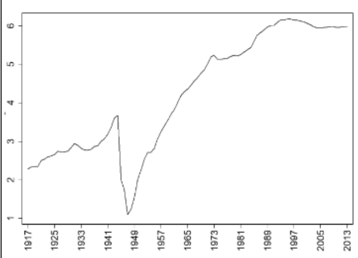
AO means Additive Outlier; TC means Temporary Change; LS means Level Shift

Table 76: Japanese real credit statistics

Series:	Real credit	**Frequency:**	Annual
Country:	Japan	**Observations:**	97
Period:	1917 - 2013	**Source:**	JST

Graphs

Logarithmic transformation



First logarithmic differences

Descriptive Statistics

	Level	*Log*	*Diff Log*	*Gr. Rate*
Mean	165.54	4.22	3.86%	5.64%
Median	78.58	4.36	4.60%	4.71%
Standard. Dev.	172.09	1.53	21.37%	15.00%
Skewness	0.66	-0.14	-5.77	-1.97
Kurtosis	-1.23	-1.46	44.76	13.42
Minimum	3.02	1.10	-167.47%	-81.26%
Maximum	481.86	6.18	43.14%	53.94%
Range	478.84	5.07	210.61%	135.21%
IQ Range	368.08	3.18	10.59%	11.21%

Trend Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
Daniels test	>10	0.0000	Trend	1.908	0.0564	No trend

Structural Breaks Tests

	Log		*Diff log*			
	PY test	Date	F(0/1)	Conclusion	AIC	Date
1st break	137.5970	1969	0.06248	No break	1	1947
2nd break	97.4670	1945				
3rd break	11.9680	2001				

PY corresponds to the F test in Perron and Yabu (2009), with 5% significance
F(0/1) corresponds to the test in Bai and Perron (2003) of zero breaks againts at least one break
AIC indicates the number of breaks according to the AIC criterion (Bai and Perron, 2003)

Stationarity Tests

	Log			*Diff Log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ADF	-2.1789	0.5069	I(1)	-5.5010	0.0000	I(0)
ADF-GLS	-1.8116	[-3.030]	I(1)	-4.8117	0.0556	I(0)
PP [z(rho)]	-1.6320	[-13.668]	I(1)	-73.2250	[-13.668]	I(0)
PP [z(t)]	-0.9390	[-2.893]	I(1)	-7.4070	[-2.893]	I(0)
KPSS	0.2253	[0.1480]	I(1)	0.0709	[0.462]	I(0)

ARIMA process: ARIMA(1.1.1)

Estimates	ϕ_1	θ_1	σ^2	*ll*	AIC
	-0.7965	0.6234	2.4635	-223.925	483.851
	(0.0000)	*(0.0000)*			

Outliers detected in the estimated ARIMA

Type	**Date**	**Estimate**	**Type**	**Date**	**Estimate**
LS	1945	-23.99	LS	1984	6.24
AO	1970	-5.75	LS	1986	8.83
TC	1972	8.29	AO	1989	4.46
LS	1974	-14.53	TC	1991	-4.09
AO	1977	-4.22	LS	1992	4.7
TC	1980	-4.83	TC	1993	12.11
TC	1984	-7.07	TC	2010	-4.62

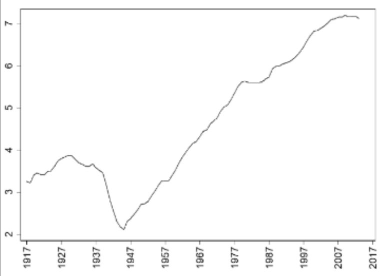
AO means Additive Outlier; TC means Temporary Change; LS means Level Shift

Table 77: Dutch real credit statistics

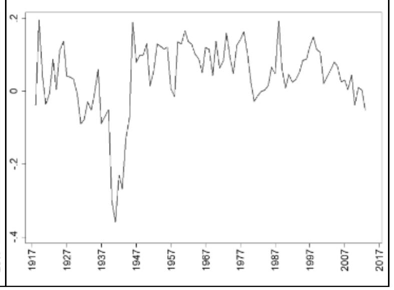
Series:	Real credit	**Frequency:**	Annual
Country:	Netherlands	**Observations:**	97
Period:	1917 - 2013	**Source:**	JST

Graphs

Logarithmic transformation



First logarithmic differences



Descriptive Statistics

	Level	*Log*	*Diff Log*	*Gr. Rate*
Mean	293.65	4.62	4.03%	4.59%
Median	63.93	4.16	4.89%	5.01%
Standard. Dev.	406.97	1.54	9.86%	9.64%
Skewness	1.55	0.28	-1.55	-1.08
Kurtosis	4.07	1.77	6.86	5.16
Minimum	8.27	2.11	-35.78%	-30.08%
Maximum	1,342.99	7.20	19.66%	21.72%
Range	1,334.72	5.09	55.44%	51.80%
IQ Range	368.90	2.57	11.20%	11.88%

Trend Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
Daniels test	3.6898	0.0000	Trend	1.7825	0.0673	Trend

Structural Breaks Tests

	Log		*Diff log*			
	PY test	Date	F(0/1)	Conclusion	AIC	Date
1st break	8.2309	1964	0.2872	No break	1	1945
2nd break	20.0328	1985				
3rd break	-					

PY corresponds to the F test in Perron and Yabu (2009), with 5% significance

F(0/1) corresponds to the test in Bai and Perron (2003) of zero breaks againts at least one break

AIC indicates the number of breaks according to the AIC criterion (Bai and Perron, 2003)

Stationarity Tests

	Log			*Diff Log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ADF	-1.8824	0.6584	I(1)	-2.2375	0.1960	I(1)
ADF-GLS	-1.6581	[-3.0300]	I(1)	-1.3439	0.1662	I(1)
PP [z(rho)]	-0.5110	[-20.628]	I(1)	-26.6150	[-13.9960]	I(0)
PP [z(t)]	-0.3480	[-3.4540]	I(1)	-3.5770	[-2.9200]	I(0)
KPSS	0.5499	[0.1480]	I(1)	0.0564	[0.4620]	I(0)

ARIMA process: ARIMA(1.1.3)

Estimates	ϕ_1	θ_1	θ_2	θ_3	σ^2	*ll*	AIC
	-0.6139	0.2773	0.0778	0.406	0.0547	141.85	49.85
	(0.0000)	*(0.0526)*	*(0.5723)*	*0.0000*			

Outliers detected in the estimated ARIMA

Type	Date	Estimate	Type	Date	Estimate
LS	1919	0.2149	LS	1988	0.1352
LS	1946	0.2325			

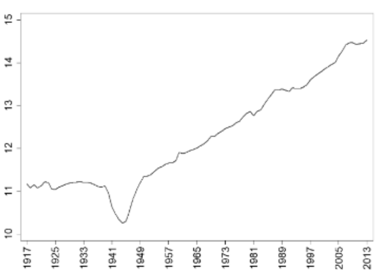
AO means Additive Outlier; TC means Temporary Change; LS means Level Shift

Table 78: Norwegian real credit statistics

Series:	Real credit	**Frequency:**	Annual
Country:	Norway	**Observations:**	97
Period:	1917 - 2013	**Source:**	JST

Graphs

Logarithmic transformation



First logarithmic differences

Descriptive Statistics

	Level	*Log*	*Diff Log*	*Gr. Rate*
Mean	428,600.61	12.26	3.49%	3.92%
Median	164,430.22	12.01	3.97%	4.05%
Standard. Dev.	533,963.22	1.21	8.48%	8.62%
Skewness	1.73	0.35	-0.74	-0.08
Kurtosis	2.12	-1.10	4.14	3.07
Minimum	28,422.89	10.25	-33.75%	-28.64%
Maximum	2,041,266.9	14.53	28.76%	33.32%
Range	2,012,844.1	4.27	62.50%	61.96%
IQ Range	563,316.55	2.17	6.96%	7.24%

Trend Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
Daniels test	>10	0.0000	Trend	6.0428	0.0000	Trend

Structural Breaks Tests

	Log		*Diff log*			
	PY test	Date	F(0/1)	Conclusion	AIC	Date
1st break	18.8121	1941	0.8061	No break	2	1945
2nd break	3.5674	1959				1969
3rd break						

PY corresponds to the F test in Perron and Yabu (2009), with 5% significance

F(0/1) corresponds to the test in Bai and Perron (2003) of zero breaks againts at least one break

AIC indicates the number of breaks according to the AIC criterion (Bai and Perron, 2003)

Stationarity Tests

	Log			*Diff Log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ADF	-2.2355	0.4691	I(1)	-5.0629	0.0000	I(0)
ADF-GLS	-1.4517	[-3.030]	I(1)	-3.3586	0.0007	I(0)
PP [z(rho)]	0.9090	[-13.668]	I(1)	-42.3860	[-13.668]	I(0)
PP [z(t)]	0.8750	[-2.893]	I(1)	-5.1720	[-2.893]	I(0)
KPSS	0.4095	[0.1480]	I(1)	0.3444	[0.462]	I(0)

ARIMA process: ARIMA(1.1.0

Estimates	ϕ_1	θ_1	σ^2	*ll*	AIC
	-0.6627		0.05512	141.712	2086.01
	(0.0000)				

Outliers detected in the estimated ARIMA

Type	**Date**	**Estimate**	**Type**	**Date**	**Estimate**
LS	1941	-0.1927	TC	1981	-0.157
TC	1960	0.1587			

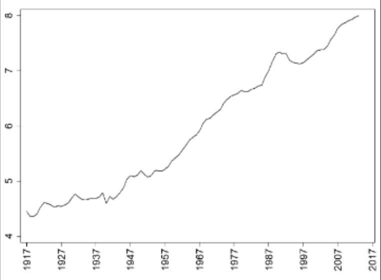
AO means Additive Outlier; TC means Temporary Change; LS means Level Shift

Table 79: Swedish real credit statistics

Series:	Real credit	**Frequency:**	Annual
Country:	Sweden	**Observations:**	97
Period:	1917 - 2013	**Source:**	JST

Graphs

Logarithmic transformation



First logarithmic differences

Descriptive Statistics

	Level	*Log*	*Diff Log*	*Gr. Rate*
Mean	712.04	5.94	3.70%	3.94%
Median	326.93	5.79	3.83%	3.90%
Standard. Dev.	773.95	1.17	5.86%	5.98%
Skewness	1.35	0.23	-0.71	-0.45
Kurtosis	4.01	1.56	4.74	4.07
Minimum	77.98	4.36	-19.16%	-17.43%
Maximum	2,982.95	8.00	15.94%	17.28%
Range	2,904.97	3.64	35.10%	34.72%
IQ Range	1,152.50	2.42	7.07%	7.36%

Trend Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
Daniels test	7.6518	0.0000	Trend	1.6901	0.0455	Trend

Structural Breaks Tests

	Log		*Diff log*			
	PY test	Date	F(0/1)	Conclusion	AIC	Date
1st break	4.5331	1946	0.2707	No break	0	-
2nd break	30.9271	1959				
3rd break	18.5135	1975				

PY corresponds to the F test in Perron and Yabu (2009), with 5% significance

F(0/1) corresponds to the test in Bai and Perron (2003) of zero breaks againts at least one break

AIC indicates the number of breaks according to the AIC criterion (Bai and Perron, 2003)

Stationarity Tests

	Log			*Diff Log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ADF	1.0991	0.9999	I(1)	-1.9322	0.3176	I(1)
ADF-GLS	-0.8253	[-3.0300]	I(1)	-1.5277	0.119	I(1)
PP [z(rho)]	1.7600	[-20.6280]	I(1)	-26.6550	[-13.9960]	I(0)
PP [z(t)]	0.8070	[-3.4540]	I(1)	-13.6600	[-2.9200]	I(0)
KPSS	0.5261	[0.1480]	I(1)	0.9034	[0.4620]	I(1)

ARIMA process: ARIMA(0.1.1)

Estimates	ϕ_1	θ_1	σ^2	*ll*	AIC
		0.5485	0.0458	159.52	23.87
		(0.0000)			

Outliers detected in the estimated ARIMA

Type	**Date**	**Estimate**
AO	1940	-0,1892

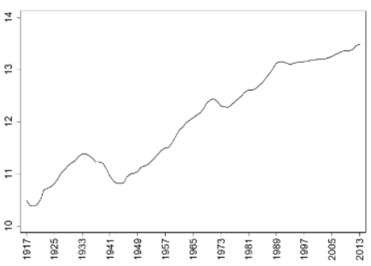
AO means Additive Outlier; TC means Temporary Change; LS means Level Shift

Table 80: Swiss real credit statistics

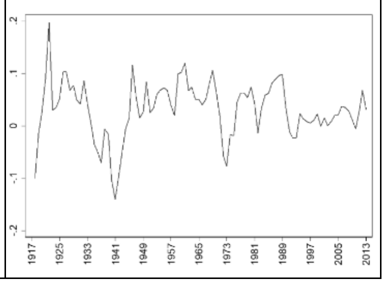
Series:	Real credit	**Frequency:**	Annual
Country:	Switzerland	**Observations:**	97.00
Period:	1917 - 2013	**Source:**	JST

Graphs

Logarithmic transformation



First logarithmic differences



Descriptive Statistics

	Level	*Log*	*Diff Log*	*Gr. Rate*
Mean	248,459.30	12.01	3.12%	3.31%
Median	176,316.40	12.08	3.43%	3.49%
Standard. Dev.	208,956.15	0.96	5.39%	5.50%
Skewness	0.72	0.01	-0.49	-0.24
Kurtosis	-0.96	-1.44	1.33	1.32
Minimum	32,281.14	10.38	-14.06%	-13.12%
Maximum	719,766.37	13.49	19.76%	21.84%
Range	687,485.23	3.10	33.82%	34.96%
IQ Range	418,317.33	1.94	6.03%	6.26%

Trend Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
Daniels test	>10	0.0000	Trend	4.3731	0.0000	Trend

Structural Breaks Tests

	Log		*Diff log*			
	PY test	Date	F(0/1)	Conclusion	AIC	Date
1st break	-	-	0.0484	No break	0	-
2nd break	-	-				
3rd break	-	-				

PY corresponds to the F test in Perron and Yabu (2009), with 5% significance

F(0/1) corresponds to the test in Bai and Perron (2003) of zero breaks againts at least one break

AIC indicates the number of breaks according to the AIC criterion (Bai and Perron, 2003)

Stationarity Tests

	Log			*Diff Log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ADF	-2.6933	0.2393	I(1)	-4.4965	0.0001	I(0)
ADF-GLS	-2.3557	[-3.030]	I(1)	-2.0681	0.0371	I(0)
PP [z(rho)]	-0.4400	[-13.668]	I(1)	-34.4920	[-13.668]	I(0)
PP [z(t)]	-0.5020	[-2.893]	I(1)	-4.6870	[-2.893]	I(0)
KPSS	0.9220	[0.1480]	I(1)	0.0812	[0.462]	I(0)

ARIMA process: ARIMA(1.1.1)

Estimates	ϕ_1	ϕ_2	θ_1	σ^2	*ll*	AIC
	-1.2859	0.5607		4629.15	-947.41	1916.83
	(0.0000)	*(0.0000)*				

Outliers detected in the estimated ARIMA

Type	Date	Estimate	Type	Date	Estimate
AO	1974	5634.53	AO	2000	-7232.87
TC	1982	-10517.30	TC	2010	-12408.48
LS	1989	12496.34	LS	2012	24701.31
AO	1993	-7095.75			

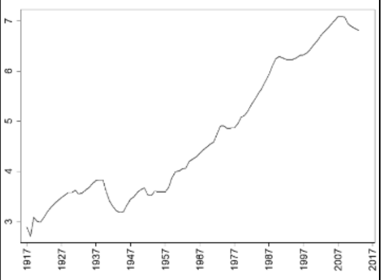
AO means Additive Outlier; TC means Temporary Change; LS means Level Shift

Table 81: British real credit statistics

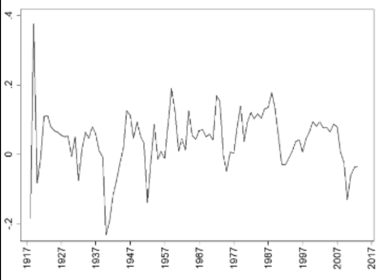
Series:	Real credit	**Frequency:**	Annual
Country:	United Kingdom	**Observations:**	97
Period:	1917 - 2013	**Source:**	JST

Graphs

Logarithmic transformation



First logarithmic differences



Descriptive Statistics

	Level	*Log*	*Diff Log*	*Gr. Rate*
Mean	263.13	4.69	4.09%	4.56%
Median	70.02	4.25	5.10%	5.23%
Standard. Dev.	343.37	1.35	8.56%	8.94%
Skewness	1.45	0.47	-0.21	0.46
Kurtosis	3.88	1.73	5.97	7.47
Minimum	14.98	2.71	-23.11%	-20.63%
Maximum	1,214.23	7.10	37.63%	45.69%
Range	1,199.25	4.40	60.74%	66.32%
IQ Range	470.45	2.65	9.15%	9.56%

Trend Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
Daniels test	6.6694	0.0000	Trend	0.9568	0.8307	No trend

Structural Breaks Tests

	Log		*Diff log*			
	PY test	Date	F(0/1)	Conclusion	AIC	Date
1st break	504.2900	1978	0.0043	No break	0	-
2nd break						
3rd break	-					

PY corresponds to the F test in Perron and Yabu (2009), with 5% significance
F(0/1) corresponds to the test in Bai and Perron (2003) of zero breaks againts at least one break
AIC indicates the number of breaks according to the AIC criterion (Bai and Perron, 2003)

Stationarity Tests

	Log			*Diff Log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ADF	0.6535	0.9996	I(1)	-3.5931	0.0059	I(0)
ADF-GLS	-1.1508	[-3.0300]	I(1)	-3.2092	0.0013	I(0)
PP [z(rho)]	-3.4490	[-20.6280]	I(1)	-25.0660	[-13.9960]	I(0)
PP [z(t)]	-1.4060	[-3.4540]	I(1)	-3.6170	[-2.9200]	I(0)
KPSS	0.5456	[0.1480]	I(1)	0.3303	[0.4620]	I(0)

ARIMA process: ARIMA(1.1.0)

Estimates	ϕ_1	θ_1	σ^2	*ll*	AIC
	-0.6156		0.0592	134.94	53.98
	(0.0000)				

Outliers detected in the estimated ARIMA

Type	**Date**	**Estimate**
AO	1918	-0,3062

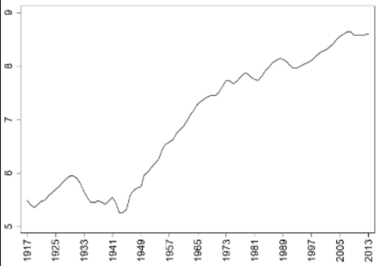
AO means Additive Outlier; TC means Temporary Change; LS means Level Shift

Table 82: United States' real credit statistics

Series:	Real credit	**Frequency:**	Annual
Country:	United States	**Observations:**	97
Period:	1917 - 2013	**Source:**	JST

Graphs

Logarithmic transformation



First logarithmic differences

Descriptive Statistics

	Level	*Log*	*Diff Log*	*Gr. Rate*
Mean	1,870.09	6.97	3.24%	3.54%
Median	1,479.83	7.30	4.38%	4.47%
Standard. Dev.	1,708.26	1.17	7.02%	7.22%
Skewness	0.77	-0.10	-0.30	0.09
Kurtosis	-0.56	-1.61	1.70	2.00
Minimum	192.33	5.26	-18.79%	-17.13%
Maximum	5,654.40	8.64	25.26%	28.74%
Range	5,462.07	3.38	44.05%	45.87%
IQ Range	2,701.62	2.28	6.63%	6.86%

Trend Test

	Log			*Diff log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
Daniels test	>10	0.0000	Trend	3.9418	0.0000	Trend

Structural Breaks Tests

	Log		*Diff log*			
	PY test	Date	F(0/1)	Conclusion	AIC	Date
1st break	4.9320	1955	0.0483	No break	1	1933
2nd break	4.2574	1969				
3rd break	4.1474	1934				

PY corresponds to the F test in Perron and Yabu (2009), with 5% significance

F(0/1) corresponds to the test in Bai and Perron (2003) of zero breaks againts at least one break

AIC indicates the number of breaks according to the AIC criterion (Bai and Perron, 2003)

Stationarity Tests

	Log			*Diff Log*		
	Statistic	pvalue	Result	Statistic	pvalue	Result
ADF	-3.0443	0.1209	I(1)	-2.2745	0.1804	I(1)
ADF-GLS	-1.5070	[-3.030]	I(1)	-1.0290	0.2738	I(1)
PP [z(rho)]	-0.1780	[-13.668]	I(1)	-39.2920	[-13.668]	I(0)
PP [z(t)]	-0.2080	[-2.893]	I(1)	-5.0890	[-2.893]	I(0)
KPSS	0.2387	[0.1480]	I(1)	0.1622	[0.462]	I(0)

ARIMA process: ARIMA(1.1.1)

Estimates	ϕ_1	θ_1	σ^2	*ll*	AIC
	-0.401	0.5284	0.04437	162.38	1027.93
	(0.0016)	*(0.0000)*			

Outliers detected in the estimated ARIMA

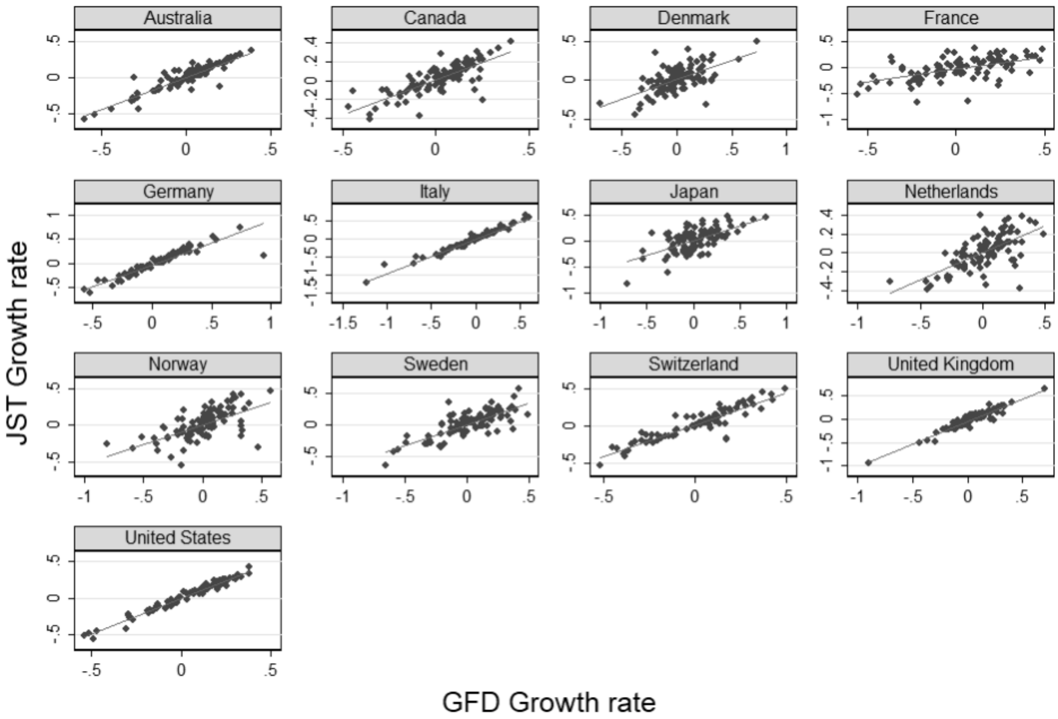
Type	**Date**	**Estimate**	**Type**	**Date**	**Estimate**
LS	1946	0.1805	LS	1950	0,1805

AO means Additive Outlier; TC means Temporary Change; LS means Level Shift

Annex 3. Comparing Stock Market Indices (JST and GFD)

A strong criticisim of the stock market index series from GFD emerges from the black-box nature of their construction. An alternative series, whose construction is thoroughly detailed is the one offered by Jorda, Schularick and Taylor (2017). In what follows we compare both series. We take the datum for the last trading day of each year from the different GFD series describes in Section 2.1.1 to build an annual database. We take the annual observation from JST, in nominal terms and deflate it using the CPI in the same database. We then calculate the annual growth rate in each series as the first difference of its logarithmic transformation. In Figure 26 we resent a scatter plot of both series by country.

Figure 26: Scatterplot of the growth rate in JST and GFD real stock market indices



Note: The growth rates are calculated as the first difference of the logarithmic transformation of each series. The original indices are expressed in real terms to make them comparable.

As the figure shows, there is a strong positive linear relationship that holds for the different countries in the database.

Annex 4. Full Sample VS Recursive Application of a GARCH (1,1)

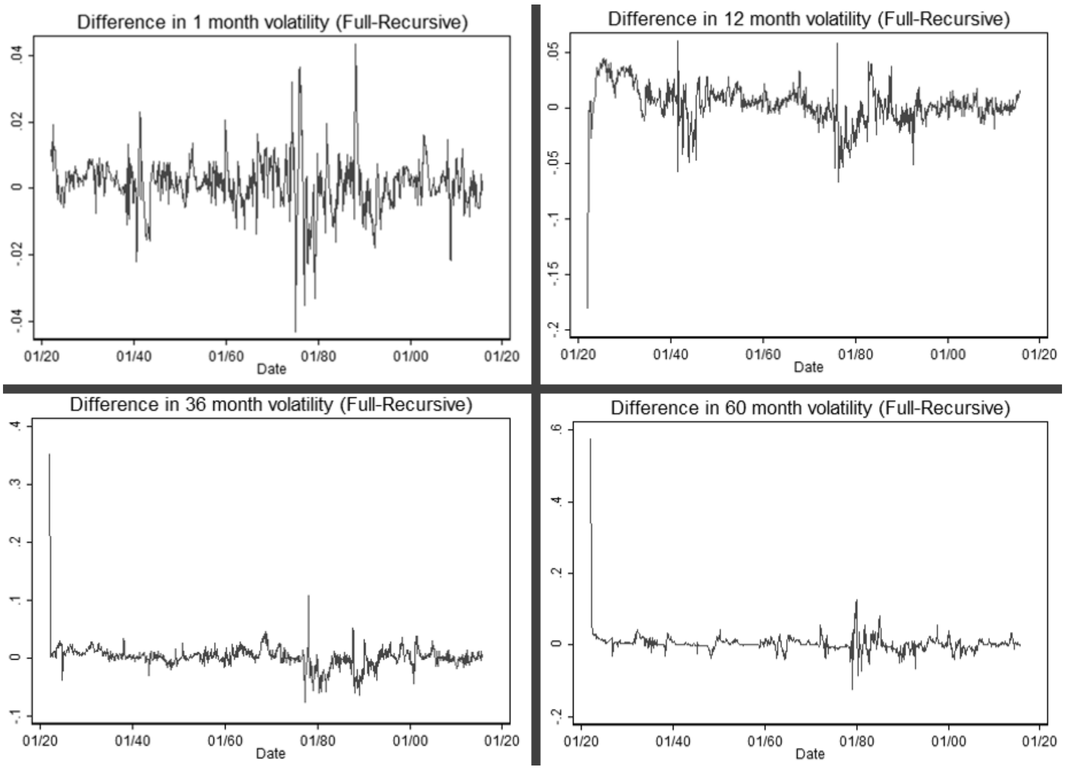
When calculating LBBIs, we have highlighted the relevance of employing time-varying means and measures of dispersion in the standardisation process. To calculate the time-changing mean we performed a 5-year rolling exponentially weighted moving average (EWMA). However, to obtain time-varying volatility, we suggested fitting a GARCH(1,1) stochastic process directly to the full sample of each of the vectors of returns $\mathbf{r_n}$. A natural question that arises is why, if we perform a recursive calculation of the mean, we do not fit a the GARCH (1,1) model recursively as well?

First, let us recall that the goal of fitting a stochastic process to estimate volatility is to obtain a time-varying measure of dispersion, which is the immediate result of fitting a GARCH process directly to the full sample. Doing so in a recursive fashion, with a five-year moving window as we do for the mean, implies an excessively large number of calculations. For the monthly stock market series for the UK, for example, which covers 1,185 observations, we would require fitting the model to 1,125 windows of 60 months each. This dramatically increases the number of parameters to estimate as well as the computation time required to obtain the indicator, and the resulting measure is still time-varying volatility.

A second issue arises when we move from data of a monthly frequency to annual series. Even if fitting a GARCH (1,1) recursively to a series with 60-month windows might make sense, doing so with 5-year windows for annual data presents all sorts of small sample issues. The standard errors for the parameters when fitting a GARCH process to a set of five data points would be excessively large and include unnecessary model bias into the indicator.

In what follows, as a robustness check, we estimate the time-varying volatility of the returns in $\mathbf{R}$ for the UK stock market series using a recursive GARCH(1,1) for a moving window of 5 years where we store the value of the fitted volatility for the last observation in a new series of time-varying standard deviations. In Figure 27 we present the differences between the full sample volatility calculation against the recursive calculation described above for selected vectors $\mathbf{r_1}$, $\mathbf{r_{12}}$, $\mathbf{r_{36}}$ and $\mathbf{r_{60}}$.

Figure 27: Difference between full-sample and recursive volatility of returns for selected time horizons



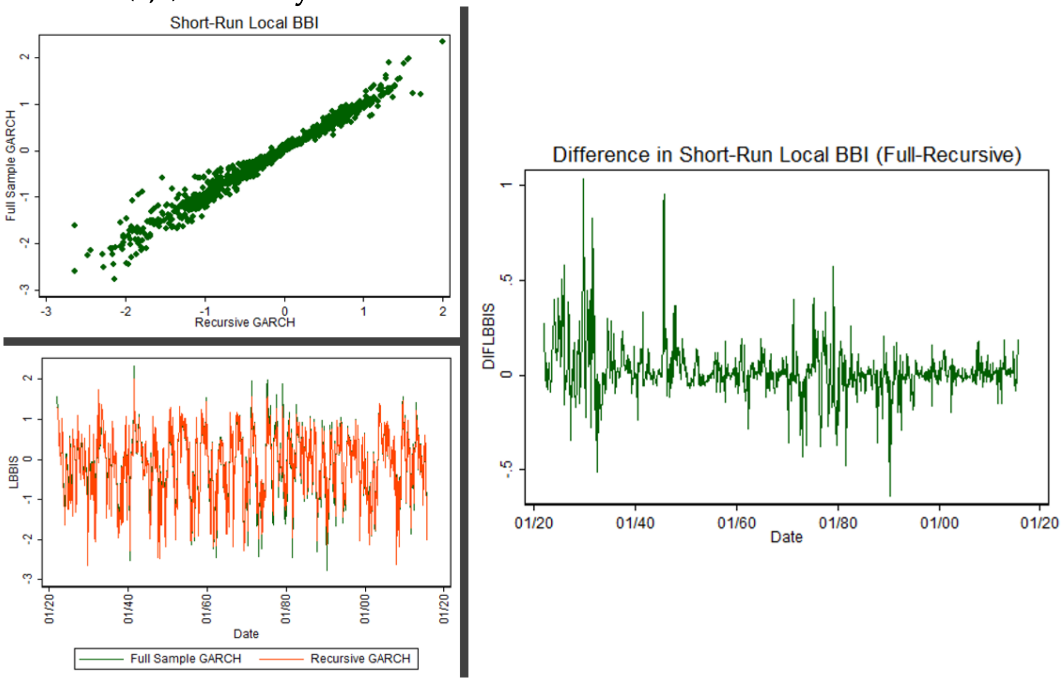
Note: Starting at the top-left panel and turning clockwise, each panel presents the differences between the volatility calculated using the full-sample GARCH (1,1) against the model fitted recursively for 1-month, 12-month, 36-month, and 60-month returns. When the measure takes on a positive (negative) value, the full sample volatility is larger (smaller) than the recursively calculated one.

A significant result evidenced in the Figure is that the volatility calculated recursively is neither strictly above nor below the volatility calculated using the full sample. The main differences occur from the end of the 1970s until the early-1990s. During this period, volatility estimated using the recursive process is usually higher than the volatility using the full sample, which may be because the 60 observation window contains only high-volatility observations, in particular after the first oil shock in 1973, where the market turned especially volatile (Figure 13).

We then perform the rolling standardisation in (14) and use the resulting **D** matrix to calculate the Local Bull Bear Indicators to different time horizons in (19). It is noteworthy that changing the way in which we calculate time-varying volatility will not alter the direction of the indicator because volatility is strictly positive so the sign of the indicator is solely determined by the whether a given return is above or below its time-varying average.

The following figures present the differences between LBBIs obtained using a full-sample or a recursive GARCH. In each figure, we present the evolution of both series against time, a scatterplot of the LBBI using a recursive GARCH (x-axis) against the LBBI using a full-sample GARCH, and the difference between both LBBIs (Full sample – recursive GARCH).

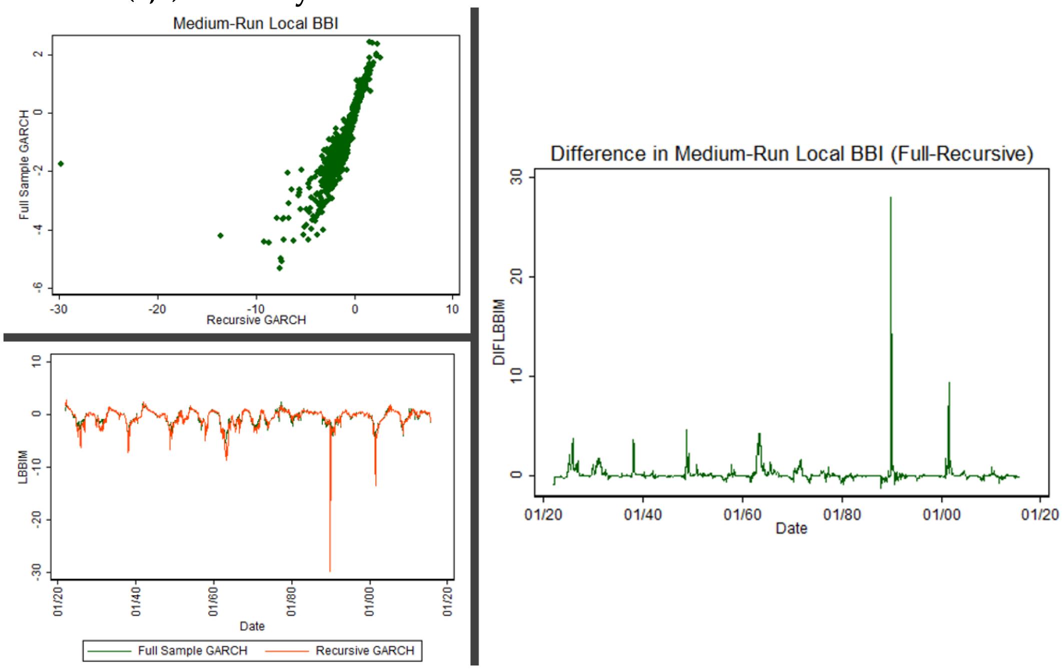
Figure 28: Comparison of short-run LBBI using recursive or full-sample GARCH (1,1) volatility



Note: Top-left panel presents a scatterplot of LBBIS calculated using a recursive 60-observation GARCH (1,1) (X-axis) against LBBIS calculated using the full-sample GARCH (1,1). The bottom-left panel presents LBBIS calculated using a recursive 60-observation GARCH (1,1) (orange line) and LBBIS calculated using the full-sample GARCH (1,1) (green line). The right panel presents the difference between LBBIS using a full sample GARCH (1,1) and LBBIS using a recursive 60-observation GARCH (1,1).

The figure shows that the relationship between both LBBS is stable. As indicated above there are no changes of signs in the indicator. However, we do find changes in the dimension of the indicator all throughout the sample. The most significant difference between both LBBIs is around one standard deviation, which occurs in the late 1920s and mid-1940s.

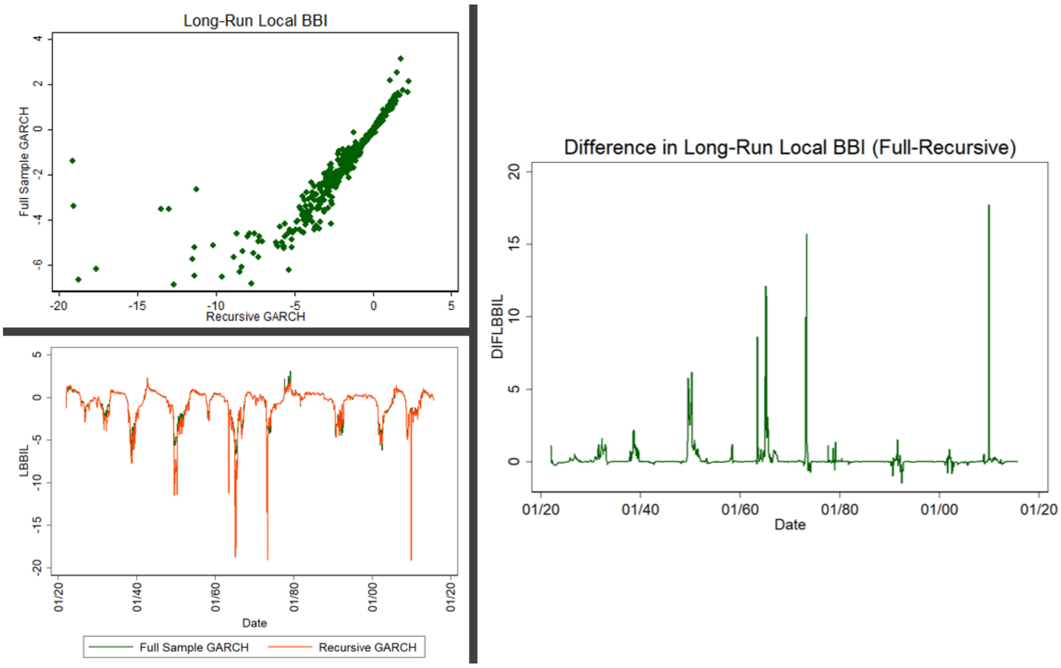
Figure 29: Comparison of medium-run LBBI using recursive or full-sample GARCH (1,1) volatility



Note: Top-left panel presents a scatterplot of LBBIM calculated using a recursive 60-observation GARCH (1,1) (X-axis) against LBBIM calculated using the full-sample GARCH (1,1). The bottom-left panel presents LBBIM calculated using a recursive 60-observation GARCH (1,1) (orange line) and LBBIM calculated using the full-sample GARCH (1,1) (green line). The right panel presents the difference between LBBIM using a full sample GARCH (1,1) and LBBIM using a recursive 60-observation GARCH (1,1).

Figure 29 shows significant differences across both indicators, notably deeper busts at the end of the 1930s, late 1940s, early 1960s, the crash of 1987 and the early 2000s. These differences are associated with lower volatilities for those periods, when we use the recursive calculation, due to the shorter observation window. When the window contains observations with very low volatility, the prediction from the recursive process will be a lower volatility than the one predicted by the full-sample specification. In this case, a lower value of the denominator in the indicator will push its value toward infinity. That explains the substantial differences that occur, on occasions between the LBBIM calculated using the full sample and the recursive GARCH (1,1) specification.

Figure 30: Comparison of long-run LBBI using recursive or full-sample GARCH (1,1) volatility



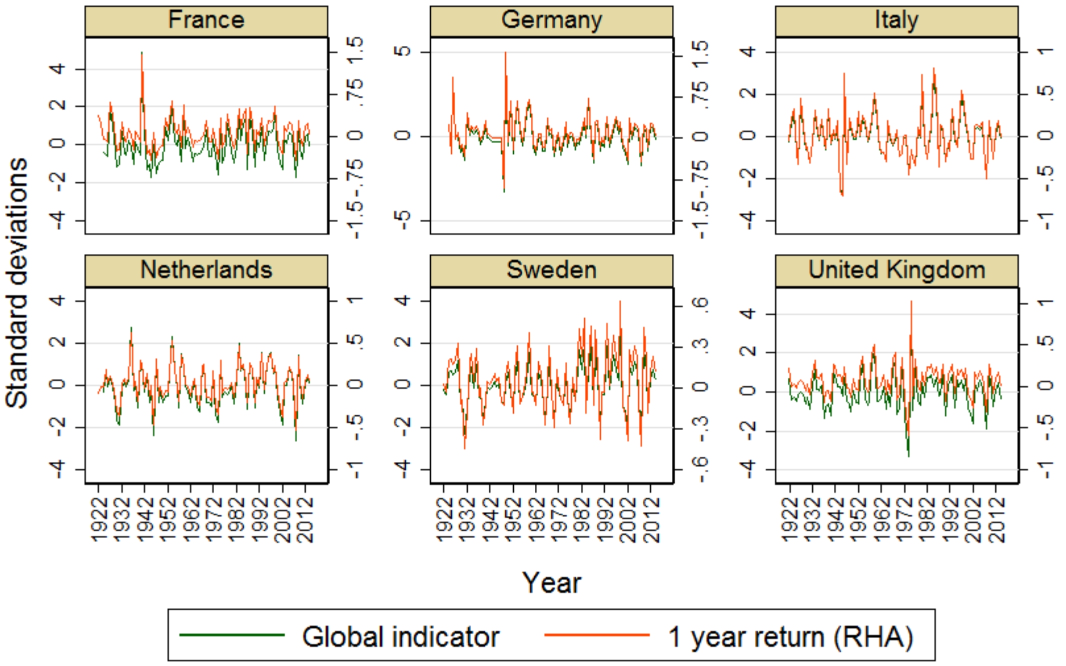
Note: Top-left panel presents a scatterplot of LBBIL calculated using a recursive 60-observation GARCH (1,1) (X-axis) against LBBIL calculated using the full-sample GARCH (1,1). The bottom-left panel presents LBBIL calculated using a recursive 60-observation GARCH (1,1) (orange line) and LBBIL calculated using the full-sample GARCH (1,1) (green line). The right panel presents the difference between LBBIL using a full sample GARCH (1,1) and LBBIL using a recursive 60-observation GARCH (1,1).

As in Figure 29, the differences between indicators in Figure 30 are due to the lower values of volatility when the observation window contains periods of low volatility. These differences may be substantial, as they allow the LBBIL to reach absolute values close to 20 standard deviations. In general, such large observations, which we classify as outliers resulting from a particular choice of model specification, may excessively weight when using the LBBIs as dependent variables in our empirical applications of chapters 3, 4 and 5. This may, in turn, bias the results of the econometric specifications and increase Type I Errors (accepting a false positive). Consequently, for the rest of the dissertation, whenever we discuss LBBIs, the time-varying volatility will be calculated fitting a GARCH(1,1) to the full sample of each vector in **R**.

Annex 5. GBBIs and period returns

In this annex, we present two different figures, for a sample of six countries, to evidence that GBBIs track the behaviour of returns calculated to different time horizons. All other cases behave similarly. In Figure 31 we present the short-run GBBI for the stock indices of six selected countries in the database. In the same plot, we include the 1-year return as a proxy for the short-run.

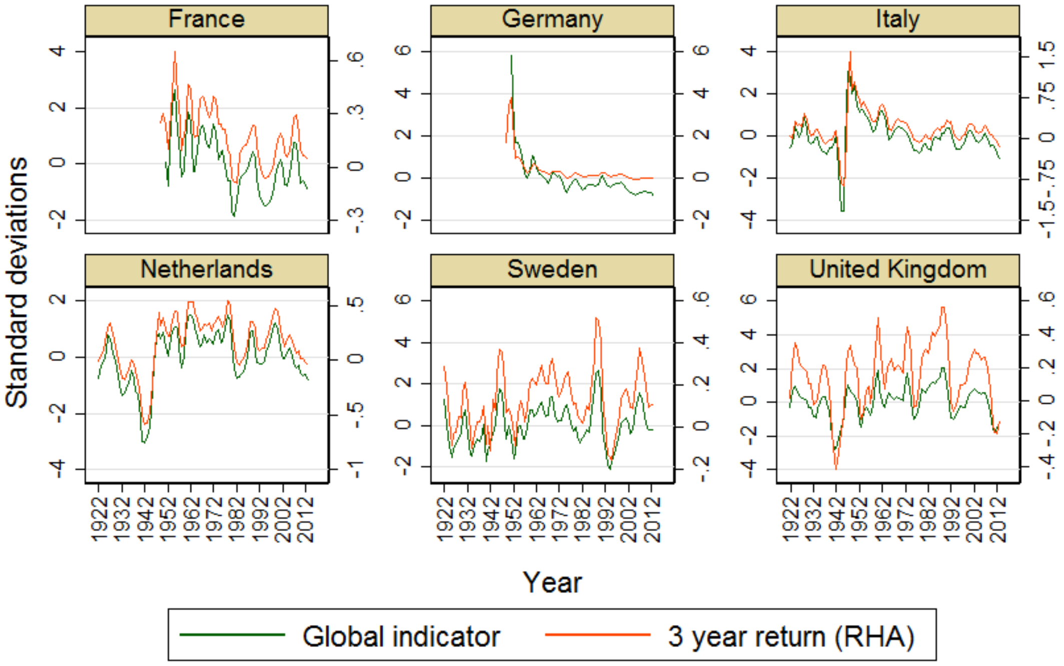
Figure 31: Short-run GBBI and 1-year return for stock market indices



Note: Global Bull Bear Indicator for the real stock market index for the six countries in the database (green and left-hand axis). 1-year return of the real stock market index for the six countries in the database (orange and right-hand axis).

In Figure 32 we present the medium-run GBBI for real credit for six selected countries in the database. In the same plot, we include the 3-year return as a proxy for the medium-run.

Figure 32: Medium-run GBBI and 3-year return for real credit to the non-financial private sector



Note: Global Bull Bear Indicator for real credit to the non-financial private sector for the six countries in the database (green and left-hand axis). 3-year return of real credit to the non-financial private sector for the six countries in the database (orange and right-hand axis).

Annex 6. Statistical Characterisation of LBBIs for all the Time Series.

The following tables include a statistical characterisation of the LBBI series calculated as discussed in section 2.5.2. A first section describes the different series by type, frequency, country, number of observations and starting and ending dates. Then we include a graph for each of the series. The first panel in the right section includes descriptive statistics for the three series.

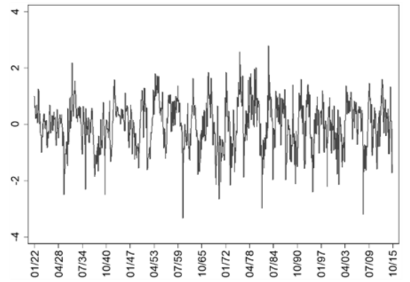
The right column includes a Daniels' (1950) trend test for the three series. We then follow Bai & Perron (1998, 2003) and perform their test for structural breaks since it is designed explicitly for I(0) series. We present the statistic for the test where the null hypothesis is the absence of breaks against the alternative of one break. We establish our conclusion based on this test, although we also include the number and dates of sequential breaks suggested following the Bayesian Information Criterion (BIC).

The bottom panel includes stationarity tests for the series in levels. In all cases, we include the ADF, ADF-GLS and KPSS tests. For monthly series, we present the HEGY and CH tests. For annual series, we include the PP test. All of these tests are discussed at length in Annex 2. Note that numbers in brackets ([]) represent critical values and not p-values. Whenever the statistic exceeds the critical value, we cannot reject the alternative hypothesis.

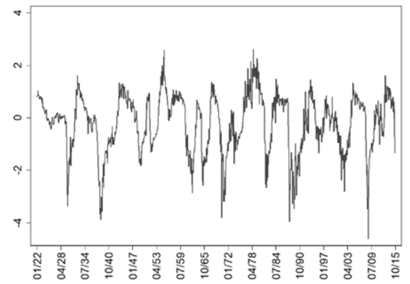
Table 83: Australian stock market LBBIs statistics

LBBI:	Stock market	**Frequency:**	Monthly
Country:	Australia	**Observations:**	1125
Period:	Jan/1922 - Sep/2015		

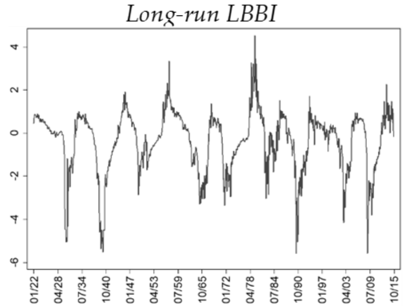
Short-run LBBI



Medium-run LBBI



Long-run LBBI



Descriptive Statistics	*LBBIS*	*LBBIM*	*LBBIL*
Mean	-0.02	-0.20	-0.38
Median	0.07	-0.01	-0.05
Standard. Dev.	0.84	1.10	1.41
Skewness	-0.32	-0.67	-0.91
Kurtosis	3.30	3.38	4.43
Minimum	-3.34	-4.60	-5.58
Maximum	2.80	2.63	4.53
Range	6.14	7.23	10.11
IQ Range	1.13	1.56	1.75

Trend Test

Daniels test	*LBBIS*	*LBBIM*	*LBBIL*
Statistic	0.5813	-0.5043	-1.4583
pvalue	0.5610	0.6141	0.1448
Result	No trend	No trend	No trend

Structural Breaks Tests

	LBBIS	*LBBIM*	*LBBIL*
F(0/1)	0.0356	0.0133	0.0216
Conclusion	No break	No break	No break
BIC	0	3	3
Date 1		Oct-42	May-42
Date 2		Dec-75	Jan-78
Date 3		Mar-91	Oct-92

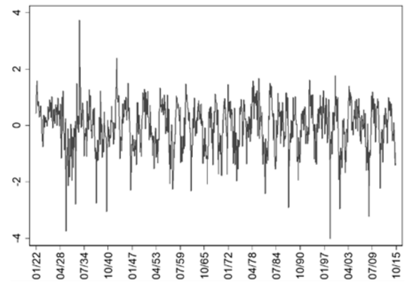
Stationarity tests

	LBBIS			*LBBIM*			*LBBIL*		
	Statistic	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*
ADF	-9.9160	0.0000	I(0)	-4.7590	0.0001	I(0)	-4.2260	0.0006	I(0)
ADF-GLS	-4.3874	0.0000	I(0)	-3.4578	0.0005	I(0)	-3.8509	0.0001	I(0)
KPSS	0.0392	[0,462]	I(0)	0.0744	[0,462]	I(0)	0.0902	[0,462]	I(0)
HEGY	-8.250	0.0000	I(0)	-6.210	0.0000	I(0)	-5.170	0.0000	I(0)
CH	2.4230	0.0907	I(0)	2.1394	0.2094	I(0)	2.1744	0.1906	I(0)

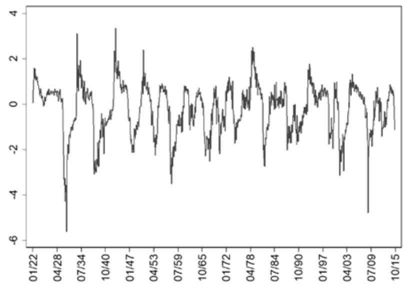
Table 84: Canadian stock market LBBIs statistics

LBBI:	Stock market	**Frequency:**	Monthly
Country:	Canada	**Observations:**	1125
Period:	Jan/1922 - Sep/2015		

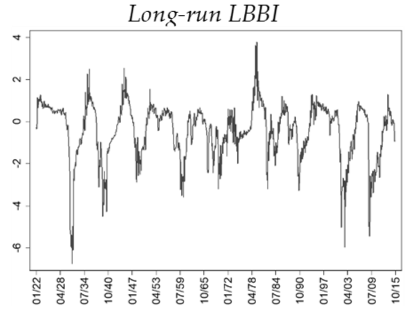
Short-run LBBI



Medium-run LBBI



Long-run LBBI



Descriptive Statistics	*LBBIS*	*LBBIM*	*LBBIL*
Mean	-0.04	-0.22	-0.44
Median	0.05	0.00	-0.15
Standard. Dev.	0.81	1.09	1.34
Skewness	-0.58	-0.68	-1.13
Kurtosis	4.39	3.94	5.33
Minimum	-4.00	-5.61	-6.75
Maximum	3.73	3.35	3.79
Range	7.73	8.95	10.54
IQ Range	1.09	1.47	1.66

Trend Test			
Daniels test	*LBBIS*	*LBBIM*	*LBBIL*
Statistic	-0.1682	-2.1764	-4.3151
pvalue	0.8664	0.0295	0.0000
Result	No trend	Trend	Trend

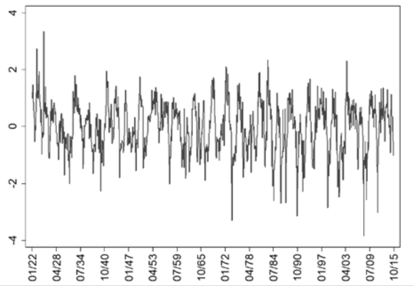
Structural Breaks Tests	*LBBIS*	*LBBIM*	*LBBIL*
F(0/1)	0.0089	0.0049	0.2678
Conclusion	No break	No break	No break
BIC	1	2	2
Date 1	Jun-41	Sep-42	Feb-41
Date 2		Oct-60	Jan-01
Date 3			

Stationarity tests	*LBBIS*			*LBBIM*			*LBBIL*		
	Statistic	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*
ADF	-10.5300	0.0000	I(0)	-5.5120	0.0001	I(0)	-4.7610	0.0006	I(0)
ADF-GLS	-7.5000	0.0000	I(0)	-5.3265	0.0005	I(0)	-5.0691	0.0001	I(0)
KPSS	0.0317	[0.462]	I(0)	0.0660	[0.462]	I(0)	0.1758	[0.462]	I(0)
HEGY	-9.520	0.0000	I(0)	-7.030	0.0000	I(0)	-5.1000	0.0000	I(0)
CH	1.9801	0.3153	I(0)	2.3236	0.1239	I(0)	1.7111	0.5444	I(0)

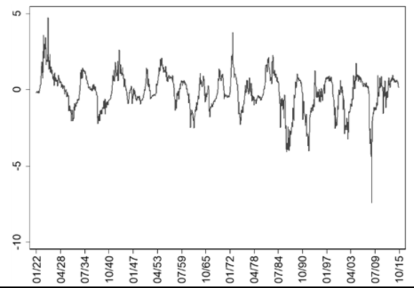
Table 85: Danish stock market LBBIs statistics

LBBI:	Stock market	**Frequency:**	Monthly
Country:	Denmark	**Observations:**	1125
Period:	Jan/1922 - Sep/2015		

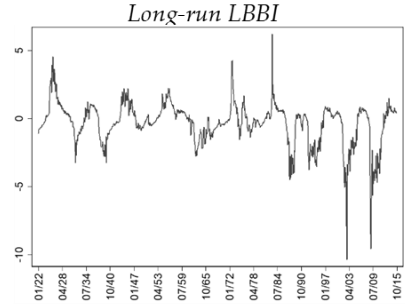
Short-run LBBI



Medium-run LBBI



Long-run LBBI



Descriptive Statistics

	LBBIS	*LBBIM*	*LBBIL*
Mean	-0.02	-0.14	-0.32
Median	0.05	-0.07	-0.09
Standard. Dev.	0.88	1.18	1.53
Skewness	-0.34	-0.62	-1.16
Kurtosis	3.55	5.17	7.83
Minimum	-3.86	-7.43	-10.35
Maximum	3.35	4.74	6.21
Range	7.20	12.17	16.56
IQ Range	1.22	1.36	1.36

Trend Test

Daniels test	*LBBIS*	*LBBIM*	*LBBIL*
Statistic	-1.2278	-5.8862	-6.5139
pvalue	0.2195	0.0000	0.0000
Result	No trend	Trend	Trend

Structural Breaks Tests

	LBBIS	*LBBIM*	*LBBIL*
F(0/1)	1.8797	0.7211	0.3229
Conclusion	No break	No break	No break
BIC	3	3	3
Date 1	Aug-40	Jul-40	Sep-62
Date 2	Jan-84	Jan-61	Nov-86
Date 3	May-86	Oct-84	Aug-01

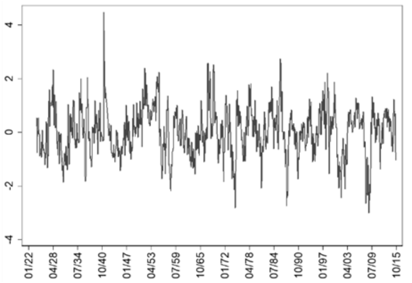
Stationarity tests

	LBBIS			*LBBIM*			*LBBIL*		
	Statistic	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*
ADF	-8.9980	0.0000	I(0)	-4.8930	0.0001	I(0)	-5.1470	0.0006	I(0)
ADF-GLS	-4.8867	0.0000	I(0)	-4.8883	0.0005	I(0)	-3.7659	0.0001	I(0)
KPSS	0.1711	[0.462]	I(0)	0.9789	[0.462]	I(1)	1.5558	[0.462]	I(1)
HEGY	-9.380	0.0000	I(0)	-5.970	0.0000	I(0)	-5.3400	0.0000	I(0)
CH	2.6045	0.0491	I(1)	1.6300	0.6370	I(0)	1.5774	0.6834	I(0)

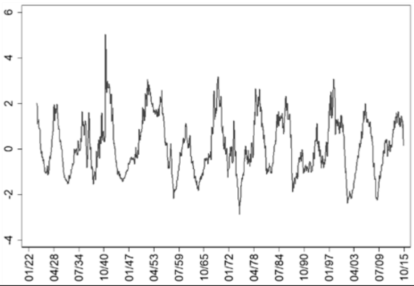
Table 86: French stock market LBBIs statistics

LBBI:	Stock market	**Frequency:**	Monthly
Country:	France	**Observations:**	1101
Period:	01/1924 - 09/2015		

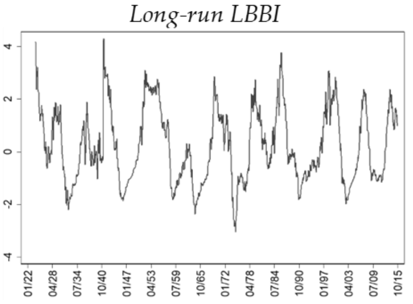
Short-run LBBI



Medium-run LBBI



Long-run LBBI



Descriptive Statistics	*LBBIS*	*LBBIM*	*LBBIL*
Mean	0.03	0.14	0.21
Median	0.05	-0.02	-0.04
Standard. Dev.	0.91	1.22	1.40
Skewness	0.05	0.34	0.33
Kurtosis	3.90	2.58	2.23
Minimum	-3.01	-2.86	-3.04
Maximum	4.47	5.03	4.31
Range	7.48	7.89	7.35
IQ Range	1.19	1.95	2.28

Trend Test			
Daniels test	*LBBIS*	*LBBIM*	*LBBIL*
Statistic	1.7200	0.7021	-0.6027
pvalue	0.0854	0.4822	0.5467
Result	No trend	No trend	No trend

Structural Breaks Tests	*LBBIS*	*LBBIM*	*LBBIL*
F(0/1)	0.0887	0.1119	0.6076
Conclusion	No break	No break	No break
BIC	3	3	3
Date 1	Feb-53	Apr-38	Jun-37
Date 2	Dec-82	Apr-51	Jun-50
Date 3	Mar-96	Mar-96	Oct-95

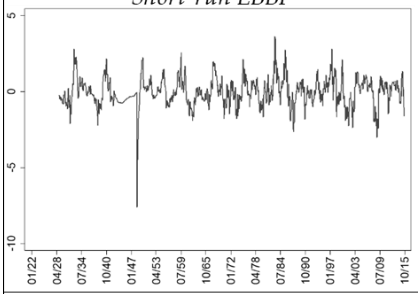
Stationarity tests

	LBBIS			*LBBIM*			*LBBIL*		
	Statistic	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*
ADF	-8.8331	0.0000	I(0)	-5.8396	0.0000	I(0)	-5.6678	0.0000	I(0)
ADF-GLS	-8.5976	0.0000	I(0)	-2.7245	0.0063	I(0)	-1.5982	0.1037	I(1)
KPSS	0.04	[0,462]	I(0)	0.08	[0,462]	I(0)	0.10	[0,462]	I(0)
HEGY	82.190	0.0000	I(0)	68.5800	0.0000	I(0)	71.1100	0.0000	I(0)
CH	1.8791	0.3974	I(0)	1.0152	0.9954	I(0)	1.2674	0.4330	I(0)

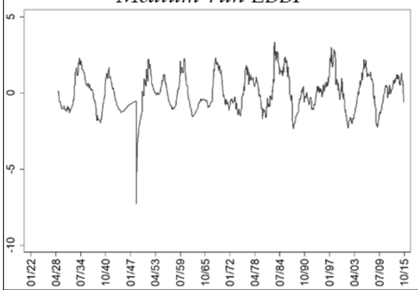
Table 87: German stock market LBBIs statistics

LBBI:	Stock market	**Frequency:**	Monthly
Country:	Germany	**Observations:**	1043
Period:	11/1928 - 09/2015		

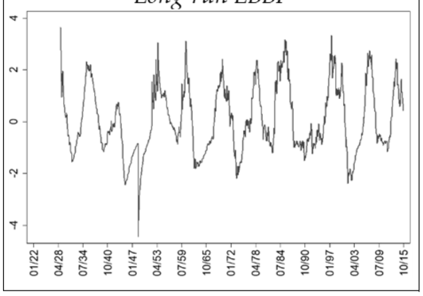
Short-run LBBI



Medium-run LBBI



Long-run LBBI



Descriptive Statistics	*LBBIS*	*LBBIM*	*LBBIL*
Mean	-0.02	-0.01	0.05
Median	-0.04	-0.11	-0.21
Standard. Dev.	0.92	1.18	1.30
Skewness	-0.46	-0.11	0.24
Kurtosis	8.35	4.12	2.37
Minimum	-7.62	-7.28	-4.44
Maximum	3.62	3.33	3.64
Range	11.23	10.61	8.07
IQ Range	1.06	1.72	1.97

Trend Test			
Daniels test	*LBBIS*	*LBBIM*	*LBBIL*
Statistic	3.4628	3.9648	3.2310
pvalue	0.0003	0.0000	0.0006
Result	Trend	Trend	Trend

Structural Breaks Tests	*LBBIS*	*LBBIM*	*LBBIL*
F(0/1)	0.039	0.0327	0.0092
Conclusion	No break	No break	No break
BIC	3	3	3
Date 1	Oct-60	Dec-49	Jan-51
Date 2	Apr-86	Apr-87	Oct-87
Date 3	Apr-00	Apr-00	Oct-00

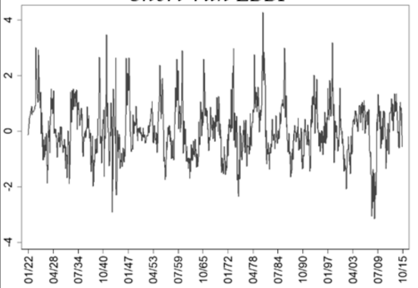
Stationarity tests

	LBBIS			*LBBIM*			*LBBIL*		
	Statistic	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*
ADF	-9.6161	0.0000	I(0)	-4.4663	0.0000	I(0)	-3.8872	0.0000	I(0)
ADF-GLS	-7.9326	0.0000	I(0)	-4.4576	0.0000	I(0)	-1.0349	0.2715	I(1)
KPSS	0.10	[0,462]	I(0)	0.26	[0,462]	I(0)	0.29	[0,462]	I(0)
HEGY	49.080	0.0000	I(0)	1158.640	0.0000	I(0)	1690.2300	0.0000	I(0)
CH	2.3644	0.1074	I(0)	1.7180	0.5363	I(0)	1.7012	0.5560	I(0)

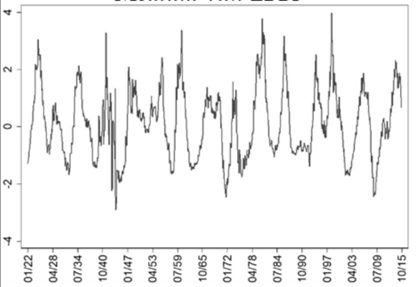
Table 88: Italian stock market LBBIs statistics

LBBI:	Stock market	**Frequency:**	Monthly
Country:	Italy	**Observations:**	1125
Period:	01/1922 - 09/2015		

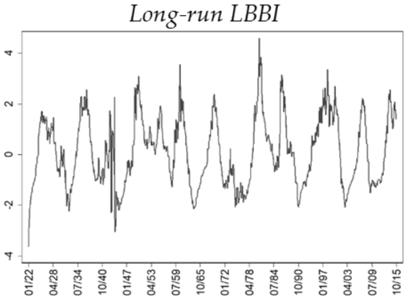
Short-run LBBI



Medium-run LBBI



Long-run LBBI



Descriptive Statistics

	LBBIS	*LBBIM*	*LBBIL*
Mean	0.04	0.10	0.11
Median	-0.01	0.05	0.03
Standard. Dev.	0.95	1.20	1.34
Skewness	0.32	0.30	0.27
Kurtosis	3.99	2.56	2.29
Minimum	-3.16	-2.90	-3.62
Maximum	4.27	3.99	4.58
Range	7.43	6.89	8.21
IQ Range	1.19	1.77	2.18

Trend Test

Daniels test	*LBBIS*	*LBBIM*	*LBBIL*
Statistic	-0.0385	0.6109	1.9091
pvalue	0.0854	0.5412	0.0596
Result	No trend	No trend	No trend

Structural Breaks Tests

	LBBIS	*LBBIM*	*LBBIL*
F(0/1)	0.0102	0.3755	0.0185
Conclusion	No break	No break	No break
BIC	3	3	3
Date 1	Feb-40	Apr-54	Sep-41
Date 2	Oct-71	Jul-74	Jul-72
Date 3	May-86	Sep-91	Mar-87

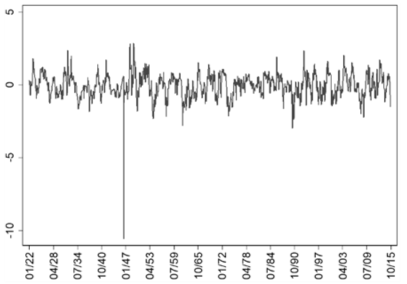
Stationarity tests

	LBBIS			*LBBIM*			*LBBIL*		
	Statistic	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*
ADF	-10.5485	0.0000	I(0)	-4.5179	0.0002	I(0)	-4.6620	0.0001	I(0)
ADF-GLS	-10.3841	0.0000	I(0)	-2.9117	0.0035	I(0)	-1.2229	0.2036	I(1)
KPSS	0.06	[0,462]	I(0)	0.07	[0,462]	I(0)	0.16	[0,462]	I(0)
HEGY	79.540	0.0000	I(0)	68.0800	0.0000	I(0)	62.4300	0.0000	I(0)
CH	2.6769	0.0370	$I_S(1)$	1.8456	0.4285	I(0)	1.3759	0.8670	I(0)

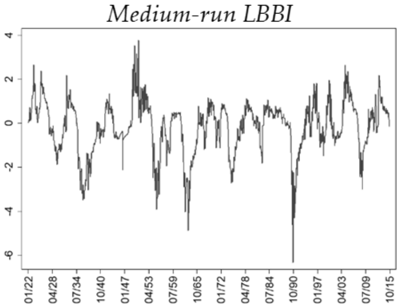
Table 89: Japanese stock market LBBIs statistics

LBBI:	Stock market	**Frequency:**	Monthly
Country:	Japan	**Observations:**	1125
Period:	Jan/1922 - Sep/2015		

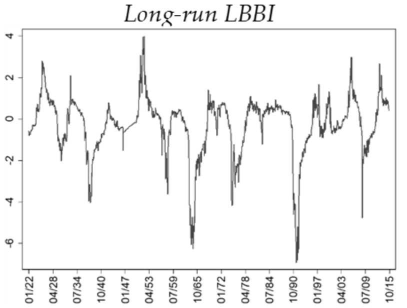
Short-run LBBI



Medium-run LBBI



Long-run LBBI



Descriptive Statistics

	LBBIS	*LBBIM*	*LBBIL*
Mean	-0.05	-0.18	-0.30
Median	-0.02	0.00	-0.03
Standard. Dev.	0.84	1.21	1.44
Skewness	-1.74	-0.75	-1.42
Kurtosis	24.39	4.31	6.88
Minimum	-10.54	-6.32	-6.92
Maximum	2.88	3.77	3.97
Range	13.42	10.09	10.89
IQ Range	1.02	1.39	1.34

Trend Test

Daniels test	*LBBIS*	*LBBIM*	*LBBIL*
Statistic	0.5892	2.0445	0.3404
pvalue	0.5557	0.0409	0.7336
Result	No trend	Trend	No trend

Structural Breaks Tests

	LBBIS	*LBBIM*	*LBBIL*
F(0/1)	0.0722	0.1125	0.0002
Conclusion	No break	No break	No break
BIC	2	3	3
Date 1	Nov-47	Jan-36	Jul-50
Date 2	Jun-65	Dec-53	Aug-66
Date 3		Jan-90	Jul-90

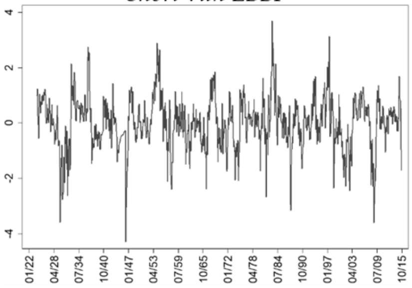
Stationarity tests

	LBBIS			*LBBIM*			*LBBIL*		
	Statistic	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*
ADF	-9.8590	0.0000	I(0)	-5.3380	0.0001	I(0)	-5.2960	0.0006	I(0)
ADF-GLS	-8.5537	0.0000	I(0)	-4.9193	0.0005	I(0)	-4.1602	0.0001	I(0)
KPSS	0.0620	[0.462]	I(0)	0.2386	[0.462]	I(0)	0.2230	[0.462]	I(0)
HEGY	-8.190	0.0000	I(0)	-5.930	0.0000	I(0)	-5.7300	0.0000	I(0)
CH	1.8115	0.4564	I(0)	1.0714	0.9919	I(0)	2.2714	0.1671	I(0)

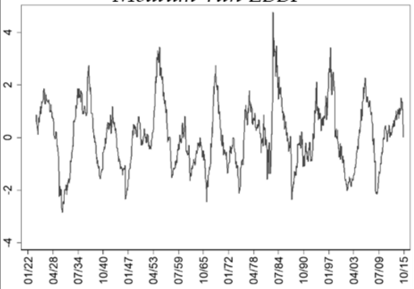
Table 90: Dutch stock market LBBIs statistics

LBBI:	Stock market	**Frequency:**	Monthly
Country:	Netherlands	**Observations:**	1101
Period:	01/1924 - 09/2015		

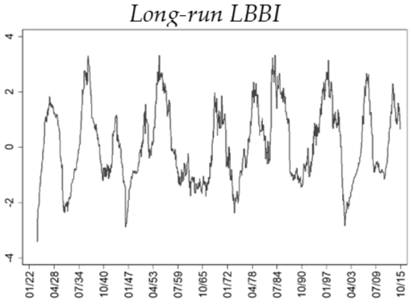
Short-run LBBI



Medium-run LBBI



Long-run LBBI



Descriptive Statistics

	LBBIS	*LBBIM*	*LBBIL*
Mean	0.01	0.08	0.10
Median	0.06	0.01	-0.09
Standard. Dev.	0.94	1.21	1.37
Skewness	-0.32	0.29	0.23
Kurtosis	4.55	2.90	2.12
Minimum	-4.29	-2.85	-3.41
Maximum	3.70	4.76	3.34
Range	7.98	7.61	6.74
IQ Range	1.08	1.73	2.12

Trend Test

Daniels test	*LBBIS*	*LBBIM*	*LBBIL*
Statistic	0.7796	0.2361	-2.7674
pvalue	0.4356	0.8134	0.00557
Result	No trend	No trend	Trend

Structural Breaks Tests

	LBBIS	*LBBIM*	*LBBIL*
F(0/1)	1.403	0.0034	0.011
Conclusion	No break	No break	No break
BIC	3	3	3
Date 1	Jul-38	Aug-52	Apr-54
Date 2	Jul-51	Jul-81	Feb-18
Date 3	Sep-93	Jul-64	Nov-95

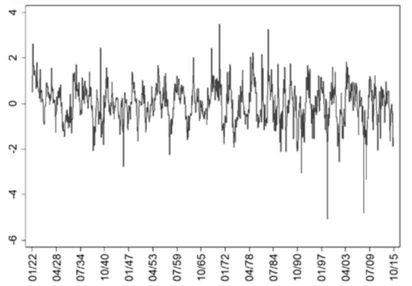
Stationarity tests

	LBBIS			*LBBIM*			*LBBIL*		
	Statistic	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*
ADF	-9.8267	0.0000	I(0)	-3.6815	0.0045	I(0)	-3.4796	0.0087	I(0)
ADF-GLS	-6.6690	0.0000	I(0)	-3.3723	0.0007	I(0)	-0.8465	0.3494	I(1)
KPSS	0.04	[0,462]	I(0)	0.08	[0,462]	I(0)	0.21	[0,462]	I(0)
HEGY	472.070	0.0000	I(0)	73.4600	0.0000	I(0)	71.9700	0.0000	I(0)
CH	3.4116	0.0012	$I_S(1)$	1.4746	0.7893	I(0)	1.4870	0.7785	I(0)

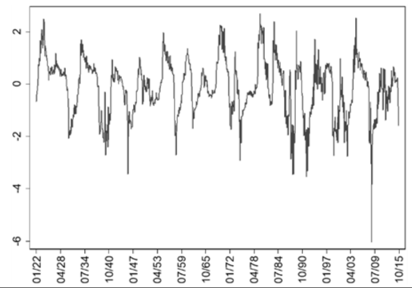
Table 91: Norwegian stock market LBBIs statistics

LBBI:	Stock market	**Frequency:**	Monthly
Country:	Norway	**Observations:**	1125
Period:	Jan/1922 - Sep/2015		

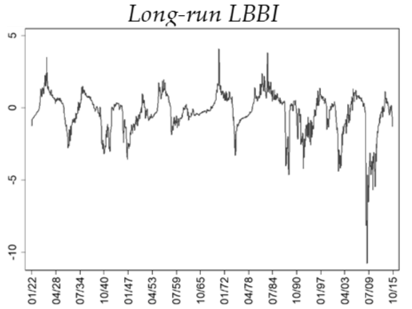
Short-run LBBI



Medium-run LBBI



Long-run LBBI



Descriptive Statistics	*LBBIS*	*LBBIM*	*LBBIL*
Mean	-0.01	-0.14	-0.36
Median	0.05	-0.04	-0.17
Standard. Dev.	0.85	1.06	1.43
Skewness	-0.36	-0.41	-1.54
Kurtosis	5.27	3.73	8.52
Minimum	-5.07	-6.03	-10.77
Maximum	3.49	2.69	4.08
Range	8.56	8.72	14.85
IQ Range	1.09	1.39	1.51

Trend Test			
Daniels test	*LBBIS*	*LBBIM*	*LBBIL*
Statistic	-2.4705	-5.0998	-3.5998
pvalue	0.0135	0.0000	0.0003
Result	Trend	Trend	Trend

Structural Breaks Tests	*LBBIS*	*LBBIM*	*LBBIL*
F(0/1)	0.0058	0.0029	0.064
Conclusion	No break	No break	No break
BIC	1	3	3
Date 1	Jul-47	Feb-38	Dec-39
Date 2		Oct-71	Jan-58
Date 3		Dec-85	Sep-87

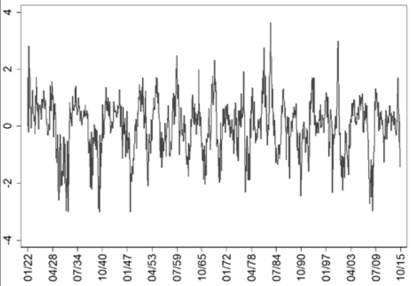
Stationarity tests

	LBBIS			*LBBIM*			*LBBIL*		
	Statistic	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*
ADF	-10.2250	0.0000	I(0)	-4.6666	0.0001	I(0)	-4.1330	0.0009	I(0)
ADF-GLS	-8.0655	0.0000	I(0)	-4.4490	0.0000	I(0)	-3.9743	0.0000	I(0)
KPSS	0.2165	[0.462]	I(0)	0.4213	[0.462]	I(0)	0.6999	[0.462]	I(1)
HEGY	-9.080	0.0000	I(0)	-6.470	0.0000	I(0)	-5.2000	0.0000	I(0)
CH	3.1181	0.0052	I(1)	2.1363	0.2110	I(0)	1.6529	0.6124	I(0)

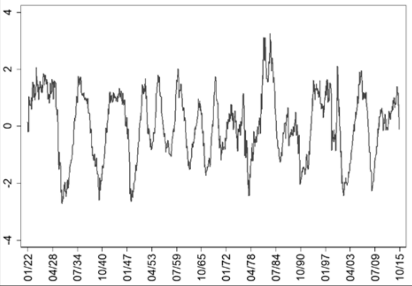
Table 92: Swedish stock market LBBIs statistics

LBBI:	Stock market	**Frequency:**	Monthly
Country:	Sweden	**Observations:**	1125
Period:	01/1922 - 09/2015		

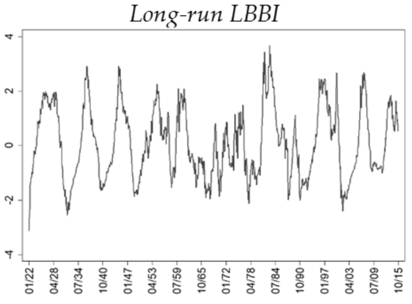
Short-run LBBI



Medium-run LBBI



Long-run LBBI



Descriptive Statistics

	LBBIS	*LBBIM*	*LBBIL*
Mean	0.00	0.04	0.10
Median	0.11	0.09	-0.03
Standard. Dev.	0.95	1.17	1.30
Skewness	-0.35	-0.19	0.26
Kurtosis	3.63	2.38	2.15
Minimum	-3.02	-2.72	-3.12
Maximum	3.65	3.25	3.67
Range	6.67	5.97	6.79
IQ Range	1.14	1.80	2.06

Trend Test

Daniels test	*LBBIS*	*LBBIM*	*LBBIL*
Statistic	-1.2692	2.3095	-0.0090
pvalue	0.2044	0.0209	0.9928
Result	No trend	Trend	No trend

Structural Breaks Tests

	LBBIS	*LBBIM*	*LBBIL*
F(0/1)	0.1111	0.0086	0.0137
Conclusion	No break	No break	No break
BIC	3	3	3
Date 1	Aug-62	Feb-35	Jul-55
Date 2	Jan-77	Sep-73	Apr-74
Date 3	Jul-93	Sep-86	Apr-87

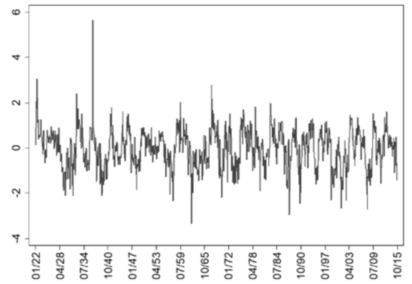
Stationarity tests

	LBBIS			*LBBIM*			*LBBIL*		
	Statistic	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*
ADF	-9.5834	0.0000	I(0)	-3.5561	0.0068	I(0)	-3.7044	0.0042	I(0)
ADF-GLS	-4.2529	0.0000	I(0)	-3.5415	0.0004	I(0)	-1.0347	0.2715	I(1)
KPSS	0.04	[0,462]	I(0)	0.10	[0,462]	I(0)	0.09	[0,462]	I(0)
HEGY	615.340	0.0000	I(0)	2266.520	0.0000	I(0)	83.4200	0.0000	I(0)
CH	2.1690	0.1932	I(0)	1.4642	0.7983	I(0)	1.5333	0.7378	I(0)

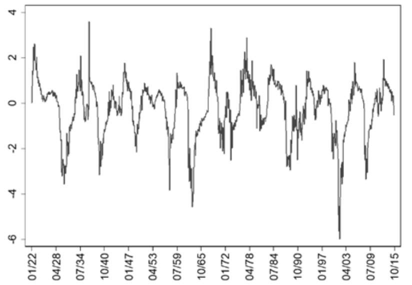
Table 93: Swiss stock market LBBIs statistics

LBBI:	Stock market	**Frequency:**	Monthly
Country:	Switzerland	**Observations:**	1125
Period:	Jan/1922 - Sep/2015		

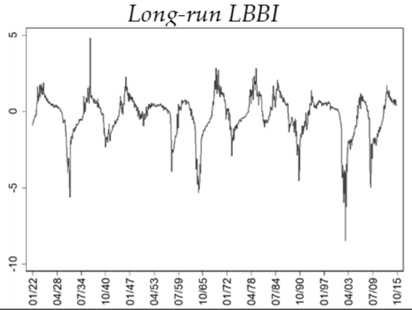
Short-run LBBI



Medium-run LBBI



Long-run LBBI



Descriptive Statistics

	LBBIS	*LBBIM*	*LBBIL*
Mean	-0.04	-0.23	-0.24
Median	0.03	0.05	0.11
Standard. Dev.	0.85	1.22	1.35
Skewness	-0.01	-0.92	-1.36
Kurtosis	4.83	4.57	6.46
Minimum	-3.36	-5.99	-8.47
Maximum	5.64	3.59	4.81
Range	9.00	9.58	13.29
IQ Range	1.15	1.50	1.45

Trend Test

Daniels test	*LBBIS*	*LBBIM*	*LBBIL*
Statistic	0.1236	-1.0015	-2.2543
pvalue	0.9016	0.3166	0.0242
Result	No trend	No trend	Trend

Structural Breaks Tests

	LBBIS	*LBBIM*	*LBBIL*
F(0/1)	1.5696	0.0676	1.1258
Conclusion	No break	No break	No break
BIC	3	3	3
Date 1	Jan-41	May-62	May-44
Date 2	Dec-34	Oct-79	Jul-67
Date 3	Feb-98	Jul-99	Jun-01

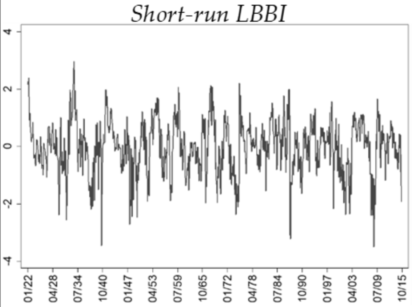
Stationarity tests

	LBBIS			*LBBIM*			*LBBIL*		
	Statistic	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*
ADF	-9.2720	0.0000	I(0)	-4.5220	0.0002	I(0)	-4.4650	0.0002	I(0)
ADF-GLS	-7.9287	0.0000	I(0)	-4.4159	0.0000	I(0)	-4.4287	0.0000	I(0)
KPSS	0.0465	[0.462]	I(0)	0.1151	[0.462]	I(0)	0.2447	[0.462]	I(0)
HEGY	8.090	0.0000	I(0)	-6.470	0.0000	I(0)	-5.3100	0.0000	I(0)
CH	3.1379	0.0064	I(1)	2.4859	0.0738	I(0)	1.8643	0.4094	I(0)

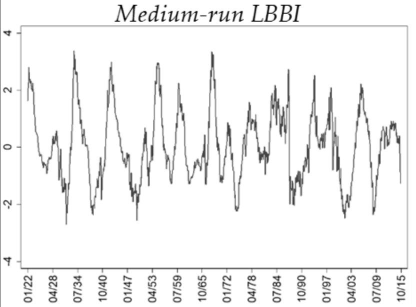
Table 94: British stock market LBBIs statistics

LBBI:	Stock market	**Frequency:**	Monthly
Country:	United Kingdom	**Observations:**	1125
Period:	Jan/1922 - Sep/2015		

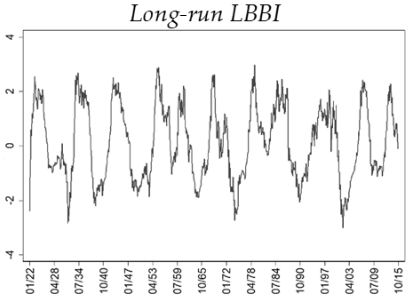
Short-run LBBI



Medium-run LBBI



Long-run LBBI



Descriptive Statistics

	LBBIS	*LBBIM*	*LBBIL*
Mean	-0.02	0.04	0.13
Median	0.04	-0.02	0.02
Standard. Dev.	0.92	1.22	1.34
Skewness	-0.32	0.29	0.06
Kurtosis	3.54	2.63	1.92
Minimum	-3.52	-2.71	-3.02
Maximum	2.96	3.38	2.98
Range	6.47	6.08	6.00
IQ Range	1.14	1.65	2.24

Trend Test

Daniels test	*LBBIS*	*LBBIM*	*LBBIL*
Statistic	0.3500	0.9199	-0.6156
pvalue	0.7265	0.3576	0.5382
Result	No trend	No trend	No trend

Structural Breaks Tests

	LBBIS	*LBBIM*	*LBBIL*
F(0/1)	0.2365	0.0027	0.0031
Conclusion	No break	No break	No break
BIC	3	3	3
Date 1	Sep-45	Apr-63	Oct-65
Date 2	Feb-68	Nov-80	Nov-80
Date 3	Nov-95	Nov-93	Nov-93

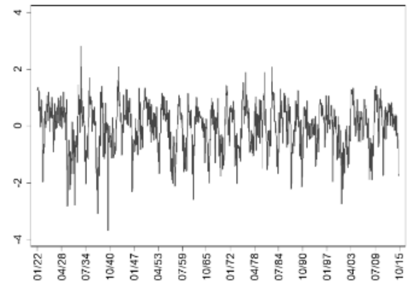
Stationarity tests

	LBBIS			*LBBIM*			*LBBIL*		
	Statistic	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*
ADF	-10.9516	0.0000	I(0)	-4.0227	0.0013	I(0)	-3.6044	0.0057	I(0)
ADF-GLS	-4.0399	0.0000	I(0)	-2.2908	0.0212	I(0)	-1.6450	0.0945	I(0)
KPSS	0.04	[0,462]	I(0)	0.05	[0,462]	I(0)	0.07	[0,462]	I(0)
HEGY	443.550	0.0000	I(0)	76.2800	0.0000	I(0)	83.1400	0.0000	I(0)
CH	2.0528	0.2655	I(0)	1.1995	0.9610	I(0)	1.2114	0.9568	I(0)

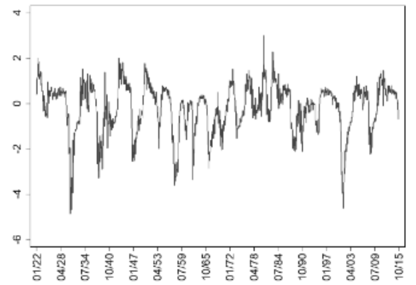
Table 95: United States' stocks LBBIs statistics

LBBI:	Stock market	**Frequency:**	Monthly
Country:	United States	**Observations:**	1125
Period:	Jan/1922 - Sep/2015		

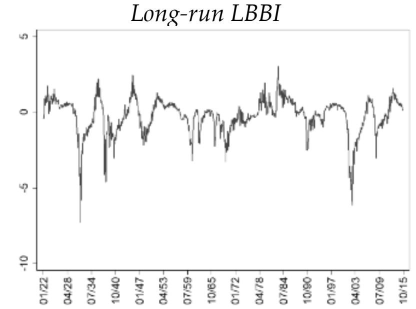
Short-run LBBI



Medium-run LBBI



Long-run LBBI



Descriptive Statistics

	LBBIS	*LBBIM*	*LBBIL*
Mean	-0.04	-0.18	-0.25
Median	0.06	0.05	-0.09
Standard. Dev.	0.81	1.09	1.15
Skewness	-0.53	-0.99	-1.39
Kurtosis	3.56	4.36	7.09
Minimum	-3.70	-4.87	-7.28
Maximum	2.82	3.00	3.04
Range	6.52	7.87	10.32
IQ Range	1.10	1.34	1.29

Trend Test

Daniels test	*LBBIS*	*LBBIM*	*LBBIL*
Statistic	-0.4570	-0.0664	-0.3667
pvalue	0.3238	0.5265	0.3569
Result	No trend	No trend	No trend

Structural Breaks Tests

	LBBIS	*LBBIM*	*LBBIL*
F(0/1)	0.0656	0.0314	2.1714
Conclusion	No break	No break	No break
BIC	3	3	3
Date 1	Apr-42	Oct-42	Aug-42
Date 2	May-56	Dec-56	Nov-77
Date 3	Jun-99	Sep-87	Jun-01

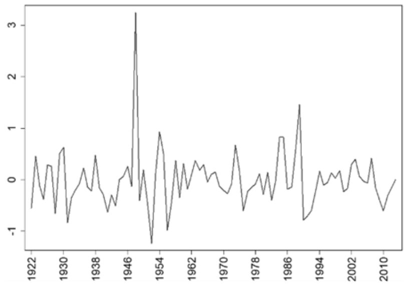
Stationarity tests

	LBBIS			*LBBIM*			*LBBIL*		
	Statistic	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*
ADF	-9.2008	0.0000	I(0)	-5.5958	0.0000	I(0)	-5.1451	0.0000	I(0)
ADF-GLS	-6.2360	0.0000	I(0)	-5.1417	0.0000	I(0)	-4.6638	0.0000	I(0)
KPSS	0.0442	[0.462]	I(0)	0.1148	[0.462]	I(0)	0.1448	[0.462]	I(0)
HEGY	371.980	0.0000	I(0)	84.520	0.0000	I(0)	648.5300	0.0000	I(0)
CH	1.4573	0.2655	I(0)	0.9747	0.9958	I(1)	0.9394	0.9391	I(1)

Table 96: Australian real credit LBBIs statistics

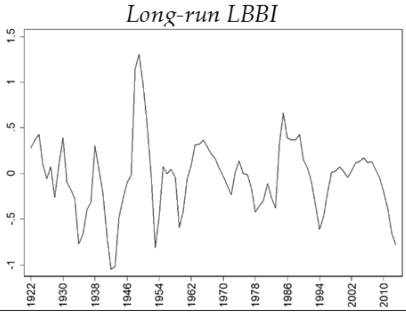
LBBI:	Real credit	**Frequency:**	Annual
Country:	Australia	**Observations:**	92
Period:	1922 - 2013	**Source**	JST

Short-run LBBI



Medium-run LBBI

Long-run LBBI



Descriptive Statistics

	LBBIS	*LBBIM*	*LBBIL*
Mean	0.00	-0.04	-0.04
Median	-0.08	-0.02	-0.01
Standard. Dev.	0.55	0.49	0.41
Skewness	2.35	0.76	0.28
Kurtosis	15.86	6.53	4.47
Minimum	-1.24	-1.31	-1.05
Maximum	3.25	2.11	1.31
Range	4.49	3.42	2.36
IQ Range	0.49	0.46	0.42

Trend Test

Daniels test	*LBBIS*	*LBBIM*	*LBBIL*
Statistic	0.2351	-0.3968	0.0738
pvalue	0.8141	0.6915	0.9412
Result	No trend	No trend	No trend

Structural Breaks Tests

	LBBIS	*LBBIM*	*LBBIL*
F(0/1)	0.0042	0.0267	0.0004
Conclusion	No break	No break	No break
BIC	0	0	3
Date 1	-	-	1948
Date 2	-	-	1962
Date 3	-	-	1984

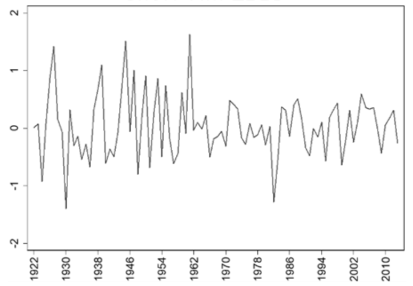
Stationarity tests

	LBBIS			*LBBIM*			*LBBIL*		
	Statistic	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*
ADF	-9.4053	0.0000	I(0)	-7.1261	0.0000	I(0)	-5.0812	0.0000	I(0)
ADF-GLS	-7.1196	0.0002	I(0)	-4.8615	0.0000	I(0)	-2.9751	0.0028	I(0)
PP [z(rho)]	-81.97	[-13.396]	I(0)	-42.83	[-13.396]	I(0)	-29.48	[-13.396]	I(0)
PP [z(t)]	-9.4450	[-2.920]	I(0)	-5.3670	[-2.920]	I(0)	-3.8900	[-2.920]	I(0)
KPSS	0.0409	[0.462]	I(0)	0.0485	[0.462]	I(0)	0.0475	[0.462]	I(0)

Table 97: Canadian real credit LBBIs statistics

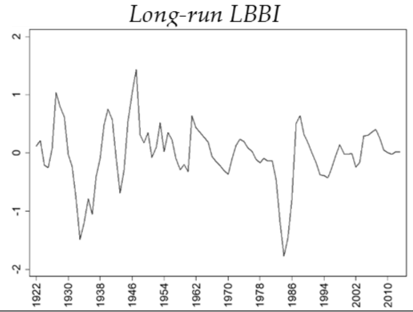
LBBI:	Real credit	**Frequency:**	Annual
Country:	Canada	**Observations:**	92
Period:	1922 - 2013	**Source**	JST

Short-run LBBI



Medium-run LBBI

Long-run LBBI



Descriptive Statistics

	LBBIS	*LBBIM*	*LBBIL*
Mean	0.04	0.00	-0.03
Median	0.00	-0.01	-0.01
Standard. Dev.	0.54	0.50	0.53
Skewness	0.37	0.11	-0.68
Kurtosis	4.01	5.54	4.95
Minimum	-1.40	-1.81	-1.77
Maximum	1.63	1.71	1.43
Range	3.03	3.52	3.21
IQ Range	0.61	0.54	0.51

Trend Test

Daniels test	*LBBIS*	*LBBIM*	*LBBIL*
Statistic	0.3492	0.3955	-0.4250
pvalue	0.7269	0.6925	0.6708
Result	No trend	No trend	No trend

Structural Breaks Tests

	LBBIS	*LBBIM*	*LBBIL*
F(0/1)	0.017	0.0171	0.386
Conclusion	No break	No break	No break
BIC	0	0	3
Date 1	-	-	1938
Date 2	-	-	1973
Date 3	-	-	1987

Stationarity tests

	LBBIS			*LBBIM*			*LBBIL*		
	Statistic	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*
ADF	-8.9674	0.0000	I(0)	-6.9760	0.0000	I(0)	-2.8499	0.0515	I(1)
ADF-GLS	-8.9844	0.0000	I(0)	-4.9837	0.0000	I(0)	-3.6234	0.0003	I(0)
PP [z(rho)]	-19.48	[-13.396]	I(0)	-19.64	[-13.396]	I(0)	-30.95	[-13.396]	I(0)
PP [z(t)]	-8.9490	[-2.920]	I(0)	-5.0740	[-2.920]	I(0)	-4.1160	[-2.920]	I(0)
KPSS	0.0601	[0.462]	I(0)	0.0582	[0.462]	I(0)	0.0859	[0.462]	I(0)

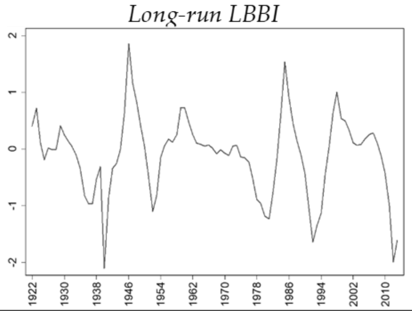
Table 98: Danish real credit LBBIs statistics

LBBI:	Real credit	**Frequency:**	Annual
Country:	Denmark	**Observations:**	92
Period:	1922 - 2013	**Source**	JST

Short-run LBBI

Medium-run LBBI

Long-run LBBI



Descriptive Statistics

	LBBIS	*LBBIM*	*LBBIL*
Mean	-0.01	-0.09	-0.11
Median	-0.06	-0.06	0.01
Standard. Dev.	0.57	0.68	0.70
Skewness	-0.10	-0.15	-0.37
Kurtosis	4.54	3.70	3.91
Minimum	-2.10	-2.13	-2.11
Maximum	1.70	1.96	1.86
Range	3.80	4.09	3.97
IQ Range	0.72	0.80	0.70

Trend Test

Daniels test	*LBBIS*	*LBBIM*	*LBBIL*
Statistic	-0.4342	-0.8514	-0.4856
pvalue	0.6641	0.3945	0.6273
Result	No trend	No trend	No trend

Structural Breaks Tests

	LBBIS	*LBBIM*	*LBBIL*
F(0/1)	0.1809	0.0288	0.0067
Conclusion	No break	No break	No break
BIC	0	2	3
Date 1	-	1942	1942
Date 2	-	1996	1983
Date 3	-	-	1997

Stationarity tests

	LBBIS			*LBBIM*			*LBBIL*		
	Statistic	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*
ADF	-4.9939	0.0000	I(0)	-5.4383	0.0000	I(0)	-3.4010	0.0107	I(0)
ADF-GLS	-6.6453	0.0000	I(0)	-3.3815	0.0001	I(0)	-2.5603	0.0101	I(0)
PP [z(rho)]	-55.80	[-13.396]	I(0)	-34.28	[-13.396]	I(0)	-25.16	[-13.396]	I(0)
PP [z(t)]	-6.5470	[-2.920]	I(0)	-4.4680	[-2.920]	I(0)	-3.4880	[-2.920]	I(0)
KPSS	0.0458	[0.462]	I(0)	0.0717	[0.462]	I(0)	0.0774	[0.462]	I(0)

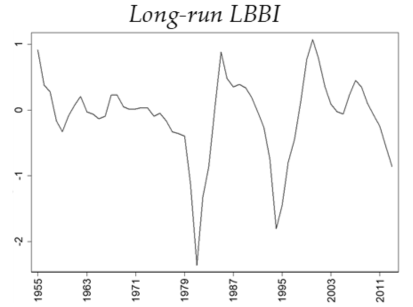
Table 99: French real credit LBBIs statistics

LBBI:	Real credit	**Frequency:**	Annual
Country:	France	**Observations:**	59
Period:	1955 - 2013		

Short-run LBBI

Medium-run LBBI

Long-run LBBI



Descriptive Statistics

	LBBIS	*LBBIM*	*LBBIL*
Mean	-0.02	-0.06	-0.10
Median	0.11	-0.05	-0.02
Standard. Dev.	0.54	0.53	0.63
Skewness	-1.24	-0.42	-1.26
Kurtosis	6.63	3.41	5.76
Minimum	-2.25	-1.55	-2.36
Maximum	0.97	1.08	1.07
Range	3.22	2.62	3.43
IQ Range	0.64	0.73	0.52

Trend Test

Daniels test	*LBBIS*	*LBBIM*	*LBBIL*
Statistic	0.5190	0.3457	-0.3886
pvalue	0.6038	0.7296	0.6976
Result	No trend	No trend	No trend

Structural Breaks Tests

	LBBIS	*LBBIM*	*LBBIL*
F(0/1)	0.0002	0.0788	0.2029
Conclusion	No break	No break	No break
BIC	0	2	2
Date 1	-	1982	1983
Date 2	-	1990	1997
Date 3	-	-	-

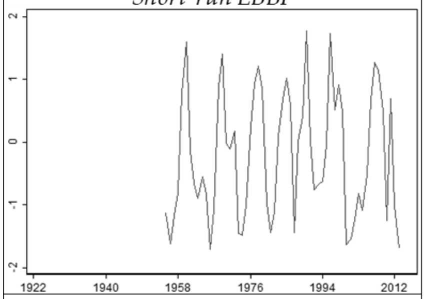
Stationarity tests

	LBBIS			*LBBIM*			*LBBIL*		
	Statistic	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*
ADF	-5.3188	0.0000	I(0)	-3.4799	0.0085	I(0)	-4.2746	0.0005	I(0)
ADF-GLS	-3.6898	0.0002	I(0)	-3.5346	0.0004	I(0)	-2.3970	0.0160	I(0)
PP [z(rho)]	-33.85	[-13.396]	I(0)	-22.63	[-13.396]	I(0)	-19.93	[-13.396]	I(0)
PP [z(t)]	-4.8400	[-2.920]	I(0)	-3.5430	[-2.920]	I(0)	-3.5630	[-2.920]	I(0)
KPSS	0.0911	[0.462]	I(0)	0.0537	[0.462]	I(0)	0.0835	[0.462]	I(0)

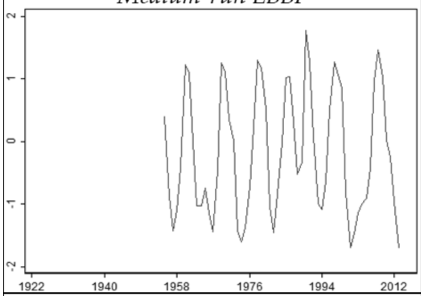
Table 100: German real credit LBBIs statistics

LBBI:	Real credit	**Frequency:**	Annual
Country:	Germany	**Observations:**	59
Period:	1955 - 2013		

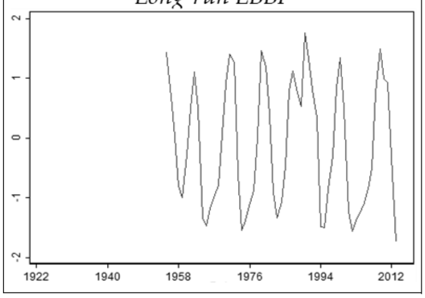
Short-run LBBI



Medium-run LBBI



Long-run LBBI



Descriptive Statistics

	LBBIS	*LBBIM*	*LBBIL*
Mean	-0.20	-0.18	-0.10
Median	-0.13	-0.41	-0.29
Standard. Dev.	1.02	1.01	1.06
Skewness	0.23	0.26	0.10
Kurtosis	1.81	1.70	1.52
Minimum	-1.70	-1.70	-1.73
Maximum	1.78	1.77	1.75
Range	3.48	3.47	3.49
IQ Range	1.75	1.94	1.90

Trend Test

Daniels test	*LBBIS*	*LBBIM*	*LBBIL*
Statistic	0.6160	0.3436	-0.3396
pvalue	0.5379	0.7311	0.7341
Result	No trend	No trend	No trend

Structural Breaks Tests

	LBBIS	*LBBIM*	*LBBIL*
F(0/1)	0.0973	4.4573	0.2538
Conclusion	No break	No break	No break
BIC	0	0	0
Date 1	-	-	-
Date 2	-	-	-
Date 3	-	-	-

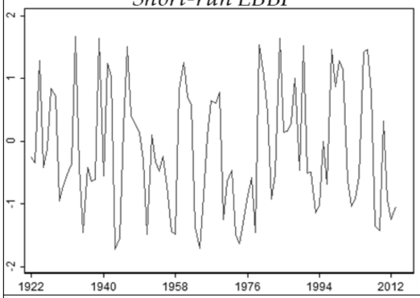
Stationarity tests

	LBBIS			*LBBIM*			*LBBIL*		
	Statistic	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*
ADF	-5.5446	0.0000	I(0)	-7.3708	0.0000	I(0)	-5.2738	0.0000	I(0)
ADF-GLS	-3.7010	0.0002	I(0)	-3.2182	0.0012	I(0)	-2.3778	0.0168	I(0)
PP [z(rho)]	-28.47	[-13,396]	I(0)	-25.32	[-13,396]	I(0)	-25.07	[-13,396]	I(0)
PP [z(t)]	-4.2600	[-2,920]	I(0)	-3.6910	[-2,920]	I(0)	-3.6960	[-2,920]	I(0)
KPSS	0.0819	[0,462]	I(0)	0.0578	[0,462]	I(0)	0.0392	[0,462]	I(0)

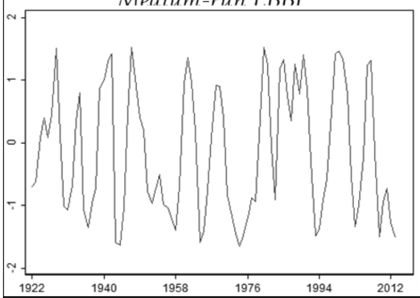
Table 101: Italian real credit LBBIs statistics

LBBI:	Real credit	**Frequency:**	Annual
Country:	Italy	**Observations:**	92
Period:	1922 - 2013		

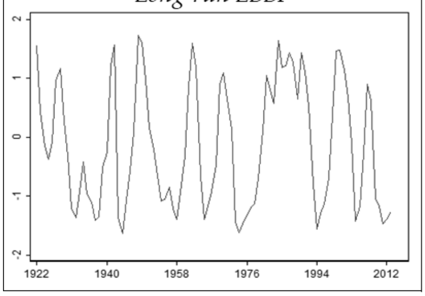
Short-run LBBI



Medium-run LBBI



Long-run LBBI



Descriptive Statistics	*LBBIS*	*LBBIM*	*LBBIL*
Mean	-0.14	-0.14	-0.14
Median	-0.38	-0.25	-0.32
Standard. Dev.	0.98	1.02	1.06
Skewness	0.28	0.19	0.27
Kurtosis	1.94	1.59	1.60
Minimum	-1.72	-1.65	-1.64
Maximum	1.67	1.53	1.72
Range	3.40	3.17	3.36
IQ Range	1.61	1.86	2.04

Trend Test			
Daniels test	*LBBIS*	*LBBIM*	*LBBIL*
Statistic	0.4143	0.8923	0.7664
pvalue	0.6786	0.3722	0.4435
Result	No trend	No trend	No trend

Structural Breaks Tests	*LBBIS*	*LBBIM*	*LBBIL*
F(0/1)	0.02444	0.0154	0.0336
Conclusion	No break	No break	No break
BIC	0	1	1
Date 1	-	1979	1980
Date 2	-	-	-
Date 3	-	-	-

Stationarity tests	*LBBIS*			*LBBIM*			*LBBIL*		
	Statistic	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*
ADF	-5.9199	0.0000	I(0)	-6.9864	0.0000	I(0)	-5.9306	0.0000	I(0)
ADF-GLS	-6.9278	0.0000	I(0)	-3.9527	0.0000	I(0)	-2.4051	0.0156	I(0)
PP [z(rho)]	-60.28	[-13,396]	I(0)	-36.31	[-13,396]	I(0)	-32.32	[-13,396]	I(0)
PP [z(t)]	-6.8470	[-2,920]	I(0)	-4.5260	[-2,920]	I(0)	-4.2590	[-2,920]	I(0)
KPSS	0.0501	[0,462]	I(0)	0.0529	[0,462]	I(0)	0.0679	[0,462]	I(0)

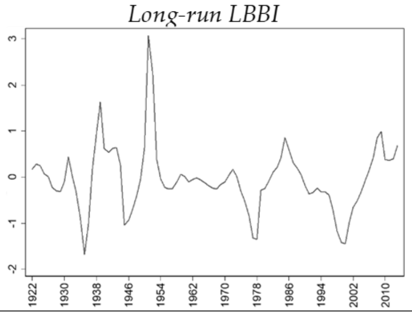
Table 102: Japanese real credit LBBIs statistics

LBBI:	Real credit	**Frequency:**	Annual
Country:	Japan	**Observations:**	92
Period:	1922 - 2013	**Source**	JST

Short-run LBBI

Medium-run LBBI

Long-run LBBI



Descriptive Statistics

	LBBIS	*LBBIM*	*LBBIL*
Mean	0.00	-0.02	-0.05
Median	-0.04	-0.06	-0.07
Standard. Dev.	0.67	0.60	0.71
Skewness	-1.72	0.27	1.00
Kurtosis	13.58	4.41	7.36
Minimum	-3.81	-1.61	-1.68
Maximum	1.54	2.17	3.07
Range	5.34	3.79	4.75
IQ Range	0.77	0.67	0.60

Trend Test

Daniels test	*LBBIS*	*LBBIM*	*LBBIL*
Statistic	-0.9536	-0.9580	-0.8363
pvalue	0.3403	0.3381	0.4030
Result	No trend	No trend	No trend

Structural Breaks Tests

	LBBIS	*LBBIM*	*LBBIL*
F(0/1)	0.0531	0.0069	0.001
Conclusion	No break	No break	No break
BIC	0	1	2
Date 1	-	1999	1937
Date 2	-	-	1999
Date 3	-	-	-

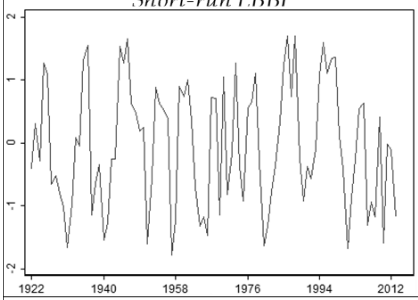
Stationarity tests

	LBBIS			*LBBIM*			*LBBIL*		
	Statistic	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*
ADF	-7.0173	0.0000	I(0)	-2.5639	0.1006	I(1)	-5.2228	0.0000	I(0)
ADF-GLS	-7.0416	0.0002	I(0)	-3.9620	0.0000	I(0)	-3.4022	0.0007	I(0)
PP [z(rho)]	-63.29	[-13.396]	I(0)	-33.62	[-13.396]	I(0)	-28.28	[-13.396]	I(0)
PP [z(t)]	-6.9730	[-2.920]	I(0)	-4.3190	[-2.920]	I(0)	-3.8810	[-2.920]	I(0)
KPSS	0.0632	[0.462]	I(0)	0.1139	[0.462]	I(0)	0.1199	[0.462]	I(0)

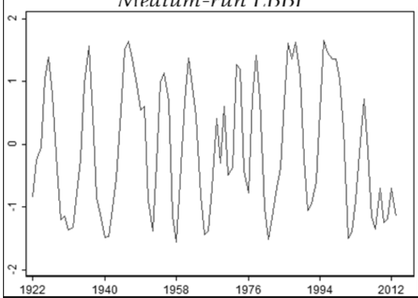
Table 103: Dutch real credit LBBIs statistics

LBBI:	Real credit	**Frequency:**	Annual
Country:	Netherlands	**Observations:**	92
Period:	1922 - 2013		

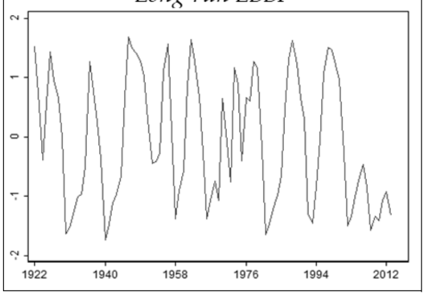
Short-run LBBI



Medium-run LBBI



Long-run LBBI



Descriptive Statistics	*LBBIS*	*LBBIM*	*LBBIL*
Mean	-0.05	-0.06	-0.06
Median	-0.14	-0.28	-0.26
Standard. Dev.	0.99	1.04	1.07
Skewness	0.05	0.18	0.10
Kurtosis	1.88	1.57	1.57
Minimum	-1.78	-1.55	-1.74
Maximum	1.70	1.66	1.69
Range	3.48	3.21	3.43
IQ Range	1.60	1.95	1.98

Trend Test			
Daniels test	*LBBIS*	*LBBIM*	*LBBIL*
Statistic	0.8584	0.6232	-0.6171
pvalue	0.3907	0.5332	0.5372
Result	No trend	No trend	No trend

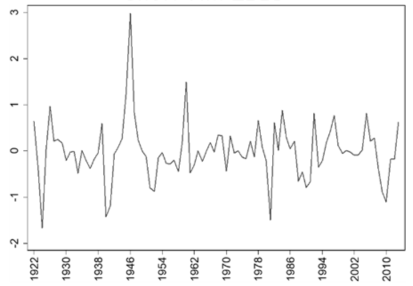
Structural Breaks Tests	*LBBIS*	*LBBIM*	*LBBIL*
F(0/1)	0.0078	0.0182	0.0139
Conclusion	No break	No break	No break
BIC	0	1	1
Date 1	-	1994	1944
Date 2	-	-	-
Date 3	-	-	-

Stationarity tests	*LBBIS*			*LBBIM*			*LBBIL*		
	Statistic	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*
ADF	-5.7068	0.0000	I(0)	-7.1386	0.0000	I(0)	-3.9927	0.0014	I(0)
ADF-GLS	-6.6146	0.0000	I(0)	-3.5161	0.0004	I(0)	2.6216	0.0085	I(0)
PP [z(rho)]	-53.11	[-13,396]	I(0)	-35.11	[-13,396]	I(0)	-33.69	[-13,396]	I(0)
PP [z(t)]	-6.0070	[-2,920]	I(0)	-4.4100	[-2,920]	I(0)	-4.3430	[-2,920]	I(0)
KPSS	0.0481	[0,462]	I(0)	0.0629	[0,462]	I(0)	0.1504	[0,462]	I(0)

Table 104: Norwegian real credit LBBIs statistics

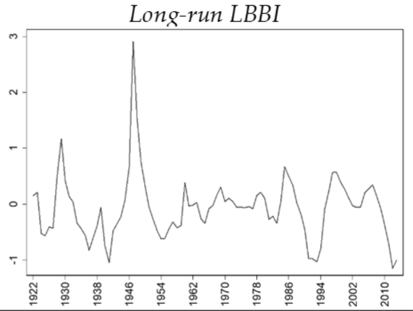
LBBI:	Real credit	**Frequency:**	Annual
Country:	Norway	**Observations:**	92
Period:	1922 - 2013	**Source**	JST

Short-run LBBI



Medium-run LBBI

Long-run LBBI



Descriptive Statistics

	LBBIS	*LBBIM*	*LBBIL*
Mean	-0.01	-0.05	-0.07
Median	-0.02	-0.04	-0.06
Standard. Dev.	0.63	0.58	0.57
Skewness	0.90	0.99	1.66
Kurtosis	8.50	7.52	10.67
Minimum	-1.67	-1.46	-1.15
Maximum	2.98	2.45	2.91
Range	4.65	3.91	4.06
IQ Range	0.46	0.58	0.57

Trend Test

Daniels test	*LBBIS*	*LBBIM*	*LBBIL*
Statistic	0.1578	0.3784	0.7459
pvalue	0.8746	0.7051	0.4557
Result	No trend	No trend	No trend

Structural Breaks Tests

	LBBIS	*LBBIM*	*LBBIL*
F(0/1)	0.0874	0.6281	0.0026
Conclusion	No break	No break	No break
BIC	0	2	3
Date 1	-	1945	1946
Date 2	-	1959	1960
Date 3	-	-	1996

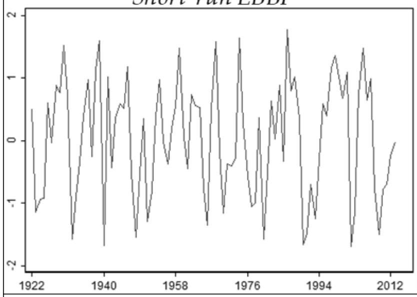
Stationarity tests

	LBBIS			*LBBIM*			*LBBIL*		
	Statistic	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*
ADF	-6.8654	0.0000	I(0)	-5.6710	0.0000	I(0)	-4.5581	0.0000	I(0)
ADF-GLS	-5.2736	0.0000	I(0)	-4.1404	0.0000	I(0)	-3.5254	0.0004	I(0)
PP [z(rho)]	-62.50	[-13.396]	I(0)	-36.69	[-13.396]	I(0)	-30.55	[-13.396]	I(0)
PP [z(t)]	-6.8520	[-2.920]	I(0)	-4.6680	[-2.920]	I(0)	-4.0030	[-2.920]	I(0)
KPSS	0.0266	[0.462]	I(0)	0.0357	[0.462]	I(0)	0.0401	[0.462]	I(0)

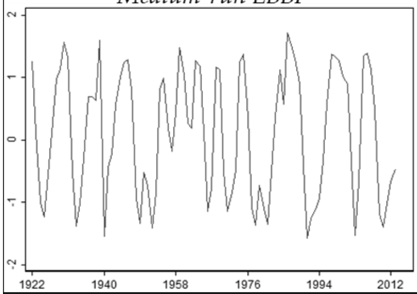
Table 105: Swedish real credit LBBIs statistics

LBBI:	Real credit	**Frequency:**	Annual
Country:	Sweden	**Observations:**	92
Period:	1922 - 2013		

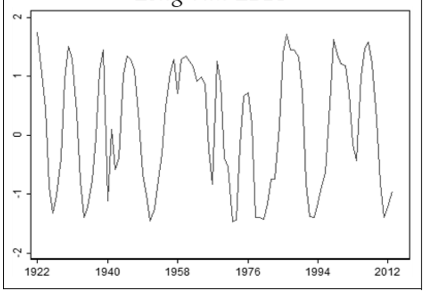
Short-run LBBI



Medium-run LBBI



Long-run LBBI



Descriptive Statistics	*LBBIS*	*LBBIM*	*LBBIL*
Mean	0.03	0.09	0.13
Median	0.12	0.15	0.20
Standard. Dev.	0.94	1.01	1.06
Skewness	-0.15	-0.07	-0.10
Kurtosis	2.01	1.53	1.46
Minimum	-1.69	-1.57	-1.47
Maximum	1.77	1.71	1.75
Range	3.45	3.29	3.21
IQ Range	1.45	1.96	1.99

Trend Test			
Daniels test	*LBBIS*	*LBBIM*	*LBBIL*
Statistic	0.7174	0.5624	0.9077
pvalue	0.4731	0.5738	0.3641
Result	No trend	No trend	No trend

Structural Breaks Tests	*LBBIS*	*LBBIM*	*LBBIL*
F(0/1)	0.121	0.0067	0.0188
Conclusion	No break	No break	No break
BIC	0	0	0
Date 1	-	-	-
Date 2	-	-	-
Date 3	-	-	-

Stationarity tests	*LBBIS*			*LBBIM*			*LBBIL*		
	Statistic	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*
ADF	-7.1189	0.0000	I(0)	-6.8762	0.0000	I(0)	-5.8092	0.0000	I(0)
ADF-GLS	-6.6712	0.0000	I(0)	-3.6669	0.0002	I(0)	-2.5180	0.0114	I(0)
PP [z(rho)]	-63.24	[-13,396]	I(0)	-39.75	[-13,396]	I(0)	-34.05	[-13,396]	I(0)
PP [z(t)]	-7.0560	[-2,920]	I(0)	-4.9040	[-2,920]	I(0)	-4.3660	[-2,920]	I(0)
KPSS	0.0364	[0,462]	I(0)	0.0341	[0,462]	I(0)	0.0331	[0,462]	I(0)

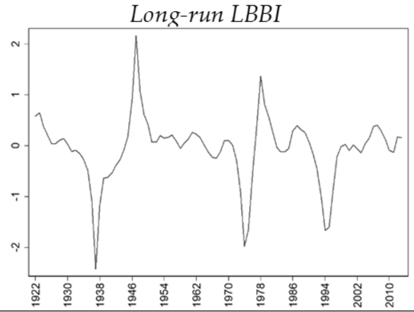
Table 106: Swiss real credit LBBIs statistics

LBBI:	Real credit	**Frequency:**	Annual
Country:	Switzerland	**Observations:**	92
Period:	1922 - 2013	**Source**	JST

Short-run LBBI

Medium-run LBBI

Long-run LBBI



Descriptive Statistics

	LBBIS	*LBBIM*	*LBBIL*
Mean	0.02	-0.01	-0.06
Median	0.00	-0.02	0.03
Standard. Dev.	0.53	0.56	0.65
Skewness	0.46	-0.12	-0.78
Kurtosis	5.11	5.86	6.82
Minimum	-1.32	-1.68	-2.43
Maximum	1.86	2.01	2.17
Range	3.18	3.69	4.60
IQ Range	0.54	0.54	0.38

Trend Test

Daniels test	*LBBIS*	*LBBIM*	*LBBIL*
Statistic	1.0550	0.7110	-0.1343
pvalue	0.2914	0.4771	0.8932
Result	No trend	No trend	No trend

Structural Breaks Tests

	LBBIS	*LBBIM*	*LBBIL*
F(0/1)	0.0168	0.5817	0.0168
Conclusion	No break	No break	No break
BIC	3	3	3
Date 1	1945	1943	1945
Date 2	1977	1976	1977
Date 3	1997	1997	1997

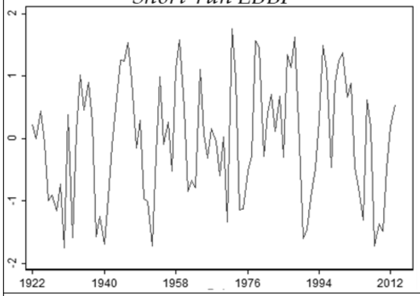
Stationarity tests

	LBBIS			*LBBIM*			*LBBIL*		
	Statistic	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*
ADF	-5.8055	0.0000	I(0)	-5.8772	0.0000	I(0)	-4.9900	0.0000	I(0)
ADF-GLS	-2.2196	0.0255	I(0)	-2.2515	0.0235	I(0)	-2.7533	0.0057	I(0)
PP [z(rho)]	-58.82	[-13.396]	I(0)	-34.58	[-13.396]	I(0)	-26.80	[-13.396]	I(0)
PP [z(t)]	-6.8340	[-2.920]	I(0)	-4.5730	[-2.920]	I(0)	-3.7960	[-2.920]	I(0)
KPSS	0.0587	[0.462]	I(0)	0.0489	[0.462]	I(0)	0.0557	[0.462]	I(0)

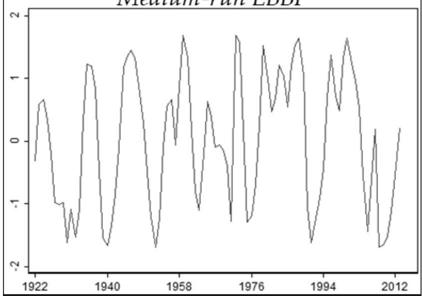
Table 107: British real credit LBBIs statistics

LBBI:	Real credit	**Frequency:**	Annual
Country:	United Kingdom	**Observations:**	92
Period:	1922 - 2013		

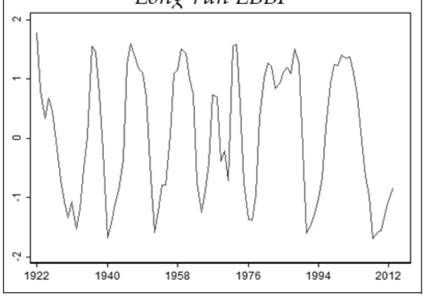
Short-run LBBI



Medium-run LBBI



Long-run LBBI



Descriptive Statistics	*LBBIS*	*LBBIM*	*LBBIL*
Mean	-0.02	0.02	0.06
Median	0.01	0.17	0.03
Standard. Dev.	0.97	1.05	1.09
Skewness	-0.05	-0.08	-0.09
Kurtosis	1.98	1.72	1.48
Minimum	-1.76	-1.69	-1.69
Maximum	1.75	1.69	1.77
Range	3.51	3.38	3.46
IQ Range	1.56	1.88	2.07

Trend Test			
Daniels test	*LBBIS*	*LBBIM*	*LBBIL*
Statistic	1.6725	1.5566	0.6555
pvalue	0.0944	0.1196	0.5121
Result	No trend	No trend	No trend

Structural Breaks Tests	*LBBIS*	*LBBIM*	*LBBIL*
F(0/1)	0.2845	0.0187	0.1037
Conclusion	No break	No break	No break
BIC	0	1	1
Date 1	-	1995	1997
Date 2	-	-	-
Date 3	-	-	-

Stationarity tests	*LBBIS*			*LBBIM*			*LBBIL*		
	Statistic	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*
ADF	-5.4380	0.0000	I(0)	-5.8897	0.0000	I(0)	-5.3575	0.0005	I(0)
ADF-GLS	-5.7600	0.0000	I(0)	-3.7830	0.0001	I(0)	-2.0918	0.0160	I(0)
PP [z(rho)]	-50.76	[-13,396]	I(0)	-31.89	[-13,396]	I(0)	-29.12	[-13,396]	I(0)
PP [z(t)]	-5.8551	[-2,920]	I(0)	-4.2110	[-2,920]	I(0)	-3.9870	[-2,920]	I(0)
KPSS	0.1131	[0,462]	I(0)	0.1160	[0,462]	I(0)	0.0568	[0,462]	I(0)

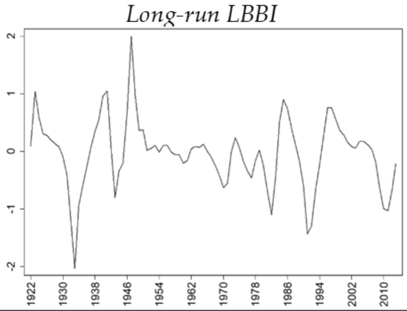
Table 108: United States' real credit LBBIs statistics

LBBI:	Real credit	**Frequency:**	Annual
Country:	United States	**Observations:**	92
Period:	1922 - 2013	**Source**	JST

Short-run LBBI

Medium-run LBBI

Long-run LBBI



Descriptive Statistics

	LBBIS	*LBBIM*	*LBBIL*
Mean	0.00	-0.02	-0.04
Median	0.00	0.02	0.04
Standard. Dev.	0.59	0.57	0.60
Skewness	0.26	0.13	-0.19
Kurtosis	4.83	5.14	4.93
Minimum	-1.39	-1.50	-2.03
Maximum	2.27	2.17	1.99
Range	3.66	3.67	4.02
IQ Range	0.55	0.65	0.52

Trend Test

Daniels test	*LBBIS*	*LBBIM*	*LBBIL*
Statistic	-0.2439	-0.9914	-1.4827
pvalue	0.8073	0.3215	0.1382
Result	No trend	No trend	No trend

Structural Breaks Tests

	LBBIS	*LBBIM*	*LBBIL*
F(0/1)	0.0294	0.0302	0.0295
Conclusion	No break	No break	No break
BIC	2	1	2
Date 1	1936	1936	1936
Date 2	1995	-	1995
Date 3	-	-	-

Stationarity tests

	LBBIS			*LBBIM*			*LBBIL*		
	Statistic	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*	*Statistic*	*pvalue*	*Result*
ADF	-3.1350	0.0000	I(0)	-4.8305	0.0000	I(0)	-4.3025	0.0000	I(0)
ADF-GLS	-5.8628	0.0000	I(0)	-4.2918	0.0000	I(0)	-3.5710	0.0003	I(0)
PP [z(rho)]	-47.34	[-13.396]	I(0)	-35.87	[-13.396]	I(0)	-30.33	[-13.396]	I(0)
PP [z(t)]	-5.8480	[-2.920]	I(0)	-4.6840	[-2.920]	I(0)	-4.0590	[-2.920]	I(0)
KPSS	0.0355	[0.462]	I(0)	0.0626	[0.462]	I(0)	0.1207	[0.462]	I(0)

Annex 7. Dating and Severity of Expansions and Contractions for Stocks and Real Credit.

As we indicated in section 2.6.3, to date expansions and contractions we follow a simple rule. An expansion (contraction) will begin the first time, and LBBI takes a value above (below) (-)0.5, and the phase will end the first time that the indicator takes a value below (above) (-)0.5. For stocks, if two expansions (contractions) are separated by less than three months, and the indicator never changes sign, we will treat it as a single phase. The former censoring rule does not apply to the annual real credit series. Additionally, we will not allow expansions or contractions that last for a single month (or year in the case of annual series), unless the indicator takes an absolute value of at least 1.0 standard deviations.

To characterise each phase, we include detailed measures. First, we define duration as the number of months or years between the start and end date. We take the starting date to be the first day of the given month or year. The ending date, similarly, is defined as the last day of the stated month or year.

Second, we deal with two measures of amplitude. First, the CAGR between the level of the original series at the starting and ending dates. Second, the difference between the 1, 3 and 5-year CAGR for the short, medium and long-run BBIs respectively between starting and ending date.

Finally, we will define severity as the accumulated value of the indicator between the starting and ending date of a bull or bear phase. This measure can be thought of as the area between the LBBI and the horizontal axis for a set period.

We firmly believe the additional information contained in this annex is of interest for researchers, a valuable contribution of this dissertation, and a precious resource for further research.

Table 109: Australian stock market expansions and contractions

Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.	Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.
Short-run LBBI							*Short-run LBBI*						
Bull	01/22	03/22	3	29.91%	-0.66%	2.27	Bull	01/75	08/76	20	20.87%	64.32%	23.35
Bull	01/23	03/23	3	53.93%	4.87%	2.97	Bear	10/76	11/76	2	-62.36%	-18.29%	-3.01
Bear	11/23	12/23	2	-11.43%	-3.66%	-2.01	Bull	12/77	01/78	2	25.89%	1.46%	2.25
Bear	04/25	07/25	4	-1.29%	-3.49%	-2.37	Bull	04/78	03/79	12	19.90%	24.94%	12.63
Bear	08/27	09/27	2	-9.45%	-4.27%	-1.30	Bull	08/79	02/80	7	82.99%	31.90%	8.87
Bear	09/29	09/30	13	-38.43%	-45.98%	-16.31	Bull	05/80	10/80	6	76.63%	20.09%	4.72
Bear	11/30	12/30	2	-66.40%	-8.41%	-1.35	Bear	01/81	02/81	2	-50.74%	-30.63%	-2.23
Bull	04/31	05/31	2	48.54%	11.74%	1.88	Bear	04/81	07/82	16	-35.21%	-60.56%	-18.18
Bull	09/31	01/33	17	36.32%	30.38%	15.76	Bull	01/83	01/83	1	161.27%	14.45%	1.03
Bear	06/34	08/34	3	-1.24%	-6.39%	-2.79	Bull	04/83	01/84	10	51.17%	35.10%	11.66
Bull	10/34	11/34	2	58.42%	5.26%	1.20	Bear	05/84	07/84	3	-37.12%	-24.89%	-4.04
Bear	03/35	05/35	3	-35.03%	-10.99%	-3.65	Bull	02/85	05/86	16	31.74%	34.35%	10.33
Bear	04/36	05/36	2	-2.89%	9.71%	-1.29	Bull	02/87	09/87	8	74.96%	39.44%	5.60
Bear	06/37	04/39	23	-10.65%	-24.56%	-25.37	Bear	10/87	02/88	5	-77.77%	-94.18%	-7.17
Bear	06/39	09/39	4	-17.71%	-0.41%	-2.66	Bear	11/88	06/89	8	-10.81%	-23.02%	-7.69
Bull	01/40	02/40	2	13.90%	4.84%	1.35	Bull	08/89	08/89	1	148.80%	10.06%	1.39
Bear	05/40	07/40	3	-44.68%	-15.68%	-4.49	Bear	02/90	12/90	11	-29.29%	-27.00%	-12.06
Bear	10/41	04/42	7	-41.51%	-25.13%	-6.64	Bull	04/91	10/91	7	26.29%	35.24%	6.10
Bull	08/42	03/43	8	29.07%	41.08%	8.61	Bull	04/92	05/92	2	44.96%	2.09%	1.32
Bull	08/43	10/43	3	11.98%	-6.59%	1.80	Bear	08/92	11/92	4	-29.35%	-12.22%	-4.95
Bull	10/45	05/46	8	20.58%	9.87%	5.62	Bull	02/93	01/94	12	48.83%	56.10%	10.71
Bear	10/46	11/46	2	-9.98%	-9.66%	-1.52	Bear	06/94	03/95	10	-13.30%	-28.40%	-11.31
Bull	03/47	04/47	2	33.64%	2.08%	1.24	Bull	11/95	02/96	4	33.30%	18.43%	2.72
Bear	08/47	08/47	1	-30.73%	-6.09%	-1.06	Bear	07/96	08/96	2	6.26%	-3.59%	-1.10
Bear	03/48	04/48	2	-16.88%	-7.83%	-2.00	Bull	04/97	07/97	4	46.86%	18.28%	3.42
Bear	07/48	07/49	13	-18.54%	-14.16%	-12.05	Bear	10/97	11/97	2	-50.74%	-17.65%	-1.95
Bull	12/49	04/50	5	18.96%	18.09%	4.88	Bear	06/98	09/98	4	-14.19%	-11.08%	-4.32
Bull	08/50	01/51	6	31.42%	3.41%	5.16	Bull	03/99	04/99	2	52.11%	5.63%	1.59
Bear	07/51	06/52	12	-43.83%	-52.99%	-13.20	Bear	09/99	10/99	2	-15.74%	-9.92%	-1.98
Bull	01/53	08/55	32	8.97%	29.45%	31.46	Bear	04/00	05/00	2	-20.38%	-1.13%	-1.62
Bear	03/56	07/56	5	-21.91%	-14.47%	-4.63	Bear	10/00	03/01	6	-11.43%	-12.96%	-5.49
Bull	01/57	09/57	9	18.39%	17.87%	7.96	Bear	07/01	09/01	3	-42.77%	-9.39%	-3.61
Bull	06/58	08/58	3	33.55%	2.55%	2.33	Bear	06/02	02/03	9	-24.19%	-17.50%	-8.84
Bull	12/58	01/60	14	39.03%	30.22%	10.64	Bull	07/03	02/05	20	18.59%	28.06%	15.63
Bear	09/60	03/61	7	-27.96%	-29.64%	-10.88	Bear	04/05	04/05	1	-41.92%	-4.36%	-0.53
Bear	04/62	09/62	6	-14.84%	-11.28%	-5.94	Bull	06/05	07/05	2	40.17%	4.09%	1.06
Bull	06/63	02/64	9	27.13%	19.37%	6.57	Bull	12/05	01/06	2	38.35%	2.31%	1.30
Bear	09/64	06/65	10	-24.52%	-25.46%	-12.94	Bull	12/06	01/07	2	36.74%	-0.23%	1.16
Bear	08/66	10/66	3	-21.10%	-4.80%	-1.76	Bear	12/07	02/09	15	-44.40%	-60.56%	-19.52
Bull	12/66	01/67	2	37.99%	1.84%	1.34	Bull	06/09	12/09	7	48.93%	65.58%	7.49
Bull	04/67	06/68	15	60.31%	61.92%	14.78	Bear	05/10	06/10	2	-48.71%	-18.96%	-2.09
Bear	09/68	10/68	2	-61.17%	-32.36%	-1.45	Bear	06/11	12/11	7	-23.83%	-21.53%	-6.73
Bear	05/69	11/69	7	-12.38%	-10.97%	-9.51	Bull	09/12	04/13	8	28.12%	15.61%	8.23
Bear	01/70	11/71	23	-24.89%	-28.68%	-24.01	Bull	09/13	10/13	2	33.62%	0.69%	1.47
Bull	02/72	06/72	5	56.14%	22.07%	6.23	Bear	11/14	12/14	2	-12.03%	-0.88%	-1.54
Bear	02/73	12/73	11	-37.83%	-53.45%	-12.27	Bull	02/15	03/15	2	37.14%	1.81%	1.87
Bear	04/74	09/74	6	-76.95%	-30.13%	-6.44	Bear	08/15	09/15	2	-50.19%	-5.46%	-3.16

Australian stock market expansions and contractions (continued…)

Phase	Start date	End date	Dur.	Amplitude		Sev.
				Δ price	Δ CAGR	
Medium-run LBBI						
Bull	01/22	06/23	18	15.57%	9.48%	14.21
Bear	10/29	10/31	25	-16.22%	-17.05%	-37.67
Bull	05/32	03/34	23	28.47%	31.68%	22.42
Bear	05/36	06/36	2	19.40%	-1.16%	-1.07
Bear	09/37	08/42	60	-9.12%	-19.93%	-92.96
Bull	06/43	06/46	37	6.77%	11.48%	33.05
Bear	06/48	03/50	22	-4.09%	-7.11%	-25.52
Bull	11/50	06/51	8	9.01%	2.00%	5.98
Bear	09/51	06/53	22	-22.88%	-12.79%	-18.77
Bull	12/53	03/56	28	5.51%	21.35%	36.60
Bull	04/57	07/60	40	17.05%	13.93%	30.06
Bear	12/60	06/63	31	4.68%	-11.79%	-46.30
Bull	11/63	03/64	5	21.39%	6.00%	2.91
Bear	02/65	02/67	25	-6.70%	-10.64%	-35.87
Bull	06/67	04/69	23	33.29%	25.91%	20.05
Bear	11/69	04/72	30	-6.94%	-28.17%	-50.54
Bear	08/73	08/75	25	-28.93%	-16.08%	-20.72
Bull	01/76	05/81	65	6.50%	38.65%	75.14
Bear	08/81	06/83	23	-11.48%	-21.99%	-34.60
Bull	12/83	01/84	2	22.73%	5.26%	1.40
Bull	07/84	12/86	30	27.38%	25.69%	21.24
Bull	02/87	09/87	8	74.96%	17.78%	5.27
Bear	11/87	09/91	47	-0.82%	-15.72%	-87.17
Bull	04/92	04/92	1	78.32%	1.46%	1.00
Bull	03/93	08/94	18	18.08%	11.25%	15.67
Bear	01/95	03/95	3	-7.67%	0.79%	-2.02
Bear	10/95	10/95	1	-35.92%	0.29%	-1.33
Bear	06/96	08/96	3	-0.21%	-4.07%	-2.27
Bull	05/97	07/97	3	48.50%	3.78%	1.91
Bear	09/00	11/03	39	-3.25%	-7.80%	-48.19
Bull	07/04	03/05	9	19.13%	5.74%	8.10
Bull	05/05	04/06	12	27.00%	13.60%	9.20
Bear	02/08	02/10	25	-11.56%	-18.11%	-42.19
Bear	08/11	09/11	2	-45.29%	-0.42%	-1.70
Bear	05/12	09/12	5	-6.40%	-8.38%	-3.01
Bull	01/13	08/14	20	9.08%	10.54%	19.41
Bull	02/15	03/15	2	37.14%	1.17%	1.37
Bear	08/15	09/15	2	-50.19%	-5.01%	-2.07
Long-run LBBI						
Bull	02/22	12/24	35	8.96%	4.80%	23.39
Bear	11/29	08/32	34	-1.34%	-4.87%	-76.49
Bull	04/33	12/35	33	13.40%	15.66%	23.34
Bear	11/37	05/43	67	-5.48%	-14.26%	-148.7
Bull	08/44	06/47	35	6.63%	10.59%	36.95
Bear	11/48	10/50	24	0.36%	-1.64%	-32.90
Bear	06/51	06/53	25	-25.50%	-11.58%	-22.85
Bull	07/55	09/60	63	8.92%	15.39%	73.02

Phase	Start date	End date	Dur.	Amplitude		Sev.
				Δ price	Δ CAGR	
Long-run LBBI						
Bear	11/62	06/67	56	2.12%	-4.56%	-101.4
Bull	10/67	04/69	19	26.73%	2.88%	12.58
Bull	09/69	12/69	4	62.31%	4.14%	2.29
Bear	02/71	08/75	55	-15.68%	-22.69%	-82.92
Bull	02/78	06/81	41	16.08%	23.02%	73.15
Bear	02/82	03/83	14	-13.90%	-2.69%	-23.55
Bear	01/84	02/85	14	-1.48%	-7.84%	-13.51
Bull	01/86	09/87	21	46.03%	26.68%	17.63
Bear	03/89	06/93	52	-0.12%	-9.12%	-99.86
Bull	08/93	05/94	10	13.92%	4.33%	8.64
Bull	08/95	02/96	7	12.26%	4.31%	3.48
Bear	08/98	09/98	2	-23.41%	-2.26%	-1.41
Bear	07/01	08/04	38	-1.38%	-5.99%	-69.83
Bull	01/05	10/07	34	16.21%	12.83%	20.85
Bear	07/08	03/12	45	-7.06%	-17.34%	-93.40
Bull	11/12	05/15	31	7.59%	13.12%	27.78

Table 110: Canadian stock market expansions and contractions

Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.
Short-run LBBI						
Bull	02/22	10/22	9	27.08%	17.42%	8.85
Bear	09/23	11/23	3	-6.41%	-2.83%	-1.89
Bull	07/25	02/26	8	34.09%	15.45%	5.33
Bull	08/26	09/26	2	46.04%	2.35%	1.16
Bull	02/27	04/27	3	50.02%	9.95%	2.02
Bull	08/27	10/27	3	85.59%	13.29%	2.34
Bull	04/28	05/28	2	87.66%	7.68%	1.30
Bear	08/28	08/28	1	-41.78%	-13.59%	-1.15
Bull	11/28	02/29	4	94.41%	22.58%	3.09
Bear	05/29	07/29	3	-1.59%	1.55%	-2.11
Bear	10/29	01/31	16	-38.69%	-60.77%	-20.71
Bear	04/31	12/31	9	-46.18%	-7.06%	-8.14
Bear	05/32	06/32	2	-88.43%	-12.37%	-3.69
Bull	08/32	09/32	2	319.91%	34.87%	2.35
Bull	04/33	09/33	6	172.02%	50.86%	9.42
Bear	07/34	07/34	1	-56.86%	-18.24%	-1.07
Bear	03/35	04/35	2	-9.19%	-5.14%	-1.65
Bull	11/35	02/36	4	92.50%	22.85%	3.90
Bull	01/37	03/37	3	61.12%	3.65%	1.73
Bear	05/37	05/38	13	-26.53%	-39.00%	-14.96
Bull	10/38	11/38	2	110.39%	26.51%	2.09
Bear	04/39	08/39	5	-20.59%	-15.32%	-3.99
Bear	04/40	07/40	4	-62.00%	-21.08%	-5.94
Bear	03/42	04/42	2	-33.03%	-5.01%	-1.17
Bull	10/42	07/43	10	51.45%	56.64%	12.74
Bear	11/43	05/44	7	-11.16%	-34.69%	-4.58
Bull	01/45	02/46	14	32.02%	20.32%	9.80
Bear	07/46	03/48	21	-19.92%	-35.00%	-19.28
Bull	05/48	06/48	2	57.83%	9.89%	1.63
Bear	02/49	06/49	5	-27.82%	-17.71%	-4.09
Bull	10/49	06/50	9	24.42%	32.76%	8.12
Bull	08/50	02/51	7	48.10%	13.10%	5.91
Bull	09/51	10/51	2	47.86%	2.55%	1.22
Bear	04/52	10/53	19	-9.40%	-10.92%	-13.82
Bull	03/54	07/55	17	33.79%	39.22%	12.81
Bull	03/56	03/56	1	152.58%	10.24%	1.09
Bear	09/56	03/57	7	-11.96%	-20.57%	-8.25
Bear	06/57	02/58	9	-36.12%	-24.72%	-10.48
Bull	06/58	02/59	9	25.62%	49.64%	6.89
Bear	09/59	07/60	11	-15.21%	-27.62%	-10.08
Bear	09/60	10/60	2	-33.25%	-0.16%	-1.41
Bull	12/60	08/61	9	41.09%	30.23%	8.18
Bear	04/62	10/62	7	-26.87%	-27.40%	-8.61
Bull	04/63	05/63	2	41.58%	18.24%	1.83
Bull	03/64	07/64	5	31.32%	11.73%	3.37
Bear	06/65	11/66	18	-13.58%	-25.92%	-17.09
Bull	03/67	04/67	2	30.20%	5.53%	1.22

Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.
Short-run LBBI						
Bear	01/68	03/68	3	-34.99%	-20.91%	-3.41
Bull	09/68	01/69	5	37.08%	19.30%	4.57
Bear	06/69	06/70	13	-28.98%	-44.52%	-12.22
Bull	12/70	04/71	5	16.94%	19.60%	3.79
Bear	10/71	11/71	2	-40.58%	-9.84%	-2.55
Bull	01/72	05/72	5	31.97%	11.52%	4.61
Bear	04/73	06/73	3	-33.22%	-11.42%	-3.24
Bear	11/73	12/74	14	-39.53%	-44.17%	-13.61
Bull	01/75	08/75	8	25.27%	39.38%	5.12
Bull	01/76	05/76	5	25.91%	-8.12%	3.35
Bear	11/76	11/76	1	-63.78%	-12.14%	-1.35
Bull	03/78	09/79	19	30.01%	33.14%	18.24
Bull	12/79	02/80	3	158.29%	22.25%	3.76
Bear	01/81	07/82	19	-33.88%	-56.15%	-20.62
Bull	10/82	07/83	10	60.34%	89.38%	11.12
Bear	02/84	07/84	6	-27.82%	-32.45%	-7.40
Bull	01/85	03/85	3	32.97%	14.99%	2.24
Bull	03/86	04/86	2	53.40%	6.83%	1.35
Bull	01/87	04/87	4	69.65%	14.03%	3.78
Bull	07/87	07/87	1	127.78%	15.56%	1.00
Bear	10/87	02/88	5	-40.00%	-37.32%	-6.99
Bull	07/89	08/89	2	40.23%	12.17%	1.68
Bear	01/90	11/90	11	-26.36%	-35.23%	-11.27
Bear	03/92	04/92	2	-34.02%	-6.60%	-1.19
Bull	02/93	01/94	12	35.82%	46.04%	10.82
Bear	06/94	06/94	1	-58.95%	-10.17%	-1.19
Bear	11/94	02/95	4	-15.50%	-9.52%	-3.83
Bull	06/95	07/95	2	23.23%	7.83%	1.17
Bull	11/95	05/96	7	28.95%	14.75%	4.28
Bull	10/96	11/96	2	107.84%	11.50%	2.23
Bull	03/98	04/98	2	59.32%	13.18%	1.43
Bear	07/98	02/99	8	-21.16%	-24.92%	-9.24
Bull	11/99	08/00	10	64.94%	43.13%	8.07
Bear	10/00	10/01	13	-32.82%	-75.16%	-17.25
Bear	06/02	10/02	5	-40.88%	-4.89%	-5.82
Bull	05/03	02/04	10	39.73%	49.62%	10.30
Bull	07/05	09/05	3	44.10%	8.93%	2.26
Bull	12/05	01/06	2	75.68%	8.73%	1.67
Bear	11/07	04/08	6	-12.20%	-13.57%	-5.95
Bear	07/08	02/09	8	-57.34%	-41.91%	-11.86
Bull	07/09	12/09	6	28.85%	57.08%	5.28
Bull	02/10	04/10	3	41.16%	3.31%	1.99
Bull	09/10	02/11	6	37.97%	11.24%	4.42
Bear	06/11	12/11	7	-21.39%	-26.22%	-7.17
Bear	05/12	06/12	2	-27.40%	-0.53%	-1.93
Bull	10/13	08/14	11	21.86%	18.21%	7.30
Bear	05/15	09/15	5	-28.83%	-15.05%	-5.40

Canadian stock market expansions and contractions (continued…)

Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.
Medium-run LBBI						
Bull	02/22	02/24	25	13.26%	13.00%	23.89
Bull	01/26	02/26	2	85.48%	2.20%	1.27
Bull	08/26	09/26	2	46.04%	3.02%	1.15
Bull	02/27	05/28	16	39.90%	13.85%	8.40
Bear	11/29	03/33	41	-26.91%	-47.56%	-77.56
Bull	06/33	06/35	25	16.96%	47.87%	27.55
Bull	01/36	02/36	2	103.88%	6.40%	1.28
Bear	09/37	10/41	50	-15.50%	-30.13%	-76.22
Bear	03/42	04/42	2	-33.03%	0.34%	-1.21
Bull	12/42	05/46	42	18.10%	27.71%	49.23
Bear	10/46	07/49	34	-7.98%	-15.56%	-42.24
Bull	03/50	02/52	24	13.78%	16.76%	22.12
Bear	10/52	04/54	19	1.12%	-10.00%	-24.80
Bull	11/54	07/56	21	26.90%	19.59%	14.22
Bear	02/57	10/60	45	-5.17%	-16.05%	-62.17
Bull	03/61	03/62	13	14.15%	-2.94%	8.27
Bear	06/62	10/62	5	-14.19%	0.09%	-4.45
Bear	06/63	11/63	6	-8.86%	-1.20%	-4.21
Bull	01/65	05/65	5	14.95%	7.16%	2.71
Bear	04/66	03/68	24	-7.26%	-13.77%	-38.90
Bull	11/68	05/69	7	16.42%	5.10%	3.95
Bear	03/70	11/71	21	-9.61%	-9.66%	-19.70
Bull	12/71	05/73	18	12.25%	15.26%	12.94
Bull	10/73	10/73	1	82.53%	2.79%	1.01
Bear	01/74	10/75	22	-21.30%	-16.41%	-21.00
Bull	05/78	11/80	31	23.55%	26.71%	40.38
Bear	07/81	02/83	20	-14.47%	-26.59%	-30.62
Bull	08/84	09/84	2	93.74%	9.84%	1.43
Bull	03/86	04/86	2	53.40%	-1.11%	1.16
Bull	01/87	07/87	7	51.53%	16.34%	4.69
Bear	11/87	06/89	20	8.79%	-2.16%	-25.11
Bear	01/90	01/92	25	-8.65%	-8.92%	-26.42
Bull	03/93	10/94	20	13.63%	11.10%	20.94
Bull	04/96	05/96	2	33.59%	-0.90%	1.14
Bull	10/96	07/97	10	34.55%	7.52%	6.26
Bull	02/98	04/98	3	68.67%	3.16%	1.68
Bear	08/98	11/99	16	4.47%	-6.80%	-20.42
Bear	03/01	07/03	29	-6.64%	-15.63%	-49.48
Bull	12/03	04/06	29	17.14%	26.05%	22.45
Bear	02/08	06/10	29	-7.59%	-18.28%	-37.46
Bear	03/12	08/13	18	-0.98%	-13.26%	-14.93
Bull	05/14	12/14	8	0.64%	5.54%	5.48
Bear	08/15	09/15	2	-38.91%	-4.57%	-1.78
Long-run LBBI						
Bull	04/22	02/26	47	13.49%	18.11%	37.77
Bull	07/26	09/26	3	40.54%	2.87%	1.52
Bull	08/27	05/28	10	50.20%	5.47%	5.40
Bull	10/28	02/29	5	93.30%	5.14%	2.76
Bear	06/30	03/34	46	-8.05%	-24.75%	-112.1
Bull	11/34	05/37	31	15.97%	32.81%	30.99
Bear	11/37	09/42	59	-10.65%	-25.29%	-105.2
Bull	12/43	08/46	33	13.14%	17.03%	38.10
Bear	08/47	07/50	36	-1.29%	-10.05%	-55.40
Bull	08/51	03/53	20	2.93%	8.07%	14.37
Bull	05/55	07/55	3	68.05%	3.44%	1.77
Bull	03/56	04/56	2	50.54%	2.15%	1.17
Bear	10/57	07/61	46	7.18%	-5.07%	-73.45
Bear	05/62	10/62	6	-25.91%	2.90%	-5.49
Bull	03/64	05/64	3	51.05%	2.07%	1.71
Bear	07/66	01/67	7	-5.05%	-1.61%	-12.03
Bear	10/67	11/71	50	-4.36%	-7.81%	-65.51
Bear	04/73	06/73	3	-33.22%	-4.47%	-2.31
Bear	11/73	02/77	40	-15.52%	-10.32%	-28.13
Bull	05/78	08/81	40	11.36%	15.51%	55.70
Bear	02/82	03/83	14	8.22%	2.73%	-20.87
Bear	07/83	02/85	20	-0.42%	-10.72%	-22.23
Bull	03/86	08/87	18	19.82%	15.64%	11.26
Bear	11/87	02/88	4	15.90%	-2.25%	-3.76
Bear	08/88	12/88	5	-1.57%	-0.45%	-3.19
Bear	01/90	02/93	38	-7.70%	-8.38%	-55.92
Bull	10/93	05/94	8	13.90%	0.07%	6.93
Bull	07/94	07/97	37	16.75%	14.43%	26.70
Bear	02/01	02/05	49	-1.36%	-12.55%	-107.7
Bull	11/05	10/07	24	16.74%	17.06%	15.84
Bear	09/08	06/12	46	-5.64%	-15.46%	-108.7
Bull	10/13	02/14	5	27.23%	9.50%	3.82
Bear	08/15	09/15	2	-38.91%	-2.75%	-1.86

Table 111: Danish stock market expansions and contractions

Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.
Short-run LBBI						
Bull	01/22	06/22	6	-9.03%	15.47%	5.97
Bull	01/23	02/24	14	16.09%	25.49%	18.03
Bull	01/25	08/25	8	35.90%	32.98%	9.23
Bear	04/26	06/26	3	-23.00%	-4.64%	-3.12
Bull	01/27	02/27	2	36.34%	3.66%	1.86
Bull	08/27	11/27	4	28.15%	5.09%	3.06
Bear	07/28	11/28	5	-5.11%	-11.32%	-3.74
Bear	04/29	05/29	2	-16.29%	-2.39%	-1.12
Bear	05/30	01/31	9	-6.57%	-9.69%	-6.42
Bear	05/31	04/32	12	-26.26%	-22.47%	-11.46
Bull	08/32	01/34	18	21.08%	46.83%	16.81
Bear	03/35	04/35	2	-25.67%	-6.53%	-2.82
Bear	05/37	06/38	14	-12.15%	-17.75%	-12.34
Bear	07/39	08/40	14	-32.07%	-35.48%	-12.33
Bull	03/41	11/41	9	26.34%	34.33%	11.44
Bull	06/42	07/42	2	22.45%	1.62%	1.37
Bull	05/43	05/44	13	16.96%	15.63%	10.72
Bear	08/44	10/45	15	-12.38%	-19.24%	-11.58
Bull	01/46	08/46	8	16.45%	16.32%	6.29
Bear	10/46	12/46	3	-15.79%	-4.52%	-1.85
Bear	07/47	12/47	6	-13.86%	-0.49%	-4.05
Bear	10/48	06/49	9	-21.97%	-13.40%	-6.73
Bull	09/49	09/50	13	14.76%	27.90%	12.66
Bear	11/50	08/51	10	-22.78%	-28.31%	-8.60
Bull	01/53	07/54	19	8.05%	10.85%	17.52
Bull	06/55	09/55	4	18.84%	5.85%	3.09
Bull	02/56	01/57	12	17.46%	13.16%	7.72
Bear	06/57	12/57	7	-23.58%	-24.10%	-8.38
Bull	05/58	09/58	5	27.15%	24.81%	4.02
Bull	03/59	08/59	6	19.38%	1.98%	3.59
Bear	09/60	05/61	9	-8.07%	-13.14%	-9.38
Bear	08/61	12/61	5	-17.04%	-5.94%	-5.28
Bear	10/62	04/63	7	-20.57%	-11.97%	-6.95
Bull	07/63	05/64	11	22.43%	32.20%	9.44
Bear	10/64	12/64	3	-21.79%	-11.22%	-3.09
Bear	06/65	10/65	5	-21.79%	-4.79%	-4.83
Bull	06/66	07/66	2	23.82%	9.74%	1.84
Bear	09/66	10/67	14	-28.64%	-31.40%	-12.78
Bull	06/68	04/69	11	25.00%	36.69%	14.57
Bear	09/69	10/69	2	-36.18%	-10.79%	-2.14
Bear	05/70	10/70	6	-24.46%	3.69%	-4.57
Bull	01/72	01/73	13	87.00%	99.86%	17.85
Bear	09/73	11/74	15	-41.62%	-75.04%	-18.79
Bull	04/75	01/76	10	36.21%	48.93%	10.53
Bull	06/76	07/76	2	44.79%	5.03%	1.49
Bear	09/76	01/77	5	-28.55%	-26.23%	-5.60
Bear	07/77	01/78	7	-23.03%	-1.64%	-5.90
Bear	10/78	12/78	3	-29.92%	-0.03%	-2.72
Bear	09/79	03/80	7	-37.84%	-16.44%	-5.81
Bull	07/80	08/81	14	24.52%	47.05%	14.90
Bull	10/81	02/82	5	24.30%	-2.23%	3.49
Bear	05/82	08/82	4	-29.38%	-13.53%	-4.38
Bull	12/82	09/83	10	154.02%	124.04%	13.06
Bear	02/84	03/85	14	-21.15%	-107.98%	-18.29
Bull	07/85	10/85	4	63.08%	29.40%	3.01
Bear	05/86	12/86	8	-30.08%	-46.89%	-12.16
Bear	02/87	05/87	4	-22.30%	-6.11%	-2.91
Bear	10/87	01/88	4	-29.97%	-19.63%	-5.72
Bull	05/88	07/89	15	52.91%	53.69%	12.43
Bear	08/90	01/91	6	-35.13%	-24.22%	-10.91
Bear	11/91	11/92	13	-28.42%	-31.72%	-15.78
Bull	05/93	02/94	10	47.43%	55.16%	10.35
Bear	08/94	03/95	8	-19.68%	-33.44%	-8.61
Bull	07/95	08/95	2	40.88%	8.25%	1.31
Bull	01/96	02/96	2	37.58%	5.10%	1.99
Bull	08/96	07/97	12	55.66%	47.62%	9.95
Bull	12/97	03/98	4	78.02%	5.35%	2.32
Bear	08/98	03/99	8	-26.37%	-34.10%	-12.56
Bull	11/99	03/00	5	72.52%	31.91%	4.49
Bull	08/00	08/00	1	184.92%	10.49%	1.22
Bear	11/00	02/03	28	-23.83%	-71.34%	-29.69
Bull	04/03	02/04	11	59.10%	89.10%	11.54
Bull	11/04	08/05	10	43.83%	29.30%	6.66
Bear	05/06	08/06	4	-6.43%	-23.71%	-4.92
Bull	04/07	05/07	2	67.25%	20.89%	1.20
Bear	11/07	03/09	17	-47.41%	-72.39%	-24.34
Bull	07/09	04/10	10	44.75%	78.20%	9.50
Bull	09/10	01/11	5	41.22%	8.07%	3.44
Bear	06/11	10/11	5	-42.43%	-28.80%	-8.05
Bull	07/12	02/13	8	32.18%	18.73%	6.00
Bull	09/13	02/14	6	67.10%	18.28%	4.92
Bull	01/15	03/15	3	127.76%	11.26%	2.56
Bear	08/15	09/15	2	-37.99%	-12.97%	-1.53
Medium-run LBBI						
Bull	03/23	03/28	61	7.04%	18.57%	86.43
Bear	05/30	01/33	33	-9.58%	-13.59%	-39.98
Bull	06/33	02/35	21	9.35%	13.41%	21.88
Bear	10/37	03/41	42	-13.20%	-14.58%	-48.63
Bull	09/41	08/44	36	2.09%	10.39%	40.41
Bear	07/45	12/45	6	-9.08%	0.46%	-4.56
Bear	10/46	12/46	3	-15.79%	-2.13%	-2.10
Bear	09/47	08/49	24	-9.93%	-5.90%	-14.59
Bull	05/50	10/50	6	0.13%	1.65%	6.45
Bear	07/51	08/51	2	-26.22%	-1.93%	-1.16

Danish stock market expansions and contractions (continued)

Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.
Medium-run LBBI						
Bull	05/53	04/57	48	8.25%	15.54%	53.49
Bear	10/57	04/58	7	1.83%	0.77%	-6.28
Bull	06/59	04/60	11	14.04%	-0.64%	5.61
Bear	07/61	10/63	28	-4.88%	-10.36%	-41.06
Bull	04/64	08/64	5	3.35%	0.57%	3.44
Bull	02/65	04/65	3	27.13%	1.01%	2.18
Bear	09/65	10/65	2	-22.63%	0.72%	-1.49
Bear	09/66	06/68	22	-18.09%	-15.07%	-21.40
Bull	01/69	04/70	16	-5.37%	2.45%	14.52
Bull	04/72	10/73	19	32.07%	25.33%	27.07
Bear	03/74	10/75	20	-6.42%	-15.20%	-27.27
Bull	06/76	07/76	2	44.79%	0.50%	1.22
Bear	12/77	02/79	15	-7.56%	-12.74%	-10.08
Bear	08/79	03/80	8	-36.62%	-5.10%	-4.48
Bull	03/81	07/84	41	17.76%	25.54%	49.16
Bear	12/84	08/88	45	3.18%	-17.91%	-95.63
Bull	04/89	03/90	12	26.49%	17.76%	8.33
Bear	11/90	11/93	37	-1.68%	-18.46%	-68.97
Bull	01/94	02/94	2	77.42%	0.02%	1.86
Bear	03/95	04/95	2	-14.74%	1.05%	-1.29
Bear	12/95	01/96	2	55.32%	-0.60%	-1.27
Bull	09/96	05/98	21	34.03%	18.52%	14.62
Bear	11/98	01/00	15	17.29%	-5.42%	-24.19
Bear	04/01	09/03	30	-6.72%	-11.33%	-50.20
Bull	01/04	03/06	27	26.30%	38.39%	19.83
Bear	01/08	03/10	27	-13.70%	-27.39%	-56.56
Bull	03/11	04/11	2	-20.02%	-0.70%	1.53
Bear	08/11	10/11	3	-43.99%	7.78%	-3.04
Bear	04/12	06/12	3	-3.86%	-8.72%	-2.38
Bull	01/13	02/13	2	70.86%	1.52%	1.38
Bull	08/13	05/15	22	32.46%	22.15%	13.85
Long-run LBBI						
Bear	01/22	12/22	12	-11.92%	-19.92%	-8.60
Bull	11/24	10/28	48	8.02%	16.96%	88.57
Bear	02/31	10/33	33	-2.57%	-3.33%	-41.14
Bull	05/34	12/34	8	4.61%	0.17%	5.33
Bull	06/35	04/37	23	6.77%	9.35%	19.72
Bear	11/37	07/41	45	-9.05%	-12.87%	-67.84
Bull	07/43	08/46	38	1.50%	5.30%	47.55
Bear	09/47	07/49	23	-11.21%	-6.46%	-15.07
Bear	07/51	08/51	2	-26.22%	-1.00%	-1.07
Bull	02/54	08/57	43	5.01%	7.38%	54.20
Bull	05/58	07/58	3	32.89%	1.12%	1.73
Bull	07/59	08/59	2	16.71%	0.70%	1.09
Bear	11/61	01/62	3	8.63%	-0.36%	-3.02
Bear	10/62	03/66	42	0.36%	-4.81%	-68.14
Bear	09/66	11/68	27	-12.78%	-4.54%	-24.82

Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.
Long-run LBBI						
Bear	09/69	10/69	2	-36.18%	-0.42%	-1.08
Bull	04/72	10/73	19	32.07%	10.95%	36.43
Bull	12/73	01/74	2	-9.64%	-1.46%	1.49
Bear	07/74	01/75	7	-21.81%	-0.84%	-6.41
Bull	04/75	01/76	10	36.21%	7.92%	10.46
Bear	09/76	01/78	17	-18.19%	-17.63%	-13.70
Bear	01/80	05/80	5	-32.71%	-5.61%	-2.83
Bull	12/82	03/86	40	30.03%	22.24%	42.69
Bear	11/86	02/89	28	11.08%	-7.30%	-75.07
Bear	12/90	01/91	2	-19.05%	-0.50%	-1.53
Bear	07/92	03/96	45	3.25%	-5.53%	-100.7
Bull	09/96	03/98	19	42.41%	19.33%	13.19
Bear	07/01	04/05	46	1.80%	-12.52%	-134.0
Bull	12/05	07/07	20	21.92%	15.67%	12.43
Bear	08/08	03/12	44	-3.36%	-18.93%	-152.4
Bull	03/13	09/14	19	23.37%	14.48%	13.76
Bull	01/15	05/15	5	71.52%	2.74%	3.13

Table 112: French stock market expansions and contractions

Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.	Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.
Short-run LBBI							*Short-run LBBI*						
Bear	11/24	06/25	8	-23.51%	-25.17%	-7.90	Bear	04/70	11/70	8	-14.67%	-13.05%	-6.62
Bear	12/25	05/26	6	-17.80%	2.48%	-4.10	Bear	08/71	10/71	3	-58.13%	-17.89%	-3.55
Bear	11/26	12/26	2	-31.50%	-3.88%	-1.64	Bull	03/72	08/72	6	36.76%	21.95%	5.00
Bull	01/27	05/28	17	67.42%	68.90%	14.71	Bear	11/72	12/72	2	-39.42%	-17.55%	-1.26
Bear	04/29	12/31	33	-22.46%	-51.68%	-33.03	Bull	04/73	04/73	1	125.26%	4.63%	1.09
Bull	02/32	02/32	1	567.01%	11.95%	1.53	Bear	07/73	10/74	16	-42.87%	-59.68%	-15.57
Bear	05/32	05/32	1	-75.06%	-4.86%	-1.14	Bull	01/75	02/76	14	33.52%	56.07%	11.32
Bull	08/32	12/32	5	30.76%	35.51%	4.25	Bear	07/76	11/76	5	-45.11%	-30.37%	-4.76
Bull	05/33	08/33	4	56.24%	7.35%	3.95	Bear	03/77	04/77	2	-59.38%	-3.58%	-1.91
Bear	11/33	01/34	3	-29.45%	-12.89%	-2.35	Bull	08/77	11/77	4	39.01%	27.80%	3.94
Bear	07/34	11/34	5	-27.04%	1.10%	-2.97	Bull	03/78	09/78	7	110.67%	46.63%	9.23
Bull	01/35	05/35	5	91.36%	24.29%	5.60	Bull	08/79	09/79	2	159.30%	6.94%	2.20
Bear	05/36	08/36	4	-66.04%	-34.64%	-5.77	Bear	03/80	09/80	7	-11.67%	-38.30%	-4.41
Bull	10/36	03/37	6	110.92%	33.21%	6.04	Bear	12/80	06/81	7	-51.24%	-34.20%	-8.63
Bear	09/37	03/38	7	-36.85%	-64.78%	-6.58	Bull	01/82	05/82	5	34.92%	40.96%	3.69
Bull	12/38	05/39	6	26.90%	16.17%	5.02	Bull	02/83	01/84	12	53.61%	51.83%	10.03
Bear	09/39	09/39	1	-67.18%	-2.25%	-1.18	Bull	11/85	04/86	6	210.21%	62.72%	6.26
Bull	11/39	04/40	6	57.31%	12.83%	5.19	Bear	05/87	01/88	9	-53.24%	-53.58%	-16.07
Bear	11/40	02/41	4	-12.40%	-10.63%	-2.42	Bull	09/88	01/89	5	85.24%	97.51%	3.86
Bull	03/41	01/42	11	192.06%	170.93%	14.08	Bear	01/90	03/90	3	-13.10%	-9.46%	-2.15
Bear	06/42	07/42	2	-15.66%	8.16%	-1.36	Bear	07/90	01/91	7	-38.90%	-34.06%	-10.31
Bear	10/42	11/42	2	-26.25%	-17.26%	-2.04	Bear	07/92	11/92	5	-17.60%	-9.19%	-4.98
Bear	02/43	05/44	16	-30.91%	-51.22%	-24.98	Bull	02/93	03/93	2	118.16%	10.24%	1.32
Bear	09/44	12/45	16	-48.55%	-41.25%	-15.80	Bull	06/93	01/94	8	51.13%	45.81%	5.36
Bull	05/46	07/46	3	44.95%	46.94%	2.46	Bear	05/94	03/95	11	-15.20%	-30.83%	-10.82
Bear	08/46	09/46	2	-72.12%	-33.71%	-1.63	Bull	01/96	06/96	6	39.99%	17.94%	4.24
Bull	12/46	12/46	1	381.86%	12.60%	1.44	Bull	11/96	07/97	9	58.36%	27.10%	6.39
Bear	10/47	02/48	5	-55.66%	-27.57%	-4.13	Bull	01/98	06/98	6	97.62%	20.05%	4.77
Bear	04/48	06/48	3	-41.74%	-2.86%	-1.64	Bear	08/98	10/98	3	-49.02%	-6.31%	-2.79
Bull	07/49	08/49	2	86.68%	7.52%	1.74	Bull	11/99	12/99	2	221.89%	13.95%	1.95
Bull	06/50	06/50	1	137.27%	6.73%	1.08	Bear	09/00	03/03	31	-28.91%	-85.22%	-34.85
Bull	02/51	07/52	18	26.54%	42.90%	18.33	Bull	06/03	02/04	9	35.49%	67.98%	8.57
Bull	01/53	02/53	2	68.21%	-2.67%	1.47	Bull	01/05	02/05	2	44.42%	0.77%	1.30
Bull	07/53	04/55	22	60.14%	63.39%	15.37	Bull	05/05	07/05	3	83.58%	15.73%	2.38
Bear	10/55	06/56	9	-0.30%	-27.18%	-10.64	Bull	12/05	01/06	2	66.69%	3.72%	1.29
Bear	11/56	01/57	3	-12.03%	6.69%	-2.65	Bear	08/07	03/09	20	-34.87%	-56.54%	-21.10
Bull	03/57	07/57	5	106.58%	16.79%	3.46	Bull	07/09	12/09	6	57.62%	53.35%	6.47
Bear	10/57	08/58	11	-32.80%	-68.16%	-13.77	Bull	12/10	02/11	3	63.54%	11.80%	2.28
Bull	01/59	11/59	11	62.42%	73.48%	7.97	Bear	07/11	12/11	6	-36.27%	-34.57%	-5.91
Bear	10/60	12/60	3	-17.04%	-17.52%	-2.32	Bull	07/12	11/13	17	27.03%	41.61%	11.00
Bear	07/61	10/61	4	-33.38%	-15.66%	-3.55	Bull	01/15	03/15	3	91.15%	14.62%	2.10
Bear	06/62	06/64	25	-17.85%	-22.65%	-22.80	Bear	08/15	09/15	2	-53.22%	-17.71%	-1.66
Bear	06/65	07/65	2	-39.89%	-7.49%	-1.44	*Medium-run LBBI*						
Bull	01/66	02/66	2	60.04%	13.16%	1.84	Bull	01/24	07/24	7	18.93%	-2.40%	5.28
Bear	09/66	10/66	2	-41.75%	-6.57%	-1.45	Bear	01/25	02/27	26	-1.27%	-21.84%	-38.12
Bull	09/67	05/68	9	32.17%	32.04%	7.91	Bull	09/27	03/29	19	41.07%	31.57%	14.42
Bull	01/69	05/69	5	93.55%	16.39%	5.66	Bear	11/29	03/33	41	-12.75%	-43.27%	-62.13

French stock market expansions and contractions (continued)

Phase	Start date	End date	Dur.	Amplitude Δ price	Δ CAGR	Sev.
Medium-run LBBI						
Bear	02/34	03/34	2	-14.11%	-0.87%	-1.34
Bear	08/34	09/34	2	-23.38%	1.36%	-1.34
Bull	04/35	05/35	2	143.57%	12.50%	2.59
Bull	01/36	04/36	4	19.15%	3.78%	2.56
Bear	05/36	09/36	5	-50.73%	-13.10%	-4.76
Bull	12/36	03/37	4	47.18%	6.99%	3.99
Bear	09/37	10/38	14	-16.51%	-10.83%	-9.13
Bear	01/39	01/39	1	-74.20%	-5.70%	-0.64
Bull	07/39	07/39	1	31.11%	3.48%	0.95
Bull	11/39	10/40	12	5.00%	5.31%	8.13
Bull	03/41	01/43	23	92.36%	45.61%	25.94
Bear	05/43	05/47	49	-24.80%	-55.99%	-96.99
Bear	04/48	06/48	3	-41.74%	8.04%	-1.63
Bull	02/51	09/55	56	30.95%	50.95%	65.61
Bear	10/56	03/57	6	23.74%	-0.97%	-5.44
Bear	11/57	09/59	23	5.13%	-8.59%	-60.25
Bear	02/60	03/60	2	-12.39%	-5.24%	-1.24
Bear	07/62	12/65	42	-9.36%	-24.39%	-67.98
Bear	07/66	11/66	5	-11.90%	-0.96%	-2.94
Bear	07/67	08/67	2	-11.59%	-3.74%	-1.10
Bull	03/68	03/70	25	12.96%	13.75%	22.41
Bear	03/71	02/72	12	-4.68%	-7.65%	-9.17
Bull	03/73	06/73	4	24.05%	7.15%	3.08
Bear	11/73	09/75	23	-19.73%	-17.73%	-21.94
Bull	04/78	02/80	23	20.30%	21.47%	29.87
Bear	03/81	11/82	21	-8.66%	-22.83%	-27.44
Bull	07/83	05/85	23	31.13%	24.96%	17.93
Bull	11/85	08/86	10	114.86%	16.00%	6.45
Bear	10/87	08/89	23	13.85%	-20.19%	-43.17
Bear	02/90	03/90	2	19.96%	-1.06%	-1.35
Bear	08/90	05/93	34	-1.86%	-11.97%	-60.10
Bull	12/93	01/94	2	105.23%	5.70%	1.48
Bear	09/94	02/96	18	-0.86%	-2.49%	-17.58
Bear	07/96	08/96	2	-28.49%	-6.20%	-1.44
Bull	02/97	07/98	18	38.79%	26.09%	12.30
Bear	03/01	05/04	39	-8.87%	-27.06%	-70.54
Bull	01/05	10/06	22	23.20%	22.36%	14.85
Bear	01/08	02/10	26	-14.63%	-26.01%	-41.55
Bull	01/11	02/11	2	53.31%	7.08%	1.16
Bear	09/11	09/11	1	-64.19%	0.65%	-1.01
Bear	04/12	05/12	2	-45.41%	-10.02%	-1.22
Bull	04/13	04/15	25	20.31%	18.69%	16.61
Long-run LBBI						
Bull	02/24	12/24	11	-7.31%	-2.52%	8.39
Bull	06/25	08/25	3	42.28%	3.78%	1.69
Bear	04/26	08/27	17	24.41%	-0.33%	-18.17
Bull	03/28	03/29	13	37.88%	6.67%	7.16

Phase	Start date	End date	Dur.	Amplitude Δ price	Δ CAGR	Sev.
Long-run LBBI						
Bear	12/30	12/34	49	-6.35%	-17.92%	-93.50
Bull	04/35	04/36	13	6.46%	8.25%	8.94
Bear	06/36	08/36	3	-51.93%	-3.80%	-2.86
Bull	11/36	03/37	5	50.30%	0.85%	4.65
Bear	09/37	10/38	14	-16.51%	-4.43%	-9.19
Bear	08/39	09/39	2	-63.15%	-2.39%	-1.20
Bull	11/39	04/40	6	57.31%	0.71%	3.74
Bull	03/41	01/43	23	92.36%	36.45%	23.71
Bear	10/44	03/49	54	-27.72%	-43.15%	-101.4
Bull	10/51	12/55	51	25.15%	39.17%	77.83
Bear	03/58	05/60	27	14.87%	-10.79%	-43.44
Bear	10/60	02/61	5	14.75%	3.68%	-4.05
Bear	08/61	10/61	3	-20.74%	-1.06%	-1.73
Bear	04/63	08/67	53	-9.25%	-20.82%	-120.5
Bull	01/69	07/71	31	8.28%	7.88%	29.36
Bear	10/71	10/71	1	-56.24%	-0.34%	-1.07
Bull	03/72	05/72	3	82.64%	3.74%	2.07
Bear	08/73	05/77	46	-18.24%	-20.69%	-41.15
Bull	03/78	04/81	38	12.79%	14.97%	49.18
Bear	06/82	03/83	10	8.19%	-3.80%	-8.82
Bull	11/83	01/87	39	35.56%	25.08%	25.68
Bear	12/87	04/88	5	13.73%	-3.00%	-3.18
Bear	02/90	12/95	71	0.61%	-13.95%	-167.8
Bull	03/98	07/98	5	65.08%	2.65%	3.22
Bull	03/99	04/00	14	47.28%	14.95%	7.73
Bear	08/01	10/05	51	-0.44%	-24.55%	-151.3
Bull	08/06	07/07	12	18.10%	10.93%	7.91
Bear	07/08	03/12	45	-3.14%	-16.32%	-86.86
Bull	12/12	06/14	19	19.87%	16.82%	15.69
Bull	01/15	05/15	5	52.24%	5.52%	3.57

Table 113: German stock market expansions and contractions

Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.
Short-run LBBI						
Bear	12/28	01/31	26	-15.93%	-35.85%	-28.07
Bear	05/31	12/31	8	-53.38%	-20.25%	-8.31
Bull	07/32	05/33	11	63.92%	74.09%	12.49
Bear	09/33	11/33	3	-15.83%	-21.12%	-2.31
Bull	02/34	03/34	2	81.82%	0.22%	1.37
Bull	08/34	09/34	2	56.55%	20.27%	1.27
Bear	11/35	12/35	2	-9.56%	2.33%	-1.27
Bear	05/38	07/39	15	-6.90%	-10.66%	-12.03
Bull	01/40	11/40	11	36.15%	29.69%	6.58
Bear	11/41	08/42	10	1.40%	-12.49%	-6.40
Bear	07/43	03/44	9	0.00%	-4.17%	-4.92
Bull	07/48	01/48	-5	0.00%	0.00%	0.49
Bull	02/49	12/49	11	167.77%	245.84%	14.51
Bull	07/51	01/52	7	133.77%	53.84%	6.66
Bear	05/52	07/53	15	-16.30%	-61.40%	-19.54
Bull	09/53	02/54	6	53.24%	32.29%	3.80
Bull	06/54	01/55	8	107.78%	36.46%	6.27
Bear	10/55	07/57	22	-7.66%	-55.02%	-32.26
Bull	08/58	11/58	4	120.40%	26.48%	3.57
Bull	04/59	08/59	5	208.12%	49.19%	4.36
Bull	06/60	08/60	3	220.74%	-7.74%	2.27
Bear	11/60	03/63	29	-18.49%	-82.90%	-42.17
Bull	05/63	09/63	5	55.13%	42.01%	3.63
Bull	01/64	03/64	3	63.73%	24.09%	1.73
Bear	11/64	11/66	25	-16.87%	-26.23%	-20.26
Bull	02/67	06/68	17	37.75%	68.75%	13.44
Bear	01/70	12/70	12	-24.51%	-41.16%	-11.64
Bear	09/71	11/71	3	-35.62%	-2.43%	-2.86
Bull	02/72	03/72	2	84.38%	6.55%	1.74
Bear	04/73	03/74	12	-29.12%	-31.13%	-10.22
Bull	10/76	01/76	-8	-7.62%	14.41%	0.87
Bull	01/75	03/76	15	24.96%	16.39%	11.89
Bull	10/77	11/77	2	20.71%	7.09%	1.22
Bull	07/78	09/78	3	41.96%	4.72%	2.06
Bear	03/79	03/80	13	-15.53%	-18.25%	-8.77
Bull	06/81	07/81	2	48.08%	0.63%	1.39
Bull	11/82	11/83	13	43.31%	38.35%	10.15
Bear	07/84	07/84	1	-52.36%	-9.70%	-1.14
Bull	04/85	04/86	13	73.70%	58.04%	9.15
Bear	06/86	07/86	2	-26.72%	-11.25%	-1.81
Bear	09/86	01/88	17	-31.97%	-75.71%	-22.11
Bull	09/88	10/88	2	79.69%	34.78%	1.88
Bull	06/89	09/89	4	58.25%	1.90%	2.95
Bull	12/89	01/90	2	96.95%	8.46%	1.66
Bear	08/90	01/91	6	-43.83%	-43.80%	-8.65
Bear	10/91	12/91	3	-22.48%	-11.45%	-2.82
Bear	07/92	12/92	6	-26.92%	-4.28%	-5.94

Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.
Short-run LBBI						
Bull	07/93	12/93	6	65.90%	46.63%	6.20
Bear	09/94	04/95	8	-14.18%	-21.89%	-6.93
Bull	01/96	01/96	1	128.51%	12.57%	1.04
Bull	11/96	07/97	9	78.21%	46.94%	7.47
Bull	02/98	06/98	5	79.11%	5.61%	3.50
Bear	08/98	05/99	10	-15.02%	-36.01%	-9.52
Bull	11/99	03/00	5	105.25%	33.21%	4.40
Bear	09/00	10/01	14	-33.23%	-64.80%	-19.00
Bear	05/02	03/03	11	-52.17%	-34.77%	-10.91
Bull	04/03	02/04	11	72.01%	108.67%	12.26
Bull	12/04	02/05	3	23.97%	-1.34%	1.73
Bull	05/05	03/06	11	47.57%	33.54%	8.08
Bull	04/07	06/07	3	66.87%	23.67%	2.16
Bear	01/08	03/09	15	-44.22%	-57.54%	-19.57
Bull	07/09	04/10	10	34.34%	57.81%	8.50
Bull	10/10	02/11	5	42.85%	19.55%	3.81
Bear	08/11	12/11	5	-37.76%	-31.74%	-6.36
Bull	08/12	01/13	6	31.81%	25.82%	3.73
Bull	09/13	12/13	4	58.66%	8.22%	2.65
Bear	07/14	10/14	4	-15.22%	-20.60%	-3.26
Bull	01/15	03/15	3	115.41%	21.52%	2.62
Bear	08/15	09/15	2	-62.51%	-18.75%	-2.70
Medium-run LBBI						
Bear	12/28	08/32	45	-13.15%	-44.59%	-68.99
Bull	12/32	07/35	32	22.56%	35.30%	29.91
Bear	06/38	02/40	21	4.38%	-5.41%	-31.40
Bull	11/40	11/40	1	42.28%	1.35%	0.51
Bull	06/41	07/41	2	38.06%	3.63%	1.02
Bear	01/43	12/49	84	-18.44%	-53.03%	-102.5
Bull	01/51	04/52	16	46.68%	89.73%	12.46
Bear	02/53	03/54	14	24.94%	5.03%	-13.86
Bull	10/54	09/55	12	55.16%	16.12%	7.30
Bear	07/56	08/58	26	15.72%	-27.48%	-61.52
Bull	05/59	09/60	17	77.86%	36.52%	10.21
Bear	08/61	07/67	72	-7.04%	-51.52%	-167.2
Bull	11/67	06/69	20	19.05%	21.12%	15.81
Bear	04/70	04/72	25	-2.87%	-16.47%	-40.19
Bear	09/72	10/72	2	-34.97%	-3.83%	-1.57
Bear	05/73	12/74	20	-17.24%	-6.24%	-19.72
Bull	10/75	12/76	15	2.40%	10.68%	12.57
Bull	07/78	10/78	4	21.30%	-0.90%	2.52
Bear	05/79	03/81	23	-5.61%	-5.11%	-17.73
Bear	12/81	01/82	2	-6.75%	-0.61%	-1.06
Bull	11/82	04/86	42	38.40%	31.91%	30.20
Bear	04/87	11/89	32	5.26%	-21.92%	-67.33
Bear	09/90	07/93	35	-3.22%	-10.19%	-44.66
Bull	12/93	01/94	2	27.29%	2.19%	1.55

German stock market expansions and contractions (continued…)

Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.
Medium-run LBBI						
Bear	03/95	04/95	2	-19.69%	-0.61%	-1.30
Bull	01/97	07/98	19	46.77%	25.49%	13.23
Bear	08/99	11/99	4	42.05%	0.39%	-3.10
Bear	11/00	11/03	37	-17.44%	-32.79%	-69.96
Bull	09/04	06/07	34	29.11%	32.94%	26.80
Bear	02/08	03/10	26	-6.97%	-21.93%	-40.92
Bull	01/11	07/11	7	3.06%	8.15%	4.01
Bear	09/11	09/11	1	-52.15%	1.77%	-1.25
Bear	05/12	06/12	2	-26.85%	-2.31%	-1.30
Bull	09/13	12/13	4	58.66%	-0.21%	2.47
Bull	01/15	03/15	3	115.41%	1.65%	1.69
Long-run LBBI						
Bull	11/28	06/29	8	-5.34%	21.17%	5.94
Bear	03/30	02/33	36	-4.83%	-8.31%	-47.89
Bear	08/33	10/33	3	-32.40%	-1.88%	-1.86
Bull	02/34	12/36	35	18.14%	26.22%	30.68
Bear	02/39	01/40	12	10.35%	-2.12%	-7.99
Bear	05/44	06/50	74	-22.95%	-37.67%	-123.1
Bull	01/52	01/52	1	309.96%	1.95%	1.99
Bull	07/52	07/52	1	-47.91%	-0.87%	1.28
Bull	01/53	02/53	2	-2.31%	-0.06%	1.79
Bull	07/53	05/55	23	64.88%	53.20%	15.06
Bull	06/60	08/60	3	220.74%	6.13%	1.61
Bear	06/62	03/68	70	1.25%	-18.51%	-235.7
Bull	10/69	12/69	3	22.19%	2.56%	1.87
Bear	09/71	01/75	41	-5.75%	-14.56%	-52.92
Bear	08/75	09/75	2	-29.76%	-0.87%	-1.24
Bull	08/77	02/79	19	5.94%	9.25%	15.52
Bear	12/79	05/80	6	-6.13%	-3.22%	-4.90
Bear	11/80	03/81	5	-9.02%	-2.23%	-4.29
Bear	09/81	08/82	12	-6.68%	-2.21%	-9.33
Bull	02/83	06/86	41	32.47%	21.77%	31.59
Bear	11/87	04/92	54	6.45%	-14.74%	-96.96
Bear	06/92	07/95	38	2.82%	-5.38%	-54.05
Bull	11/96	07/98	21	46.55%	15.07%	13.10
Bull	02/00	03/00	2	97.55%	4.12%	1.18
Bear	02/01	02/05	49	-8.92%	-27.53%	-102.8
Bull	11/05	12/07	26	22.56%	27.67%	23.72
Bear	10/08	05/12	44	0.99%	-16.40%	-87.52
Bull	03/13	02/14	12	24.21%	18.37%	8.01
Bull	01/15	03/15	3	115.41%	3.51%	1.94

Table 114: Italian stock market expansions and contractions

Phase	Start date	End date	Dur.	Amplitude Δ price	Δ CAGR	Sev.	Phase	Start date	End date	Dur.	Amplitude Δ price	Δ CAGR	Sev.
Short-run LBBI							*Short-run LBBI*						
Bull	05/22	12/24	32	17.34%	47.28%	31.34	Bull	01/76	02/76	2	31.31%	-10.08%	1.22
Bull	02/25	02/25	1	184.67%	11.99%	0.99	Bear	10/76	10/76	1	-83.61%	-11.90%	-1.17
Bear	07/25	12/26	18	-32.23%	-65.27%	-15.88	Bull	05/78	09/79	17	17.11%	16.52%	20.26
Bull	07/27	05/28	11	81.19%	80.74%	11.32	Bull	01/80	05/81	17	100.19%	144.90%	17.14
Bear	03/29	12/29	10	-17.68%	-22.86%	-8.37	Bear	09/81	12/82	16	-34.38%	-86.99%	-18.00
Bear	06/30	11/31	18	-30.95%	-33.41%	-13.91	Bull	02/83	03/83	2	100.83%	6.57%	1.86
Bear	04/32	06/32	3	-66.23%	-10.52%	-3.07	Bear	10/83	12/83	3	-19.94%	-3.96%	-2.31
Bull	08/32	03/34	20	36.73%	66.18%	18.84	Bull	01/84	01/84	1	638.05%	7.52%	1.22
Bull	06/34	09/34	4	45.96%	5.32%	2.78	Bull	01/85	04/86	16	126.18%	142.50%	15.63
Bull	03/35	05/35	3	49.05%	17.45%	1.95	Bear	11/86	05/88	19	-30.68%	-113.09%	-29.96
Bear	09/35	01/36	5	-18.69%	-8.72%	-5.50	Bull	07/89	08/89	2	104.84%	12.93%	1.84
Bull	10/36	12/36	3	50.91%	14.28%	2.65	Bear	02/90	04/90	3	-2.13%	-0.96%	-2.09
Bear	09/37	01/39	17	-16.60%	-34.86%	-12.91	Bear	08/90	01/91	6	-57.01%	-32.75%	-8.16
Bull	07/39	12/39	6	67.05%	35.33%	6.44	Bear	09/91	09/92	13	-35.53%	-19.08%	-9.17
Bear	05/40	05/40	1	-64.80%	-13.11%	-1.10	Bull	01/93	08/93	8	60.97%	70.53%	8.66
Bear	01/41	02/41	2	-64.21%	0.07%	-2.01	Bull	12/93	04/94	5	138.19%	26.21%	5.32
Bull	06/41	09/41	4	138.19%	18.01%	5.37	Bear	10/94	03/95	6	-26.96%	-30.72%	-5.89
Bear	03/42	06/42	4	-42.46%	-34.76%	-4.67	Bear	09/95	11/95	3	-45.41%	-3.46%	-2.98
Bear	01/43	03/43	3	-90.30%	-38.07%	-5.81	Bull	04/96	05/96	2	121.88%	8.28%	1.71
Bull	05/43	06/43	2	685.26%	36.45%	1.65	Bull	11/96	05/98	19	74.99%	95.51%	16.63
Bull	12/43	12/43	1	27413.53%	47.84%	2.39	Bear	08/98	10/98	3	-60.74%	-33.43%	-2.87
Bear	01/44	03/44	3	-99.14%	-54.10%	-3.59	Bear	05/99	11/99	7	-5.23%	-4.01%	-6.94
Bear	01/45	01/46	13	-73.83%	-0.03%	-10.22	Bull	12/99	02/00	3	248.74%	32.35%	2.99
Bull	06/46	05/47	12	308.32%	369.30%	17.93	Bear	11/00	10/01	12	-36.12%	-73.26%	-17.78
Bear	09/47	03/48	7	-71.89%	-77.84%	-8.31	Bear	05/02	01/03	9	-37.75%	-9.24%	-7.65
Bull	01/49	03/49	3	178.42%	68.48%	3.78	Bull	05/03	02/04	10	18.43%	45.22%	8.06
Bear	06/49	06/49	1	-71.51%	7.72%	-1.18	Bull	10/04	03/05	6	33.72%	7.19%	4.72
Bear	05/50	07/50	3	-37.96%	-7.86%	-2.93	Bull	01/06	03/06	3	39.89%	4.78%	2.07
Bear	04/51	07/51	4	-23.63%	1.54%	-2.92	Bear	07/07	03/09	21	-43.17%	-64.16%	-20.85
Bull	01/52	03/52	3	54.78%	6.56%	1.93	Bull	07/09	12/09	6	40.06%	52.31%	6.66
Bull	10/52	01/53	4	83.33%	18.73%	3.59	Bear	05/10	06/10	2	-49.91%	-12.20%	-1.42
Bear	11/53	06/54	8	-3.37%	-5.15%	-4.76	Bull	01/11	04/11	4	25.91%	12.34%	3.85
Bull	10/54	09/55	12	49.80%	42.49%	7.17	Bear	07/11	09/11	3	-66.46%	-29.24%	-3.73
Bear	12/55	10/56	11	-13.18%	-47.06%	-10.90	Bear	05/12	05/12	1	-75.94%	-4.27%	-1.18
Bear	11/57	07/58	9	-9.47%	-16.35%	-8.61	Bull	08/12	05/13	10	26.69%	52.98%	9.49
Bull	10/58	08/59	11	88.07%	89.59%	9.53	Bull	07/13	04/14	10	49.05%	18.26%	9.62
Bull	06/60	08/60	3	314.32%	18.70%	3.28	Bear	12/14	12/14	1	-42.02%	-4.00%	-1.07
Bear	11/60	08/64	46	-18.71%	-70.61%	-44.42	Bull	02/15	05/15	4	48.36%	3.09%	3.06
Bull	02/65	04/65	3	100.86%	23.39%	3.29	*Medium-run LBBI*						
Bull	11/65	03/66	5	67.50%	14.32%	6.20	Bear	01/22	02/22	2	-5.34%	1.16%	-1.16
Bear	02/67	06/67	5	-25.73%	-3.09%	-3.90	Bull	06/23	08/25	27	20.23%	37.52%	41.75
Bull	03/69	10/69	8	24.86%	21.02%	6.22	Bear	06/26	08/27	15	-7.93%	-18.13%	-14.06
Bear	05/70	09/71	17	-29.26%	-28.10%	-12.78	Bull	03/28	06/29	16	-1.56%	12.09%	13.97
Bull	05/72	06/73	14	30.65%	53.64%	13.38	Bear	03/30	07/32	29	-26.65%	-29.42%	-27.03
Bear	11/73	12/73	2	-52.02%	-17.05%	-1.11	Bull	05/33	07/35	27	24.37%	43.25%	31.22
Bear	05/74	10/74	6	-67.20%	-42.97%	-6.92	Bear	07/36	09/36	3	8.23%	-1.88%	-2.44
Bear	06/75	07/75	2	-69.72%	-2.57%	-1.66	Bear	10/37	08/39	23	-5.57%	-4.03%	-28.74

Italian stock market expansions and contractions (continued…)

Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.
			Medium-run LBBI			
Bear	01/40	03/40	3	-50.10%	-7.33%	-1.79
Bull	10/40	12/40	3	25.09%	2.57%	1.98
Bull	07/41	09/41	3	141.80%	9.29%	3.67
Bear	04/42	06/42	3	-35.44%	-4.89%	-2.92
Bear	01/43	04/43	4	-66.98%	-6.07%	-6.62
Bear	08/43	11/43	4	-48.92%	-10.61%	-4.37
Bull	12/43	12/43	1	27414%	14.37%	1.62
Bear	01/44	04/46	28	-68.19%	-59.30%	-22.02
Bull	01/47	01/48	13	-34.33%	22.39%	16.48
Bull	04/48	04/49	13	60.81%	57.35%	11.82
Bull	12/49	01/50	2	72.50%	-4.13%	1.62
Bull	10/50	12/50	3	22.08%	17.71%	2.97
Bull	06/52	10/53	17	19.85%	4.13%	11.37
Bull	12/54	02/55	3	78.78%	2.37%	1.72
Bull	06/55	10/55	5	59.95%	1.59%	3.15
Bear	07/56	11/58	29	10.62%	-9.86%	-35.31
Bull	03/59	09/60	19	60.68%	27.74%	12.72
Bear	12/61	10/65	47	-17.58%	-43.17%	-89.87
Bull	12/65	01/67	14	8.16%	11.38%	9.72
Bull	09/67	11/67	3	10.54%	-0.62%	1.67
Bull	04/69	04/70	13	4.78%	7.68%	11.01
Bear	09/70	04/72	20	-20.58%	-14.82%	-15.05
Bull	03/73	04/74	14	5.73%	11.16%	16.09
Bear	08/74	10/75	15	-35.63%	-12.65%	-9.41
Bull	09/78	12/81	40	16.42%	37.55%	61.31
Bear	04/82	09/84	30	-9.26%	-25.73%	-31.04
Bull	04/85	12/86	21	65.79%	47.01%	19.02
Bear	09/87	12/92	64	-11.36%	-51.18%	#####
Bull	08/93	01/95	18	7.04%	15.56%	19.71
Bear	10/95	03/96	6	-15.39%	-11.67%	-4.70
Bear	07/96	10/96	4	-23.10%	-5.32%	-4.14
Bull	04/97	04/99	25	41.34%	34.50%	20.20
Bear	09/99	11/99	3	17.05%	-2.12%	-2.55
Bear	12/00	12/03	37	-16.54%	-41.01%	-78.97
Bull	09/04	04/06	20	22.14%	23.85%	15.77
Bull	10/06	12/06	3	36.88%	0.29%	1.68
Bear	12/07	02/10	27	-24.01%	-28.55%	-34.22
Bull	12/10	06/11	7	5.35%	9.32%	5.62
Bull	04/13	07/15	28	19.46%	30.20%	32.57
			Long-run LBBI			
Bear	01/22	12/22	12	-4.68%	-26.24%	-8.17
Bull	07/24	09/26	27	-5.19%	15.23%	47.78
Bull	01/27	05/27	5	33.33%	2.52%	6.44
Bull	07/27	05/28	11	81.19%	12.12%	12.10
Bear	04/31	12/32	21	-20.18%	-7.55%	-15.69
Bull	06/34	06/37	37	9.35%	22.89%	44.84
Bear	04/38	09/39	18	-0.52%	-8.38%	-32.08

Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.
			Long-run LBBI			
Bear	01/40	05/41	17	-11.03%	-3.66%	-19.13
Bull	08/41	09/41	2	155.85%	2.51%	2.44
Bear	03/42	06/42	4	-42.46%	-4.25%	-3.16
Bull	09/42	11/42	3	64.98%	5.19%	2.23
Bear	01/43	04/43	4	-66.98%	-5.31%	-4.96
Bear	10/43	11/43	2	-61.98%	-3.43%	-2.20
Bull	12/43	12/43	1	27413.5%	10.30%	3.27
Bear	01/44	06/46	30	-60.02%	-42.96%	-25.05
Bull	01/49	11/50	23	10.03%	40.52%	32.50
Bull	04/51	02/52	11	4.36%	-17.17%	6.49
Bull	09/52	12/53	16	12.61%	10.45%	12.62
Bull	06/54	11/55	18	37.43%	7.61%	11.07
Bear	05/58	09/58	5	15.46%	-0.89%	-4.81
Bull	06/60	08/60	3	314.32%	3.69%	1.99
Bear	09/62	07/67	59	-10.62%	-23.59%	-114.1
Bull	06/68	08/68	3	25.37%	2.13%	2.31
Bull	12/68	04/70	17	10.96%	7.73%	17.94
Bear	11/70	03/72	17	-21.35%	-6.69%	-10.16
Bear	08/74	09/74	2	-79.49%	-6.30%	-1.14
Bull	04/80	04/83	37	9.73%	24.28%	50.16
Bear	03/84	10/84	8	-11.16%	-1.93%	-5.48
Bull	12/85	06/87	19	27.08%	16.17%	14.41
Bear	03/89	01/94	59	-2.53%	-17.42%	-98.73
Bull	12/95	06/00	55	29.28%	26.61%	41.29
Bear	07/01	08/05	50	-2.67%	-24.45%	-113.8
Bull	02/06	09/07	20	4.56%	15.98%	13.22
Bear	03/08	11/11	45	-18.55%	-24.29%	-46.39
Bull	02/13	09/15	32	8.27%	13.22%	50.72

Table 115: Japanese stock market expansions and contractions

Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.
Short-run LBBI						
Bear	03/22	05/22	3	-50.50%	-10.43%	-2.06
Bull	11/22	06/23	8	28.23%	26.74%	8.75
Bear	11/23	12/23	2	-39.96%	-16.41%	-1.64
Bull	11/24	03/26	17	28.79%	38.91%	14.92
Bear	04/27	09/27	6	-17.14%	-10.98%	-5.50
Bull	05/28	07/28	3	27.84%	12.27%	1.68
Bear	10/28	10/29	13	-14.24%	-20.30%	-8.10
Bear	06/30	10/30	5	-30.60%	-6.91%	-3.71
Bull	12/30	07/31	8	28.25%	29.68%	6.58
Bear	10/31	11/31	2	-29.03%	-13.60%	-1.30
Bull	01/32	03/32	3	135.33%	16.41%	4.33
Bull	09/32	01/33	5	147.11%	29.42%	5.85
Bear	05/34	07/35	15	-10.95%	-28.00%	-16.08
Bear	08/37	12/38	17	-22.55%	-25.27%	-13.27
Bull	07/39	12/39	6	25.10%	21.45%	5.43
Bear	05/40	10/40	6	-38.29%	-33.03%	-5.15
Bull	12/41	10/42	11	18.95%	22.88%	8.32
Bear	03/43	04/43	2	-23.84%	-3.63%	-1.27
Bear	03/44	08/44	6	-26.40%	-8.67%	-3.94
Bear	03/45	08/45	6	-40.01%	-7.94%	-4.38
Bull	05/46	06/46	2	0.00%	9.33%	1.14
Bear	07/46	02/47	8	-98.00%	-85.18%	-14.81
Bear	06/47	08/47	3	-90.56%	40.21%	-2.24
Bull	01/48	07/48	7	107.88%	89.29%	11.98
Bull	10/48	08/49	11	180.29%	128.85%	13.60
Bear	11/49	06/50	8	-44.36%	-130.97%	-7.36
Bull	10/50	11/50	2	51.22%	22.60%	1.48
Bull	01/51	02/51	2	72.29%	8.44%	1.12
Bull	05/51	01/53	21	104.86%	136.45%	19.48
Bear	05/53	06/53	2	8.62%	-27.46%	-1.45
Bear	11/53	11/54	13	-23.99%	-49.69%	-18.23
Bear	04/55	05/55	2	-2.65%	-2.08%	-1.29
Bull	02/56	03/56	2	54.53%	13.80%	1.09
Bear	05/57	12/57	8	-27.81%	-36.79%	-11.07
Bull	11/58	03/59	5	80.93%	23.69%	3.61
Bear	08/61	01/63	18	-18.23%	-60.95%	-22.33
Bear	07/63	04/64	10	-27.22%	-25.24%	-10.62
Bear	09/64	06/65	10	-25.43%	-17.59%	-7.45
Bull	11/65	03/66	5	67.68%	34.28%	5.88
Bear	10/66	04/67	7	-8.19%	-25.52%	-3.94
Bear	08/67	12/67	5	-36.35%	-12.45%	-4.84
Bull	06/68	09/68	4	84.94%	39.69%	4.90
Bull	10/69	12/69	3	82.56%	25.19%	2.56
Bear	04/70	12/70	9	-30.82%	-47.91%	-8.42
Bull	03/71	07/71	5	43.09%	25.49%	3.73
Bull	12/71	12/72	13	91.89%	65.72%	11.00
Bear	04/73	10/74	19	-35.45%	-90.77%	-24.73

Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.
Short-run LBBI						
Bear	08/75	09/75	2	-54.27%	2.13%	-1.58
Bull	03/78	04/78	2	24.84%	5.66%	1.33
Bull	09/78	01/79	5	28.20%	15.51%	3.17
Bear	02/82	09/82	8	-21.98%	-15.68%	-5.50
Bull	11/82	04/84	18	29.95%	29.53%	11.07
Bull	03/86	06/86	4	117.53%	27.35%	4.27
Bull	01/87	05/87	5	93.92%	6.82%	3.24
Bear	10/87	01/88	4	-22.05%	-27.23%	-4.23
Bear	02/90	01/91	12	-39.67%	-53.80%	-16.93
Bear	11/91	07/92	9	-45.90%	-32.61%	-8.57
Bull	03/93	08/93	6	49.15%	35.82%	7.03
Bear	11/93	11/93	1	-87.89%	-24.05%	-1.41
Bull	01/94	01/94	1	487.86%	15.43%	1.04
Bull	05/94	06/94	2	33.85%	11.44%	1.43
Bear	01/95	06/95	6	-45.93%	-42.41%	-5.75
Bull	11/95	06/96	8	44.39%	66.63%	7.74
Bear	12/96	03/97	4	-36.79%	-27.87%	-4.23
Bear	08/97	12/97	5	-50.03%	-18.99%	-5.13
Bear	08/98	10/98	3	-55.88%	1.45%	-2.82
Bull	03/99	03/00	13	38.59%	43.84%	12.17
Bear	04/00	03/01	12	-35.49%	-64.69%	-10.48
Bear	07/01	09/01	3	-67.60%	-12.54%	-3.42
Bull	03/02	05/02	3	46.81%	5.90%	2.60
Bear	12/02	01/03	2	-43.33%	-2.56%	-1.11
Bull	06/03	04/04	11	45.06%	79.29%	12.78
Bull	07/05	01/06	7	85.91%	48.07%	7.45
Bear	07/07	02/09	20	-41.02%	-61.07%	-20.56
Bull	05/09	04/10	12	26.42%	62.62%	9.47
Bear	08/10	08/10	1	-61.63%	-7.99%	-1.06
Bull	12/10	02/11	3	33.73%	-0.97%	2.07
Bear	08/11	12/11	5	-29.69%	-19.94%	-3.61
Bull	02/12	03/12	2	112.23%	16.82%	1.89
Bull	11/12	06/13	8	88.71%	51.47%	9.37
Bull	11/13	12/13	2	114.75%	-4.51%	1.59
Bear	04/14	06/14	3	-2.45%	-11.08%	-2.61
Bull	02/15	05/15	4	51.77%	24.50%	2.38
Bear	08/15	09/15	2	-64.11%	-23.88%	-2.15
Medium-run LBBI						
Bull	11/22	04/24	18	-0.12%	16.22%	22.07
Bull	11/24	03/27	29	17.72%	19.66%	34.84
Bear	08/28	11/30	28	-12.61%	-13.29%	-32.31
Bull	01/32	04/34	28	33.86%	27.18%	26.21
Bear	11/34	09/39	59	-4.50%	-31.53%	-113.8
Bear	09/40	01/41	5	-15.69%	-3.14%	-2.87
Bull	01/42	10/43	22	-4.72%	2.15%	16.72
Bear	06/44	12/45	19	-20.58%	-12.89%	-11.70
Bear	07/46	08/47	14	-93.58%	-53.16%	-10.04

Japanese stock market expansions and contractions (continued…)

Phase	Start date	End date	Dur.	Amplitude Δ price	Δ CAGR	Sev.
			Medium-run LBBI			
Bull	01/49	09/53	57	37.86%	112.24%	77.76
Bear	04/54	10/56	31	18.91%	-24.63%	-58.92
Bear	07/57	10/58	16	11.19%	-0.98%	-17.18
Bear	11/61	11/65	49	-4.59%	-32.33%	-101.1
Bear	08/67	02/68	7	-20.75%	-0.23%	-5.46
Bull	08/68	09/68	2	88.80%	0.89%	1.87
Bull	03/69	03/70	13	28.47%	12.44%	10.38
Bear	10/70	01/71	4	-5.08%	0.62%	-3.01
Bear	08/71	11/71	4	-26.14%	-5.04%	-3.45
Bull	02/72	03/73	14	55.02%	10.85%	10.24
Bear	12/73	11/76	36	-12.07%	-32.85%	-53.35
Bull	03/78	01/80	23	9.01%	6.44%	16.63
Bear	02/82	10/82	9	-14.12%	-3.31%	-10.78
Bull	03/83	03/85	25	20.74%	15.63%	15.55
Bull	05/86	08/86	4	72.01%	4.91%	2.40
Bull	01/87	08/87	8	63.63%	11.37%	4.73
Bear	02/90	06/93	41	-18.97%	-37.78%	-84.26
Bull	04/94	06/94	3	37.25%	6.36%	2.17
Bull	12/94	12/94	1	56.76%	0.64%	1.27
Bear	02/95	06/95	5	-44.75%	2.71%	-2.51
Bull	11/95	11/96	13	17.59%	7.08%	14.72
Bear	10/97	02/99	17	-13.83%	-7.67%	-11.73
Bull	09/99	06/00	10	0.55%	0.27%	11.15
Bull	08/00	08/00	1	122.28%	5.59%	1.11
Bear	12/00	02/01	3	-40.36%	-4.49%	-1.88
Bear	05/01	10/02	18	-26.63%	-17.61%	-11.44
Bull	08/03	02/07	43	18.87%	31.62%	52.52
Bear	09/07	02/10	30	-17.61%	-31.11%	-39.41
Bull	04/11	05/11	2	-4.92%	-4.08%	1.36
Bull	01/12	03/12	3	93.17%	8.52%	2.89
Bull	11/12	09/14	23	32.75%	24.55%	23.72
			Long-run LBBI			
Bear	01/22	10/22	10	-16.84%	-18.67%	-6.47
Bull	10/24	09/28	48	9.31%	19.76%	62.94
Bear	07/29	12/31	30	-4.23%	-9.94%	-33.72
Bull	09/32	08/34	24	26.96%	11.45%	20.67
Bear	07/36	10/41	64	-8.16%	-20.21%	-105.0
Bull	10/42	11/42	2	-10.45%	0.16%	1.46
Bear	07/46	05/47	11	-94.22%	-37.87%	-7.44
Bull	08/50	12/53	41	35.25%	73.33%	68.76
Bear	06/56	08/56	3	1.94%	-2.34%	-3.14
Bear	01/57	10/58	22	3.72%	-17.92%	-32.41
Bear	01/63	05/68	65	-4.50%	-25.48%	-166.9
Bull	08/68	03/70	20	21.59%	12.87%	14.34
Bull	06/71	03/73	22	41.79%	18.52%	13.47
Bear	07/74	02/78	44	-4.95%	-17.76%	-90.82
Bull	01/79	07/81	31	4.37%	7.49%	19.74

Phase	Start date	End date	Dur.	Amplitude Δ price	Δ CAGR	Sev.
			Long-run LBBI			
Bear	08/82	10/82	3	-4.79%	-0.46%	-2.53
Bull	12/83	04/84	5	45.16%	2.80%	2.93
Bull	10/84	06/85	9	27.04%	4.52%	4.83
Bull	02/86	08/87	19	55.40%	18.20%	11.56
Bear	08/90	07/95	60	-12.78%	-31.98%	-157.9
Bull	03/96	07/97	17	-0.93%	10.28%	12.42
Bear	03/98	02/99	12	-14.72%	-6.05%	-6.79
Bull	09/99	03/00	7	31.55%	8.08%	5.99
Bear	09/00	09/01	13	-38.92%	-12.89%	-7.58
Bull	01/05	10/07	34	13.99%	23.11%	42.29
Bear	07/08	12/11	42	-11.60%	-20.84%	-52.54
Bull	11/12	08/15	34	27.99%	26.80%	36.67

Table 116: Dutch stock market expansions and contractions

Phase	Start date	End date	Dur.	Amplitude Δ price	Δ CAGR	Sev.
Short-run LBBI						
Bull	01/24	02/24	2	91.99%	2.11%	2.21
Bull	08/24	02/26	19	22.04%	30.52%	16.87
Bull	02/27	03/27	2	53.16%	8.88%	1.98
Bear	06/28	07/28	2	-19.54%	-0.11%	-1.45
Bear	10/29	01/31	16	-32.60%	-34.85%	-14.41
Bear	05/31	10/31	6	-49.72%	-5.09%	-4.83
Bear	04/32	06/32	3	-67.30%	-5.61%	-2.64
Bull	08/32	09/34	26	15.55%	45.17%	25.37
Bull	04/35	06/35	3	26.98%	6.82%	2.42
Bull	01/36	03/36	3	55.04%	6.45%	3.46
Bull	10/36	03/37	6	212.40%	63.63%	8.68
Bear	09/37	02/40	30	-12.57%	-87.54%	-32.15
Bull	09/40	04/41	8	68.01%	50.20%	8.00
Bull	08/41	09/41	2	119.62%	0.03%	2.00
Bear	05/42	11/42	7	-7.97%	-17.76%	-6.60
Bear	01/44	01/45	13	-11.88%	-26.88%	-12.98
Bear	05/46	09/46	5	-74.71%	-43.60%	-9.82
Bull	01/47	03/48	15	36.91%	77.67%	15.27
Bear	06/48	03/49	10	-23.08%	-35.48%	-7.39
Bull	08/49	10/49	3	23.72%	8.29%	2.65
Bear	03/50	05/50	3	-37.09%	-10.12%	-2.39
Bull	01/51	03/51	3	25.99%	11.08%	3.03
Bear	03/52	04/52	2	-30.25%	2.48%	-1.12
Bull	12/52	08/55	33	33.48%	53.05%	26.62
Bear	08/56	02/57	7	-15.50%	-14.26%	-9.19
Bear	08/57	02/58	7	-42.77%	-21.10%	-9.91
Bull	08/58	11/58	4	62.73%	46.91%	3.75
Bull	06/60	06/60	1	174.46%	14.06%	1.22
Bear	10/60	12/60	3	-1.40%	-14.12%	-2.13
Bull	02/61	03/61	2	49.32%	6.15%	1.05
Bear	05/61	11/61	7	-21.94%	-22.91%	-8.58
Bear	04/62	10/62	7	-35.81%	-7.06%	-7.94
Bull	04/63	05/63	2	47.87%	25.40%	1.94
Bear	03/65	12/65	10	-19.77%	-19.06%	-8.02
Bear	03/66	08/66	6	-45.24%	-11.45%	-5.86
Bull	03/67	11/68	21	27.42%	56.39%	19.25
Bear	06/69	06/70	13	-22.96%	-33.01%	-12.91
Bear	11/70	12/70	2	-43.52%	-5.20%	-1.91
Bear	08/71	11/71	4	-53.28%	-13.65%	-4.55
Bull	05/72	08/72	4	49.66%	21.71%	4.73
Bear	05/73	10/74	18	-38.99%	-52.87%	-14.90
Bull	01/75	04/75	4	94.75%	23.22%	4.35
Bull	06/75	08/75	3	6.30%	15.90%	2.81
Bull	11/75	05/76	7	31.78%	-0.89%	8.05
Bear	09/76	10/76	2	-43.20%	-5.14%	-1.73
Bull	04/77	04/77	1	83.22%	6.61%	1.14
Bull	07/78	08/78	2	37.72%	9.96%	1.82

Phase	Start date	End date	Dur.	Amplitude Δ price	Δ CAGR	Sev.
Short-run LBBI						
Bull	08/79	09/79	2	15.68%	1.54%	1.26
Bear	03/80	03/80	1	-67.88%	-11.36%	-1.54
Bull	10/80	02/81	5	24.24%	16.46%	4.70
Bear	09/81	10/81	2	-50.29%	-16.31%	-2.84
Bull	04/82	05/82	2	16.43%	5.94%	1.39
Bull	10/82	08/83	11	64.88%	51.97%	12.41
Bull	12/83	01/84	2	210.19%	15.32%	2.40
Bear	05/84	07/84	3	-31.09%	-21.66%	-2.57
Bull	01/85	02/85	2	99.31%	6.57%	1.64
Bear	10/86	02/87	5	-1.94%	-7.54%	-4.35
Bull	06/87	07/87	2	99.86%	17.32%	1.49
Bear	10/87	01/88	4	-62.23%	-31.66%	-6.84
Bull	01/89	08/89	8	36.16%	3.01%	5.07
Bear	01/90	01/91	13	-18.35%	-36.83%	-14.20
Bull	03/91	04/91	2	68.74%	7.27%	1.16
Bear	11/91	12/91	2	-11.94%	-1.09%	-1.11
Bear	07/92	11/92	5	-15.87%	-1.91%	-4.32
Bull	06/93	01/94	8	53.22%	42.63%	6.97
Bear	05/94	03/95	11	-7.37%	-30.00%	-8.19
Bull	11/95	05/96	7	49.00%	23.15%	4.62
Bull	11/96	07/97	9	96.96%	50.20%	7.23
Bull	02/98	03/98	2	127.70%	9.25%	1.41
Bear	08/98	03/99	8	-13.39%	-20.67%	-10.61
Bear	05/99	07/99	3	-11.82%	-10.31%	-2.29
Bull	12/99	12/99	1	273.42%	6.85%	1.28
Bear	09/00	11/01	15	-27.78%	-48.92%	-20.49
Bear	05/02	03/03	11	-52.00%	-33.19%	-10.84
Bull	07/03	02/04	8	29.15%	63.20%	9.29
Bull	11/04	03/05	5	28.47%	6.81%	4.85
Bull	05/05	03/06	11	38.02%	23.69%	9.43
Bull	04/07	05/07	2	38.81%	14.14%	1.27
Bear	11/07	03/09	17	-48.45%	-64.00%	-19.68
Bull	05/09	04/10	12	42.05%	91.47%	12.54
Bull	12/10	02/11	3	57.83%	8.44%	3.05
Bear	07/11	09/11	3	-56.73%	-24.99%	-4.28
Bull	07/12	01/13	7	18.44%	17.04%	4.39
Bull	09/13	12/13	4	33.34%	7.68%	3.23
Bull	01/15	03/15	3	69.68%	14.15%	3.01
Bear	08/15	09/15	2	-63.49%	-21.82%	-2.72
Medium-run LBBI						
Bull	02/24	12/27	47	6.15%	23.24%	51.55
Bear	09/29	06/32	34	-34.96%	-37.58%	-36.72
Bull	06/33	09/37	52	18.13%	43.95%	66.76
Bear	06/38	11/40	30	3.43%	-13.43%	-49.11
Bull	08/41	02/42	7	20.47%	5.57%	4.42
Bear	03/44	09/47	43	-11.85%	-22.16%	-78.04
Bull	07/49	09/49	3	55.68%	7.29%	2.87

Dutch stock market expansions and contractions (continued…)

Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.
Medium-run LBBI						
Bull	05/53	04/56	36	33.04%	37.33%	40.02
Bear	11/56	03/57	5	9.76%	-6.11%	-3.94
Bear	08/57	07/59	24	2.85%	-16.75%	-61.24
Bear	06/61	08/64	39	-3.05%	-14.51%	-61.54
Bear	02/65	07/67	30	-13.88%	-10.36%	-26.66
Bull	02/68	06/69	17	13.13%	16.98%	20.95
Bear	04/70	04/72	25	-10.79%	-19.66%	-24.79
Bear	11/73	12/74	14	-36.18%	-6.75%	-9.86
Bull	12/75	12/77	25	-3.18%	19.91%	29.77
Bull	02/78	09/78	8	5.03%	3.56%	7.51
Bull	08/79	10/79	3	-5.28%	4.30%	2.88
Bull	10/80	02/81	5	24.24%	4.49%	5.25
Bear	09/81	09/81	1	-84.23%	-3.76%	-1.03
Bull	12/82	02/85	27	38.42%	33.86%	29.01
Bear	10/87	03/89	18	-1.36%	-10.22%	-56.41
Bear	06/89	07/89	2	38.20%	3.18%	-1.14
Bear	01/90	01/93	37	-2.89%	-8.47%	-46.90
Bull	10/93	02/94	5	40.75%	2.13%	3.70
Bull	11/96	07/97	9	96.96%	19.91%	5.91
Bull	12/97	05/98	6	72.67%	10.07%	3.40
Bear	07/99	12/03	54	-12.21%	-44.64%	-97.64
Bull	12/04	06/07	31	20.38%	28.71%	32.20
Bear	01/08	02/10	26	-20.39%	-27.62%	-33.49
Bull	12/10	05/11	6	9.65%	2.96%	4.36
Bull	11/11	12/11	2	14.07%	4.02%	1.27
Bull	07/13	07/15	25	17.07%	11.88%	21.69
Long-run LBBI						
Bear	01/24	09/24	9	2.48%	-13.93%	-6.06
Bull	09/25	03/29	43	8.31%	16.16%	50.60
Bear	12/29	03/33	40	-20.76%	-20.61%	-43.51
Bull	02/35	03/38	38	18.55%	27.02%	49.27
Bear	04/40	09/41	18	34.87%	6.18%	-21.79
Bear	02/42	07/42	6	-6.33%	-1.25%	-4.74
Bear	02/45	06/49	53	-11.41%	-20.11%	-75.12
Bull	12/50	03/51	4	12.97%	0.72%	3.15
Bull	11/53	06/57	44	26.68%	27.24%	51.42
Bear	05/58	07/58	3	21.10%	-0.03%	-1.94
Bear	02/59	04/60	15	8.61%	-8.99%	-10.33
Bear	10/60	12/60	3	-1.40%	-0.08%	-2.11
Bear	06/61	11/67	78	-5.36%	-9.02%	-127.9
Bull	09/68	05/69	9	11.87%	1.47%	11.57
Bull	10/69	11/69	2	15.62%	0.73%	1.50
Bull	07/70	10/70	4	32.88%	2.05%	3.47
Bull	04/71	05/71	2	9.64%	1.31%	1.41
Bear	09/71	04/72	8	-9.01%	-3.62%	-5.64
Bear	09/72	12/74	28	-27.70%	-17.11%	-17.94
Bull	02/78	02/80	25	-2.99%	8.73%	31.99

Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.
Long-run LBBI						
Bull	09/80	02/81	6	17.00%	-0.83%	5.82
Bull	12/82	08/86	45	28.38%	22.79%	44.13
Bear	11/87	03/89	17	19.08%	-5.72%	-18.72
Bear	10/89	07/93	46	1.29%	-4.93%	-85.60
Bull	04/96	06/96	3	36.49%	1.62%	1.56
Bull	11/96	07/97	9	96.96%	12.02%	5.41
Bull	02/98	03/98	2	127.70%	1.56%	1.19
Bear	01/01	08/05	56	-11.00%	-32.08%	-135.5
Bull	01/06	01/06	1	77.85%	0.88%	1.04
Bull	07/06	05/08	23	5.32%	17.20%	22.21
Bear	09/08	12/11	40	-9.06%	-14.42%	-41.46
Bull	10/12	08/15	35	9.34%	15.99%	34.78

Table 117: Norwegian stock market expansions and contractions

Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.
Short-run LBBI						
Bull	01/22	06/24	30	14.31%	21.35%	31.34
Bear	12/24	03/25	4	-21.41%	-10.33%	-3.39
Bull	09/25	01/26	5	17.76%	12.24%	4.11
Bull	01/27	05/27	5	25.76%	8.93%	4.18
Bear	01/28	02/28	2	-27.22%	-11.40%	-1.84
Bear	11/29	11/30	13	-13.34%	-17.94%	-12.30
Bear	04/31	09/31	6	-26.21%	-6.66%	-5.14
Bear	03/32	06/32	4	-41.51%	-6.96%	-3.69
Bull	08/32	02/34	19	27.73%	36.30%	15.96
Bull	01/35	02/35	2	57.92%	1.99%	1.92
Bull	08/35	02/36	7	37.46%	8.50%	4.73
Bull	11/36	01/37	3	75.91%	11.93%	2.74
Bear	09/37	07/38	11	-19.76%	-41.20%	-14.58
Bear	07/39	08/39	2	-1.27%	-7.29%	-1.28
Bull	09/39	09/39	1	508.53%	13.07%	2.45
Bear	12/39	07/40	8	-22.88%	-11.28%	-8.52
Bull	03/41	08/41	6	52.85%	17.94%	6.17
Bear	06/44	12/44	7	-4.33%	-9.73%	-5.39
Bear	06/45	11/45	6	-34.81%	-16.45%	-7.77
Bear	10/46	12/46	3	-30.01%	-15.96%	-3.16
Bull	11/47	06/48	8	24.79%	21.24%	7.08
Bear	03/49	08/49	6	-23.72%	-16.74%	-6.12
Bull	08/50	09/50	2	31.15%	-0.05%	1.76
Bull	01/51	02/51	2	36.26%	5.66%	1.56
Bear	04/51	09/51	6	-23.26%	-18.12%	-5.00
Bear	03/52	07/52	5	-21.96%	3.96%	-3.35
Bull	02/54	03/55	14	17.04%	24.04%	11.78
Bull	03/56	04/56	2	49.05%	5.81%	1.70
Bull	08/56	09/56	2	87.86%	7.51%	2.25
Bear	07/57	06/58	12	-29.90%	-40.26%	-13.11
Bull	01/59	02/60	14	10.01%	19.52%	10.31
Bull	08/60	04/61	9	15.60%	5.79%	5.78
Bear	10/61	04/63	19	-22.05%	-29.16%	-15.12
Bull	08/63	01/64	6	19.31%	19.12%	6.53
Bear	05/65	07/65	3	-22.09%	-3.97%	-1.94
Bear	05/66	10/66	6	-20.47%	-6.38%	-3.27
Bear	04/67	05/67	2	-40.17%	-4.63%	-1.63
Bull	06/68	11/70	30	25.51%	51.11%	27.49
Bear	04/71	05/72	14	-28.68%	-65.83%	-14.34
Bull	01/73	08/73	8	89.05%	35.57%	8.79
Bear	12/73	12/73	1	-66.56%	-13.32%	-1.05
Bear	02/74	04/75	15	-46.10%	-86.06%	-16.87
Bear	10/75	12/75	3	-35.65%	-1.47%	-1.77
Bull	01/76	08/76	8	21.68%	18.07%	4.62
Bear	04/77	11/77	8	-37.88%	-20.36%	-5.12
Bull	08/78	12/79	17	35.89%	73.18%	22.12
Bear	03/80	02/81	12	-19.44%	-58.27%	-8.23
Short-run LBBI						
Bull	08/81	11/81	4	47.09%	15.02%	4.56
Bear	03/82	12/82	10	-25.34%	-24.38%	-7.51
Bull	02/83	04/84	15	74.71%	65.33%	15.18
Bear	06/84	07/84	2	-57.91%	-36.15%	-1.54
Bear	11/84	12/84	2	-25.76%	-15.95%	-2.33
Bear	03/85	03/85	1	-57.77%	-10.58%	-1.21
Bull	10/85	11/85	2	133.89%	20.91%	2.41
Bear	02/86	01/87	12	-8.89%	-17.11%	-10.93
Bull	03/87	09/87	7	74.14%	42.89%	6.11
Bear	10/87	02/88	5	-71.71%	-59.99%	-6.13
Bull	11/88	05/89	7	120.79%	71.24%	7.61
Bear	10/89	11/89	2	-31.52%	-20.46%	-2.15
Bull	01/90	02/90	2	145.25%	-1.61%	1.43
Bear	08/90	02/91	7	-44.81%	-50.87%	-10.65
Bear	10/91	09/92	12	-42.06%	-35.59%	-13.74
Bull	03/93	02/94	12	57.08%	71.62%	12.17
Bear	09/94	03/95	7	-18.28%	-19.75%	-6.26
Bull	04/96	05/96	2	49.39%	-0.94%	1.76
Bull	10/96	07/97	10	60.68%	46.20%	7.73
Bear	11/97	02/98	4	-7.10%	-27.42%	-2.89
Bear	05/98	12/98	8	-45.74%	-48.86%	-13.09
Bull	08/99	09/99	2	24.40%	44.12%	1.46
Bull	11/99	12/99	2	166.35%	30.91%	2.37
Bull	06/00	08/00	3	113.02%	16.84%	2.90
Bear	11/00	10/01	12	-33.64%	-71.66%	-14.32
Bear	05/02	02/03	10	-49.35%	-26.84%	-9.61
Bull	05/03	02/04	10	84.46%	126.60%	12.30
Bull	11/04	02/05	4	75.42%	-3.93%	2.95
Bull	06/05	09/05	4	100.86%	13.33%	3.24
Bear	08/06	09/06	2	-26.79%	-15.35%	-1.98
Bull	12/06	01/07	2	113.30%	-0.29%	1.13
Bear	11/07	02/09	16	-49.83%	-76.68%	-22.99
Bull	05/09	01/10	9	55.53%	101.09%	7.56
Bear	05/10	06/10	2	-63.46%	-31.79%	-1.97
Bull	12/10	12/10	1	195.00%	2.94%	1.23
Bear	06/11	12/11	7	-20.93%	-36.71%	-7.70
Bear	05/12	05/12	1	-76.83%	-7.62%	-1.53
Bull	08/12	09/12	2	33.72%	24.63%	1.44
Bull	10/13	12/13	3	42.20%	12.35%	2.19
Bull	05/14	06/14	2	24.94%	10.98%	1.11
Bear	10/14	12/14	3	-24.29%	-16.58%	-3.83
Bear	08/15	09/15	2	-49.47%	-9.89%	-3.39
Medium-run LBBI						
Bull	07/22	02/25	32	3.88%	26.51%	42.28
Bull	11/25	01/26	3	11.63%	1.22%	1.90
Bull	11/26	12/27	14	10.50%	4.11%	9.80
Bear	03/30	08/32	30	-12.03%	-15.40%	-38.60

Norwegian stock market expansions and contractions (continued…)

Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.
			Medium-run LBBI			
Bull	06/33	05/36	36	14.52%	19.21%	32.69
Bull	11/36	04/37	6	50.54%	6.42%	3.70
Bear	03/38	03/41	37	-0.24%	-8.95%	-60.33
Bull	06/42	09/42	4	35.46%	-1.56%	2.29
Bear	10/44	12/44	3	-5.47%	1.21%	-2.05
Bear	06/45	10/47	29	-9.06%	-11.34%	-38.14
Bull	05/48	01/49	9	6.79%	3.62%	6.09
Bear	06/49	08/49	3	-25.15%	-1.65%	-2.00
Bear	05/51	08/53	28	-9.47%	-7.33%	-17.06
Bull	09/54	03/57	31	13.06%	14.41%	31.86
Bear	09/57	07/59	23	-12.10%	-15.29%	-29.16
Bull	08/60	12/61	17	4.96%	12.68%	15.55
Bear	04/62	10/63	19	-13.57%	-10.63%	-17.70
Bull	08/68	06/71	35	12.51%	21.15%	46.32
Bear	12/71	03/73	16	9.65%	0.04%	-16.48
Bull	05/73	06/73	2	271.45%	9.37%	2.27
Bear	06/74	06/76	25	-24.79%	-24.49%	-29.73
Bull	04/79	08/81	29	6.99%	18.70%	43.12
Bear	06/82	12/82	7	-32.51%	-12.34%	-5.28
Bull	04/83	01/85	22	36.75%	23.82%	24.46
Bear	04/86	05/87	14	9.99%	-16.68%	-17.53
Bear	10/87	12/88	15	-18.37%	-17.35%	-31.87
Bull	04/89	05/90	14	23.22%	5.04%	9.85
Bear	11/90	07/93	33	-6.61%	-26.20%	-52.42
Bull	12/93	02/94	3	119.45%	8.82%	3.73
Bull	07/94	08/94	2	62.42%	1.83%	1.32
Bull	11/94	02/95	4	8.33%	6.96%	3.38
Bull	11/96	04/98	18	31.35%	16.27%	11.18
Bear	08/98	07/00	24	5.10%	-14.26%	-38.55
Bear	03/01	09/03	31	-16.10%	-18.78%	-38.68
Bull	01/04	04/06	28	36.03%	51.42%	28.51
Bear	01/08	06/10	30	-18.48%	-38.67%	-52.26
Bear	08/11	09/11	2	-65.53%	4.10%	-1.54
Bear	04/12	12/12	9	-1.17%	-16.79%	-6.51
Bull	05/14	06/14	2	24.94%	4.11%	1.28
Bear	08/15	09/15	2	-49.47%	-5.62%	-2.41
			Long-run LBBI			
Bear	01/22	11/22	11	23.11%	-20.26%	-7.81
Bull	03/24	03/29	61	4.52%	16.31%	64.77
Bear	07/30	08/33	38	-0.93%	-5.28%	-51.96
Bull	10/34	07/37	34	19.36%	20.98%	30.00
Bear	12/39	09/42	34	6.60%	-6.82%	-71.90
Bear	08/45	02/50	55	-1.75%	-10.12%	-83.91
Bull	02/51	03/51	2	4.63%	0.47%	1.07
Bear	07/51	08/51	2	-10.22%	0.14%	-1.32
Bear	02/52	09/53	20	-9.48%	-5.27%	-13.14
Bull	11/54	08/57	34	6.05%	6.53%	38.20

Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.
			Long-run LBBI			
Bear	02/58	12/60	35	0.61%	-2.67%	-35.19
Bear	10/62	07/63	10	-14.19%	2.17%	-5.87
Bear	05/64	06/64	2	-19.65%	-0.86%	-1.04
Bull	10/69	08/72	35	5.73%	10.15%	43.44
Bull	10/72	10/72	1	-6.06%	0.32%	0.63
Bull	12/72	11/73	12	44.10%	6.84%	8.99
Bear	04/74	04/78	49	-26.27%	-29.22%	-51.82
Bull	10/79	06/86	81	7.17%	22.91%	88.83
Bear	11/87	12/88	14	9.12%	-8.82%	-42.19
Bear	11/90	03/91	5	-3.77%	2.57%	-7.58
Bear	08/91	05/95	46	-2.35%	-15.35%	-81.51
Bull	01/96	12/97	24	26.32%	17.49%	16.68
Bear	09/98	03/99	7	9.24%	-0.65%	-7.59
Bear	01/01	12/03	36	-8.87%	-9.06%	-75.13
Bear	04/04	08/04	5	4.44%	-1.83%	-3.76
Bull	02/05	03/05	2	34.48%	-0.06%	1.48
Bull	06/05	10/07	29	28.89%	25.96%	23.31
Bear	09/08	06/12	46	-6.17%	-25.75%	-178.5
Bull	09/13	12/13	4	29.86%	15.61%	3.05
Bear	08/15	09/15	2	-49.47%	-3.56%	-1.89

Table 118: Swedish stock market expansions and contractions

Phase	Start date	End date	Dur.	Amplitude		Sev.
				Δ price	Δ CAGR	
Short-run LBBI						
Bull	01/22	01/22	1	160.69%	-5.99%	1.29
Bull	04/22	10/22	7	34.49%	20.94%	9.91
Bull	02/23	10/23	9	4.28%	5.92%	6.99
Bull	01/24	08/24	8	30.74%	18.31%	8.95
Bull	12/24	07/26	20	27.83%	16.45%	15.35
Bull	08/27	03/28	8	49.32%	31.02%	5.53
Bear	03/29	05/32	39	-33.13%	-82.38%	-40.92
Bull	03/33	04/34	14	34.56%	53.05%	16.16
Bull	09/34	01/35	5	39.65%	-1.05%	4.35
Bull	06/35	07/35	2	36.18%	6.28%	1.13
Bull	02/36	07/36	6	36.14%	14.56%	4.15
Bull	11/36	12/36	2	46.50%	5.19%	1.35
Bear	04/37	06/38	15	-11.88%	-31.28%	-14.35
Bear	08/39	02/40	7	-51.04%	-36.07%	-9.47
Bear	04/40	05/40	2	-66.55%	-13.88%	-1.75
Bull	11/40	12/40	2	76.23%	12.82%	1.86
Bull	04/41	08/42	17	18.20%	31.64%	14.52
Bull	09/43	03/44	7	12.10%	13.22%	4.60
Bull	10/44	02/45	5	33.64%	12.33%	3.92
Bear	11/45	12/45	2	-9.55%	-3.90%	-1.52
Bear	09/47	10/48	14	-20.08%	-13.42%	-12.55
Bull	09/49	12/50	16	20.71%	21.66%	12.71
Bull	08/51	09/51	2	59.82%	3.49%	1.50
Bear	11/51	06/52	8	-27.00%	-25.84%	-8.36
Bear	11/52	12/52	2	-23.87%	-0.25%	-1.38
Bull	07/53	08/54	14	29.48%	29.64%	12.19
Bear	04/55	12/56	21	-10.08%	-26.57%	-18.29
Bull	05/57	05/57	1	49.62%	4.36%	0.91
Bear	09/57	03/58	7	-15.92%	-8.19%	-4.94
Bull	06/58	08/59	15	33.72%	39.57%	12.08
Bear	03/60	06/60	4	-2.65%	-15.96%	-3.76
Bear	12/60	03/61	4	-8.23%	5.06%	-2.94
Bear	09/61	12/62	16	-15.49%	-15.43%	-15.51
Bull	04/63	08/63	5	32.02%	17.09%	4.62
Bull	01/65	01/65	1	189.19%	3.70%	1.77
Bear	09/65	12/66	16	-23.88%	-36.58%	-16.74
Bull	07/67	08/67	2	44.91%	16.05%	1.69
Bull	04/68	05/69	14	38.87%	32.58%	13.34
Bear	07/69	10/70	16	-32.14%	-60.52%	-15.46
Bull	05/71	07/71	3	19.61%	-2.55%	2.34
Bull	10/71	08/72	11	19.58%	15.34%	8.44
Bear	08/73	12/73	5	-23.02%	-7.60%	-4.60
Bull	03/74	04/74	2	24.22%	3.29%	1.31
Bear	08/74	12/74	5	-39.47%	-9.27%	-5.31
Bull	06/75	10/75	5	22.52%	18.76%	3.75
Bull	03/76	04/76	2	90.87%	11.22%	2.81
Bear	08/76	01/77	6	-37.11%	-25.88%	-6.14
Bear	06/77	11/77	6	-47.09%	-8.76%	-5.96
Bull	03/78	09/78	7	21.29%	29.47%	7.16
Bull	01/79	01/79	1	141.97%	0.30%	1.20
Bull	06/80	07/80	2	5.22%	2.37%	1.13
Bull	11/80	11/81	13	53.36%	51.12%	14.21
Bear	03/82	06/82	4	-14.92%	-28.14%	-3.39
Bull	10/82	04/83	7	171.35%	87.34%	7.78
Bear	04/84	09/85	18	-18.82%	-34.71%	-29.09
Bull	11/85	07/86	9	100.50%	81.77%	8.19
Bear	01/87	01/87	1	-81.07%	-20.61%	-1.97
Bear	10/87	04/88	7	-28.04%	-35.49%	-9.98
Bull	12/88	01/89	2	83.33%	-4.84%	1.24
Bear	10/89	12/90	15	-33.37%	-71.03%	-21.41
Bear	09/91	12/91	4	-44.61%	10.25%	-3.94
Bear	06/92	10/92	5	-57.00%	-19.50%	-6.04
Bull	02/93	01/94	12	75.67%	88.10%	11.86
Bear	08/94	03/95	8	-3.44%	-17.27%	-5.95
Bull	06/95	07/95	2	62.20%	9.92%	1.33
Bull	09/96	07/97	11	63.93%	50.46%	6.99
Bear	10/97	01/98	4	-9.71%	-33.08%	-2.76
Bear	08/98	03/99	8	-9.19%	-18.41%	-9.96
Bull	10/99	02/00	5	243.50%	52.11%	5.27
Bear	08/00	10/01	15	-35.07%	-86.19%	-21.78
Bear	04/02	09/02	6	-67.02%	-29.31%	-8.10
Bear	12/02	03/03	4	-49.97%	-13.41%	-2.34
Bull	06/03	02/04	9	55.18%	74.21%	10.78
Bull	11/04	12/04	2	51.95%	3.94%	1.61
Bull	05/05	07/05	3	78.77%	17.48%	2.47
Bull	11/05	03/06	5	64.65%	11.25%	3.53
Bull	12/06	01/07	2	99.96%	4.52%	1.46
Bear	08/07	01/09	18	-40.54%	-69.21%	-22.61
Bull	04/09	04/10	13	58.33%	75.23%	11.66
Bear	06/11	12/11	7	-27.09%	-33.59%	-8.92
Bull	01/13	03/13	3	41.78%	-1.05%	2.85
Bull	09/13	12/13	4	33.46%	4.14%	2.31
Bull	01/15	02/15	2	152.76%	11.88%	2.42
Bear	08/15	09/15	2	-52.37%	-14.28%	-2.63
Medium-run LBBI						
Bull	05/22	12/26	56	11.72%	31.98%	77.00
Bull	09/27	03/28	7	42.86%	5.98%	3.71
Bull	08/28	09/28	2	89.81%	2.38%	1.04
Bear	11/29	03/33	41	-23.67%	-43.14%	-68.76
Bull	09/33	03/37	43	19.42%	38.12%	39.62
Bear	03/38	06/41	40	-13.37%	-21.41%	-53.58
Bull	01/42	01/46	49	7.87%	22.45%	42.16
Bear	09/47	08/49	24	-11.45%	-13.78%	-32.05
Bull	04/50	10/51	19	10.89%	13.96%	15.85

Swedish stock market expansions and contractions (continued…)

Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.
Medium-run LBBI						
Bear	03/52	08/53	18	-4.08%	-6.84%	-18.75
Bull	03/54	08/55	18	13.75%	11.57%	13.78
Bear	02/56	04/58	27	-4.28%	-14.35%	-30.43
Bull	01/59	09/60	21	20.91%	13.33%	15.04
Bear	11/61	11/63	25	-0.39%	-10.81%	-41.09
Bull	12/64	01/65	2	96.02%	5.81%	1.42
Bear	02/66	03/68	26	-10.14%	-17.49%	-33.69
Bull	10/68	12/69	15	6.29%	14.04%	13.52
Bear	04/70	09/71	18	-9.85%	-9.62%	-19.21
Bull	03/72	04/72	2	51.06%	0.64%	1.54
Bull	08/72	08/73	13	-3.41%	8.04%	10.89
Bear	08/74	01/75	6	-20.09%	-5.59%	-5.52
Bull	03/76	07/76	5	17.38%	1.94%	4.55
Bear	10/76	10/76	1	-67.91%	-3.63%	-1.32
Bear	01/77	01/77	1	-55.28%	-3.98%	-1.16
Bear	06/77	06/78	13	-12.67%	-2.62%	-9.70
Bull	11/80	03/84	41	40.08%	38.87%	42.43
Bear	09/84	04/86	20	17.05%	-14.67%	-43.19
Bear	11/87	12/88	14	21.92%	4.86%	-14.13
Bear	02/90	03/93	38	-12.35%	-26.69%	-73.18
Bull	07/93	01/95	19	20.72%	23.69%	16.67
Bull	11/96	07/97	9	69.10%	15.26%	5.04
Bear	09/98	03/99	7	15.99%	0.00%	-4.52
Bear	12/00	11/03	36	-15.29%	-32.55%	-78.02
Bull	11/04	04/06	18	33.91%	29.29%	14.59
Bull	09/06	10/06	2	69.91%	1.76%	1.12
Bear	12/07	12/09	25	-9.49%	-23.53%	-47.78
Bull	12/10	04/11	5	13.16%	6.27%	4.02
Bear	08/11	12/12	17	0.69%	-2.26%	-15.88
Bull	02/14	03/14	2	33.54%	2.22%	1.37
Bull	11/14	04/15	6	40.95%	3.87%	3.47
Long-run LBBI						
Bear	01/22	04/22	4	8.03%	-23.61%	-2.91
Bull	02/24	12/28	59	20.36%	30.15%	67.58
Bear	08/30	09/34	50	-12.51%	-26.00%	-84.09
Bull	04/35	08/37	29	14.58%	24.48%	29.64
Bear	08/39	02/43	43	-9.16%	-14.37%	-60.30
Bull	10/43	01/47	40	8.54%	11.84%	37.07
Bear	02/48	10/50	33	2.57%	-3.71%	-54.74
Bull	09/51	10/51	2	2.69%	0.52%	1.68
Bear	03/52	04/52	2	-49.96%	-2.13%	-1.19
Bull	03/54	01/55	11	27.56%	3.55%	7.35
Bear	10/57	03/59	18	9.83%	-0.24%	-17.07
Bull	05/59	12/59	8	41.81%	1.19%	4.66
Bull	04/61	05/61	2	53.76%	1.66%	1.12
Bear	09/62	12/64	28	10.66%	-2.70%	-28.78
Bear	02/66	10/68	33	-2.45%	-2.12%	-52.61

Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.
Long-run LBBI						
Bull	04/69	05/69	2	43.19%	1.69%	1.76
Bear	08/69	01/71	18	-20.76%	-7.33%	-15.05
Bull	12/71	04/72	5	21.07%	1.24%	3.67
Bull	02/74	04/74	3	32.69%	0.37%	2.43
Bull	02/75	07/76	18	11.08%	6.41%	16.56
Bear	10/76	02/78	17	-20.08%	-8.86%	-12.97
Bull	02/81	07/84	42	32.00%	28.83%	50.48
Bear	11/87	05/88	7	17.38%	-9.43%	-7.98
Bear	03/90	02/95	60	0.38%	-17.15%	-190.4
Bull	08/95	07/97	24	35.78%	25.90%	15.92
Bear	02/01	06/05	53	-5.18%	-30.11%	-167.5
Bull	02/06	09/07	20	12.82%	23.34%	14.64
Bear	06/08	12/11	43	-2.87%	-20.15%	-112.2
Bear	05/12	05/12	1	-62.52%	-1.78%	-1.13
Bull	12/12	12/13	13	23.20%	17.05%	8.06
Bull	01/15	02/15	2	152.76%	3.25%	1.34

Table 119: Swiss stock market expansions and contractions

Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.
Short-run LBBI						
Bull	02/22	07/23	18	34.66%	18.14%	20.07
Bull	01/24	02/24	2	60.70%	6.87%	1.52
Bear	06/24	07/24	2	-12.29%	-1.27%	-1.26
Bull	01/25	02/25	2	27.99%	-4.02%	1.33
Bull	07/25	08/25	2	28.50%	2.07%	1.09
Bull	01/26	04/26	4	38.92%	9.29%	2.90
Bull	01/27	02/27	2	73.69%	1.09%	1.34
Bear	10/28	12/29	15	-12.23%	-23.19%	-18.46
Bear	06/30	12/30	7	-25.70%	-7.59%	-6.88
Bear	05/31	12/31	8	-54.51%	-26.68%	-9.04
Bear	04/32	05/32	2	-75.35%	-9.45%	-2.30
Bull	08/32	08/33	13	26.83%	49.52%	15.54
Bull	01/34	02/34	2	94.25%	8.35%	2.42
Bear	09/34	11/34	3	-19.06%	-1.02%	-2.32
Bear	04/35	12/35	9	-19.24%	-6.78%	-6.94
Bull	02/36	02/37	13	55.22%	64.84%	14.74
Bear	10/37	12/37	3	-2.56%	-48.62%	-3.65
Bear	03/38	04/38	2	-22.51%	-3.30%	-1.55
Bear	09/38	09/38	1	-77.09%	-8.71%	-1.60
Bear	01/39	11/40	23	-21.48%	-24.48%	-23.52
Bull	05/41	11/41	7	19.90%	22.79%	7.27
Bull	01/42	02/42	2	44.13%	8.23%	1.60
Bear	05/42	07/42	3	-17.17%	-9.78%	-2.15
Bear	05/43	06/43	2	-24.82%	-1.63%	-1.27
Bear	11/43	12/43	2	-22.15%	-4.10%	-1.36
Bull	06/44	08/44	3	46.63%	11.32%	3.32
Bull	08/45	06/46	11	34.94%	33.54%	10.41
Bear	10/46	12/46	3	-8.73%	-8.47%	-2.25
Bear	11/47	03/49	17	-11.85%	-15.15%	-13.42
Bull	07/49	04/50	10	18.15%	18.28%	7.15
Bull	02/51	04/51	3	21.83%	1.50%	1.70
Bear	05/52	06/52	2	-20.07%	0.32%	-1.24
Bull	01/54	01/55	13	25.09%	17.39%	7.13
Bear	10/55	01/56	4	-7.65%	-12.81%	-3.34
Bear	08/56	10/57	15	-23.09%	-29.32%	-15.16
Bull	06/58	04/59	11	34.25%	43.58%	9.52
Bull	07/59	08/59	2	272.29%	23.12%	3.37
Bull	05/60	06/61	14	60.17%	28.12%	9.08
Bear	08/61	10/61	3	11.18%	-8.86%	-2.44
Bear	04/62	10/64	31	-22.19%	-39.32%	-30.61
Bear	03/65	07/65	5	-37.00%	-9.33%	-4.54
Bear	04/66	08/66	5	-32.57%	-12.75%	-3.32
Bull	02/67	05/69	28	27.70%	44.64%	24.35
Bear	07/69	09/69	3	-21.71%	-6.70%	-3.38
Bear	11/69	11/70	13	-21.56%	-32.02%	-11.94
Bull	03/71	04/71	2	52.32%	18.08%	2.22
Bull	06/71	07/71	2	41.27%	1.31%	1.19

Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.
Short-run LBBI						
Bear	09/71	10/71	2	-53.77%	-7.79%	-2.03
Bull	01/72	05/72	5	52.71%	12.45%	4.58
Bull	07/72	08/72	2	79.76%	8.83%	1.59
Bear	11/72	12/74	26	-34.22%	-63.45%	-23.02
Bull	01/75	08/76	20	22.31%	54.02%	18.28
Bull	12/76	04/77	5	19.89%	4.52%	4.04
Bull	08/77	01/78	6	22.13%	7.31%	4.57
Bear	09/78	10/78	2	-33.51%	-9.32%	-1.66
Bull	01/79	04/79	4	22.84%	14.76%	3.79
Bear	03/80	04/80	2	-33.52%	-7.07%	-2.49
Bear	03/81	10/81	8	-27.86%	-18.50%	-6.86
Bull	10/82	01/84	16	27.49%	24.41%	15.08
Bear	06/84	07/84	2	-13.26%	-7.38%	-1.29
Bull	01/85	04/86	16	40.39%	47.52%	11.92
Bear	07/86	07/86	1	-57.66%	-11.33%	-1.17
Bear	01/87	06/87	6	-13.14%	-7.44%	-8.05
Bear	10/87	01/88	4	-73.81%	-43.55%	-6.95
Bull	09/88	08/89	12	29.69%	54.17%	8.78
Bear	01/90	04/90	4	-27.66%	-18.01%	-4.47
Bear	07/90	12/90	6	-45.26%	-27.01%	-7.31
Bull	02/91	08/91	7	27.09%	24.19%	3.43
Bull	04/92	05/92	2	25.68%	0.39%	1.21
Bull	12/92	01/94	14	54.77%	46.85%	12.87
Bear	06/94	04/95	11	-8.85%	-31.30%	-12.15
Bull	09/95	03/96	7	38.54%	32.77%	4.68
Bull	01/97	07/97	7	94.45%	48.25%	6.11
Bull	12/97	03/98	4	118.02%	14.65%	2.92
Bear	08/98	02/00	19	-7.03%	-32.21%	-21.78
Bear	01/01	11/01	11	-27.32%	-32.65%	-15.76
Bear	06/02	03/03	10	-43.19%	-24.92%	-10.57
Bull	06/03	02/04	9	38.26%	71.09%	10.69
Bull	01/05	03/06	15	31.27%	30.47%	11.02
Bear	07/07	02/09	20	-34.24%	-61.50%	-23.89
Bull	07/09	03/10	9	37.50%	61.40%	9.61
Bear	05/10	06/10	2	-36.99%	-12.98%	-1.30
Bear	06/11	09/11	4	-40.90%	-18.17%	-4.64
Bull	02/12	03/12	2	21.59%	5.46%	1.11
Bull	07/12	05/13	11	32.68%	37.38%	10.11
Bear	01/15	01/15	1	-54.28%	-7.13%	-1.09
Bear	08/15	09/15	2	-44.02%	-14.53%	-2.08
Medium-run LBBI						
Bull	02/22	05/24	28	21.92%	30.32%	38.72
Bear	03/29	12/32	46	-12.77%	-24.90%	-82.28
Bull	09/33	12/34	16	-2.59%	16.19%	15.07
Bear	09/35	01/36	5	-3.81%	-3.58%	-3.59
Bear	07/36	08/36	2	-10.50%	-1.11%	-1.32
Bull	10/36	03/38	18	34.34%	16.06%	18.15

Swiss stock market expansions and contractions (continued…)

Phase	Start date	End date	Dur.	Amplitude Δ price	Δ CAGR	Sev.
Medium-run LBBI						
Bear	01/39	08/41	32	-12.67%	-35.67%	-52.27
Bear	02/44	03/44	2	-4.50%	-1.21%	-1.05
Bull	08/45	05/47	22	15.34%	11.08%	21.84
Bear	02/48	09/49	20	-4.97%	-11.76%	-25.04
Bull	12/50	01/52	14	14.54%	8.93%	8.65
Bull	10/54	12/54	3	35.34%	1.90%	1.71
Bear	09/56	12/58	28	-1.93%	-10.86%	-41.43
Bull	07/59	06/61	24	48.35%	36.70%	18.65
Bear	06/62	12/66	55	-18.10%	-44.31%	-100.2
Bull	10/67	11/69	26	15.53%	29.60%	35.36
Bear	04/70	01/72	22	-0.86%	-17.28%	-27.78
Bear	02/73	05/75	28	-23.35%	-20.73%	-26.74
Bull	01/76	10/79	46	1.84%	20.64%	48.31
Bear	03/80	03/80	1	-65.58%	-3.21%	-1.10
Bear	01/81	09/82	21	-16.93%	-10.95%	-16.29
Bull	02/83	11/86	46	18.40%	25.89%	42.72
Bear	10/87	04/90	31	-9.69%	-24.35%	-54.04
Bear	07/90	01/92	19	-10.22%	-0.93%	-21.57
Bear	06/92	08/92	3	-31.82%	-8.71%	-2.24
Bull	02/93	05/94	16	24.76%	13.15%	14.75
Bear	03/95	07/95	5	20.21%	4.06%	-2.90
Bull	02/97	07/98	18	50.13%	30.02%	10.82
Bear	07/99	12/03	54	-5.23%	-34.40%	-113.0
Bull	12/04	04/07	29	25.90%	22.36%	22.53
Bear	01/08	02/10	26	-11.07%	-23.84%	-42.89
Bull	04/11	05/11	2	12.68%	-0.22%	1.19
Bear	08/11	09/11	2	-30.37%	0.26%	-1.10
Bull	11/12	09/14	23	16.99%	15.82%	20.24
Long-run LBBI						
Bear	01/22	05/22	5	78.19%	-14.17%	-3.51
Bull	03/23	08/26	42	13.79%	22.74%	42.93
Bear	11/29	10/34	60	-5.46%	-15.52%	-93.85
Bull	09/35	12/38	40	18.07%	17.24%	36.24
Bear	04/40	12/43	45	-5.52%	-13.39%	-54.93
Bull	07/44	11/44	5	-0.23%	2.62%	3.20
Bull	08/45	01/48	30	11.07%	3.72%	32.38
Bear	07/50	08/50	2	-6.22%	-0.73%	-1.92
Bull	02/53	03/53	2	-5.49%	1.89%	1.04
Bear	07/57	06/59	24	5.30%	-1.72%	-44.82
Bull	05/60	03/62	23	36.70%	12.95%	14.69
Bear	07/63	08/67	50	-13.12%	-26.00%	-104.9
Bull	09/68	08/71	36	0.38%	14.00%	50.83
Bear	10/72	09/75	36	-22.74%	-18.15%	-40.28
Bull	11/77	12/80	38	-0.87%	10.70%	50.65
Bear	05/81	09/82	17	-15.59%	-6.11%	-11.46
Bull	10/83	01/87	40	17.93%	16.35%	41.90
Bear	12/87	10/92	59	1.95%	-7.87%	-77.59

Phase	Start date	End date	Dur.	Amplitude Δ price	Δ CAGR	Sev.
Long-run LBBI						
Bull	10/93	05/94	8	20.44%	1.49%	6.47
Bull	05/95	06/96	14	30.43%	7.80%	8.34
Bull	01/97	07/97	7	94.45%	8.17%	3.84
Bull	02/98	05/98	4	61.53%	1.92%	2.30
Bear	03/01	06/05	52	-5.28%	-21.69%	-135.6
Bull	03/06	09/07	19	9.34%	13.81%	14.07
Bear	09/08	02/12	42	-4.83%	-14.48%	-77.72
Bull	11/12	05/15	31	14.83%	15.06%	27.63

Table 120: British stock market expansions and contractions

Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.
Short-run LBBI						
Bull	01/22	08/22	8	36.28%	1.32%	7.41
Bear	07/23	02/24	8	-11.80%	-15.84%	-6.66
Bear	09/24	02/25	6	-8.48%	-1.45%	-4.01
Bear	11/25	12/25	2	-9.87%	-2.81%	-1.39
Bear	10/26	11/26	2	-18.51%	-1.29%	-1.64
Bull	03/27	05/27	3	22.98%	3.45%	1.95
Bear	10/29	12/29	3	-20.27%	-5.78%	-3.37
Bull	03/30	04/30	2	41.17%	3.30%	1.13
Bear	05/31	12/31	8	-17.36%	-5.33%	-5.88
Bull	07/32	09/33	15	34.35%	35.48%	12.50
Bear	07/34	09/34	3	-8.69%	-18.53%	-2.57
Bear	10/35	11/35	2	-3.42%	-2.42%	-1.71
Bull	02/36	03/36	2	53.17%	6.61%	1.45
Bear	03/37	10/38	20	-20.98%	-29.42%	-21.78
Bull	06/39	06/39	1	117.81%	16.61%	1.02
Bear	09/39	10/39	2	-55.24%	-0.44%	-2.49
Bear	06/40	08/40	3	-71.92%	-29.10%	-5.09
Bull	05/41	01/42	9	48.05%	48.77%	9.83
Bull	08/42	01/43	6	56.55%	10.12%	5.35
Bear	05/45	09/45	5	-4.96%	-8.97%	-5.36
Bull	05/46	05/46	1	90.62%	11.60%	0.97
Bull	11/46	12/46	2	57.40%	11.81%	1.43
Bear	07/47	09/48	15	-11.07%	-18.56%	-15.08
Bear	03/49	11/49	9	-18.96%	-23.18%	-8.40
Bull	05/50	02/51	10	19.56%	25.05%	7.11
Bull	04/51	05/51	2	60.88%	6.24%	1.70
Bear	11/51	06/52	8	-37.96%	-34.52%	-9.25
Bull	11/52	03/53	5	21.88%	31.46%	4.56
Bull	07/53	10/54	16	46.56%	25.31%	13.20
Bear	02/55	04/55	3	-20.13%	-17.02%	-1.75
Bear	08/55	11/56	16	-14.05%	-32.86%	-18.25
Bull	04/57	05/57	2	50.46%	2.76%	1.62
Bear	09/57	02/58	6	-35.17%	-24.85%	-7.88
Bull	06/58	05/59	12	47.60%	58.08%	9.04
Bull	10/59	12/59	3	144.68%	17.19%	3.00
Bear	06/60	01/61	8	7.02%	-28.35%	-7.96
Bear	06/61	07/62	14	-22.05%	-32.25%	-19.74
Bear	05/64	08/65	16	-8.02%	-22.55%	-13.16
Bull	10/65	02/66	5	24.40%	17.63%	3.50
Bull	05/66	06/66	2	41.71%	12.72%	1.14
Bear	07/66	11/66	5	-35.38%	-33.00%	-5.86
Bull	06/67	08/68	15	47.16%	52.43%	11.86
Bear	02/69	10/69	9	-33.22%	-55.57%	-12.85
Bear	04/70	06/70	3	-44.20%	0.22%	-4.63
Bear	11/70	11/70	1	-57.94%	-11.66%	-1.12
Bull	03/71	04/72	14	50.59%	47.60%	10.88
Bear	09/72	12/74	28	-44.67%	-78.70%	-30.49
Short-run LBBI						
Bull	01/75	01/76	13	105.57%	105.02%	14.19
Bear	05/76	11/76	7	-41.36%	-29.66%	-7.14
Bull	01/77	10/77	10	45.07%	81.22%	8.72
Bull	02/79	04/79	3	120.33%	22.55%	3.35
Bear	07/79	05/80	11	-14.04%	-30.00%	-10.64
Bull	07/80	11/80	5	35.19%	27.03%	4.13
Bear	09/81	10/81	2	-61.70%	-23.90%	-3.50
Bull	08/82	04/83	9	46.18%	33.85%	6.99
Bear	05/84	07/84	3	-36.23%	-14.54%	-2.57
Bull	12/84	01/85	2	77.10%	0.81%	1.44
Bear	06/85	07/85	2	-19.80%	-4.96%	-1.62
Bull	02/86	03/86	2	143.68%	19.05%	1.91
Bull	01/87	07/87	7	86.20%	31.95%	4.64
Bear	10/87	09/88	12	-22.70%	-79.16%	-13.15
Bear	11/88	12/88	2	-21.52%	-2.59%	-2.11
Bull	07/89	08/89	2	78.28%	18.58%	1.49
Bear	02/90	12/90	11	-15.56%	-25.10%	-13.90
Bull	02/91	04/91	3	74.36%	28.29%	2.23
Bull	07/91	08/91	2	80.07%	22.78%	1.78
Bear	11/91	03/92	5	-10.89%	-27.22%	-2.77
Bear	06/92	08/92	3	-47.69%	-22.09%	-3.99
Bull	11/92	03/93	5	38.92%	20.92%	3.62
Bull	12/93	01/94	2	106.23%	8.17%	1.89
Bear	03/94	02/95	12	-10.65%	-32.74%	-11.49
Bull	01/98	03/98	3	70.00%	11.06%	2.16
Bear	08/98	01/99	6	-1.08%	-11.69%	-6.32
Bear	09/99	10/99	2	-8.66%	-4.78%	-1.46
Bear	01/00	07/00	7	-10.30%	-18.39%	-5.69
Bear	09/00	10/01	14	-21.25%	-29.15%	-17.39
Bear	06/02	02/03	9	-36.43%	-18.07%	-8.61
Bull	05/03	02/04	10	24.12%	53.09%	10.48
Bull	09/04	02/05	6	27.26%	4.14%	4.51
Bull	05/05	03/06	11	31.90%	17.96%	7.30
Bear	07/07	08/07	2	-19.68%	-5.87%	-1.25
Bear	11/07	02/09	16	-33.47%	-41.98%	-18.35
Bull	07/09	03/10	9	45.99%	65.04%	8.87
Bear	06/10	06/10	1	-44.85%	-1.65%	-1.09
Bull	09/10	10/10	2	64.15%	6.78%	1.35
Bear	07/11	12/11	6	-15.14%	-27.59%	-5.89
Bear	05/12	05/12	1	-58.01%	-5.67%	-1.26
Bull	01/13	03/13	3	43.67%	4.13%	2.87
Bear	09/14	10/14	2	-20.24%	-9.00%	-1.85
Bear	08/15	09/15	2	-48.29%	-9.63%	-3.21
Medium-run LBBI						
Bull	01/22	06/23	18	21.52%	21.54%	20.90
Bear	01/24	02/24	2	6.60%	-2.88%	-1.11
Bear	08/24	12/26	29	0.02%	-12.15%	-47.30

British stock market expansions and contractions (continued…)

Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.
			Medium-run LBBI			
Bear	09/29	06/32	34	-3.33%	-7.33%	-38.04
Bull	02/33	10/34	21	20.67%	13.72%	16.73
Bear	10/35	11/35	2	-3.42%	0.37%	-1.32
Bear	06/37	02/40	33	-10.18%	-16.36%	-57.90
Bear	05/40	03/41	11	-22.04%	-1.16%	-8.93
Bull	08/41	12/43	29	21.22%	26.02%	33.98
Bear	12/45	03/46	4	2.95%	-1.97%	-2.39
Bear	08/47	12/50	41	-2.39%	-10.69%	-64.40
Bear	01/52	06/53	18	-1.91%	1.65%	-16.93
Bull	11/53	07/55	21	29.34%	24.14%	18.05
Bear	02/56	07/58	30	3.64%	-17.51%	-54.37
Bull	02/59	03/60	14	43.23%	13.83%	9.24
Bear	07/61	05/67	71	0.89%	-24.16%	-148.9
Bull	09/67	01/69	17	40.38%	17.53%	12.78
Bear	07/69	11/71	29	7.57%	-8.11%	-48.74
Bull	04/72	08/72	5	0.80%	6.66%	3.12
Bear	02/73	07/75	30	-25.80%	-30.83%	-38.94
Bull	11/75	06/76	8	-2.96%	2.40%	6.23
Bear	10/76	10/76	1	-78.80%	-3.76%	-1.27
Bull	12/76	09/78	22	30.30%	26.71%	22.81
Bull	02/79	04/79	3	120.33%	8.76%	2.16
Bear	10/79	09/80	12	4.94%	-13.56%	-13.27
Bear	09/81	10/81	2	-61.70%	-3.89%	-2.01
Bear	04/82	04/82	1	-11.71%	-1.51%	-1.08
Bull	11/82	04/84	18	27.75%	5.80%	10.64
Bull	05/87	07/87	3	96.58%	12.17%	1.57
Bear	11/87	09/92	59	5.05%	-17.41%	-98.03
Bull	12/93	01/94	2	106.23%	4.39%	1.52
Bear	01/95	07/95	7	22.16%	5.59%	-5.03
Bear	09/99	10/99	2	-8.66%	-1.42%	-1.52
Bear	04/00	11/03	44	-9.02%	-22.94%	-78.16
Bull	06/04	10/06	29	16.05%	21.02%	24.24
Bear	01/08	12/09	24	-6.08%	-14.26%	-38.30
Bull	03/10	03/10	1	101.96%	1.03%	1.11
Bull	09/10	07/11	11	11.16%	9.29%	7.57
Bear	09/12	10/12	2	6.47%	-0.34%	-1.43
Bull	01/13	02/13	2	65.39%	3.13%	1.19
Bull	10/13	11/13	2	22.74%	1.37%	1.09
Bear	08/15	09/15	2	-48.29%	-4.76%	-2.56
			Long-run LBBI			
Bull	03/22	12/24	34	5.00%	8.88%	29.34
Bull	02/25	05/25	4	23.80%	5.36%	2.35
Bear	11/25	12/25	2	-9.87%	-0.17%	-1.44
Bear	05/26	01/28	21	4.12%	-7.14%	-23.88
Bear	11/29	01/30	3	-6.54%	-0.10%	-2.52
Bear	08/30	02/33	31	1.33%	-2.08%	-40.59
Bull	05/33	03/36	35	18.23%	10.34%	20.97

Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.
			Long-run LBBI			
Bear	10/37	08/41	47	-6.40%	-16.23%	-126.5
Bull	06/42	04/45	35	18.16%	15.15%	33.21
Bear	09/47	05/53	69	-1.42%	-13.79%	-153.9
Bull	10/53	07/55	22	29.85%	11.29%	15.91
Bear	11/57	08/58	10	25.41%	1.64%	-13.77
Bear	04/63	06/67	51	2.78%	-10.25%	-154.8
Bull	03/68	01/69	11	44.70%	5.49%	6.30
Bear	05/70	06/70	2	-14.02%	0.59%	-1.62
Bear	09/72	11/76	51	-20.11%	-26.73%	-81.23
Bull	09/77	09/79	25	4.41%	26.77%	30.08
Bull	06/80	11/80	6	55.80%	4.52%	3.70
Bull	11/84	01/85	3	65.68%	2.13%	1.62
Bear	10/89	10/92	37	1.40%	-10.02%	-85.43
Bear	02/01	04/05	51	-4.88%	-14.61%	-109.4
Bull	11/05	10/07	24	13.10%	14.48%	19.43
Bear	09/08	05/12	45	-0.33%	-10.42%	-84.49
Bull	01/13	02/14	14	16.72%	14.13%	9.55

Table 121: US stock market expansions and contractions

Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.
			Short-run LBBI			
Bull	01/22	10/22	10	36.26%	21.14%	10.14
Bear	05/23	10/23	6	-25.14%	-23.20%	-6.15
Bull	06/24	02/25	9	32.80%	23.76%	7.25
Bull	09/25	12/25	4	40.75%	2.48%	2.61
Bear	03/26	05/26	3	-9.61%	-3.41%	-2.11
Bull	08/26	09/26	2	48.17%	4.22%	1.34
Bull	07/27	09/27	3	86.23%	7.46%	2.60
Bull	03/28	04/28	2	124.47%	14.11%	1.75
Bull	11/28	01/29	3	103.39%	13.08%	2.36
Bear	10/29	01/31	16	-33.48%	-65.20%	-21.18
Bear	03/31	06/32	16	-60.96%	-50.22%	-15.42
Bull	08/32	01/33	6	44.05%	48.27%	5.34
Bull	04/33	06/33	3	1081.1%	175.03%	6.28
Bear	05/34	03/35	11	-23.20%	-42.89%	-11.15
Bull	06/35	03/36	10	71.63%	80.21%	9.30
Bear	04/37	03/38	12	-52.23%	-68.08%	-18.43
Bull	06/38	12/38	7	85.83%	70.69%	6.21
Bear	03/39	06/39	4	-36.28%	-17.66%	-3.26
Bear	05/40	07/40	3	-49.25%	-25.81%	-5.08
Bear	01/41	05/41	5	-29.41%	13.94%	-3.74
Bear	10/41	04/42	7	-45.18%	-15.66%	-6.36
Bull	09/42	06/43	10	43.46%	63.03%	11.88
Bear	11/43	11/43	1	-61.02%	-6.92%	-1.03
Bull	06/44	06/44	1	69.67%	2.52%	1.09
Bull	12/44	11/45	12	31.02%	16.57%	7.93
Bear	07/46	05/47	11	-35.45%	-55.60%	-12.24
Bear	01/48	02/48	2	-43.25%	-8.84%	-2.01
Bull	05/48	06/48	2	48.99%	2.85%	2.12
Bear	05/49	06/49	2	-21.79%	-9.66%	-1.32
Bull	07/49	05/50	11	37.37%	47.65%	10.02
Bull	12/50	01/51	2	58.34%	0.46%	1.54
Bear	03/53	09/53	7	-18.40%	-16.08%	-7.01
Bull	03/54	01/55	11	45.62%	42.15%	8.66
Bull	06/55	07/55	2	123.80%	10.61%	1.79
Bear	05/56	02/58	22	-11.86%	-35.07%	-25.22
Bull	07/58	01/59	7	40.78%	38.21%	5.54
Bear	09/59	10/60	14	-10.57%	-31.96%	-14.28
Bull	01/61	05/61	5	38.52%	22.29%	3.82
Bear	04/62	10/62	7	-31.11%	-24.55%	-9.31
Bull	03/63	05/63	3	45.16%	26.58%	2.43
Bear	06/65	08/65	3	-7.90%	-3.76%	-2.81
Bear	02/66	09/66	8	-28.03%	-21.83%	-9.62
Bull	03/67	04/67	2	55.86%	8.21%	1.70
Bear	01/68	03/68	3	-27.07%	-20.34%	-3.00
Bear	02/69	06/70	17	-26.31%	-36.77%	-15.10
Bull	11/70	04/71	6	50.52%	41.28%	6.84
Bear	10/71	11/71	2	-24.88%	-7.72%	-1.26
Bull	12/71	05/72	6	30.84%	1.97%	3.74
Bull	11/72	12/72	2	36.33%	-2.67%	1.46
Bear	02/73	09/74	20	-37.06%	-55.35%	-18.33
Bull	02/75	07/76	18	14.50%	39.33%	15.43
Bear	01/77	05/77	5	-29.72%	-23.72%	-3.92
Bear	01/78	02/78	2	-46.69%	-1.01%	-1.94
Bull	07/78	09/78	3	22.66%	9.57%	2.50
Bull	08/79	09/79	2	20.74%	2.37%	1.57
Bear	03/80	03/80	1	-76.99%	-15.82%	-1.50
Bull	07/80	12/80	6	29.69%	14.73%	6.46
Bear	06/81	07/82	14	-22.40%	-31.73%	-9.76
Bull	08/82	06/83	11	59.97%	72.67%	11.52
Bear	01/84	07/84	7	-18.28%	-24.05%	-7.30
Bull	01/85	06/85	6	26.03%	23.16%	4.25
Bull	11/85	06/86	8	50.25%	17.77%	6.33
Bull	01/87	08/87	8	50.87%	11.66%	4.42
Bear	10/87	05/88	8	-28.81%	-46.34%	-8.94
Bull	04/89	08/89	5	45.73%	19.85%	3.76
Bear	01/90	04/90	4	-23.21%	-19.57%	-3.77
Bear	07/90	10/90	4	-43.60%	-23.53%	-5.64
Bull	02/91	03/91	2	62.96%	6.31%	1.24
Bull	07/91	08/91	2	42.42%	19.08%	1.13
Bear	03/94	06/94	4	-16.23%	-6.56%	-4.10
Bull	02/95	01/96	12	31.41%	36.60%	8.13
Bull	11/96	11/96	1	128.64%	3.35%	1.07
Bull	05/97	07/97	3	99.62%	26.35%	2.69
Bull	02/98	03/98	2	92.86%	20.78%	1.44
Bear	08/98	09/98	2	-44.94%	-9.70%	-3.02
Bull	12/98	01/99	2	74.93%	8.45%	1.16
Bear	09/99	09/99	1	-33.30%	-11.99%	-1.20
Bear	01/00	02/00	2	-39.16%	-9.50%	-1.72
Bear	04/00	10/01	19	-21.52%	-39.68%	-22.08
Bear	04/02	09/02	6	-50.73%	-20.29%	-6.66
Bull	04/03	02/04	11	37.23%	62.09%	11.33
Bull	11/04	12/04	2	54.92%	1.32%	1.47
Bull	09/06	05/07	9	20.64%	14.44%	4.79
Bear	11/07	02/09	16	-43.63%	-53.49%	-16.98
Bull	06/09	04/10	11	29.40%	66.50%	10.74
Bull	09/10	04/11	8	41.67%	9.74%	6.64
Bear	08/11	09/11	2	-56.10%	-17.75%	-2.94
Bull	02/12	03/12	2	41.38%	4.35%	1.23
Bull	03/13	05/13	3	32.57%	14.02%	2.16
Bull	10/13	12/13	3	48.76%	12.33%	2.26
Bear	08/15	09/15	2	-41.18%	-11.40%	-3.45
			Medium-run LBBI			
Bull	02/22	08/23	19	6.96%	11.03%	21.93
Bear	04/24	05/24	2	1.89%	-1.23%	-1.11

US stock market expansions and contractions (continued…)

Phase	Start date	End date	Dur.	Amplitude Δ price	Δ CAGR	Sev.
				Medium-run LBBI		
Bear	09/24	10/24	2	-10.96%	-3.04%	-1.13
Bull	12/24	01/26	14	20.64%	-0.87%	7.17
Bull	08/26	09/26	2	48.17%	3.16%	1.21
Bull	07/27	09/27	3	86.23%	4.46%	1.81
Bull	03/28	04/28	2	124.47%	6.98%	1.30
Bull	11/28	01/29	3	103.39%	6.11%	1.72
Bear	11/29	03/33	41	-27.57%	-55.89%	-70.30
Bull	05/33	06/33	2	390.08%	12.38%	1.70
Bull	11/33	11/34	13	3.91%	15.96%	10.91
Bull	04/35	04/35	1	177.49%	11.31%	1.32
Bull	10/35	03/37	18	30.59%	4.08%	12.98
Bear	09/37	08/39	24	-14.42%	-28.28%	-44.11
Bull	09/39	09/39	1	379.97%	3.92%	1.38
Bear	01/40	02/40	2	-16.56%	-2.21%	-1.22
Bear	04/40	08/40	5	-30.13%	-0.53%	-5.60
Bear	01/41	09/42	21	-17.45%	-17.39%	-16.97
Bull	03/43	05/46	39	15.40%	23.52%	42.04
Bear	09/46	06/49	34	-11.01%	-22.12%	-43.80
Bull	10/49	01/52	28	15.44%	16.68%	27.57
Bear	06/53	02/54	9	7.82%	-0.42%	-9.15
Bull	09/54	03/56	19	36.22%	16.66%	11.66
Bear	01/57	01/59	25	6.05%	-17.06%	-56.64
Bear	05/60	01/61	9	16.98%	8.47%	-9.51
Bear	05/62	09/63	17	5.66%	6.06%	-24.02
Bear	03/66	04/68	26	-0.28%	-10.52%	-39.33
Bear	01/69	12/70	24	-11.04%	-6.86%	-25.08
Bull	12/71	01/73	14	15.68%	15.71%	12.99
Bear	08/73	04/75	21	-20.08%	-20.87%	-18.43
Bull	01/76	09/77	21	-1.87%	24.14%	19.51
Bull	07/80	06/81	12	4.84%	5.47%	16.86
Bear	01/82	07/82	7	-25.46%	-5.41%	-4.53
Bull	11/82	08/84	22	9.01%	6.05%	23.96
Bull	11/85	08/87	22	31.45%	13.16%	13.66
Bear	11/87	09/89	23	13.70%	-1.46%	-30.17
Bear	01/90	04/90	4	-23.21%	-8.44%	-4.30
Bear	07/90	01/91	7	-12.17%	3.81%	-9.72
Bear	03/94	02/95	12	1.44%	-2.61%	-12.17
Bull	11/95	06/96	8	20.31%	2.49%	4.57
Bull	01/97	07/97	7	51.26%	10.96%	3.85
Bull	02/98	03/98	2	92.86%	2.43%	1.11
Bear	06/00	09/03	40	-12.15%	-29.42%	-76.10
Bull	06/04	11/05	18	4.42%	12.68%	11.46
Bull	09/06	11/06	3	39.63%	1.21%	1.79
Bull	04/07	10/07	7	12.61%	2.99%	3.27
Bear	01/08	11/09	23	-15.48%	-13.17%	-26.36
Bull	10/10	08/11	11	3.26%	7.86%	11.00
Bull	10/11	04/12	7	40.30%	16.27%	6.79

Phase	Start date	End date	Dur.	Amplitude Δ price	Δ CAGR	Sev.
				Medium-run LBBI		
Bull	01/13	06/14	18	20.58%	5.67%	11.09
				Long-run LBBI		
Bull	05/22	05/23	13	3.30%	7.58%	12.02
Bull	11/23	01/26	27	20.97%	15.06%	22.43
Bull	11/27	01/29	15	46.65%	12.49%	8.06
Bear	09/30	02/35	54	-14.58%	-29.46%	-100.2
Bull	09/35	05/37	21	19.52%	36.77%	25.09
Bear	10/37	08/42	59	-11.32%	-23.28%	-84.24
Bull	06/44	07/46	26	12.28%	8.55%	31.53
Bear	03/47	02/50	36	0.70%	-7.68%	-43.88
Bull	02/51	03/53	26	5.14%	11.62%	20.81
Bull	11/54	12/54	2	119.48%	1.87%	1.25
Bull	06/55	07/55	2	123.80%	4.64%	1.22
Bear	09/59	02/61	18	2.86%	-8.27%	-30.57
Bear	05/62	07/63	15	3.38%	1.04%	-17.26
Bear	06/66	02/67	9	-1.45%	-1.05%	-11.65
Bear	01/68	07/72	55	-2.26%	-8.52%	-66.37
Bear	04/73	05/73	2	-36.04%	-3.11%	-1.60
Bear	02/74	03/75	14	-20.58%	-1.12%	-9.55
Bull	05/78	02/80	22	-2.73%	7.68%	18.63
Bull	09/80	05/81	9	0.67%	-1.90%	6.21
Bull	10/82	08/87	59	18.91%	23.49%	63.28
Bear	08/90	09/92	26	3.73%	-7.94%	-29.69
Bear	05/94	01/95	9	3.10%	-0.08%	-6.12
Bull	05/97	04/98	12	36.77%	6.53%	6.30
Bear	02/01	08/05	55	-4.84%	-20.31%	-126.8
Bull	08/06	10/07	15	14.32%	10.37%	11.63
Bear	06/08	08/10	27	-12.34%	-9.25%	-29.70
Bear	08/11	09/11	2	-56.10%	-3.57%	-1.30
Bull	02/12	04/12	3	20.98%	0.75%	2.17
Bull	07/12	12/14	30	16.89%	15.00%	26.27

Table 122: Australian real credit expansions and contractions

Phase	Start date	End date	Dur.	Amplitude Δ level	Amplitude Δ CAGR	Sev.
Short-run LBBI						
Bull	1929	1930	2	12.97%	18.92%	1.14
Bull	1948	1948	1	44.85%	51.89%	3.25
Bear	1952	1952	1	-11.34%	-14.83%	-1.24
Bull	1954	1955	2	15.78%	11.52%	1.44
Bull	1984	1985	2	17.15%	17.65%	1.66
Bull	1988	1989	2	26.27%	27.53%	2.05
Bear	1990	1992	3	4.77%	-32.50%	-2.08
Medium-run LBBI						
Bear	1932	1933	2	-0.62%	-8.76%	-1.39
Bear	1941	1943	3	-9.36%	-11.39%	-2.29
Bull	1948	1949	2	23.28%	17.21%	2.98
Bear	1952	1953	2	-4.24%	-8.51%	-2.17
Bull	1955	1955	1	14.94%	9.25%	1.16
Bear	1957	1958	2	2.45%	-8.47%	-1.39
Bull	1984	1985	2	17.15%	10.01%	1.72
Bear	1992	1993	2	3.94%	-10.72%	-1.68
Bear	2011	2012	2	2.55%	-3.84%	-1.58
Long-run LBBI						
Bear	1934	1935	2	2.56%	-3.94%	-1.44
Bear	1941	1943	3	-9.36%	-6.94%	-2.77
Bull	1948	1951	4	15.24%	17.13%	3.99
Bear	2012	2013	2	3.81%	-3.96%	-1.44

Table 123: Canadian real credit expansions and contractions

Phase	Start date	End date	Dur.	Amplitude Δ level	Amplitude Δ CAGR	Sev.
Short-run LBBI						
Bull	1926	1927	2	13.01%	17.73%	2.29
Bear	1930	1930	1	-12.30%	-19.81%	-1.40
Bull	1938	1939	2	6.56%	10.60%	1.77
Bull	1944	1945	2	7.94%	15.98%	2.21
Bull	1947	1947	1	14.30%	11.28%	1.01
Bull	1961	1961	1	27.68%	22.48%	1.63
Bear	1982	1983	2	-7.91%	-14.86%	-1.84
Medium-run LBBI						
Bull	1927	1928	2	13.86%	11.88%	2.36
Bear	1930	1932	3	-2.81%	-14.51%	-2.36
Bear	1934	1936	3	-6.40%	-7.83%	-2.00
Bull	1939	1939	1	9.67%	6.41%	1.23
Bull	1945	1947	3	9.85%	11.82%	2.64
Bull	1961	1961	1	27.68%	9.14%	1.04
Bear	1982	1984	3	-3.83%	-12.40%	-3.29
Long-run LBBI						
Bull	1927	1929	3	11.70%	7.40%	2.45
Bear	1932	1936	5	-4.24%	-9.60%	-5.34
Bull	1940	1941	2	-3.82%	1.30%	1.33
Bull	1945	1947	3	9.85%	8.51%	3.02
Bear	1983	1986	4	1.34%	-5.63%	-5.24
Bull	1987	1988	2	8.01%	6.52%	1.15

Table 124: Danish real credit expansions and contractions

Phase	Start date	End date	Dur.	Amplitude Δ level	Amplitude Δ CAGR	Sev.
Short-run LBBI						
Bear	1924	1924	1	-6.56%	-15.10%	-1.14
Bull	1926	1926	1	17.65%	19.59%	1.70
Bear	1932	1933	2	-0.95%	-12.67%	-1.44
Bear	1940	1941	2	-17.29%	-14.50%	-2.81
Bull	1942	1942	1	1.88%	15.58%	1.06
Bull	1945	1946	2	7.18%	13.19%	1.83
Bull	1958	1960	3	10.58%	9.75%	2.08
Bull	1983	1986	4	10.11%	15.47%	3.14
Bear	1988	1989	2	0.21%	-5.98%	-1.34
Bear	2008	2011	4	-0.20%	-14.01%	-2.75
Medium-run LBBI						
Bear	1925	1925	1	-1.94%	-1.50%	-1.59
Bear	1933	1935	3	-0.48%	-7.20%	-2.44
Bear	1940	1941	2	-17.29%	-11.32%	-2.98
Bull	1944	1947	4	4.79%	11.38%	4.59
Bear	1951	1952	2	-2.29%	-3.96%	-1.95
Bull	1958	1960	3	10.58%	10.32%	2.28
Bear	1976	1981	6	-0.61%	-6.85%	-4.20
Bull	1984	1986	3	11.69%	11.33%	2.92
Bear	1989	1994	6	-1.08%	-8.57%	-4.98
Bull	1996	1998	3	5.51%	6.30%	2.04
Bear	2010	2012	3	-2.31%	-7.06%	-3.96
Long-run LBBI						
Bear	1935	1938	4	0.28%	-3.36%	-3.31
Bear	1940	1941	2	-17.29%	-7.88%	-2.96
Bull	1945	1948	4	6.85%	12.44%	4.48
Bear	1952	1953	2	2.13%	-1.70%	-1.92
Bull	1959	1960	2	12.11%	3.99%	1.45
Bear	1977	1982	6	-1.30%	-6.96%	-5.57
Bull	1984	1986	3	11.69%	8.07%	3.10
Bear	1991	1994	4	-1.99%	-5.59%	-5.15
Bull	1997	1999	3	5.57%	4.51%	2.16
Bear	2011	2013	3	-1.87%	-6.25%	-4.61

Table 125: French real credit expansions and contractions

Phase	Start date	End date	Dur.	Amplitude Δ level	Amplitude Δ CAGR	Sev.
			Short-run LBBI			
Bear	1980	1980	1	-11.36%	-14.31%	-2.25
Bear	1991	1994	4	-1.71%	-7.79%	-2.64
Bull	1998	2000	3	4.84%	7.05%	2.44
Bull	2005	2006	2	7.59%	6.08%	1.26
			Medium-run LBBI			
Bear	1979	1981	3	-2.90%	-6.12%	-3.31
Bull	1983	1984	2	3.43%	6.16%	1.06
Bear	1992	1995	4	-1.78%	-5.94%	-3.67
Bull	1998	2001	4	5.30%	6.89%	3.03
Bull	2006	2007	2	9.70%	5.46%	1.19
Bear	2012	2013	2	-0.06%	-0.74%	-1.16
			Long-run LBBI			
Bear	1980	1983	4	-1.46%	-5.66%	-5.66
Bear	1993	1996	4	-1.85%	-5.51%	-4.80
Bull	1999	2001	3	5.94%	4.69%	2.61
Bear	2012	2013	2	-0.06%	-3.41%	-1.43

Table 126: German real credit expansions and contractions

Phase	Start date	End date	Dur.	Amplitude Δ level	Amplitude Δ CAGR	Sev.
			Short-run LBBI			
Bear	1957	1958	2	7.85%	-2.30%	-1.25
Bear	1974	1975	2	-0.65%	-4.67%	-3.04
Bear	1981	1982	2	0.57%	-4.06%	-1.76
Bull	1990	1990	1	14.83%	10.46%	1.49
Bear	2001	2004	4	-1.08%	-5.57%	-3.75
Bear	2013	2013	1	-4.86%	-3.60%	-1.13
			Medium-run LBBI			
Bear	1974	1976	3	1.09%	-6.48%	-3.82
Bear	1982	1983	2	1.87%	-2.78%	-1.56
Bear	2002	2005	4	-1.61%	-4.77%	-5.41
			Long-run LBBI			
Bull	1955	1955	1	19.82%	23.70%	1.60
Bear	1975	1977	3	2.92%	-3.62%	-2.23
Bear	2003	2007	5	-1.32%	-4.05%	-6.73

Table 127: Italian real credit expansions and contractions

Phase	Start date	End date	Dur.	Amplitude Δ level	Amplitude Δ CAGR	Sev.
Short-run LBBI						
Bear	1935	1935	1	-5.80%	-8.72%	-1.02
Bull	1941	1942	2	9.19%	13.79%	1.54
Bear	1943	1944	2	-60.91%	-86.47%	-4.02
Bull	1946	1946	1	80.50%	95.12%	1.86
Bear	1974	1976	3	-0.76%	-7.36%	-2.01
Bull	1984	1984	1	11.75%	12.63%	1.64
Bull	1990	1990	1	16.89%	12.67%	0.92
Bear	1993	1994	2	-1.72%	-9.17%	-1.47
Bear	2011	2013	3	-5.66%	-13.87%	-2.15
Medium-run LBBI						
Bull	1924	1924	1	19.43%	9.38%	1.05
Bear	1931	1932	2	2.86%	-3.60%	-1.36
Bear	1936	1938	3	-2.71%	-5.11%	-2.49
Bull	1941	1942	2	9.19%	5.42%	1.70
Bear	1943	1944	2	-60.91%	-49.57%	-3.13
Bull	1947	1948	2	19.94%	65.76%	2.19
Bear	1965	1966	2	6.59%	-5.77%	-1.35
Bear	1975	1978	4	-2.34%	-7.78%	-3.97
Bull	1984	1985	2	7.41%	5.52%	1.42
Bear	1994	1996	3	-0.74%	-4.72%	-2.69
Bull	1999	2000	2	10.22%	5.68%	1.12
Bear	2009	2010	2	1.61%	-4.27%	-1.08
Bear	2012	2013	2	-7.33%	-5.98%	-2.19
Long-run LBBI						
Bear	1936	1938	3	-2.71%	-4.83%	-3.39
Bull	1942	1942	1	10.38%	2.69%	1.40
Bear	1943	1944	2	-60.91%	-32.56%	-3.06
Bull	1948	1950	3	26.99%	56.92%	4.13
Bear	1976	1979	4	-1.32%	-5.97%	-5.47
Bull	1986	1987	2	4.98%	2.42%	1.11
Bear	1995	1997	3	1.90%	-4.61%	-3.29
Bear	2011	2013	3	-5.66%	-6.90%	-3.60

Table 128: Japanese real credit expansions and contractions

Phase	Start date	End date	Dur.	Amplitude Δ level	Amplitude Δ CAGR	Sev.
Short-run LBBI						
Bull	1930	1931	2	10.35%	9.81%	2.04
Bear	1932	1933	2	-5.85%	-18.71%	-1.75
Bull	1936	1937	2	5.04%	7.33%	1.74
Bull	1939	1939	1	11.87%	9.63%	1.42
Bull	1941	1943	3	19.65%	20.87%	1.98
Bear	1945	1945	1	-81.26%	-88.53%	-3.81
Bull	1948	1950	3	34.36%	102.26%	2.55
Bear	1974	1974	1	-10.86%	-15.52%	-1.17
Bull	1985	1985	1	18.41%	12.18%	1.54
Bear	1997	1998	2	-1.68%	-2.21%	-1.59
Bear	2000	2001	2	-3.11%	-2.41%	-1.45
Bull	2005	2006	2	0.54%	3.87%	1.30
Bull	2011	2012	2	1.00%	2.79%	1.13
Medium-run LBBI						
Bear	1928	1929	2	1.33%	-3.35%	-1.14
Bull	1930	1931	2	10.35%	7.24%	1.64
Bear	1933	1934	2	-6.08%	-10.73%	-2.15
Bull	1937	1939	3	6.95%	7.65%	2.69
Bull	1942	1943	2	23.22%	9.32%	1.25
Bear	1945	1946	2	-61.52%	-63.49%	-2.41
Bull	1949	1951	3	40.45%	62.92%	3.68
Bear	1974	1976	3	-2.97%	-16.73%	-2.41
Bull	1982	1983	2	5.85%	3.48%	1.12
Bull	1985	1986	2	17.80%	7.83%	1.45
Bear	1995	2002	8	-1.68%	-8.49%	-6.59
Bull	2006	2008	3	0.74%	3.17%	2.21
Long-run LBBI						
Bear	1934	1936	3	-0.70%	-4.63%	-3.55
Bull	1938	1943	6	13.02%	15.93%	4.98
Bear	1945	1947	3	-57.54%	-50.69%	-2.67
Bull	1950	1952	3	38.80%	67.83%	5.93
Bear	1975	1978	4	2.16%	-8.03%	-4.03
Bull	1985	1986	2	17.80%	6.52%	1.46
Bear	1997	2003	7	-2.76%	-6.50%	-6.92
Bull	2008	2009	2	0.48%	1.70%	1.85

Table 129: Dutch real credit expansions and contractions

Phase	Start date	End date	Dur.	Amplitude Δ level	Amplitude Δ CAGR	Sev.
Short-run LBBI						
Bull	1925	1926	2	13.39%	14.31%	1.31
Bear	1930	1932	3	-5.60%	-10.99%	-2.15
Bear	1940	1941	2	-27.98%	-25.17%	-2.45
Bull	1946	1946	1	20.87%	27.82%	2.18
Bear	1957	1958	2	-0.33%	-14.21%	-1.31
Bear	1980	1982	3	-0.49%	-12.37%	-2.06
Bull	1988	1988	1	21.34%	16.34%	1.45
Medium-run LBBI						
Bull	1925	1926	2	13.39%	5.98%	1.34
Bear	1930	1932	3	-5.60%	-9.55%	-3.47
Bear	1940	1941	2	-27.98%	-14.29%	-1.61
Bull	1946	1948	3	13.06%	27.54%	4.77
Bull	1960	1961	2	16.00%	11.11%	1.03
Bear	1981	1984	4	-0.86%	-10.58%	-4.74
Bull	1988	1988	1	21.34%	6.35%	1.04
Bear	2002	2003	2	4.44%	-4.98%	-1.07
Bear	2010	2011	2	-1.26%	-2.09%	-1.26
Long-run LBBI						
Bear	1931	1934	4	-5.97%	-10.00%	-4.58
Bear	1940	1941	2	-27.98%	-12.86%	-1.59
Bull	1947	1950	4	10.77%	22.41%	5.82
Bear	1982	1985	4	0.21%	-8.92%	-4.88
Bear	2010	2013	4	-1.85%	-4.30%	-2.74

Table 130: Norwegian real credit expansions and contractions

Phase	Start date	End date	Dur.	Amplitude Δ level	Amplitude Δ CAGR	Sev.
Short-run LBBI						
Bear	1924	1924	1	-13.19%	-11.05%	-1.67
Bear	1940	1941	2	-21.81%	-32.01%	-2.62
Bull	1945	1947	3	21.03%	41.79%	5.03
Bear	1951	1952	2	2.02%	-11.36%	-1.67
Bull	1960	1960	1	21.10%	15.53%	1.49
Bear	1981	1981	1	-9.32%	-13.88%	-1.50
Bear	1990	1991	2	-2.70%	-5.87%	-1.45
Bear	2009	2010	2	-1.49%	-7.42%	-1.99
Medium-run LBBI						
Bear	1924	1925	2	-7.95%	-10.20%	-1.78
Bull	1927	1928	2	3.17%	7.62%	1.30
Bear	1940	1941	2	-21.81%	-13.35%	-2.16
Bull	1946	1948	3	27.98%	33.34%	5.05
Bear	1952	1953	2	5.41%	-7.10%	-1.60
Bull	1960	1960	1	21.10%	5.40%	1.02
Bear	1981	1982	2	-0.08%	-6.57%	-1.31
Bear	1989	1991	3	-0.97%	-8.03%	-2.81
Bear	2010	2012	3	-0.36%	-6.84%	-3.00
Long-run LBBI						
Bear	1924	1925	2	-7.95%	-3.32%	-1.09
Bull	1929	1929	1	3.60%	3.57%	1.17
Bear	1935	1937	3	-2.90%	-2.48%	-2.00
Bear	1940	1941	2	-21.81%	-8.23%	-1.79
Bull	1946	1949	4	25.38%	33.56%	5.88
Bear	1954	1955	2	6.19%	-3.92%	-1.23
Bull	1985	1986	2	11.63%	5.86%	1.17
Bear	1991	1994	4	0.87%	-4.00%	-3.77
Bull	1997	1998	2	9.90%	2.50%	1.14
Bear	2011	2013	3	3.30%	-4.37%	-2.86

Table 131: Swedish real credit expansions and contractions

Phase	Start date	End date	Dur.	Amplitude Δ level	Amplitude Δ CAGR	Sev.
			Short-run LBBI			
Bear	1923	1925	3	-6.05%	-13.08%	-1.94
Bear	1932	1933	2	-0.53%	-4.29%	-1.56
Bear	1940	1940	1	-14.33%	-17.70%	-1.82
Bull	1943	1946	4	1.75%	41.77%	2.58
Bear	1948	1948	1	24.28%	-9.03%	-1.02
Bear	1951	1952	2	2.02%	-11.36%	-1.70
Bull	1954	1954	1	7.79%	0.51%	1.01
Bull	1986	1986	1	10.19%	-2.90%	1.68
Bear	1991	1993	3	1.19%	0.63%	-3.98
Bull	1997	1998	2	9.90%	2.20%	1.23
			Medium-run LBBI			
Bear	1924	1925	2	-7.95%	-10.20%	-2.11
Bull	1930	1931	2	1.00%	-1.45%	1.44
Bear	1933	1934	2	-1.21%	-1.48%	-2.03
Bull	1944	1946	3	6.77%	25.71%	2.42
Bear	1951	1953	3	3.74%	-15.24%	-2.59
Bull	1986	1988	3	7.07%	-3.18%	2.17
Bear	1991	1994	4	0.87%	2.60%	-5.47
Bull	1998	1999	2	6.97%	1.81%	1.67
			Long-run LBBI			
Bear	1926	1927	2	4.55%	-1.08%	-2.14
Bull	1930	1931	2	1.00%	-0.36%	1.43
Bear	1934	1936	3	-1.72%	-2.14%	-2.30
Bull	1944	1947	4	12.86%	21.36%	3.46
Bear	1951	1954	4	4.74%	-16.52%	-3.84
Bear	1981	1982	2	-0.08%	-2.14%	-1.24
Bull	1986	1988	3	7.07%	3.52%	1.83
Bear	1993	1996	4	1.72%	2.26%	-5.87
Bull	1999	2001	3	6.25%	2.10%	2.53

Table 132: Swiss real credit expansions and contractions

Phase	Start date	End date	Dur.	Amplitude Δ level	Amplitude Δ CAGR	Sev.
			Short-run LBBI			
Bull	1922	1922	1	21.84%	12.55%	1.78
Bear	1934	1937	4	-3.64%	-10.92%	-3.23
Bear	1940	1941	2	-11.47%	-11.52%	-2.15
Bull	1944	1946	3	4.23%	17.27%	3.01
Bear	1972	1973	2	-6.48%	-9.43%	-2.10
Bull	1976	1977	2	5.54%	8.30%	1.68
Bear	1991	1993	3	-1.85%	-5.57%	-1.92
Bull	2012	2012	1	7.04%	4.17%	1.15
			Medium-run LBBI			
Bull	1922	1922	1	21.84%	7.56%	1.20
Bear	1935	1937	3	-5.06%	-9.64%	-3.83
Bear	1940	1941	2	-11.47%	-5.29%	-1.51
Bull	1945	1947	3	6.43%	11.36%	3.79
Bear	1972	1974	3	-4.91%	-11.51%	-3.31
Bull	1977	1978	2	6.46%	5.52%	2.26
Bear	1992	1994	3	-0.69%	-4.78%	-2.95
			Long-run LBBI			
Bull	1922	1923	2	12.09%	6.77%	1.23
Bear	1936	1941	6	-6.23%	-9.36%	-6.49
Bull	1946	1949	4	5.52%	10.09%	4.76
Bear	1973	1975	3	-3.67%	-7.34%	-4.55
Bull	1978	1980	3	6.57%	6.25%	2.76
Bear	1993	1996	4	0.60%	-3.94%	-5.16

Table 133: British real credit expansions and contractions

Phase	Start date	End date	Dur.	Amplitude Δ level	Amplitude Δ CAGR	Sev.
			Short-run LBBI			
Bear	1940	1941	2	-19.08%	-16.80%	-2.71
Bull	1944	1947	4	6.04%	19.31%	3.53
Bear	1952	1952	1	-12.80%	-16.28%	-1.60
Bull	1958	1959	2	15.15%	22.12%	2.14
Bull	1972	1972	1	18.48%	14.18%	1.12
Bear	1974	1975	2	-2.48%	-21.37%	-1.87
Bull	1978	1979	2	11.38%	14.61%	1.41
Bear	1990	1992	3	-0.24%	-17.41%	-2.69
Bear	2008	2010	3	-4.68%	-20.39%	-2.66
			Medium-run LBBI			
Bull	1923	1923	1	11.93%	6.72%	0.85
Bear	1932	1933	2	-2.92%	-3.62%	-1.36
Bear	1940	1941	2	-19.08%	-15.53%	-2.89
Bull	1945	1947	3	9.05%	16.04%	3.62
Bear	1952	1953	2	-7.26%	-10.01%	-2.09
Bull	1959	1960	2	16.97%	11.44%	2.10
Bull	1972	1973	2	17.56%	7.74%	1.07
Bear	1975	1977	3	-1.24%	-12.56%	-2.62
Bear	1991	1994	4	-1.48%	-13.95%	-4.22
Bear	2009	2011	3	-6.83%	-12.85%	-3.24
			Long-run LBBI			
Bull	1922	1923	2	11.74%	10.57%	1.14
Bear	1932	1933	2	-2.92%	-3.41%	-1.50
Bear	1940	1942	3	-16.43%	-14.03%	-3.46
Bull	1946	1949	4	9.98%	15.85%	4.72
Bear	1953	1955	3	2.00%	-2.71%	-2.76
Bull	1959	1960	2	16.97%	5.08%	1.64
Bear	1977	1978	2	4.06%	-5.04%	-1.82
Bear	1992	1996	5	1.00%	-8.89%	-5.53
Bear	2010	2013	4	-6.29%	-9.96%	-4.64

Table 134: US real credit expansions and contractions

Phase	Start date	End date	Dur.	Amplitude Δ level	Amplitude Δ CAGR	Sev.
Short-run LBBI						
Bear	1930	1933	4	-7.20%	-20.05%	-3.90
Bull	1936	1937	2	1.99%	12.79%	1.35
Bull	1940	1941	2	6.80%	11.01%	1.67
Bear	1942	1943	2	-13.62%	-24.64%	-2.64
Bull	1944	1946	3	11.40%	45.87%	3.58
Bull	1950	1950	1	24.82%	22.91%	1.09
Bear	1974	1975	2	-3.03%	-15.66%	-1.54
Bear	1980	1980	1	-6.96%	-7.20%	-1.07
Bull	1983	1984	2	9.49%	13.58%	2.13
Bear	1989	1991	3	-4.43%	-11.35%	-2.38
Bear	2008	2009	2	-2.89%	-9.77%	-1.79
Medium-run LBBI						
Bear	1931	1934	4	-9.78%	-16.01%	-4.07
Bull	1937	1938	2	0.28%	6.64%	1.29
Bull	1941	1941	1	7.51%	3.55%	1.12
Bear	1943	1943	1	-17.13%	-7.98%	-1.50
Bull	1946	1947	2	19.11%	18.55%	3.02
Bull	1972	1973	2	11.70%	7.23%	1.17
Bear	1975	1976	2	-0.51%	-7.97%	-1.42
Bear	1980	1982	3	-4.19%	-9.27%	-2.26
Bull	1984	1985	2	9.22%	8.10%	1.94
Bear	1990	1992	3	-5.57%	-7.87%	-2.84
Bear	2009	2010	2	-2.49%	-4.51%	-1.67
Long-run LBBI						
Bull	1923	1924	2	7.16%	5.62%	1.63
Bear	1932	1935	4	-10.93%	-12.72%	-4.74
Bull	1939	1941	3	3.25%	5.85%	2.55
Bull	1946	1948	3	14.20%	12.79%	3.69
Bear	1970	1971	2	2.75%	-2.00%	-1.18
Bear	1981	1982	2	-2.77%	-3.52%	-1.82
Bull	1984	1986	3	8.96%	7.46%	2.15
Bear	1990	1993	4	-4.01%	-7.87%	-3.99
Bull	1996	1998	3	4.64%	5.17%	2.08
Bear	2009	2012	4	-1.21%	-5.70%	-3.34

Annex 8. Expansions and Contractions for the UK Stock Market Using Turning Points, Bandpass and HP Filters.

Table 135 presents the dating and characterisation of bull and bear phases for the UK stock market using the TPBC and HP methodologies as described in section 2.7.

Table 135: Expansions and contractions in the UK stock market using the turning point algorithm and the band-pass and HP filters

Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.
Turning Point and Busines Cycle (TPBC)						
Bear	04/23	01/24	10	-7.54%	-16.29%	-31.61
Bull	02/24	04/30	75	4.02%	4.25%	1,048.57
Bear	05/30	12/31	20	-10.17%	-11.71%	-163.65
Bull	01/32	12/36	60	15.98%	25.22%	3,296.26
Bear	01/37	07/40	43	-18.72%	-51.91%	-1,127.11
Bull	08/40	06/47	83	19.14%	53.91%	9,787.39
Bear	07/47	06/49	24	-13.73%	-27.35%	-306.85
Bull	07/49	05/51	23	13.17%	27.62%	307.77
Bear	06/51	06/52	13	-26.52%	-45.51%	-184.52
Bull	07/52	07/57	61	16.62%	43.95%	3,614.67
Bear	08/57	02/58	7	-33.51%	-29.39%	-72.82
Bull	04/58	04/61	37	32.62%	31.31%	2,567.82
Bear	06/61	07/62	14	-22.05%	-32.25%	-176.56
Bull	08/62	01/69	78	13.40%	53.07%	4,931.74
Bear	02/69	05/70	16	-27.78%	-58.09%	-283.74
Bull	06/70	04/72	23	34.05%	59.77%	866.71
Bear	05/72	11/74	31	-42.06%	-101.25%	-1,171.61
Bull	12/74	01/76	14	95%	108.33%	828.06
Bear	02/76	09/76	8	-35.11%	-59.06%	-100.96
Bull	10/76	04/79	31	25.46%	42.14%	1,234.92
Bear	05/79	05/80	13	-22.45%	-47.10%	-156.47
Bull	06/80	09/87	88	23.22%	75.00%	15,940.07
Bear	10/87	11/87	2	-92.07%	-59.20%	-34.45
Bull	12/87	09/89	22	20.98%	22.98%	459.74
Bear	10/89	09/90	12	-21.86%	-42.10%	-131.16
Bull	10/90	01/94	40	21.77%	51.86%	1,855.79
Bear	02/94	06/94	5	-35.04%	-26.59%	-42.19
Bull	07/94	12/99	66	16.50%	18.63%	4,343.45
Bear	01/00	01/03	37	-18.19%	-52.96%	-853.75
Bull	02/03	10/07	57	15.82%	39.91%	2,883.09
Bear	11/07	02/09	16	-33.47%	-41.98%	-332.91
Bull	03/09	04/11	26	23.88%	41.03%	767.35
Bear	05/11	05/12	13	-11.02%	-18.99%	-77.21
Bull	06/12	06/13	13	18.59%	25.14%	131.85

Phase	Start date	End date	Dur.	Amplitude Δ price	Amplitude Δ CAGR	Sev.
HP Filter λ=129,600						
Bear	11/29	12/29	2	-18.78%	-3.37%	-3.41
Bear	08/31	01/32	6	-16.98%	-7.54%	-26.66
Bull	03/33	02/35	24	21.96%	-3.37%	581.43
Bull	02/36	03/36	2	53.17%	6.61%	7.62
Bear	06/37	02/40	33	-10.18%	-1.56%	-420.89
Bear	06/40	12/40	7	-28.29%	-15.25%	-61.71
Bull	07/41	11/44	41	21.81%	12.17%	1,973.12
Bear	08/47	09/48	14	-6.81%	-11.38%	-55.27
Bear	03/49	04/50	14	-10.70%	-16.09%	-86.54
Bull	02/51	06/51	5	15.85%	-1.58%	16.23
Bear	01/52	07/52	7	-20.97%	-13.56%	-44.90
Bull	08/53	08/55	25	26.77%	-5.35%	798.77
Bear	02/56	12/56	11	-2.28%	1.62%	-11.57
Bear	09/57	04/58	8	-15.51%	-22.02%	-42.52
Bull	09/58	05/61	33	27.69%	12.39%	1,581.37
Bear	08/61	12/62	17	-2.69%	-5.12%	-32.23
Bear	12/64	08/65	9	-8.29%	-7.47%	-28.27
Bear	08/66	11/66	4	-22%	-21.36%	-16.20
Bull	06/67	03/69	22	28.55%	19.56%	643.16
Bear	06/69	02/71	21	-8.57%	-9.52%	-151.47
Bull	07/71	08/72	14	23.86%	-7.39%	198.48
Bear	01/73	03/75	27	-30.39%	-18.29%	-752.48
Bear	06/75	07/75	2	-65.43%	-1.42%	-16.22
Bull	09/75	08/76	12	-5.03%	-41.50%	-30.19
Bull	12/76	06/79	31	22.00%	33.10%	1,040.58
Bear	03/80	05/80	3	-37.71%	-17.51%	-16.74
Bull	10/80	11/80	2	36.76%	17.92%	5.36
Bear	09/81	10/81	2	-61.70%	-23.90%	-14.78
Bull	09/82	08/86	48	24.35%	27.29%	3,337.97
Bull	01/87	09/87	9	63.66%	33.58%	201.13
Bear	10/87	12/88	15	-20.39%	-51.99%	-186.01
Bear	03/90	01/91	11	-11.41%	-18.96%	-57.81
Bear	07/92	08/92	2	-42.43%	-18.34%	-8.79
Bull	11/92	02/94	16	27.48%	19.24%	303.02
Bull	11/95	04/96	6	23.34%	9.69%	33.18
Bull	01/97	06/98	18	21.90%	10.10%	311.27
Bear	11/00	06/03	32	-14.62%	-17.38%	-550.39
Bull	12/03	06/07	43	13.39%	4.92%	1,223.23
Bear	01/08	06/09	18	-21.31%	-20.45%	-271.71
Bull	03/10	04/10	2	23.46%	-12.42%	3.57
Bull	09/10	06/11	10	15.09%	14.11%	62.15
Bull	01/13	02/14	14	16.72%	1.41%	137.00
Bear	08/15	09/15	2	-48.29%	-9.63%	-10.41

Note: The left panel presents results obtained using both the turning point algorithm and the band-pass filter as in Christiano & Fitzgerald (2003). The former was conducted under two specifications: a short-run specification with an observation window of 8 months, a minimum cycle length of 16 months and minimum phase duration of 4 months; and a long-run specification with an observation window of 12 months, a minimum cycle length of 24 months and minimum phase duration of 6 months. The latter extracts a business cycle with a duration between 18 and 96 months. A given month is defined to be a bull or bear month if at least two out of the three specifications coincide. The right panel presents the dating according to the recursive application of an HP filter to the stock market index with a parameter of 129,600. A bull (bear) occurs whenever the gap between the predicted value of the trend and the observed value of the index exceeds (-) 6.5% (half a standard deviation). Duration is defined as the number of months between the beginning and end of a phase. Amplitude is defined in two ways. The first column refers to the price change in percentage points between the starting and ending date expressed as a CAGR for comparability. The second measure of amplitude is the change in the one-year average CAGR between starting and ending date. The measure of severity follows the triangular approximation in Harding & Pagan (2002b) and Agnello & Schuknecht (2011) (Equation (1) in section 2.4.2). The measure of amplitude employed is the period price change in percentage, rather than the reported CAGR.

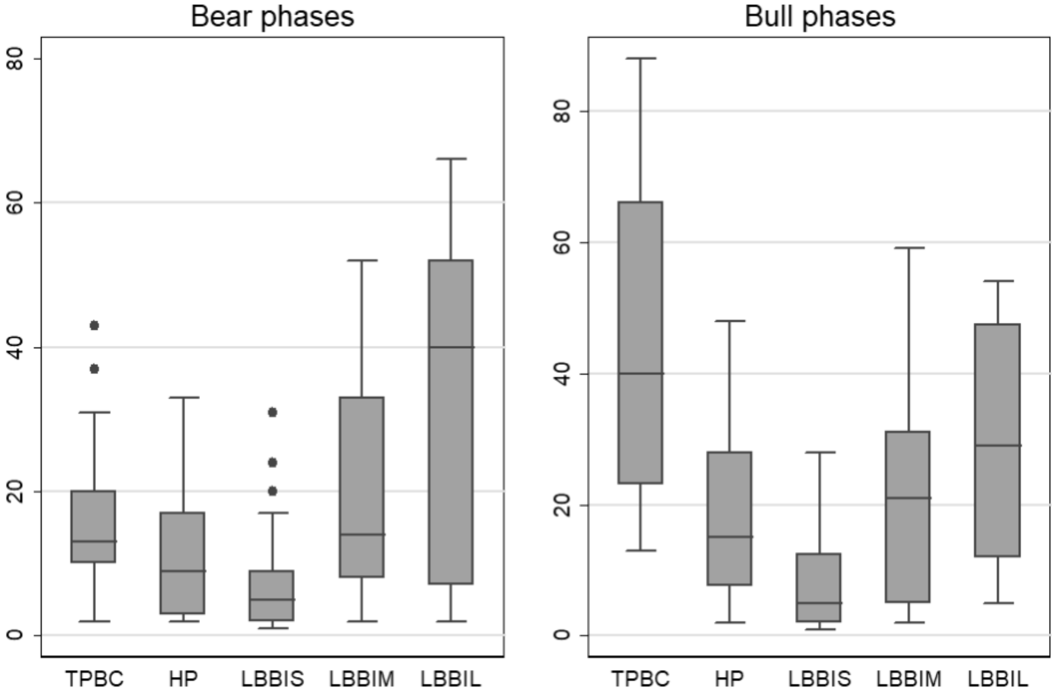
Annex 9. Boxplots and Pairwise Comparisons of Means for Different Measures by Phase and Methodology

We employ boxplots to present a statistical description of the different measures (duration, amplitude, and severity) by methodology. Even if from this graphical representation some statistical inference can be performed. We also include tables with the statistics and p-values for the different pairwise mean comparison tests discussed throughout section 2.7.

In the boxplot, the line inside the box measures the median, the edges of the box represent the 25th and 75th percentiles. The whiskers at the bottom of each box reach the maximum between the minimum value of the variable and the value of the 25th percentile minus 1.5 times the interquartile range (measured as the height of the box). The whiskers at the top of the box reach the minimum between the maximum value and the value of the 75th percentile plus 1.5 times the interquartile range. All observations beyond the whiskers are indicated as outliers.

To provide interpretations of the boxplot, we propose a simple rule. When the boxes for two variables do not overlap, they are statistically different; this is the same as saying that the 75th percentile of one of the variables is below the 25th percentile of the other. A second alternative is that while there is overlap in the boxes, there is no overlap in the medians. This is the case when the 75th (25th) percentile of a variable is below (above) the 50th percentile of the other. In this case, we will indicate that the variables are likely to be different. The final case, when the boxes and medians overlap, is evidence of a statistically insignificant difference between variables.

Figure 33: Boxplot for the duration of phases by methodology



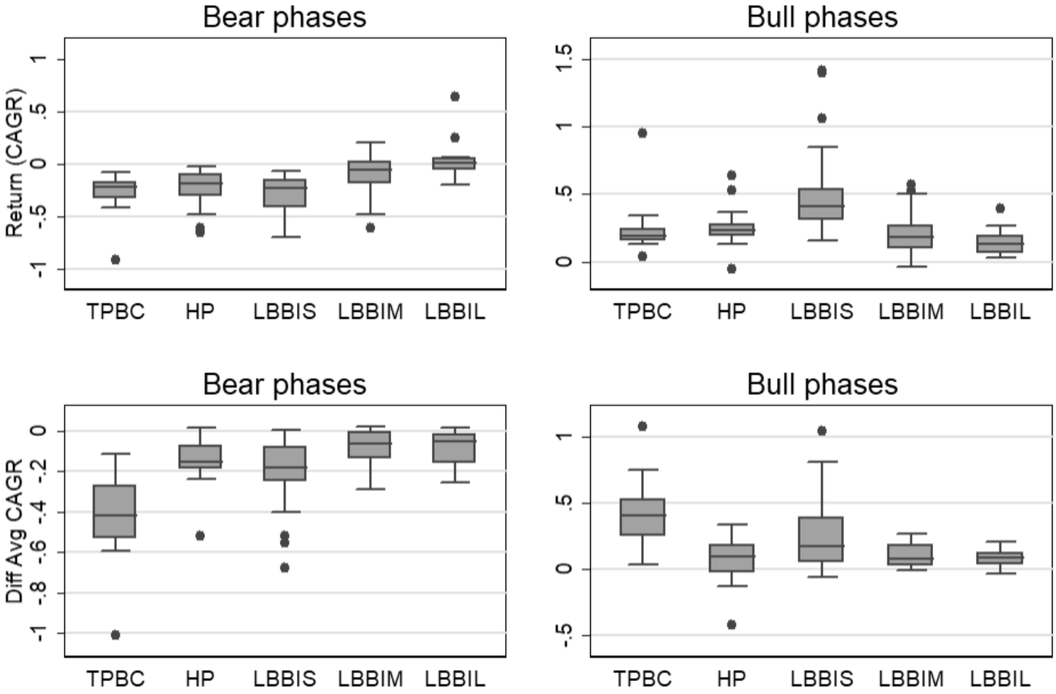
Note: Duration is defined as the number of months between the starting and ending date of a given phase. TPBC refers to the turning point and business cycle consensus. HP refers to the phases identified through the use of the Hodrick and Prescott filter. LBBIS, LBBIM, and LBBIL refer to the phases identified using the short-run, medium-run, and long-run LBBIs respectively.

Table 136: Statistics for pairwise comparison of mean duration by phase and methodology

Duration									
Bear phases					*Bull phases*				
	TPBC	HP	LBBIS	LBBIM		TPBC	HP	LBBIS	LBBIM
HP	-5.10 *0.20*				HP	-28.03 *0.00*			
LBBIS	-9.49 *0.01*	-4.39 *0.18*			LBBIS	-38.47 *0.00*	-10.43 *0.02*		
LBBIM	2.89 *0.48*	7.99 *0.04*	12.38 *0.00*		LBBIM	-26.51 *0.00*	1.52 *0.76*	11.95 *0.01*	
LBBIL	17.22 *0.00*	22.31 *0.00*	26.70 *0.00*	14.32 *0.02*	LBBIL	-17.26 *0.00*	10.78 *0.04*	21.21 *0.00*	9.26 *0.09*

Note: P values in italics underneath the corresponding statistic. Results compare the mean corresponding to the methodology in the row with that of the methodology in the column. If the statistic is positive (negative), then duration presents a higher (lower) mean in the row methodology than in the column methodology. The null hypothesis is that the difference between two means is statistically equal to 0.

Figure 34: Boxplot for the amplitude of phases by methodology



Note: TPBC refers to the turning point and business cycle consensus. HP refers to the phases identified through the use of the Hodrick and Prescott filter. LBBIS, LBBIM, and LBBIL refer to the phases identified using the short-run, medium-run, and long-run LBBIs respectively. The two top panels measure amplitude as the percentage CAGR change between the level in the UK stock market at the beginning and the ending dates of the phase. The two panels at the bottom measure amplitude as the difference between the 60-observation rolling average 1, 3 or 5-year CAGR between starting and ending date. For TPBC, HP, and LBBIS. We employ the one-year CAGR, for LBBIM we use the three-year CAGR, and for LBBIL we use the five-year CAGR.

Table 137: Statistics for pairwise comparison of mean amplitude (return) by phase and methodology

Amplitude - Return (CAGR)									
Bear phases					*Bull phases*				
	TPBC	HP	LBBIS	LBBIM		TPBC	HP	LBBIS	LBBIM
HP	0.05				HP	0.01			
	0.41					*0.89*			
LBBIS	-0.01	-0.06			LBBIS	0.24	0.23		
	0.80	*0.20*				*0.00*	*0.00*		
LBBIM	0.17	0.13	0.19		LBBIM	-0.04	-0.05	-0.28	
	0.01	*0.03*	*0.00*			*0.60*	*0.49*	*0.00*	
LBBIL	0.32	0.27	0.33	0.14	LBBIL	-0.10	-0.11	-0.34	-0.06
	0.00	*0.00*	*0.00*	*0.03*		*0.20*	*0.15*	*0.00*	*0.43*

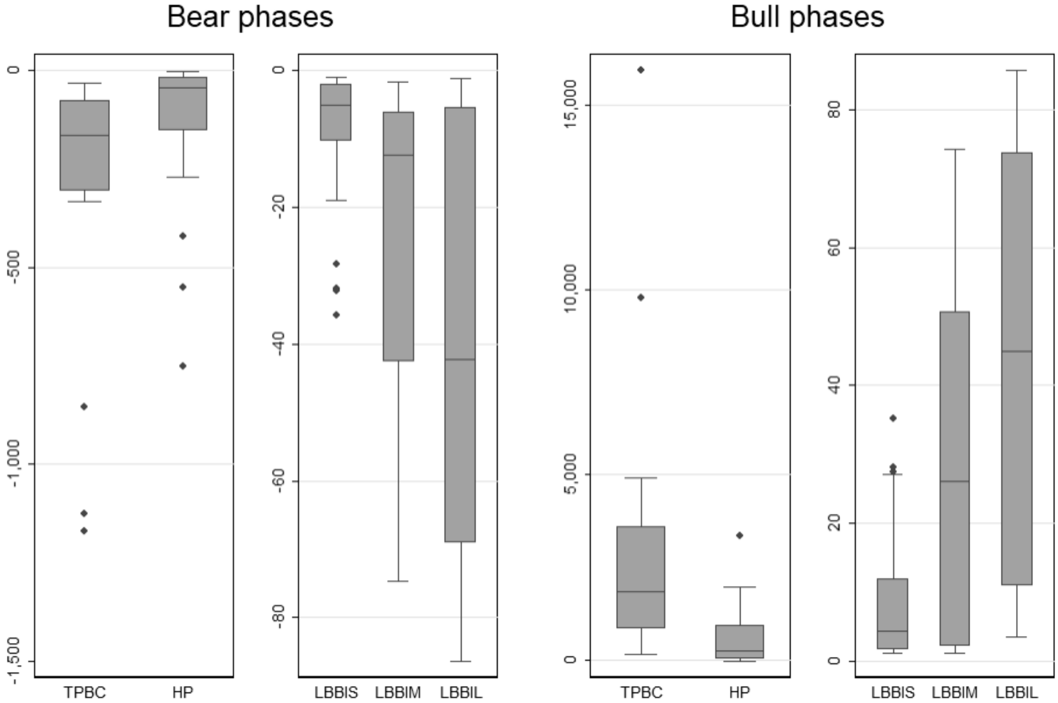
Note: P values in italics underneath the corresponding statistic. Results compare the mean corresponding to the methodology in the row with that of the methodology in the column. If the statistic is positive (negative) then amplitude (CAGR phase return) presents a higher (lower) mean in the row methodology than in the column methodology. The null hypothesis is that the difference between two means is statistically equal to 0.

Table 138: Statistics for pairwise comparison of mean amplitude (difference in growth rate) by phase and methodology

Amplitude - Difference short, medium or long-run CAGR									
Bear phases					*Bull phases*				
	TPBC	HP	LBBIS	LBBIM		TPBC	HP	LBBIS	LBBIM
HP	0.28				HP	-0.35			
	0.00					*0.00*			
LBBIS	0.23	-0.05			LBBIS	-0.18	0.17		
	0.00	*0.19*				*0.00*	*0.00*		
LBBIM	0.33	0.05	0.10		LBBIM	-0.32	0.03	-0.14	
	0.00	*0.22*	*0.01*			*0.00*	*0.59*	*0.01*	
LBBIL	0.33	0.05	0.10	0.00	LBBIL	-0.34	0.01	-0.16	-0.02
	0.00	*0.28*	*0.03*	*1.00*		*0.00*	*0.84*	*0.01*	*0.75*

Note: P values in italics underneath the corresponding statistic. Results compare the mean corresponding to the methodology in the row with that of the methodology in the column. If the statistic is positive (negative) then amplitude (difference in growth rate) presents a higher (lower) mean in the row methodology than in the column methodology. The null hypothesis is that the difference between two means is statistically equal to 0.

Figure 35: Boxplot for the severity of phases by methodology



Note: TPBC refers to the turning point and business cycle consensus. HP refers to the phases identified through the use of the Hodrick and Prescott filter. LBBIS, LBBIM, and LBBIL refer to the phases identified using the short-run, medium-run, and long-run LBBIs respectively. For TPBC and HP, severity is measured following the triangular approximation as in Harding & Pagan (2002b) and equation (1). For LBBIS, LBBIM, and LBBIL severity is measured as the cumulative value of the respective Bull Bear Indicator between the starting and ending date of each phase. These two approximations to severity are not expressed in the same units of measurement and are not comparable.

Table 139: Statistics for pairwise comparison of mean severity by phase and methodology

	Severity						
	Bear phases				*Bull phases*		
	TPBC	LBBIS	LBBIM		TPBC	LBBIS	LBBIM
HP	184.03 *0.00*			HP	-2605.9 *0.00*		
LBBIM		-15.59 *0.00*		LBBIM		19.73 *0.00*	
LBBIL		-33.82 *0.00*	-18.23 *0.01*	LBBIL		35.12 *0.00*	15.39 *0.03*

Note: P values in italics underneath the corresponding statistic. Results compare the mean corresponding to the methodology in the row with that of the methodology in the column. If the statistic is positive (negative), then severity presents a higher (lower) mean in the row methodology than in the column methodology. The null hypothesis is that the difference between two means is statistically equal to 0.

Annex 10. UK bulls and bears in a historical context: A narrative approach

In this annex, we present the results from LBBIs as presented in Figure 16 in the broader political and economic context of the time. This section is designed to serve as a companion for the results in section 2.7. We break down the presentation by trilemma regime to follow the general theme of the dissertation. When we refer to phases as explosive, expansive or pervasive/persistent, we are indicating that they show up in the short, medium or long-run indicators respectively.

The interwar years: 1922-1945

A first boom occurs, according to LBBIS and LBBIM, in early 1922 affecting short-run returns until late 1922 and medium-run returns until early 1924. Concurrently, LBBIL evidences a period of low returns between January and March 1922. The parallel appearance of explosive and expansive booms and a pervasive bust shows that the LBBI methodology discriminates between different types of booms and busts by the persistence of the phase across time. This granular identification allows for booms and busts with different persistence to coincide in time. Following Alford (1972), this bear market may be a consequence of the turmoil after the end of the First World War, the currency problems with the sterling, and the depression and deflation that hit the economy in 1921-22, while the boom phases denote the beginning of a recovery.

Subsequently, LBBIs find bear phases in 1923-24 (LBBIS), 1925 (LBBIS and LBBIM), 1926 and 1929 (all specifications). These bear phases coincide with events like the return to the gold standard at the prewar parity (1925) and the general strike of 1926 (Huberman, 2014). A bust corresponding to the stock market crash of 1929 in the US shows up in all specifications. However, according to Annex 7, these phases are not very relevant when compared to others during the twentieth century. After the crash, the Great Depression shook the world economy both east and west of the Atlantic, with implications for the British stock market. The long-run indicator showcases a boom in 1924-26, linked to economic recovery after a recession. The interesting issue from this analysis is that LBBIs allow us to nuance the story that would have been told otherwise if only using TPBC (as in findings by Bordo & Landon-Lane, 2013)

However, the effects of the Great Depression, the pressure on the gold standard, the failure of the *Credit Anstalt* Bank in Austria (1931), a weakening trade position, and measures such as tax increases and wage cuts to balance the budget coincide with a bear market picked up by LBBIS (1930-31 and 1931-32), LBBIM (1929-32) and LBBIL (1930-33) (Wolf, 2008 and James, 2014). Interestingly, although the acute phase seems to take place only up until January 1932, a few months after the abandonment of gold convertibility, the effects on medium and long-run returns is evidenced by LBBIL until 1933.

After the abandonment of the gold standard in September 1931, LBBIs date a boom that starts in 1932 or 1933 according to the specification of the indicator. Its short-run effects last until 1934, while the medium-run indicator dates its end by 1935 and the long-run indicator found an effect until 1936 when the seeds of the Second World War had already been planted. All LBBIs identify a relevant bust phase during the height of the Second World War, starting in 1937. While the medium and long-run indicators find a single bear phase lasting until 1941, the short-run indicator breaks down the bear phase into three distinct stages. The first stage in 1937-38, coincides with the reoccupation of the Rhineland (1936) and the annexation of Austria (1938). The second phase during a few months during 1939, coincides with the British declaration of war against Germany (September 1939). A final stage lasting a few months by the end of 1940, coincides with the occupation of France, Belgium, the Netherlands, Luxembourg, Latvia, Estonia, and Lithuania, all of which took place during that year (Hobsbawn, 1994).

For the end of this period, LBBIs find a boom that varies in dating depending on the indicator. LBBIS finds it starts in early-1941 and ends by late-1943. Conversely, LBBIM dates its beginning in late-1941 and its end by 1944. Finally, LBBIL indicates it begins in 1942 and runs until 1946. This complicated process of recovery and boom could relate to the fact that both output and employment increased due to the war effort even if the public coffers were nearing exhaustion. Both the establishment of exchange controls (1939) and the entry of the US into the conflict (1941) may have supported the stock market by avoiding divestment and pumping investor's expectations (Milward, 1970).

Bretton Woods: 1945-1971

A first bust, solely identified by LBBIS, occurs between the end of the war in Europe (May 1945) and the bombing of Hiroshima and Nagasaki by the US (August 1945) which sealed the end of the Second World War. By late 1947, all LBBI specifications, note the beginning of a bear phase. While LBBIM indicates this phase runs until late-1950, LBBIL dates its end in early 1953. LBBIS, on the other hand, indicates that this bear trend occurred in two different waves (1947-48 and 1949-50). A bull phase, dated only by the short and medium-run indicators, occurs in 1950-51. This boom is illustrative of the communication between short, medium and long-run LBBIs. The bull phase, according to the LBBIS begins in mid-1950, while both LBBIM and LBBIL still indicate the presence of a bust. Short-run risk-adjusted returns improve enough to start affecting medium-run returns and thus moving the LBBIM above the threshold of a bust phase. By mid-1951, short-run returns have been above average for a sustained period, thus passing the medium-run risk-adjusted returns above the threshold for a bull phase. However, this boom is not powerful enough to revert the trend in long run returns, which keep signalling a contraction until early 1952. In that sense, instead of describing this phase as a full-fledged expansion, it can be better thought of as a recovery. A second bust is dated by LBBIS (1952) and LBBIM (1951-52)

The dynamic described throughout the previous paragraph coincides with the ascent of the Labour government after the end of the war (1945), which was accompanied by increased taxes and nationalisation of industries (Dow, 1964). Additionally, the bear phases may be associated with the threatening of British colonial rule, since in July 1947 the UK signed the Indian Independence Act and Kenya and the Federation of Malaya rebelled against British rule in 1951-52 (Austin, 2014). From an exchange rate perspective, it is worthwhile to recall the UK devalued the pound in 1949 as one of the measures to help solve the dollar shortage that troubled the international monetary order at the time (Bordo

& Schwartz, 1997; Eichengreen & Sussman, 2000). The other two measures put in place were the European Reconstruction Plan (Marshall Plan) in 1948-52, and the establishment of the European Payments Union in 1950 (Neal, 2015).

The following expansion is dated by LBBIS in 1952-54, while the medium-run indicator dates in 1953-55, and the long-run indicator indicate it runs from 1953 until 1957. This expansion coincides with a wave of European stock market booms (Bordo & Wheelock, 2009). It was an intense expansion since its medium and long-run effects could be identified almost by the end of the decade. Subsequently, a new crash that shows up in all BBIs occurs in 1957-58. The bust shows up in the medium and long-run returns propelled by two explosive a busts registered by BBIS in 1955-56 and 1957-58. The first one roughly coincides with the end of the Bandung conference which continued the decolonisation process, and the Suez Crisis which undermined the perception of a British Empire (Hyam, 2006). The second bear market may be associated with the US recession of 1958 which coincides with the only negative GDP growth in the UK in 1950-70. The decade ends as LBBIS dates a new boom period in 1958-60. Concurrently, LBBIM indicates this boom lasts until 1961 while LBBIL indicates its long-run effects wane by 1962. The results for the 1950s coincide with the historiography which points out that the decade was one of unparalleled economic growth in the UK, with low levels of unemployment, a reduction of the national debt, and increasing demand, particularly after the end of the rationing in 1954 (Hobsbawm, 1994; Middleton, 2000).

In general, the decade of the 1960s is one of underperformance in the stock market. LBBIS and LBBIM register a crash in 1961-62 with medium-run effects until 1964. This bust may be related to brief dips in the UK's output at the beginning of the decade, and to a rolling recession that occurred in the US in 1960-61. LBBIS and LBBIM identify a significant crash in 1964-65. A third crash in 1966-67, shows up both in the short and medium-run indicators. This crash may be associated with the balance of payments and exchange rate problems that characterised the UK economy at the time, and that ended with the devaluation of the pound in

November of 1967. The effects of these three explosive and expansive busts compounded to produce a single long crash which registers in the long-run indicator from 1963 until 1967. According to the three specifications of the indicator, a boom takes place in 1967-69. This finding is consistent with those by Bordo & Landon-Lane (2013) who date the boom in 1966-68. Finally, the decade ends with two successive bear phases, as identified by the short-run indicator in 1969 and 1970. LBBIM identifies the effects of this crash until 1971.

Interestingly, this description of relative economic underperformance of the UK during the European Golden Age of economic development is consistent with the findings by Crafts (2012). The Bretton Woods era ends with a short boom in 1971-1972 which quickly affects long-run returns and thus shows up in all three indicators. We associated this boom with a period of rapid UK growth, deregulation of the mortgage market and significant tax cuts that were implemented in 1970-72 (Aldcroft, 2002).

Post Bretton Woods: 1971-2015

The first significant bust in the period occurs under the conservative government of Edward Heath (1970-74) that faced dire economic conditions, with union strikes, increasing unemployment, very high inflation and the first oil shock (1973-74) which led the broadest crash in the series according to the LBBI methodology (Huberman, 2014). This bust starts, according to LBBIS, in August 1972 and lasts until December 1974. This bust affects medium-run returns until late 1975. A second contraction is registered by LBBIS during 1976. The compounded effect of these two successive crashes shows up as a pervasive crash during 1972-77. This finding is consistent with the idea that the effects of the oil shocks could be felt well until the end of the decade (Kindleberger & Aliber, 2005).

A short-run recovery from the oil-shock crash begins in early 1975 and lasts until early 1976. A second boom starts in 1977 according to all LBBIs and lasts until 1977, 1979, and 1981 according to the short, medium and long-run indicators respectively. This second boom roughly coincides with a bail-out authorised by the IMF in 1976 aimed to attack the significant budget deficits and the concerns over the value of the pound, which had lost 20% of its value since 1972. After implementing spending cuts the economy started a recovery period, also aided by a recovery in the balance of payments via oil exports (Aldcroft, 2002). We can conclude that, as in the 1960s, the UK stock market underperformed during the 1970s and that the recoveries that occurred (1974-76 and 1976-79) were unable to reverse the negative behaviour of long-run returns until a few months before the decade was over.

The 1980s begin with a crash identified only by the short-run indicator in mid-1979 and lasting until May 1980. This bear phase coincides with the second oil shock, a recession characterised by union strikes all around Britain, high inflation, and unemployment (Minford, 2015). LBBIS then identifies six different booms during 1980-87: 1980, 1982-83, 1984, 1984-85, 1986, and 1987. LBBIM and LBBIL identify a single boom during this period starting in 1982 and 1983 respectively. This is the lengthiest long-run boom in the series and coincides with a period of high GDP growth, receding inflation, and decreasing unemployment after the first critical years of the Thatcher government. Bordo & Landon-Lane (2013) associate this boom with increasing house prices, growing GDP, low taxes and decreasing interest rates.

However, this expansive era is nuanced by a quick bust that shows up in the short and medium-run indicators during September-October 1981. Subsequently, the expansion of the 1980s comes to an immediate halt with a crash that begins in 1987 (the Black Monday). It is a sudden event that affects simultaneously short and medium-run returns and, after only a few months, appears in the long run indicator. The short-run phase ends by 1988 but is quickly followed by another contraction during 1990. A third bear phase, which shows up both BBIM and BBIL, occurs in July and August 1992. The effects of these three bear phases are compounded and appear in a medium and long-run crash that lasts until 1992. This contractionary phase in the UK stock market coincides with the entrance of the UK in the European Monetary System (EMS) in October 1990, and with episodes of rising inflation and unemployment accompanied by decreasing industrial output and GDP. By the end of the Thatcher government (November 1990) the economy had slid in what would be the most prolonged recession since the Great Depression (1990-93). Additionally, speculative attacks against the British Pound by institutional investors resulted in the abandonment of the EMS in late 1992 (Eichengreen, 2008; Minford, 2015).

By the end of 1992, both LBBIS and LBBIM register an expansive phase that lasts until early or mid-1994 respectively. By late 1994, these expansions seem to affect the long-run indicator, which shows a boom that runs with short interruptions until 1999. The short-run indicator shows two short contractions in 1994-95, and then two short expansions in 1995 and 1997. The medium-run indicator shows a boom that starts in late 1996 and runs uninterrupted until 1998. These booms coincide with the Conservative governments of John Major and the first Labour government of Tony Blair, and occurred during a period of stability, decreasing inflation, and GDP growth after the recession of 1990-93.

By the end of the century, global capital markets started facing severe risks from emerging markets: Asian crisis in 1997, Russian default in 1998, Brazilian crisis in 1999, Argentinean crisis 2001, Dotcom bubble 2001-03 (Kindleberger & Aliber, 2005). All these events coincided with significant corrections in the stock market which show up in the three specifications of BBIs as a long and severe bust in 2000-03 with long-run effects running until 2004.

After this period of turmoil, the three indicators register a boom that occurs between the burst of the technological bubble (2003-04) and the beginning of the Global Financial Crisis (2007). The period was also one of financial innovation and market deregulation which allowed the stock market to recover. Most of the capital that was fleeing the emerging markets looks for haven either in the US or Europe and with that additional capital inflows the stock market started booming (James, 2014). The length of the boom is nuanced by LBBIM and LBBIL, as they find that the medium and long-run returns only boom starting in 2005 and 2006 respectively. While the short-run indicator dates the end of the boom phase in 2006, the other two indicators date its end in mid to late 2007, coinciding with the first announcements of problems in the subprime market in the US.

The indicators show the bear associated with the GFC beginning in late 2007 or early 2008 and its end in 2009, 2010, or 2012 according to LBBIS, LBBIM, and LBBIL respectively. Its long-lasting effects occur in part because recovery was prolonged (only two bull episodes in the short-run indicator in 2009-10) and because there was a short-run downturn in 2011 that coincided with the peak of the European debt crisis (Neal, 2015).

An exciting result takes the form of an incipient bear market that shows up the short and medium-run indicators, for the last two months of the sample: August and September of 2015. This bust may be associated with the Brexit talks and the current transit that the European Union Referendum Act 2015. This legislation was currently advancing through the UK legislative: it was approved by the House of Commons in June 2015 and would be approved by the House of Lords in December of that same year.

Annex 11. A Comparison between VIX and LBBIs: Are they related?

Following Wilmott (2006), financial derivatives are contracts signed at a time t_0, which mature at time t_k. The two best-known derivatives contracts are forwards and European options. The forward contract is one in which the issuer of the contract commits him or herself to buy or sell a given asset (the underlying), at a future date (expiration), at a set price that is known at time t_0 (strike price). The beneficiary, the counterparty to the issuer, also commits him or herself to sell or buy the underlying asset under the agreed upon conditions. The strike price of a forward contract is set in such a way that there is no need to exchange cash flows on the date of issuance.

A European option contract is similarly defined, but in this case, while the issuer commits to buying or selling the underlying, the beneficiary of the contract can choose to sell or buy depending on current market conditions.[248] In a call option, the beneficiary of the contract can buy the underlying at the strike price on the maturity date. He or she will only do so if the market price is above the strike price (the option is "in the money"). In a put option, the beneficiary of the contract can sell the underlying at the strike price on the maturity date. He or she will only do so if the market price is below the strike price. On the date of issuance, options are quoted and negotiated out of the money, meaning that for a call (put) option, the strike price must be above (below) the market price (spot price). Since the bearer of the option has no downside in his or her future cash flows, just as in an insurance contract, options have a positive price at the time of issuance (premium) which the beneficiary pays to the issuer. The premium for call and put options on a stock market index are calculated as follows (Wilmott, 2016, V1 pp 116-118):

$$c = Se^{-D(T-t)}N(d_1) - Ke^{-r(T-t)}N(d_2) \qquad (29)$$

[248] A relevant characteristic of European options is that they can only be exercised at the maturity date. Conversely, American options can be exercised at any point in time between issuance and maturity.

$$p = -Se^{-D(T-t)}N(-d_1) + Ke^{-r(T-t)}N(-d_2) \quad (30)$$

$$d_1 = \frac{log\left(\frac{S}{K}\right) + \left(r - D + \frac{1}{2}\sigma^2\right)(T-t)}{\sigma\sqrt{T-t}} \quad (31)$$

$$d_2 = \frac{log\left(\frac{S}{K}\right) + \left(r - D - \frac{1}{2}\sigma^2\right)(T-t)}{\sigma\sqrt{T-t}} = d_1 - \sigma\sqrt{T-t} \quad (32)$$

Where *S* is the spot value of the index, *D* is the continuous expected dividend growth rate, *(T-t)* represents time to maturity, N is the standard normal distribution function, *K* is the agreed upon strike price, *r* is the continuous risk-free interest rate between time *t* and time *T*, and σ is the volatility of the underlying asset. Several important relationships from equations (29) and (30) are relevant:

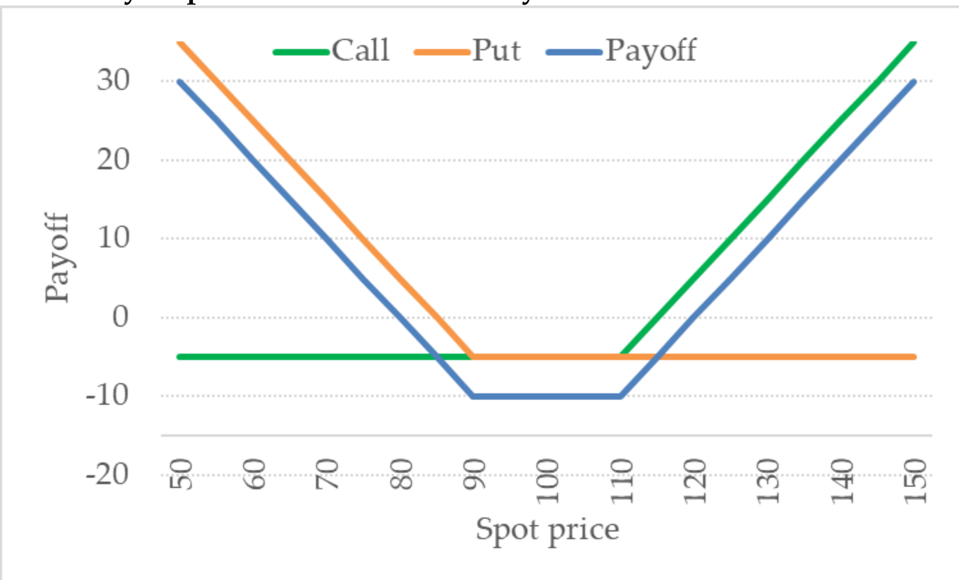
All else equal, if the strike price increases call (put) options become more in the (out of the) money and their price *c* (*p*) increases (decreases). With regards to the pay out, higher expected dividend growth rates *D* imply a lower value for both put and call options. On the other hand, higher σ increases the value of both types of contracts. Note that the relationship between expected dividend growth, volatility, and LBBIs mirror their relations to the price of call and put options. When expected dividends increase, the stock price increases and so do LBBIs. When volatility increases the denominator in the LBBI function increases, and thus the LBBI decreases.

According to CBOE (2014, p. 4), the generalised formula for calculating the VIX index is:

$$\frac{VIX}{100} = \sigma^2 = \left(\frac{2}{(T-t)}\sum_i \frac{\Delta K_i}{2_i^2} e^{r(T-t)} Q(K_i)\right) - \left(\frac{1}{(T-t)}\left(\frac{\left(K + e^{r(T-t)}(c-p)\right)}{K_0} - 1\right)\right) \quad (33)$$

Where *c* and *p* correspond to the price of out-of-the-money call and put options centred around an at-the-money strike price K. K_0 is the first traded strike price below strike price K, K_i is the strike price of the i-th out-of-the-money option such that for call options $K_i > K_0$ and for put options $K_i < K_0$, and $Q(K_i)$ is the mid-point of the bid-ask spread for each option with strike K_i. According to Wilmott (2006), buying an out-of-the-money call option and selling an out-of-the-money put option is an investment structure called an at-the-money straddle. The payoff structure of that investment strategy at time T is depicted in Figure 36.

Figure 36: Payoff profile of an at-the-money straddle



Note: In the payoff structure depicted above the current stock market price is \$100. The out-of-the-money call option (green line) has a strike price of \$110. The out-of-the-money put option (orange line) has a strike price of \$90. To exemplify, the premium paid for each option is \$5. The payoff for the portfolio of options is depicted in the blue line.

If the current stock price is \$100, such that both options are out-of-the-money, higher expected volatility will increase the probability that the structure has a positive payoff. Consequently, higher volatility will increase the value of the structure and affect the VIX index positively. In the payoff structure shown in **Error! Reference source not found.** we assume there are no dividend payments. If a dividend payment occurs during the life of the contracts, that is a payoff that the beneficiary is not entitled to and thus would cause a parallel downward shift of the payoff structure. Consequently, as the expected dividend growth rate increases the payoff in the structure and the value of the VIX is reduced.

Annex 12. Comparison Between US LBBIs and Advanced Economies' Stock Market Principal Component

As described in Section 3.1.1 we have built three matrices $\mathbf{M}_{\text{short}}$, $\mathbf{M}_{\text{medium}}$, and $\mathbf{M}_{\text{long}}$ using the short, medium, and long-run stock market LBBIs for the twelve countries in the database. We obtain the first principal component out of the variance-covariance matrix of each matrix $\mathbf{M}_{\text{x}}$ which represents the common driver with the highest explanatory power over twelve stock markets. In Table 140 we present the Augmented Dickey-Fuller test for the presence of a unit root for both the principal components described above and the LBBIs for the US stock market.

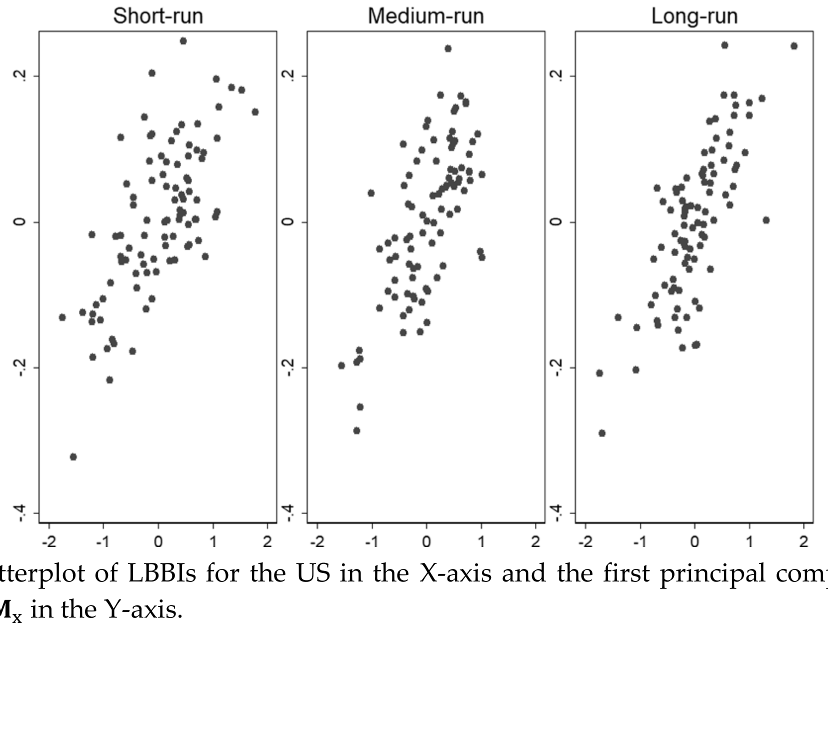
Table 140: Augmented Dickey-Fuller test for the presence of a unit root

	Short-run		Medium-run		Long-run	
	Advanced Economies PC	*USA LBBI*	*Advanced Economies PC*	*USA LBBI*	*Advanced Economies PC*	*USA LBBI*
ADF statistic	-9.966***	-10.460***	-5.333***	-5.353***	-4.124***	-4.565***

Note: Null hypothesis is the existence of a unit root. Test includes a constant and time trend. Critical values: 10% (*) -3.155; 5% (**) -3.459; 1% (***) -4.060.

In Figure 37 we present a scatterplot of the LBBIs for the US in the X-axis, against the first principal component for each matrix **M** in the Y axis.

Figure 37: Scatterplot of LBBIs for the US stock market against the common component of the advanced economies' stock markets



Note: Scatterplot of LBBIs for the US in the X-axis and the first principal component of matrices $\mathbf{M}_{\text{x}}$ in the Y-axis.

It is clear from the figure that there is a strong, positive and linear relationship between both variables. In that sense, we can safely indicate that the factor that is common to the twelve stock markets used as dependent variables is also common to the LBBIs that proxy for a global financial cycle.

Annex 13. Panel Unit Root Tests for the Variables in the Stock Market Model

In the following table, we present the results of a battery of panel unit root tests applied to the independent variables in the stock market model described in Chapter 3. All tests coincide in that every series in panel-stationary which allows us to exclude the possibility of cointegration between the variables.

Table 141: Panel unit root tests on variables for the stock market model

Series	Source	IPS (2003)	Maddala & Wu (1999)			Choi (2001)			Conclusion
			Pm statistic	*z statistic*	*L* statistic*	*Pm statistic*	*z statistic*	*L* statistic*	
Short-run LBBI	GFD, Author's calculations	-22.573 *0.000*	845.64 *0.000*	-27.793 *0.000*	-67.834 *0.000*	28.441 *0.000*	-12.883 *0.000*	-17.590 *0.000*	No unit root
Medium-run LBBI	GFD, Author's calculations	-13.721 *0.000*	314.44 *0.000*	-15.910 *0.000*	-25.227 *0.000*	26.415 *0.000*	-13.011 *0.000*	-19.114 *0.000*	No unit root
Long-run LBBI	GFD, Author's calculations	-11.798 *0.000*	218.11 *0.000*	-12.706 *0.000*	-17.495 *0.000*	29.310 *0.000*	-15.119 *0.000*	-16.313 *0.000*	No unit root
Change in real GDP per capita	JST (2017)	-18.290 *0.000*	523.85 *0.000*	-21.045 *0.000*	-42.022 *0.000*	27.372 *0.000*	-12.574 *0.000*	-17.000 *0.000*	No unit root
Change in openness to trade	JST (2017)	-20.013 *0.000*	701.93 *0.000*	-25.065 *0.000*	-56.356 *0.000*	28.442 *0.000*	-12.883 *0.000*	-17.590 *0.000*	No unit root
Change in financial development	JST (2017)	-16.468 *0.000*	472.84 *0.000*	-19.566 *0.000*	-37.821 *0.000*	27.206 *0.000*	-12.516 *0.000*	-16.908 *0.000*	No unit root
Overall current balance to GDP	Mitchell (2013), Authors calculations	-9.286 *0.000*	180.12 *0.000*	-10.594 *0.000*	-14.396 *0.000*	27.162 *0.000*	-12.488 *0.000*	-16.867 *0.000*	No unit root
Net capital account to GDP	Mitchell (2013), Authors calculations	-11.614 *0.000*	272.71 *0.000*	-13.598 *0.000*	-21.845 *0.000*	27.226 *0.000*	-12.523 *0.000*	-16.912 *0.000*	No unit root
Short-term interest rate differencial (domestic-foreign)	JST (2017)	-8.485 *0.000*	145.16 *0.000*	-9.474 *0.000*	-11.604 *0.000*	25.721 *0.000*	-12.044 *0.000*	-16.085 *0.000*	No unit root
Inflation rate differential (domestic - foregin)	JST (2017)	-15.606 *0.000*	389.26 *0.000*	-17.385 *0.000*	-31.225 *0.000*	25.967 *0.000*	-11.789 *0.000*	-16.106 *0.000*	No unit root

Note: IPS (2003) refers to the test by Im, Pesaran & Shin (2003). Pm, z and L* are the Fisher unit root panel tests of Maddala and Wu (1999) and Choi (2001) respectively. All tests include individual effects and a linear time trend. The null hypothesis of all the tests is that there is no unit root in the panel series, whereas the alternative hypothesis is that not all panel series are I(0). All the panel tests are asymptotically distributed as N(0,1). IPS (2003) and Maddala & Wu (1999) test assume independence between the units in the cross-section whereas the Choi (2001) tests are robust to cross-sectional dependence

Annex 14. Regressions by Trilemma Regime and by Phase and Trilemma Regime for the Stock Market

The following tables contain all the coefficients of the tables summarised in Section 3.4. First, we include the coefficients for the control variables as well as the variables of interest in the regressions by trilemma regime (Table 142, Table 143, and Table 144). In these tables, the firs column labeled "base" presents the results for the unconditional regression. Second, we present the full sample regressions broken down by phase (Table 145). Finally, we present the coefficients for the regressions by phase and trilemma regime including both control variables and variables of interest (Table 146, Table 147, and Table 148). Tables are organised by dependent variable rather than by trilemma regime.

Table 142: Regressions for the short-run LBBIs by trilemma regime

Variable		Short-run				
		Base	*Fi Cl*	*Fi Op*	*Fl Cl*	*Fl Op*
Controls	Constant	0.0716	0.1725	-0.1296	0.2985	.68***
	Trend	-0.0012	-0.0024	-0.0006	-.0102***	-.007***
	% Change in real GDP per capita	0.4357	**1.55***	-0.1649	**5.648***	**-5.801***
	Change in openness to trade	0.1064	-0.2992	2.0460	**-9.928***	0.5169
	Change in financial development	0.8194	1.2900	1.9010	-2.4670	0.3096
Variables of interest	Overall current balance to GDP	2.029**	1.3290	**3.571***	**14.32***	2.0710
	Capital account to GDP	1.113**	0.3642	**1.999**	**17.75***	0.4001
	Short term rate diferential (domestic-foreign)	-0.0149	-0.0134	0.0067	**-.05***	-0.0069
	Inflation differential (domestic-foreign)	-.598***	**-.4626**	-1.2510	-1.5730	**-2.874**
	Global cycle (US LBBI to time horizon)	.5097***	**.3287***	**.5721***	**.4929***	**.6509***
	N	938	337	336	83	182
	R squared	0.2955	0.1711	0.3929	0.5012	0.5994

Note: Results from PCSE regressions with country fixed effects. Significance level * 10%, ** 5%, *** 1%. *Fi* refers to fixed exchange rates. *Fl* refers to flexible exchange rates. *Cl* refers to closed capital accounts. *Op* refers to open capital accounts. Significant coefficients are highlighted in bold. The base case scenario uses the full sample.

Table 143: Regressions for the medium-run LBBIs by trilemma regime

Variable		Medium-run				
		Base	*Fi Cl*	*Fi Op*	*Fl Cl*	*Fl Op*
Controls	Constant	0.1271	0.048	-0.0861	-0.2455	.6602***
	Trend	-0.0020	-0.0011	-0.0008	-0.0055	-.0071***
	% Change in real GDP per capita	2.004***	**1.918*** **	**2.308** **	**6.049*** **	0.0255
	Change in openness to trade	1.158**	0.3769	**2.939*** **	-1.7350	**1.857** **
	Change in financial development	0.5373	0.4875	**1.669***	0.9403	**1.635** **
Variables of interest	Overall current balance to GDP	2.633***	1.0200	**4.145*** **	**7.855** **	1.9540
	Capital account to GDP	1.037**	0.6706	**2.077*** **	**5.065***	0.6053
	Short term rate diferential (domestic-foreign)	-.0524***	**-.0703*** **	-0.0270	-0.0163	**-.0405** **
	Inflation differential (domestic-foreign)	-.4306***	**-.4441*** **	-1.2170	0.2790	0.7774
	Global cycle (US LBBI to time horizon)	.5842***	**.4605*** **	**.6312*** **	**.5302*** **	**.7151*** **
	N	938	337	336	83	182
	R squared	0.3718	0.2837	0.4707	0.5120	0.6379

Note: Results from PCSE regressions with country fixed effects. Significance level * 10%, ** 5%, *** 1%. *Fi* refers to fixed exchange rates. *Fl* refers to flexible exchange rates. *Cl* refers to closed capital accounts. *Op* refers to open capital accounts. Significant coefficients are highlighted in bold. The base case scenario uses the full sample.

Table 144: Regressions for the long-run LBBIs by trilemma regime

Variable		Long-run				
		Base	*Fi Cl*	*Fi Op*	*Fl Cl*	*Fl Op*
Controls	Constant	0.1795	-0.0848	0.096	-.55**	.5329***
	Trend	-0.0023	0.0021	-0.0020	-0.0039	-.0056***
	% Change in real GDP per capita	1.261**	0.7904	**2.286****	**4.375*****	**3.484****
	Change in openness to trade	-0.2195	-0.2491	0.6232	-3.254*	-0.4205
	Change in financial development	0.6028	0.2334	**2.278****	1.6700	**1.738****
Variables of interest	Overall current balance to GDP	2.872***	**2.599*****	**3.05****	**6.645***	**3.467****
	Capital account to GDP	.8175*	0.3885	0.8893	3.1290	**2.001*****
	Short term rate diferential (domestic-foreign)	-.0498***	-0.0260	**-.0438*****	0.0227	**-.0529*****
	Inflation differential (domestic-foreign)	-.3072**	**-.3555****	**-1.963***	-1.1330	0.6371
	Global cycle (US LBBI to time horizon)	.5429***	**.4112*****	**.6121*****	**.4277*****	**.5883*****
	N	938	337	336	83	182
	R squared	0.3345	0.2145	0.4336	0.6309	0.5778

Note: Results from PCSE regressions with country fixed effects. Significance level * 10%, ** 5%, *** 1%. *Fi* refers to fixed exchange rates. *Fl* refers to flexible exchange rates. *Cl* refers to closed capital accounts. *Op* refers to open capital accounts. Significant coefficients are highlighted in bold. The base case scenario uses the full sample.

Table 145: Regressions by phase full sample

Variable		Short-run		Medium-run		Long-run	
		Bear	*Bull*	*Bear*	*Bull*	*Bear*	*Bull*
Controls	Constant	-.3588***	.4018***	-.2976***	.5388***	-.2188**	.7557***
	Trend	-.0029***	0.0013	-.0023**	-0.000021	-.0029**	0.00025
	% Change in real GDP per capita	0.3254	1.102	**1.166****	**2.226****	**.8948***	**1.883***
	Change in openness to trade	0.4345	**-1.294***	0.2739	0.3041	0.4224	-0.524
	Change in financial development	-0.1444	0.6328	0.3169	-0.5579	**1.169****	0.0071
Variables of interest	Overall current balance to GDP	**1.19***	-0.2466	**1.194****	0.6262	**1.089***	**4.551*****
	Capital account to GDP	0.6451	0.2737	0.5514	0.3131	0.2275	0.5077
	Short term rate diferential (domestic-foreign)	-0.0115	0.0064	**-.0193*****	-0.0024	**-.0175***	-0.0079
	Inflation differential (domestic-foreign)	**-.4857*****	1.076*	**-.3496*****	0.514	-0.1795	0.3305
	Global cycle (US LBBI to time horizon)	**.2659*****	**.1069****	**.3238*****	**.1661****	**.3433*****	**.3283*****
	N	466	472	477	329	488	240
	R squared	0.4348	0.095	0.3328	0.0926	0.2138	0.3296

Note: Table contains the results for the PCSE regressions by phase using the full sample. We use country fixed effects. Significance level * 10%, ** 5%, *** 1%. Booms occur when the indicator has a positive value. Busts occur when the indicator takes a negative value. Significant coefficients highlighted in bold.

Table 146: Regressions for the short-run LBBIs by phase and trilemma regime

	Variable	Fi CL		Fi Op		Fl Cl		Fl Op	
		Bear	*Bull*	*Bear*	*Bull*	*Bear*	*Bull*	*Bear*	*Bull*
Controls	Constant	-.3482***	.5032***	-.3903***	0.2448	-.3218***	1.031	0.1262	.6801***
	Trend	-.0073***	0.0021	-.0052***	0.0024	-.0044**	0.0025	-0.0017	-.0035***
	% Change in real GDP per capita	**.7525***	**1.795***	1.0170	0.7854	-0.8829	6.8810	**-5.632****	**-3.434***
	Change in openness to trade	**.8773***	-1.2320	1.0570	-1.0270	**-5.226*****	0.7617	1.2210	-0.8124
	Change in financial development	0.2986	-1.0480	-0.8980	**3.576*****	-2.4340	-0.9729	-2.706**	1.2200
Variables of interest	Overall current balance to GDP	1.3360	-0.9577	**3.342*****	0.3245	1.0490	-3.3250	2.7790	1.0760
	Capital account to GDP	-0.0499	-2.0510	**1.254***	1.2790	1.3360	-5.8240	**2.761****	**-.7131***
	Short term rate diferential (domestic-foreign)	-0.0044	-0.0181	0.0025	0.0212	**-.0528*****	0.0613	-0.0200	**.0292***
	Inflation differential (domestic-foreign)	**-.3695*****	0.6495	**-2.658****	**3.175***	-0.5750	1.6270	-0.7774	-1.9170
	Global cycle (US LBBI to time horizon)	**.0894*****	**.1453****	**.2879*****	0.0602	**.2852*****	0.1272	**.4399*****	**.1874*****
	N	159	178	170	166	49	34	88	94
	R squared	0.5625	0.1574	0.5795	0.2712	0.7535	0.4382	0.7986	0.5099

Note: Results from PCSE regressions with country fixed effects. Significance level * 10%, ** 5%, *** 1%. *Fi* refers to fixed exchange rates. *Fl* refers to flexible exchange rates. *Cl* refers to closed capital accounts. *Op* refers to open capital accounts. Booms occur when the indicator has a positive value. Busts occur when the indicator takes a negative value. Significant coefficients highlighted in bold. Significant coefficients are highlighted in bold.

Table 147: Regressions for the medium-run LBBIs by phase and trilemma regime

	Variable	Fi CL		Fi Op		Fl Cl		Fl Op	
		Bear	*Bull*	*Bear*	*Bull*	*Bear*	*Bull*	*Bear*	*Bull*
Controls	Constant	-.4475***	.2827*	-.2673**	0.2187	-.791***	-0.3752	0.2592	.9263***
	Trend	-0.0005	.0039*	-.0033***	0.0024	.0089***	0.0074	-.0056***	-.0065***
	% Change in real GDP per capita	**1.478*** **	**2.091** **	0.0015	2.6250	**8.602*** **	2.1830	-0.8456	-3.1760
	Change in openness to trade	0.6429	-0.3401	0.6812	1.6030	**-6.547*** **	-0.7327	0.7518	**2.173***
	Change in financial development	0.4376	-0.4291	-0.2615	1.8770	-1.5390	0.2534	-0.3005	0.4067
Variables of interest	Overall current balance to GDP	1.0810	-0.6309	**2.572***	1.6880	2.8660	3.6450	1.1870	**3.042** **
	Capital account to GDP	0.2231	0.9284	1.2680	0.6027	-4.6780	4.0010	1.3270	0.1824
	Short term rate diferential (domestic-foreign)	**-.0359*** **	0.0006	**-.0182***	0.0197	-0.0196	**.0878***	-0.0147	-0.0200
	Inflation differential (domestic-foreign)	**-.2305** **	-0.5038	**-2.573*** **	-0.6125	**-1.561*** **	0.4678	-1.3080	-0.2125
	Global cycle (US LBBI to time horizon)	**.1795*** **	**.2131*** **	**.4018*** **	**.2446** **	0.0559	0.0798	**.4332*** **	**.3814*** **
	N	171	166	174	162	43	40	89	93
	R squared	0.3251	0.4349	0.5146	0.1967	0.9317	0.5214	0.6571	0.6541

Note: Results from PCSE regressions with country fixed effects. Significance level * 10%, ** 5%, *** 1%. *Fi* refers to fixed exchange rates. *Fl* refers to flexible exchange rates. *Cl* refers to closed capital accounts. *Op* refers to open capital accounts. Booms occur when the indicator has a positive value. Busts occur when the indicator takes a negative value. Significant coefficients highlighted in bold. Significant coefficients are highlighted in bold.

Table 148: Regressions for the long-run LBBIs by phase and trilemma regime

Variable		Fi CL		Fi Op		Fl Cl		Fl Op	
		Bear	*Bull*	*Bear*	*Bull*	*Bear*	*Bull*	*Bear*	*Bull*
Controls	Constant	-.3553***	.4126***	-.4473***	0.2618	-0.6903	0.6057	-.4545**	0.4096
	Trend	0.0013	0.0031	-.0046***	0.0013	-0.0002	-0.0077	-.0038*	-0.0016
	% Change in real GDP per capita	0.2657	0.9568	1.0650	1.0570	0.7080	3.9460	1.3820	3.4480
	Change in openness to trade	0.9228	**-1.811****	0.1930	0.2597	-2.4430	-1.5840	0.3471	1.3380
	Change in financial development	1.2060	-0.1936	1.0060	**2.07***	-0.9974	4.2530	**1.383****	1.2250
Variables of interest	Overall current balance to GDP	1.2780	0.3657	1.0060	**7.185*****	1.4280	-2.3230	0.9453	**5.492*****
	Capital account to GDP	-0.3450	0.5547	0.4378	**4.552****	-1.3460	-4.0520	0.2426	**2.547*****
	Short term rate diferential (domestic-foreign)	0.0095	-0.0123	-0.0192	0.0125	0.0227	-0.0126	**-.0314****	-0.0047
	Inflation differential (domestic-foreign)	-0.2063	-0.5206	-1.6230	-1.8270	-0.3121	1.8490	0.2794	-0.8533
	Global cycle (US LBBI to time horizon)	**.1713*****	**.2901*****	**.4442*****	**.352*****	0.4174	-0.2563	**.3497*****	**.4115*****
	N	167	170	169	167	45	38	107	75
	R squared	0.2002	0.3262	0.4231	0.3924	0.8638	0.8946	0.5180	0.4611

Note: Results from PCSE regressions with country fixed effects. Significance level * 10%, ** 5%, *** 1%. *Fi* refers to fixed exchange rates. *Fl* refers to flexible exchange rates. *Cl* refers to closed capital accounts. *Op* refers to open capital accounts. Booms occur when the indicator has a positive value. Busts occur when the indicator takes a negative value. Significant coefficients highlighted in bold. Significant coefficients are highlighted in bold.

Annex 15. Robustness Tests for the Stock Market Model

In this annex, we present three robustness tests for the results in Chapter 3. First, we present a regression table for the unconditional model including a dummy for the years when the Second World War took place (1939-46) (Table 149). Second, we present a regression table for the unconditional model including a dummy for every country-year observation since 1999 to control for the arrival of the euro (Table 150). Finally, we present the unconditional regression and the regression for the TR IV subsample, including a dummy that takes the value of 1 for every eurozone country since 1999 (Table 151).

Table 149: Unconditional regressions including WW2 dummy

		Short-run	Medium-run	Long-run
Control variables	Constant	0.0577	0.1255	0.1419
	Trend	-0.0011	-0.0024	-0.0026
	% Change in real GDP per capita	0.4591	**2.011*** **	**1.27** **
	Change in Trade Openness	0.1538	**1.178** **	-0.2045
	Change in Financial Development	0.8103	0.579	0.6227
Variables of interest	Overall current balance to GDP	**1.873** **	**2.422*** **	**2.69*** **
	Capital account to GDP	**1.062** **	**.9468** **	**.7619***
	Short term rate diferential (domestic-foreign)	-0.0084	**-.0437*** **	**-.0432*** **
	Inflation differential (domestic-foreign)	**-.5907*** **	**-.4062** **	**-.2964** **
	Global cycle (US LBBI to time horizon)	**.5093*** **	**.5866*** **	**.5432*** **
	World War II	0.058	-0.1119	-0.0686
	N	938	938	938
	R squared	0.2923	0.3652	0.3282

Note: Dependent variables are short-run, medium-run and long-run stock market LBBIs. The regressions were run using Panel Corrected Standard Errors (PCSE). Statistically significant coefficients in bold. Significance: * 10%, ** 5%, *** 1%. World War II takes the value of one for every country-year observation between 1939 and 1946.

Table 150: Unconditional regressions including post-1999 dummy

		Short-run	Medium-run	Long-run
Control variables	Constant	0.0678	0.1411	0.2188
	Trend	-0.00093	-0.0012	-0.0026
	% Change in real GDP per capita	0.4001	**3.098*** **	**1.736*** **
	Change in Trade Openness	0.1099	**2.019*** **	0.0809
	Change in Financial Development	0.8231	0.1543	0.2603
Variables of interest	Overall current balance to GDP	**2.095** **	**3.164*** **	**2.83*** **
	Capital account to GDP	**1.095** **	0.6931	0.2136
	Short term rate diferential (domestic-foreign)	-0.0151	**-.058*** **	**-.063*** **
	Inflation differential (domestic-foreign)	**-.5988*** **	**-.2928* **	**-.3421** **
	Global cycle (US LBBI to time horizon)	**.508*** **	**.2048*** **	**.1601*** **
	Post 1999 dummy	-0.0326	-0.1722	-0.1262
	N	938	938	938
	R squared	0.2957	0.192	0.1583

Note: Dependent variables are short-run, medium-run and long-run stock market LBBIs. The regressions were run using Panel Corrected Standard Errors (PCSE). Statistically significant coefficients in bold. Significance: * 10%, ** 5%, *** 1%. Post-1999 dummy takes the value of one for every country-year observation since 1999.

Table 151: Unconditional and TR IV regressions including eurozone dummy

	Short-run		Medium-run		Long-run	
	Full	**Fl Op**	**Full**	**Fl Op**	**Full**	**Fl Op**
Constant	0.063	**.6944*** **	0.1119	**.7428*** **	0.181	**.5909*** **
Trend	-0.00096	**-.0073*** **	-0.0016	**-.0088*** **	-0.0023	**-.0069*** **
% Change in real GDP per	0.385	**-5.731*** **	**1.981*** **	0.1383	**1.261** **	**3.561** **
Change in Trade Openness	0.1317	0.4983	**1.169** **	**1.814** **	-0.2185	-0.4146
Change in Financial	0.8243	0.2842	0.5375	**1.646** **	0.6052	**1.776** **
Overall current balance to	**2.008** **	2.052	**2.613*** **	1.825	**2.873*** **	**3.368** **
Capital account to GDP	**1.091** **	0.411	**1.024** **	0.4306	**.8187* **	**1.968*** **
Short term rate diferential	-0.0152	-0.0066	**-.0528*** **	**-.0366** **	**-.0497*** **	**-.0468*** **
Inflation differential	**-.6034*** **	**-2.844** **	**-.4341*** **	0.946	-.307**	0.792
Global cycle (US LBBI to	**.5086*** **	**.6522*** **	**.5826*** **	**.7314*** **	**.5432*** **	**.613*** **
Eurozone dummy	-0.0808	0.0485	-0.1254	0.2355	0.0146	0.2712
N	938	182	938	182	938	182
R squared	0.2961	0.5999	0.3725	0.6438	0.3346	0.5801

Note: Dependent variables are short-run, medium-run and long-run stock market LBBIs. The regressions were run using Panel Corrected Standard Errors (PCSE). Statistically significant coefficients in bold. Significance: * 10%, ** 5%, *** 1%. Eurozone dummy takes the value of one for every observation when a country uses the euro as its domestic currency. The first column in each panel presents the result for the unconditional model. The second column in each panel presents the results when the subsample is restricted to trilemma regime IV. *Fl* refers to flexible exchange rates. *Op* refers to open capital accounts.

Annex 16. Comparison Between US LBBIs and Advanced Economies' Real Credit Principal Component

As described in Section 4.1.1 we have built three matrices $\mathbf{M}_{\text{short}}$, $\mathbf{M}_{\text{medium}}$, and $\mathbf{M}_{\text{long}}$ using the short, medium, and long-run real credit LBBIs for the twelve countries in the database. We obtain the first principal component out of the variance-covariance matrix of each matrix $\mathbf{M}_{\text{x}}$ which represents the common driver with the highest explanatory power over the twelve real credit levels. In Table 152 we present the Augmented Dickey- Fuller test for the presence of a unit root for both the principal components described above and the LBBIs for the US real credit variable.

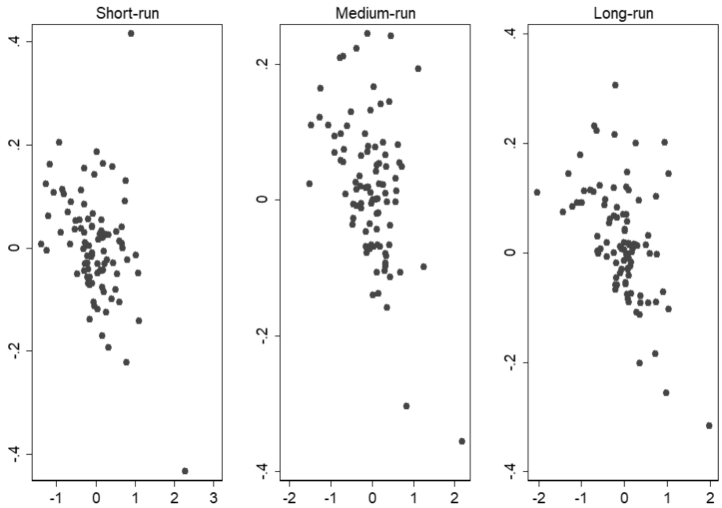
Table 152: Augmented Dickey-Fuller test for the presence of a unit root

	Short-run		Medium-run		Long-run	
	Advanced Economies PC	*USA LBBI*	*Advanced Economies PC*	*USA LBBI*	*Advanced Economies PC*	*USA LBBI*
ADF statistic	-5.779***	-6.003***	-3.666**	-4.651***	-2.481	-3.618**

Note: Null hypothesis is the existence of a unit root. Test includes a constant and time trend. Critical values: 10% (*) -3.155; 5% (**) -3.459; 1% (***) -4.060.

In Figure 38 we present a scatterplot of the LBBIs for the US in the X-axis, against the first PC for each matrix **M** in the Y axis.

Figure 38: Scatterplot of LBBIs for the US real credit against the common component of the advanced economies' real credit



Note: Scatterplot of LBBIs for the US in the X-axis and the first principal component of matrices $\mathbf{M}_{\text{x}}$ in the Y-axis.

It is clear from the figure that there is a negative linear relationship between both variables. In that sense, we can safely indicate that the factor that is common to the twelve stock markets used as dependent variables is also common to the LBBIs that proxy for a global financial cycle.

Annex 17. Panel Unit Root Tests for the Variables in the Real Credit Model

In the following table, we present the results of a battery of panel unit root tests applied to the independent variables in the real credit model described in Chapter 4. This annex complements the results obtained in Annex 13. All tests coincide in that every series in panel-stationary which allows us to exclude the possibility of cointegration between the variables.

Table 153: Panel unit root tests on variables for the real credit model

Series	Source	IPS (2003)	Maddala & Wu (1999)			Choi (2001)			Conclusion
			Pm statistic	*z statistic*	*L* statistic*	*Pm statistic*	*z statistic*	*L* statistic*	
Short-run LBBI	GFD, Author's calculations	-14.577 *0.000*	51.92 *0.000*	-16.766 *0.000*	-30.775 *0.000*	26.236 *0.000*	-12.242 *0.000*	-16.374 *0.000*	No unit root
Medium-run LBBI	GFD, Author's calculations	-8.697 *0.000*	16.75 *0.000*	-8.688 *0.000*	-11.114 *0.000*	19.111 *0.000*	-9.091 *0.000*	-11.902 *0.000*	No unit root
Long-run LBBI	GFD, Author's calculations	-5.071 *0.000*	6.41 *0.000*	-4.526 *0.000*	-4.893 *0.000*	17.365 *0.000*	-7.929 *0.000*	-10.586 *0.000*	No unit root
Domestic loans to the private non-financial sector to GDP	JST (2017)	1.514 *0.935*	19.70 *0.714*	1.513 *0.935*	1.647 *0.948*	28.442 *0.000*	-12.883 *0.000*	-17.590 *0.000*	No unit root
Annual inflation rate	JST (2017)	-17.046 *0.000*	321.90 *0.000*	-15.911 *0.000*	-25.820 *0.000*	28.442 *0.000*	-12.883 *0.000*	-17.540 *0.000*	No unit root
Change in investment to GDP	JST (2017)	-11.390 *0.000*	183.57 *0.000*	-11.124 *0.000*	-14.722 *0.000*	26.400 *0.000*	-12.152 *0.000*	-16.442 *0.000*	No unit root

Note: IPS (2003) refers to the test by Im, Pesaran & Shin (2003). Pm, z and L* are the Fisher unit root panel tests of Maddala and Wu (1999) and Choi (2001) respectively. All tests include individual effects and a linear time trend. The null hypothesis of all the tests is that there is no unit root in the panel series, whereas the alternative hypothesis is that not all panel series are I(0). All the panel tests are asymptotically distributed as N(0,1). IPS (2003) and Maddala & Wu (1999) test assume independence between the units in the cross-section whereas the Choi (2001) tests are robust to cross-sectional dependence

Annex 18. Regressions by Trilemma Regime and by Phase and Trilemma Regime for Real Credit

The following tables contain all the coefficients of the tables summarised in Section 4.4. First, we include the coefficients for the control variables as well as the variables of interest in the regressions by trilemma regime (Table 154, Table 155, and Table 156). In these tables, the first column labeled "Base" presents the results for the unconditional regression. Second, we present the full sample regressions broken down by phase (Table 157). Thirdly, we present the coefficients for the regressions by phase and trilemma regime including both control variables and variables of interest (Table 158, Table 159, Table 160). Finally, we present the coefficients for the regression by structure of the financial system and trilemma regime including both control variables and variables of interest (Table 161, Table 162, Table 163). Tables are organised by dependent variable rather than by trilemma regime.

Table 154: Regressions for the short-run LBBIs by trilemma regime

Variable		Short-run				
		Base	*Fi Cl*	*Fi Op*	*Fl Cl*	*Fl Op*
Controls	Constant	-0.0649	-.3597***	.2392**	.7537**	.3562*
	Trend	.0033***	.0069**	.0041**	.0105*	.0065**
	Loans to GDP (Lag 1)	-.5288***	**-.7858****	**-.8048*****	**-2.188****	**-1.159*****
	Domestic inflation (Lag 1)	.56***	**.6837*****	-0.5319	-1.7490	-0.3279
	% Change in real GDP per capita	3.906***	**4.823*****	**4.756*****	2.2490	2.8560
	Change in investment to GDP	2.857***	0.4823	**3.439***	-0.1496	**18*****
	Change in openness to trade	-0.0481	**2.126*****	-1.0810	-1.5550	-0.5821
	Change in financial development	3.491***	**3.529*****	**3.392*****	-2.6520	**3.996*****
Variables of interest	Overall current balance to GDP	-1.263**	**-3.283*****	-0.9693	**13.48*****	**3.047***
	Capital account to GDP	-1.302***	-1.2670	**-1.089***	2.4360	1.9270
	Short term rate diferential (domestic-foreign)	-.0192**	0.0223	**-.0317*****	0.0214	0.0099
	Inflation differential (domestic-foreign)	-.5595***	**-.529*****	**-7.28*****	**-6.444*****	**-4.447*****
	Global cycle (US LBBI to time horizon)	.1615***	**.2739*****	**.1599*****	**.198***	0.0228
	N	894	284	284	45	141
	R squared	0.2440	0.3878	0.4184	0.7749	0.4682

Note: Results from PCSE regressions with country fixed effects. Significance: * 10%, ** 5%, *** 1%. *Fi* refers to fixed exchange rates. *Fl* refers to flexible exchange rates. *Cl* refers to closed capital accounts. *Op* refers to open capital accounts. Significant coefficients are highlighted in bold. The base case scenario uses the full sample.

Table 155: Regressions for the medium-run LBBIs by trilemma regime

Variable		Medium-run				
		Base	*Fi Cl*	*Fi Op*	*Fl Cl*	*Fl Op*
Controls	Constant	-0.0210	-0.1894	.2416**	0.4616	.398*
	Trend	.0046**	.0076**	.0074***	0.0115	.0077**
	Loans to GDP (Lag 1)	-.711***	**-1.218*****	**-1.008*****	0.0789	**-.9932*****
	Domestic inflation (Lag 1)	-.2219*	-0.0883	**-4.931*****	**-5.734*****	**-3.313****
	% Change in real GDP per capita	1.197**	1.2730	0.5016	-0.6998	-1.9310
	Change in investment to GDP	0.9722	**2.375***	**4.049*****	**-12.71****	4.6000
	Change in openness to trade	.722*	**2.965*****	**-1.054***	**4.249****	-0.6900
	Change in financial development	1.266***	0.8082	**1.642****	-1.0950	0.2043
Variables of interest	Overall current balance to GDP	-2.412***	**-1.992***	**-2.292*****	**12.89*****	1.6160
	Capital account to GDP	-1.244***	-1.3140	**-1.242****	-2.6220	2.7660
	Short term rate diferential (domestic-foreign)	-0.0121	0.0163	**-.0239***	-0.0254	0.0036
	Inflation differential (domestic-foreign)	-.5069***	**-.4785*****	**-3.689*****	-0.0577	**-4.763*****
	Global cycle (US LBBI to time horizon)	.1686***	**.1636****	**.1062***	**.2321***	**.1729***
	N	894	284	284	45	141
	R squared	0.1663	0.3275	0.3360	0.6796	0.4501

Note: Results from PCSE regressions with country fixed effects. Significance: * 10%, ** 5%, *** 1%. *Fi* refers to fixed exchange rates. *Fl* refers to flexible exchange rates. *Cl* refers to closed capital accounts. *Op* refers to open capital accounts. Significant coefficients are highlighted in bold. The base case scenario uses the full sample.

Table 156: Regressions for the long-run LBBIs by trilemma regime

Variable		Long-run				
		Base	*Fi Cl*	*Fi Op*	*Fl Cl*	*Fl Op*
Controls	Constant	-0.0435	-0.1802	-0.0538	0.0413	0.1743
	Trend	0.0036	.0081**	0.0033	0.0099	.0054**
	Loans to GDP (Lag 1)	-.491**	**-1.2*** **	-0.3022	0.2064	**-.6329*** **
	Domestic inflation (Lag 1)	-0.0128	-0.0045	-0.5373	**-3.581***	-1.8100
	% Change in real GDP per capita	0.5375	0.5226	-0.5350	-3.2310	0.6183
	Change in investment to GDP	1.82**	1.4820	**4.621*** **	**-13.61** **	2.4020
	Change in openness to trade	0.2444	**1.987*** **	**-1.645** **	**8.845*** **	**-1.663** **
	Change in financial development	.6982*	**1.106***	0.4785	0.7705	0.2985
Variables of interest	Overall current balance to GDP	-2.028***	**-1.855** **	**-3.207*** **	5.7950	-0.2582
	Capital account to GDP	-.7671**	-0.8483	**-3.386*** **	-5.8370	5.0720
	Short term rate diferential (domestic-foreign)	0.0056	0.0038	-0.0166	0.0002	-0.0203
	Inflation differential (domestic-foreign)	-.5884***	**-.5521*** **	-1.2220	**4.44** **	-1.7070
	Global cycle (US LBBI to time horizon)	.1959***	**.4453*** **	0.1572	**.3063*** **	0.0675
	N	894	284	284	45	141
	R squared	0.1258	0.3478	0.2089	0.6063	0.4125

Note: Results from PCSE regressions with country fixed effects. Significance: * 10%, ** 5%, *** 1%. *Fi* refers to fixed exchange rates. *Fl* refers to flexible exchange rates. *Cl* refers to closed capital accounts. *Op* refers to open capital accounts. Significant coefficients are highlighted in bold. The base case scenario uses the full sample.

Table 157: Regressions by phase full sample

Variable		Short-run		Medium-run		Long-run	
		Bear	*Bull*	*Bear*	*Bull*	*Bear*	*Bull*
Controls	Constant	-.1894**	.6146***	-.3874***	.3754***	-.3866***	.3443***
	Trend	.003***	-0.0011	.0035**	0.0013	0.0021	0.0003
	Loans to GDP (Lag 1)	**-.5079*** **	**-.2683** **	**-.4376*** **	**-.4231*** **	-0.2519	**-.3941*** **
	Domestic inflation (Lag 1)	**-.9031** **	**.7015** **	0.0723	-0.3825	0.0597	-0.1944
	% Change in real GDP per capita	**1.424** **	0.2725	1.1090	1.0070	0.1555	**1.077***
	Change in investment to GDP	**3.374*** **	2.5530	**3.371** **	1.2990	1.5110	0.2997
	Change in openness to trade	0.7324	0.6002	0.2252	**.9146***	-0.2149	0.1038
	Change in financial development	**2.324*** **	0.9746	0.3494	**2.213*** **	0.4669	0.8247
Variables of interest	Overall current balance to GDP	0.4359	0.3007	-1.3450	-0.9221	-2.139**	-0.3174
	Capital account to GDP	**-1.114*** **	-0.2850	**-1.574*** **	**-.7837***	**-1.9*** **	0.8387
	Short term rate diferential (domestic-foreign)	0.0074	-0.0066	-0.0145	-0.0029	0.0037	0.0135
	Inflation differential (domestic-foreign)	-0.0098	-0.8541	**-.3891*** **	0.1105	**-.5047*** **	**-2.46*** **
	Global cycle (US LBBI to time horizon)	**.0592***	0.0478	0.0777	**.1536*** **	0.0215	**.2864*** **
	N	302	251	364	298	375	335
	R squared	0.4653	0.3485	0.2775	0.3161	0.1590	0.4095

Note: Table contains the results for the PCSE regressions by phase using the full sample. We use country fixed effects. Significance: * 10%, ** 5%, *** 1%. Booms occur when the indicator has a positive value. Busts occur when the indicator takes a negative value. Significant coefficients highlighted in bold.

Table 158: Regressions for the short-run LBBIs by phase and trilemma regime

	Variable	Fixed Closed		Fixed Open		Flexible Closed		Flexible Open	
		Bear	*Bull*	*Bear*	*Bull*	*Bear*	*Bull*	*Bear*	*Bull*
Controls	Constant	-.9392***	.4451**	-0.1657	.619***	-1.349***		-0.6241	1.528**
	Trend	0.0040	0.0006	.0055***	0.0025	-0.0065		.0118***	0.0018
	Loans to GDP (Lag 1)	0.6642	**-.5304****	**-.7522*****	**-.619*****	**2.206*****		**-.5768***	-0.1535
	Domestic inflation (Lag 1)	-0.2133	**2.071*****	0.0104	-0.8766	**8.512****		-0.5078	1.1170
	% Change in real GDP per capita	**4.159*****	-0.8051	**5.889*****	0.7069	**-5.613*****		0.5056	-0.4922
	Change in investment to GDP	0.9927	-2.5910	**3.694****	-0.0899	-2.7310		**19.42*****	7.3460
	Change in openness to trade	**3.486***	**2.016*****	-1.0780	**1.063***	**4.272****		2.8370	2.1410
	Change in financial development	**3.829*****	1.5830	**3.061*****	1.3590	-3.6300		2.8710	-0.2706
Variables of interest	Overall current balance to GDP	1.6780	-1.2140	1.3430	0.5163	**6.697*****		**9.534***	**19.5*****
	Capital account to GDP	**6.024****	-0.1234	**.8887****	-0.3027	**5.811*****		**10.97****	**19.16*****
	Short term rate diferential (domestic-foreign)	**.0732*****	-0.0044	**-.0337****	0.0177	-0.0694		**-.0501***	-0.0119
	Inflation differential (domestic-foreign)	0.0341	-1.1640	**-2.437***	-4.27**	1.4690		**12.26*****	1.5490
	Global cycle (US LBBI to time horizon)	0.0467	**.136****	0.0374	0.0142	**.5357*****		0.0927	-0.1096
	N	83	84	98	79	24		49	42
	R squared	0.7398	0.6938	0.6919	0.6999	0.9374		0.8443	0.8545

Note: Results from PCSE regressions with country fixed effects. Significance: * 10%, ** 5%, *** 1%. The first adjective in the title refers to the exchange rate regime. The second adjective in the title refers to the capital account regime. Booms occur when the indicator has a positive value. Busts occur when the indicator takes a negative value. Significant coefficients highlighted in bold.

Table 159: Regressions for the medium-run LBBIs by phase and trilemma regime

Variable		Fixed Closed		Fixed Open		Flexible Closed		Flexible Open	
		Bear	*Bull*	*Bear*	*Bull*	*Bear*	*Bull*	*Bear*	*Bull*
Controls	Constant	-.6013***	.8292***	-0.0542	.4078***	-0.1884		-0.4356	.4385**
	Trend	0.0036	-.0129***	.0051**	.0053**	-.036***		.0157**	.0082***
	Loans to GDP (Lag 1)	-0.2329	-0.0557	**-.8173*** **	**-.7385*** **	**7.174*** **		-1.0210	**-1.056*** **
	Domestic inflation (Lag 1)	0.1346	**1.967***	-0.8178	-2.5650	**10.53*** **		-5.6870	**-4.557*** **
	% Change in real GDP per capita	**3.07** **	0.5897	0.9246	0.4471	**-3.451*** **		5.9930	1.3160
	Change in investment to GDP	**3.552***	2.5290	**7.941*** **	2.6690	-4.1890		-11.2600	**5.282** **
	Change in openness to trade	**3.669*** **	0.6909	-1.6380	-0.7879	**-4.992** **		-1.6890	**3.205*** **
	Change in financial development	0.2317	**2.124***	1.8410	**2.011** **	**-11.67*** **		1.6680	0.2579
Variables of interest	Overall current balance to GDP	**-3.006***	-0.3677	1.8880	-1.2360	**11.19*** **		6.0930	**6.418***
	Capital account to GDP	-0.7198	-0.1927	1.9000	-1.4470	**5.592*** **		7.5620	6.9310
	Short term rate diferential (domestic-foreign)	**.0296***	0.0101	-0.0223	0.0093	**-.1144*** **		-0.0212	-0.0037
	Inflation differential (domestic-foreign)	**-.3471*** **	**-2.542*** **	-0.4847	**-5.474*** **	**-3.06*** **		-4.2920	**2.981***
	Global cycle (US LBBI to time horizon)	0.0678	.1653**	0.0949	**.256*** **	**.4904*** **		**.3652** **	**-.3354*** **
	N	111	101	118	91	24		55	46
	R squared	0.5411	0.6240	0.5191	0.6434	0.9933		0.5133	0.9078

Note: Results from PCSE regressions with country fixed effects. Significance: * 10%, ** 5%, *** 1%. The first adjective in the title refers to the exchange rate regime. The second adjective in the title refers to the capital account regime. Booms occur when the indicator has a positive value. Busts occur when the indicator takes a negative value. Significant coefficients highlighted in bold.

Table 160: Regressions for the long-run LBBIs by phase and trilemma regime

Variable		Fixed Closed		Fixed Open		Flexible Closed		Flexible Open	
		Bear	*Bull*	*Bear*	*Bull*	*Bear*	*Bull*	*Bear*	*Bull*
Controls	Constant	-.9415***	.7162***	-0.2272	0.1169			0.1072	.3864**
	Trend	.0098***	-0.0080	-0.0035	0.0022			-0.0008	.0042*
	Loans to GDP (Lag 1)	-0.2145	-0.5881	-0.0710	-0.2360			-0.3424	**-.8266*** **
	Domestic inflation (Lag 1)	0.1542	1.0430	2.1000	0.4072			1.7350	0.0513
	% Change in real GDP per capita	**2.155*** **	0.0139	-2.3510	1.2900			4.4090	1.7950
	Change in investment to GDP	1.7320	-0.2407	**5.94** **	-1.1850			-2.9830	1.9930
	Change in openness to trade	**3.488*** **	0.8102	**-2.385*** **	-1.2390			-1.2440	0.5914
	Change in financial development	0.9367	0.5995	-0.7997	0.0284			1.2680	**2.647*** **
Variables of interest	Overall current balance to GDP	**2.424* **	1.5250	-1.6160	**-3.177** **			-5.2100	**-3.7*** **
	Capital account to GDP	**3.409** **	**5.354*** **	**-4.121*** **	-0.5811			-1.9140	**-4.289*** **
	Short term rate diferential (domestic-foreign)	**.0394** **	0.0311	0.0091	-0.0047			0.0281	0.0093
	Inflation differential (domestic-foreign)	**-.364*** **	**-2.592** **	0.8150	**-5.946*** **			-4.2990	-1.9130
	Global cycle (US LBBI to time horizon)	-0.0005	**.4363*** **	**.1267* **	**.2365*** **			0.1274	-0.0040
	N	118	103	124	108			54	59
	R squared	0.5941	0.5933	0.4812	0.5357			0.6054	0.8019

Note: Results from PCSE regressions with country fixed effects. Significance: * 10%, ** 5%, *** 1%. The first adjective in the title refers to the exchange rate regime. The second adjective in the title refers to the capital account regime. Booms occur when the indicator has a positive value. Busts occur when the indicator takes a negative value. Significant coefficients highlighted in bold.

Table 161: Regressions for the short-run LBBIs by structure of the financial system and trilemma regime

Variable		Fixed Closed		Fixed Open		Flexible Closed		Flexible Open	
		Bank	*Market*	*Bank*	*Market*	*Bank*	*Market*	*Bank*	*Market*
Controls	Constant	-0.2177	.9543***	1.327***	0.0270	2.315***		.6028**	-0.2072
	Trend	.0123**	.0206***	.0082**	0.0010	0.0067		0.0048	0.0069
	Loans to GDP (Lag 1)	**-1.193****	**-9.391*****	**-2.919*****	-0.5068	**-2.432****		**-1.412****	**-.8761****
	Domestic inflation (Lag 1)	**.5498*****	1.1030	0.5954	0.8078	**-6.987****		**-5.651*****	**3.895***
	% Change in real GDP per capita	**5.427*****	2.9220	**5.382***	2.0140	4.0300		**7.881****	**10.27*****
	Change in investment to GDP	**-5.688****	1.6520	**9.058****	**10.61****	**-12.71***		**18.62*****	**12.52***
	Change in openness to trade	**4.699*****	2.6210	-0.5891	-2.6700	-9.755**		-0.8759	-0.2997
	Change in financial development	1.9740	2.8120	-0.0298	**6.226*****	**-5.666****		**9.316*****	1.8930
Variables of interest	Overall current balance to GDP	-0.7618	**-4.953****	3.3360	**-14.17*****	-7.4010		**7.736***	-4.0130
	Capital account to GDP	1.8890	**-5.376****	1.9830	**-9.385****	**-15.63***		**7.37***	-0.1014
	Short term rate diferential (domestic-foreign)	0.0260	-0.0236	**-.0635****	-0.0253	-0.0203		-0.0336	0.0024
	Inflation differential (domestic-foreign)	**-.4076****	**-4.885*****	**-6.713****	**-9.579*****	-1.1540		1.4160	**-8.342****
	Global cycle (US LBBI to time horizon)	**.3299*****	**.2635****	**-.2258***	**.3914*****	0.1175		-0.0480	**-.2428****
	N	117	72	57	88	30		87	34
	R squared	0.5182	0.6074	0.5529	0.4243	0.8466		0.5651	0.6890

Note: Results from PCSE regressions with country fixed effects. Significance: * 10%, ** 5%, *** 1%. The first adjective in the title refers to the exchange rate regime. The second adjective in the title refers to the capital account regime. Significant coefficients highlighted in bold

Table 162: Regressions for the medium-run LBBIs by structure of the financial system and trilemma regime

Variable		Fixed Closed		Fixed Open		Flexible Closed		Flexible Open	
		Bank	*Market*	*Bank*	*Market*	*Bank*	*Market*	*Bank*	*Market*
Controls	Constant	0.2624	0.5530	.8747*	0.1395	2.633***		1.592***	0.1557
	Trend	0.0056	.0172***	.0092**	0.0043	.015***		0.0089	0.0029
	Loans to GDP (Lag 1)	**-1.043***	**-5.183****	**-2.431*****	**-.868****	**-2.738*****		**-2.628*****	**-.636*****
	Domestic inflation (Lag 1)	-0.1127	**-4.26*****	-2.5790	**-3.97****	**-13.99*****		**-8.889*****	**2.509****
	% Change in real GDP per capita	-0.1340	-1.4780	0.4461	-0.3567	**4.792****		-0.3083	-0.9284
	Change in investment to GDP	1.4290	3.5000	**9.398*****	6.4240	**-8.132****		3.5140	3.5760
	Change in openness to trade	**3.84*****	**3.96*****	-1.7100	-1.9120	**-11.63*****		-1.8780	-0.2343
	Change in financial development	1.2720	1.0820	-0.4597	1.8550	1.5470		0.2398	0.7629
Variables of interest	Overall current balance to GDP	0.8763	**-5.229*****	3.1030	-6.2050	**-18.93*****		2.9240	**-9.715*****
	Capital account to GDP	2.3740	**-4.408*****	**4.268****	-1.4830	**-9.302***		1.6360	**-6.504****
	Short term rate diferential (domestic-foreign)	0.0055	-0.0204	**-.0873*****	0.0123	**-.036****		-0.0127	**.0428*****
	Inflation differential (domestic-foreign)	**-.4943*****	0.2048	**-5.345****	-3.0200	2.2220		-3.405*	**-8.127*****
	Global cycle (US LBBI to time horizon)	**.3423*****	**.1884****	-0.1436	0.1308	**.2268*****		0.0539	0.0340
	N	117	72	57	88	30		87	34
	R squared	0.4649	0.6349	0.5046	0.3079	0.9394		0.3860	0.8602

Note: Results from PCSE regressions with country fixed effects. Significance: * 10%, ** 5%, *** 1%. The first adjective in the title refers to the exchange rate regime. The second adjective in the title refers to the capital account regime. Significant coefficients highlighted in bold

Table 163: Regressions for the long-run LBBIs by structure of the financial system and trilemma regime

	Variable	Fixed Closed		Fixed Open		Flexible Closed		Flexible Open	
		Bank	*Market*	*Bank*	*Market*	*Bank*	*Market*	*Bank*	*Market*
Controls	Constant	0.2276	0.0239	-0.3012	-0.1196	0.1852		1.001***	.2441**
	Trend	0.0082	.0143*	0.0017	0.0027	0.0056		.0141***	-.0036**
	Loans to GDP (Lag 1)	**-1.214***	-2.2310	-0.3665	-0.6398	0.4200		**-2.376*****	-0.1724
	Domestic inflation (Lag 1)	0.0329	**-2.342***	-0.5556	1.0510	**-9.739*****		-2.5280	**4.449*****
	% Change in real GDP per capita	-0.3418	-2.1360	-0.0516	-0.7115	-2.6900		1.6410	**2.264***
	Change in investment to GDP	2.0230	2.2020	-0.5581	2.2480	**-21.71*****		-1.7640	-1.7610
	Change in openness to trade	**2.73****	0.9780	-2.8850	-2.7370	2.1810		-1.8640	-0.0159
	Change in financial development	**2.066****	-1.4420	-0.4821	-1.3630	2.0660		0.1026	-0.7906
Variables of interest	Overall current balance to GDP	3.5690	-0.9509	-1.6120	-6.2370	**-13.72***		-3.9770	**-13.99*****
	Capital account to GDP	4.4290	-0.7122	-1.0140	1.6940	-11.0200		1.3550	**-11.31*****
	Short term rate diferential (domestic-foreign)	-0.0091	-0.0087	-0.0488	-0.0338	**-.0539****		0.0034	**.0323****
	Inflation differential (domestic-foreign)	**-.5147*****	-0.1267	-4.1880	-1.4730	**10.52*****		-0.9274	**-4.151*****
	Global cycle (US LBBI to time horizon)	**.6157*****	**.5775*****	0.0159	0.0460	**.3231*****		-0.0226	**.0799****
	N	117	72	57	88	30		87	34
	R squared	0.4332	0.5293	0.1606	0.1858	0.7679		0.3416	0.9189

Note: Results from PCSE regressions with country fixed effects. Significance: * 10%, ** 5%, *** 1%. The first adjective in the title refers to the exchange rate regime. The second adjective in the title refers to the capital account regime. Significant coefficients highlighted in bold

Annex 19. Robustness Tests for the Real Credit Model

In this annex, we present the robustness tests for the results in Chapter 4. First, we present a regression table for the unconditional model including a dummy for the years when the Second World War took place (1939-46). Second, we present a regression table for the unconditional model including a dummy for every country-year observation since 1999 to control for the arrival of the euro. Third, we present the unconditional regression including a dummy that takes the value of 1 for every eurozone country since 1999.

Finally, we replicate the results for the regressions by trilemma regime and type of phase for the sample starting in 1971 to account only for the post Bretton Woods period. We include the Chow (1960) tests for individual and joint structural breaks by trilemma, by type of phase to motivate the inclusion of all the sample-specific regression tables. We do not include the regressions for expansions and contractions by trilemma regime because sample size is too small to make the results credible or relevant.

Table 164: Unconditional regressions including WW2 dummy

		Short-run	Medium-run	Long-run
Control variables	Constant	-0.0474	0.0261	-0.0024
	Trend	0.0014	0.0026	0.002
	Loans to GDP (lag 1)	**-.2349*** **	**-.3366*** **	**-.2366***
	Domestic inflation (lag 1)	**.6098*** **	-0.1962	0.0097
	% Change in real GDP per capita	**4.06*** **	**1.266** **	0.5696
	% Change in investment to GDP	**2.649** **	0.8038	**1.815** **
	Change in Trade Openness	-0.1359	**.6725***	0.2162
	Change in Financial Development	**3.316*** **	**1.234*** **	**.7027***
Variables of interest	Overall current balance to GDP	**-1.224** **	**-2.334*** **	**-1.914*** **
	Capital account to GDP	**-1.243*** **	**-1.186*** **	**-.7649** **
	Short term rate diferential (domestic-foreign)	**-.0183** **	-0.0122	0.004
	Inflation differential (domestic-foreign)	**-.6026*** **	**-.5231*** **	**-.59*** **
	Global cycle (US LBBI to time horizon)	**.1699*** **	**.1787*** **	**.2034*** **
	World War II dummy	0.0474	0.1196	-0.0335
	N	894	894	894
	R squared	0.2196	0.1487	0.1183

Note: Dependent variables are short-run, medium-run and long-run real credit LBBIs. The regressions were run using Panel Corrected Standard Errors (PCSE). Statistically significant coefficients in bold. Significance: * 10%, ** 5%, *** 1%. World War II takes the value of one for every country-year observation between 1939 and 1946.

Table 165: Unconditional regressions including post-1999 dummy

		Short-run	Medium-run	Long-run
Control variables	Constant	-0.0118	0.1060	0.0822
	Trend	0.0007	0.0010	0.0003
	Loans to GDP (lag 1)	**-.2577*** **	**-.3811*** **	**-.3109** **
	Domestic inflation (lag 1)	**.6334*** **	-0.1651	0.0073
	% Change in real GDP per capita	**4.123*** **	**1.357** **	0.5813
	% Change in investment to GDP	**2.521** **	0.7282	**1.758** **
	Change in Trade Openness	-0.1395	**.6774* **	0.2279
	Change in Financial Development	**3.333*** **	**1.283*** **	**.7205** **
Variables of interest	Overall current balance to GDP	**-1.305** **	**-2.455*** **	**-2.042*** **
	Capital account to GDP	**-1.216*** **	**-1.206*** **	**-.7509** **
	Short term rate diferential (domestic-foreign)	**-.0175** **	-0.0110	0.0042
	Inflation differential (domestic-foreign)	**-.6006*** **	**-.5075*** **	**-.5933*** **
	Global cycle (US LBBI to time horizon)	**.1745*** **	**.1827*** **	**.2046*** **
	Post-1999 dummy	0.0874	0.1772	**.2412* **
	N	894	894	894
	R squared	0.2209	0.1514	0.1254

Note: Dependent variables are short-run, medium-run and long-run real credit LBBIs. The regressions were run using Panel Corrected Standard Errors (PCSE). Statistically significant coefficients in bold. Significance: * 10%, ** 5%, *** 1%. Post-1999 dummy takes the value of one for every country-year observation since 1999.

Table 166: Unconditional regressions including eurozone dummy

		Short-run	Medium-run	Long-run
Control variables	Constant	-0.0391	0.0459	0.0106
	Trend	0.0012	0.0022	0.0017
	Loans to GDP (lag 1)	**-.2338*** **	**-.3334*** **	**-.2526***
	Domestic inflation (lag 1)	**.6225*** **	-0.1724	0.0058
	% Change in real GDP per capita	**4.076*** **	**1.31** **	0.5669
	% Change in investment to GDP	**2.628** **	0.8166	**1.78** **
	Change in Trade Openness	-0.1395	**.6706***	0.2166
	Change in Financial Development	**3.354*** **	**1.269*** **	**.6961***
Variables of interest	Overall current balance to GDP	**-1.219** **	**-2.318*** **	**-1.902*** **
	Capital account to GDP	**-1.262*** **	**-1.234*** **	**-.7528** **
	Short term rate diferential (domestic-foreign)	**-.0182** **	-0.0117	0.0042
	Inflation differential (domestic-foreign)	**-.5886*** **	**-.5062*** **	**-.5938*** **
	Global cycle (US LBBI to time horizon)	**.1718*** **	**.1805*** **	**.2036*** **
	Eurozone dummy	-0.0018	0.0147	0.1237
	N	894	894	894
	R squared	0.2191	0.1469	0.1192

Note: Dependent variables are short-run, medium-run and long-run real credit LBBIs. The regressions were run using Panel Corrected Standard Errors (PCSE). Statistically significant coefficients in bold. Significance: * 10%, ** 5%, *** 1%. Eurozone dummy takes the value of one for every observation when a country uses the euro as its domestic currency.

Table 167: Unconditional regressions post 1971

		Short-run	Medium-run	Long-run
Control variables	Constant	-1.189***	0.048	-0.1339
	Trend	.0248***	.0141**	0.0086
	Loans to GDP (lag 1)	**-1.351*****	**-1.444*****	**-.632****
	Domestic inflation (lag 1)	1.586	**-3.933*****	**-2.322****
	% Change in real GDP per capita	**8.613*****	0.9809	-0.2769
	% Change in investment to GDP	**4.123****	1.567	1.474
	Change in Trade Openness	**-1.416*****	**-.9567****	**-.7452***
	Change in Financial Development	**2.239*****	0.4097	0.4044
Variables of interest	Overall current balance to GDP	-0.5638	**-1.868****	**-1.928****
	Capital account to GDP	-0.6391	**-1.237*****	**-1.281****
	Short term rate diferential (domestic-foreign)	-0.0099	-0.009	0.005
	Inflation differential (domestic-foreign)	**-2.788****	**-2.07***	-0.7513
	USA LBBI stocks	**.1174****	**.1325****	**.1315***
	N	466	466	466
	R squared	0.3823	0.2382	0.09

Note: Dependent variables are short-run, medium-run and long-run real credit LBBIs. The regressions were run using Panel Corrected Standard Errors (PCSE). Statistically significant coefficients in bold. Significance: * 10%, ** 5%, *** 1%.

Table 168: Chow test for structural breaks in coefficients by group post 1971

Hypothesis I: There is a break by trilemma regime			
Horizon	*Short*	*Medium*	*Long*
Statistic	**4.73**	**3.23**	**2.46**
P-value	**0.00**	**0.00**	**0.00**

Hypothesis II: There is a break between expansions and contractions.			
Horizon	*Short*	*Medium*	*Long*
Statistic	**54.87**	**12.55**	**9.17**
P-value	**0.00**	**0.00**	**0.00**

Hypothesis III: There is a joint break between expansions and contractions by trilemma regime						
Phase	*Contractions*			*Expansions*		
Horizon	*Short*	*Medium**	*Long*	*Short**	*Medium**	*Long**
Statistic	**2.24**	**1.46**	**1.71**	0.91	**1.74**	0.64
P-value	**0.00**	**0.04**	**0.01**	0.65	**0.01**	0.98

Note: Each panel contains a Chow test for structural breaks in the coefficient of the regressions in Table 167 by different groups. The null hypothesis is there is no break.

Table 169: Regressions for the short-run LBBIs by trilemma regime post 1971

Variable		Short-run				
		Base	*Fi Cl*	*Fi Op*	*Fl Cl*	*Fl Op*
Controls	Constant	-1.189***	-3.746***	-.9429*	-2.4510	-0.7904
	Trend	.0248***	.0777***	.0214***	0.0639	.0254***
	Loans to GDP (Lag 1)	-1.351***	**-3.666*** **	**-1.38*** **	**-4.937** **	**-1.594*** **
	Domestic inflation (Lag 1)	1.5860	-2.5170	-0.0741	**-3.995** **	1.0760
	% Change in real GDP per capita	8.613***	**17.21*** **	**8.308*** **	6.5440	**5.771** **
	Change in investment to GDP	4.123**	-8.0100	2.9330	8.2820	**17.54*** **
	Change in openness to trade	-1.416***	**-1.651** **	-0.7615	**-6.026** **	-1.3050
	Change in financial development	2.239***	2.078***	**3.845*** **	0.2009	**3.439** **
Variables of interest	Overall current balance to GDP	-0.5638	-2.519*	-0.0536	-0.0688	0.9525
	Capital account to GDP	-0.6391	0.9835	-0.0980	-0.1336	2.3530
	Short term rate diferential (domestic-foreign)	-0.0099	**.0574*** **	**-.0265** **	-0.0090	**-.0474** **
	Inflation differential (domestic-foreign)	-2.788**	**-4.629* **	**-6.139*** **	0.5770	-0.2686
	Global cycle (US LBBI to time horizon)	.1174**	**.3384*** **	0.0719	**.2451* **	-0.0302
	N	466	50	168	34	126
	R squared	0.3823	0.9037	0.5642	0.7526	0.4413

Note: Results from PCSE regressions with country fixed effects. Significance: * 10%, ** 5%, *** 1%. *Fi* refers to fixed exchange rates. *Fl* refers to flexible exchange rates. *Cl* refers to closed capital accounts. *Op* refers to open capital accounts. Significant coefficients are highlighted in bold. The base case scenario uses the full sample starting in 1971.

Table 170: Regressions for the medium-run LBBIs by trilemma regime post 1971

Variable		Medium-run				
		Base	*Fi Cl*	*Fi Op*	*Fl Cl*	*Fl Op*
Controls	Constant	0.0480	-0.2628	-0.0950	1.7120	0.9158
	Trend	.0141**	0.0136	.0174*	-0.0033	0.0087
	Loans to GDP (Lag 1)	-1.444***	-1.0440	**-1.536***	**-2.238***	**-1.442***
	Domestic inflation (Lag 1)	-3.933***	**-4.106**	-6.405***	**-10.5***	-4.8290
	% Change in real GDP per capita	0.9809	**11.72***	1.9420	1.6870	-0.7842
	Change in investment to GDP	1.5670	3.7020	3.7580	-0.7306	4.0640
	Change in openness to trade	**-.9567**	-1.437*	**-1.041***	-5.491***	-1.3010
	Change in financial development	0.4097	-2.184***	**2.983***	1.3990	-0.0861
Variables of interest	Overall current balance to GDP	-1.868**	-2.6310	-1.2110	-5.1660	3.2430
	Capital account to GDP	-1.237***	**-5.581***	-0.4743	-3.4830	**3.536***
	Short term rate diferential (domestic-foreign)	-0.0090	**.0677***	**-.0498***	0.0007	-0.0137
	Inflation differential (domestic-foreign)	-2.07*	-3.0320	1.1160	-0.6742	**-7.33**
	Global cycle (US LBBI to time horizon)	.1325**	**.2125***	-0.0701	0.1618	0.0380
	N	466	50	168	34	126
	R squared	0.2382	0.8102	0.4203	0.8747	0.3765

Note: Results from PCSE regressions with country fixed effects. Significance: * 10%, ** 5%, *** 1%. *Fi* refers to fixed exchange rates. *Fl* refers to flexible exchange rates. *Cl* refers to closed capital accounts. *Op* refers to open capital accounts. Significant coefficients are highlighted in bold. The base case scenario uses the full sample starting in 1971.

Table 171: Regressions for the long-run LBBIs by trilemma regime post 1971

Variable		Long-run				
		Base	*Fi Cl*	*Fi Op*	*Fl Cl*	*Fl Op*
Controls	Constant	-0.1339	0.5876	-1.1640	-2.6370	1.2110
	Trend	0.0086	-0.0250	0.0200	0.0300	0.0005
	Loans to GDP (Lag 1)	-.632**	**2.731*** **	-0.5596	0.6621	**-1.205*** **
	Domestic inflation (Lag 1)	-2.322**	-0.9328	0.5144	-4.4060	-4.7160
	% Change in real GDP per capita	-0.2769	**7.275** **	-0.4244	2.9370	0.0711
	Change in investment to GDP	1.4740	6.4670	3.3260	-25.4900	2.0630
	Change in openness to trade	-.7452*	-0.7429	**-1.733** **	2.5260	**-1.8** **
	Change in financial development	0.4044	-0.1758	0.9768	5.5080	0.7188
Variables of interest	Overall current balance to GDP	-1.928**	0.5354	**-3.54*** **	-20.8700	1.9750
	Capital account to GDP	-1.281**	1.4400	**-3.738*** **	-7.2710	**6.262** **
	Short term rate diferential (domestic-foreign)	0.0050	-0.0180	-0.0279	-0.0404	-0.0144
	Inflation differential (domestic-foreign)	-0.7513	**4.539* **	0.4406	6.6800	**-6.662** **
	Global cycle (US LBBI to time horizon)	.1315*	**.7574*** **	0.0609	0.6466	-0.1570
	N	466	50	168	34	126
	R squared	0.0900	0.7380	0.2436	0.7677	0.4504

Note: Results from PCSE regressions with country fixed effects. Significance: * 10%, ** 5%, *** 1%. *Fi* refers to fixed exchange rates. *Fl* refers to flexible exchange rates. *Cl* refers to closed capital accounts. *Op* refers to open capital accounts. Significant coefficients are highlighted in bold. The base case scenario uses the full sample starting in 1971.

Table 172: Regressions by type of phase post 1971

	Variable	Short-run		Medium-run		Long-run	
		Bear	*Bull*	*Bear*	*Bull*	*Bear*	*Bull*
Controls	Constant	-1.551***	0.5330	-0.3203	-0.3393	0.3833	-0.1199
	Trend	.022***	.0075*	0.0051	.0192***	-0.0121	.0125***
	Loans to GDP (Lag 1)	**-.8245*** **	**-1.089*** **	**-.4451* **	**-1.321*** **	0.5081	**-1.017*** **
	Domestic inflation (Lag 1)	1.3830	**-2.046** **	-1.646*	0.1901	-0.7090	-0.8997
	% Change in real GDP per capita	**6.377*** **	**4.441*** **	1.9910	**3.505*** **	-0.9340	0.6327
	Change in investment to GDP	0.8280	2.2950	0.3253	2.5000	1.9900	1.7320
	Change in openness to trade	-0.3415	**1.128** **	**-1.363** **	-0.2952	**-1.181** **	-0.4071
	Change in financial development	**2.387*** **	0.2637	-0.1239	**1.695** **	-0.1775	**1.28** **
Variables of interest	Overall current balance to GDP	**-2.219** **	1.9640	**-2.011* **	-0.1134	**-2.717* **	-1.308*
	Capital account to GDP	**-1.415*** **	0.4059	**-1.537*** **	-0.0062	**-2.923*** **	-0.4047
	Short term rate diferential (domestic-foreign)	0.0009	**.0259** **	**-.0255* **	-0.0045	-0.0016	0.0095
	Inflation differential (domestic-foreign)	-0.8631	-0.9133	0.9296	1.0650	1.0090	**-2.022** **
	Global cycle (US LBBI to time horizon)	**.1243*** **	**-.0674* **	**.1444** **	**.0807** **	0.0737	**.183*** **
	N	159	147	199	161	196	185
	R squared	0.6706	0.5903	0.4088	0.5525	0.2548	0.5384

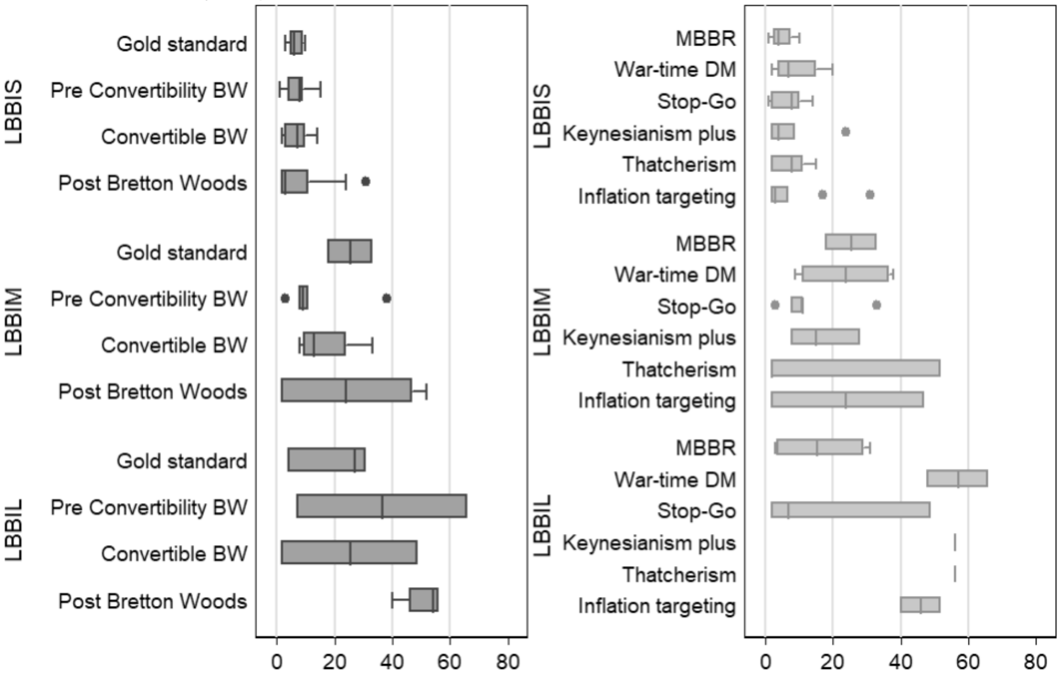
Note: Table contains the results for the PCSE regressions by phase using the full sample starting in 1971. We use country fixed effects. Significance: * 10%, ** 5%, *** 1%. Booms occur when the indicator has a positive value. Busts occur when the indicator takes a negative value. Significant coefficients highlighted in bold.

Annex 20. Boxplots and Pairwise Comparison of Means by Phase for Trilemma and Economic Policy Regimes

We employ boxplots to present a statistical description of the different measures (duration, amplitude, and severity) by methodology. We also include tables with the statistics and p-values for the different pairwise mean comparison tests discussed throughout section 2.7.

Duration

Figure 39: Boxplot for the duration of bear phases by indicator and trilemma or economic policy regimes



Note: Duration is defined as the number of months between the starting and ending date of each phase. Trilemma and economic policy regimes follow the dating presented in section 5.1. LBBIS, LBBIM, and LBBIL refer to the phases identified using the short-run, medium-run, and long-run local Bull Bear Indicator respectively.

Table 173: Statistics for pairwise comparison of mean duration of bear phases by trilemma and domestic policy regimes

Panel A: Short-run LBBI

Trilemma Regimes

	GES	PCBWS	CBWS
PCBWS	0.83 *0.84*		
CBWS	0.57 *0.89*	-0.26 *0.95*	
PBWS	1.34 *0.71*	0.51 *0.87*	0.77 *0.82*

Domestic Policy Regimes

	MBBR	WDM	SGP	KePl	ThM
WDM	4.29 *0.27*				
SGP	2.27 *0.54*	-2.02 *0.61*			
KePl	2.63 *0.50*	-1.67 *0.68*	0.36 *0.93*		
ThM	2.73 *0.50*	-1.57 *0.72*	0.46 *0.91*	0.10 *0.98*	
IT	2.79 *0.42*	-1.50 *0.69*	0.52 *0.88*	0.17 *0.96*	0.07 *0.99*

Panel B: Medium-run LBBI

Trilemma Regimes

	GES	PCBWS	CBWS
PCBWS	-11.70 *0.42*		
CBWS	-8.75 *0.56*	2.95 *0.80*	
PBWS	-3.07 *0.82*	8.63 *0.40*	5.68 *0.60*

Domestic Policy Regimes

	MBBR	WDM	SGP	KePl	ThM
WDM	-1.75 *0.91*				
SGP	-12.30 *0.41*	-10.55 *0.38*			
KePl	-8.50 *0.60*	-6.75 *0.62*	3.80 *0.77*		
ThM	-6.83 *0.67*	-5.08 *0.71*	5.47 *0.67*	1.67 *0.91*	
IT	-1.17 *0.94*	0.58 *0.97*	11.13 *0.39*	7.33 *0.61*	5.67 *0.69*

Panel C: Long-run LBBI

Trilemma Regimes

	GES	PCBWS	CBWS
PCBWS	15.83 *0.46*		
CBWS	4.83 *0.82*	-11.00 *0.64*	
PBWS	30.33 *0.12*	14.50 *0.48*	25.50 *0.23*

Domestic Policy Regimes

	MBBR	WDM	SGP	KePl	ThM
WDM	40.75 *0.03*				
SGP	3.08 *0.83*	-37.67 *0.05*			
KePl	39.75 *0.09*	-1.00 *0.97*	36.67 *0.12*		
ThM	39.75 *0.09*	-1.00 *0.97*	36.67 *0.12*	0.00 *1.00*	
IT	29.75 *0.10*	-11.00 *0.56*	26.67 *0.15*	-10.00 *0.66*	-10.00 *0.66*

Note: P values in italics underneath the corresponding statistic. If the statistic is positive (negative) then duration presents a higher (lower) mean in the row regime than in the column regime. The null hypothesis is that the difference between two means is statistically equal to 0.

The only significant differences we find for the duration of bear phases occur using the long-run indicator, which measures the more persistent expansions and contractions, affecting returns up to five years.

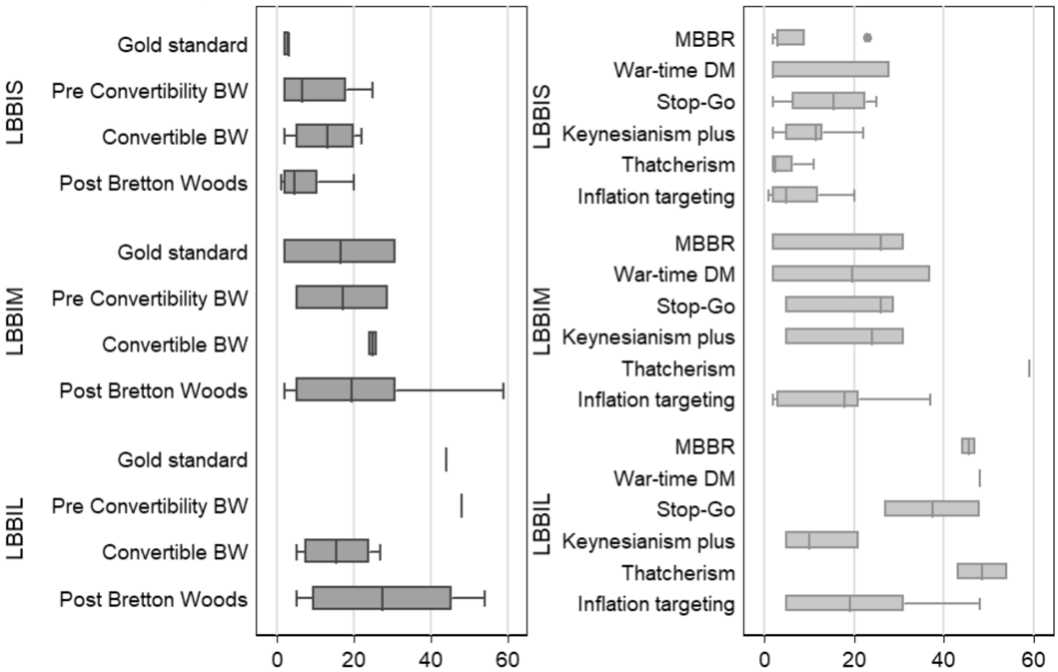
According to the macroeconomic trilemma, bear phases are longer during the post-Bretton Woods period than under the gold standard or the convertible Bretton Woods (75% confidence). There is no single different trait between GES, CBWS, and PBWS that allows us to advance a hypothesis as to the cause of this difference.[249] These results, contradict the findings by Bordo et al. (2001), who indicate that the length of financial crises has remained constant since Bretton Woods until today.

When we break down the sample by domestic economic policy regime, we find that for the long-run indicator bear phases are longer under war-time demand management than under the minimal balanced budget rule (95% confidence). We also find that this holds when comparing WDM with the Keynesianism plus, Thatcherism and inflation targetting eras (90% confidence). Conversely, we find that bear phases are shorter under the stop-go policy than under WDM (90% confidence), or under KePl, ThM and IT (75% confidence).

MBBR and SGP represent two extremes in the level of state intervention in the economy. While the MBBR period is one closely linked to *laissez-faire* policies, the stop-go period of demand management, was one strongly linked to state intervention when the economy is either booming or cooling down. It also coincides with an era of expansion in social services provided by the UK. Apparently, the duration of faces expressed as a function of state intervention in the economy follows an inverted "U" pattern that troughs when the state follows either a "hands-off" or an "all-hands-on-deck" approach.

[249] When we discuss the traits of the trilemma regime we are referring to exchange rate stability, capital controls and autonomous monetary policy.

Figure 40: Boxplot for the duration of bull phases by indicator and trilemma or economic policy regimes



Note: Duration is defined as the number of months between the starting and ending date of each phase. Trilemma and economic policy regimes follow the dating presented in section 5.1. LBBIS, LBBIM, and LBBIL refer to the phases identified using the short-run, medium-run, and long-run local Bull Bear Indicator respectively.

Table 174: Statistics for pairwise comparison of mean duration of bull phases by trilemma and domestic policy regimes

Panel A: Short-run LBBI

Trilemma Regimes	GES	PCBWS	CBWS
PCBWS	7.33		
	0.16		
CBWS	9.73	2.40	
	0.05	*0.59*	
PBWS	3.88	-3.45	-5.85
	0.35	*0.35*	*0.09*

Domestic Policy Regimes	MBBR	WDM	SGP	KePl	ThM
WDM	2.67				
	0.64				
SGP	6.50	3.83			
	0.22	*0.52*			
KePl	2.83	0.17	-3.67		
	0.55	*0.98*	*0.47*		
ThM	-3.63	-6.29	-10.13	-6.46	
	0.42	*0.24*	*0.04*	*0.13*	
IT	-0.70	-3.37	-7.20	-3.53	2.93
	0.87	*0.51*	*0.13*	*0.38*	*0.43*

Panel B: Medium-run LBBI

Trilemma Regimes	GES	PCBWS	CBWS
PCBWS	0.50		
	0.98		
CBWS	8.50	8.00	
	0.63	*0.65*	
PBWS	4.00	3.50	-4.50
	0.77	*0.80*	*0.74*

Domestic Policy Regimes	MBBR	WDM	SGP	KePl	ThM
WDM	-0.17				
	0.99				
SGP	0.33	0.50			
	0.98	*0.97*			
KePl	0.33	0.50	0.00		
	0.98	*0.97*	*1.00*		
ThM	39.33	39.50	39.00	39.00	
	0.04	*0.04*	*0.04*	*0.04*	
IT	-3.95	-3.79	-4.29	-4.29	-43.29
	0.70	*0.75*	*0.68*	*0.68*	*0.02*

Panel C: Long-run LBBI

Trilemma Regimes	GES	PCBWS	CBWS
PCBWS	4.00		
	0.87		
CBWS	-28.25	-32.25	
	0.17	*0.12*	
PBWS	-16.00	-20.00	12.25
	0.40	*0.29*	*0.27*

Domestic Policy Regimes	MBBR	WDM	SGP	KePl	ThM
WDM	2.50				
	0.88				
SGP	-8.00	-10.50			
	0.57	*0.54*			
KePl	-33.50	-36.00	-25.50		
	0.02	*0.04*	*0.07*		
ThM	3.00	0.50	11.00	36.50	
	0.83	*0.98*	*0.43*	*0.01*	
IT	-24.33	-26.83	-16.33	9.17	-27.33
	0.05	*0.10*	*0.17*	*0.36*	*0.03*

Note: P values in italics underneath the corresponding statistic. If the statistic is positive (negative) then duration presents a higher (lower) mean in the row regime than in the column regime. The null hypothesis is that the difference between two means is statistically equal to 0.

From the perspective of the trilemma, and using the short-run indicator, we find that bull phases under the GES are shorter than under the pre-convertible Bretton Woods system (75% confidence) and under the convertible Bretton Woods system (90% confidence). Also, the expansions are longer under CBWS than under the post-Bretton Woods era. Since short-run expansions are longer under both stages of the Bretton Woods system than under any other period, we may find a culprit on the extended capital controls that distinguish this period from the others.

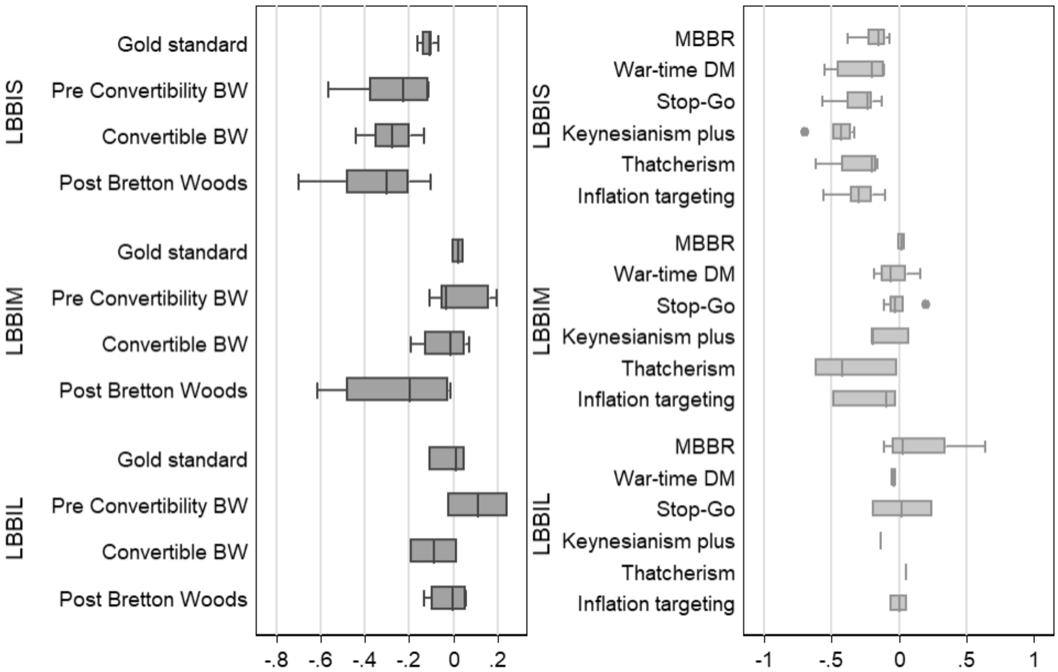
However, the fact that most of this relationships fade out in the medium and long-run indicator attests to the literature on capital controls that indicate that in the long-run investors find mechanisms and loopholes to overcome restrictions (Grilli & Milese-Ferreti, 1995; Borio, James & Shin, 2014). Interestingly, following the dating of the long-run indicator, both under the GES and the pre-convertible Bretton Woods, bull phases are more extended than under the convertible Bretton Woods (75% confidence). This may be due to the incentives for investors provided by the stability of exchange rates. It is also possible that this particular relationship is due to post-World War booms rather than related to trilemma-specific traits.

With regards to the domestic policy regime we find that according to the dating of the short-run indicator, bull phases under Thatcherism are shorter than under the Stop-Go policy (95% confidence) and under war-time demand management and the Keynesianism plus periods (75% confidence). However, this relationship is reversed according to the medium-run indicator where the most extended bull phases for any subsample occur under Thatcherism (95% confidence). This may indicate that while under the Thatcher government there were no significant stock market movements, in the medium-run (with a 3-year observation window) the situation in the stock market improved. Even if the political turmoil at the beginning of the Thatcher period could have dampened expectations about economic recovery, apparently the steps taken during the Thatcher / Monetarist years reassured investors and allowed for medium-run expansion that exceeded in length all others.

Finally, bulls measured by the long-run indicator are shortest under the KePL or IT periods (different confidence levels). This may have to do with the shifting nature of state intervention under each of these regimes. Under KePl, the focus was on price-stability and unemployment under a scenario of run-away inflation after the oil shocks. Restrictive monetary and fiscal policies in the face of budget imbalances and concerns about the value of the pound in capital markets plague this period. Conversely, the inflation targetting period may probably present shorter long-run booms given that increasing asset prices may transfer to the real economy via wealth effects and the financial accelerator mechanism, causing a stabilising reaction from the central bank to hinder inflation growth and whose unintended consequence may have been a bear stock market. This would be consistent with the more extended busts phases in IT presented above.

Amplitude

Figure 41: Boxplot for the price change (CAGR) of bear phases by indicator and trilemma or economic policy regimes



Note: Amplitude is measured as the percentage CAGR change between the level in the UK stock market at the beginning and the ending dates of the phase. Trilemma and economic policy regimes follow the dating presented in section 5.1. LBBIS, LBBIM, and LBBIL refer to the phases identified using the short-run, medium-run, and long-run local Bull Bear Indicator respectively.

Table 175: Statistics for pairwise comparison of mean amplitude (CAGR phase return) of bear phases by trilemma and domestic policy regimes

Panel A: Short-run LBBI

Trilemma Regimes

	GES	PCBWS	CBWS
PCBWS	-0.15		
	0.12		
CBWS	-0.17	-0.02	
	0.09	*0.84*	
PBWS	-0.23	-0.08	-0.06
	0.01	*0.27*	*0.42*

Domestic Policy Regimes

	MBBR	WDM	SGP	KePl	ThM
WDM	-0.10				
	0.25				
SGP	-0.11	-0.01			
	0.19	*0.91*			
KePl	-0.28	-0.18	-0.17		
	0.00	*0.04*	*0.05*		
ThM	-0.14	-0.04	-0.03	0.14	
	0.12	*0.65*	*0.73*	*0.13*	
IT	-0.12	-0.02	-0.01	0.16	0.02
	0.13	*0.80*	*0.90*	*0.05*	*0.80*

Panel B: Medium-run LBBI

Trilemma Regimes

	GES	PCBWS	CBWS
PCBWS	0.01		
	0.94		
CBWS	-0.06	-0.07	
	0.72	*0.58*	
PBWS	-0.29	-0.30	-0.23
	0.07	*0.02*	*0.07*

Domestic Policy Regimes

	MBBR	WDM	SGP	KePl	ThM
WDM	-0.06				
	0.72				
SGP	-0.01	0.04			
	0.92	*0.73*			
KePl	-0.13	-0.07	-0.11		
	0.46	*0.64*	*0.42*		
ThM	-0.37	-0.31	-0.36	-0.25	
	0.04	*0.04*	*0.02*	*0.13*	
IT	-0.22	-0.16	-0.21	-0.09	0.15
	0.21	*0.27*	*0.15*	*0.54*	*0.33*

Panel C: Long-run LBBI

Trilemma Regimes

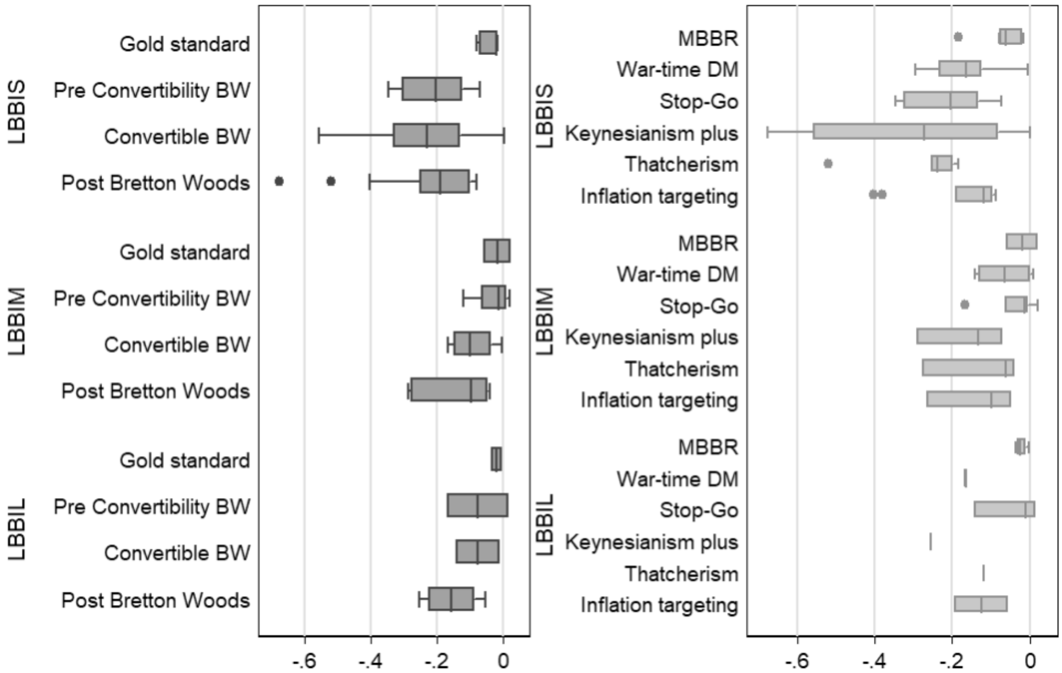
	GES	PCBWS	CBWS
PCBWS	0.13		
	0.29		
CBWS	-0.07	-0.20	
	0.53	*0.14*	
PBWS	0.00	-0.13	0.07
	0.97	*0.25*	*0.53*

Domestic Policy Regimes

	MBBR	WDM	SGP	KePl	ThM
WDM	-0.19				
	0.41				
SGP	-0.13	0.06			
	0.53	*0.79*			
KePl	-0.28	-0.09	-0.16		
	0.35	*0.77*	*0.61*		
ThM	-0.09	0.10	0.03	0.19	
	0.75	*0.76*	*0.91*	*0.61*	
IT	-0.15	0.04	-0.02	0.13	-0.06
	0.52	*0.88*	*0.92*	*0.68*	*0.86*

Note: P values in italics underneath the corresponding statistic. If the statistic is positive (negative) then amplitude (CAGR phase return) presents a higher (lower) mean in the row regime than in the column regime. The null hypothesis is that the difference between two means is statistically equal to 0.

Figure 42: Boxplot for the change in average period CAGR of bear phases by indicator and trilemma or economic policy regimes



Note: LBBIS, LBBIM, and LBBIL refer to the phases identified using the short-run, medium-run, and long-run local Bull Bear Indicator respectively. Amplitude is measured as the difference between the CAGR for a period X months at the starting and ending dates of the phase. For LBBIS, X is 12 months; for LBBIM, X is 36 months; and for LBBIL, X is 60 months. Trilemma and economic policy regimes follow the dating presented in section 5.1.

Table 176: Statistics for pairwise comparison of the mean change in average period CAGR of bear phases by trilemma and domestic policy regimes

Panel A: Short-run LBBI

Trilemma Regimes

	GES	PCBWS	CBWS
PCBWS	-0.17		
	0.07		
CBWS	-0.20	-0.04	
	0.03	*0.67*	
PBWS	-0.20	-0.03	0.01
	0.02	*0.70*	*0.89*

Domestic Policy Regimes

	MBBR	WDM	SGP	KePl	ThM
WDM	-0.10				
	0.20				
SGP	-0.15	-0.05			
	0.04	*0.50*			
KePl	-0.25	-0.15	-0.09		
	0.00	*0.08*	*0.25*		
ThM	-0.21	-0.11	-0.06	0.03	
	0.01	*0.19*	*0.46*	*0.72*	
IT	-0.12	-0.02	0.03	0.13	0.09
	0.09	*0.79*	*0.64*	*0.10*	*0.24*

Panel B: Medium-run LBBI

Trilemma Regimes

	GES	PCBWS	CBWS
PCBWS	-0.01		
	0.85		
CBWS	-0.07	-0.06	
	0.36	*0.34*	
PBWS	-0.14	-0.12	-0.06
	0.08	*0.04*	*0.30*

Domestic Policy Regimes

	MBBR	WDM	SGP	KePl	ThM
WDM	-0.05				
	0.58				
SGP	-0.03	0.02			
	0.75	*0.76*			
KePl	-0.14	-0.10	-0.12		
	0.12	*0.20*	*0.11*		
ThM	-0.11	-0.06	-0.08	0.04	
	0.24	*0.42*	*0.27*	*0.64*	
IT	-0.12	-0.07	-0.09	0.03	-0.01
	0.20	*0.35*	*0.21*	*0.74*	*0.89*

Panel C: Long-run LBBI

Trilemma Regimes

	GES	PCBWS	CBWS
PCBWS	-0.06		
	0.49		
CBWS	-0.06	0.00	
	0.48	*1.00*	
PBWS	-0.14	-0.08	-0.08
	0.07	*0.31*	*0.31*

Domestic Policy Regimes

	MBBR	WDM	SGP	KePl	ThM
WDM	-0.14				
	0.03				
SGP	-0.02	0.12			
	0.61	*0.06*			
KePl	-0.23	-0.09	-0.21		
	0.01	*0.26*	*0.02*		
ThM	-0.10	0.05	-0.07	0.14	
	0.19	*0.54*	*0.32*	*0.15*	
IT	-0.10	0.04	-0.08	0.13	-0.01
	0.09	*0.52*	*0.19*	*0.12*	*0.94*

Note: P values in italics underneath the corresponding statistic. If the statistic is positive (negative) then amplitude presents a higher (lower) mean in the row regime than in the column regime. Amplitude is measured as the difference between the average CAGR for a window of size X observations at the starting and ending dates of the phase. For LBBIS, X is 12 months; for LBBIM, X is 36 months; and for LBBIL, X is 60 months. The null hypothesis is that the difference between two means is statistically equal to 0.

Regarding trilemma regimes, we find that according to the short-run indicator, bear phases have less negative amplitudes during the GES than in any other period (Confidence above 90%). According to the medium-run indicator, the post-Bretton Woods period presents more negative bear phases than the pre-convertible Bretton Woods (95% confidence) or the gold exchange standard (90% confidence). The same is true for the GES and PBWS as identified by the long-run LBBI (75% confidence). Interestingly, this is the only case in which pairwise comparisons find more statistically significant differences under the trilemma than under the domestic policy regime break-down.

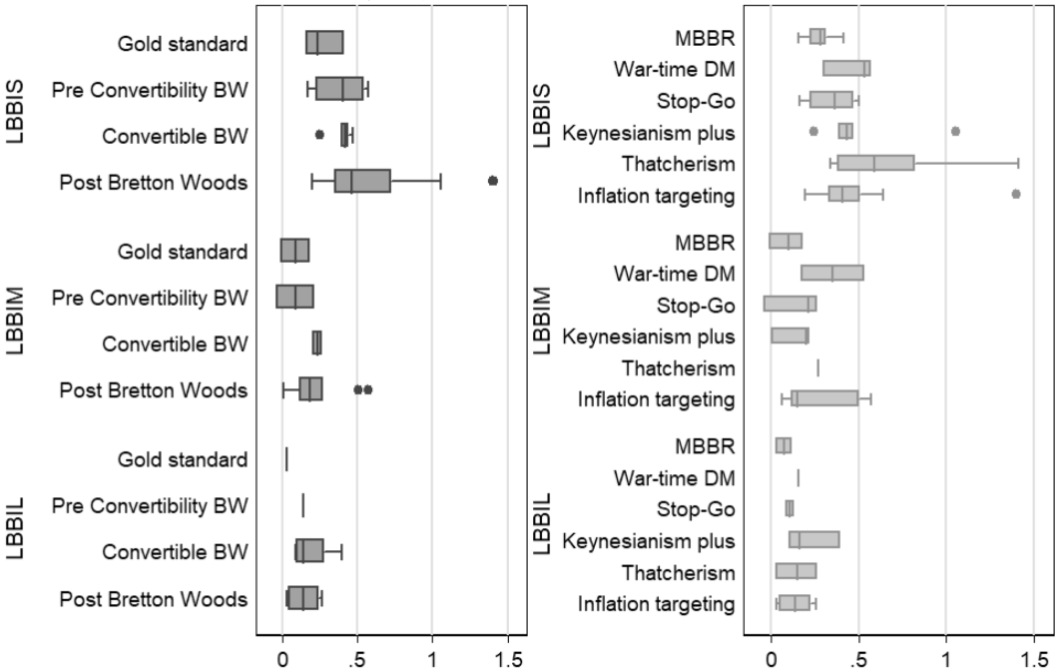
The fact that amplitude is closer to zero under the gold exchange standard suggests that probably the adjustment of the stock market was quicker during these downward phases. This may be due to the stabilising role played by capital flows to keep convertibility in place. In all cases, bear phases are more severe under the post-Bretton Woods era, which is consistent with a history of successive local and international financial crises since the oil shocks of 1973 and 1979 (see Annex 10). Since this era is characterised by financial deregulation, volatile exchange rates, increasing capital mobility and independent monetary policy, there are several potential culprits for this finding.

Regarding domestic policy, according to the three indicators bear phases have an amplitude closest to zero under the Minimal Balanced Budget Rule, and farthest from zero during the Keynesianism Plus policy era (several confidence levels). The result for the MBBR is consistent with the result for the GES described above and may be due then, not only to the stabilising role of capital flows but the reduced state intervention in the stock market. Either way, these two competing hypothesis allow for further research on the subject.

According to the short-run indicator, contractions under WDM, SGP and IT have an amplitude closer to zero than under ThM (Several confidence levels). However, the amplitude of phases during Thatcherism moves closer to zero under the medium-run indicator (75% confidence) and becomes statistically indifferent from the amplitude of bear phases in any other regime when we employ the dating provided by the long-run indicator. The reduction in amplitude as booms increase in persistence indicates that under Thatcherism, bust phases that affected medium-run returns were milder than under other policy regimes. The fact that under Thatcherism, as under the MBBR, state intervention in the market was minimal (with, for example, capital controls definitively eliminated by 1978), indicates that probably, lower state intervention leads to a quicker adjustment in the stock market. This is sensible in light of the literature on adverse selection: usually, the expectation of a bailout delays and increases expected losses in the face of liquidation (Bebczuk, 2003).

Finally, the case of the stop-go period is compelling, as it usually ranks close to MBBR in the amplitude measure (Several confidence levels). This period, of extreme government intervention in the economy, is then characterized by bear faces of amplitude closer to zero, which suggests that the inverted "U" shape of duration as a function of state intervention may also apply to the amplitude of bear phases: amplitude is closer to zero in scenarios with either very low or extensive state intervention (MBBR, ThM, and SGP) and more negative in intermediate scenarios (WDM, KePl, and IT).

Figure 43: Boxplot for the price change (CAGR) of bull phases by indicator and trilemma or economic policy regimes



Note: Amplitude is measured as the percentage CAGR change between the level in the UK stock market at the beginning and the ending dates of the phase. Trilemma and economic policy regimes follow the dating presented in section 5.1. LBBIS, LBBIM, and LBBIL refer to the phases identified using the short-run, medium-run, and long-run local Bull Bear Indicator respectively.

Table 177: Statistics for pairwise comparison of mean amplitude (CAGR phase return) of bull phases by trilemma and domestic policy regimes

Panel A: Short-run LBBI

Trilemma Regimes

	GES	PCBWS	CBWS
PCBWS	0.12		
	0.61		
CBWS	0.13	0.01	
	0.57	*0.97*	
PBWS	0.32	0.20	0.20
	0.09	*0.22*	*0.20*

Domestic Policy Regimes

	MBBR	WDM	SGP	KePl	ThM
WDM	0.19				
	0.38				
SGP	0.07	-0.12			
	0.72	*0.59*			
KePl	0.23	0.04	0.15		
	0.21	*0.86*	*0.42*		
ThM	0.39	0.20	0.32	0.16	
	0.03	*0.32*	*0.08*	*0.30*	
IT	0.21	0.02	0.14	-0.01	-0.18
	0.19	*0.91*	*0.42*	*0.93*	*0.21*

Panel B: Medium-run LBBI

Trilemma Regimes

	GES	PCBWS	CBWS
PCBWS	0.00		
	0.99		
CBWS	0.15	0.14	
	0.41	*0.41*	
PBWS	0.14	0.14	-0.01
	0.32	*0.32*	*0.95*

Domestic Policy Regimes

	MBBR	WDM	SGP	KePl	ThM
WDM	0.26				
	0.13				
SGP	0.06	-0.21			
	0.71	*0.22*			
KePl	0.05	-0.21	0.00		
	0.73	*0.21*	*0.98*		
ThM	0.18	-0.08	0.12	0.13	
	0.39	*0.71*	*0.55*	*0.54*	
IT	0.16	-0.10	0.10	0.11	-0.02
	0.22	*0.48*	*0.42*	*0.40*	*0.91*

Panel C: Long-run LBBI

Trilemma Regimes

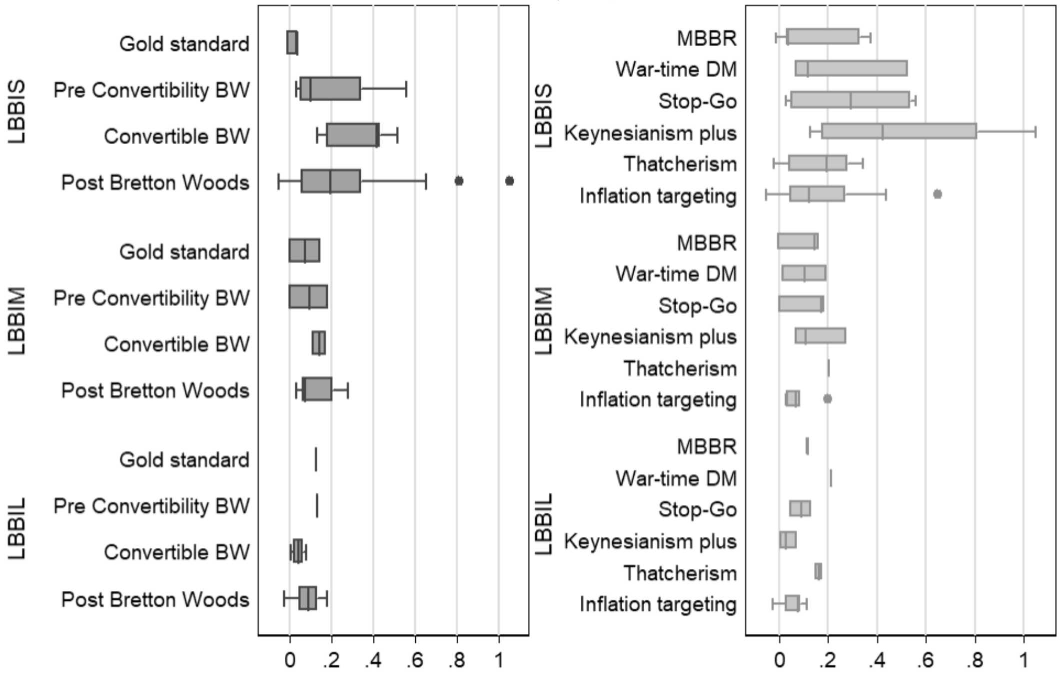
	GES	PCBWS	CBWS
PCBWS	0.10		
	0.54		
CBWS	0.16	0.05	
	0.25	*0.68*	
PBWS	0.11	0.01	-0.05
	0.38	*0.95*	*0.53*

Domestic Policy Regimes

	MBBR	WDM	SGP	KePl	ThM
WDM	0.08				
	0.57				
SGP	0.03	-0.05			
	0.77	*0.74*			
KePl	0.15	0.07	0.11		
	0.18	*0.62*	*0.29*		
ThM	0.07	-0.01	0.04	-0.07	
	0.52	*0.96*	*0.73*	*0.49*	
IT	0.06	-0.02	0.03	-0.08	-0.01
	0.50	*0.89*	*0.75*	*0.32*	*0.92*

Note: P values in italics underneath the corresponding statistic. If the statistic is positive (negative) then amplitude (CAGR phase return) presents a higher (lower) mean in the row regime than in the column regime. The null hypothesis is that the difference between two means is statistically equal to 0.

Figure 44: Boxplot for the change in average period CAGR of bull phases by indicator and trilemma or economic policy regimes



Note: LBBIS, LBBIM, and LBBIL refer to the phases identified using the short-run, medium-run, and long-run local Bull Bear Indicator respectively. Amplitude is measured as the difference between the CAGR for a period of X months at the starting and ending dates of the phase. For LBBIS, X is 12 months; for LBBIM, X is 36 months; and for LBBIL, X is 60 months. Trilemma and economic policy regimes follow the dating presented in section 5.1.

Table 178: Statistics for pairwise comparison of the mean change in average period CAGR of bull phases by trilemma and domestic policy regimes

Panel A: Short-run LBBI

Trilemma Regimes

	GES	PCBWS	CBWS
PCBWS	0.18		
	0.38		
CBWS	0.31	0.14	
	0.11	*0.44*	
PBWS	0.24	0.06	-0.08
	0.15	*0.67*	*0.57*

Domestic Policy Regimes

	MBBR	WDM	SGP	KePl	ThM
WDM	0.08				
	0.63				
SGP	0.14	0.06			
	0.38	*0.76*			
KePl	0.35	0.27	0.21		
	0.02	*0.13*	*0.19*		
ThM	0.02	-0.07	-0.12	-0.33	
	0.90	*0.68*	*0.40*	*0.02*	
IT	0.04	-0.04	-0.10	-0.31	0.02
	0.76	*0.78*	*0.48*	*0.02*	*0.84*

Panel B: Medium-run LBBI

Trilemma Regimes

	GES	PCBWS	CBWS
PCBWS	0.02		
	0.81		
CBWS	0.07	0.05	
	0.44	*0.59*	
PBWS	0.04	0.02	-0.03
	0.58	*0.80*	*0.65*

Domestic Policy Regimes

	MBBR	WDM	SGP	KePl	ThM
WDM	0.00				
	0.97				
SGP	0.02	0.01			
	0.80	*0.86*			
KePl	0.05	0.05	0.03		
	0.50	*0.57*	*0.67*		
ThM	0.10	0.10	0.08	0.05	
	0.33	*0.37*	*0.42*	*0.61*	
IT	-0.02	-0.03	-0.04	-0.07	-0.12
	0.72	*0.72*	*0.51*	*0.25*	*0.20*

Panel C: Long-run LBBI

Trilemma Regimes

	GES	PCBWS	CBWS
PCBWS	0.01		
	0.92		
CBWS	-0.08	-0.09	
	0.22	*0.18*	
PBWS	-0.04	-0.05	0.05
	0.55	*0.47*	*0.21*

Domestic Policy Regimes

	MBBR	WDM	SGP	KePl	ThM
WDM	0.09				
	0.11				
SGP	-0.03	-0.12			
	0.52	*0.04*			
KePl	-0.08	-0.18	-0.05		
	0.07	*0.01*	*0.22*		
ThM	0.04	-0.05	0.07	0.13	
	0.34	*0.38*	*0.12*	*0.01*	
IT	-0.06	-0.15	-0.03	0.02	-0.10
	0.13	*0.01*	*0.43*	*0.48*	*0.02*

Note: P values in italics underneath the corresponding statistic. If the statistic is positive (negative) then amplitude presents a higher (lower) mean in the row regime than in the column regime. Amplitude is measured as the difference between the average CAGR for a window of size X observations at the starting and ending dates of the phase. For LBBIS, X is 12 months; for LBBIM, X is 36 months; and for LBBIL, X is 60 months. The null hypothesis is that the difference between two means is statistically equal to 0.

From the perspective of the trilemma, we find that short-run bull phases are less broad during the gold exchange standard than under the convertible stage of Bretton Woods and the post-Bretton Woods era (75% confidence). These results are reversed under the long-run indicator, where the amplitude of bulls is smaller under the convertible Bretton Woods period than under any other regime (75% confidence).

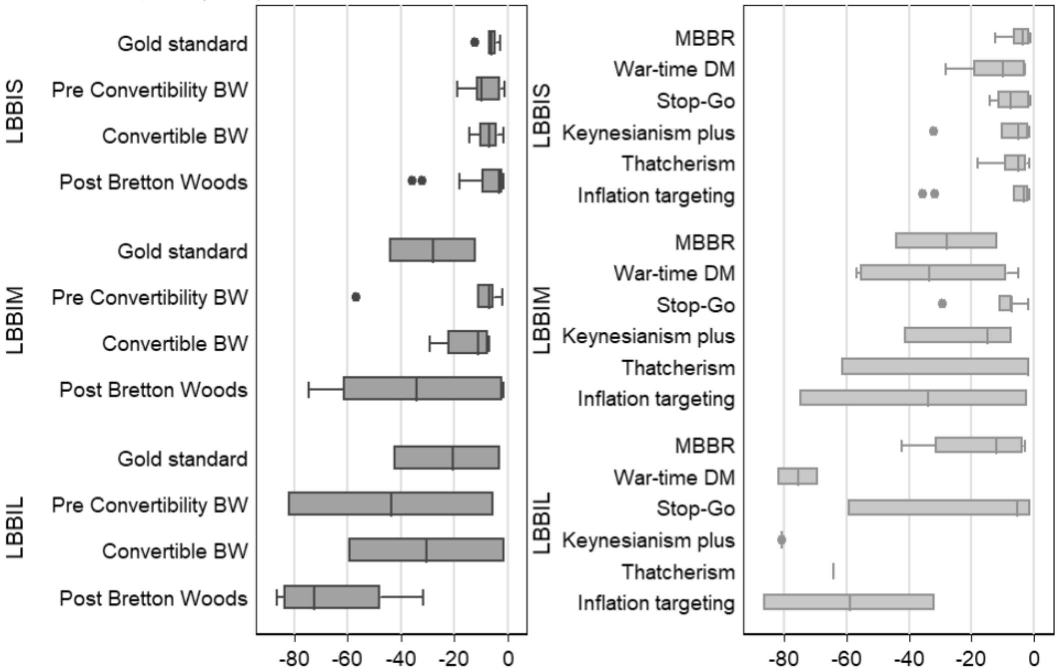
The low amplitude of bull phases under the convertible stage of the Bretton Woods system may be due to the restrictive nature of capital controls: hindered international capital flows, which in the end act as foreign credit, may reduce the supply of funds available for investors to enter the stock market. Periods with strong capital mobility (such as the GES or PBWS) may facilitate the appearance of long-run booms.

However free capital flows, the only shared characteristic between GES and PBWS, seem to have a differential effect on the amplitude of bull phases when looking at the short or long-run indicators. While the adjustment to short-run booms seems quick (thus garnering a below-par amplitude), there seems to be a build-up effect which causes booms identified by the long-run indicator to be broader under these regimes.

Regarding the domestic policy regimes, short-run expansions seem to have a statistically higher amplitude under the Keynesianism Plus regime than under any other policy era. With regards to long-run booms, the amplitude can be broken down into three distinct pairs of regimes from lowest to highest: IT and KePl, MBBR and SGP, and ThM and WDM (Various confidence levels). This sorting is puzzling for two reasons. On the one hand, the first era in each pair is one of low state intervention while the second one is an era of active state intervention in the economy. On the other hand, phases are not paired chronologically nor sorted in any order that illuminates any testable hypothesis. In that sense, we suggest that the drivers of amplitude in long-run bull phases may not necessarily be related to some domestic economic policy characteristic.

Severity

Figure 45: Boxplot for the severity of bear phases by indicator and trilemma or economic policy regimes



Note: LBBIS, LBBIM, and LBBIL refer to the phases identified using the short-run, medium-run, and long-run local Bull Bear Indicator respectively. Severity is measured as the cumulative value of the respective Bull Bear Indicator between the starting and ending date of each phase. Trilemma and economic policy regimes follow the dating presented in section 5.1.

Table 179: Statistics for pairwise comparison of mean severity of bear phases by trilemma and domestic policy regimes

Panel A: Short-run LBBI

Trilemma Regimes

	GES	PCBWS	CBWS
PCBWS	-2.35		
	0.67		
CBWS	-0.86	1.49	
	0.88	*0.78*	
PBWS	-3.11	-0.76	-2.25
	0.52	*0.86*	*0.62*

Domestic Policy Regimes

	MBBR	WDM	SGP	KePl	ThM
WDM	-7.55				
	0.15				
SGP	-2.89	4.66			
	0.56	*0.38*			
KePl	-4.78	2.77	-1.89		
	0.35	*0.61*	*0.72*		
ThM	-2.78	4.76	0.10	2.00	
	0.61	*0.41*	*0.99*	*0.73*	
IT	-5.43	2.12	-2.54	-0.65	-2.65
	0.24	*0.67*	*0.59*	*0.90*	*0.62*

Panel B: Medium-run LBBI

Trilemma Regimes

	GES	PCBWS	CBWS
PCBWS	11.54		
	0.58		
CBWS	13.25	1.71	
	0.54	*0.92*	
PBWS	-3.04	-14.58	-16.29
	0.88	*0.33*	*0.31*

Domestic Policy Regimes

	MBBR	WDM	SGP	KePl	ThM
WDM	-4.24				
	0.85				
SGP	16.58	20.82			
	0.44	*0.24*			
KePl	6.80	11.04	-9.78		
	0.77	*0.57*	*0.60*		
ThM	6.34	10.59	-10.24	-0.45	
	0.79	*0.59*	*0.59*	*0.98*	
IT	-8.98	-4.74	-25.56	-15.77	-15.32
	0.70	*0.81*	*0.19*	*0.45*	*0.47*

Panel C: Long-run LBBI

Trilemma Regimes

	GES	PCBWS	CBWS
PCBWS	-21.74		
	0.48		
CBWS	-8.38	13.37	
	0.78	*0.69*	
PBWS	-43.78	-22.03	-35.40
	0.12	*0.45*	*0.24*

Domestic Policy Regimes

	MBBR	WDM	SGP	KePl	ThM
WDM	-58.09				
	0.04				
SGP	-4.53	53.56			
	0.83	*0.06*			
KePl	-63.15	-5.06	-58.62		
	0.07	*0.88*	*0.09*		
ThM	-46.63	11.46	-42.10	16.52	
	0.15	*0.73*	*0.20*	*0.67*	
IT	-41.56	16.53	-37.03	21.59	5.08
	0.11	*0.54*	*0.16*	*0.52*	*0.88*

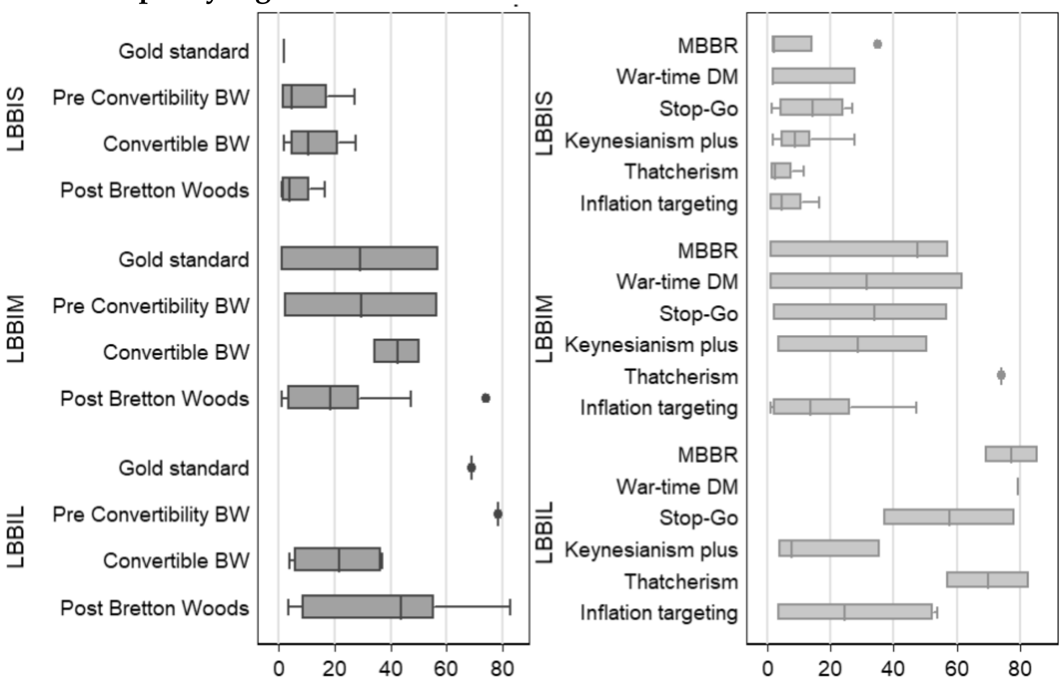
Note: P values in italics underneath the corresponding statistic. If the statistic is positive (negative) then severity presents a higher (lower) mean in the row regime than in the column regime. The null hypothesis is that the difference between two means is statistically equal to 0.

From the perspective of the trilemma, long-run bear phases are less severe under the post-Bretton Woods era than under the gold exchange standard or the convertible stage of Bretton Woods (75% confidence). This is consistent with the findings by Bordo et al. (2001), where they find that financial crises (and not just stock market crashes as in our case) have not grown more severe over the last quarter of the twentieth century.

Regarding the domestic policy perspective, we find that long-run busts under the MBBR and SGP are less severe (severity closer to zero from below) than under any other policy regime (Various confidence levels). This is a similar result to the one we found for the duration of bear phases. Apparently, regarding severity, bear phases also follow an inverted "U" shape as a function of state intervention in the economy. When state intervention peaks (SGP) or troughs (MBBR), the severity of bear phases is closest to zero, while under other regimes it moves further into negative territory.

Surprisingly, there are no statistically significant differences worth mentioning for severity employing the datings obtained by either the short-run or medium-run indicators.

Figure 46: Boxplot for the severity of bull phases by indicator and trilemma or economic policy regimes



Note: LBBIS, LBBIM, and LBBIL refer to the phases identified using the short-run, medium-run, and long-run local Bull Bear Indicator respectively. Severity is measured as the cumulative value of the respective Bull Bear Indicator between the starting and ending date of each phase. Trilemma and economic policy regimes follow the dating presented in section 5.1.

Table 180: Statistics for pairwise comparison of mean severity of bull phases by trilemma and domestic policy regimes

Panel A: Short-run LBBI

Trilemma Regimes

	GES	PCBWS	CBWS
PCBWS	7.51		
	0.18		
CBWS	11.23	3.72	
	0.04	*0.44*	
PBWS	4.10	-3.41	-7.13
	0.36	*0.39*	*0.06*

Domestic Policy Regimes

	MBBR	WDM	SGP	KePl	ThM
WDM	-0.52				
	0.94				
SGP	3.24	3.77			
	0.61	*0.60*			
KePl	-0.25	0.28	-3.49		
	0.97	*0.97*	*0.56*		
ThM	-6.53	-6.01	-9.78	-6.29	
	0.23	*0.35*	*0.10*	*0.22*	
IT	-4.78	-4.25	-8.02	-4.53	1.76
	0.35	*0.49*	*0.15*	*0.35*	*0.69*

Panel B: Medium-run LBBI

Trilemma Regimes

	GES	PCBWS	CBWS
PCBWS	0.27		
	0.99		
CBWS	13.17	12.90	
	0.62	*0.63*	
PBWS	-6.72	-7.00	-19.89
	0.75	*0.74*	*0.34*

Domestic Policy Regimes

	MBBR	WDM	SGP	KePl	ThM
WDM	-3.71				
	0.87				
SGP	-4.27	-0.56			
	0.84	*0.98*			
KePl	-7.70	-3.99	-3.43		
	0.71	*0.86*	*0.87*		
ThM	38.93	42.64	43.20	46.63	
	0.20	*0.18*	*0.15*	*0.13*	
IT	-18.37	-14.66	-14.10	-10.66	-57.29
	0.30	*0.47*	*0.42*	*0.54*	*0.05*

Panel C: Long-run LBBI

Trilemma Regimes

	GES	PCBWS	CBWS
PCBWS	9.33		
	0.81		
CBWS	-48.01	-57.34	
	0.13	*0.08*	
PBWS	-31.37	-40.70	16.64
	0.28	*0.17*	*0.32*

Domestic Policy Regimes

	MBBR	WDM	SGP	KePl	ThM
WDM	1.77				
	0.95				
SGP	-19.59	-21.36			
	0.38	*0.44*			
KePl	-61.67	-63.44	-42.08		
	0.01	*0.03*	*0.06*		
ThM	-7.55	-9.33	12.04	54.11	
	0.73	*0.73*	*0.59*	*0.02*	
IT	-50.37	-52.15	-30.78	11.29	-42.82
	0.02	*0.05*	*0.11*	*0.48*	*0.04*

Note: P values in italics underneath the corresponding statistic. If the statistic is positive (negative) then severity presents a higher (lower) mean in the row regime than in the column regime. The null hypothesis is that the difference between two means is statistically equal to 0.

According to the trilemma periodisation, short-run bull phases are more severe during the convertible phase of Bretton Woods than under the gold exchange standard (95% confidence). However, this result reverses for the long-run indicator where bull phases are more severe under the GES and PCBWS than under CBWS or PBWS (Various confidence levels).

A possibility that explains the fact that in the short-run phases are more severe under CBWS than under GES but in the long-run, the opposite happens has to do with the effect of capital controls. Short-run booms can be quickly fed with domestic capital, and thus may occur as fast or even faster than when the capital account is liberalised. However, persistent long-run booms are not easily sustained only by domestic investors and need some degree of foreign capital to keep their upward trend. That would explain why both phases of Bretton Woods would present less severe long-run expansions than any other trilemma regime.

Regarding the domestic policy perspective, booms to all horizons are less severe under inflation targeting. For short-run booms, IT ranks lowest with Thatcherism, while for the long-run indicator it ranks lowest with bulls during the Keynesianism Plus period. This may appear surprising since the IT period the booms that took place during the 1990s, and before the GFC, however, these booms occurred in scenarios of heightened volatility, and thus the LBBI may have been muted.

That KePl and ThM also rank below the other eras according to at least one of the indicators may be due to contextual conditions. Figure 16 shows that the KePl period (1966-78) did not have very many long-run phases and they were short in timespan, which would not allow for high values of severity. Thatcherism (1978-1992) on the other hand, presents several short-run booms, but they are frequent and short, thus presenting lower average severity levels. This, of course, is worthy of further study, as short booms may reflect either low investor confidence or quick market corrections due to impending uncertainty about the future.

Annex 21. Bulls and Bears for the UK Stock Market Using a Restrictive Threshold

We present the dating, duration, amplitude, and severity of expansions and contractions for the UK stock market according to the procedure described in section 5.2.

Table 181: Bulls and bears in the UK stock market - Restrictive threshold

Phase	Start date	End date	Dur	Amp	Sev	Phase	Start date	End date	Dur	Amp	Sev
Short-run LBBI						*Medium-run LBBI*					
Bull	1/31/1922	5/31/1922	5	39.38%	10.73	Bull	1/31/1922	10/31/1923	22	20.28%	44.79
Bear	10/31/1929	12/31/1929	3	-5.78%	-5.39	Bear	11/30/1929	1/31/1930	3	-2.55%	-3.25
Bear	8/31/1931	12/31/1931	5	-8.76%	-8.63	Bull	12/31/1941	4/30/1944	29	23.80%	55.57
Bull	7/31/1932	10/31/1932	4	16.14%	7.14	Bear	8/31/1947	7/31/1950	36	-12.24%	-55.37
Bull	3/31/1933	4/30/1934	14	24.09%	23.73	Bear	5/31/1952	6/30/1952	2	1.03%	-2.44
Bear	3/31/1937	4/30/1938	14	-30.43%	-22.14	Bull	11/30/1953	9/30/1955	23	18.05%	52.17
Bear	9/30/1939	10/31/1939	2	-0.44%	-2.81	Bear	10/31/1957	2/28/1958	5	-4.39%	-5.97
Bear	6/30/1940	8/31/1940	3	-29.10%	-7.36	Bull	8/31/1959	3/31/1961	20	18.16%	29.53
Bull	6/30/1941	1/31/1942	8	44.79%	12.77	Bear	5/31/1962	6/30/1963	14	-9.91%	-15.96
Bull	10/31/1942	1/31/1943	4	9.70%	4.99	Bear	8/31/1966	11/30/1966	4	-5.31%	-4.73
Bear	7/31/1947	7/31/1948	13	-27.64%	-17.77	Bull	9/30/1967	4/30/1969	20	12.13%	47.44
Bear	5/31/1949	8/31/1949	4	-6.39%	-6.31	Bear	5/31/1970	3/31/1971	11	-8.09%	-12.13
Bear	11/30/1951	6/30/1952	8	-34.52%	-11.33	Bear	11/30/1973	7/31/1975	21	-30.52%	-36.11
Bull	1/31/1953	3/31/1953	3	20.13%	3.45	Bull	5/31/1977	12/31/1977	8	32.85%	10.05
Bull	8/31/1953	10/31/1954	15	29.67%	20.18	Bull	3/31/1983	5/31/1985	27	11.97%	40.50
Bear	2/29/1956	3/31/1956	2	1.84%	-2.32	Bull	2/28/1986	6/30/1986	5	0.75%	5.88
Bear	9/30/1957	2/28/1958	6	-24.85%	-9.07	Bull	1/31/1987	9/30/1987	9	10.10%	16.22
Bull	8/31/1958	10/31/1958	3	33.73%	3.46	Bear	10/31/1987	1/31/1991	40	-29.66%	-53.65
Bull	4/30/1959	5/31/1959	2	5.67%	2.24	Bull	3/31/1993	3/31/1994	13	3.83%	20.04
Bull	10/31/1959	1/31/1960	4	19.79%	6.81	Bull	12/31/1997	6/30/1998	7	4.20%	11.28
Bear	6/30/1961	11/30/1961	6	-18.00%	-7.02	Bear	5/31/2000	7/31/2003	39	-23.52%	-68.86
Bear	5/31/1962	7/31/1962	3	-2.80%	-3.98	Bull	12/31/2004	1/31/2007	26	15.26%	38.58
Bull	6/30/1967	8/31/1968	15	52.43%	22.69	Bear	6/30/2008	11/30/2009	18	-11.02%	-29.91
Bear	4/30/1969	8/31/1969	5	-34.61%	-7.16	*Long-run LBBI*					
Bear	4/30/1970	5/31/1970	2	-8.29%	-3.13	Bear	1/31/1922	2/28/1922	2	-3.50%	-3.55
Bull	4/30/1971	5/31/1971	2	35.43%	2.12	Bull	8/31/1922	9/30/1925	38	11.29%	64.79
Bear	1/31/1973	5/31/1975	29	-0.44%	-24.13	Bear	5/31/1931	7/31/1932	15	-1.48%	-29.76
Bear	9/30/1981	10/31/1981	2	-23.90%	-2.62	Bull	7/31/1933	2/28/1937	44	11.96%	83.31
Bull	12/31/1982	6/30/1983	7	25.96%	8.29	Bear	12/31/1937	5/31/1941	42	-17.93%	-64.59
Bull	12/31/1984	1/31/1985	2	0.81%	2.15	Bull	10/31/1942	11/30/1945	38	18.02%	71.17
Bull	2/28/1986	4/30/1986	3	20.55%	4.06	Bear	10/31/1947	1/31/1951	40	-8.51%	-55.21
Bull	2/28/1987	7/31/1987	6	24.82%	9.24	Bear	11/30/1951	8/31/1952	10	-3.23%	-13.67
Bear	10/31/1987	8/31/1988	11	-77.99%	-16.10	Bull	10/31/1953	7/31/1957	46	14.39%	76.82
Bear	8/31/1990	10/31/1990	3	-6.38%	-4.00	Bull	10/31/1959	6/30/1961	21	6.18%	33.24
Bull	12/31/1993	1/31/1994	2	8.17%	2.49	Bear	8/31/1963	10/31/1965	27	-11.87%	-41.63
Bull	2/28/1998	3/31/1998	2	10.48%	2.96	Bull	3/31/1968	5/31/1969	15	1.51%	30.81
Bear	8/31/1998	9/30/1998	2	-23.18%	-4.21	Bear	9/30/1972	11/30/1975	39	-16.94%	-64.83
Bear	1/31/2000	5/31/2000	5	-18.43%	-4.79	Bear	5/31/1976	11/30/1976	7	-7.79%	-7.56
Bear	11/30/2000	12/31/2001	14	-19.00%	-18.20	Bull	3/31/1978	12/31/1979	22	25.83%	42.89
Bear	6/30/2002	1/31/2003	8	-20.30%	-11.52	Bull	11/30/1983	9/30/1987	47	17.76%	77.54
Bull	7/31/2003	12/31/2003	6	29.84%	6.22	Bear	11/30/1988	12/31/1988	2	-2.66%	-2.17
Bear	1/31/2008	3/31/2009	15	-30.28%	-29.98	Bear	9/30/1989	9/30/1992	37	-18.77%	-49.43
Bull	8/31/2009	12/31/2009	5	36.28%	6.52	Bull	4/30/1995	3/31/1997	24	6.93%	29.87
Bear	8/31/2015	9/30/2015	2	-9.63%	-3.30	Bull	12/31/1997	7/31/1998	8	1.06%	11.75
Medium-run LBBI						Bull	2/28/1999	6/30/1999	5	6.12%	6.45
Bear	7/31/1930	6/30/1932	24	-5.26%	-37.94	Bear	11/30/2000	3/31/2004	41	-17.46%	-76.86
Bull	5/31/1933	2/28/1935	22	18.45%	49.89	Bull	1/31/2006	1/31/2008	25	11.99%	47.61
Bear	7/31/1937	11/30/1939	29	-16.16%	-48.90	Bear	2/28/2009	3/31/2009	2	-0.94%	-2.09
Bear	6/30/1940	10/31/1940	5	-5.24%	-6.92	Bull	1/31/2013	6/30/2014	18	11.03%	30.52