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Essays in Empirical Industrial Organization, Finance Market and Public Policies

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To Jorge, Montserrat y Josefa

Contents

Chapter 1

Introduction

The following dissertation deals with economic analysis in the banking industry. Particularly it try to measure the effect of different kinds of regulations applied in this sector.

Because of concern over the stability of the financial system in economic crises, regulators have adopted several macroeconomic policies. In recent years, banking regulation has become less pervasive, and has shifted from structural regulation to other, more market oriented forms of regulation. This new regulation has aimed to reduce barriers to entry in the commercial banking system, to open up to international competition (Edey, Malcolm and K. Hviding (1995)), and to diminish asymmetric information between borrowers and firms, considering that economic agents possess different level of information on relevant economic variables, and will use this information for their own profit (Freixas and Tirole (2008)).

In this research, I evaluate different kinds of banking regulation in each one of the aforementioned regulation flanks, with the objective to contribute to the literature oriented to promote stability and foster competition in banking industry.

This dissertation encompasses three main topics: 1) how foreign bank penetration and dollarization in Latin America has affected competition between banking institutions; 2) to evaluate if changes in bank′s capital standards would determine changes in the real economy; and 3) to evaluate whether stronger banking regulation regarding the way that cost information of loans is provided to consumers can help borrowers make more informed decisions, therefore reducing asymmetric information.

The theory of financial intermediaries demonstrates that banking institutions produce better information between borrowers and savers (Leland and Pyle (1976), Diamond (1984), Gertler and Bernacke (1987)), therefore improv-

ing the allocation of resources in the economy, in order to finance the most profitable investment opportunities.

The literature has demonstrated that industries that depend more on external finance grow relatively faster in economies with a higher level of financial development (Greenwood and Jovanovic (1990), Rajan and Zingales (1998), King and Levine (1993)). In addition, it also finds that financial development stimulates the establishment of new firms (Levine and Beck (2000)).

However, economic analysis recognizes that, in order to determine the relationship between the financial system and economic growth, other specific characteristics such as stability, efficiency and access need to be considered (Chiack et al (2012)).

Both theoretical and empirical research has supported the importance of regulations and public policies such as bank capital requirements, deposit insurance, and the necessary monitoring in the banking sector as tools that mitigate the macroeconomic effects of economic crises.

The discussion of financial stability using the theoretical dynamic macroeconomic model of Bertrand and Gertler (1990) showed that credit market frictions may significantly amplify real and nominal shocks in the economy, a result has is economically justified (Gertler and Bernacke (1987)). And empirical literature that studied what happens to the banking sector and the economy at large in the period following a crisis (Bernacke (1983), Calmoris and Mason (2000)) found that the variation in the supply of bank credit may enhance and prolong the adverse effects of crises, and explain the variation in income growth.

The second topic of this dissertation deals with the following concern: would changes in bank′s capital requirements result in changes in the real economy in Latin America? I answer this question with a policy evaluation methodology. Specifically, I use a difference-in-difference approach and matching methodology to assess the effect of Basel II regulation in the access of firms to bank finance (measured as firm′s debt) and in the level of investment (measured as capital expenditures).

A competitive financial sector is a crucial component of market economies. Competition in the banking sector allows consumers to smooth consumption, and firms to finance their investment at a lower cost. Most of the literature supports a positive relationship between competition and productivity. Therefore, the globalization and financial crises in the last decades have forced the banking industry and the regulators to decrease the barriers of entry at the national level and open up financial markets to foreign competition. The hypothesis behind these policies is that foreign banking competition could in-

crease the efficiency level in the domestic banking system and increase access to financing for firms and individuals.

Several authors have addressed the potential benefits of foreign bank entry in the financial system for the domestic economy in terms of better resource allocation and higher efficiency (Claessens et al. (2001) Levine (1996), Walter and Gray (1983), Gelb and Sagari (1990)).

However, other authors have concluded that foreign penetration had a destabilizing effect on the financial system, especially if domestic prudential regulations and supervision are not strong, because foreign banks can act as international transmitters of shocks (Peek and Rosengren (1997, 2000) De Haas and Lelyveld (2013)).

Other studies have focused on the relationship between private credit and foreign bank ownership, in order to determine if the entrance of the latter has increased the available credit amount in the economies. Surprisingly, little is known regarding under what conditions foreign ownership is positively related to private credit. Some suggest that foreign banks cherry pick their borrowers. Detragiache, Gupta and Tressel (2008) show that greater presence of foreign banks in low income countries is associated with less credit being extended.

Claessens and Van Horen (2013) demonstrate that several country characteristics -not only income of the country- are relevant when analysing the potential effect of foreign bank penetration. Foreign banks only seem to have a negative impact on credit in low-income countries, in countries where they have a limited market share, where enforcing contracts is costly, where availability of credit information is limited, and when they come from distant countries. This shows that accounting for heterogeneity, including bilateral ownership, is crucial to better understand the implications of foreign bank ownership.

The first topic of the thesis deals with the relationship between foreign bank penetration and dollarization/currency board, and the intensity of competition in the banking sector in Latin America. We exploit the panel structure of pooled data of commercial banks, using Boone estimators by country using alternative methods -fixed effects, random effects, and Anderson-Hsiao models-
.

Recently, policy-makers are beginning to acknowledge the central importance of improving consumer′s economic decisions in order to increase efficiency and consumer welfare in traditionally publicly provided markets, as a complement to stability regulations. Van Rooij et al. (2007) found that financial sophistication is correlated with greater wealth, a higher probability to invest in the stock market and a higher propensity to plan for retirement. Behrman et. al (2010) found that financial literacy and schooling attainment have been

linked to household wealth accumulation. In related papers, Christelis et al. (2010) and McArdle et al. (2009) found that the accuracy of responses to simple mathematical questions is a strong predictor of total wealth, financial wealth, stockholding and the fraction of wealth held in stocks.

The traditional models of savings and consumption assume that individuals are rational and fully informed, therefore they can evaluate their future income and interest rates and discount them appropriately. In reality, many studies have provided convincing evidence that a large proportion of the adult population knows little about finance and that many individuals are unfamiliar with basic economic concepts, such as risk diversification, inflation, and interest compounding. The literature suggest that people who cannot calculate interest rates correctly given a stream of payments tend to borrow more and accumulate less wealth (Stango and Zinman (2008)).

One of the most effective ways to help consumers is to empower them with information: a better-informed consumer likely results in more-prudent decision making and, consequently, less harm to the economy. Regulations with the objective to grant more access to relevant loan cost information could be considered in different levels of depth: they could only be a simplification in the information frame that banking institutions give to consumers, or they can aim to increase the level of financial literacy.

Hasting and Tejada-Hanston (2008) examine, with a survey and experiment with participants in Mexico′s privatized social security, how financial literacy impacts workers choice behaviour and how simplifying information on management fees may increase measures of price elasticity sensitivity among the financially illiterate. These results support that the presentation of government-mandated information has potential to influence choices, and therefore competition, in privatized markets. In addition, they show that financially literate respondents place much higher importance on fees, relative to brand name, when selecting funds in a hypothetical situation. This implies that wealth accumulation in a privatized system will be on average higher for these individuals.

Japeli and Padula (2013) present an intertemporal consumption model of investment in financial literacy. They show that consumers benefit from such investment, since financial literacy allows them to increase the returns on wealth. Since literacy depreciates over time, and it ahs a cost in terms of current consumption, the model delivers an optimal investment in literacy. Furthermore, literacy and wealth are determined jointly, and are positively correlated over the life cycle.

In the context of challenges to banking system regulations around the

world, evaluating the effectiveness of public policies in reducing asymmetric information or increasing financial stability is crucial. The focus of the analysis in this thesis is centred in analysing the effect of different set of regulations in banks, firms and individual consumers, with econometric techniques and different methodologies.

The current investigation has assessed different databases and sources of information, despite the difficulties to access appropriate databases at micro level of consumer in the banking system, due to the legal confidentiality authorities are bound to with this information.

Given the discussion described above, the rest of this dissertation is comprised of four chapters. As mentioned before, a competitive financial sector is a crucial component of robust market economies, since it allows consumers to smooth consumption, and firms to finance their investment at a lower cost. In the last decades, the Latin American banking industry has gone through important changes. In this regard, Chapter 2, titled *"Dollarization, Foreign Ownership and Competition in the Banking Industry in Latin America"* studies how foreign bank penetration, as well as dollarization, affects banking competition in these economies.

I estimate the correlation of foreign bank penetration and dollarization on competition in the banking industry in Latin-American during the period 1995-2008. Using Fitch-IBCA Bankscope dataset, which provides bank-level annual financial information, I apply Boone′s methodology to compute the intensity of competition in the banking sector over time in 16 Latin American countries with panel data techniques. According to Boone′s indicator the relationship between efficiency and profits should be stronger in more competitive markets.

My results suggest that foreign investment in the banking industry has a positive correlation with the intensity of competition among countries. In countries with an initial low level of competition, foreign ownership tends to foster rivalry among banks, whereas the opposite is true in countries with an initial high level of competition. In our sample, the adoption of dollarization or a currency board, which reduces transaction costs and facilitates financial integration, has a positive correlation with competition. This is the case for Ecuador, El Salvador and Argentina.

The main objective of Chapter 3, titled *"The Effect of Banking Regulation Basel II in the Real Economy in Latin America"* is to examine the potential effects of tighter capital requirements -due to regulatory changes- in firm′s debt and investment level. This study analyses if these effects could be heterogeneous, considering the size of the firms. In this paper I will exploit the different timing in the implementation of Basel II across countries in a difference-in-

difference and matching econometric techniques to assess the effect of Basel II in the access of firms to bank finance (measured as firms debt) and in the level of investment (measured as capital expenditures) and analyses empirically if this kind of regulation could be heterogeneous in firm size.

I use a World Scope Thomson unbalanced panel database since 1995 to 2013 of firms traded in exchange in Chile, Brazil, Colombia, Mexico and Peru.

The most relevant result of this paper is that the effect of bank capital requirement regulation in firms debt is a function of it size, but it has not been identified and quantified an investment effect. These results could be explained following the literature of financial intermediation (Halmstron and Tirole, 1997) because some firms could finance their investment projects with their own capital but another firms could stop to doing some of them and reduce the investment level, therefore the final effect is ambiguous.

Next, in a context of asymmetric information between borrowers and banking institutions, there is an increasing concern that lending institutions might be able to use information complexity as a device to soften competition. Given this, financial education has been targeted as an important tool to potentially improve the decision making process of less sophisticated consumers. In this regard, Chapter 4, titled *"Evaluating New Regulations on the Information Frame in the Credit Markets"*.

Regulations requiring the financial information to be summarized in a prominent and simple way, and to be readily available to borrowers are pervasive around the world. However, empirical assessments of their effectiveness are rarely found. We use detailed individual-level data to evaluate the effects of the regulation on interest rates and loan amounts in the Chilean banking sector since 2009-2014.

Our difference-in-difference estimates suggest that consumers at the top 40 percent in the income distribution achieved a lower interest rates after the regulation was implemented. I find no statistically significant effect on the rest of the consumers, nor on other financial outcomes.

I explore whether my findings can be explained by educational background or by search behaviour. To identify the relative weight of each of the two hypotheses, we construct the number of banking institutions that the customer has had a business relationship in the past, as a measure for individuals being more prone to quote different banking institutions. We also merge our credit data with educational outcomes for a relevant sub-sample in order to have a solid measure of financial education. I also merge the credit data with educational outcomes for a relevant sub-sample in order to have a solid measure of financial education. The difference-in-differences estimates including both

set of covariates suggest that the hypothesis of financial literacy is the most relevant factor that could explain the effect of the new law.

Finally, Chapter 5 summarizes the conclusions and the policy implications of the different analyses presented in this thesis.

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Chapter 2

Dollarization, Foreign Ownership and Competition in the Banking Industry in Latin America

2.1 Introduction

A competitive financial sector is a crucial component of market economies. Competition in the banking sector allows consumers to smooth consumption and firms to finance their investment at a lower cost. Most of the literature supports a positive relationship between competition and productivity. Under a more competitive environment, firms have higher incentives to innovate and to reduce managerial slack. In the banking industry, the impact of competition also works through a different channel since banks are a primary source of credit for firms. Prompt access to credit funds, as an indicator of competition, allows more firms to finance innovation process and product. [1]

The purpose of this paper is to reassess the relationship between foreign ownership, dollarization and competition in the banking industry. Using the Fitch-IBCA Bankscope dataset that provides bank-level annual financial information, we apply Boone′s (2008) methodology to compute the intensity of competition in the banking sector over time in 16 countries in Latin America. According to Boone′s technique, the relationship between efficiency and profits should be stronger in more competitive markets. The data allow us to run a difference in difference model to test the relationship between foreign bank

[1] See Boldrin & Levine (2008).

penetration, and dollarization/currency-board on the intensity of competition in the banking sector. During the last two decades, the Latin American banking industry has gone through important changes. First, consolidation has led to more concentrated market. Secondly, several countries have experienced significant increases in foreign bank penetration, as reported by Levy-Yeyati and Micco (2007). Finally, some countries, Argentina (1991-2001), Ecuador (2000-), and El Salvador (2001-) have undertaken more radical reforms. They dollarized or introduced a currency board. We use these changes on foreign bank penetration and dollarization to study their correlation with competition.

We find that foreign banks tend to increase market rivalry in countries with an initial low level of competition, whereas the opposite occurs in countries with an initial high level of competition. In our sample, the adoption of dollarization or currency boards has a positive correlation with competition. This is the case for Ecuador, El Salvador and Argentina.

On the measurement of competition, we employ the methodology proposed by Boone (2008). In this method, the relationship between efficiency and profits/revenues should be stronger in more competitive markets.

The Boone indicator is based on the notion that more efficient firms, with lower marginal costs, gain higher market shares or profits in relation to their less efficient rivals. As competition becomes stronger, there is an reallocation of output from less efficient to more efficient firms.

Levine (1996) provides a conceptual framework to analyze the potential costs and benefits of foreign bank entry. On the benefits side, he emphasizes how foreign banks can play a useful role in promoting capital inflows and competition. Foreign entry may foster competition by different channels. Foreign banks may have superior access to funds from aboard. Holding a more diversified portfolio may also induce banks to a more aggressive lending policy. Finally, the entry of a foreign bank, without ties or relationship with local firms, may destabilize collusive agreements among domestic banks. Concerns about foreign banks are associated to the risk of capital outflows, increasing the economic volatility. Other possible negative impacts of the presence of foreign banks are the crowding out of domestic banks and the greater difficulty of the government to lead the economy.

Hawkins and Mihaljek (2001) claim that global market and technological developments, macroeconomic pressures and banking crises in the 1990s in developing countries have forced the banking industry and regulators to change their old way of doing business. These trends have pushed authorities to deregulate the banking industry at the national level and to open up financial markets to foreign competition. As a result, borders between finan-

cial products, banks and non-bank financial institutions and the geographical locations of financial institutions have started to break down. These changes have significantly increased competitive pressures on banks in the emerging economies and have led to deep changes in the structure of the banking industry. Claessens and Laeven (2004), use Panzar and Roses (1987) methodology and find that greater foreign bank presence and fewer activity restrictions in the banking industry render a more competitive banking system.

A high degree of financial integration, which not only comes through foreign banks but also through cross border lending, enhances competition among financial institutions, as well as among financial market infrastructures, and reduces the costs of financial intermediation. Using a theoretical model, Arellano and Heathcote (2010) claims that dollarization lowers transaction and information costs, encouraging trade and financial integration. Berg, A. and E. Borensztein (2000) claims that one of the most profound effects of Panama′s dollarization is the close integration of its banking system with that of the United States and indeed with the rest of the world, particularly since a major liberalization in 1969-1970. Dollarization expands the array of financial options open to emerging-market governments and firms, and should therefore increase competition.

The data allow us to estimate the Boone indicator for each Latin American country. Also, using a difference in difference approach, we test how foreign bank penetration as well as dollarization affect competition in these economies. For the 1995-2008 period, our results show that since the dollarization in the year 2000, Ecuador has been the most competitive banking system in our sample while Venezuela, Costa Rica and Honduras have been the least competitive. In countries with a higher initial level of competition foreign penetration appears to have led to a less competitive industry. Following Levy-Yeyati and Micco (2007), we argue that foreign banks in more competitive countries increase the degree of product differentiation to reap oligopolistic rents. In countries with a low initial competition level, foreign penetration improved competition. In less competitive countries, foreign banks can steal rents from domestic banks just by being more aggressive in their prices.

We present evidence that dollarization and currency boards are positively correlated with competition in the banking industry. This is the case of countries that implemented such reforms: Argentina, Ecuador and El Salvador. Our results results are in line with the idea that dollarization reduces transaction costs, increases financial integration, and therefore offers firms and households more financial options.

The contribution of this article to the current literature is twofold. This

paper is the first that applies a new measure of competition, the Boone indicator, to a set of banks in 16 Latin American countries and it focuses on the evolution of this indicator within countries. Secondly, and more importantly, using the evolution of the Boone indicator this paper provides new insights about the suggestive correlation between foreign penetration and dollarization on competition in the commercial banking system in Latin American countries.

The paper is structured as follows. Section two contains a brief literature review of the different methods currently used to measure the competition in banking industry. Section three describes the data. Section four explains the empirical methodology that we employ in the model. In section five we show the econometric results and finally section six concludes.

2.2 Measuring competition in the banking industry

The empirical literature in industrial organization supports the use of structural models to analyze competition in the banking sector. Panzar and Rose (1987) develop a methodology that measures how changes in input prices are reflected in revenues earned by banks. The authors propose a parameter dubbed the H-statistic, which is defined as the sum of the elasticities of the reduced-form revenue function with respect to factor prices. Under perfect competition H =1 since any increase or reduction in production costs will be passed through revenues in a one-to-one basis. In the case of monopoly, the H-statistic is negative since the monopolist reacts by reducing output and revenues, following an increase in the input price. In the intermediate case of monopolistic or imperfect competition, the value of H will range between 0 and 1. Claessens and Laeven (2004) apply this methodology to a set of banks from 50 countries during the period 1994-2001. They find that most of banking markets behave according to a monopolistic competition model, obtaining an H′tatistic that varies between 0,6 and 0,8. Levy-Yeyati and Micco (2007) obtain H-statistic values ranging between 0,50 and 0,87 for a set of seven Latin American countries during the period 1993-2001.

Bresnahan (1982) introduces conjectural variation models to characterize the level of competition. In these models, the conjectural coefficient represents the reaction of rivals with respect to the level of output chosen by a particular firm. A negative parameter where one firm expects that other to reduce its output- corresponds to a competitive scenario, since induce firms to place more output in the market. Inversely, a positive value signals a less competitive

market since firms will be reluctant to increase their output due to their rival′s reaction. Examples of conjectural variation methods applied to the banking industry are the works of Shaffer in the United States (1989) and Canada (1993) and Berg and Kim (1998) in Norway. In Latin America, Spiller and Favaro (1984) employ this methodology to estimate how competition in the Uruguayan market is affected by the entry of foreign firms.

Boone (2008) proposes a novel methodology that infers the degree of competition in a market from the relationship between profits and efficiency of firms. Under a more competitive market more efficient firms get a higher market share and profits with respect to less efficient firms. This reallocation of output from less to more efficient firms, which enlarges the difference in market shares between them, is called the selection effect of competition as explained by Aghion and Shankerman (2004). Thus, in a scenario of strong competition, such as Bertrand with homogenous product, the efficient firm gets one-hundred percent of the market and obtains positive profits, whereas the inefficient firm gets zero of the market share and profits. On the contrary, under a less competitive scenario such as Cournot, an inefficient firm gets a strictly positive market share and profits, but at a lower magnitude than those of the efficient firm. The Boone Method is representative of the efficiency hypothesis which predicts that a firm′s profitability is driven by its own efficiency. In the banking industry, the Boone technique has been applied by Van Leuvensteijn, Bikker, Van Rixtel, and Sorensen (2007) for European countries and by Schaeck and Cihk (2010) for banks in Europe and the United States. In Latin America, Paz (2009) and Oda and Silva (2010) have measured competition using this method for banking markets in Peru and Chile.

2.3 The data

Our main source of data is the Fitch-IBCA Bankscope (BSC) dataset. Our dataset covers 516 commercial banks with lending activities and deposits in 16 Latin American Countries: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Paraguay, Peru, Uruguay and Venezuela (see Table 2). The unbalanced panel dataset has 4.526 bank-year observations of all commercial banks in the Fitch-IBCA Bankscope.

Tables 1 provides a brief description of the main variables related to the commercial activities of banks such as revenue market share, foreign market share and variable cost. Revenue is the sum of interest income, commission

income, fee income, trading income and other operating income. Variable cost includes overheads costs, interest expense and commission expense. The average market share in our sample is 7%, ranging from 1.2% in Brazil to 15% in El Salvador. Paraguay, Uruguay and El Salvador present the largest share of foreign penetration in the data (over 80%).

Table 2.1. Mean Values of main Variables by country.

Country Name	Average Market Share per Bank	Average Market Share of Foreign Bank	Std. Deviation Market Share of Foreign Bank	Total Variable Cost over Total Income	Wages over Total Income over Total Income
Argentina	2,4%	60,3%	11,7%	73,2%	12,2%
Bolivia	11,3%	25,5%	3,8%	74,5%	13,9%
Brazil	1,2%	36,3%	5,2%	84,1%	13,0%
Chile	4,9%	48,4%	9,0%	65,7%	11,7%
Colombia	7,7%	18,8%	5,4%	64,7%	12,3%
Costa Rica	10,7%	37,8%	5,0%	76,3%	16,5%
Dominican Republic	6,8%	17,2%	4,0%	75,9%	16,2%
Ecuador	5,1%	2,9%	1,8%	70,2%	12,6%
El Salvador	14,7%	81,0%	20,7%	75,0%	14,8%
Guatemala	6,3%	12,6%	7,4%	83,6%	
Honduras	7,9%	33,3%	6,6%	66,4%	15,1%
Mexico	4,0%	60,5%	21,0%	72,4%	2,9%
Paraguay	8,7%	86,3%	5,7%	89,8%	8,9%
Peru	8,6%	58,4%	5,6%	61,9%	15,8%
Uruguay	6,3%	89,7%	11,5%	87,9%	8,9%
Venezuela	4,4%	23,7%	7,8%	71,9%	17,0%
Average	6,9%	43,3%	8,3%	74,6%	12,8%

Source: Fitch-IBCA Bankscope dataset

2.4 The Empirical Model

Boone et al. (2005) estimate the following equation:[2]

$$\ln(\pi_i) = \alpha + \beta AVC_i + \epsilon_i \tag{2.1}$$

where profits (π_i), are revenues minus labor and intermediates costs (variable cost) and (AVC_i) represents variable costs share. The latter is a proxy for marginal cost in case of constant return to scale ($c_i q_i / p_i q_i = c_i/p_i$=1-profit margin). Empirical studies focusing on developed and Latin American countries find that economies of scale in the banking sector are exhausted at a relatively small size and then remain constant, therefore we can use average costs as a proxy for marginal cost.[3] More efficient firms have higher profit margins and therefore lower values of c_i/p_i.

The parameter β is the elasticity of a firm′s profits with respect to its cost level. A higher value of this profit elasticity, in absolute value, signals more intense competition. Van Leuvensteijn et al. (2007) works with revenue based market shares instead of profits. Market share is always positive, whereas profit could be negative creating a sample bias. In our econometric exercises we use market share as our dependent variable.

We compute the Boone estimator (β) which is defined as the elasticity of bank market share with respect to the proxy of marginal cost (variable costs share). Our empirical study is conducted in three steps.

In the first step, using the pooled sample of banks, we compute one Boone estimator (β_j) per country. We use (β_j) to compare competition across countries. In the second step, we compute one Boone indicator per country-year (β_{jt}) to describe the evolution of competition within countries over time. Finally, in the third step we estimate a Boone indicator which is a linear function of foreign bank penetration and dollarization. In all cases we exploit the panel structure of the pooled data of commercial banks.

Our main specification allows for a time-varying Boone indicator at the

[2] Instead of using the relation between profits of firm i and some reference j , they estimate log profits. This is equivalent to estimate the relative profits, because using the log profits the reference profit is absorbed into the constant term. They use that because in the practice is problematic to specify this reference profit.

[3] For developed countries Shaffer (1993), Rhoades (1998), Peristiani (1997) and Berger, Demsetz, and Strahan (1998) find that cost scale economies are exhausted at around US$10 billion in assets. For Latin America, IADB (2004) shows that there are substantial scale economies for small banks that have less than $150 million in assets. However, banks that have between $150 million and $8 billion in assets have similar overhead costs, indicating that economies of scale are not at work for these banks.

country level. Changes over time are key to the purposes of our paper. From a methodological perspective, the Boone indicator depends on industry-specific characteristics. Thus, by extension, the degree to which cross-country variations reveal differences in competition is not straightforward. As a result, a simple cross-country comparison is likely to lead to misleading conclusions unless we control for other country-specific characteristics. To avoid this omitted variable problem we use a difference in difference approach. Within-country variation provides useful information about the evolution of competition and its determinants.

1. **Degree of competition across countries:**
   To compare the degree of competition across countries, we compute the elasticity of a firm′ revenues with respect to its cost level for each country over the entire period 1995-2008 (β_j):[4]

   $$\ln(share_{ijt}) = \alpha + \beta_j d_j \ln(mc_{ijt}) + \eta_{jt} + \eta_i + \epsilon_{ijt},\ t = 1, \ldots, T.\ i = 1, \ldots, N \tag{2.2}$$

   where i, j , and t refer to bank, country, and year, respectively. d_j is a dummy that takes a value of 1 for country j , and η_{jt} and η_i are country-time and firm fixed-effects. $Share_{it}$ is the market share of the revenue; mc_{it} is a proxy of efficiency. We use variable cost over total revenue of bank i as a proxy for marginal costs. We include country-time dummies (η_{jt}) to control for country specific shocks.ε_{ijt} is a random disturbance term.

2. **Degree of competition across countries:**
   To analyze how competition has changed over time in each country, we allow the elasticity to vary over time (1995-2008)(β_{jt}):[5]

   $$\ln(share_{ijt}) = \alpha + \beta_{jt} d_t \ln(mc_{ijt}) + \eta_{jt} + \eta_i + \epsilon_{ijt}.t = 1, \ldots, T.i = 1, \ldots, N \tag{2.3}$$

3. **Foreign penetration and dollarization:**
   Finally, in order to test the correlations of foreign penetration and dol-

[4]Except Costa Rica is (1998-2008), Ecuador (1997 -2008), Guatemala (1999-2008) and Salvador (2000-2008).

[5]Except Costa Rica (1998-2008), Ecuador (1997 -2008), Guatemala (1999-2008) and Salvador (2000-2008).

larization on competition we estimate the following equation:

$$\begin{aligned} \ln(share_{ijt}) &= \alpha + (\beta_j + \gamma_j * x_{jt}) \ln(mc_{ijt}) + \eta_{jt} + \eta_i \\ &+ \epsilon_{ijt}. \qquad t = 1, \ldots, T.i = 1, \ldots, N \end{aligned} \tag{2.4}$$

where x_{jt} includes market share of foreign banks and a dummy that takes a value 1 if country j is dollarized in year t.

If γ_j is positive and statistically significant at the conventional level, foreign penetration and/or dollarization are negatively correlated with the intensity of competition.

In this estimation is important to consider that we do not have a causal effect of the impact of these policy changes on the effects of competition on outcomes, the results are a suggestive correlations because this event could be triggered by other omitted phenomena.

2.5 Endogeneity

Previous models have endogeneity problems between marginal costs and market share. Endogeniety could come from three sources. i) The variable of interest $ln(mc_{ijt})$ is related to the dependent variable we use market share (revenue). Thus, β would be biased downward. ii) The presence of time invariant unobserved heterogeneity across banks (fixed effects (η_i)): quality of management due to innate abilities and business experience which is constant in time but different across banks. iii) Time variant shocks (ϵ_{ijt}): investment in new technology, the bank gain higher market shares and decrease the marginal costs, or investment in quality which can increase market shares but at the same time rises marginal cost (Hay and Liu, 1997).

The error term of the model, ε_{ijt}, could be written as:

$$\varepsilon_{ijt} = \eta_i + \epsilon_{ijt} \tag{2.5}$$

If we assume that $corr(\eta_i, mc_{it}) = 0$ and $corr(\epsilon_{ijt}, mc_{it}) = 0$ we can estimate the models using Random Effect and obtain a consistent estimator of the intensity of competition, but if $corr(\eta_i, mc_{it}) \neq 0$ and $corr(\epsilon_{ijt}, mc_{it}) = 0$, we need to account for bank fixed effects.[6]. In the case that $corr(\eta_i, mc_{it}) \neq 0$ and $corr(\epsilon_{ijt}, mc_{it}) \neq 0$.

[6]Levy-Yeyati and Micco (2007)

The literature uses the Generalized Method of Moments (GMM) or the Anderson-Hsiao approach (which it is an special case of the GMM), using lagged values of the explanatory variables as instruments.[7].[8]

In order to estimate the model using GMM one necessary condition is to have an instrument that, once controlled for the others covariates, is uncorrelated with the error term of the structural equation, i.e. the instrument must be exogenous. Nonetheless, instrument exogeneity is not sufficient to identify the causal effect. The instrument must also be relevant, i.e. correlated with the endogenous variable. Instruments that fulfill both conditions are called valid. In some cases, the instrument is only weakly correlated with the endogenous variable, raising the problem of weak instruments. Although we can identify the causal effects, in the presence of weak instruments inference can be misleading. With weak instruments the sampling distribution of GMM coefficients are in general non-normal, the endogeneity bias increases and standard errors are unreliable. We check for weak instruments comparing the Kleibergen-Paap F statistic with the 95 percent confident interval, the rule of thumb value of 10[9], and the critical values computed by Stock and Yogo (2005).

As a benchmark, we first estimate Equation 2 using Fixed Effects. Next we apply the Anderson-Hsiao approach to take into account fixed effects and the potential correlation between our proxy for marginal costs and the error term $corr(\epsilon_{ijt}, mc_{it}) \neq 0$.

If the error term is un-correlated with the marginal costs proxy, both models are un-biased although the Fixed Effects model is more efficient. If the error term is correlated, the Fixed Effects model is biased in which case we have to use the Anderson-Hsiao model. For the latter we see whether the whole model is underidentified [10], we find a serious problem in this estimation. However there are some countries in which the instruments are relevant[11], for robustness we test if the Fixed Effects coefficients are equal to the Anderson-Hsiao coefficients in this cases. We can not reject the null hypothesis that both sets of coefficients are equal.

Third, if individual specific effects are uncorrelated with the independent variables, random effect is more efficient than fixed effect. We use DWH to test the null hypothesis $corr(\eta_i, mc_{it}) = 0$.

We reject the null hypothesis at standard levels of significance and therefore

[7] See Arellano Bond (1991)

[8] Van Leuvensteijin et al.(2007); Schaeck et al.(2010) and Maslovych (2009)

[9] Staiger and Stock (1997) suggest an F-statistic less than 10 is problematic and a value of 5 or less is a sign of extreme finite-sample bias.

[10] Kleinberg-Paap LM Statistic.

[11] Test of exclude instruments to measure the instrument relevance.

cannot use the Random Effect model.

2.6 Estimation Results

Table 3 presents Boone Estimators by country using bank Fixed Effects (Column 1), Random Effect(Column 1) and Anderson-Hsiao Column 3) models. In all empirical models we include country-time dummies. Under the null hypothesis that both bank idiosyncratic effects $corr(\eta_i, mc_{it}) \neq 0$ and marginal costs $corr(\epsilon_{ijt}, mc_{it}) \neq 0$ are correlated with the error term, only Anderson-Hsiao coefficients are unbiased. Under the null hypothesis that only the bank idiosyncratic effects are correlated with the error term $corr(\eta_i, mc_{it}) \neq 0$, the Anderson-Hsiao and Fixed Effect coefficients are unbiased, although the Fixed Effect model is more efficient. Finally, under the null that neither idiosyncratic effects nor marginal costs are correlated with the error term, all three models are unbiased, although the Random Effect is the most efficient model.

For the Anderson-Hsiao model, we first compute the T-statistic for the AR(1) and AR(2) of error terms in first differences. By construction AR(1) should be significant. Serial correlation in the first-difference errors at an order higher than 1 implies that the moment conditions used by Anderson-Hsiao are not valid; in our sample the T-statistic for the AR(2) is -0.41, therefore AR(2) is not significantly different from zero. Next we test if the correlation between the difference and the second lag of marginal cost in level is different from zero and if this correlation is weak[12][13]. The Kleibergen-Paap underidentification LM statistic (0.65) and Wald F test (0.01) show that the model as a whole, is under and weakly identified, therefore the instruments may be inadequate to identify the equation. In the Column 4, we present the F test for each first stage results in the Anderson-Hsio model, and we conclude that the instruments are correlated with the potential endogenous regressors in some countries. The DWH test in the Anderson-Hsiao model is 19.9, we cannot reject the null that difference of marginal cost may be treated as exogenous, but this results have to be included with caution because of the problem with the instruments. For robustness and due the problems of underidentification and weak instruments in the Anderson-Hsio model as whole, we applied in each country in which the correlation is different from cero and the instruments are not weak(Column 5) the Wu-Hausman F-test. In this cases we cannot reject the null that the Fixed Effects coefficient is equal to the one estimated using the Anderson-

[12]Stock and Yogo test was applied to test the null hypothesis of weak instruments.

[13]The Anderson-Hsiao model takes first differences and then use the second lag as instrument

Hsiao model. The previous statement is true whether we use the 95 percent confident interval for the standard F-test, the rule of thumb of a value of 10 for the F-test, or the stricter critical value computed by Stock and Yogo to test if we are in presence of weak instruments (16.38 in our case). For example in the case of Argentina, the Kleibergen-Paap F-statistic (22.28) rejects the null that we are using a weak instrument, and the Wu-Hausman F-statistic cannot reject the null that the Fixed Effect coefficient is statistically equal to the Anderson-Hsiao one.

Table 2.2. Boone statistics by country, 1995-2008

	Bank Fixed Effects Model	Bank Random Effect Model	Anderson-Hsiao Model	Test of excluded instruments F statistic +	++Kleibergen-Paap F statistic	Wu-Hausman F statistic ++
Argentina	-1.05***	-1.05***	-0.83***	21.98	22.28	0.78
x Marg.Cost (ln)	(0.00)	(0.00)	(0.00)			
Brazil	-0.37**	-0.33**	0.08	10.22	10.61	0.17
x Marg.Cost (ln)	(0.02)	(0.04)	(0.85)			
Bolivia	-1.31***	-1.31***	-1.23*	0.33	0.30	0.02**
x Marg.Cost (ln)	(0.00)	(0.00)	(0.09)			
Chile	-1.05***	-1.04***	-0.981***	18.51	17.85	0.66
x Marg.Cost (ln)	(0.00)	(0.00)	(0.00)			
Colombia	-1.21***	-1.24***	1060	4.00	3.65	0.14
x Marg.Cost (ln)	(0.00)	(0.00)	(0.36)			
Costa Rica	-0.04	-0.09	-5.08	1.04	0.92	0.03**
x Marg.Cost (ln)	(0.94)	(0.85)	(0.25)			
Domin.Rep	-1.65***	-1.70***	-1.54	3.57	3.34	0.67
x Marg.Cost (ln)	(0.00)	(0.00)	(0.14)			
Ecuador	-1.93***	-1.91***	-1.15	2.02	1.94	0.84
x Marg.Cost (ln)	(0.00)	(0.00)	(0.26)			
El Salvador	-0.99**	-1.10***	-1.31**	15.99	13.19	0.65
x Marg.Cost (ln)	(0.01)	(0.01)	(0.03)			
Guatemala	-1.01**	-1.00**	-2.06	0.19	0.18	0.74
x Marg.Cost (ln)	(0.03)	(0.03)	(0.76)			
Honduras	0.49**	0.18	1.07**	6.93	6.32	0.20
x Marg.Cost (ln)	(0.00)	(0.57)	(0.02)			
Mexico	-1.29***	-1.36***	-1.80***	12.53	12.30	0.03**
x Marg.Cost (ln)	(0.00)	(0.00)	(0.00)			
Paraguay	-0.67**	-0.68**	0.43	7.20	6.43	0.49
x Marg.Cost (ln)	(0.04)	(0.04)	(0.70)			
Peru	-1.23***	-1.30***	-0.91***	37.02	33.52	0.57
x Marg.Cost (ln)	(0.00)	(0.00)	(0.00)			
Uruguay	-0.94***	-0.86***	0.98*	57.45	53.48	0.08*
x Marg.Cost (ln)	(0.00)	(0.00)	(0.07)			
Venezuela	-0.19	-0.19	0.37	14.38	14.52	0.18
x Marg.Cost (ln)	(0.58)	(0.58)	(0.52)			
Observations	4526	4526	3251			
Durbin Wu Hausman test		25.8**	19.9			
T-statistic for AR(1) in first differences			-2,59**			
T-statistic for AR(2) in first differences			-0,28			
Kleibergen-Paap rk LM statistic p-val			0.652			
Kleibergen-Paap rk Wald F statistic			0.012			

+Test of exclude instruments to measure the instrument relevance.
++ Kleibergen-Paap rk Wald F statistic for weak instrument
+++ Wu-Hausman F-test for difference in coefficients between Fixed Effect and Anderson-Hsiao models.
Bank Cluster standard errors. Standard error in parenthesis: * significant at 10%; ** significant at 5%; *** significant at 1%
All regression include country-year dummies.

Table 3 also presents the DWH test for the null hypothesis that Fixed Effect coefficients (Column 1) and Random Effect coefficients (Column 2) are equal. In our sample the DWH is 25.8, therefore we reject the null. Summing up, previous results suggest that FE is the best econometric technique to compute the Boone estimator in our sample. Once we account for FE, we do not find evidence of correlation between our proxy of marginal costs (mc_{it}) and the error term (ϵ_{ijt}). This result is consistent with the empirical literature cited in Section 4, which find that economies of scale in the banking sector are exhausted at a relatively small size and then remain constant, so once we control for bank and country-time fixed effect we do not have a reverse causality between marginal costs and market share. This could be explained because the marginal costs in the Latin American countries are mainly determined by the changes of international cost of funds.

1. **Degree of competition across countries:**

   Column 1 in Table 3 shows that Ecuador presents the highest Boone estimator (in absolute value), although its level is not statistically different from those computed for Argentina, Bolivia, Chile, Colombia, Dominican Republic, Salvador, Guatemala, Mexico and Peru. (see Appendix 2). Honduras presents the lowest competition index in the sample. Its competition coefficient is significantly different from all other countries except Costa Rica and Venezuela at the standard confidence level.[14]

   These results are in line with Micco et al (2004) who find that Venezuela has the third-highest interest spreads[15] in the world (18.3 percent), which could be the results of a very low degree of competition in the Commercial Banking sector.

   Leuvensteijn et. al. (2007) compute Boone estimators for 8 developed countries during the period 1994-2004 (Germany, Spain, France, Italy, Netherlands, UK, United States and Japan). They find that Japan has the lowest competitive banking sector with a Boone estimator equal to .72 and that the United States has the most competitive market with an estimator of -5.41. In our sample of 16 Latin American countries, no country reaches the level of competition existing in the U.S.

[14] The differences are significant at 10% level.

[15] Interest rate spreads-measured as net interest income divided by the average of loans and deposits-in 1995-2002

2. **Development of Competition over time:**

As mentioned in section 4, cross-country comparisons can be misleading due to accounting and regulatory differences across countries. We henceforth center our analysis on results that can be inferred from the dynamic dimension.

Table 4 shows the Boone indicator across countries over time using bank Fixed Effects. Results at the country level, based on Table 3, are still valid; although there are differences within countries over time. For each country we reject the null hypothesis that Boone estimators are equal for a given country over time (see F-Test). We also reject that the difference between the highest and lowest values of the Boone indicator for each country are statistically different from zero (see Max. Diff.)[16]

[16]The significant refers to the 90% level of confidence

Table 2.3. Boone′s estimator over time with banks FE

Year	Argentina	Brazil	Bolivia	Chile	Colombia	Costa Rica	Ecuador	Domin. Rep
1995	-2.02**	0.20	-0.27	-1.43***	-0.90			-2.36***
	(0.03)	(0.64)	(0.89)	(0.00)	(0.31)			(0.01)
1996	-1.27***	0.25	1.33	-1.31***	-0.26			-4.70***
	(0.01)	(0.48)	(0.57)	(0.00)	(0.71)			(0.01)
1997	-0.70	-0.35	-3.44	-1.22***	-0.16		-4.31***	0.07
	(0.14)	(0.33)	(0.36)	(0.00)	(0.79)		(0.00)	(0.96)
1998	-1.25***	-0.45	1.74	-0.54*	-0.07	-0.79	-0.78	-2.78*
	(0.00)	(0.18)	(0.20)	(0.07)	(0.89)	(0.15)	(0.30)	(0.07)
1999	-1.17***	0.11	3.17***	-0.67***	-1.03*	-1.98***	-0.10	-3.98***
	(0.00)	(0.57)	(0.00)	(0.00)	(0.08)	(0.00)	(0.91)	(0.01)
2000	0.54	-1.33***	-1.24**	-0.40**	-0.74	-0.07	-1.06***	-1.20
	(0.01)	(0.74)	(0.61)	(0.16)	(0.02)	(0.29)	(0.01)	(0.14)
2001	-0.73***	0.06	-0.48*	-1.11***	-1.12**	0.91	-2.05***	-0.92**
	(0.00)	(0.86)	(0.08)	(0.00)	(0.04)	(0.62)	(0.00)	(0.02)
2002	-0.81***	0.42	-0.80**	-0.91***	-0.94***	0.55	-1.69***	-1.94***
	(0.00)	(0.11)	(0.03)	(0.00)	(0.01)	(0.47)	(0.00)	(0.00)
2003	-0.91***	-0.35	-1.59***	-1.27***	-1.41***	1.17**	-2.46***	-1.30***
	(0.00)	(0.51)	(0.01)	(0.00)	(0.00)	(0.03)	(0.00)	(0.00)
2004	-1.06***	-0.78*	-0.86***	-1.26***	-1.18**	-0.29	-3.04***	-1.25**
	(0.00)	(0.07)	(0.00)	(0.00)	(0.02)	(0.62)	(0.00)	(0.04)
2005	-1.25***	-1.55***	-0.09	-1.44***	-1.08**	-0.16	-2.04**	-1.70***
	(0.00)	(0.00)	(0.92)	(0.00)	(0.04)	(0.64)	(0.02)	(0.00)
2006	-1.20***	-0.82	-1.96	-1.01***	-2.33**	0.40	-2.51***	-1.99***
	(0.00)	(0.14)	(0.23)	(0.00)	(0.01)	(0.57)	(0.01)	(0.00)
2007	-1.09***	-1.96***	-1.84***	-1.02***	-1.97**	1.06	-2.63***	-3.21***
	(0.00)	(0.00)	(0.01)	(0.00)	(0.05)	(0.24)	(0.01)	(0.00)
2008	-1.41***	-0.14	-1.47***	-2.02***	-2.74*	0.93***	-3.45***	-3.07*
	(0.00)	(0.85)	(0.00)	(0.00)	(0.10)	(0.01)	(0.00)	(0.08)
Observations	4526							
(Prob>F) +	0.03**	0.00***	0.027**	0.01***	0.06*	0.00***	0.01**	0.00***
F-Test (Prob>F) ++	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***

+ Max. Diff.: is the p value of the null hypothesis that the difference between the largest and smallest Boone Estimator for a given country are equals.
++ F-Test: is the p value of the null hypothesis that all Boone Estimator for a given country are equals.
Bank Cluster std errors. Standard errors in parenthesis: * significant at 10%; ** significant at 5%; *** significant at 1%
All coefficient are estimated together.

Table 2.4. Boone′s estimator over time with banks FE

Year	Salvador	Guatemala	Honduras	Mexico	Paraguay	Peru	Uruguay	Venezuela
1995			1.34**	3.49***	1.44***	-0.22	-0.98	1.25
			(0.05)	(0.01)	(0.47)	(0.65)	(0.44)	(0.32)
1996			0.67	-1.31***	-0.10	-2.05***	-2.58***	-0.13
			(0.16)	(0.02)	(0.95)	(0.00)	(0.01)	(0.75)
1997			-0.07	-0.85**	-0.78***	-1.26**	-1.75***	-3.08**
			(0.73)	(0.05)	(0.29)	(0.04)	(0.01)	(0.05)
1998			0.18	-1.28**	-0.97**	0.04	-1.38***	-2.58**
			(0.74)	(0.03)	(0.04)	(0.93)	(0.00)	(0.03)
1999		-1.92	0.57	-2.05***	-2.43***	-1.25*	-0.74**	-0.46
		(0.03)	(0.23)	(0.00)	(0.00)	(0.07)	(0.04)	(0.34)
2000	-0.03	-1.12	0.54	-1.33***	-1.24**	-0.40**	-0.74	-0.07
	(0.94)	(0.09)	(0.19)	(0.00)	(0.05)	(0.04)	(0.15)	(0.87)
2001	-0.17	-2.01***	0.73*	-1.31***	-2.22	-0.44	0.83	-0.72*
	(0.40)	(0.00)	(0.08)	(0.00)	(0.27)	(0.48)	(0.21)	(0.10)
2002	-0.01	-1.19	0.66	-1.92***	-2.54	-0.01	-2.25	-0.01
	(0.99)	(0.13)	(0.15)	(0.00)	(0.63)	(0.92)	(0.17)	(0.98)
2003	-0.62	-0.99	0.62	-1.37***	-12.21	-0.93***	1.01	0.66
	(0.45)	(0.11)	(0.17)	(0.00)	(0.12)	(0.01)	(0.29)	(0.34)
2004	-0.57	-0.51	0.40	-0.81*	-2.4	-1.24**	0.05	1.25
	(0.29)	(0.5)	(0.62)	(0.09)	(0.23)	(0.02)	(0.91)	(0.21)
2005	-0.96**	-0.68	-0.99*	-0.91	-2.36**	-0.94***	0.82	0.22
	(0.04)	(0.37)	(0.09)	(0.18)	(0.02)	(0.00)	(0.38)	(0.71)
2006	-1.34***	-0.55	-0.82	-1.23***	-0.33***	-1.42	-0.93	0.82
	(0.00)	(0.63)	(0.19)	(0.00)	(0.00)	(0.00)	(0.02)	(0.22)
2007	-1.27*	0.04	0.07	-0.62**	-4.72**	-0.55*	-1.01***	1.30*
	(0.06)	(0.98)	(0.91)	(0.05)	(0.03)	(0.03)	(0.09)	(0.09)
2008	-1.28*	-0.98	-0.03	-0.45	1.33	-0.01		1.35**
	(0.06)	(0.11)	(0.93)	(0.31)	(0.82)	(0.99)		(0.04)
Observations	4526							
Max. Diff. (Prob>F) +	0.00***	0.07*	0.01***	0.00***	0.06*	0.00***	0.00***	0.01***
F-Test (Prob>F) ++	0.00***	0.41	0.01***	0.00***	0.00***	0.00***	0.00***	0.00***

+ Max. Diff.: is the p value of the null hypothesis that the difference between the largest and smallest Boone Estimator for a given country are equals.
++ F-Test: is the p value of the null hypothesis that all Boone Estimator for a given country are equals.
Bank Cluster std errors. Standard errors in parenthesis: * significant at 10%; ** significant at 5%; *** significant at 1%
All coefficient are estimated together.

In Ecuador, competition has increased since 1999 (see Table 4). These results, initially surprising, may be explained by Ecuador′s dollarization in 2000. As Quispe-Angoli and Whisler (2006) pointed out, official dollarization lowers transaction and information costs, encouraging trade and financial integration. A less opaque market increase competition. Table 4 shows that Ecuador′s Boone estimator increases in absolute terms after 2000, confirming this hypothesis. Also, during the first half of the last decade, due to the 1999 financial crisis and the post crisis improvement in regulation, total credit shrank in Ecuador. If lending contraction is done in small and opaque clients, competition should also increase.

Boone estimators for Brazil, Bolivia, Colombia and El Salvador have decreased since 1999 implying an increase in competition. The results show that the level of competition in Mexico increased abruptly in 1996, after the tequila crises when the country implemented a big scale banking reform. Competition continues to increase until 2000 then remains flat until 2007 when it decreases.

El Salvador, which dollarized the economy in 2001, presents a relatively low Boone estimator in spite of its level of development. Just after the dollarization the Boone estimator is not significantly different from zero although it starts to decrease over time. The Salvadorian Boone estimator becomes statistically different from zero in 2006, five years after dollarization.

Chile, Argentina and the Dominican Republic experience a decrease in competition during the period 1995-2000. After 2000 the Boone estimator increases in each of these countries. Competition in Peru falls during 1995 and 2002 and then increases until 2006. Chile and Argentina have on average the same Boone indicator during the whole period, but since 2000 our estimates show a higher increase in the level of competition in Chile. Competition falls in Argentina after 2000. Argentina experienced an economic and financial crisis in 1999. During the same year the real Gross Domestic Product dropped by 4%. The crisis caused the government′s fall, a default on the country′s foreign debt, widespread unemployment, riots, the rise of alternative currencies and the end of the currency board (fixed exchange rate to the US dollar) by the end of 2001. The economic and financial crisis may have caused the decrease in competition in 2000, but it remained low relative to previous years because of the country abandonment of the currency board which reduces transaction costs and allows firms to access international financial

Table 2.5. Competition, foreign penetration and dollarization at the country level

	Country Dummy x Marg.Cost (ln)		Foreign Mkt. Share x Marg.Cost (ln)		Dollarization x Marg.Cost (ln)	
Argentina	-2.53***	(0.00)	2.73**	(0.03)	-0.52**	(0.05)
Brazil	1.34	(0.13)	-4.58*	(0.06)		
Bolivia	2.32	(0.62)	- 14,00	(0.46)		
Chile	-1.46***	(0.00)	0.68	(0.20)		
Colombia	-2.35*	(0.07)	6.61	(0.19)		
Costa Rica	-3.31**	(0.04)	9.21***	(0.00)		
Domin.Rep	-2.68*	(0.08)	6.02	(0.50)		
Ecuador	-1.02	(0.27)	25.5	(0.13)	-2.02**	(0.02)
Salvador	-1.22***	(0.00)	1.15**	(0.04)	-0.66 ϕ	(0.11)
Guatemala	-1.68*	(0.00)	4.95	(0.28)		
Honduras	0.38	(0.45)	0.33	(0.84)		
Mexico	-0.82	(0.18)	-0.62	(0.40)		
Paraguay	6.63	(0.11)	-8.56*	(0.08)		
Peru	-1.29*	(0.64)	0.10	(0.98)		
Uruguay	-1.40**	(0.28)	0.48	(0.73)		
Venezuela	-1.86***	(0.01)	-8.54***	(0.02)		
Observation:	4526					

Bank Cluster std errors. Standard errors in parenthesis: ϕ significant at 15%; * significant at 10%; ** significant at 5%; *** significant at 1%
Model: Bank Fixed Effects with time dummies. Coefficients are estimated together.

markets.

Venezuela, Costa Rica and Uruguay show a significantly increasing trend since 1997, indicating a decline in competition in the banking sector until 2008. This trend has changed in Uruguay in the last few years. Paraguay shows an increase in competition during the whole period.

3. **Effects of foreign penetration and dollarization:**
   To study the effect of foreign bank penetration and dollarization on competition, Tables 5 and show the estimation of the equation (3) using bank FE.

Table 5 suggests that foreign penetration has a positive correlation with the intensity of competition in Brazil and Venezuela during the period; in contrast, foreign penetration has negative correlation with the degree of competition in Argentina, Costa Rica and El Salvador.[17] These results are in line with Micco et al (2005) interpretation. In countries with a higher initial level of competition foreign banks can increase the degree of product differentiation and reduce competition, but in countries where the initial level of competition is lower (Brazil and Venezuela) foreign banks can substitute national products and therefore increase the level of competition. Our results show that dollarization has a positive correlation with competition in Argentina and Ecuador.

[17]In all the other countries the effect is positive but not significant, except in the case of Paraguay and Bolivia.

In the case of El Salvador results suggest that competition is positively correlated with dollarization although the effect is only significant at the 15 percent level.

Table 6 implies that dollarization has the same effect in all country (Argentina, Ecuador and El Salvador) but allows for different correlations of foreign bank penetration in countries with different levels of competition. Using results from Table 3, we create three groups of countries to determine if the strategies used by the foreign banks depend on the level of competition in each country. The first group is composed of Ecuador, Mexico, the Dominican Republic, Bolivia, Peru and Colombia (High competition); the second group includes Argentina, Chile, Guatemala, El Salvador and Uruguay (Medium Competition); and the third includes Paraguay, Brazil, Venezuela, Costa Rica and Honduras (Low Competition). Regressions include country-year dummies.

As predicted by previous results, Column 1 shows that for countries in the first group (Group Low Competition, the omitted one) foreign bank penetration has a positive correlation with competition (reduces Boone coefficient). For countries in the second group (Medium Level of Competition) foreign bank penetration has a negative correlation with competition. For countries in the last group (High Level of Competition) foreign bank penetration is negatively correlated with the level of competition too, which is significant at the standard confidence level. The coefficient for Dollarization is negative and significant at the standard level. These results confirm the hypothesis that countries that dollarized or implemented the currency board could increased competition in their banking system. Dollarization lowers transaction and information costs, encouraging financial integration, and therefore expands the array of financial options open to emerging-market governments and firms, ultimately increasing competition.

The main variables of interest are the interaction of marginal costs (ln), and foreign bank penetration and dollarization. These last two variables only vary across country and year, and do not change across banks within a country in a given year. For robustness, Column 2 repeats the previous regression weighting by market share at the country level. In this regression each country-year has the same weight. All previous results remain.

Summing up, while foreign penetration has had a different correlation with the intensity of competition across countries with different initial level of competition, dollarization has a significant positive correlation on competition.

Table 2.6. Boone estimator, and foreign penetration and dollarization

	Bank Fixed Effect Model	Bank Fixed Effect Model
Argentina	-1,751	-1,47
x Marg.Cost (ln)	(0.198)***	(0.376)***
Brazil	1,408	1,13
x Marg.Cost (ln)	-0,945	(0.667)*
Bolivia	-1,195	-1,271
x Marg.Cost (ln)	(0.238)***	(0.260)***
Chile	-1,853	-2,015
x Marg.Cost (ln)	(0.207)***	(0.451)***
Colombia	-1,128	-1,105
x Marg.Cost (ln)	(0.194)***	(0.184)***
Costa Rica	1,653	1,489
x Marg.Cost (ln)	-1,102	(0.672)**
Domin.Rep	-1,572	-1,35
x Marg.Cost (ln)	(0.278)***	(0.226)***
Ecuador	-1,603	0,141
x Marg.Cost (ln)	(0.225)***	-0,393
El Salvador	-1,635	-1,565
x Marg.Cost (ln)	(0.257)***	(0.475)***
Guatemala	-1,191	-0,796
x Marg.Cost (ln)	(0.574)**	(0.419)*
Honduras	2,01	1,347
x Marg.Cost (ln)	(0.909)**	(0.534)**
Mexico	-0,943	-0,611
x Marg.Cost (ln)	(0.488)*	-0,538
Paraguay	3,397	1,967
x Marg.Cost (ln)	-2,346	-1,438
Peru	-0,973	-0,943
x Marg.Cost (ln)	(0.427)**	(0.492)*
Uruguay	-2,202	-0,475
x Marg.Cost (ln)	(0.497)***	-0,638
Venezuela	0,957	1,124
x Marg.Cost (ln)	-0,689	(0.450)**
Foreign Mkt.Share (1)	-4,769	-3,03
x Marg.Cost (ln)	(2.722)*	(1.659)*
For.Mkt.Share Medium Competition (2)	4,314	4,272
x Marg.Cost (ln)	(-2,785)**	(1.822)**
For.Mkt.Share High Competition (3)	6,108	4,617
x Marg.Cost (ln)	(2.743)**	(1.779)**
Dollarization	-0,368	-0,66
x Marg.Cost (ln)	(0.130)***	(0.322)**
Observation	4526	4526
Weight	-	Revenue country Market Share
test (1) + (2) = 0 (Prob¿F)	0,44	0,10
test (1) + (3) = 0 (Prob¿F)	0,00	0,01

Bank Cluster std errors. Standard errors in parenthesis: * significant at 10%; ** significant at 5%; *** significant at 1%
All regression include country-year dummies.

2.7 Conclusions

We obtained suggestive correlations between competition and two institutional variables of the banking industry in Latin American countries: foreign penetration and dollarization. We use a new methodology to compute the level of competition: the Boone indicator.

Our main results are inferred from time variation within countries of the Boone′s indicator. In our sample foreign bank penetration has a positive correlation with the intensity of competition across countries. In countries with an initial low level of competition, foreign ownership spurs rivalry among banks, whereas the opposite is true for countries with an initial high level of competition.

The presence of foreign banks has a positive correlation with the intensity of competition in Brazil and Venezuela who initially had less competitive banking industries. In contrast, in El Salvador, which has an intermediate level of competition, foreign penetration has a negative correlation with the degree of competition. Following Levy-Yeyati and Micco (2007), we argue that foreign banks in more competitive countries increase the degree of product differentiation to reap oligopolistic rents. On the contrary, in less competitive countries, foreign banks can steal rents from domestic firms just by being more aggressive in their prices.

We present evidence that dollarization and currency boards are positively correlated with competition in the banking industry. This is the case of countries that implemented such reforms: Argentina, Ecuador and El Salvador. These results are in line with the idea that dollarization reduces transaction costs, increases financial integration, and extends the financial options from which firms and households can choose.

Comparing the degree of competition across countries, our results suggest that Ecuador, after dollarization, has the most competitive commercial banking sector among the Latin American countries, although Boone′ estimator is not statistically different from another countries. Venezuela, Costa Rica and Honduras present the lowest level of competition in our sample.

Comparing our results with Van Leuvensteijn et al (2007), we conclude that no country in Latin American reaches the level of competition existing in the United States. Additionally, the least competitive country in Latin America has a much lower level of competition in comparison with Japan, which has one of the least competitive banking sectors in Leuvensteijn et al (2007)′s sample. However, as noted in the empirical literature, cross-country comparisons can be misleading due to accounting and regulatory differences,

among others reasons, across countries.

Summing up, the most important contribution of this article is that using the Boone indicator for measuring the evolution of competition in banking, this paper provides new insights regarding the suggested correlation between foreign penetration (and also dollarization) and competition in the commercial banking system in Latin American countries.

This suggests that dollarization is positive and induces a higher level of competition in the banking system, which is consistent with the literature. Whereas the effect of foreign penetration in competition is not direct, and it depends on the level of development of the banking industry in the different countries. This last result is a new empirical insight in the analysis of the effect of foreign penetration, because in the vast literature on the subject, the focus of most studies is on the effect of foreign penetration on the stability of the financial system, but not on the intensity of competition between banks and its beneficial effect for the final consumers.

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Chapter 3

The Effect of Banking Regulation Basel II in the Real Economy in Latin America

3.1 Introduction

This paper analyses the potential effects of banking regulation Basel II capital standard in the real economy, measured as credit and firm investment in Latin American countries. Regulatory capital minimums are threshold levels required by regulators to protect against bank insolvency as well as to protect against losses to the deposit insurance fund (Santos 2001). This limits the use of deposits as a credible commitment against the insolvency in banking industry.

Since risk-sensitivity is at the core of Basel II, the flow and cost of credit to firms is going to vary depending upon their respective risk-profile. Those with high risk and low credit worthiness are going to lose whereas those with low risk and high credit worthiness shall derive benefits, as banks would have to allocate their capital accordingly. Therefore, the Basel II proposal raises questions about the effect on supply of credit to the real economy, understood as firm′s debt and investment level in countries under the capital regime. Banks facing higher risk-weighted capital requirements can choose among three alternative responses i) raising equity, ii) restricting the lending level or iii) reducing asset risk. This paper considers the potential effect of capital regulation on real economy under these alternatives.

Much of the theoretical and empirical literature suggests that holding a higher proportion of capital for riskier assets will be costly for banks, since

capital constituents are more expensive to hold than debts (Van den Heuvel (2004), Freixas and Rochet (2008)) due to the asymmetric information and lemons problems (Myers and Majluf 1984). Therefore, maintaining a higher capital ratio is costly for a bank and may result in a downward shift in loan supply (Gambacorta and Mistrulli (2004)). For example, Fidrmuc, J., Schreiber, P. & Siddiqui (2015) analyse empirically the potential effect of tighter capital requirements on the access to loans for specific industries in Germany; they found that the higher capital requirements may worsen the access to financing, especially for manufacturing and financial service.

Previous research also shows that regulatory tightening of capital ratios can produce analogous aggregate shocks and, therefore, that prudential capital requirements can influence macro-economic outcomes (see, for example, Bliss and Kaufman (2002)). The implication is that policy-makers, in their design of capital regulation, and supervisors, in their review of capital adequacy plans or in setting bank-specific capital requirements of the Basel rules, should ideally (i) consider the potential effects of capital requirements on financial stability and lending activity and (ii) assess the consequences for economic output. A well designed capital requirement would balance the costs that it imposes (e.g., loss of economic output due to slowdown in lending due to higher capital requirements) with the benefits it intends to deliver (e.g., reduction in the likelihood of financial crises and ensuing losses).

Therefore, Basel II could have a negative impact on credit markets. Basel II will generate effects in the real economy if the regulatory capital constraint (i.e., for a given portfolio, minimum regulatory capital requirements cause banks to hold more capital than they would hold in the absence of the requirement) reduces the level of credits given by the banks to the firms and it decreases their investment level. A central component of our analysis will be to determine if the regulation generates this effect, and to distinguish between different firm sizes.

The contribution of this article to the current literature is twofold. It is the first article that evaluates if changes in banks capital requirements would result in changes in the real economy with the policy evaluation methodology; and analyses empirically if this kind of regulation could have an heterogeneous effect in the firm debt level and due this potential changes in funding mechanism the firms investment level could be affected considering its size.

This paper is filling a gap in the literature, since no previous papers had used diff-in-diff and matching methodologies to analyze empirically the insight regarding the connection of bank′ capital requirement, bank loans and firm′s investments, considering the asymmetric effect among firms of different size.

The most recent paper that analyzes the transmission of bank funds to corporate lending in Germany uses a dataset for banks and their corporate lenders debt levels in Germany between 2005 and 2007. They show that the financial health of banks, measured as bank′s debt ratio, determines the access to finance for the corporate sector, and they find that more indebted banks allocate more capital to riskier projects.

In this paper we want to evaluate which is the effect of banking regulation Basel II in the real economy, measured as credits and firm investment in Latin American countries. In developing countries, implementation of Basel II rules is not mandatory; therefore, different countries have made different implementation decisions. The Basel II agreement was implemented in Brazil in 2007, Mexico in 2008 and Peru in 2009[1] and it was not implemented in Chile[2] and Colombia[3]. We will exploit the different timing in the implementation of Basel II across countries in a difference-in-difference approach to assess the effect of Basel II in the access of firms to bank finance (measured as firms debt) and in the level of investment (measured as capital expenditures).

The most relevant result of this paper is the effect of bank capital requirement regulation in firms debt is a function of its size, but it has not been identified and quantified an investment effect. The effect on investment is not conclusive since the firms could have another financing mechanisms.

The remainder of the paper is organized as follows: Section 2 describes the Basel regulatory capital framework. Section 3 presents the literature review. Section 4 presents the data. Section 5 presents the methodology, results and several robustness checks, and section 6 concludes.

3.2 Basel II Regulatory Capital Framework

The Basel Committee on Banking Supervision was created in 1975 with dependence of the Bank of International Payments (BIS)[4] with the objectives

[1]Brazil implemented the internal ratings-based approach (IRB), while Peru used the Standard Approach.

[2]Chile and Colombia used the leverage ratio as a regulatory capital adequacy regime. It requires that banks maintain a regulatory minimum level of regulatory capital in relation to their balance sheet total, regardless of the different riskiness of different groups of assets. Under a leverage ratio, e.g. government debt as well as commercial mortgages count for the full amount when calculating total assets.

[3]For more information, see
http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/
,,contentMDK:20345037 pagePK:64214825 piPK:64214943 theSitePK:469382,00.html

[4]is the worlds oldest international financial organisation. The BIS has 60 member central banks, representing countries from around the world that together make up about 95% of world GDP

of establishing and disseminating principles, prudential regulation and supervision standards aimed at strengthening the solvency and stability of banks, and to level the playing field between them in a context of a growing internationalization of the financial markets.

The first Basel capital requirements accord was launched in 1988 to set the regulatory capital ratio. These regulations require that the capital of banks be equal to at least 8% of a weighted sum of the volumes of risky assets held by them[5] the Basel I framework appeared insufficient because these include a uniform risk for all business exposures without consider their different risk profiles. Basel failure in differentiate levels of credit risk within particular asset classes, e.g., commercial and industrial loans. Basel II proposed to correct that by increasing the sensitivity to credit risk exposure of the risk classification process.

In June 2004, the Committee published the document "International Convergence of Standards and Capital: Revised Framework ", better known as Basel II. Although the revised Framework had been designed to offer varied possibilities to banks and banking systems around the world, the Committee recognizes that its adoption may not be among the priorities of the supervisors of some of the non-G10 countries. In determining whether Basel II can be applied to a particular jurisdiction, supervisors should compare the costs and benefits associated with their implementation with other national priorities. They have to consider the supervisor ability to implement the reform and if the banking institutions have the infrastructure to applied the new requirements required in Basel II.

The Basel II accord instituted the three pillar concept: i) a more complex capital ratio; the Committee revised the weight system and the idea was to reduce the incentives for bank excessive risk-taking[6], ii) implementation of a proactive supervision, and iii) fostering market discipline.

Pillar 1 offers a choice to resort to either a Standardized Approach (SA), which has pre-specified weights based on ratings from External Credit Rating Agencies to quantify required capital for credit risk, or to turn to an Internal Rating Based (IRB) approach. Under the latter approach, banks are allowed to develop their own empirical model to estimate the probability of default (PD) for individual clients or groups of clients. These approaches are differentiated on the basis of (i) in-house risk assessment expertise available, (ii) size and product mix of the bank, and (iii) overall financial sophistication. There is

[5]The weights are supposed to reflect different credit risks associated with different categories of assets.

[6]The risk of default by the counter-party.

considerable national discretion for regulators to decide, within the parameters defined under Basel II, on risk weights for different types of finances, treatment of collateral, risk mitigation, etc.

The core pillar is complemented by two other pillars; and all three pillars are interlinked and mutually reinforce each other. Pillar 2 (Supervisory Review) underscores the need for strengthening financial institution′s internal capital assessment processes, in order to capture risks which remained uncovered under Pillar 1, and thus set aside capital in line with their risk profile and control environment. The supervisory review process validates bank′s internal assessments by ensuring that the whole array of risks has been taken care of. Pillar 3 (Market Discipline) complements the other two pillars by requiring disclosures and transparency in financial reporting, to promote market discipline.

3.3 Literature Review

The literature on bank regulation is very ex tense, but it offers few empirical analyses of the impact of regulatory constraints policies in real economy which allowed to differentiate the effects according to characteristics of the firms. The great majority of studies have focused on studied theoretically banks capital regulation effect on the incentive to lend and how this change the financial mechanism adopted by firms.

The empirical literature which analysed Basel II is focused in determine what happens with the competition level between financial institutions when regulation affects them asymmetrically, or if the current capital adequacy framework, Basel II, may introduce an additional source of procyclicality in the banking sector, due to the fact that it makes bank′s capital requirements more sensitive to the underlying risk of the assets or if this strengthening regulation affect the aggregate loan supply.

Diamond, D and R.Rajan (2000) analyse theoretically the role of bank capital requirement and conclude that the optimal bank capital structure have to consider the trades off considering the effect of reduce liquidity creation, the expected costs of bank distress and the ease of forcing borrower repayment. Capital allow the banker to extract some rents, thus reducing his ability to create liquidity, it also buffers the bank better against shocks to asset values. In particular, they found that the effect of minimum capital requirements is not homogeneous between costumers, considering it can cause a credit crush for the cash poor and potentially alleviate the of burden debt for the cash

rich. Therefore, the greater safety has adverse distributional consequences for some consumers. This theoretical result oriented our analysis to consider the asymmetric firm size to evaluate the effect of bank capital regulation in Basel II.

Recent theoretical research is trying to establish clearly the costs and benefits of capital requirements regulations. For instance Nicolo, Gamba, and Lucchetta (2012), show that if capital requirements are mild, a bank subject only to capital regulation invests more in lending and its probability of default is lower than its unregulated counterpart. This additional lending is financed by higher levels of retained earnings or equity issuance. Importantly, under mild capital regulation bank efficiency and social values are higher than under no regulation, and their benefits are larger. However, if capital requirements become too stringent, then the efficiency and welfare benefits of capital regulation disappear and turn into costs, even though default risk remains subdued: lending declines, and the metrics of bank efficiency and social value drop below those of the unregulated bank. Thus, there exists an inverted-U-shaped relationship between bank lending, efficiency, welfare and the stringency of capital requirements. These findings suggest the existence of an optimal level of bank-specific regulatory capital under deposit insurance.

A large body of theoretical and empirical literature suggests that, maintaining a higher capital ratio is costly for a bank and, consequently, a shortfall relative to the desired capital ratio may result in a downward shift in loan supply (Van den Heuvel (2004); Gambacorta and Mistrulli (2004)). Adrian and Shin (2008) showed that, historically, banks tends to adjust their balance sheets to attain a target level of leverage, and hence negative shocks to capital can lead to a downward shift in credit supply. Bliss and Kaufman (2002) show that a regulatory tightening of capital ratios can produce analogous aggregate shocks and, therefore, prudential capital requirements can influence macroeconomic outputs.

Francis and Osborne (2009) investigate evidence on the existence of a bank capital channel in the UK lending market. They find that in the period between 1996 to 2007, banks with surpluses of capital relative to this target tend to have higher growth in credit. The authors also propose simulations based on their empirical model, finding that a single percentage point increase in capital regulation in 2002 would have reduced lending by 1.2% and total risk weighted assets by 2.4% after four years. They also simulate the impact of a countercyclical capital requirement imposing three one-point rises in capital requirements in 1997, 2001, and 2003. By the end of 2007, these changes might have reduced the stock of lending by 5.2% and total risk weighted assets by

10.2%.

Fidrmuc, Schreiber, Siddiqui (2014), using data on firm-bank relationships in Germany between 2005 and 2007, tried to assess the potential effects of capital banking ratio in firms lending rates to infer what will be the effect of a regulatory caused decrease in bank′s debt ratio. They analysed industry specific responses of loan conditions to bank debt levels. Their findings imply that manufacturing and financial services are potentially facing a more restricted access to bank loans after tightening of capital requirements.

Related to the theoretical literature of financial intermediation, the effect of capital constrained lending on firm′s investment is ambiguous (Halmstron and Tirole (1997)), because if the banking credit level decreases due to intermediarie′s capital constraints, firms could finance their profitable investment projects with their own capital, or go directly to the commercial paper or bond markets. Therefore, the effect of Basel II in the firms investment level could be ambiguous. According to the literature, the firms who choose direct finance by issuing securities in the financial market can be those with best reputation (Diamond 1991), the highest level of collateral (Halmstron and Tirole (1997)), best technology or best credit rating (Bolton and Freixas 2000). In this paper we are going to determine if the banking capital regulation has heterogeneous effect in the firm investment according with their size as a proxy of risk level.

Banking is a pro-cyclical business itself; that is, banks tend to contract their lending activity when the business turns down because of their concerns about loan quality and repayment probability. This exacerbates the economic downturn, as credit constrained business and individuals cut back on their real investment activity. In contrast, banks expand their lending activity during boom periods. However, increased risk sensibility in bank capital requirements may exacerbate these pro-cyclical tendencies. Several research studies have focused on the effects of regulatory measures, like Basel I and Basel II, on the cyclicity of bank business.

For instance, Jackson et al (1999) state that banks tend to meet regulatory capital requirements using the least cost approach. During cyclical downturns and financial crises, the cost of issuing additional capital may become prohibitive; thus, banks meet their capital requirements by restricting lending. However, during upturns, the opposite is true and banks may expand both lending and capital positions. Thus, explicit capital requirements (both Basel I and II) promote procyclicality in banking sector.

Gordy and Howell (2006) analyse empirically -with a pure simulation approach- the degree of procyclicality in the IRB capital formula used in Basel II. They

explore the consequences of alternative rating philosophies and lending strategies. Their simulations results make clear that the degree of cyclicality in capital requirements depends quite strongly on how new lending varies with macroeconomic conditions. Andersen (2010) assesses the potential cyclicality of Basel II for the entire bank portfolio of six Norwegian banks with a macro econometric methodology. They find a substantial increase in the calculated Basel II capital requirements at the same time as bank capital deteriorates as banks record high losses on loans and securities in a recession scenario. However, they also find that the cyclicality of Basel II capital requirements may be effectively contained if risk weightings are based on a sufficiently long observation period, which includes economic downturns.

Moreover, Monfort and Mulder (2000) find strong evidence of procyclicality in credit rantings for 20 emerging market economies. Estimation of dynamic error correction model, suggest the ratings agencies not only react to news and do not completely see through business cycle and trends. Their simulations show that capital requirements would increase dramatically during times of economic or financial crisis, possibly exacerbating the detrimental real economic effects.

In summary, considering the literature related to banks capital regulation, it could have several effects on the economy as a whole. There are effects in the lending level due to prudential policies, distributional effects on borrowers and even in economic growth.

Considering that we do not know of any other work that examines with the policy evaluation methodology if a change in capital structure regulation on an intermediaries would result in changes in the firms investment level and analyses empirically if this kind of regulation could have an heterogeneous effect in the firm. This paper contribute to the empirical literature which try to measure the effect of minimum capital banking requirements.

3.4 Data

We will estimate the effect of Basel II using a World Scope Thomson unbalanced yearly panel database from 1999 to 2013 of firms traded in exchange in Chile, Brazil, Colombia, Mexico and Peru (Table 1). This data set includes financial information of balance sheet and income statements of each firm, measure in USD and deflacted by country inflation. We complement this

database with OECD yearly country risk information[7] and GDP.

Table 3.1. Firms included in Unbalanced Panel Data per Country and year.

Year	Brazil	Chile	Colombia	Mexico	Peru	Total
1999	132	115	4	51	57	339
2000	150	94	5	55	52	356
2001	156	93	6	59	59	373
2002	161	119	13	63	69	425
2003	170	123	14	64	75	446
2004	169	128	16	6	79	458
2005	176	132	16	75	80	479
2006	184	140	17	79	90	510
2007	205	143	18	83	99	548
2008	247	147	23	85	107	609
2009	253	148	27	88	108	624
2010	259	152	36	88	105	640
2011	267	155	41	89	102	654
2012	273	158	41	87	95	654
2013	271	163	47	91	69	641
Total	3,073	2,010	324	1,123	1,226	7,759

Table 3.2. Total Debt in Treated and Non Treated Country in MUSD

	(1) Treated	(2) Non Treated
Before	181,589.1	182,115.8
After	393,967.4	248,163.8
Difference	212,378.3	66,048
Diff-Diff	146,330.3	

In table 2 and 3 we can appreciate the mean of capital expenditure and debt firms in treated and no treated country. We can infer that firms in treated country increased the level of debt and capital expenditure on average in higher magnitude than in firms in no treated countries, but we can not consider this

[7]Country risk is composed of transfer and convertibility risk (i.e. the risk a government imposes capital or exchange controls that prevent an entity from converting local currency into foreign currency and/or transferring funds to creditors located outside the country) and cases of force majeure (e.g. war, expropriation, revolution, civil disturbance, floods, earthquakes)

Table 3.3. Total Capital Expenditure in Treated and Non Treated Country in MUSD

	(1) Treated	(2) Non Treated
Before	59,555.55	31,386.68
After	101,275.9	56,335.17
Difference	41,720.35	24,948.49
Diff-Diff	16,771.86	

results as the effect of Basel II, because we need to control for particular firms or country characteristics in the unbalanced panel data as firms economic sector, size of the firm, country risk or another relevant variable that could bias the inference.

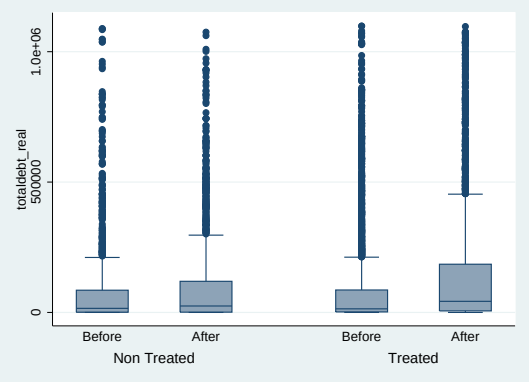

Figure 3.1. Distribution Total Debt in MUSD by Treated Group, Before and After Basel II

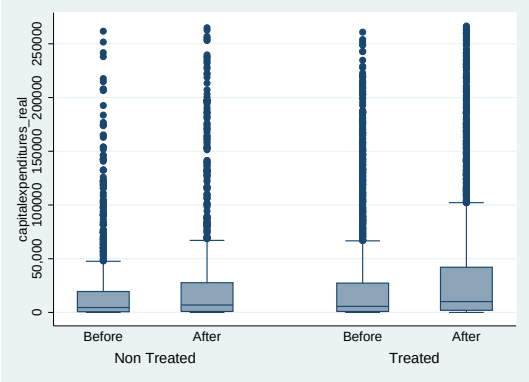

Figure 3.2. Distribution Total Capital Expenditures in MUSD by Treated Group, Before and After Basel II

The figure 2 and 3 shows the distribution of Total Debt and Capital Expenditures are very asymmetric. For this reason we decide to estimate the effect of Basel II with the variables in logarithm.

3.5 Methodology and Results

The dynamics of the adoption of Basel II agreement are ideally suited to the settings of a program evaluation exercise. Typically, the main problem in an empirical exercise of this type is assessing the impact of exposing a set of units to a treatment on a given outcome.

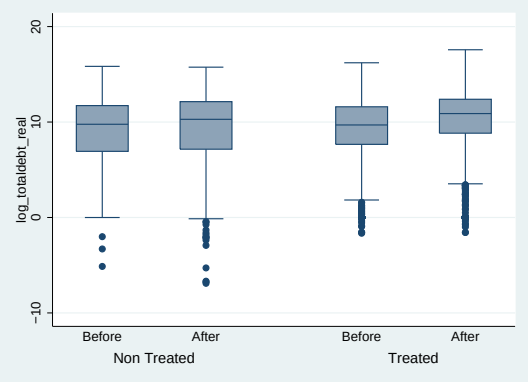

Figure 3.3. Distribution Log Total Debt by Treated Group, Before and After Basel II

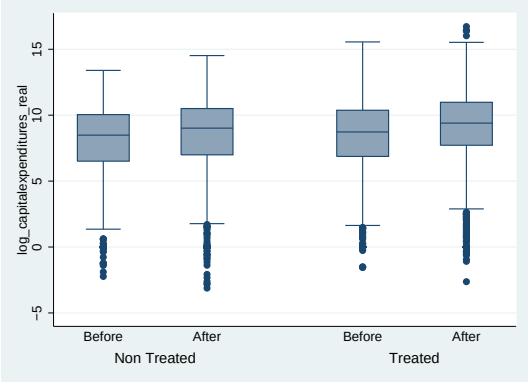

Figure 3.4. Distribution Log Total Capital Expenditures by Treated Group, Before and After Basel II

Our units are the firms of the country, our treatment is the adoption of Basel II rules in banking industry, and the outcome is the credit or investment level. To assess the impact of Basel II, we need to compare countries at different points in time, some of which have adopted Basel II (treated group) and others who have not (control group).

In this article, we will use two inference techniques to identify and quantify the causal effect of Basel II across countries. First, we estimate diff-in-diff regressions to determine the causal effect[8]. This framework allows us to control for time invariant unobservables that could affect the implementation decision at the country level. Finally, we control for time-invariant firm unobserved heterogeneity and compare, on average, more similar firms using matching propensity score a with diff-in-diff approach[9] .

The diff-ind-diff methodology can be refined in a number of ways. One is by using matching propensity scores (PSM) in the period without the treatment, to compare a group of firms in the control group similar to the treatment group, and then applying double differences between them. This way, the observable heterogeneity between firms in the initial conditions can be dealt with.

The key identifying assumption here is that credit and investment firms trends would be the same in both groups of countries in absence of treatment. The treatment induces a deviation from this common trend. Although the treatment and control groups can differ, this difference is meant to be captured

[8]Diff-in-diff relaxes the assumptions of conditional exogeneity or selection only on observed characteristics. The notion of time-invariant selection bias.

[9]See James J. Heckman, Hidehiko Ichimura & Petra E. Todd, *Matching as an Econometric Evaluation Estimator: Evidence from Evaluating a Job Training Programme*, 64 REV. ECON. STUD. 605 (1997).

by the fixed effect by firm, which plays the same role as the unobserved firm fixed effect. We can also control for observable variables at the country level: country risk, per capita GDP, real interest rate, or firm level as revenue, Tobin′s Q[10] and if firm ownership is local or foreigner[11].

In Figure 1, we can appreciate the evolution of deflacted average logarithm debt by country. The "Brasil", "Mexico" and "Peru" lines show when Basel II began to apply in each country′s respective banking system. At first, we investigate the common trends assumption using data on multiple periods previous to the treatment and using control firm/ country variables (ownership of firm, lag real interest rate, lag real revenue, lag Tobin′s Q, GDP per capita and country risk).

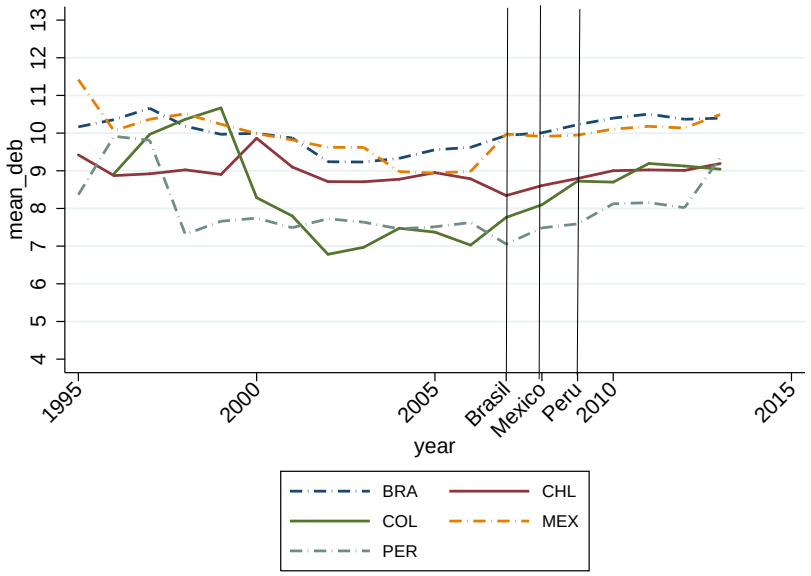

Figure 3.5. Weighted Average Logarithm Debt by Country, 1995-2013

We estimate diff-in-diff econometric model regressions to evaluate the pre-trend on firm debt and capital expenditure in the period between 1999 to 2008. The general specification we estimate is the following:

$$Y_{ikt} = \beta' X_i + \beta'' Y_k + \beta trend + \beta trend2 + \theta trend * basil_{ikt} + \lambda_i + \varepsilon_{ikt} \quad (3.1)$$

where Y_{ikt} is the capital expenditure or Total Debt of firm i in country k in year t ; X_{it} is a vector of firm characteristics, such as a dummy variable that takes value 1 if firm ownership is local and 0 otherwise, lag revenue, lag

[10]Tobin′s Q is estimated as stock market value plus liabilities, divided by total assets.
[11]If the majority stakeholder is local, the firm is consider local.

Table 3.4. Pre-Trend Identification

	(1) log_totaldebt	(2) log_capitalexpenditure
Ownership	0.0904	0.00523
	(0.97)	(0.06)
L.real_interest	0.00823	-0.0187**
	(0.94)	(-2.61)
trend	-0.129	-0.300**
	(-0.64)	(-2.51)
trend2	0.00691	0.0165**
	(0.64)	(2.55)
trend_basil	**-0.0715**	**0.0217**
	(-1.33)	(0.58)
country_risk	-0.183*	-0.0972
	(-1.95)	(-1.47)
L.revenue_real	0.000000334**	0.000000360*
	(2.22)	(1.76)
L.Qtobin	-0.000434	-0.00198
	(-0.76)	(-1.62)
GDP_real	-0.0943	0.211**
	(-0.93)	(3.65)
_cons	10.66**	9.286**
	(7.80)	(13.08)
N	4006	2868
p	0.00148	2.59e-13

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$

Tobin′s Q as a measure of long run investor expectation; Y_{kt} is a vector of country characteristics such as lag real interest rate, country risk measure, real per capita GDP; *basil* is a dummy variable that takes a value of one for each country k which implemented Basel II and 0 otherwise; *trend* is a year trend; *trend*2 is year trend squared; λ_i is the firm fixed effect; ε is the standard firm time-varying error, and is assumed to be independently distributed.

As Table 2 shows, we cannot reject that, on average, firms had the same trend in credit and investment level in treated and non treated countries in the period previous to the treatment.

Another important requirement to apply the diff-in-diff policy evaluation methodology is the exogeneity condition. This is key for obtaining a causal interpretation of the estimated effects.

Given the general context of Basel II describe in section 2, it implementa-

tion is not related with the degree of indebtedness of the firms in each country. In this case, the implementation of Basel II is a political decision in the majority of the cases, except for the OECD countries where it is mandatory (Mexico, in this case). We assume that the time variant firm′s unobservables are not correlated with the implementation of Basel II banking regulation.

In the identification strategy, two sources of endogeneity could arise. In the first place, due to a possible simultaneity between the firm′ debt or investment choice and the implementation of banking regulation Basel 2. This happens because the probability to implement Basel 2 could depend on the firm′ decision, or they could influence or lobby to the regulator to implement or not this kind of reform. And because of this, the equilibrium of the firm could anticipate these changes and adjust its decisions. We discard this potential bias, since the decision to implement Basel 2 is a political decision of banking regulators, and it is related with the development of supervisions at a country level, and not with the firm′ decisions. In addition, when we analyse the pre-trend of firms indebtness and investment level between the control and the treatment firms-country groups, there are no differences on average between them; therefore, we can discard that the capital market anticipates these potential regulation changes. The second potential bias comes from unobservables which could affect the Basel 2 implementation and firm′ decisions. We include firms and country fixed effects in the econometric models to control for that potential endogeneity bias. Furthermore, we include country control variables, that change with time.

The econometric approach seeks to quantify the effect of *Basel II* on different financial outcomes. We estimate diff-in-diff econometric model regressions to measure the effect on firm debt and capital expenditure. The general specification we estimate is as follows:

$$Y_{ikt} = \beta' X_i + \beta'' Y_k + \beta D_t + \theta D_t lag.revenue_{ikt} + \lambda_i + \lambda_t + \varepsilon_{ikt} \qquad (3.2)$$

where Y_{ikt} is the log capital expenditure or log total debt of firm i in country k in year t ; X_{it} is a vector of firm characteristics, such as if firm ownership is local or not, lag revenue, lag Tobin′s Q as a measure of long run investor expectation, Y_{kt} is a vector of country characteristics such as real interest rate, country risk measure, real per capita GDP; D_t is a dummy variable that takes a value of one after Basel II was implemented in country k, 0 otherwise; $D_t lag.revenue_{ikt}$ measures if the effect of Basel II is heterogeneous for different firm sizes; λ_t are fixed effects for each year; λ_i is a firm fixed effect. ε is the standard individual time-varying error, and is assumed to be independently

distributed.

In this model we control for firms and country characteristics to distinguish Basel II effect from another credit supply and credit demand effect. Contraction of lending may be caused by firms demand factors, such as weakening of the borrowers balance sheets, we control for Q Tobin and revenue. However, banks may also decrease their loan supply due to the macroeconomic economic conditions, for this reasons we control for country risk, GDP and annual real interest rate.

We assume that the firms revenue is a proxy of risk, considering for example Z-score (Altman 1968) used in US to forecast the probability of firm defaults include firms revenue as relevant variable.

The model is estimated by panel data techniques with firm and year fixed effects, and clustering standard errors at country level and firm′s economic sector.

The estimation results of equation 1 with diff-in-diff methodology are presented in Table 3. Column (1) reports estimates of the fixed effects estimation of capital expenditures; column (2) reports estimates of total debt, both allowing for a variance-covariance structure with standard errors clustered by country level and firm economic sector. This estimation not only allows to control for unobservable factors influencing investment and debt evolution but also for time invariant differences between firms and countries. With the firms panel data we can control for the concerns about lending to particular risky sectors.

The results (Table 5) show that the effect of Basel II rules affect the level of debt and investment, but this effect depends on the size of firms. These results are consistent with the methodology implemented through the Basel II regulation to estimate bank′s capital level requirements, which considers firms external credit rating evaluation.

All the control′s estimators at firm and country level variables have the expected signs. Tobin′s Q has a positive and significant correlation with the investment level, and higher levels of GDP increase firm′s investment level, If GDP increases by 1% the firms investment increases on average by 0.2%. The expected profitability, measured as Tobin′s Q, is negatively related to leverage, as was showed in Rajan and Zingales (1995).

Table 6 shows the average effect in debt and capital investment, considering firm size. We can appreciate that firms with a lower revenue level -in the 25th percentile- have decreased, on average, 7% of the debt level and 15% of capital expenditures as a proxy for investment, but firms with higher revenue level have increased the liabilities and investment level.

The intuition behind these results is the following: riskier assets are more expensive for the banking industry (this is correlated with the size of the firms), because they require a higher level of capital reserves. Our results indicate that regulatory pressure induce banks to reallocate loans between firms considering their sizes. Another interesting result is that the level of credit and investment increases in larger firms in countries that have implemented Basel II. This could be explained because these countries are considered much safer.

3.5.1 Matching with Diff-in-diff Methodology

A valid concern is that there are differences in pre-existent firm′s characteristics that condition debt and investment evolution, between countries with regulation and areas without. Specifically, firms in areas with financial regulation might differ in terms of firms productivity, rather than deregulation accounting for differences in investment or debt evolution. To overcome these concerns, I first perform matching procedures and estimate equation 1 only with firms that have common support. Matching procedures eliminate the potential bias by pairing firms subject to regulation (treated group) with firms without entry (control group) with similar characteristics and exposed to the same characteristics prior to deregulation.

Hence, following Rosenbaum and Rubin (1983), in a first step I estimate the probability of being treated, conditional on the pretreatment characteristics of firms, and match treated and control firms using this estimated probability, known as the propensity score.

I estimate the propensity score for each firm using a probit regression . First, I estimate the propensity score conditional on the characteristics of firms that differed in the treated and control groups. The estimation takes the following form:

$$P(Di = 1|z) = \alpha + \beta Z_i + \varepsilon_{ikt} \tag{3.3}$$

where Z is a vector representing all the characteristics of firms i in the treated and control groups; that is: age of firm, capital expenditures, cash from operations, total debt, total equity, revenue, Tobin′s Q. In the estimation of propensity score, we only consider a cross section for firms in Chile, Mexico, Peru and Colombia in 2006.

Having obtained the propensity score, we then only keep matched firms in the panel sample; in other words, for every treated observation on common support the algorithm looks for the control observation with the closest

Table 3.5. Difference and Difference Estimation Basel II

	(1) log_capitalexpenditure	(2) log_totaldebt
Ownership	0.121	0.0904
	(1.09)	(0.93)
L.real_interest	-0.00205	0.00822
	(-0.48)	(1.04)
basel2	**-1.399***	**-2.239****
	(-1.89)	(-3.34)
size_basel	**0.125***	**0.217****
	(1.99)	(3.70)
country_risk	-0.0842	-0.0481
	(-1.22)	(-0.51)
L.revenue_real	5.67e-08	8.67e-08
	(1.43)	(1.30)
L.qtobin	0.000133**	-0.00000170**
	(6.34)	(-57.13)
L.GDP_real	0.201**	-0.0112
	(3.98)	(-0.14)
1999	-0.0296	0.0275
	(-0.19)	(0.08)
2000	0.0513	0.0668
	(0.29)	(0.18)
2001	-0.187	-0.0462
	(-1.04)	(-0.14)
2002	-0.309**	-0.297
	(-2.03)	(-0.89)
2003	-0.234	-0.230
	(-1.43)	(-0.63)
2004	0.000699	-0.207
	(0.00)	(-0.61)
2005	0.218	-0.151
	(1.24)	(-0.58)
2006	0.225	-0.237
	(1.47)	(-1.05)
2007	0.305**	-0.236
	(2.69)	(-1.42)
2008	0.166	-0.261*
	(1.33)	(-1.82)
2009	-0.0117	-0.136
	(-0.12)	(-1.00)
2010	0.231**	0.0660
	(2.72)	(0.53)
2011	0.000858	0.148**
	(0.02)	(2.75)
2013	-0.167**	0.0838
	(-3.35)	(1.01)
_cons	8.046**	9.288**
	(16.40)	(21.33)
N	6235	7756
p	1.44e-24	1.21e-57

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$

propensity score.

After matching each treated observation with its closest control, all remaining observations were dropped. This process allows to eliminate the potential bias due to differences in the firms.

Then, we applied the matching methodology with diff-in-diff (Table 7). The results obtained for debt levels are similar to those estimated with the

Table 3.6. Basel II effect considering size of the firm

	(1) Total Debt	(2) Capital Expenditures
P25 Size	-0.071	-0.148
P50 Size	0.222	0.021
P75 Size	0.486	0.173

previous methodology. However, the Basel II effect on the level of investments is negative but not statistically significant, and its effect in firm size is positive, but not significant either.

These results could be explained following the literature of financial intermediation (Halmstron and Tirole (1997)) because some firms in the margin could finance investment projects with their own capital or issuing securties in financial markets, whereas other firms could simply stop some projects and reduce their investment level. Therefore, the final effect could be ambiguous. This is evidence that banks play a special role in financial markets, particularly in their lending to smaller companies, and that it may be difficult for such borrowers to find alternative sources of funding.

3.5.2 Robustness Check

I run a placebo test to check that the effect is only found when Basel II regulation takes place. The placebo involves dropping all treated observations and include only firms in Chile and Mexico in the pre-treatment period (2005-2007), and assigning treatment to Mexico in 2006. As can be observed in Table 8, the variable of interest is not significant when the experiment is run only with control observations.

3.6 Conclusions

We have found that strengthening banking capital regulation, Basel II capital standards, has affected the firms level of credits, but this magnitude depend on the size of the firm. Firms with higher level of revenue have increased the credit amount but the smallest size firm have decreased this mechanism of financing. This is consistent, because the Basel II risk evaluation could consider the firms rating score into their analysis, which is correlated with the

Table 3.7. Efect Basel II Matching with Diff-Diff

	(1) log_capitalexpenditures	(2) log_totaldebt
size_basel	**0.112**	**0.267****
	(1.40)	(3.26)
basel2	**-1.207**	**-2.732****
	(-1.27)	(-2.90)
ownership	0.103	0.129
	(0.82)	(1.18)
country_risk	-0.0831	0.151
	(-0.99)	(1.13)
L.real_interest	0.000155	0.00113
	(0.03)	(0.09)
1999	-0.164	-0.268
	(-0.85)	(-0.50)
2000	-0.0134	-0.197
	(-0.06)	(-0.35)
2001	-0.224	-0.371
	(-1.04)	(-0.77)
2002	-0.356*	-0.528
	(-1.82)	(-1.02)
2003	-0.272	-0.447
	(-1.26)	(-0.85)
2004	-0.0345	-0.519
	(-0.17)	(-1.08)
2005	0.225	-0.425
	(1.09)	(-1.16)
2006	0.204	-0.332
	(1.20)	(-1.01)
2007	0.303**	-0.387*
	(2.46)	(-1.70)
2008	0.126	-0.227
	(1.03)	(-1.11)
2009	-0.0407	-0.0872
	(-0.37)	(-0.42)
2010	0.207**	0.0748
	(2.04)	(0.37)
2011	0.0162	0.0498
	(0.24)	(0.79)
2013	-0.196**	0.112
	(-3.99)	(1.15)
L.revenue_real	5.57e-08	5.74e-08
	(1.28)	(1.02)
L.Qtobin	-0.00168	-0.00102
	(-0.76)	(-1.51)
L.pibpercapitaus_real	0.189**	-0.0719
	(2.97)	(-0.59)
cons	8.188**	9.409**
	(14.66)	(16.89)
N	4501	4899
p	5.64e-20	5.82e-09

t statistics in parentheses
* $p < 0.10$, ** $p < 0.05$

firms revenues. Considering the asymmetric banking capital cost between entrepreneurship finance institutions can reallocate resources.

Another interesting result is that the level of credit increases in larger firms in countries that have implemented Basel II. This could be explained because these countries are considered much safer due the higher exigencies imposed in the regulation.

Table 3.8. Placebo Test Mexico and Chile period 2005-2007

	(1) log_totaldebt	(2) log_capitalexpenditures
basel	**-1.692**	**0.722**
	(-1.19)	(0.56)
size_basel	**0.0833**	**-0.0253**
	(0.86)	(-0.25)
ownership	0.0587	0.309*
	(0.31)	(1.78)
L.GDP_real	-1.142**	0.361**
	(-3.89)	(2.41)
L.revenue_real	0.000000258	0.000000102
	(1.69)	(1.71)
L.Qtobin	-0.00148	-0.0258**
	(-1.20)	(-3.06)
2006	0.769**	-0.255
	(3.52)	(-1.47)
2007	1.704**	-0.273
	(3.81)	(-1.04)
cons	13.30**	6.987**
	(11.79)	(10.88)
N	652	623
p	0.000	0.000

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$

Theory does not paint a clear picture about how banking capital regulation ought to affect the firm-size distribution, but the empirical work does. Comparing industry structure across Latin American countries, one reaches the conclusion the effect is not uniform. Our empirical evidence is consistent with the idea that firms with higher cost in term of banking capital could erect an important financial barrier to access of loan. However in the investment level it has not a clear effect. Significantly, changes in loan as mechanism of financing have no conclusive effect on the average in the investment, which makes sense given their access to financial resources in the commercial paper,

corporate bond and equity market.

The policy implications associated with this issue are especially relevant. Banking market structure is a traditional policy variable whose control regulators across countries and over time often attempt to influence, although sometimes in conflicting ways. But it would be relevant to see if the imperfections in capital markets force the concentration of firms and as a consequence the optimal firm size is larger due financing mechanisms. This could increase or erect higher barriers to entry in industries with higher asymmetries between firms, this is relevant to investigate in other research because this could leading to long-term declines in a countrys growth prospects affecting the market structure.

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Chapter 4

Evaluating Informational Regulations in the CreditMarket

4.1 Introduction

How to improve financial decisions of consumers has been a permanent concern for policy makers. The ability of consumers to correctly account for costs and benefits of their options in the credit market is key to achieve an efficient allocation of risk and resources, and also important to ensure the stability of the financial sector (Lusardi and Mitchell [10]).

However, the financial information is perceived as complex for most consumers. Compelling evidence shows heterogeneous levels of understanding across borrowers, typically showing that poorer and less educated consumers display an unsatisfactory level of thorough understanding (Soll et al. [12]).

Moreover, there is an increasing concern that lending institutions might be using information complexity to soften competition (Carlin [4], Chioveanu and Zhou [5], Wilson [15]). If firms choose the available information in the contracts to maximize profits, then we should expect texts that are difficult to understand, as well as difficult to compare between different options within and between financial institutions.

Given the existence of suboptimal decisions, authorities and researchers have suggested legal regulations regarding contracts, and information provided to consumers in order to help borrowers make more informed decisions (Agarwal et al. [1], Campbell [2], Woodward and Hall [16]). The assumption is that this type of regulation will improve understanding of the critical aspects of

the loan, and simplify comparisons between different options. Along the same lines, financial education has been targeted as an important tool to potentially improve the decision making of less sophisticated consumers (Fernandes et al. [6], Hastings et al. [8]).

For instance, the Dodd-Frank Wall Street Reform and the Consumer Protection Act of 2010 have established a Consumer Financial Protection Bureau that requires lenders to disclose cost information of mortgages, student loans, credit cards, and other consumer products in a form that is easy for consumers to use.[1] Similarly, in November 2011, the European Commission has modified the Consumer Credit Directive to ensure a high level of consumer protection by focusing on transparency and consumer rights.[2]

Despite the massive introduction of new informational regulations, empirical evaluations are virtually non-existent. An important exception is Agarwal et al. [1], who study the fee regulation implemented by the 2009 Credit Card Accountability Responsibility and Disclosure (CARD) Act. Using a panel data of 160 million credit card accounts, they compare individual consumers, who were subject to the regulation, relative to the small business credit cards, who were not covered by the law. They find that regulatory limits on credit card fees reduced overall borrowing costs by an annualized 1.6% of average daily balances. Importantly, the CARD act only regulated fees, and thus, whether informational policies on consumer information are effective remains as an open empirical question.

Our contribution is to evaluate the effects of an informational regulation on different credit outcomes using detailed individual-level data on banking loans. Moreover we explore the potential mechanisms through which these policies can be effective.

We think our results are relevant to a vast number of markets with complex contracts and non-sophisticated consumers possibly choosing suboptimal decisions. For instance, choices of health insurance, savings for retirement and investment decisions in general may find similar suboptimal choices for some consumers.

We study the national regulation that set the frame of the information should be provided to borrowers in the Chilean credit market. The so-called *CAE* regulation explicitly defined what information should be provided in

[1] See Campbell et al. [3]; Campbell [2]; and Posner [11].

[2] In order to allow consumers to compare various offers easily, and to better understand the information provided, creditors have to provide pre-contractual information in a standardized form (Standard European Consumer Credit Information). Moreover, they also provide consumers with the Annual Percentage Rate of Charge, which is a single figure, harmonized at EU level, representing the total cost of the credit.

every single transaction in the credit market, including loans by the financial institutions, retailers, supermarkets, car dealers, etc.[3] In particular, the *CAE* regulation requires the construction of a yearly measure of the interest rate based on the total amount of the credit, including the principal and all fees involved, and to clearly state the amount and number of instalments.

To assess the impact of this regulation we use data on all the new personal loans approved in the Chilean banking system, covering more than 4.4 millions of transactions between the years 2009 and 2014. The dataset includes a rich set of covariates of the borrower such as income, gender and age.

Our results suggest that consumers at the top 40 percent in the income distribution achieved lower interest rates after the regulation was implemented. We find no statistically significant effects on the rest of the consumers. Also, we find no significant effects on any other financial outcome. Our results are robust to several specifications that considered different sets of explanatory variables and alternative regulation dates, including several placebo tests.

The richest consumers achieving lower interest rates after the regulation is consistent with two explanations. One explanation relies on a better understanding due to the new informational framing. Another explanation is that the new regulation facilitates comparisons between different banking institutions, increasing the returns to search behavior like quoting the same loan in multiple banks.

To identify the relative weight of each hypothesis, we estimate a difference-in-difference regression including the following regressors: i) educational background; and ii) the number of banking institutions that the customer has had business relationships in the past. The idea is to assess the importance of pure understanding explained by educational factors such as the type of education -college vs non-college-, the number of years of formal education, and the mathematical or financial contents of each different degrees. In addition, we use the number of banks in the individual history to measure of how prone individuals are to quote the same loan with different banks. We find that the educational factors explain most of the *CAE* effects.

The remainder of this paper is organized as follows. Section 4.2 presents the regulation we study, institutional details and descriptive statistics of our data. Section 4.3 introduces a theoretical framework of firms competing in complexity with confused consumers. Section 4.4 presents our econometric approach while Section 4.5 presents the results and robustness checks. Section 4.6 tests potential mechanisms that rationalize our findings and Section 4.7

[3]CAE is an acronym that refers to 'Carga Anual Equivalente', that translates as Annual Equivalent Amount.

concludes.

4.2 *CAE* Regulation and Data

4.2.1 *CAE* Regulation

In March 2012, the Chilean government passed law 20.555, that introduced a new mandatory format or information frame for the information that should be provided to consumers in a financial transaction. The so-called *CAE* regulation explicitly defined what information should be provided in every single transaction in the credit market, including loans by the financial institutions, retailers, supermarkets, car dealers, etc.[4]

The *CAE* regulation requires the construction of a yearly measure of the interest rate, based on the total amount of the credit, including the principal and all fees involved, and also to clearly state the total amount and number of instalments.

Strictly speaking, the Chilean *CAE* regulation did not provide new information that was not available before. Instead, the *CAE* regulation required the information to be summarized in a salient and simple way and readily available for consumers in all credit markets.

Before the introduction of the *CAE* regulation in Chile, it is fair to assume that the only salient dimension for consumers was the amount of instalment. In fact, retailers and banking institutions focused their entire marketing campaigns mostly on the amount of the monthly instalment. Although other dimensions of the repayment scheme of the loan were available, it was very unlikely for the average consumer ever to request that information.

4.2.2 Data description

Our analysis is based on micro data requested and recorded by the regulator of banks and financial institutions in Chile (hereafter *SBIF*[5]). The *SBIF* is an autonomous institution that looks after financial stability in Chile and is granted with powerful legal authority to pursue that goal.[6]

[4]CAE is an acronym that refers to "Carga Anual Equivalente", that translates as Annual Equivalent Amount.

[5]SBIF is an acronym that refers to "Superintendencia de Bancos e Instituciones Financieras", that translates as Superintendence of Banks and Financial Institutions.

[6]The Superintendence has the authority to examine all the businesses, properties, books, accounts, files, documents and correspondence of the banking institutions without any restriction, and by any means it may deem convenient, and to request from their administrators

We use the individual-level data of all new credits extended by commercial banks for the period between 2009-2014, obtained from SBIF. The data contains credit characteristics (amount, annual interest rate, credit horizon, lending bank), and consumer characteristics (age, gender, income, financial and default history). The total number of observations is approximately 4.4 millions of new credits.

We present summary statistics for our sample, dividing the analysis before and after the introduction of the CAE regulation. Table 4.1 provide a brief description of the main variables of the credit and individual characteristics before and after the CAE regulation. We present yearly interest rates, loan amounts and individual income, age and individual default probability. From the tables, we can see that the individual characteristics are largely similar before and after the regulation or treatment, slightly differing in a few dimensions.

and personnel all the information and explanations it may consider necessary.

Table 4.1. Individual and Loan characteristics before and after the CAE regulation

Before CAE Regulation	mean	sd	min	max	p50	cv	N
Yearly Interest Rate	22,71%	12,90%	0,52%	69,19%	18,6%	0,53	1.576.289
Loan Amount (USD)	6.140,72	9.319,18	146,99	108.778,73	3.111,13	1,51	1.576.289
Yearly Income (USD)	17.492,79	24.842,71	3.034,06	501.264,18	10.627,14	1,42	1.576.289
Gender (=1 women, 0=men)	36,2%	48,1%	0	1		1,32	1.576.289
Age	42,30	12,44	18,07	74,99	40,64	0,29	1.576.289
Default	13,11%						
After CAE Regulation	**mean**	**sd**	**min**	**max**	**p50**	**cv**	**N**
Yearly Interest Rate	25,54%	13,10%	0,55%	75,12%	22,4%	0,51	2.831.728
Loan Amount (USD)	7.210,80	10.149,04	147,24	108.778,73	4.033,18	1,40	2.831.728
Yearly Income (USD)	17.345,79	21.755,74	3.034,09	502.734,16	10.950,05	1,26	2.831.728
Gender (=1 women, 0=men)	37,4%	48,3%	0	1		1,29	2.831.728
Age	42,86	12,55	18,01	74,99	41,21	0,29	2.831.728
Default	14,59%						2.831.728

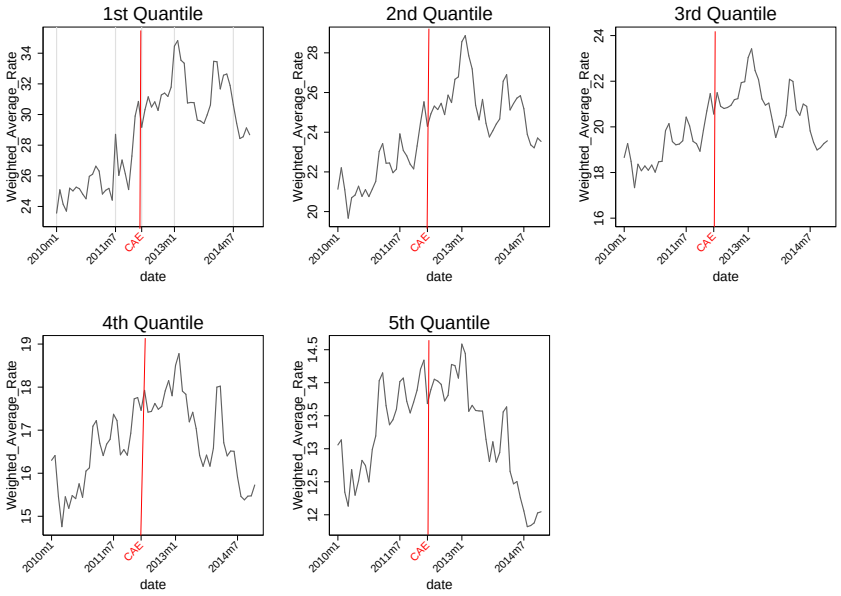

Figure 4.1. Weighted Average Loan Interest Rate by quintile, 2010-2014

The main source of heterogeneity in the data is income that, of course, is correlated with the amount of the loans. We present the same summary statistics for each income quintile (see Appendix B.1), stressing that neither demographics nor income seems to change before and after the regulation.

Figure 4.1 shows the evolution of the weighted average of the interest rate for the years between 2010 and 2014 for each quintile of the income population. We can see different patterns between the lowest quintile and the top quintile in terms of the level of the interest rate and their volatility.

4.3 Theoretical Framework

Models aim at rationalizing effects of different informational frames in consumer behavior should allow for consumers and suppliers to have different information sets (Stigler [14] and Ippolito [9]). The level of information of consumers depends on the quality of the available information and the search costs. Thus, some consumers might not be perfectly informed usually failing to make optimal decisions and suppliers enjoying market power (Stahl [13]).

There is evidence that more complex informational frames are associated with higher prices. Woodward and Hall [16] show that borrowers in the mortgage market who choose to roll all settlement costs into a single rate obtain, on average, lower interest rates than those on deals with separate fees. The idea is that the informational advantage of the broker is less severe when borrowers

can shop on the basis of a single rate alone.

We explore recent developments in theoretical models of non-standard but rational consumers that can explain how consumers could benefit from the new information framing imposed by the *CAE* regulation. Thus, we adapt the framework developed by Chioveanu and Zhou [5] (hereafter CZ).

Consider a credit market with two financial institutions, bank 1 and 2, whose constant marginal costs of capital are normalized to zero. There is a unit mass of consumers, each borrowing at most one unit of credit and willing to pay at most 1.

There are two alternative information frames for interest rates, referred to as frames A and B. We assume that frame A is a simple frame (in which the two interest rates are easily comparable) and that frame B is a a more complex frame, in which not every consumer is able to perfectly compare alternative options. Each bank i will choose frame $z_i = \{A, B\}$, so the vector of frames will be $Z{=}(z_1, z_2)$ and the share of the population that gets confused is denoted by $\alpha(Z){\in}[0,1)$.

The banks simultaneously and non cooperatively choose frames and interest rates r_1 and r_2; the demand function is given by $q_i(r_i, r_j)$. If firm i is the cheapest option ($r_i < r_j$), then firm i captures the entire demand ($q_i = 1$) and firm j has no customers ($q_j = 0$). When both banks set identical prices, $r_i = r_j$, each bank serves half of the demand: $q_i = q_j = \frac{1}{2}$.

If both banks choose the same simple frame, $Z = (A, A)$, then almost nobody gets confused, $\alpha(A, A) = \alpha_0 \geq 0$, and most consumers buy the cheaper product with a positive net surplus.

If the two banks adopt different frames, $Z = (A, B)$ or $Z = (B, A)$, then a larger fraction $\alpha(A, B) = \alpha(B, A) = \alpha_1 > \alpha_0 \geq 0$ of consumers gets confused and they are unable to compare the two alternative options. The remaining $(1 - \alpha_1)$ fraction of consumers can still accurately compare interest rates. In this duopoly example, for simplicity, we assume that confused consumers shop at random: half of them buy from bank 1 and the other half buy from bank 2.[7]

If both firms choose the same complex frame B, ie $Z = (B, B)$, then a larger fraction $\alpha(B, B) = \alpha_2 > \alpha_1 > \alpha_0 \geq 0$ of consumers get confutased and shop randomly. In this setting frame complexity leads to a larger share of confused consumers than does frame differentiation.

Notice that the simple frame A can cause confusion only when it is combined with a different frame B, whereas frame B is confusing by itself and can

[7]Similar results can be obtained if consumers favor the bank with the simpler frame whenever facing two different frames. See Chioveanu and Zhou [5].

obfuscate price comparisons even if both firms adopt it. Also, in this setting consumers have limited cognitive capabilities that prevent them to infer prices from the information frames.

Firm i's profit is

$$\pi_i(r_i, r_j, z_i, z_j) = r_i \times \left(\frac{1}{2} \times \underbrace{\alpha(Z)}_{\text{confused-share}} + q_i(r_i, r_j) \times \underbrace{(1 - \alpha(Z))}_{\text{non-confused-share}} \right)$$

Proposition 2 in CZ shows that there is a unique symmetric mixed-strategy equilibrium where each bank adopts frame A with probability $\lambda = \lambda(\alpha_0, \alpha_1, \alpha_2)$ and frame B with probability $(1 - \lambda)$. When a bank uses frame A, it chooses its price randomly according to the cdf F_A defined on the support given by prices in the $[\underline{p}, \hat{p}]$ interval and when a firm uses frame B, it chooses its price randomly according to the cdf F_B defined on support $[\hat{p}, \bar{p}]$, which contains more expensive prices.

The implications for the authorities are straightforward: 1) the market equilibrium involves mixing simple and complex frames that exploits the share of confused customers; 2) if the regulators establish the simple frame A as the mandatory frame in the credit market, the share of confused customers will fall.

Importantly, the reduction in the share of confused consumers due to a change in the information frame can be explained by two forces that play simultaneously: i) a better understanding of the credit market (given by the relative simplicity of frame A); and ii) an easier comparison between banks that can be rationalized as a decrease in search costs. The better understanding should affect the more educated consumers in the population; instead the reduction in search costs should affect the population that interacts with more financial institutions, regardless of their education level. We aim at empirically identifying the relative weight of these two hypotheses.

4.4 Econometric Approach

Our econometric approach seeks to quantify the effect of the *CAE* regulation on different financial outcomes. Namely, we estimate reduced form regressions to measure the effect of the new regulation on interest rates and credit amounts.

4.4.1 Interest Rate Regressions

The first specification in Equation (4.1), denoted by Model 1, is as follows:

$$Y_{ikt} = \alpha' X_{it} + \beta CAE_t + \theta\ CAE_t \times Income_{it} + \gamma_1 Le_{ikt} + \gamma_2 Am_{ikt} + \lambda_t + \lambda_k + \varepsilon_{ikt} \tag{4.1}$$

where Y_{ikt} is the annual interest rate charged by bank k to consumer i at time t; X_{it} is a vector of individual characteristics such as gender, age and income; CAE_t is a dummy variable equal to one after March 2012, and zero otherwise; Am_{ikt} is the log of the loan amount, Le_{ikt} is the length or maturity of the loan. We also include monthly fixed effects, λ_t, and bank fixed effects, λ_k. ε_{ikt} is the standard individual time-varying random term that is assumed to be independently distributed.

Our key estimate of interest is θ, which represents the effect of the CAE regulation on interest rates. The main identifying assumption is that changes in credit conditions after the law was passed are captured by additive terms over the interest rate level that banks would have charged in the absence of the law.

In Model 2, we estimate different treatment effects of the regulation by each quintile of the income distribution of the borrowers, as described in Equation (4.2).[8] The treatment effects are captured by the interaction of the CAE dummy and each income quintile dummy. The effect on quintile j is denoted by θ_j:

$$Y_{ikt} = \alpha' X_{it} + \beta CAE_t + \sum_{j=1}^{5} \theta_j CAE_t \times Quintile_{ijt} + \gamma_1 Le_{ikt} + \gamma_2 Am_{ikt} + \lambda_t + \lambda_k + \varepsilon_{ikt} \tag{4.2}$$

where $Quintile_{ijt}$ is a dummy variable equal to one if the individual i belongs to quintile j at time period t and zero otherwise.

In the next specifications we account for the fact that the log loan amount Am_{ikt} and credit length Le_{ikt} are potentially endogenous variables. If the amount or the length agreed by the consumers depends on the interest rates of the loan, then we can have a standard reverse causality problem. To address this potential endogeneity problem, we also estimate the models 1 and 2 using Two Stage Least Squares (TSLS), considering marital status and individual

[8] Note that the population of borrowers in the banking sector is richer than the Chilean population. We define the income quintiles using our credit data.

default in the banking system as instrumental variables for amount and length.

We argue that marital status is correlated with the amount of credit but uncorrelated with random term ε_{ikt}. We believe that, ceteris paribus, married individuals need higher amounts to finance larger projects (housing, familiar vacations, children expenditure, etc) than single borrowers. The assumption is that marital status only affect interest rates through the amount of the loan.

Similarly, we argue that the interest rates are based on the latest information on default but not on the previous default history. However, default history can be linked to past negative shocks that explains the necessity of larger amounts and longer credit length. Our measure of default is given by the ratio of total amount that consumer did not pay in the maturity date in the banking institutions with respect to the total loan amount in a given period. We find that the default measure at time $t-2$ is not correlated with interest rates but correlated with the credit amount and horizon of the current loan.

The instrumental variables are valid if and only if they are uncorrelated with the error term of the structural equation and strongly correlated with the endogenous explanatory variables. Hence, the instruments must be exogenous (over-identification test) and also must be relevant (underidentification test). We applied the underidentification, weak underindentification and overidentification tests to support the use of our instrumental variables.[9]

4.4.2 Loan Amount Regressions

We also explore the effect of the CAE regulation on the log amount of the loans. Thus, we use the log amount of credit as dependent variable in the same type of regressions described previously, also including the interest rate as explanatory variable. The regression described in Equation (4.3) is denoted by Model 3:

$$Am_{ikt} = \alpha' X_{it} + \beta CAE_t + \theta\ CAE_t \times Income_{it} + \gamma_1 Le_{ikt} + \gamma_2 Y_{ikt} + \lambda_t + \lambda_k + \varepsilon_{ikt} \tag{4.3}$$

In Model 3, we have to account for the fact that the interest rate and credit length are endogenous variables. Thus, we use the interaction between the interbank interest rate and bank fixed effects as instrumental variables. These interactions capture the asymmetric bank responses to cost shocks that should affect banks differently depending on the finance structure of each corporation. These cost shifters are completely exogenous to consumer-specific shocks and

[9] We use Frisch-Waugh-Lovell (FWL) to estimate the Hansen test. For more information see Hahn and Hausman [7].

definitely correlated with the aforementioned endogenous variables as financial institutions should change their optimal policy regarding interest rates and maturity of loans.

4.5 Results

4.5.1 Interest Rate

We present our OLS and TSLS estimates of Model 1 (See Equation (4.1)). The first stage of the TSLS specification is shown in Table 4.2. We cluster standard errors at the bank level.

Table 4.2. First Stage of Model 1

Dependent Variable	Log Loan Amount	Credit Length
Risk Default	0.063*	5.447***
	(0.035)	(1.675)
Single	0.001	-2.402***
	(0.023)	(0.285)
Married	0.105***	-0.271
	(0.032)	(0.029)
Divorced	0.113***	0.051
	(0.036)	(0.455)
Widow base		
Number of observations	4,407,305	4,407,305
F Test Excluded Instruments	87.02***	29.01***

Notes: clustered standard errors by bank in parentheses. Coefficients of other control variables are omitted. *p<0.10, **p<0.5, ***p<0.01.

From Table 4.2 we conclude that our instruments satisfy the exogenous and identification conditions, and therefore, the endogeneity issue is properly addressed in the second stage. Our results suggest that married and divorced consumers borrowed larger amounts relative to single or widow individuals, consistent with our priors. Regarding the length of the credit horizon, we find evidence that single and consumers with a smaller share of unpaid debts obtain shorter maturity debts.

Table 4.3. Model 1: CAE effects on Interest Rates

Interest Rate	OLS	TSLS
Log Loan Amount	-4.783***	-4.461
	(1.148)	(4.482)
Income	-2.22e-07***	-2.24e-07
	(4.58e-08)	(1.88e-07)
Squared Income	1.06e-15***	9.98e-16
	(2.25e-16)	(6.47e-16)
CAE	**-3.942**	**-3.873**
	(2.733)	(2.569)
CAE x Income	**-6.86e-08*** **	**-6.37e-08*** **
	(3.02e-08)	(2.55e-08)
Credit Length	-0.030	-0.318
	(0.026)	(0.207)
Gender (=1 women, 0=men)	-0.845*	-1.225**
	(0.482)	(0.624)
Number of observations	4,407,305	4,407,305
Adj R2	0.46	0.26
Bank Fixed Effects	√	√
Time Fixed Effects	√	√
Hansen Statistic		3.823
Underidentifiction KleibergenPaap rk LM		4294.973***
Weak identification KleibergenPaap rk F		1020.481***

Notes: clustered standard errors by bank in parentheses. *p<0.10, **p<0.5, ***p<0.01.

Table 4.3 presents the estimates of Model 1. We find that consumer credit cost decreases after the CAE regulation, and, on average, the size of this effect depends positively on the income of the borrower. The average effect at the mean of income is equal to -0.81 points in the OLS estimation and -0.75 in the TSLS estimation, being the effect equivalent to a reduction of 3% of the average interest rate. Note that the CAE effect is only significant when interacted with the borrower′s income.

All other covariates obtained the expected effects, as credit length, gender and income quintile are also significant explaining interest rates.

Now, we turn to estimate Model 2 presented in Equation (4.2). In Table 4.4, we present the first stage estimates of the TSLS estimation. The results are similar to those obtained in the first stage of Model 1, except by the fact that the default risk is not significant for the log loan amount.

Table 4.4. First Stage of Model 2

Dependent Variable	Log Loan Amount	Credit Length
Risk Default	0.060	5.496***
	(0.035)	(1.728)
Single	0.007	-2.510***
	(0.016)	(0.294)
Married	0.077***	-0.495*
	(0.023)	(0.262)
Divorced	0.079***	-0.192
	(0.027)	(0.393)
Widow base		
Number of observations	4,407,305	4,407,305
F Test Excluded Instruments	53.26***	29.13***

Notes: clustered standard errors by bank in parentheses. Coefficients of other control variables are omitted. *p<0.10, **p<0.5, ***p<0.01.

Table 4.5. Model 2: CAE Effects on Interest Rates by Income Quintile.

Interest Rate	OLS	TSLS
Log Loan Amount	-4.143***	-0.943
	(1.010)	(4.823)
Quintile 1 x CAE	-0.267	-0.430
	(2.451)	(2.189)
Quintile 2 x CAE	-2.127	-1.976
	(2.806)	(-2.485)
Quintile 3 x CAE	-3.947	-3.777
	(2.751)	(2.704)
Quintile 4 x CAE	-4.661*	-4.459*
	(2.326)	(2.320)
Quintile 5 x CAE	-5.669**	-5.454**
	(2.351)	(2.400)
Credit Length	-0.041*	-0.367*
	(0.022)	(0.190)
Gender (=1 women, 0=men)	-0.787*	-0.947*
	(0.436)	(0.565)
Number of observations	4,407,305	4,407,305
R2	0.501	0.290
Bank Fixed Effects	√	√
Time Fixed Effects	√	√
Quintile Fixed Effects	√	√
Hansen Statistic		6.086
Underidentifiction KleibergenPaap rk LM		2975.899***
Weak identification KleibergenPaap rk F		403.377***

Notes: clustered standard errors by bank in parentheses. *p<0.10, **p<0.5, ***p<0.01.

Table 4.5 presents the main estimates of Model 2. We find that borrowers in the 4th and 5th quintile of the income distribution, obtained statistically significant lower interest rates after the CAE regulation was in force. The average interest rate decrease is about 4.5 points in the 4th quintile and 5.5 points in the top quintile of the income distribution. The effect is equivalent to a sizeable reduction of 20 percent of the average interest rate in the 4th quintile and 30 percent in the 5th quintile.

We explore empirically two potential mechanisms in section 4.6 to rationalize our findings of negative CAE effects on interest rates for the borrowers at the top of the income distribution.

4.5.2 Credit Amount

We also study the effect of the CAE regulation on the loan amount. Table 4.6 presents the estimates of Model 3 as described in Equation (4.3). We find no evidence of significant effects of the CAE regulation on the log loan amount of consumers in the banking system. The interaction of the CAE and income does not suggest any heterogeneous effect on the total loan amount.[10]

[10]The first stage estimates support the cost shifters as valid instruments. See Table B.5 in Appendix B.2.

Table 4.6. Model 3: CAE effects on Loan Amount

Log Loan Amount	OLS	TSLS
Interest Rate	-0.031***	0.045***
	(0.006)	(0.013)
Income	3.19e-08***	6.51e-08***
	(3.39e-09)	(9.94e-09)
Squared Income	-1.08e-16***	-2.45e-16***
	(1.46e-17)	(4.25e-17)
CAE	**-0.121**	**0.178**
	(0.108)	(0.133)
CAE x Income	**-1.48e-09**	**3.88e-09**
	(1.61e-09)	(3.19e-09)
Credit Length	0.0182***	0.039***
	(0.00572)	(0.014)
Gender (=1 women, 0=men)	-0.0755***	-0.017
	(0.021)	(0.034)
Number of observations	4,407,305	4,407,305
Adj R2	0.59	0.14
Bank Fixed Effects	√	√
Time Fixed Effects	√	√
Hansen Statistic		11.824
Underidentifiction KleibergenPaap rk LM		9043.523***
Weak identification KleibergenPaap rk F		579.663***

Notes: clustered standard errors by bank in parentheses. *p<0.10, **p<0.5, ***p<0.01.

4.5.3 Robustness Check

In this subsection we perform various robustness check to test our findings.

Based on Model 2, we estimate a difference-in-difference specifications to evaluate the robustness of our findings on the CAE effect on the interest rates. We consider the 2nd and 1st income quintiles as control groups for the 4th and 5th income quintile respectively (we discard the 3rd quintile of the income distribution). Table 4.7 presents the dif-in-dif estimates. We obtain very similar results: the CAE regulation only decreased the interest rate paid by the borrowers at the top 40 percent of the income distribution.

Table 4.7. Difference-in-Difference Estimation

Interest Rates	OLS	TSLS
Log Loan Amount	-4.049**	-1.398
	(1.007)	(4.199)
Quintile 1	8.119**	10.93*
	(1.321)	(6.038)
Quintile 2	4.780**	7.544
	(1.042)	(4.943)
Quintile 4	1.265**	2.635
	(0.513)	(2.009)
Quintile 4 x CAE	-3.394*	-3.230*
	(1.776)	(1.871)
Quintile 5 x CAE	-4.421**	-4.156**
	(2.090)	(1.988)
Credit Length	-0.0399*	-0.379**
	(0.0222)	(0.183)
Gender (=1 women, 0=men)	-0.783	-0.929
	(0.514)	(0.704)
Number of observations	3,541,901	3,541,901
Adj. R2	0.53	0.30

Notes: clustered standard errors by bank in parentheses. *p<0.10, **p<0.5, ***p<0.01.

As another important robustness check, we explore different dates as the definition of the establishment of the CAE regulation. We estimate the OLS specification defining the CAE regulation being in force five months before (November 2011, when the Chilean Government promulgated the Law). The results show that using previous dates do not have the significant effect on the interest rates. We find similar results when we estimate a placebo test considering only the observations in pre-treatment period and assigning a treatment in January 2011. We present the results in Table 4.8.

Table 4.8. Testing alternative CAE definitions

	(1)	(2)	(3)
Interest Rates	March 2012	Nov 2011	Jan 2010
Log Loan Amount	-4.143**	-4.144**	-3.903**
	(1.010)	(1.011)	(1.202)
Quintile 1 x CAE	-0.267	1.407	0.993
	(2.451)	(3.176)	(1.553)
Quintile 2 x CAE	-2.127	-0.374	2.113
	(2.806)	(2.969)	(1.333)
Quintile 3 x CAE	-3.947	-2.099	1.900
	(2.752)	(2.538)	(1.612)
Quintile 4 x CAE	-4.661*	-2.895	1.703
	(2.327)	(2.047)	(1.625)
Quintile 5 x CAE	-5.669**	-3.929*	1.778
	(2.352)	(34.58)	(1.541)
Credit Length	-0.0413*	-0.0412*	-0.023*
	(0.0227)	(0.0226)	(0.010)
Gender (=1 women, 0=men)	-0.787*	-0.898*	-0.347**
	(0.437)	(0.494)	(0.154)
Number of observations	4,407,305	4,407,305	1,433,838
Adj. R2	0.501	0.500	0.518
Bank Fixed Effects	√	√	√
Time Fixed Effects	√	√	√
Quintile Fixed Effects	√	√	√

Notes: clustered standard errors by bank in parentheses. *p<0.10, **p<0.5, ***p<0.01.

Another important robustness check is to test whether the groups for which a treatment effect is found had a pre-treatment trend that could explain the results. We label the poorest 1st and 2nd quintile at the bottom of income quintile as the control group, while the richest 4th and 5th quintile at the top of the income distribution are labelled as the treatment group. The key identifying assumption of our reduced form estimates is that interest rate trends would be the same in both groups of consumers in the absence of treatment, ie, using the pretreatment data only.

Table 4.9 presents the described pre-treatment trend test. Treatment induces a deviation from this common trend. In the results obtained, we strongly do not reject that there is no difference between both groups trends. Therefore, the results are consistent with the findings that the CAE regulation did

Table 4.9. Parallel Trend in Pre-Treatment period

Interest Rates	(1) OLS
Log Loan Amount	-4.127** (1.195)
Control Group Dummy	36.57 (35.53)
Credit Length	-0.0185 (0.0126)
Trend	0.209** (0.0670)
Trend x Control Group Dummy	**-0.0694** **(0.0576)**
Gender (=1 women, 0=men)	-0.130 (0.113)
Number of observations	1,267,453
Adj. R2	0.532

Notes: clustered standard errors by bank in parentheses. The control group only includes the poorest 40 percent of the income distribution. *p<0.10, **p<0.5, ***p<0.01.

affect the interest rates that the richest 40 percent of borrowers achieved.

4.5.4 Discussion of Results

Our main finding is that the CAE regulation had heterogeneous effects on interest rates across the income distribution. We find a sizeable decrease in the interest rates for borrowers at the top 40 percent of the income distribution. In contrast, we find no significant effects on interest rates for borrowers at the bottom 60 percent of the income distribution. Notice that the absence of effects can have two interpretations: i) evidence of an irrelevant regulation; or ii) the behaviour at the bottom of the income distribution was already optimal before the CAE regulation was implemented, with no room for improvement. In general, we are able to detect changes in outcomes but not whether those outcomes were optimal before or after the implementation of the CAE regulation. Non-significant results on loan amount, default probability and credit length are consistent with the theoretical model, where the expected effect is mainly on prices. We perform several robustness checks (different measures,

specifications and placebo tests) that confirm our main results. Given our solid findings, we explore potential mechanisms that can rationalize our results.

4.6 Mechanism

We have two potential explanations to rationalize our findings of a negative CAE effect on the interest rates but only for the richest borrowers. One hypothesis is that the CAE effect is related to higher educational levels, and therefore, higher levels of financial literacy. The other hypothesis is that the CAE regulation boosts search behavior among rich borrowers since comparisons between and within banks are easier. Hence, regardless of their level of financial literacy, richer individuals face more and better options when quoting the same loan in different banks.

To study the two competing hypotheses, we require to have data on educational background that is not available for the entire sample. Instead, we only have records of educational background for a sub-sample that corresponds to the borrowers between 18 and 35 years old, who took the national exam of college admissions in 2007.

To test the aforementioned financial literacy hypothesis, we build a measure of "exposure to financial education" using the classification made by the OECD. We consider as the treatment group those students who have enrolled in university programs classified as Business Education.[11]

To test whether the CAE effect is mainly driven by search behavior, we construct the number of banks that the consumer has had financial products in the past. The intuition is that the number of banks is a good proxy for consumer search, as a larger number banks suggest that it is more likely to quote the same loan with different banks.

Using the difference-in-difference approach, we include both set of regressors to estimate the effects of financial literacy and searching behaviour. We expect to identify the relative weight of each hypothesis. Table 4.10 presents our estimates to disentangle the underlying mechanism of the CAE regulation.

Our estimates support the hypothesis that financial literacy is the main source of the statistically significant decrease on interest rates after the CAE regulation is in force. After the CAE regulation, the level of financial literacy is strongly negative for the richest quintiles only. Therefore, we conclude that

[11]For example, the OECD classifies education programs in seven groups: Agriculture; Sciences; Social Sciences and Business Education; Education; Humanities and Arts; Engineering, Manufacturing and Construction; and, Health and Welfare Services

the hypothesis of financial literacy is supported by the data to explain the CAE effect in the Chilean credit market.

Regarding the search behaviour, we find that borrowers, who have financial products in more than one bank, achieve higher interest rates after the CAE regulation is in force that is contrary to our hypothesis of searching behaviour. This could happen because multi-bank individuals have more experience in the financial system, therefore the gap between them and consumers with only one bank is higher before the CAE regulation. Once the CAE regulation simplified the informational frame this gap decreased.

4.7 Conclusions

In March 2012, the Chilean government introduced a national regulation, aiming at improving the decision making of borrowers, which set a new mandatory frame to simplify the information that should be provided to consumers in the credit market.

We evaluate the impact of this informational change by exploiting a quasi-experimental environment and we explore the mechanism which can explain the results. Using detailed individual level data of all the new loans approved between 2009 and 2014, we estimate a difference-in-differences regression to assess the effect of this financial regulation on the interest rates and loan amounts.

Our findings suggest that consumers at the top 40 percent in the income distribution achieved lower interest rates after the regulation was implemented. This represents a reduction, on average, of more than 4 points in the average yearly interest rate. We find no statistically significant effects for the rest of the consumers. Also, we find no significant effects on the loan amounts. Our results are robust to several alternative specifications and placebo tests to different definitions regarding when the CAE took place.

Our findings are consistent with two possible explanations. One relies on better understanding of consumers in the highest income quintile relative to poorer borrowers, in line with the financial literacy arguments. Another explanation is that the new regulation facilitates comparisons between different banks, increasing the returns of a more active search behaviour, like quoting the same loan in more than one bank. To identify the relative weight of each of the two hypotheses, we construct the number of banking institutions that the customer has had a business relationship in the past, as a measure for individuals being more prone to quote different banking institutions. We also merge

Table 4.10. Mechanisms that affect Interest Rate through CAE Regulation

Interest Rates	OLS	TSLS
Age	-0.0162	-0.0738*
	(0.0399)	(0.00945)
Age x CAE	-0.0348	-0.0563
	(0.0295)	(0.0384)
Gender (=1 women, 0=men)	-0.182*	0.0446
	(0.0653)	(0.154)
Gender (=1 women, 0=men) x CAE	0.134	0.186
	(0.0845)	(0.168)
Credit Length	-0.0433**	-0.241*
	(0.00144)	(0.138)
Fin Litera 1	-2.729*	-2.000*
	(0.975)	(1.174)
Fin Litera 2	-2.309**	-2.418**
	(0.0881)	(0.113)
Fin Litera 3	-0.579**	-1.018**
	(0.126)	(0.0994)
Fin Litera 4	-0.262	-0.386**
	(0.173)	(0.176)
Fin Litera 5	0.745**	1.330*
	(0.196)	(0.726)
Fin Litera 1 x CAE	1.993**	0.673
	(0.0736)	(0.995)
Fin Litera 2 x CAE	1.430**	1.607**
	(0.0882)	(0.193)
Fin Litera 3 x CAE	-0.529**	0.230
	(0.0965)	(0.456)
Fin Litera 4 x CAE	-0.641**	-0.316*
	(0.109)	(0.162)
Fin Litera 5 x CAE	-1.290**	-2.070*
	(0.167)	(0.640)
Multi-bank	-0.938**	-1.339**
	(0.0828)	(0.245)
Multi-bank x CAE	0.972**	0.642**
	(0.112)	(0.261)
Number of observations	390,485	390,485
Adj. R2	0.450	0.051
Bank Fixed Effects	√	√
Time Fixed Effects	√	√
Quintile Fixed Effects	√	√

Notes: clustered standard errors by bank in parentheses. *p<0.10, **p<0.5, ***p<0.01.

our credit data with educational outcomes for a relevant sub-sample in order to have a solid measure of financial education. Our difference-in-differences estimates including both set of covariates suggest that the hypothesis of financial literacy is the most relevant factor that could explain the effect of the new law.

We believe our results presented here are not only of interest for banking institutions or regulators, but they should also be particularly informative for public policy makers concerned with education, as well as for other countries that can learn about this financial policy, and how it can increase the positive welfare effects of this kind of banking regulations.

In future research we plan to address potential concerns of endogeneity of the educational decisions that can be relevant for credit market decisions.

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Chapter 5

Conclusion and Policy Implications

This present dissertation deals with the economic analysis in the banking industry, particularly try to measure the effect of different kinds of regulations applied in this sector. In a context of structural regulation the Chapter 2 focusses on the effect foreign bank penetration and dollarization in banking competition in Latin America. Chapter 3 analyses if changes in banking capital standard may affect the level of firms debt and investment. Chapter 4, aims to identify the effect of an information regulation on different credit outcomes and explore the potential mechanisms through which these policies can be effective. Finally, this current chapter presents the main results as well as some policy implications that may be derived from these findings.

Generally, it is accepted that competitive and stable financial sector is a crucial component of market economies. In order to evaluate different regulations which are focus on these objectives, Chapter 2 asses the relationship between foreign ownership and dollarization in the level of competition in banking industry. For the specific analysis in Latin America, the results show that foreign banks tend to increase market rivalry in countries with an initial low level of competition, whereas the opposite occurs in countries with an initial high level of competition. Currency boards are positively correlated with competition in banking industry, this is the case of countries that implemented such reforms as Argentina, Ecuador and El Salvador. This results are in line with the idea that dollarization reduces transaction costs and increases financial integration. This studies contributes to the literature because is the first paper that applies a new measure of competition, Boone indicator, to a set of banks in Latin American countries and it focuses to analyse the evolution of competition among them. Secondly, and more important using the

competition indicator provides a new insights about suggestive correlation between foreign penetration and dollarization on competition in the commercial banking system in Latin American countries.

As a policy implications, this research suggest that to adopt dollarization in less developed countries has a positive impact in the level of competition in commercial banking system, therefore in cases of financial crises or less depth financial market could be a good mechanism to improve the banking sector. Regarded with the foreign penetration the effect depend on the level of banking competition in different countries, is a good policy to reduce the structural barriers in countries with lower level of competition, but in those where the level of competition is higher the authorities need to implement another policies to increase the competition level, which is in line with the new kinds of regulations related with the asymmetric information between consumers and bank in the banking sector, which is going to be evaluated in Chapter 4.

The economic analysis recognizes that in order to have a competitive banking system and foster the economic growth the banking stability is crucial factor. Related to this situation, Chapter 3 aims to measure if changes in banks capital standard would determine changes in real economy. The contribution of this article to the current literature is twofold. It is the first article that evaluates if changes in banks capital requirements would result in changes in the real economy with the policy evaluation methodology; and analyses empirically if this kind of regulation could have an heterogeneous effect in the firm debt level and due this potential changes in funding mechanism the firms investment level could be affected considering its size.

We have found that strengthening banking capital regulation, Basel II capital standards, has affected the firms level of credits, but this magnitude depend on the size of the firm. This is consistent, because the Basel II risk evaluation could consider the firms rating score into their analysis, which is correlated with the firms revenues. Considering the asymmetric banking capital cost between entrepreneurship finance institutions can reallocate resources.

Another interesting result is that the level of credit increases in larger firms in countries that have implemented Basel II. This could be explained because these countries are considered much safer due the higher exigencies imposed in the regulation.

Theory does not paint a clear picture about how banking capital regulation ought to affect the firm-size distribution, but the empirical work does. Comparing industry structure across Latin American countries, one reaches the conclusion the effect is not uniform. Our empirical evidence is consistent

with the idea that firms with higher cost in term of banking capital could erect an important financial barrier to access of loan. However in the investment level it has not a clear effect. Significantly, changes in loan as mechanism of financing have no conclusive effect on the average in the investment, which makes sense given their access to financial resources in the commercial paper, corporate bond and equity market.

The policy implications associated with this issue are especially relevant, because the Basel II regulation to looking for increase the banking financial stability at least in Latin American countries on average, does not have a negative impact in the investment level. Therefore if the effect that the public policy searched was to induce the banking system to reallocate the resources to less riskier firms they succeed. Due the implementation of this capital standards is not mandatory in the less developed countries, they authorities could consider this results to foster the necessary conditions to adopt the new capital standards in Basel III, which consider an improvement of Basel II.

Banking market structure is a traditional policy variable whose control regulators across countries and over time often attempt to influence, although sometimes in conflicting ways. But it would be relevant to see if the imperfections in capital markets force the concentration of firms and as a consequence the optimal firm size is larger due financing mechanisms. This could increase or erect higher barriers to entry in industries with higher asymmetries between firms, this is relevant to investigate in other research because this could leading to long-term declines in a country′s growth prospects affecting the market structure.

In a context of asymmetric information between borrowers and banking institutions, there is an increasing concern that lending institutions might be able to use information complexity as a device to soften competition. Related with this, the Chapter 4 evaluate the impact of and informational change in loan credit market by exploiting a quasi-experimental environment and we assess the effect of this financial regulation on the interest rates and loan amounts.

Our findings suggest that consumers at the top 40 percent in the income distribution achieved lower interest rates after the regulation was implemented. This represents a reduction, on average, of more than 4 points in the average yearly interest rate. We find no statistically significant effects for the rest of the consumers. Also, we find no significant effects on the loan amounts. Our results are robust to several alternative specifications and placebo tests to different definitions regarding when the CAE took place.

Our findings are consistent with two possible explanations. One relies on

better understanding of consumers in the highest income quintile relative to poorer borrowers, in line with the financial literacy arguments. Another explanation is that the new regulation facilitates comparisons between different banks, increasing the returns of a more active search behaviour, like quoting the same loan in more than one bank. To identify the relative weight of each of the two hypotheses, we construct the number of banking institutions that the customer has had a business relationship in the past, as a measure for individuals being more prone to quote different banking institutions. We also merge our credit data with educational outcomes for a relevant sub-sample in order to have a solid measure of financial education. Our difference-in-differences estimates including both set of covariates suggest that the hypothesis of financial literacy is the most relevant factor that could explain the effect of the new law.

The public policy implications is direct, in countries with higher dispersion in the income distribution is not only necessary to simplified the cost information if we want to extend the benefits of reducing the asymmetric information between the firms and consumers, we need to complement this kind of policies with financial education.

We believe our results presented here are not only of interest for banking institutions or regulators, but they should also be particularly informative for public policy makers concerned with education, as well as for other countries that can learn about this financial policy, and how it can increase the positive welfare effects of this kind of banking regulations.

In future research we plan to address potential concerns of endogeneity of the educational decisions that can be relevant for credit market decisions.

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Appendix A

Supplemental material for Chapter 2

Following Boone et al. (2005) and Van Leuvensteijn et al. (2007), we consider a banking industry where each bank i produces a product q_i (or portfolio of banking products) which faces a demand curve of the form:

$$p(q_i) = a - bq_i - d\sum_{i=1}^{n} q_j \tag{A.1}$$

Whereby each bank has constant marginal cost mc_i. The bank maximizes profits choosing the optimal level of q_i. The model considers that the parameter a captures the size of the market and b denotes the market elasticity of demand. We assume that a¿mc_i and d characterize the extent which consumers see the different products in a market as close substitutes ($0 < d \leq b$), the model allows for the possibility that goods are heterogenous ($b \neq d$)[1] The bank i decides the optimal output level q_i maximize profits:

$$Max \prod(q_1, ..., q_n) = (a - bq_i - d\sum_{i=1}^{n} q_j - mc_i)q_i \tag{A.2}$$

The first order condition for a Cournot-Nash equilibrium can be written as:

$$a - 2bq_i - d\sum_{i=1}^{n} q_j - mc_i = 0 \tag{A.3}$$

[1]The ratio $\frac{b}{d}$ measures how close substitutes the goods are. If $d = b$ then goods are perfect substitutes, for $d < b$ firms have some monopoly power due to product differentiation.

For a banking system with N banks that produce $q_i¿0$, one can solve the n first order conditions (3). This yields:

$$q_i(mc_i) = \frac{(\frac{2b}{d} - 1)a - (\frac{2b}{d} + n - 1)mc_i + \sum_j mc_j)}{(\frac{2b}{d} - 1)d(n-1) + 2b)} \tag{A.4}$$

Further, rewriting equation (3) as:

$$a - bq_i - d\sum_{i=1}^{n} q_j - mc_i = bq_i \tag{A.5}$$

allows one to write profits of firms i as:

$$\prod(q_i) = (bq_i)q_i \tag{A.6}$$

And the price of firm i as:

$$p_i = bq_i + mc_i \tag{A.7}$$

Equation (4) gives the relation between output q_i and marginal cost mc_i and we can see from Equation (2) that profits depend on marginal cost in quadratic way. We define profits Π_i as variable profits excluding entry costs ξ. A bank will only enter in the industry if $\pi(mc_i) > \xi$ in equilibrium. In this market competition can increase for two ways: i) when the portfolio of products becomes more substitutable, that is d increases, ii) when the entry costs ξ decline. Boone et al. (2005) prove that relative profits or market shares[2] of more efficient bank -that is firms with lower marginal cost- increase in both cases under stronger substitution and lower entry costs in the industry. The intuition behind is that an in increase in competition reallocates output form less efficient firm to more efficient firms increasing the profits (or market shares[3]) of a efficient firms relative to a less efficient firm. Equation (4) supports the use of the following model for market share, defined as[4]:

$$mshare = \frac{p_i q_i}{\sum_j p_j q_j} \tag{A.8}$$

[2] Boone et. al (2005) define market shares as firm revenues divided by total industry revenues in the same way as Hay and Liu (1997).

[3]Boone (2008) argues that measure which is based on the reallocation revenues, instead of the reallocation of profits applied by Hay and Liu (1997) are complementary.

[4] See Boone et al (2005) page 3.

Table A.1. Boone Estimates per Country: Difference test

	BOL	BRA	CHL	COL	CRI	DOM	ECU	SLV	GTM	HND	MEX	PRY	PER	URY	VEN
ARG	0.04***	0.00***	0.96	0.69	0.06*	0.08*	0.11	0.90	0.93	0.00***	0.13	0.25	0.61	0.67	0.01***
BOL		0.00***	0.07*	0.79	0.02**	0.34	0.26	Salvador	-1.22***	(0.00)	1.15**	(0.04)	-0.66 ϕ	(0.11)	
0.45	0.51	0.00***	0.89	0.06*	0.82	0.15	0.00***								
BRA			0.00***	0.05*	0.55	0.00***	0.01**	0.14	0.18	0.00***	0.00***	0.40	0.02**	0.05**	0.63
CHL				0.71	0.06*	0.09*	0.11	0.89	0.92	0.00***	0.18	0.26	0.63	0.66	0.02**
COL					0.07*	0.39	0.28	0.71	0.74	0.00***	0.84	0.29	0.96	0.56	0.05**
CRI						0.01***	0.01***	0.14	0.16	0.33	0.02**	0.31	0.06*	0.12	0.82
DOM							0.66	0.21	0.26	0.00***	0.32	0.04**	0.39	0.09*	0.00***
ECU								0.17	0.19	0.00***	0.25	0.05**	0.28	0.10*	0.01***
SLV									0.99	0.00***	0.49	0.52	0.66	0.90	0.12
GTM										0.00***	0.55	0.54	0.70	0.89	0.15
HND											0.00***	0.00***	0.00***	0.00***	0.08*
MEX												0.08*	0.88	0.21	0.00***
PRY													0.24	0.50	0.31
PER														0.49	0.03**
URY															0.07*

t test for the null that both countries have the same Boone Estimator. Coefficient from Column 1 in Table 3.
(Prob>t) : * significant at 10%; ** significant at 5%; *** significant at 1%

Appendix B

Supplemental material for Chapter 4

B.1 Summary Statistics per Income Quintile

Table B.1. Yearly Income (USD) by Quintile before and after the CAE regulation

Treatment	Yearly Income by Quintile (USD)	mean	std.dev.	cv
Before CAE	1	4,172.95	594.00	0.14
	2	6,812.23	900.84	0.13
	3	10,516.39	1.317.34	0.13
	4	17,198.8	2,868.65	0.17
	5	46,157.46	41,894.51	0.91
After CAE	1	4,319.55	615.67	0.14
	2	6,827.07	884.33	0.13
	3	10,524.29	1,336.37	0.13
	4	17,198.80	2,843.34	0.17
	5	43,592.49	34,250.60	0.78

Table B.2. Age by Quintile Before and After the CAE regulation

Treatment	Yearly Age by quintile	mean	sd	cv
Before CAE	1	42.95	13.74	0.32
	2	41.09	13.49	0.32
	3	40.34	12.04	0.29
	4	41.96	11.51	0.27
	5	45.07	10.68	0.23
After CAE	1	46.84	13.74	0.29
	2	41.90	13.36	0.31
	3	40.21	12.26	0.30
	4	41.22	11.49	0.27
	5	44.31	10.72	0.24

Table B.3. Default by Quintile Before and After the CAE regulation

Treatment	Default by quintile	mean	sd	cv
Before CAE	1	0.11	0.31	2.84
	2	0.13	0.33	2.32
	3	0.14	0.34	2.52
	4	0.14	0.35	2.46
	5	0.14	0.35	2.46
After CAE	1	0.15	0.36	2.37
	2	0.16	0.36	2.32
	3	0.15	0.36	2.34
	4	0.14	0.35	2.43
	5	0.13	0.33	2.61

Table B.4. Loan Amount (USD) by quintile before and after the CAE regulation

Treatment	Loan Amount by Quintile (USD)	mean	std.dev	cv
Before CAE	1	1,952.06	3,033.28	1.55
	2	3,136.02	3,476.27	1.11
	3	4,664.76	4,483.44	0.96
	4	6,803.18	7,134.07	1.05
	5	13,358.98	15,581.82	1.16
After CAE	1	2,381.44	2,734.02	1.15
	2	3,649.31	3,433.69	0.94
	3	5,171.89	4,652.84	0.90
	4	7,731.19	7,549.85	0.98
	5	15,875.82	16,463.81	1.04

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