Essays on Trade Integration and Firm Dynamics

PhD Thesis

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August 2008

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to my parents
to Shulim

Aknowledgement

Completing the Ph.D thesis has been an important experience, I would like to thank many people for this. My first thank goes to my supervisor Jaume Ventura for showing me what is interesting, teaching me to focus and giving me stimulating advice. I am very grateful to Paula Bustos and Gino Gancia for their invaluable advice and their patience. Gino supported me in many occasions and provided me with good suggestions anytime I needed. Talks with Paula were fundamental to this work: her positive attitude towards research was of great inspiration for me.

A special thanks goes to Sebastien Roux, Pauline Givord, Dider Blanchet and Hélèn Erkel-Rousse who allowed me to conduct my research at INSEE.

Further, my work hugely benefited from discussions with my coauthors Harald Fadinger, Guy Lalanne and Stefan Berger; from comments of the participants to the International Breakfast Seminars and from talks with Romain Ranciere, Diego Puga, Thijes Van Reens, Francis Kramarz and Libertad Gonzalez.

Anthony Briandt, Xavier Boutin, Simon Quantin, Jean-Jacques Kasparian and Claire Lelarge helped me with data issues and, more importantly, with enjoying my Parisian experience.

The best time of my Ph.D. was the one spent with my friends. I had the chance to know wonderful people who shared with me joys, pains and emotions. They were the most precious gift I received in these years.

Finally I thank my sister who took care of me, provided me with energies when I had none and never let me gave up.

This thesis is dedicated to my parents, my inner strength and to Shulim, my inspiration. Leaving away from them was the most difficult part in the writing of this thesis.

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Chapter 1

Introduction

This thesis deals with the integration of firms into export markets when trade barriers decrease.

Since the mid-1990s empirical studies on firm-level data sets have uncovered new stylized-facts on firms that trade. Exporters have been shown to be few and systematically bigger, more productive, more capital and skill-intensive than non-exporters. Moreover these characteristics hold in all sectors, even if narrowly defined. These findings, being at odds with the usual hypothesis of firm-homogeneity in trade models, have motivated a lively debate in trade literature. Melitz (2003) relaxed that assumption in a trade model a la Krugman. By doing this he provided an elegant theoretical framework to rationalize those stylized facts. This model has become the new workhorse of trade theory based on firm-heterogeneity. Since then theoretical research has progressed substantially. Empirical research, on the other hand, is lagging behind.

By using one of the best available data sets on firm-level trade, this thesis aims to partially fill the gap between theoretical and empirical literature, with a particular interest in the relation between firm-level trade and the main policy trade barrier, namely tariffs.

The first chapter analyzes the effects of a reduction in tariffs by a trading partner on the exports of firms. More precisely, it focuses on how cross-industry differences in factor intensities and within-industry differences in firm productivity shape the response of the extensive (the decision to export) and the intensive (the exported volumes) margin of firm's export. I examine the response of French firms to the reduction of Turkish import tariffs that followed the entry of Turkey in the European Customs Union in 1996.

As expected a reduction in variable export costs increases the probability to export. Somewhat surprisingly, the effect is stronger in sectors without comparative advantage. At first sight this finding seem at odds with the intuition that trade liberalization leads to specialization in comparative advantage sectors, like in standard neoclassical models. However, I illustrate a possible explanation through a partial equilibrium model which includes firm level heterogeneity and sector level compara-

tive advantage in a standard way. In this model only firms with productivity above a threshold enter the export market, this threshold being lower for sectors with comparative advantage. As trade partner tariffs fall, the productivity threshold to export decreases by more in sectors without comparative advantage. This is the case because, even if the cut-off productivity to enter the export market falls in the same proportion as tariffs in all sectors, its level was initially higher in sectors that do not have comparative advantage.

The aim of the second chapter is to decompose the effect of tariffs on the extensive and intensive margins of trade. We provide an answer to the following question: do tariffs inhibit trade flows by limiting the entry of exporters ('firm extensive margin') or rather by restricting the volumes exported by firms ('firm intensive margin')?

Using a gravity equation approach we analyze how the decrease in tariffs promoted during the 90's by the Uruguay Round multilateral trade agreement affected the trade margins of French firms for 57 products to 147 countries from 1993 to 2002. Our results suggest that both margins contribute to the increase in aggregate French trade when tariffs drop, even after controlling for all sets of countries, products fixed effects as well as macro-shocks. We then discuss the biases that may affect the specification and the reason why a IV procedure is needed. By taking those biases into account, we find that tariffs significantly affect trade only through the *extensive margin* (the number of exporters).

The third chapter describes the dynamics of firms' exports to different countries. Using a panel of almost 19,000 French firms, we define an export-relation as an observed positive flow from a French firm to a destination. We thus establish the following facts:

1. There is great deal of firm-level export dynamics that washes out at a more aggregate level;

2. Quantities shipped by individual firms to specific destinations are very volatile: most of the changes occur within established export relations (*intensive margin*), with new relations or relations that are terminated contributing little to quantity adjustments at firm level (*extensive margin*);

3. The export flows within a newly-created relation involve very small quantities, usually inferior to 1000 euros;

4. Export-relations are also very volatile. Moreover from year to year single firms create and destroy relations *simultaneously*, and country are *simultaneously* involved in the formation and termination of relations;

5. While most of the changes in shipped quantities are explained by firm specific shocks, formation or termination of export relations are rather explained by firm-country specific shocks;

6. The share of not-broken relations is correlated with countries' characteristics: it is higher in bigger and closer markets.

We discuss how those findings could be related to a shock-augmented standard heterogeneous firm model (Melitz (2003)) and to a relation-specific trade model, arguing that the second one seem to fit more naturally *all* the documented facts.

Chapter 2

Firm Heterogeneity and Comparative Advantage: an Empirical Analysis

2.1 Introduction

How do firms react to a decrease in export tariffs? Intuitively, we expect that firms expand their exports. But how does this come about? Which firms expand by more? Along which margin do they expand? Is it that more non exporters begin to export or that firms that were already exporting increase their shipped sales? What is the quantification of these two margins? Do these margins move in the same way across sectors?

The goal of this paper is to provide a description of firm's response to a marginal change in export tariffs. In doing this I consider the main forces that recent heterogeneous firm literature and standard neoclassical theory point out to explain trade: firm level productivity and sector-level comparative advantage. The firm-heterogeneity literature, started with Melitz(2003), shows that only the most productive firms export, and, as tariffs decrease, the more productive non-exporters begin to export. However neoclassical literature extensively uses sector characteristics, and the key concept of comparative advantage, to explain and study trade. Extending the firm heterogeneity model allowing for differences in sector characteristics, or, from the other perspective, relaxing the hypothesis of homogeneous-firms in models that explain trade through sector differences seems the natural direction of trade literature. Very few papers begin to address this issue. None of them provide an empirical analysis of the interaction between sector comparative advantage and firm-heterogeneity. This is the main contribution of this paper.

I provide answers to the questions outlined above by analyzing the response of French firms to the reduction in Turkish tariffs which followed the entry of Turkey in the European Customs Union in 1996. I study France among European countries for two reasons. The first is that France is provided with detailed firm-level data. The

data sets I use, collected at INSEE, report information on French firms' balance-sheet characteristics and on their export sales to each foreign country. I can thus observe the characteristics of those firms, among 60.000 firms within 60 manufacturing sectors, who export precisely to Turkey in the years around the Customs Union formation. The second is that France is Turkey's third trading-partner among European countries. If Turkey's entry into European Customs Union affected European countries, then I could capture a big part of the effect by observing French economy.

I find that:

- The Customs Union formation had a huge impact on French aggregate export to Turkey, which increased by 40% between 1995 and 1996 and by 80% between 1995 and 1999. The 60% of this increase was explained by the average shipped volumes (intensive margin) and the remaining 40% by the number of French exporters (extensive margin) to Turkey.

Previous results were specific to Turkey: French exports to the rest of the world in that same period increased by 16% only.

As expected the response of French economy was substantial. I thus turn to study the firm-level export-market participation. The empirical identification of the impact of a reduction in variable trade costs on French firms' export behavior is based on a generalized difference in difference methodology where the source of variation is the change in Turkish tariffs across time and industries. On this margin I find that:

- A 1 percentage-points decrease of Turkish import tariffs increased the probability of a French firm to export to Turkey by 0.042 percentage-points;

- The result above changes if we take into account capital (skill) intensity of French sectors. In fact, the probability of exporting to Turkey for French firm increases by 0.135 percentage points in the top 1st percentile of labor-intensive sectors and by 0.012 percentage points in the bottom 75th percentile of labor-intensive ones. Thus, the extensive margin is more reactive for sectors without comparative advantage as tariffs decrease.

I control for potential biases of my results. First, time fixed effects take account of differences in export-market participation over time. Second, the main concern on tariffs coefficient could be that tariffs are correlated with industry characteristics. By introducing time-invariant industry fixed effects at the same level of tariffs I control for this potential bias. Third, tariffs coefficient may be biased if tariffs and firm characteristics are correlated: if French sectors which export big volumes to Turkey, are very concentrated, then Turkey could have set industry tariffs considering French firms' specific characteristics. I address this issue by introducing firms' unobserved fixed effects. Finally the generalized difference in difference approach could not take account of time-varying industry trends which, in turn, may be correlated with tariffs. To address this issue I perform a set of control-experiments that consist in using as dependent variable the probability of French firms to export to other destinations or blocks of destinations, like Morocco, China, Italy, Romania, Russia, Hungary, Algeria,

the entire world and the entire world except Turkey. If my results on Turkey come from time-varying industry trends which are spuriously correlated with import Turkish tariffs change, then those control experiments should deliver the same results I found for Turkey. This is not the case, thus confirming the robustness of my results. This finding is puzzling if we have in mind a neoclassical model of comparative advantage, that predict that each country specializes and thus exports mostly in sectors with comparative advantage.

Finally on the intensive margin my results are the followings:

- A decrease of Turkish tariffs by 1 percentage-point increases the shipped flows to Turkey at existing French exporters by 3% on average and by more in high labor- intensive sectors.

Albeit results on the intensive margin are big in magnitude, they are not robust to the inclusion of time trends. This may be the case if exporters were sensitive to the entry of Turkey in European Customs Union but not specifically to the reduction in tariffs. In fact, since I include the exported flows by each firm to other destinations, Turkish tariffs capture the remaining effect of time-trends on Turkey flows. Thus my tentative conclusion is that the intensive margin reacted to Customs Union but through channels different from tariffs. Also in this case, the effect was surprisingly bigger for labor-intensive sectors.

A trade model that could explain these results should combine the following ingredients: firm level heterogeneity within each industry (only some firms manage to export), comparative advantage at the industry level, a variable trade cost to export which captures the movement of tariffs. I thus build a simplified partial equilibrium model in which France and Turkey trade in a continuum of sectors, each sector uses two production factors with different intensities, firms are heterogeneous within each sector and there are fixed and variable costs to trade. As in the standard Hecksher-Olihn model, capital-intensive sectors enjoy a cost advantage when located in France, since its capital/labour ratio is higher than in Turkey. As in the Melitz (2003) model, only firms with productivity above a threshold enter the export market since they are productive enough to cover costs to export. The export threshold is lower for comparative advantage sectors, since firms in these sectors enjoy a cost advantage given by the relative lower cost of production's factors used intensively. Thus, even with high tariffs firms in comparative advantage sectors have a higher probability of exporting than firms with the same productivity level in sectors with no comparative advantage.

As trade partner tariffs fall, the productivity threshold to export decreases by more in less comparative advantage industries and, as a result, the probability to enter the market increases by more for firms in these industries. This is the case because, even if the cut-off productivity to enter the export market falls in the same proportion as tariffs in all sectors, its level was initially higher in less comparative advantage sectors. This is consistent with my empirical findings.

On the intensive margin the result is opposite. The effect of partner's tariffs reduction on revenue is bigger for firms that initially exported more, the ones in

comparative advantage industries. This is the case because, as in the standard one-sector model, firm's revenues elasticity to tariffs is greater than one. This result comes from the monopolistic competition assumption and from the love of variety utility. My empirical results on this margin are not completely consistent with the ones in this model.

The model I propose is related to Bernard, Redding and Schott (2007) one. They study a general equilibrium economy with two countries that differ in factor abundance, two sectors which differ in factor intensities and heterogeneous firms within each sector. Their model is built in a general equilibrium framework and does not clearly assess the mechanism I am interested in since many results are simulated. My contribution in this sense has been to reconcile the theory to my specific case-study and pin down a clear mechanism through which theory can account for my puzzling results on the extensive margin.

The findings in this paper are related to empirical studies on firms and trade liberalization, firm-level intensive and extensive margin and trade and comparative advantage.

First, there are many papers that use firm-level data to analyze firms that trade. Many of them analyze the characteristics of firms that export without considering a trade liberalization episode (Bernard and Jensen (1997a), Aw and Hwang (1995) among others). Others study how trade liberalization induces a change within each firm (Bustos 2005, Bustos 2007 for technology adoption, Pavnick (2002), Schor (2004) among others for productivity upgrading, Trefler (2004) analyzes different outcomes for Canadian sectors). Finally few papers analyze the choice of firms to export after a reduction in trade costs, albeit using a change in import tariffs to identify their empirical strategy, like Bernard, Jensen and Schott (2006) for US between 1987 and 1997. Differently from previous papers I use a change in export tariffs to estimate firms export choices. Bustos (2007) uses a similar policy change and estimates the entry into export market for Argentinean firms after the reduction of Brazilian tariffs induced by the formation of Mercosur. She finds that a 1 percentage-point reduction of Brazilian import tariffs increases the probability to export for Argentinean firms of 0.42 percentage-points. Her result is much higher in magnitude than mine. The difference could arise from an over-representation of bigger firms in Argentinean data set or from differences in macro-characteristics (like industrialization level) between Argentina and France.

Second, the intensive and extensive margins of trade at firm level have been analyzed by Eaton, Kortum and Kramarz (2004) in French firm data set for 1986. They estimate how the number of exporters and the average exports by firm explain the cross-country variation of French exports in one year. They find that the number of firms capture a bigger part of that variation. Differently from them, I use a dynamic framework and I calculate how the two trade margins account for the change in French export after a policy episode which features a decrease in trade barriers.

Third, on the comparative advantage side, the empirical literature has mainly analyzed the neoclassical theories by testing predictions on the content of trade that these models feature, but without considering the specific effect of a change in tariffs

on sector marginal reaction, which models like standard Hecksher-Olhin could not predict. An improvement of neoclassical models in this direction has been made by Romalis (2004) who analyzes a trade model which features endowment comparative advantage in a monopolistic competition framework. The prediction he gets is that countries capture larger shares of world trade in sectors that use their abundant factor more intensively. However, even if the model features the existence of variable trade costs to export, there are no clear predictions when tariffs decrease. Moreover his model can not have predictions on the extensive and intensive trade margins, since firms are homogeneous. From a theoretical perspective the key of my contribution in this direction lies on the fact that I consider a marginal effect of trade on the response of sectors with different comparative advantage more than an average effect, like all other papers do. The main concerns of this literature is to analyze what happens when a closed economy becomes open, my point of view relies in observing what happens when an open economy becomes more open. Moreover, my empirical contribution is unique in this direction.

Fourth, this paper could be related to Chaney (2008) which argues that in sectors with a low elasticity of substitution the extensive margin is highly sensitive to trade barriers while the intensive margin is not. The similarity in our works is to analyze both industry and firm-level heterogeneity in a unified framework.

The remainder of the paper is organized as follows. Section 1 describes the timing of Turkey's entry in European Customs Union and provides a descriptive analysis of French reaction along the intensive and the extensive margins. In Section 2 I illustrate a model that accounts for firm heterogeneity and sector comparative advantage. In section 3 I describe the data and the variables of interest. Section 4 deals with the econometric strategy and the empirical results. Section 5 concludes.

2.2 Preliminary Analysis of EU-Turkey Customs Union

2.2.1 A brief background

Turkey's first application for European Community (EC) membership dates back to July 1959, followed by the signing of the Ankara Association Agreement. This agreement specified the three stages through which Turkey would prepare for full membership of the Community: a preparatory stage aimed at helping Turkey to develop its economy, a transitional stage aimed at reaching the Customs Union and a potential third stage to eventually bring Turkey to full membership.

In the *preparatory stage*, which lasted five years, the EC gave unilateral concessions to Turkey in the form of agricultural tariff quotas and direct financial aid to help Turkey to develop its economy. At this stage Turkey didn't have to change its trade regime, which was very inward looking.

The *transition stage* was meant to last from 12 to 22 years and to culminate with the formation of a Customs Union (CU) between the two parties. According to the Additional Protocol of 1973 (which gave practical details on the way to reach the Customs Union) the EC would have to reduce tariffs and equivalent protection

measures during the '70s. Turkey was assigned a longer transitional period between 12 and 22 years to reduce tariffs and to harmonize its standard to the EC ones. EC countries soon accomplished their requirements by abolishing tariffs and equivalent taxes and restrictions on industrial imports from Turkey, though with some strategic exceptions (machine woven carpets, cotton yarn and cotton textiles)[1]. Turkey did not manage to comply with its required tariffs reduction due to political and economic instability. After the Cyprus crises of 1974 and the military "golpe" of 1980 EU-Turkey relations was interrupted and the agreement was economically and politically broken up.

During the'80s, however, Turkey successfully managed to begin a liberalization process and to experience an economic growth. In 1987 it re-applied for EU membership. At this time EC was dealing with the completion of internal market, so negotiations began only in 1993, and finalized on the 6th March 1995 with the Association Council decision that Turkey would enter the European Customs Union, starting on January the 1st, 1996. However, according to the Maastricht Treaty, the agreement had to be ratified by the European Parliament, and that ratification was not granted due to concerns over Turkey's human right's records. After lobbying and pressures from different institutions the Parliament ratified the agreement in December 1995 and the CU came into force in January 1996.

According to the Customs Union Decision (CUD) of the 6th March 1995 the extent of the CU was the following[2] :

- Turkey had to eliminate all tariffs, customs duties, quantitative restrictions, charges having equivalent effect to customs duties and all measures having equivalent effect to quantitative restrictions in trade of industrial goods with EU by January the 1st, 1996;

- Turkey had to adopt the Common Customs Tariff (CCT) against third countries' imports by the same date and adopt all the EU preferential agreements with third countries by 2001;

- Common agricultural policy (CAP) was not included in the CUD;

- the "European Coal and Steel Community" (ECSC) products, basically iron and steel, was exempted from the CU. However in 1996 Turkey and EU signed a Free Trade Agreement (FTA) to let these goods circulate freely after three years;

- Turkey would have to work toward the harmonization of competition policy, intellectual and industrial property rights, customs classification rules, valuation, rules of origin, technical regulations, standards and government procurements;

[1]However, EC countries continued to apply quotas and minimum import price which were within the framework of the Common Agricultural Policy and also non-tariff barriers against some goods (e.g. textiles, iron and steel, raisins, fresh fruit and vegetables) remained high.

[2]This section borrows from Erdogan (2002) Togan (1995), Togan (1997).

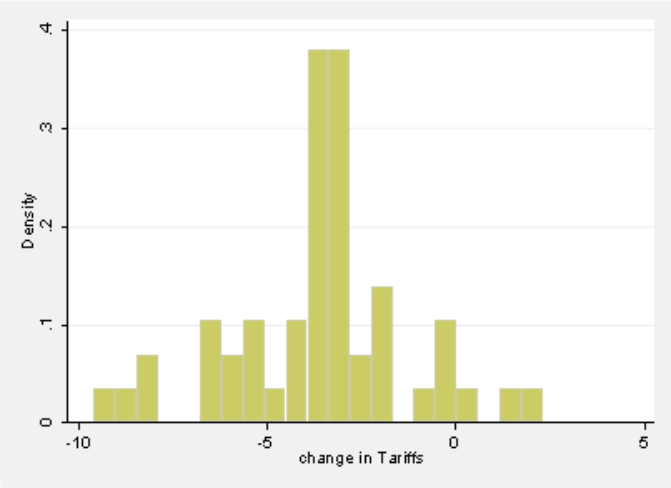

Figure 2.1: Change in Turkish import tariffs after the entrance in EU Customs Union: All sectors excluding "Food, Beverages and Tobacco"

- Finally two important issues remained out of the CUD: the supply of service and the (freely) circulation of capital and labor.

2.2.2 Elimination of the trade barriers

What has been the real extent on the trade barriers elimination provided by EU-Turkey CU?

Since it is hard to quantify the effect of the CU on non-tariffs barriers and policy harmonization, we can use the reduction in Turkish effectively applied tariffs toward EU, available in TRAINS-WTO data set, to proxy for all the other changes. According to this source of information Turkish import tariffs decrease consistently after the CU even if they were not set to "0". The variation of effectively applied tariffs is shown in Figure 2.1 for all sectors and in Figure 2.2 for all sectors excluding "Food, Beverages and Tobacco". If we exclude this sector, Turkey import tariffs against EU decreased from an average of 7.88% in 1995 to 4.65% in 1999. Moreover the variation of tariffs among sectors remained quite high: the standard deviation in tariffs in 1999 was around 4.60. Including the "Food, Beverages and Tobacco" sector the average variation of tariffs went from 9.80% in 1995 to 7.80% in 1999.

In this paper I use this reduction of Turkish tariffs to explore the response of French firms. I have chosen France, among European countries, for two reasons. The first is that French Statistical Agency-INSEE collects very detailed data on French firm balance sheet (BRN data set), and, more importantly, on French firm export sales to different destinations (DOUANE data set).This helps me in dissecting the effect of tariffs reduction on firm export choice by considering exactly those firms that export to Turkey (and not to any destination), in the years around the CU [3] .

[3]The years I consider go from 1995 to 1999, since all the data sets I combine have information for

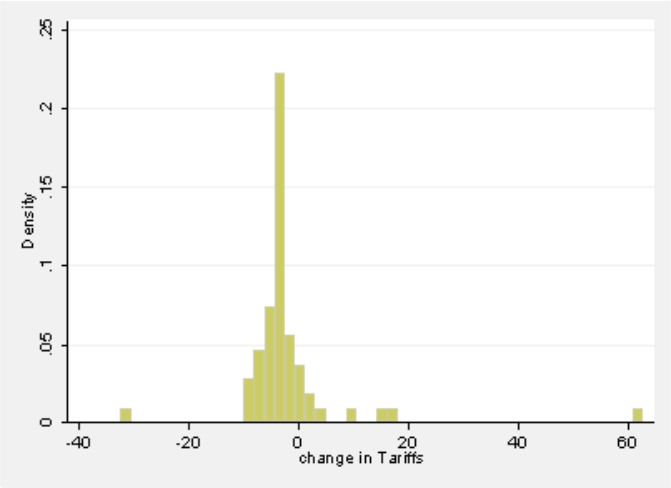

Figure 2.2: Change in Turkish import tariffs after the entrance in EU Customs Union: All sectors

The second reason is that France is Turkey's third trading-partner among European countries [4] . If Turkey's entry into EU-Customs Union affected European countries, I could capture a big part of it by analyzing French economy.

In the rest of this section I report preliminary findings on the substantial change of French exports to Turkey, before and after the CU. I then show how the aggregate increase in French export to Turkey can be explained by an increase in the number of exporters: the extensive margin and flows by exporter: the intensive margin of trade. I then propose the same decomposition at sector level, obtaining puzzling results with respect to sector capital intensity margin. The aim of this analysis is to describe in a detailed way the effect of CU on French exports and to indicate a few effects which I further analyze in the rest of the paper.

The entry of Turkey in the European Customs Union affected French exports quite strongly. Between 1995 and 1996 (the year of entry) France increased its exports to Turkey by 40% and by 80% between 1995 and 1999, as shown in Table 2.1. Compared with the growth in exports to Turkey in the years before CU (2%) or with the growth in exports to the rest of the world in the same period (-1% in 1996 and 16% between 1995 and 1999), the huge effect seems to come from the formation of the CU. The aggregate French export growth to Turkey may be decomposed in the following way:

$$ln\left(\frac{Q_t}{Q_{t-1}}\right) = ln\left(\frac{\overline{Q_t}}{\overline{Q_{t-1}}}\right) + ln\left(\frac{N_t}{N_{t-1}}\right) \tag{2.1}$$

where the first part refers to the intensive margin (the change in average flows) and the second to the extensive margin (the change in number of exporters). The interest

these years only.

[4]The first is Germany and the second Italy.

Percentage growth rate of French export to...			
	94-95	95-96	95-99
Turkey: total	0.02	**0.40**	**0.80**
Turkey: number of firms	0.13	**0.16**	**0.21**
Turkey: average quantity	-0.11	**0.24**	**0.60**
ROW: total	0.10	-0.01	0.16
ROW: number of firms	0.012	-0.007	-0.043
ROW: average quantity	0.088	-0.003	0.21
Morocco: total	0.12	-0.04	0.25
Morocco: number of firms	0.001	0.0004	0.01
Morocco: average quantity	0.12	-0.04	0.24

Table 2.1: Decomposition 1 of Total French Exports to Turkey, Rest Of the World and Morocco.

of the literature in this decomposition is not only descriptive, but also normative since the extensive margin is a proxy for product varieties[5] and a large fraction of trade models[6] predict that the number of varieties increases welfare.

Both margins explain trade between countries, but the literature still lacks a quantification of the movements of these margins following a liberalization episode. Eaton, Kortum and Kramarz (2004) estimate those extensive and intensive margins for French exports towards the rest of the world in 1986. They find that the extensive margin explains a bigger fraction of the aggregate French exports. By applying decomposition 2.1 I find that almost the 40% of the total growth in exports to Turkey is explained by the increase in the number of exporters while a 60% is explained by the increase in average flows. The same decomposition for exports to other destinations in the same years, reported in Table 2.1, reveals that, in those cases, the extensive margin explains a smaller part of the growth in total exports.

Even if many French firms entered Turkey after the CU, they exported very small quantities. We can decompose the aggregate French growth rate to Turkey according to a different perspective by considering the change in export flows for continuing exporters (which I indicate with STAY) and the change in export flows given by the entry-exit dynamic (indicated as NET-ENTRY)[7]:

[5]Under the hypothesis that each firm produces a different variety of goods, like all models with monopolistic competition suggest.

[6]Basically all models with love-of-variety utility function and monopolistic competition structure, from Krugman (1980) on.

[7]The finding that new entrants tend to export small quantities compared to continuing exporters seem to be true across all destinations. In Chapter 4 of this thesis more insights on this point are provided by looking at French export toward all destinations throughout five years.

year	ΔQ_t^{TOTAL}	$\frac{\Delta Q_t^{TOTAL}}{Q_{t-1}^{TOTAL}}$	$\frac{\Delta Q_t^{STAY}}{\Delta Q_t^{TOTAL}}$	$\frac{\Delta Q_t^{ENTRY}}{\Delta Q_t^{TOTAL}}$	$\frac{\Delta Q_t^{EXIT}}{\Delta Q_t^{TOTAL}}$	$\frac{\Delta Q_t^{ENTRY}+\Delta Q_t^{EXIT}}{\Delta Q_t^{TOTAL}}$
1994-1995	12.90	0.02	-0.79	3.43	-1.64	1.79
1995-1996	**421.80**	**0.49**	**0.9**	**0.17**	**-0.7**	**0.1**
1996-1997	276.00	0.22	0.92	0.19	-0.11	0.08
1997-1998	84.50	0.05	0.87	0.55	-0.41	0.13
1998-1999	267.20	0.16	1.07	0.17	-0.24	-0.07

Note: first column in millions of Francs

Table 2.2: Decomposition 2 of Total French *Export* to Turkey by years.

$$\frac{\Delta Q_t^{STAY}}{\Delta Q_t^{TOTAL}} + \frac{\Delta Q_t^{NET-ENTRY}}{\Delta Q_t^{TOTAL}} = 1 \tag{2.2}$$

Table 2.2 reports results for decomposition 2.2 for different years as well as the export change in levels(in column 1). The change in exported sales to Turkey between 1995 and 1996 was of 422 million francs (almost 64 million of euros) which is a huge quantity compared to the change in previous years. Almost 90% of this change came from an increase in exports by firms which were already exporting (column 3), while 17% was the exported sales by newly exporting firms and 10% by the firm exit-entry dynamic. In levels, the entry-exit margin refers to almost 43 million francs between 1995 and 1996, almost the double than the 23 millions francs between 1994 and 1995.

Are these findings constant across sectors?

In Table 2.3 I report Decomposition (2.1) and (2.2) at the sector level using 2-digit NES classification, the one used at INSEE [8] . The sectors are ordered by increasing capital intensity[9]. Here I have in mind neoclassical trade theory and the main concept of endowment comparative advantage. According to neoclassical theories each country specializes in those sectors which use relatively more intensively those factors the country is relatively more endowed with. As the French capital/labour ratio is higher than the Turkish one, neoclassical theory suggests that France should export capital intensive goods to Turkey and import labor intensive goods from Turkey. Even if existing models do not account for the movement of the extensive and the intensive margin across sectors with different degree of comparative advantage[10], I expect that both margins should react more in capital intensive sectors, the one in which France enjoy a comparative advantage with respect to Turkey[11] .

[8]The 2-digit NES classification consists in 15 manufacturing sectors while the 3-digit one consists in 60 manufacturing sectors. This is the maximum available disaggregation.

[9]Capital Intensity is calculated from NBER-US data. As I will explain in further section this refers to the "optimal capital intensity" of each sector and not to the actual capital intensity in French sectors even if the two measures are positively correlated.

[10]With the exception of Bernard-Redding-Schott (2006), which unfortunately do not provide closed form solutions to explore this issue.

[11]According to the standard HO model only comparative advantage sectors export, thus all the effects of a trade liberalization should be observable only in these sectors.

	Decomposition 1			Decomposition 2	
	TOTAL	AVERAGE	NUMBER	STAY	NET ENTRY
Total	0.40	0.24	0.16	0.90	0.10
by 2-digit NES sector					
Apparel, Textile and Leather Products	0.81	0.40	0.41	0.70	0.30
Furniture and Fixture	0.27	-0.05	0.32	0.82	0.18
Printing and Publishing	0.45	0.23	0.22	0.52	0.48
Paper, Lumber and Wood Products	0.02	-0.19	0.22	3.36	-2.36
Transportation Equipment	1.29	1.29	0.00	1.003	-0.003
Textile Mill Products	0.06	-0.13	0.19	0.85	0.15
Mechanic Equipment	0.55	0.45	0.11	0.82	0.18
Electric and Electronic Equipment	0.13	0.14	-0.02	0.28	0.72
Electric and Electronic Components	0.38	0.26	0.12	0.88	0.12
Food, Beverages and Tobacco	1.12	1.06	0.06	1.04	-0.04
Mineral Products (Stone, Clay, Glass Products)	0.51	0.29	0.23	0.96	0.04
Chemicals and Allied Products	0.27	0.21	0.06	0.90	0.10
Fabricated Metal Products	0.57	0.32	0.24	0.79	0.21
Motor Vehicles and Equipment	0.02	-0.04	0.07	0.67	0.33
Drugs, Soaps and Cleaners	0.20	0.13	0.07	0.98	0.02

Table 2.3: Decomposition 1 and 2 of Total French *Export* to Turkey by Increasing Capital Intensity Industries for year 1995-1996.

Surprisingly, results in Table 2.3 show this is not the case. The total export growth and the intensive margin vary a lot among different sectors in 1996 and they do not seem to be correlated with sector capital intensity. The margins of the second decomposition (columns (4) and (5)) are also very volatile across sectors and their movement does not seem to be associated with sector capital intensity. The movement along the extensive margin, instead, presents a puzzling kind of regularity: it grew a lot in labor-intensive sectors like Apparel, Textile and Leather Products or Furniture and Fixture while it grew very slowly in capital-intensive sectors like Drugs, Soaps and Cleaners[12].

What are the possible explanations of this finding?

A first reason may be the existence of "outsourcing": after the reduction of Turkish tariffs more French firms export to Turkey intermediate goods and import back final goods. If this was the case we should observe an increase of the number of French importers from Turkey in the same period in labor-intensive sectors. Table 2.4 shows this is not the case, in fact total imports from Turkey increased only by 6% in the same year of the Customs Union[13] and the extensive margin reacted more in capital-intensive sectors.

[12]This finding is true also controlling for the total number of firms in each sector. The probability of French firms to export to Turkey (measured as number of exporters over total number of active firms in each sector) is higher for firms in capital intensive sectors (Drugs and Soaps, Chemicals, Electric Components), but increased by more in less capital intensive ones after the Customs Union.

[13]The huge Turkish import growth rate in 1996 has been documented in some case studies. Erdogdu (2002) for example noticed that "Since the EU had already abolished its tariffs from imports from

	TOTAL	INTENSIVE	EXTENSIVE
Total	0.06	-0.07	0.13
by sector			
Apparel, Textile and Leather Products	0.13	0.04	0.09
Furniture and Fixture	0.47	0.40	0.06
Printing and Publishing	-0.70	-0.11	-0.59
Paper and Allied Products, Lumber and Wood Products	0.13	0.30	-0.17
Transportation Equipment	0.16	0.16	0.00
Textile Mill Products	-0.12	-0.21	0.08
Mechanic Equipment	0.69	0.35	0.34
Electric and Electronic Equipment	0.06	-0.38	0.44
Electric and Electronic Components	0.27	-0.09	0.36
Food, Beverages and Tobacco	-0.25	-0.29	0.04
Mineral Products (Stone, Clay and Glass Products)	-0.17	-0.61	0.44
Chemicals and Allied Products	-0.02	-0.05	0.03
Fabricated Metal Products	0.13	-0.20	0.33
Motor Vehicles and Equipment	0.28	0.11	0.17
Drugs, Soaps and Cleaners	1.35	1.62	-0.27

Table 2.4: Decomposition 1 for Total French *Import* from Turkey by Increasing Capital Intensity Industries for year 1995-1996.

A second reason may be a productivity change within French firms in the same years of CU. Recent models of trade suggest that more productive firms are the ones that export. It may be the case that French firms, in the same years I am analyzing, upgrade their productivity in some sectors while not in others and this is driving previous finding. At a first sight, figure 2.3 and 2.4 show this is not the case. In these figures I plot for sectors with very different capital intensity their firms' productivity distribution[14](in the left hand side panel of each figure) and the estimated probability of exporting for each productivity level (in the right hand side panel) for the period before and after the CU (1994-1995 vs 1996-1999). While firms' productivity distributions did not change very much in the two periods, the probability of exporting increased a lot after the 1996 for firms in "Apparel, Textile and Leather Products" for each level of TFP. The same is not true for other sectors like "Drugs and Cleaners" one for example.[15].

This description of French export to Turkey in the years around the entry of Turkey in CU showed that:

1. the growth rate of aggregate French exports to Turkey was huge;

2. it was due to an increase in the number of French exporters to Turkey (albeit they begin to export very small quantities) and to an increase in shipped volumes

Turkey, the Customs Union did not bring about a significant liberalization of Turkish exports to the EU. On the contrary, the dismantlement of trade barriers in favor of the EU led to a surge in imports from Europe, culminating in steep rise in Turkey's trade deficit with EU in 1996".

[14]TFP is calculated according to Olley-Pakes as I will explain in further section.

[15]I do not report graphs for other sectors since they are consistent with findings in Table 2.3.

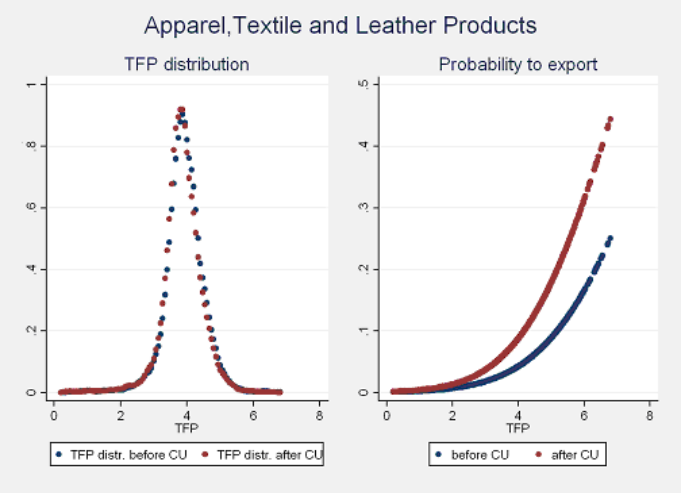

Figure 2.3: Productivity distribution and probability to export

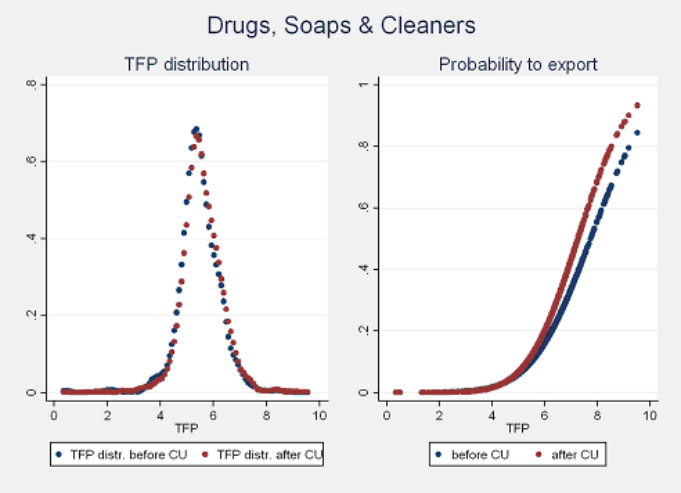

Figure 2.4: Productivity distribution and probability to export

at incumber exporters. The second effect is higher in magnitude than the first;

3. the entry of new French exporters to Turkey was higher in labor-intensive sectors, the ones in which France does not enjoy a comparative advantage with respect to Turkey.

In the rest of the paper I describe a model in which French firms could export or not to Turkey depending on their characteristics, on the level of Turkish import tariffs and on the comparative advantage their sector enjoys with respect to Turkey.

This framework clarifies that in a standard model that allows for asymmetries in the initial level of the main variables, we can generate the preliminary finding on the extensive margin discussed before. The key to the result lies in the fact that the model analyzes an open economy which becomes more open, so the main effect it captures works at the margin and not at the average. The predictions of the model are then formally tested.

2.3 The model

In this section I illustrate a trade model with standard assumptions on demand and supply side that predicts reactions at the firm-sector margin. I consider a continuum of sectors and a continuum of firms inside each sector. The heterogeneity of firms is introduced as in Melitz (2003): firms differ by an exogenous productivity. The heterogeneity of sectors is introduced similarly to a two factors Hecksher-Olihn model: each sector has a higher comparative advantage with respect to the trade partner if it uses more intensively the factor its country is more endowed with. Each country has a different capital-labor ratio (or skill-unskill ratio) and each sector uses a different share of each factor to produce. In this economy the asymmetry among countries is given by factor endowment; the asymmetry across sectors is given by factor intensities and the asymmetry across firms within sectors is given by exogenous productivity. However the firms' productivity distribution is the same across sectors and countries[16].

The assumptions of the model are the followings:

- There are two countries that only differ on factor abundance, skilled and unskilled workers[17] : Turkey (T) is less skill-abundant with respect to France (F);
- Consumers have Cobb-Douglas preferences over different sectors goods and CES preferences over goods within each sector;
- There is a continuum of sectors $i \in (0, 1)$ which use skilled and unskilled workers with a Cobb-Douglas technology. Technology is the same across countries and

[16]Bernard, Redding and Schott (2007) build a general equilibrium model with two countries, two production factors, two sectors and heterogeneous firms within each sector. The following model, described in a partial equilibrium environment, can thus be considered a simplified version of their model with a continuity of sectors.

[17]Alternatively the two factors could be capital and labor.

time. The index i ranks industries by relative factor intensity: industries with higher i are more skill intensive;

- The two factors, inelastically supplied, are mobile within country but not across them, thus skilled and unskilled wages are equalized across sectors in each country;
- In each sector there is a continuum of firms. Each firm has an exogenous productivity which does not change through time. Each sector has the same firms' productivity distribution;
- Each firm in each sector produce a different good using the same factor proportion as other firms in its sector and its own specific productivity;
- Firms compete in a monopolistic competition environment;
- There is no entry and exit of firms from the domestic market in each country;
- There are variable and fix costs to export (thus all firms produce for the domestic market and only some of them export);
- Wages are taken as given: the reduction of import tariffs in Turkey does not affect French labor market and viceversa.

These assumptions seem reasonable. First, France only exports to Turkey the 1% of its total production[18], thus the partial equilibrium framework is a good environment to study the trade between these two countries. Second, the Customs Union did not allow for labor and capital movements between Turkey and European countries. As a consequence, the skill-premium difference between Turkey and France remained positive after the tariffs reduction. Finally, this Customs Union consisted mainly in the reduction of Turkey's import tariffs. French import tariffs from Turkey had already been low since the 1970s. This allows me to abstract from the increasing competition from Turkey to France and, as a consequence, from entry/exit in French domestic market[19].

The formal description of French economy, under previous hypothesis, is described hereafter[20] . Consumer's utility is given by Equations (2.3) and (2.4), and the standard demand derived from these is given by Equation 2.5:

$$U = \int_0^1 b_i ln C_i di \tag{2.3}$$

$$C_i = \left(\int_0^1 q_i(\omega)^\rho d\omega \right)^{\frac{1}{\rho}} \tag{2.4}$$

[18]This will be shown in a later section

[19]In fact, as we saw in previous section, the French exports to Turkey grew by 40% between 1995 and 1996 while the French imports from Turkey increased by 6% in the same period: 421 millions of Francs against 14 million of Francs respectively.

[20]The sub-index F, indicating France, is omitted when it is possible without creating confusion.

$$q_i^D(\omega) = \left(\frac{p_i(\omega)}{P_i}\right)^{-\sigma} \frac{E_i}{P_i} \tag{2.5}$$

where $E_i = b_i Y$ is the fraction of income each consumer spends in goods of industry i; $\sigma = \frac{1}{1-\rho}$ is the constant elasticity of substitution greater than 1 (being $0 < \rho < 1$, P_i) is the Price Index for sector i and $p_i(\omega)$ is the price of good ω in sector i.

Price Index is given by the following:

$$P_i = \left(\int_{\omega \in \Omega_i} p(i,\omega)^{1-\sigma} d\omega\right)^{\frac{1}{1-\sigma}} \tag{2.6}$$

where Ω_i represents the exogenous mass of available goods in sector i.

Firms compete in a monopolistic competition environment. The output of each industry consists of a number of varieties that are imperfect substitutes for one another. Each variety is produced by a firm with a productivity level denoted by ϕ. In each sector and in each country the distribution of firms' productivity is the same. All firms produce for domestic market and only some of them export. From now on I focus only on the costs, revenues and profits earned from export, being the domestic ones standard. The total cost function for producing for foreigner country is:

$$TC_{i,x,F}(\varphi) = \begin{cases} f_{i,x} + \frac{\hat{q}_i(\varphi)}{\varphi} w_{S,F}^{\beta_i} w_{L,F}^{1-\beta_i} & \text{if } \hat{q}_i(\varphi) > 0 \\ TC_{i,x,F}(\varphi) = 0 & \text{otherwise} \end{cases} \tag{2.7}$$

In the total-costs function, $\hat{q}_i(\varphi)$ is the supplied quantity, $f_{i,x}$ is the fixed cost the firm pays to sell in the foreign market, β_i is the skill-factor intensity in sector i and $w_{S,F}$ and $w_{L,F}$ are skilled- and unskilled- workers wages in France respectively.

Notice that β_i is higher for sectors which use more intensively skilled workers, that is for sectors that are ranked with a higher i. Since France is more skill-endowed than Turkey, the sectors located in France with higher β_i have a higher comparative advantage degree with respect to Turkey. Thus β_i is the theoretical measure of comparative advantage.

The price each F firm sets is:

$$p_{i,F}(\varphi) = \frac{\tau_{i,T} w_{S,F}^{\beta_i} w_{L,F}^{1-\beta_i}}{\rho\varphi} \tag{2.8}$$

where $\tau_{i,T}$ is a standard iceberg trade cost that captures the tariff imposed by Turkey on sector i's goods from France.

Turkish demand faced by each French exporter is given by:

$$q_{i,T}(\varphi) = \frac{E_{i,T}}{P_{i,T}} \left(\frac{\tau_{i,T} w_{S,F}^{\beta_i} w_{L,F}^{1-\beta_i}}{\rho\varphi P_{i,T}}\right)^{-\sigma} \tag{2.9}$$

Thus total export-profits are:

$$\pi_{i,x,F}(\varphi) = \tau_{i,T}^{1-\sigma} \frac{\left(w_{S,F}^{\beta_i} w_{L,F}^{1-\beta_i}\right)^{1-\sigma}}{\sigma} \frac{E_{i,T}}{\left(\rho P_{i,T}\right)^{1-\sigma}} \varphi^{\sigma-1} - f_{i,x} \tag{2.10}$$

The open economy version of the Price Index in Turkey can be written as:

$$P_{i,T}^{1-\sigma} = N_T \left[p_{i,d,T}(\tilde{\varphi}_T)\right]^{1-\sigma} + N_{i,x,F} \left[\tau_{i,T} p_{i,d,F}(\tilde{\varphi}_{i,x,F})\right]^{1-\sigma} \tag{2.11}$$

where plugging Equation 2.8 becomes:

$$P_{i,T}^{1-\sigma} = \left(w_{S,T}^{\beta_i} w_{L,T}^{1-\beta_i}\right)^{1-\sigma} \frac{N_T}{\left(\rho\tilde{\varphi}_T\right)^{1-\sigma}} + \left(w_{S,F}^{\beta_i} w_{L,F}^{1-\beta_i}\right)^{1-\sigma} N_{i,x,F} \left(\frac{\tau_{i,T}}{\rho\tilde{\varphi}_{i,x,F}}\right)^{1-\sigma} \tag{2.12}$$

that is an average of the prices of all the goods sold in Turkey (both produced in Turkey and imported from France) weighted by their numbers. In particular we can easily distinguish goods produced and sold in Turkey (the first addend) and goods imported from France (the second addend). N_T and $N_{i,x,F}$ are respectively the number of goods (or of firms) produced and sold by each sector in Turkey and the number of goods imported from France. While $\tilde{\varphi}_T$ and $\tilde{\varphi}_{i,x,F}$ are the average productivity of Turkish firms and that of French firms which produce for the Turkish market. Notice that $\tilde{\varphi}_T$ is constant across sectors[21]; on the contrary $\tilde{\varphi}_{i,x,F}$ is sector-specific since in every French sector a different number of firms could in principle export to Turkey:

$$\tilde{\varphi}_T = \left(\int_0^{\infty} \varphi_T^{\sigma-1} \mu(\varphi) d\varphi\right)^{\frac{1}{\sigma-1}}$$

$$\tilde{\varphi}_{i,x,F} = \left(\frac{1}{N_{i,x,F}} \int_{\varphi_{i,x,F}}^{\infty} \varphi_F^{\sigma-1} \mu(\varphi) d\varphi\right)^{\frac{1}{\sigma-1}}$$

Substituting the Turkish Price Index into profit function of France exporters we have:

$$\pi_{i,x,F}(\varphi) = \tau_{i,T}^{1-\sigma} \frac{\left[\frac{w_{S,F}^{\beta_i} w_{L,F}^{1-\beta_i}}{w_{S,T}^{\beta_i} w_{L,T}^{1-\beta_i}}\right]^{1-\sigma} \frac{1}{Z_T}}{1 + \left[\frac{w_{S,F}^{\beta_i} w_{L,F}^{1-\beta_i}}{w_{S,T}^{\beta_i} w_{L,T}^{1-\beta_i}}\right]^{1-\sigma} \frac{Z_{x,F}}{Z_T}} \frac{E_{i,T}}{\sigma \left(\rho P_{i,T}\right)^{1-\sigma}} \varphi^{\sigma-1} - f_{1,x} \tag{2.13}$$

where

$$\frac{Z_{x,F}}{Z_T} = \frac{N_{i,x,F}}{N_T} \left(\frac{\tilde{\varphi}_{i,x,F}}{\tau_{i,T}\tilde{\varphi}_T}\right)^{\sigma-1}$$

[21] It is so because all firms in this model produce for the respective domestic market and we are assuming that all sectors share the same productivity distribution.

is a measure of the degree of competition between French exporters and Turkish domestic firms in Turkey. Since Turkey pre-liberalization tariffs were high and the number of French exporters was low compared to domestic producers, I analyze the case of a low degree of competition, in particular when $\frac{Z_{x,F}}{Z_T} \to 0$ we can rewrite export-profits (Equation (2.13)[22]) and export-revenues as follows

$$\pi_{i,x,F}(\varphi) = \tau_{i,T}^{1-\sigma} \left[\left(\frac{SP_F}{SP_T} \right)^{1-\sigma} \right]^{\beta_i} \varphi^{\sigma-1} F_{i,T} - f_{i,x} \tag{2.14}$$

$$r_{i,x,F}(\varphi) = \tau_{i,T}^{1-\sigma} \left[\left(\frac{SP_F}{SP_T} \right)^{1-\sigma} \right]^{\beta_i} \varphi^{\sigma-1} F_{i,T} \tag{2.15}$$

where $F_{i,T} = \left(\frac{w_{L,F}}{w_{L,T}} \right)^{1-\sigma} \frac{E_{i,T}}{\sigma Z_T \rho^{1-\sigma}}$ is a constant and $SP_\bullet$ is the skill-premium in each country.

A firm exports only if its productivity is high enough to cover fix and variable export costs and have non-negative profits. By setting Equation (2.14) equal to zero we obtain the exporting threshold. This is the minimum level of productivity that a French firm in a given sector needs to have in order export to Turkey:

$$\varphi_{i,x,F} = \tau_{i,T} \left(\frac{SP_F}{SP_T} \right)^{\beta_i} \left(\frac{f_{i,x}}{F_{i,T}} \right)^{\frac{1}{\sigma-1}} = \tau_{i,T} \left(\frac{SP_F}{SP_T} \right)^{\beta_i} D_{i,T} \tag{2.16}$$

where, in the second equality, all the constant terms have been replaced by $D_{i,T}$. All firms with productivity higher than $\varphi_{i,x,F}$ do export.

Equation (2.16) shows how the exporting-threshold varies according to tariffs and comparative advantage for given fix costs to export, foreign expenditure and productivity distribution.

Export threshold and per-firm revenue give us information on the way the probability of exporting and export flows react in different sectors as Turkey decreases its tariffs toward France.

Equation (2.16) implies that the threshold decreases when tariffs decrease and comparative advantage increases[23]. As expected a tariff liberalization increases the probability of exporting in all sectors, given comparative advantage (as in Melitz); the probability of exporting is higher for comparative advantage sectors given tariffs (HO intuition). However as the *starting* threshold is lower for comparative advantage sectors, a *marginal* tariffs reduction will affect *by more* the threshold in no comparative advantage sectors. As a consequence the probability of exporting of firms in those sectors will also be more affected. The three results are summarized by the following derivatives[24]:

[22] This assumption can be relaxed and results are valid after more cumbersome algebra and under coefficients restrictions.

[23] It is so because France is more endowed with skilled workers, its skill-premium is lower than the Turkish one, thus the ratio of skill-premiums is lower than 1.

[24] The full derivation is shown in the first Appendix of this chapter.

$$\frac{\partial \varphi_{i,x,F}}{\partial \tau_{i,T}} > 0; \frac{\partial \varphi_{i,x,F}}{\partial \beta_i} < 0; \frac{\partial^2 \varphi_{i,x,F}}{\partial \tau_{i,T} \partial \beta_i} < 0$$

It worth emphasizing that in this exercise I analyze the change from an *open* to a *more open* economy. In recent liberalization episodes it is hard to argue that we observe a transition between autarchy and open economy. This was definitely not the case of France and Turkey since even before Customs Union there was bilateral trade in all sectors.

The intensive margin, namely the change in flows by continuing exporters, is captured by revenues in Equation (2.15)[25]. The model leads to the following predictions on incumbent revenues:

$$\frac{\partial r_{i,x,F}(\varphi)}{\partial \tau_{i,T}} < 0; \frac{\partial r_{i,x,F}(\varphi)}{\partial \beta_i} > 0; \frac{\partial^2 r_{i,x,F}}{\partial \tau_{i,T} \partial \beta_i} < 0$$

and

$$\epsilon(r_{i,x,F}(\varphi), \tau_{i,T}) = 1 - \sigma < 0$$

As in Melitz (2003) I find that revenues increase with a decrease in tariffs. Similar to HO, revenues are higher in comparative advantage sectors given firm productivity level and tariffs. Finally the effect of trade liberalization is higher for comparative advantage sectors as the cross derivative shows. The intuition of this result comes from the "Krugman" part of the model: the monopolistic competition hypothesis. Demand for goods depends more than proportionally on prices (through σ). The price is inversely proportional to productivity and directly proportional to tariffs. When the price decreases (through a reduction in tariffs) demand increases more than proportional. This inflates revenues. Since revenues in sectors with a comparative advantage were already high, their level will increase by more than their counterpart in sectors with no comparative advantage.

The predictions obtained on the extensive and the intensive margins are at the firm-level. However we could obtain sector-level predictions as well. For example, the firm-level prediction on the *probability of each firm* to export becomes the sector-level prediction on the *proportion* of French exporters to Turkey. Some previous papers use a firm heterogeneity model to test sector-level predictions [26]. By doing this however we could incur in problems both at the theoretical and at the empirical level. To obtain sector-level predictions we need to aggregate firm-level productivity at the sector-level. This is usually done in the literature using a Pareto distribution function, which has been argued to well represent firm size distribution[27]. However, depending on the chosen distribution function, this aggregation could change the direction of some theoretical results. I show it for the results in this paper in the second Appendix to this chapter.

[25] I consider changes in revenues instead of changes in shipped quantities to be consistent with data.
[26] See for example Helpman-Yeaple-Melitz (2004)among others.
[27] Notice that in this kind of models firm size is a monotonic increasing function of firm productivity.

At the empirical level the aggregation of firm-level data to sector-level ones may create biases, as well. First, in order to aggregate observations at the sector level, it is necessary to use few statistics that take account of firm productivity distribution, like the mean or the standard deviation of that distribution. By using firm-level data, instead, we rather take the actual productivity distribution into account. Second it may also be the case that firm-level variables are correlated with sector-level variables included in the regression. In this case using aggregate sector statistics instead of actual firm-level variables may bias the results[28].

2.4 Data and variable construction

The data set I use has been constructed from four different sources. Data on French firm level characteristics comes from the BRN (Bénéfices Réels Normaux) data set collected at INSEE (*Institute National de la Statistique et des Études Économiques*). This data set contains, for different years, balance-sheet information of French firms whose turnover is higher than 3,5 millions of francs (about 530.000 euros). The sample accounts for the 60% of all French firms. Each firm is classified according to 3-digit NES classification that accounts for 60 manufacturing sectors.

The variables I use from this data set are described hereafter. *Labor* is a full time-equivalent measure that accounts for part-time workers and refers to the end of the year. *Value added* is defined as the difference between production and materials, added to production subsidies minus value added tax and other accrued taxes or credits for production. It is divided by the industry value added price index at the two-digit level of the French industrial classification taken by the national accounts. *Labor cost (wages)* is equal to the total labor compensation costs. *Real capital stock* is measured as the inflation-adjusted gross book value of fixed assets including construction and other fixed assets. *Total sales* and *total sales to export* are the balance sheet voices for domestic and shipped total sales (to any single country). I take all firms in manufacturing industries reported in BRN data set after eliminating the ones with negative or null value added, number of workers and capital. For each firm I then take total export sales and Turkey export sales in different years from DOUANE data set, also available at INSEE, which provides information about sales and export destination for each exporter. In some cases DOUANE and BRN have different information about the export status of a single firm; I thus eliminate these observations through all the years.

Table 2.5 reports numbers of observations in the data set, showing per year number of operating firms, exporters, exporters to Turkey, as well as total sales to Turkey compared to total exported sales of French firms. The merged data set contains information on an average of 60.000 firms between 1994 and 1999. The number of firms differs from year to year since some firms exit the BRN data sets. I consider

[28] In my analysis this may be the case if firms in a sector with high level of comparative advantage are more productive than those in other sectors. This may be for example the case if, as shown by Bernard-Redding-Schott (2007), the HO comparative advantage induces a magnification of Ricardian comparative advantage.

	Number of observations per year					
	1994	1995	1996	1997	1998	1999
Operating firms	69563	64939	61326	59848	57257	55016
of which exporters	24349	23807	23395	23469	23254	22622
of which exporters to Turkey	2082	2323	2698	2926	3015	2838
as % of operating firms	**2.99**	**3.58**	**4.4**	**4.89**	**5.27**	**5.16**
as % of total exporters	**8.55**	**9.76**	**11.53**	**12.47**	**12.97**	**12.55**
Total production (billion of Francs)	338	351	346	360	372	372
Total exported sales (billion of Francs)	119	130	129	146	155	154
Total exported sales to TK (billion of Francs)	0.842	0.847	1.27	1.54	1.61	1.89
as % of total production	**0.25**	**0.24**	**0.37**	**0.43**	**0.43**	**0.51**
as % of total exported sales	**0.71**	**0.65**	**0.98**	**1.05**	**1.04**	**1.23**

Table 2.5: Observations in the Sample

those firms that exit from the BRN data set as firms that exited from the market itself. As found in many papers for other countries, the exporters are a small percentage of overall firms, around one third. Almost the 9% of all exporters export to Turkey and this percentage increases through time. Sales to Turkey represents around the 0.4% of total French production and 1% of total French exports. This indicates that using a partial equilibrium environment in analyzing the trade relation between France and Turkey is the most convenient framework.

Standard statistics for variables used in the analysis are reported in Table 2.6. It worth noticing that French firm-level data sets contains information also on very small firms (with virtually "0" workers or "0" capital).

I next turn to explain how firm productivity is measured in the analysis, being productivity the main theoretical determinant of firm export status. As a first measure of productivity I take the distance between firm and sector average labor productivity (value added per worker)[29] . This productivity measure, even if it is only a proxy for total factor productivity, works quite well throughout the analysis. However, as firm productivity is an important control variable in regression specifications, I also consider more sophisticated and reliable measures of Total Factor Productivity (TFP). TFP is usually estimated as a residual of a Cobb-Douglas log-linearized production function. However, as many previous empirical studies argued, this estimation is biased because of simultaneity and selection biases. The first bias arises because firms may adjust one of their production factor (capital) knowing a part of their productivity, which is unknown by the econometrician. Thus the estimated coefficient for capital may be biased since it is correlated with an unknown firm level heterogeneous term which is left in the error term. Selection bias, instead, may arise because in this data set some firms exit and presumably they are the less productive ones. I thus use Olley-Pakes semi-parametric estimation method to measure TFP controlling for both biases[30]. The simultaneity bias is taken into account by using an investment

[29]This normalization allows me to take account of the sector component of labor productivity.

[30]Pavnick (2002) and Arnold (2005) explain extensively this methodology.

	main variables statistics				
	Obs	Mean	Std. Dev.	Min	Max
Dataset firm level variables					
workers in log	367949	2.58	1.35	0	11
value added in log	366059	8.09	1.47	0	17.7
capital in log	367949	7.71	1.79	0	17.8
materials in log	347894	8.14	1.81	0	18.9
wage in log	469614	6.54	1.44	0	15.4
Obtained firm level variables					
labour productivity	366059	-0.13	0.51	-5.96	5.64
TFP (OP)	366059	1.51	0.13	-3.67	2.31
TFP (OP-SB)	366058	1.52	0.14	-4.45	2.34
Dataset sector level variables					
Turkey import tariffs 1995	58	9.8	7.76	0.5	52
Turkey import tariffs 1997	58	8.17	10.84	0	67
Turkey import tariffs 1999	58	7.79	12.12	0.05	77
Obtained sector level variables					
US Capital Intensity	57	4.3	0.71	2.49	6
US Skill Intensity	57	0.39	0.13	0.19	0.74

Table 2.6: Basic Statistics

function that links capital stocks to capital flows and by estimating the coefficient of capital with a non-parametric technique[31]. Selection bias is taken into account by incorporating an estimate of the survival function in the second non-parametric stage. Table 2.6 shows some descriptive statistics on TFP estimations as well[32].

Data on industry capital and skilled comparative advantage have been obtained using NBER Manufacturing data set. Sector skill-intensity is the ratio of non-production wages over total wages. Sector capital-intensity is given by capital per worker (taken in logarithms)[33]. These are good measures for French comparative advantage with respect to Turkey. The reason is that France is more skilled- and capital-endowed than Turkey. Thus France has a relative comparative advantage, with respect to Turkey, in skilled- and capital-intensive sectors[34]. Table 2.7 and Figure 2.5 show the measures of the capital and skilled labor comparative advantage for 2-digit sector level. French sector with higher level of comparative advantage with respect to

[31]Levinshon-Petrin propose a very similar estimation methodology than the Olley-Pakes one. It consists in using a function for the demand of intermediate factors (material) instead of an investment function to correct for the simultaneity bias. They propose this method since in firm-level data sets many records for investment are zero, thus the Olley-Pakes method could not be accurate. For French data set Olley-Pakes and Levinshon-Petrin TFP estimates are very correlated. All results presented in next section are robust to both the TFP measures.

[32]Notice that correlation among different measures is very high

[33]Measures in the same fashion have been recently used in Cuñat & Melitz (2005), Romalis (2004).

[34]Notice that since I am looking at the comparative advantage index among two countries I do not need to include a term that indicates the difference in capital or skilled labor endowment in the two countries since such a term would only change the scale of the comparative advantage measure. Also notice that using US capital- and skill-intensity measures is a way to obtain a sort of "exogenous" measure of sector factor intensity. The underlying hypothesis is that US produces at the frontier in every sector, thus its factor-intensity measures are the "optimal" ones.

Sectors at 2-digit NES	Turkish Applied Import Tariffs			Difference in Tariffs		Comp. Adv.	
	1995	1997	1999	95-97	97-99	US CI*	US SI*
Apparel, Textile and Leather Products	18.83	9.22	11.18	-9.61	1.96	2.63	0.29
Furniture and Fixture	9.87	9.34	7.57	-0.529	-1.778	3.48	0.38
Printing and Publishing	8.02	5.16	3.87	-2.865	-1.285	3.65	0.56
Paper, Lumber and Wood Products	6.48	3.63	2.44	-2.848	-1.188	3.73	0.28
Transportation Equipment	6.6	3.14	2.33	-3.46	-0.806	3.84	0.41
Textile Mill Products	11.3	9.14	18.46	-2.166	9.326	3.97	0.24
Mechanic Equipment	5.27	2.85	1.92	-2.419	-0.927	3.98	0.42
Electric and Electronic Equipment	5.53	3.37	2.12	-2.164	-1.251	4.02	0.62
Electric and Electronic Components	7.95	4.21	2.46	-3.742	-1.754	4.17	0.45
Food, Beverages and Tobacco	18.4	30.71	31.07	12.311	0.361	4.27	0.33
Mineral Products	6.45	3.52	2.74	-2.931	-0.777	4.36	0.31
Chemicals and Allied Products	8.96	6.53	6.02	-2.425	-0.514	4.37	0.38
Fabricated Metal Products	12.29	4.23	3.34	-8.063	-0.885	4.47	0.3
Motor Vehicles and Equipment	9.07	6.95	5.55	-2.126	-1.401	4.66	0.21
Drugs, Soaps and Cleaners	7.03	4.16	3.68	-2.87	-0.48	4.8	0.58

*Note: US CI is US Capital Intensity and US SI is US Skill Intensity

Table 2.7: Comparative advantage measures and tariffs decrease by 2-digit NES classification

Turkey are "Drugs, Soap and Cleaners", "Chemicals Products", "Transportation", "Mechanical Equipment" and "Electric and Electronic Components". As expected Turkey has higher comparative advantage in traditional sectors like "Apparel, Textile and Leather Products" and "Textile Mills".

Finally Turkish tariffs against French goods are available in the WTO-TRAINS data set and they have been described in a previous section of this chapter.

The final data set in this paper reports the information for almost 60,000 firms, active in 57 sectors, in the years 1995, 1997 and 1999.

2.5 The empirical results

In this section I estimate the model's predictions on the impact of a tariffs reduction on French firms' export behavior. The empirical identification is based on a generalized difference in difference methodology where the source of variation is the change in Turkish tariffs across 57 manufacturing industries (at the 3-digit NES classification) in 3 years (one before the CU: 1995 and two after: 1997, 1999).

I analyze the effect of Customs Union on the following outcome in French firms: probability of exporting; probability of exporting taking sector comparative advantage into account; shipped flows at incumbent firms; shipped flows at incumbent firms taking sector comparative advantage into account.

2.5.1 Extensive margin: the probability of exporting

The model predicts that a firm will export whenever its productivity is higher than the export productivity threshold in its sector. The export threshold, in turn,

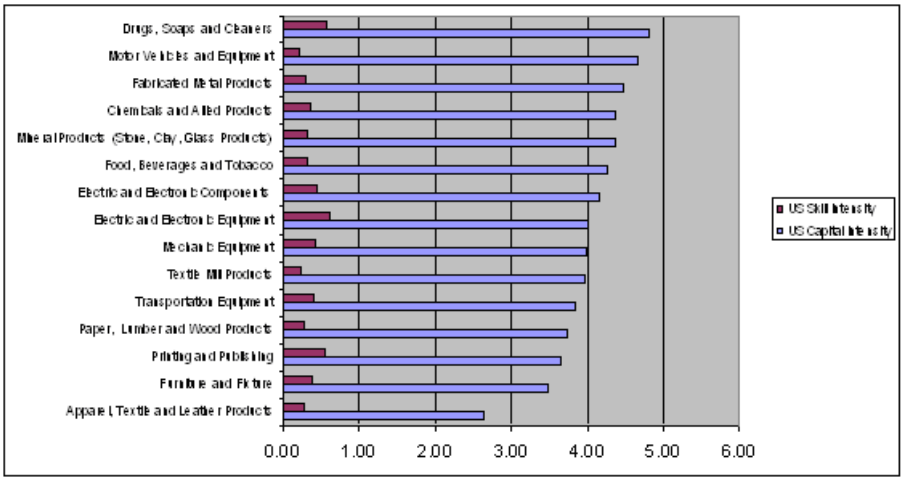

Figure 2.5: US skill-intensity and capital-intensity

depends positively on tariffs. Therefore, when tariffs decrease some firms, among very productive non-exporters, enter the export market. This is captured by the following derivative $\frac{\partial \varphi_{i,x,F}}{\partial \tau_{i,T}} > 0$.

To empirically test this prediction I run the following Linear Probability Model (LPM):

$$EXP(T)_{i,j,t} = \beta_1 \tau_{j,t} + \beta_2 \varphi_{i,j,t-1} + \beta_3 Z_{i,j,t-1} + \delta_j + \delta_t + \epsilon_{i,j,t} \tag{2.17}$$

where i indexes firms; j indexes 3-digit-NES industries; t indexes time (years 1995, 1997, 1999); $EXP(T)_{i,j,t}$ is a dummy with value 1 if the firm export to Turkey in a given year and 0 otherwise; $\tau_{j,t}$ are Turkish tariffs toward France imports in each sector and year; $\varphi_{i,j,t-1}$ is firm productivity obtained with different measures as discussed in the previous section; $Z_{i,j,t-1}$ refers to a set of firm time-variant controls which I describe afterward. Along with coefficients, regression 2.17 estimates a set of industry dummies that controls for unobserved time-invariant industry characteristics, δ_j, and a set of time-dummies that control for time-varying shocks that affect all industries proportionately, δ_t. The first ones are introduced to control for all those sector characteristics that can affect on average the probability of exporting in each sector, such a specific fixed cost to export, comparative advantage itself, elasticity of substitution and so on. Introducing them allows me to control for the possibility that the initial level of Turkish tariffs had been set to protect Turkey against the competition of specific French (or European) industries. Time fixed effect control for macro-shocks which could explain the change in probability of exporting besides the specific change in tariffs. Regression 2.17 , estimated with sector fixed effect, is a pooled regression in which panel structure is not specified. This regression, thus, estimates the average effect of tariffs (or productivity) on the probability of exporting.

The expected sign of the tariffs coefficient in regression 2.17 is negative since the probability to export for a firm in the model is given by the distance between its level

of productivity, φ, and the export threshold, $\varphi_{j,x,F}$:

$$\frac{\partial \varphi_{j,x,F}}{\partial \tau_{j,T}} > 0 \rightarrow \frac{\partial \left(\varphi - \varphi_{j,x,F}\right)}{\partial \tau_{j,T}} < 0 \rightarrow \beta_1 < 0$$

These derivatives help us to understand why it is important to control for firm level productivity in the empiric exercise. Although in the model productivity is held fixed through time for each firm, this is not the case in real world. A firm could change its export status because of a productivity upgrading in the same period in which tariffs are reduced. If that upgrade is spuriously correlated with tariffs change, by omitting firm productivity, tariffs coefficient is biased.

Moreover there could be concerns that firms that enter export market become more productive, thus I introduce one-year lagged firm productivity to control for endogeneity. However, in this analysis the endogeneity issue is not very likely since most of the firms which decide to enter the Turkish market after 1996 were already exporters, albeit in other markets. Thus, even if we are concerned by the existence of potential backward gains -from trade to firm productivity-, this is not an issue in this case[35].

The second important control variable is a dummy that takes the value of 1 if the firm exports to any other destination besides Turkey the year before and 0 otherwise. Bernard and Jensen (2004) shows that sunk cost to be an exporter (in any destination) are empirically relevant. Thus, it may be that a firm that was an exporter albeit not to Turkey could enter Turkey after the reduction in tariffs much easier than another firm. If the starting export status of French firms was correlated with Turkish tariffs, then, by omitting it, we could have a biased coefficient. Having the information on export status to any other destination I can successfully control for this potential bias.

Finally other firm level controls are firm size measured as number of workers, firm capital intensity measured as capital per worker and firm's cost of labor, all introduced in logs. These variables are mainly introduced to control for other time-variant firm level characteristics which may be important in the decision of a firm to export. Moreover since measured productivity doesn't vary so much through time, these variables may capture with more precision firm dynamic structure.

Results for regression 2.17 are reported in columns (1) to (5) of Table 2.8. As expected, a reduction of Turkish tariffs increases the average firm's probability of exporting to Turkey. In the simplest specification, in which I introduce only tariffs in the right hand side of regression 2.17 , 1 percentage-point decrease in these increases the probability to export by 0.053 percentage points. In specification (2) I add Olley-Pakes TFP estimation of firm productivity. I find that a 1 standard deviation increase in TFP increase the probability to export by 0.33 standard deviation log-points. In specification (3) I add the export status of previous year. As expected, if a firm was exporting to any destination except Turkey in previous year, it exports to Turkey with a higher probability in the current year. Not surprisingly the firm productivity

[35]There is however another reason to introduce lagged firm level productivity and this is the fact that labor is measured at the end of the year in my data set, while export refers to any date before the end of the year, thus introducing a lag gives me a more precise time structure.

coefficient is now lower, since productivity and export status were expected to be positivly correlated. When I add other firm characteristics the firm-productivity coefficient decreases from 0.030 to 0.017 due to the fact that in column (3) firm productivity was accounting for all time-variant firm level characteristics.

All the regressions have robust standard errors and are clustered at the 3-digit-NES sector level to take into account possible heteroskedasticity and to relax the hypothesis of independence of residuals, thus residuals are supposed independent across sectors but not within them.

A last observation regards the choice of using LPM instead of a probit (or a logit). Since it is necessary to estimate these regressions with fixed effects, I am more willing to accept the problems that a regression with LPM may have (prediction on probability outside the 0-1 range) than the consequences of the incidental parameter problem a probit/logit regressions have.

Regression 2.17 may be improved by allowing for the panel structure of the data set and running the following:

$$EXP(T)_{i,j,t} = \beta_1 \tau_{j,t} + \beta_2 \varphi_{i,j,t-1} + \beta_3 Z_{i,j,t-1} + \delta_i + \delta_t + \epsilon_{i,j,t} \tag{2.18}$$

which differs from 2.17 since it accounts for firm unobservable time-invariant heterogeneity through the introduction of firm, instead of sector, fixed effects. Results are reported in columns (6) to (10) of Table 2.8. Using 2.18 instead of 2.17 improves the results in different directions.

First, allowing for firm fixed effect, allows me to check for the case that Turkish tariffs are correlated with French firm characteristics. Suppose France has a sector with a very few number of firms with some specific characteristics. Suppose that this sector exports a very high volume of sales to Turkey. If Turkey set its tariff to protect against a specific French sector and if this sector is mainly composed by few firms, than it is plausible that initial Turkish tariffs are correlated with French firm characteristics (at least for some sectors), thus the tariff coefficient may be biased. If it exists, this bias is very small since tariffs coefficient in this specification does not change much, remaining in the range of -0.042.

Second, productivity coefficients in 2.17 are most probably biased since it is plausible that there are some unobservable firm characteristics (like management quality and so on) which are positively correlated with productivity. If they are not taken into account the productivity coefficients in columns (2) to (5) of Table 2.8 will be upwards biased. This seems to be the case since the estimated coefficients for TFP are much smaller when I allow for firm fixed effect (from 0.017 of column (4) to 0.007 of column (9)). The same intuition underlies the lower coefficient on past exporting status in this set of regression. Since being an exporter (to any destination) is very persistent in the data set, the dummy that controls for past export status may be very correlated with a firm fixed effect and this is why this variable is no longer significant in some specifications of regression 2.18.

Third, with this specification I can control for a third potential problem, deriving from the sector disaggregation. The maximum sector disaggregation available in this

data set is 3-digit NES one which consists in 60 manufacturing sectors[36]. It is plausible that there are sector characteristics at a more disaggregated level which are correlated with initial level of tariff and that I am not capturing by using only 60 sectors. In this way I allow for unobservable effects which may be correlated with tariffs to vary at a much more disaggregated level.

Finally, with this specification, I am taking into account the panel structure of my data (which I am not doing with the pooled OLS of the previous model). Even if, as long as individual fixed effect are not correlated with our variable of interest, the coefficients in the previous specification are unbiased, still this regression allows for more efficiency and for the specific fact that the mean effect (in the constant) is firm specific rather then constant over all observations. In column (7) I am looking at the marginal change in probability of exporting within each firm when tariffs and firm productivity changes through time. Thus the coefficient of productivity now tells us that if within a firm the productivity increases by 1 standard deviation then the probability of exporting for this firm increases by 0.05 standard deviation log-points. Finally, the coefficient of tariffs is similar to the one estimated with sector fixed effect, albeit more significant.

[36]These, in turn, becomes 57 in the analysis since 3 sectors are not considered manufacturing ones in the other data I use

Dependent Variable: export to Turkey										
	LPM with sector FE (pooled LPM)					LPM with firm FE (panel)				
	1	2	3	4	5	6	7	8	9	10
Turkey import tariffs	**-0.053**	**-0.051**	**-0.046**	**-0.044**	**-0.044**	**-0.081**	**-0.044**	**-0.044**	**-0.042**	**-0.041**
	(5.55)***	(2.04)**	(1.98)*	(1.78)*	(1.75)*	(5.55)***	(7.02)***	(7.00)***	(6.58)***	(6.55)***
firm TFP (OP)		**0.043**	**0.03**	**0.017**			**0.005**	**0.005**	**0.007**	
		(5.45)***	(4.58)***	(2.93)***			(4.17)***	(4.13)***	(3.69)***	
firm TFP (OP-SB)					**0.017**					**0.007**
					(2.88)***					(3.72)***
exporter to OD			**0.092**	**0.034**	**0.034**			**0.002**	**0.001**	**0.001**
			(8.31)***	(7.41)***	(7.37)***			(2.35)**	-1	-1
firm size				**0.008**	**0.009**				**0.009**	**0.009**
				-1.25	-1.17				(4.30)***	(4.32)***
firm capital intensity				**0.016**	**0.016**				**0.004**	**0.004**
				(6.36)***	(6.38)***				(3.78)***	(3.75)***
firm wage level				**0.016**	**0.015**				**0.004**	**0.003**
				(2.42)**	(1.94)*				(1.69)*	(1.67)*
N observations	183686	183686	183686	183681	183681	183686	183686	183686	183681	183681
R^2	0.05	0.06	0.1	0.16	0.16					
Cluster	NES 3	NES 3	NES 3	NES 3	NES 3					
Robust CI	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
year dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
sector dummies	YES	YES	YES	YES	YES					

Note:Plant-level regression. Robust t-statistics (in parenthesis)adjusted for clustering at the 3-digit NES industry level classification.
***:significant at the 1% level; **:significant at the 5% level; *: significant at the 10% level.
Dependent variable is a dummy taking value of 1 if the plant exports to Turkey and 0 otherwise.
Constant and dummies coefficient are not reported.

Table 2.8: Probability of Exporting to Turkey: LPM with sector and firm fixed-effect

2.5.2 Extensive margin: testing the comparative advantage hypothesis

I now turn to test the second and new prediction of my model: the effect of a tariff's reduction on the probability of exporting is higher for firms in sector with lower comparative advantage. This is captured by the following derivative: $\frac{\partial^2 \varphi_{i,x,F}}{\partial \tau_{j,T} \partial \beta_i} < 0$. Again this prediction regards all firms in the same sector only because the model considers firm productivity constant through time, which is not the case in real world.

To test empirically this prediction I run the following Linear Probability Models (LPM):

$$EXP(T)_{i,j,t} = \beta_1 \tau_{j,t} + \beta_2 \tau_{j,t} CA_j + \beta_3 \varphi_{i,j,t-1} + \beta_4 Z_{i,j,t-1} + \delta_j + \delta_t + \epsilon_{i,j,t} \quad (2.19)$$

$$EXP(T)_{i,j,t} = \beta_1 \tau_{j,t} + \beta_2 \tau_{j,t} CA_j + \beta_3 \varphi_{i,j,t-1} + \beta_4 Z_{i,j,t-1} + \delta_i + \delta_t + \epsilon_{i,j,t} \quad (2.20)$$

where the first is a pooled OLS model with industry fixed effects and the second a panel FE model. Notice that the difference with respect to specifications 2.17 and 2.18 lies in the introduction of an interacted term between the tariffs and the comparative advantage index. This specification thus allows for the effect of a tariff to be different across sectors according to the measure of capital or skilled intensity. All other variables introduced in these regressions are the same ones I used in specification 2.17 and 2.18, which I discussed earlier.

According to theoretical predictions, I expect the coefficients of 2.19 and 2.20 to be as follows[37]:

$$\frac{\partial \varphi_{j,x,F}}{\partial \tau_{j,T}} > 0 \rightarrow \frac{\partial \left(\varphi - \varphi_{j,x,F}\right)}{\partial \tau_{j,T}} < 0 \rightarrow \beta_1 + \beta_2 CA_j < 0$$

$$\frac{\partial^2 \varphi_{i,x,F}}{\partial \tau_{j,T} \partial \beta_i} < 0 \rightarrow \frac{\partial^2 (\varphi - \varphi_{i,x,F})}{\partial \tau_{j,T} \partial \beta_i} > 0 \rightarrow \beta_2 > 0$$

[37] Notice that there is an abuse of notation since β sub-indexed with i indicates the theoretical comparative advantage and β sub-indexed with a number indicates the coefficients of the regressions

Dependent Variable: export to Turkey								
	LPM with sector FE (pooled)				LPM with firm FE (panel)			
	1	2	3	4	5	6	7	8
Turkey import tariffs	**-0.353**	**-0.369**	**-0.372**	**-0.331**	**-0.252**	**-0.274**	**-0.275**	**-0.264**
	(2.39)**	(2.60)**	(2.63)**	(2.49)**	(3.94)***	(4.29)***	(4.30)***	(4.12)***
*US Capital Intensity	**0.073**	**0.078**	**0.078**	**0.068**	**0.05**	**0.056**	**0.056**	**0.053**
	(2.11)**	(2.31)**	(2.35)**	(2.17)**	(3.36)***	(3.75)***	(3.77)***	(3.57)***
firm TFP (OP)	**0.03**	**0.017**			**0.006**	**0.007**		
	(4.52)***	(2.90)***			(4.23)***	(3.77)***		
firm TFP (OP-SB)			**0.018**				**0.007**	
			(2.89)***				(3.81)***	
firm labor productivity			**0.023**				**0.007**	
				(5.07)***				(3.72)***
exporter to OD	**0.093**	**0.034**	**0.034**	**0.034**	**0.003**	**0.001**	**0.001**	**0.001**
	(8.21)***	(7.28)***	(7.24)***	(7.21)***	(2.36)**	-1	-1	-1.01
firm size		**0.008**	**0.009**	**0.02**		**0.009**	**0.009**	**0.011**
		-1.23	-1.16	(4.28)***		(4.30)***	(4.33)***	(4.42)***
firm capital intensity		**0.016**	**0.016**	**0.012**		**0.005**	**0.004**	**0.003**
		(6.34)***	(6.36)***	(5.78)***		(3.84)***	(3.82)***	(2.67)***
firm wage level		**0.016**	**0.015**	**0.01**		**0.004**	**0.004**	**0.004**
		(2.37)**	(1.88)*	(1.76)*		(1.72)*	(1.69)*	(1.77)*
N observations	180585	180580	180580	180580	180585	180580	180580	180580
R^2	0.1	0.16	0.16	0.16	YES	YES	YES	YES
Cluster	NES 3	NES 3	NES 3	NES 3	YES	YES	YES	YES
Robust CI	YES	YES	YES	YES	YES	YES	YES	YES
year dummies	YES	YES	YES	YES	YES	YES	YES	YES
sector dummies	YES	YES	YES	YES				

Note:Plant-level regression. Robust t-statistics (in parenthesis)adjusted for clustering at the 3-digit NES industry level classification.
***:significant at the 1% level; **:significant at the 5% level; *: significant at the 10% level.
Dependent variable is a dummy taking value of 1 if the plant exports to Turkey and 0 otherwise.
Constant and dummies coefficient are not reported.

Table 2.9: Probability of Exporting to Turkey: LPM with Capital Intensity, sector and firm fixed-effect

Results of regressions 2.19 and 2.20 are reported in Table 2.9. The coefficients of interest are significant in all specifications and of the expected sign. Table 2.10 reports the results of regressions 2.19 and 2.20 using skilled comparative advantage measure instead of capital comparative advantage one. In this case only the model with firm fixed effect yields significant coefficients.

The effect of tariffs reduction on the probability of exporting for different percentiles of capital and skill comparative advantage is reported in Table 2.13[38]. In column (2) I reported the average estimation obtained in regression 2.18, according to which a decrease of 1 percentage points of tariffs increase the probability of exporting of a firm by 0.042 percentage points. However, if we allow for the effect depending on the comparative advantage, we find that the probability of exporting increase by 0.135 percentage points in a sector in the 1st low percentile of capital comparative advantage and by 0.012 percentage points in a sector in the 75th percentile of capital comparative advantage. Thus, just as indicated in the descriptive analysis, the effect of the tariffs reduction on the probability of exporting has been higher for sectors without comparative advantage. A similar result holds for the skilled comparative advantage measure as reported in column (4) even if with a smaller magnitude. A caveat to these results is that the effect of tariffs for sectors whose capital (or skilled) comparative advantage is above the 75th percentile[39] becomes positive.

[38]Columns (3) and (4) of Table 2.13 report respectively the estimated coefficients for regressions in column (6) of Table 2.9 and column (5) in Table 2.10.

[39]This may be given by the rigid structure I used in 2.19 and 2.20 to account for comparative advantage, which I may relax by dividing sectors in different groups defined by their comparative advantage ranking.

Dependent Variable: export to Turkey						
	LPMl with sector FE (pooled)			LPM with firm FE (panel)		
	1	2	3	4	5	6
Turkey import tariffs	**-0.134**	**-0.137**	**-0.134**	**-0.137**	**-0.127**	**-0.126**
	-1.13	-1.11	-1.08	(5.13)***	(4.73)***	(4.69)***
* US Skill Intensity	**0.249**	**0.263**	**0.257**	**0.265**	**0.243**	**0.241**
	-0.84	-0.87	-0.84	(3.74)***	(3.41)***	(3.38)***
firm TFP (OP)	**0.03**	**0.017**		**0.006**	**0.007**	
	(4.53)***	(2.90)***		(4.07)***	(3.63)***	
firm TFP (OP-SB)			**0.017**			**0.007**
			(2.87)***			(3.65)***
exporter to OD	**0.093**	**0.034**	**0.034**	**0.002**	**0.001**	**0.001**
	(8.21)***	(7.27)***	(7.23)***	(2.31)**	-0.98	-0.98
firm size		**0.008**	**0.009**		**0.009**	**0.009**
		-1.24	-1.16		(4.22)***	(4.23)***
firm capital intensity		**0.016**	**0.016**		**0.004**	**0.004**
		(6.34)***	(6.36)***		(3.76)***	(3.74)***
firm wage level		**0.016**	**0.015**		**0.004**	**0.004**
		(2.38)**	(1.89)*		(1.65)*	-1.64
N observations	180585	180580	180580	180585	180580	180580
R^2	0.1	0.16	0.16			
Cluster	NES 3	NES 3	NES 3			
Robust CI	YES	YES	YES	YES	YES	YES
year dummies	YES	YES	YES	YES	YES	YES
sector dummies	YES	YES	YES	NO	NO	NO

Note:Plant-level regression. Robust t-statistics (in parenthesis) adjusted for clustering at the 3-digit NES.
***:significant at the 1% level; **:significant at the 5% level; *: significant at the 10% level.
Dependent variable is a dummy taking value of 1 if the plant exports to Turkey and 0 otherwise.
Constant and dummies coefficient are not reported.

Table 2.10: Probability of Exporting to Turkey: LPM with Skill Intensity, sector and firm fixed-effect

Dependent Variable: export to Morocco								
	OLS with firm FE (panel)				OLS with firm FE (panel)			
	1	2	3	4	5	6	7	8
Turkey import tariffs	**-0.147**	**-0.148**	**-0.034**	**-0.032**	**-0.049**	**-0.05**	**-0.012**	**-0.011**
	(1.71)*	(1.75)*	-0.37	-0.34	-0.69	-0.7	-0.37	-0.34
* US capital Intensity	**0.032**	**0.033**			**0.01**	**0.011**		
	-1.56	-1.6			-0.63	-0.64		
* US skill Intensity			**0.066**	**0.062**			**0.017**	**0.015**
			-0.29	-0.27			-0.2	-0.17
firm TFP (OP)	**0.011**		**0.011**		**0.007**		**0.007**	
	(2.13)**		(2.12)**		(3.29)***		(3.27)***	
firm TFP (OP-SB)		**0.011**		**0.011**		**0.007**		**0.007**
		(1.93)*		(1.91)*		(3.29)***		(3.27)***
exporter to OD	**0.084**	**0.084**	**0.084**	**0.084**	**0.008**	**0.008**	**0.008**	**0.008**
	(9.82)***	(9.83)***	(9.82)***	(9.83)***	(4.74)***	(4.74)***	(4.74)***	(4.74)***
firm size	**0.002**	**0.002**	**0.002**	**0.002**	**0.015**	**0.015**	**0.015**	**0.015**
	-0.36	-0.32	-0.36	-0.32	(5.89)***	(5.89)***	(5.88)***	(5.87)***
firm capital intensity	**0.013**	**0.013**	**0.013**	**0.013**	**0.004**	**0.004**	**0.004**	**0.004**
	(5.76)***	(5.61)***	(5.76)***	(5.61)***	(3.07)***	(3.04)***	(3.06)***	(3.03)***
firm wage level	**0.028**	**0.028**	**0.028**	**0.028**	**0.004**	**0.004**	**0.004**	**0.004**
	(3.69)***	(3.07)***	(3.70)***	(3.07)***	-1.51	-1.52	-1.5	-1.51
N observations	180580	180580	180580	180580	180580	180580	180580	180580
R^2	0.19	0.19	0.19	0.19				
Cluster	NES 3	NES 3	NES 3	NES 3				
Robust CI	YES	YES	YES	YES	YES	YES	YES	YES
year dummies	YES	YES	YES	YES	YES	YES	YES	YES
sector dummies	YES	YES	YES	YES	NO	NO	NO	NO

Note:Plant-level regression. Robust t-statistics (in parenthesis)adjusted for clustering at the 3-digit NES.
***:significant at the 1% level; **:significant at the 5% level; *: significant at the 10% level.
Dependent variable is a dummy taking value of 1 if the plant exports to Morocco and 0 otherwise.
Constant and dummies coefficient are not reported.

Table 2.11: Control Experiment with Morocco: LPM with sector and firm fixed effects

As a robustness check that previous results are not driven by sector-trends that might be correlated with tariffs I perform a series of control experiments. These consisted in running regressions 2.19 and 2.20 using, as dependent variable, the probability of French firms of exporting to different countries (Morocco, Romania, Hungary, Algeria, Italy, China, Russia) or to different groups of countries (any country, any country except Turkey). If my results on Turkey come from time-varying industry trends which are spuriously correlated with import Turkish tariffs change, then those control experiments should deliver the same results I found for Turkey.

Table 2.11 shows detailed results for Morocco. Table 2.12 indicates for different models and different dependent variables if Turkish tariffs and Turkish tariffs interacted with a comparative advantage measure are statistically significant with the expected sign (v), statistically significant with the opposite sign (s) or not statistically significant (x). Both these Tables show that in almost all these control experiments we do not find the same effect we find for Turkey. This confirms the robustness of previous results.

2.5.3 Intensive margin: sales to Turkey for continuing exporters

The model predicts that those firms that were exporting to Turkey before the reduction in tariffs will begin to export higher quantities after the Customs Union formation. This prediction is estimated by the following regressions:

$$q_{i,j,t} = \beta_1 \tau_{j,t} + \beta_2 \varphi_{i,j,t-1} + \beta_3 h_{ijt} + \beta_4 Z_{i,j,t-1} + \delta_j + \delta_t + \epsilon_{i,j,t} \tag{2.21}$$

$$q_{i,j,t} = \beta_1 \tau_{j,t} + \beta_2 \varphi_{i,j,t-1} + \beta_3 h_{ijt} + \beta_4 Z_{i,j,t-1} + \delta_i + \delta_t + \epsilon_{i,j,t} \tag{2.22}$$

where the dependent variable is the logarithm of sales to Turkey of each firm in each period of time (1995, 1997 and 1999), $h_{i,j,t}$ is the logarithm of sales to all other export markets and the rest is as in regressions 2.19 and 2.20. As before regression 2.21 controls for sector fixed effects, so it is a pooled OLS regression. Regression 2.22 controls for firms time-invariant unobserved heterogeneity and is panel estimation with fixed effects.

Results are reported in Table 2.14. Notice that the number of observations is now reduced to 4020 firms: the once that were exporting to Turkey from 1995 on. The first four columns report results for regression 2.21 with and without time fixed effects, while the last four columns report the analogue results for the panel specification, regression 2.22[40].

[40] I tried a different specification using the ratio of sales to Turkey on sales to all other destinations as dependent variable. Results on Turkey's import tariffs are similar to the ones reported.

Dependent Variable: export to each of the following country								
	LPM (sector FE)		LPM (firm FE)		LPM (sector FE)		LPM (firm FE)	
	Capital Intensity				Skill Intensity			
	tariff	tariff*CI	tariff	tariff*CI	tariff	tariff*SI	tariff	tariff*SI
Turkey	v	v	v	v	x	x	v	v
Morocco	v	x	x	x	x	x	x	x
Romania	x	x	v	v	x	x	v	x
Hungary	v	x	v	x	x	x	v	x
Algeria	x	x	x	x	x	x	x	x
Italy	v	v	x	x	x	x	x	x
China	x	x	x	x	x	x	x	x
Russia	v	v	v	v	x	x	v	x
All the world	x	x	s	s	x	x	s	s
All the world (no TK)	x	x	s	s	x	x	s	s
Cluster	NES 3	NES 3	NO	NO	NES 3	NES 3	NO	NO
Robust CI	YES	YES	YES	YES	YES	YES	YES	YES
year dummies	YES	YES	YES	YES	YES	YES	YES	YES
sector dummies	YES	YES	NO	NO	YES	YES	NO	NO
firm dummies	NO	NO	YES	YES	NO	NO	YES	YES

Note:V indicates that the coefficient is significant and of the expected sign
X indicates a not-significant coefficient;
s indicates a significant coefficient but with the opposite sign.

Table 2.12: Summary of Control Experiments: LPM with sector and firm fixed effects

Estimated effects of a reduction of tariffs by 1 p.p. on the probability of exporting to Turkey			
1	2	3	4
percentiles	average	over Capital Intensity	over Skill Intensity
1%	0.04%	0.14%	0.08%
5%	0.04%	0.10%	0.07%
10%	0.04%	0.08%	0.07%
25%	0.04%	0.06%	0.06%
50%	0.04%	0.04%	0.04%
75%	0.04%	0.01%	0.02%
90%	0.04%	-0.03%	-0.02%
95%	0.04%	-0.04%	-0.03%
99%	0.04%	-0.05%	-0.06%

Table 2.13: Estimated change in probability of exporting to Turkey by Capital Intensity and Skill Intensity percentiles

Dependent Variable: exported sales to Turkey (in logs)								
	Pooled OLS with sector FE				OLS with firm FE (panel)			
	1	2	3	4	5	6	7	8
Turkey import tariffs	**-0.18**	**-0.22**	**-2.92**	**-2.81**	**-0.27**	**-0.27**	**-3.13**	**-2.73**
	-0.45	-0.52	(1.99)*	(1.99)*	-0.46	-0.47	(4.44)***	(4.00)***
firm TFP (OP)	**0.16**	**0.17**	**0.16**	**0.15**	**0.16**	**0.15**	**0.14**	**0.09**
	(2.18)**	(1.96)*	(2.13)**	-1.64	-1.5	-1.38	-1.28	-0.76
exported sales to OD (in logs)	**0.61**	**0.52**	**0.61**	**0.53**	**0.36**	**0.34**	**0.5**	**0.44**
	(18.80)***	(8.37)***	(18.96)***	(8.46)***	(5.25)***	(4.83)***	(7.44)***	(6.24)***
firm size		**-0.17**		**-0.24**		**-0.09**		**-0.46**
		-0.99		-1.37		-0.44		(2.23)**
firm capital intensity		**0.15**		**0.16**		**0.07**		**0.3**
		(2.73)***		(2.81)***		-0.68		(2.97)***
firm wage level		**0.1**		**0.16**		**0.13**		**0.4**
		-0.59		-0.9		-0.73		(2.08)**
N observations	4020	4019	4020	4019	4020	4019	4020	4019
R^2	0.4	0.41	0.39	0.4				
Cluster	NES 3	NES 3	NES 3	NES 3				
Robust CI	YES	YES	YES	YES	YES	YES	YES	YES
year dummies	YES	YES	**NO**	**NO**	YES	YES	**NO**	**NO**
sector dummies	YES	YES	YES	YES				

Note:Plant-level regression for continuing exporters. Robust t-statistics (in parenthesis)adjusted for clustering at the 3-digit NES.
***:significant at the 1% level; **:significant at the 5% level; *: significant at the 10% level.
Constant and dummies coefficient are not reported.

Table 2.14: Intensive Margin for Continuing Exporters (1): OLS with sector and firm FE

When I include time dummies (columns (1), (2), (5) and (6)), Turkish import tariffs are not significantly different from zero in any specification. However without year dummies we find that a decrease in tariffs of 1 percentage points increases the exported quantity for an average exporter by a big 3%. This could be the case if tariffs are taking all the effect coming from time macro-shock. This may be an indication of the fact that exporters were sensitive to the entrance of Turkey in European Customs Union but not specifically to the reduction in tariffs. The intuition is strengthened by the fact that I control all regressions with the contemporaneous firm export to all other destination except Turkey. This variable captures the effect of a macro-shock on each French firm regarding its behavior with respect to all destinations except Turkey. The tariffs coefficient captures the remaining effect of a time macro-shock on Turkey flows. This may suggest that the time varying component of the tariffs (or of another effect that came along the CU like non- tariffs barriers) is much stronger than the across sector component, thus time dummies capture all the effects once I include them [41].

This interpretation leads to the following tentative conclusions. Although, the intensive margin has been sensitive to the entry of Turkey in European CU, the channel didn't work through tariffs reduction. But instead through other changes, mainly at aggregate level, that tariffs capture improperly. Second, if we are willing to believe the previous conclusion, then the CU effect on the intensive margin has been much bigger than CU has had a much bigger effect in terms of magnitude, as the decomposition in the initial section showed [42]. Third, even if, on average, more productive firms export big volumes to Turkey (as I find in specification with pooled OLS), the marginal change of productivity within each firm does not help in explaining the increase in those volumes(as it is clear in panel specifications). Also in the case of productivity changes it seems that the extensive margin is more reactive than the intensive margin.

Finally, results on coefficients in column (8) on other firms' characteristics seem interesting. Here I find that a firm that decreases its size (number of workers) but increases its capital intensity and its cost of labor (which is a measure of the level of wages) exports more to Turkey. The opposite sign on size and wage coefficient may be an indication of skill adoption by those firms. It is possible that these firms are decreasing their labor force but increasing paid wages since they are upgrading the skill profile of their workers. Anyway this is only a possible explanation. A more formal analysis is needed to investigate this intuition [43].

[41] I thank Paula Bustos to make me notice this.

[42] In fact decompositions in section 1 describes how the trade margins moved in the years before and after the CU, but do not assess the causal relation which is found in this econometric session using the variation of tariffs for the identification. The finding in this section are consistent with those findings.

[43] Bustos (2007) shows that as a consequence of trade liberalization, firms increase their technology adoption (which in turn could imply higher skill-premium).

2.5.4 Intensive margin and comparative advantage

What about the response of firms in sectors with different comparative advantage indexes? The model predicts that the effect of tariffs on firm export revenues should be higher if the firm is in a sector which enjoys a higher level of comparative advantage with respect to Turkey. I estimate this prediction with the following regressions:

$$q_{i,j,t} = \beta_1 \tau_{j,t} + \beta_2 \tau_{j,t} CA_j + \beta_3 \varphi_{i,j,t-1} + \beta_4 h_{ijt} + \beta_5 Z_{i,j,t-1} + \delta_i + \delta_t + \epsilon_{i,j,t} \quad (2.23)$$

I estimate this, as before with sector and firm fixed effects and with capital- as well as skill-intensity. In terms of regression 2.23 the predictions of the model translates in the following expected signs of estimated coefficients:

$$\frac{\partial r^x_{i,j,F}}{\partial \tau_{j,T}} < 0 \rightarrow \beta_1 + \beta_2 CA_j < 0$$

$$\frac{\partial^2 r^x_{i,j,F}}{\partial \tau_{j,T} \partial \beta_i} < 0 \rightarrow \beta_2 < 0$$

Results for capital- and skill-intensity measures are reported, respectively, in Tables 2.15 and 2.16 . The first Table clarifies that capital-intensity has a role only in those panel regressions without time dummies and the effect, only significant at 10%, has an opposite sign with respect to the model's predictions. Skill-intensity, instead, does not help to explain the variation of sales to Turkey. Table 2.17 shows the magnitude of the effect of regression 2.23 for the two measures of comparative advantage at different percentiles[44]. Column (3) shows that for a firm in a sector with very low capital-intensity (1st percentile) a decrease of tariffs of 1 percentage point increases the exported flows to Turkey of 5.49%, while a firm in a high capital-intensity sector (99th percentile) increases its flows to Turkey by 0.35%. Again the average effect of 3% hides a heterogeneous effect which is significantly linked to sector factor-intensities. Finally column (4) shows the result, albeit not significantly different from zero, using skill-intensity.

[44]These predictions refer to regressions in column (8) of Table 2.15 and in column (8) of Table 2.16.

Dependent Variable: exported sales to Turkey (in logs)								
	Pooled OLS with sector FE				OLS with firm FE (panel)			
	1	2	3	4	5	6	7	8
Turkey import tariffs	**-2.9**	**-3.17**	**-7.76**	**-7.89**	**-4.39**	**-4.45**	**-9.3**	**-9.06**
	-1.36	-1.42	-1.62	(1.71)*	-1.34	-1.35	(2.68)***	(2.62)***
* US Capital Intensity	**0.66**	**0.71**	**1.17**	**1.23**	**1**	**1.01**	**1.5**	**1.53**
	-1.31	-1.36	-0.92	-1	-1.29	-1.3	(1.75)*	(1.82)*
firm TFP (OP)	**0.16**	**0.17**	**0.16**	**0.15**	**0.16**	**0.16**	**0.15**	**0.1**
	(2.19)**	(1.96)*	(2.16)**	-1.66	-1.55	-1.42	-1.36	-0.84
exported sales to OD (in logs)	**0.61**	**0.52**	**0.61**	**0.53**	**0.36**	**0.34**	**0.5**	**0.44**
	(18.76)***	(8.33)***	(18.84)***	(8.39)***	(5.23)***	(4.81)***	(7.39)***	(6.19)***
firm size		**-0.17**		**-0.24**		**-0.09**		**-0.46**
		-0.98		-1.36		-0.46		(2.22)**
firm capital intensity		**0.15**		**0.15**		**0.07**		**0.31**
		(2.69)***		(2.77)***		-0.7		(2.99)***
firm wage level		**0.11**		**0.16**		**0.14**		**0.4**
		-0.59		-0.9		-0.74		(2.06)**
N observations	4002	4001	4002	4001	4002	4001	4002	4001
R^2	0.4	0.41	0.39	0.4				
Cluster	NES 3	NES 3	NES 3	NES 3				
Robust CI	YES	YES	YES	YES	YES	YES	YES	YES
year dummies	YES	YES	NO	NO	YES	YES	NO	NO
sector dummies	YES	YES	YES	YES				

Note:Plant-level regression for continuing exporters. Robust t-statistics (in parenthesis)adjusted for clustering at the 3-digit NES.
***:significant at the 1% level; **:significant at the 5% level; *: significant at the 10% level.
Constant and dummies coefficient are not reported.

Table 2.15: Intensive Margin for Continuing Exporters (2): Capital Intensity, OLS with sector and firm FE

Dependent Variable: exported sales to Turkey (in logs)								
	Pooled OLS with sector FE				OLS with firm FE (panel)			
	1	2	3	4	5	6	7	8
Turkey import tariffs	**-1.25**	**-1.29**	**0.39**	**-0.07**	**-1.44**	**-1.52**	**0.48**	**-0.82**
	-0.69	-0.68	-0.08	-0.02	-0.6	-0.63	-0.18	-0.31
* US skill Intensity	**3.06**	**3.06**	**-9.1**	**-7.55**	**3.33**	**3.54**	**-9.98**	**-5.32**
	-0.64	-0.62	-0.66	-0.57	-0.51	-0.54	-1.29	-0.7
firm TFP (OP)	**0.16**	**0.17**	**0.16**	**0.14**	**0.16**	**0.15**	**0.13**	**0.08**
	(2.17)**	(1.96)*	(2.10)**	-1.62	-1.5	-1.38	-1.2	-0.71
exported sales to OD (in logs)	**0.61**	**0.52**	**0.61**	**0.53**	**0.36**	**0.34**	**0.49**	**0.44**
	(18.80)***	(8.35)***	(18.98)***	(8.45)***	(5.26)***	(4.84)***	(7.21)***	(6.17)***
firm size		**-0.17**		**-0.24**		**-0.09**		**-0.45**
		-0.98		-1.34		-0.45		(2.20)**
firm capital intensity		**0.15**		**0.15**		**0.07**		**0.29**
		(2.69)***		(2.77)***		-0.69		(2.81)***
firm wage level		**0.11**		**0.16**		**0.14**		**0.4**
		-0.59		-0.89		-0.74		(2.06)**
N observations	4002	4001	4002	4001	4002	4001	4002	4001
R^2	0.4	0.41	0.39	0.4				
Cluster	NES 3	NES 3	NES 3	NES 3				
Robust CI	YES	YES	YES	YES	YES	YES	YES	YES
year dummies	YES	YES	NO	NO	YES	YES	NO	NO
sector dummies	YES	YES	YES	YES				

Note:Plant-level regression for continuing exporters. Robust t-statistics (in parenthesis)adjusted for clustering at the 3-digit NES.
***:significant at the 1% level; **:significant at the 5% level; *: significant at the 10% level.
Constant and dummies coefficient are not reported.

Table 2.16: Intensive Margin for Continuing Exporters (3): Skill Intensity, OLS with sector and firm FE

Estimated effects of a reduction of tariffs by 1 p.p. exported sales to Turkey			
1	2	3	4
percentiles	average	over Capital Intensity	over Skill Intensity
1%	3%	5.49%	1.83%
5%	3%	4.45%	1.99%
10%	3%	4.08%	2.04%
25%	3%	3.38%	2.36%
50%	3%	2.83%	2.74%
75%	3%	2.14%	3.16%
90%	3%	1.08%	4.07%
95%	3%	0.76%	4.22%
99%	3%	0.35%	4.81%

Table 2.17: Estimated change in exported flows to Turkey by Capital Intensity and Skill Intensity percentiles

2.6 Conclusions

In this paper I analyze how the reduction of Turkey's import tariffs, followed the entry of Turkey in EU Customs Union, affected French firms in their decision to begin exporting to Turkey or to adjust their exported sales there. I first estimate these effects for the average French firm taking into account its productivity, as well as other time-variant characteristics. I then estimate how tariffs affect firms decision depending on the comparative advantage (capital- or skill-intensity) of their sectors.

On the extensive margin I find that a 1 percentage-point decrease of Turkey's import tariffs increases the probability of exporting to Turkey by 0.042 percentage points. However when I allow for the effect to be asymmetric across sectors I find that the change in the probability of exporting induced by the tariffs decrease, is inversely correlated to the capital (or skill) comparative advantage.

This first finding is new and puzzling if we have in mind neoclassical models of trade with comparative advantage. Those models show that in open economy each country trade mostly the goods produced by its comparative advantage sectors for a given level of tariffs. My findings however do not refer to an *average effect*, but to *marginal effect*. I show that a model that introduces sector comparative advantage (in a Heckscher-Olihn fashion) in a partial equilibrium setting a la Melitz (2003) can predict my findings along the extensive margin.

On the trade intensive margin (i.e. flows by continuing exporters) the empirical results are weaker. Turkish import tariffs have an effect of exported volumes by French firms only in those regressions without time-dummies, which control for macro-shocks. The effect, however, is quite big: a 1 percentage-point reduction of tariffs increases French exports by 3%. Moreover, under the same caveat, I show that previous effect is bigger for firms in less capital intensive sectors. This last finding is, however, at odds with theoretical predictions of my model. Taken as a whole, the results on intensive margin, suggest that the Customs Union had a strong effect on French volumes to Turkey but not along the channel of the tariffs' change. These, in turn, explained

significantly the attitude of firms to export or not in Turkey.

This second finding, which would need further investigation, could be linked to the empirical adjustment effects which a static standard model does not address. From the supply side it may be that firms, in the presence of a Customs Union, may evaluate exporting to Turkey as the most important decision foreseeing a further liberalization and an increase in competitiveness in Turkey. From the demand side, it may be that Turkish demand, after the CU, has been more directed to consume new varieties (i.e. goods from different firms) than to consume higher quantities of old (already imported) ones. Probably in the years just after the Customs Union this demand-driven effect explains the different movement along the intensive and the extensive margin of French firms. Finally, results of this paper suggest that heterogeneity across sectors, associated with heterogeneity across firms, are both important in assessing the consequences of tariffs reduction and in enhancing our understanding of trade.

This paper could be improved and extended in many directions. First, a broader experiment using change in import tariffs from many countries may be helpful to generalize the findings. Next paper in this thesis analysis the effect of the multilateral tariffs reduction induced by the formation of the World Trade Organization (WTO) in 1995 on the export market participation of French firms.

Second, from a theoretical point of view the analysis suggests that extending a standard model of firm heterogeneity to the inclusion of sector characteristics is a fruitful area for future research.

Chapter 3

The Effect of the Uruguay Round Multilateral Tariff Reduction on Trade's Margins

with Guy Lalanne[1]

3.1 Introduction

Do trade costs inhibit trade flows by preventing firms from exporting or rather by restricting their exported volumes? What is the effect of trade cost reduction on the previous two channels? In this work we address these two important issues by measuring trade cost with a policy variable, tariffs, and using a worldwide multilateral tariff reduction, the Uruguay Round, as a policy change.

Answering the previous questions is at the core of recent results in trade literature. By introducing heterogeneity across firms, standard trade models (Melitz (2003) and Chaney (2008)) show that only some firms are able to export. This, in turn, generates two margins of trade: the extensive and the intensive margins. The first one is given by the number of firms that export (or by the number of exported products) while the second one is given by the average export flow by firm (or by product). The main predictions of these models rely on the effects of variable and fixed trade costs on both margins.

Our questions are particularly interesting from a policy point of view. Albeit self-selection of most productive firms into being exporters is broadly accepted, there is evidence on the beneficial effects of trade on firms' productivity and on their technology upgrading, once they begin to export. If this is the case, then the channel through which a reduction in tariffs affect the economy, may be relevant.

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Some recent papers empirically address the relation between trade costs and trade margins, relying on distance as a measure of trade variable costs.

The main novelty of our work is to use tariffs to measure variable trade costs in a micro data context. Thereby we can address interesting econometric as well as trade-related issues. First, by considering tariffs instead of simply distance, the econometric specification becomes dynamic, since tariffs move through time, distance does not. By controlling for country specific fixed effects (previous studies were prevented to do it), we are able to measure the within effect of a *change in tariffs* on both trade flows and its margins. Second, tariffs are the main trade policy instruments in the hand of governments and effort is devoted by each country in policy programmes aimed at reducing them. Thus, the real parameter of interest is the elasticity of trade flows and trade margins to tariffs, rather than to distance. Third, tariffs are well measured with respect to other policy instruments like non-tariffs barriers. Moreover they are comparable across countries, sectors and through time. Fourth, all theoretical trade models introduce trade costs through tariffs and perform comparative static analysis by letting tariffs change. In this perspective our analysis is much closer to theoretical literature than previous ones.

We study the response of French firms to the worldwide reduction of tariffs implemented with the Uruguay Round in the end of 1994. We study France among European countries because it is provided with detailed firm-level data sets which allow us to address this issue using a 3 dimension panel data. We have information on the export of French firms for 57 products to 147 destinations in a time-period ranging from 1993 to 2005. We use the multilateral agreement promoted by the Uruguay Round because it has been the only event followed by a contemporaneous multilateral tariff reduction in the last decades. As reported in WTO official documents[2] *"countries' tariffs cuts were for the most part phased in over five years starting from 1st January 1995. The result has been a 40% cut in tariffs on industrial products, [which moved] from an average of 6.3% to 3.8%"*.

Merging the French firm-level data set with TRAINS tariff data (collected by WTO, IDB and World Bank), we can exploit the tariffs imposed on French products to identify the elasticity of trade flows with respect to tariffs on both margins of trade. In fact, the structure of the Douanes data set, which specifies the export destination by firm and product, allows us to match a flow with its tariff precisely.

While few studies did it on the import side[3], we are the first, up to our knowledge, to examine the export side, which is possible due to the structure of the Douanes database. This feature is particularly relevant in the case of France since tariff reductions in the 1990s were less significant on the import side than on the export side, France having been an open economy since the 1970s.

Using gravity equations derived from Chaney (2008) model, we show that both margins contribute to the increase in aggregate French trade when tariffs decrease. The result is robust to the introduction of a full set of country and product fixed effects

[2]WTO has been created with the ending of the Uruguay Round, replacing the previous GATT.

[3]Debaere and Mostashari (2007) measure the import extensive margin of US trade in the last decade.

as well as time macro-shocks. A decrease in tariffs by 1 percentage point (starting from a level of 10%) increase total French export by 2.62%, the number of exporters by 1.57% and the average export by firms by 1%.

We address potential biases which may affect the result. First, we perform our regression in difference to take all time-invariant country-sector characteristics into account. This correction mainly aims to capture the comparative advantage structure of each country with respect to France. One of the main ideas in trade literature is that trade patterns are determined by the structure of comparative advantage. Also the way protection policies are chosen is mainly dependent on it. It is implausible that a country would set high tariffs to all its products, or that the same product would be protected in the same way throughout the whole world. Much more reliable is the hypothesis that each country sets higher tariffs on those products it wants to protect by more from French competition (as endogenous protection literature suggests). Second, we control for sector and country trends which may simultaneously determine French export and tariffs. Third, after the implementation of the Uruguay Round, almost all tariffs decreased without being completely eliminated and without reaching a predetermined final level. Thus, there may have been other unobservable reasons underlying the way countries decided to reduce their tariffs. If those unobservable country-sector time-varying characteristics are simultaneously affecting tariffs formation and import from French, then previous results are biased.

A way to deal with this problem is to instrument the bi-annual tariffs growth rate with the pre-Uruguay Round level. This kind of instrument has previously been used by Goldberg and Pavcnik (2005). As in their case, we show that the variation in tariffs after the Uruguay Round is correlated with their initial level since the highest tariffs drops concerned those country-sector pairs that set higher tariffs before the Uruguay Round. The initial level of tariffs, on the other side, does not directly affect the change in French import through years, since it is predetermined. These two considerations imply that the pre-UR level of tariffs is a good instrument for their subsequent variation. By performing a 2-SLS procedure on the regression in difference we find that tariffs affect trade only through the *extensive margin*.

Finally, we discuss other potential biases stemming from the fact that many tariffs observations are not reported (incidental truncation) and from the presence of "0" flows in our data.

Our paper mainly relates to empirical literature on extensive and intensive margins. Eaton, Kortum and Kramarz (2004) using French firm-level data for 1986 find that the extensive margin explains much of the variation of French firm exports over all possible destinations. Crozet and Koenig (2007), using a similar approach to ours, recover the effect of distance on French trade flows and on the two margins. Bernard, Jensen, Redding and Schott (2007) (BJRS hereafter), using US disaggregated export flows for 2000, find that higher distance implies lower extensive margin but higher intensive margin. Moreover their findings suggest that aggregate trade relationships are more influenced by their extensive margin than by their intensive one. We depart from these papers insofar as we use a dynamic framework which allows us to control

for product and country unobserved heterogeneity.

Helpman, Melitz and Rubinstein (2008)(HMR hereafter) derive a generalized gravity equation from a heterogeneous firm model, which contains a non-standard term: the fraction of exporters. They argue and show that, by omitting this term among the regressors of a gravity equation, "*previous works confound the effect of trade barriers on firm-level trade with the effect of those barriers on the proportion of exporters*". We depart from them inasmuch as we do not need to estimate the number of exporters for each sector and destination because we rely on a firm-level data set that contains this piece of information. This allow us to directly measure the intensive margin and to use it as one the right-hand side variables.

This paper gives also a contribution to the lively debate on the effect of WTO on world trade. This debate was originated by Rose (2004). Using a standard gravity approach to a set of bilateral trade flows in long time series, Rose (2004) showed that GATT/WTO membership *does not* explain world bilateral trade volumes. Since then, many papers explored this issue trying to point out, eventually, where the mistake was. Recently, Felbermayr and Kohler (2007) showed that, by controlling Rose's regression for zero trade-flows, the GATT/WTO membership dummy turned out to be significant. Our results are consistent with theirs, but our main innovation with respect to previous literature is to use tariffs measure instead of a dummy indicating participation in WTO. The scope of our results is different from that of previous studies since we do not consider bilateral trade flows and since the time-span in our analysis is much shorter. Nevertheless the main concern of GATT/WTO relies on tariff reduction. To this extent, our analysis is the first to address this issue using a continuous variable as well as a membership dummy and relying directly on a well-defined policy change emanated by GATT/WTO. Clearly, our results refer to France only. However, since the Uruguay Round affected mostly developing countries, the impact of its formation on the world trade may have been even bigger[4].

The remainder of the paper is organized as follows. Section 2 sketches a standard model with heterogenous firms to state the decomposition of trade in the two margins. Section 3 describes the extent of the tariff reductions induced by the Uruguay Round and the patterns of French exports between 1993 and 2002. Section 4 presents preliminary results. Section 5 addresses the main biases and provide robustness checks. In section 6 we discuss further econometric issues. Section 7 concludes.

3.2 A standard model of trade with extensive and intensive margin

Hereafter we present a simplified version of Chaney (2008) model incorporating firm heterogeneity and variable and fixed costs. The aim is to underline how such a model generates extensive and intensive margins of trade. We follow Chaney (2008)

[4]Moreover it is well-known that the Uruguay Round mainly affected agricultural sectors which we exclude from our analysis, this sector being not comparable to manufacturing.

but we economize on formulas to stress the main characteristics of the model. Moreover, we consider a simple version in which the price index and income are given.

Consider a world with J countries indexed by j=1,2,....J. Every country consumes and produces S (indexed by s) differentiated goods and a homogeneous numeraire. In each of the S manufacturing industries firms face monopolistic competition. Consumers in each country share the same CES utility function given by :

$$U = q_0^{\mu_0} \prod_{s=1}^{S} \left(\int_{j=1}^{J} q_{sj}^{\sigma-1} \right)^{\mu_s \frac{\sigma}{\sigma-1}} \tag{3.1}$$

where q_0 denotes consumption of the numeraire good, q is the demanded quantity of each good in each country, σ is the elasticity of substitution between varieties, assumed to be constant across sectors, and the μ's are the shares of expenditures devoted to product s and to the homogeneous good. They sum up to 1.

Let Y_j be the country j's income, which equals its expenditure level. Country j's demand for product s produced in country i will be :

$$q_{ijs} = \frac{{p_{ijs}}^{-\sigma}}{{P_{js}}^{1-\sigma}} \mu_s Y_j \tag{3.2}$$

where P_{js} is the country j ideal price index and p_{ijs} is the price of that good.

In each sector of each country a continuum of firms, N_i, which are active in the domestic market. These firms are heterogenous since they produce at different marginal costs a, which do not vary with quantities. Following previous empirical results, the distribution of marginal costs can be proxied by a Pareto distribution whose density function is $f(a)$ defined on the support $[0, 1]$ with a scaling parameter γ.

The total cost that incurred by each firm in country i to produce and sell in country j is given by:

$$TC_{ijs}(a) = q(a) a \tau_{ijs} + f_{ij} \tag{3.3}$$

where a is the firm specific marginal cost, τ_{ij} is the standard "iceberg" trade cost[5] and f_{ij} is a fixed cost that the firm has to pay to export. For the sake of simplicity, we focus on the export from one country toward a generic j trade partner and we assume that the iceberg trade costs are constant across sectors. Thus we omit sub-indices i and s.

Standard price set by monopolistic competitive firms will be:

$$p_j(a) = \frac{\sigma}{\sigma - 1} a \tau_{js} \tag{3.4}$$

Thus, firms with lower marginal costs (the most productive ones) will set lower prices and will be able to sell more.

The profit earned by a firm with marginal cost a from selling to market j is thus:

[5]Of the τ_{ij} units of good shipped from country i to country j, only 1 unit arrives.

$$\pi_j(a) = \frac{1}{\sigma}\left(\frac{\sigma}{\sigma-1}a\frac{\tau_j}{P_j}\right)^{1-\sigma} Y_j - f_j \tag{3.5}$$

Each firm will export if and only if exports' profits are strictly positive. The existence of export fixed costs prevents unproductive firms entering the foreign markets since, by setting high prices, they face low demand and, as a consequence, revenues are not high enough to cover the fixed costs f_j.

By setting profits equal to 0 we can recover the maximum level of marginal cost (or conversely the inverse of the minimum level of productivity) required by a firm to be able to export:

$$a_j^* = \phi_j \left(\frac{1}{f_j}\right)^{\frac{1}{\sigma-1}} \frac{1}{\tau_j} \quad \text{where} \quad \phi_j = \left(\frac{1}{\sigma}\right)^{\frac{1}{\sigma-1}} \frac{\sigma-1}{\sigma} Y_j^{\frac{1}{\sigma-1}} P_j \tag{3.6}$$

The previous equation shows how the productivity level of the marginal exporter is a negative function of the variable and the fixed export costs. We refer to this marginal cost level as $a_j^*(f_j, \tau_j)$.

The demand function (2) and the pricing equation (4) imply that the export values is given by:

$$m_j(a) = \frac{1}{\sigma}\left(\frac{\sigma}{\sigma-1}a\frac{\tau_j}{P_j}\right)^{1-\sigma} Y_j \tag{3.7}$$

The previous formula suggests that the export values depends on the variable trade cost, but not on the fixed trade costs. This is underlined by denoting the value of exports by $m_j(a, \tau_j)$.

Finally we obtain the total export to country j by summing up the individual firm's exports:

$$M_j = \int_0^{a_j^*(f_j,\tau_j)} N m_j(a, \tau_j) f(a)\, da \tag{3.8}$$

where N is the exogenous total number of active firms.

Formula (3.8) shows how total exports depend on both the number of exporters and the value exported by each firm. In particular, the variable trade cost τ_j appears in both the upper bound of the integral and the integrand. Thus, by using the Leibniz rule we obtain:

$$\begin{aligned} \frac{\partial M_j}{\partial \tau_j} \quad = \quad & \underbrace{m_j(a_j^*, \tau_j)}_{\text{Exports per new entrant}} \underbrace{\frac{\partial a_j^*(f_j,\tau_j)}{\partial \tau_j} N f(a_j^*)}_{\text{\# new entrants}} \\ & + \underbrace{\int_0^{a_j^*} \frac{\partial m_j(a,\tau_j)}{\partial \tau_j} N f(a)\, da}_{\text{Increase in exports for old exporters}} \end{aligned} \tag{3.9}$$

The previous decomposition shows that, in the model, both the number of new entrants and the average quantity by incumbent increase when variable trade costs drop. Conversely, the fixed costs affect the number of new entrants only and not the average exports per incumbent firms.

In taking the model to the data, we follow the literature and use a simple decomposition which allows us to explore the issue at the product level. The decomposition that we use is the following:

$$M_{j,s} = N_{j,s} * \frac{M_{j,s}}{N_{j,s}} \tag{3.10}$$

and our definition of intensive and extensive margins will be given, respectively, by the number of firms exporting product s to country j ($N_{j,s}$) and their average exported quantity ($\frac{M_{j,s}}{N_{j,s}}$).

The advantage of such a decomposition is that, by using the additive property of logs for linear operators such as OLS, the elasticities of a given covariate on each component sum up to the total one. Moreover this is the decomposition generally adopted in the empirical literature. Hence, for a matter of comparison, this is our starting point[6].

However we are conscious that, by using this decomposition, we are indeed aggregating model results in such a way that can create biases. The point is that new exporters may indeed export less, on average, than incumbent ones. Thus, our estimated intensive margin may actually be lower than the theoretical one.

To make the point clearer, let us consider the following way to further decompose the extensive margin of (3.10) (in which we omit country-product subscripts):

$$\frac{M}{N} = \frac{M_C}{N_C} - \frac{N_E}{N}\left(\frac{M_C}{N_C} - \frac{M_E}{N_E}\right)$$

where the subscript C refers to incumbent firms, and E to (net) entrants on the export market.

The first term on the right-hand side is the theoretical intensive margin and the second term is the error made when looking at the overall average. Clearly, if new entrants export the same average quantities as incumbent firms, then the error is equal to 0, that is average exports are equal to average exports by incumbents. As long as new entrants export lower quantities than incumbents, which we think it is the case[7], our analysis could under-estimate the trade cost elasticity on the theoretical intensive margin[8].

[6] See for instance Crozet and Koenig (2007), Mayer and Ottaviano (2007), BJRS (2007).

[7] Theoretically this is the case since marginal entrants are smaller than incumbent firms. Empirically it should be also the case since previous research (Besedes and Prusa(2006), Eaton *et al.* (2007)) has pointed out that firms usually begin to export small quantities.

[8] A last concern remains. If we aggregate the model's results in order to obtain the margins in (3.10), the total average quantity is no longer a function of the variable costs. This result comes from the specific density function used in aggregating firm-level data, the Pareto distribution. To be closer to the model conclusions and to avoid any other bias which may come trough aggregation we will complement our exercise using firm level data directly, like in Crozet and Koenig (2007). By doing

3.3 Data and descriptive analysis

3.3.1 The Uruguay Round

On December 15, 1993, 123 countries, accounting for more than 90% of world trade, concluded a historical agreement to reform international trade. The Uruguay Round (hereafter referred to as UR) of multilateral trade negotiation began in 1986 and ended in 1994 with the signature of the "Marrakesh Declaration"[9]. The latter stated that *"participation in the Uruguay Round was considerably wider than in any previous multilateral trade negotiation and, in particular, developing countries played a notably active role in it. This has marked a historic step towards a more balanced and integrated global trade partnership."*

The UR agreements includes:

- Lower tariffs and non-tariff barriers for manufactured products and other goods;
- New rules on trade in services;
- Rules to protect intellectual property ;
- Fairer competition and more open markets in agriculture;
- Full participation of developing countries in the global trading system;
- Effective rules on anti-dumping, subsidies, and import safeguards;
- A more effective dispute settlement system.

In this paper we focus on the reduction in tariffs endorsed by the UR. The eighth round of negotiations under the GATT began in 1986. Since the establishment of GATT in 1948, international trade negotiations had resulted in tariff reduction of about 85%. However, significant barriers remained. The UR resulted in significant reforms of the GATT process and in the establishment of WTO. The latter achieved a more than one-third across-the-board reduction in tariffs, a number of which were entirely eliminated in some industries. Just as significant as these tariff reductions, many non-tariff barriers such as quotas, discretionary licensing, import bans, or voluntary export restraints were eliminated or reduced. Agricultural export subsidies also became subject to constraints. Indeed, the Marrakesh Declaration states that UR is responsible for *"the global reduction by 40 per cent of tariffs and wider market-opening agreements on goods, and the increased predictability and security represented by a major expansion in the scope of tariff commitments"*.

so we can calculate the elasticity of firms' export decisions on tariffs more closely. However there are two caveats in this procedure. The first one is that our measure of tariffs varies at the product level and not at the firm level and we would associate flows to less precise tariffs. The second one is that the sample size is tremendously magnified by consider firms as the the unit of analysis. This prevents us to conduct the analysis. A solution could be to use a random selection of firms from the data.

[9]Marrakesh Declaration of the 15th of April 1994.

The timing of tariff reductions agreed upon by each Member was implemented in five equal rate reductions[10] from 1995 to 2000.

To measure the real extent of the UR tariff reductions faced by France, we use the TRAINS-WTO database, which contains Effective Applied Ad-Valorem Tariffs[11,12] at the product-country-time level. The relevant tariff data for this paper cover 147 countries, 57 products and years ranging from 1993 to 2002. Therefore the covered time period begins 2 years before the UR and ends 8 years after. Products are classified according to the French 3-digit NES (Nomenclature Économique de Synthèse). The data, however, are not available for all the country-product-year observations: therefore the panel is unbalanced.

Table $B.1$ (in appendix) reports the countries used in the analysis and indicates for which of them tariff data are available both before and after the UR. Table $B.2$ (in the appendix) lists the products according to the 3-digit NES classification.

Figure 3.1 shows the change in tariffs induced by the UR plotted on their initial level in 1993-1994[13]. Each point represents the tariff set by a French trade partner on a specific product. The left-hand side shows the relation for all available country-product pairs for which the TRAINS data set reports the observation before 1994.

We observe interesting features. First, tariff levels in the initial period show a high dispersion level, ranging between 0 to a maximum of 100%, with the median observation being below 20%. Second, Figure 3.1 suggests a downward sloped relation between tariffs' changes and their initial levels. Third, there are some country-product pairs for which tariffs actually increased. Over 2699 country-product tariff observations reported both for the initial and final periods, 416 increased between 1993 and 2002, suggesting that, in some cases, the UR did not actually manage to enforce their reduction.

Deeper investigation shows an interesting pattern: tariffs increase mainly for countries which do not belong to the WTO, for countries in Mercosur and in the "Processed Agricultural" sectors. While the first pattern is not surprising, the last two deserve some explanation.

By signing the Mercosur agreement in 1991, Argentina, Brazil, Uruguay, Paraguay and Venezuela agreed on reducing tariffs among themselves and on setting a common external tariff against third countries. Our database suggests that tariffs set by Mercosur countries against France correlate among them much more at the end of the period than at the beginning. Moreover, this correlation is higher than the average one among all countries. This suggests some kind of coordination among these countries in setting tariffs against other countries, like announced by Mercosur agreements. The tariffs increase of these countries may also be a consequence of that agreement

[10] Except if it is otherwise stated in a Member's Schedule.

[11] This is the lowest value between the Preferential Tariff, if there is any, and the Most Favoured Nation (MFN) applied tariffs. According to the MFN rule, when a country grants someone a special favour (such as a lower custom duty rate for one of their products), it has to do the same for all WTO members.

[12] From now on we refer to these simply as "tariffs".

[13] Here we have either averaged tariffs in 1993 and 1994 (when they were both available), either considered tariffs in 1993 or in 1994 (when they are not available for both years)

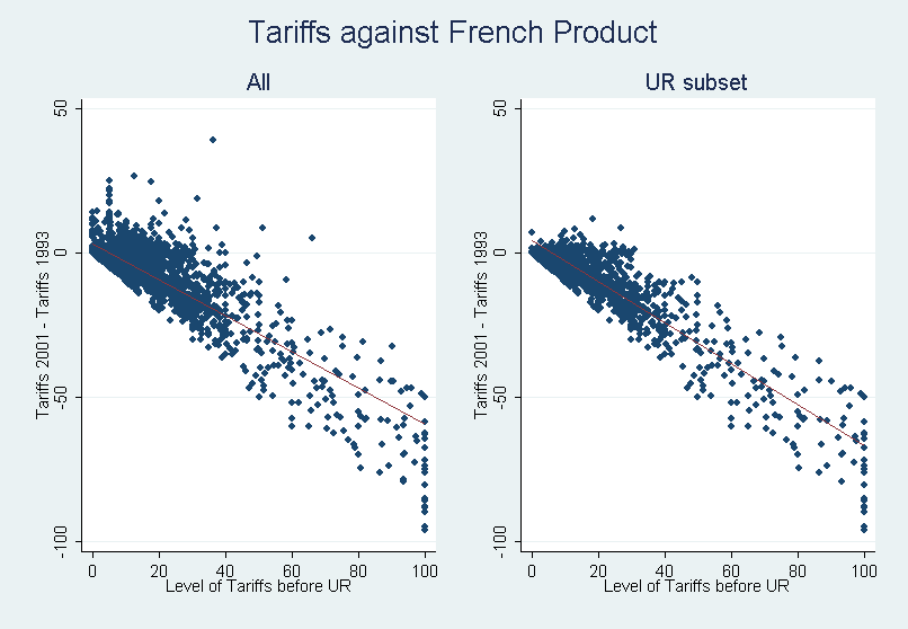


Figure 3.1: Reduction of tariffs vs their initial level

itself.

Finally, the average increase in tariffs in "Processed Agricultural" sector can be found in previous policy works that discussed the impact of the UR in tariff escalation for agricultural products[14], concluding that high level of escalation in this sector still remained after the UR tariff concession.

Once we eliminate these groups of observations, we are left with the right-hand side panel of the graph, where the number of increased-tariffs observations decreases by 71% (from 416 to 163). We define the observations which are not in the 3 mentioned categories (non-WTO members, Mercosur,"Processed Agricultural" sector) as the UR sub-sample and we use the latter to run some robustness checks in the empirical section below.

To make the point clearer, Figure 3.2 shows a sector-aggregate version of Figure 3.1 for some countries. The top panel represents two countries which are WTO-members, a less-developed and a developed one, while the bottom panel displays respectively a country which is not a WTO-member and a country which is a Mercosur-member. We notice how, for Philippine and Australia, the reduction in tariffs is much more in line with the UR concession scheme than for Vietnam and Argentina. For the latter countries, on the contrary, most of the observations lie above the 0-line.

This Figure is also interesting since it nicely shows how countries set higher tariffs on different sectors. Philippines for example protects more sectors C (manufacture of consumers goods), while Australia has higher tariffs in FE (Preparation and spinning

[14]Tariff escalation consists in setting higher tariffs on processed agricultural components than on their input products.

of textile fibres, weaving and finishing of textiles) and FG (Manufacture of knitted and crocheted fabrics and articles) ones.

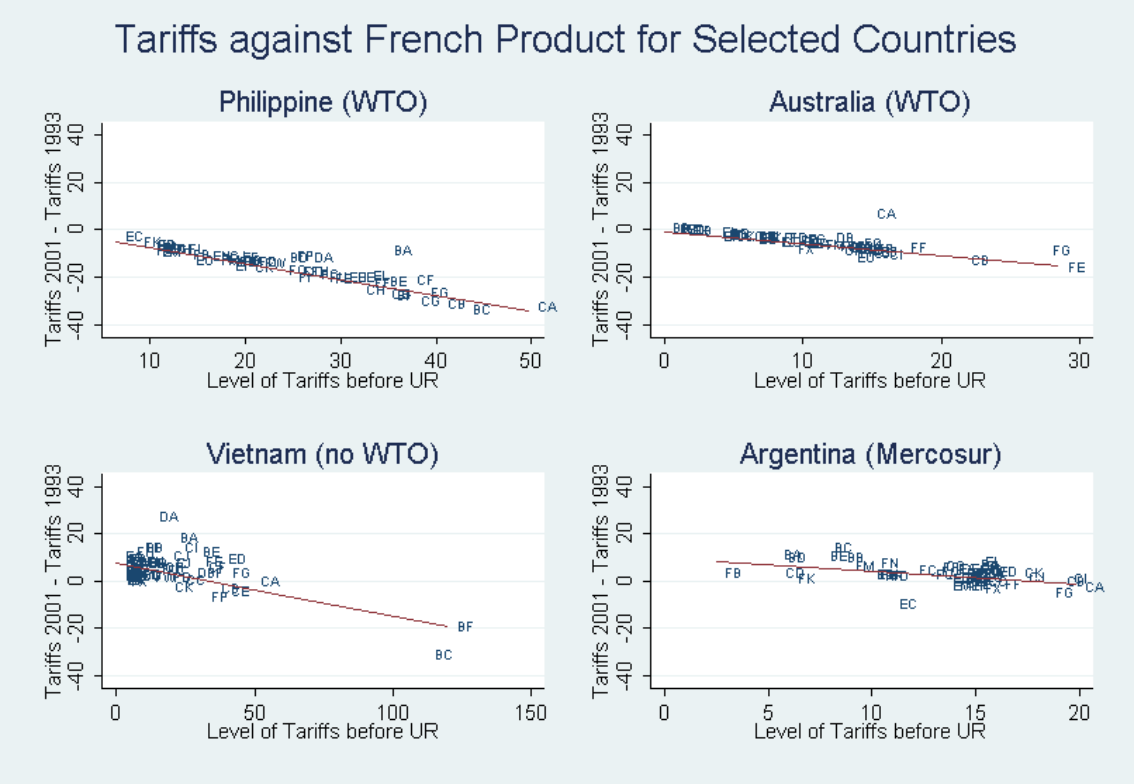


Figure 3.2: Average sectoral reduction of tariffs vs their initial level for selected countries

A more formal way to show the effect of UR on world tariffs is provided by Table 3.1. This table reports the average tariffs before and after 1995 for countries which adopted or not UR concessions (respectively countries in WTO in 1995 and outside WTO in that same year). This table shows why we can use the UR as policy experiment: the reduction in tariffs between the last year in the data and the pre-reform year was significantly higher for countries which formally signed the UR concession scheme. Thus, even if we can't assume that the UR was the only responsible for tariffs reduction in our sample, we have a clear indication of its influence on it.

Figure 3.3 shows that, once we average tariffs and their changes by sectors, we still find that the tariff reductions were higher for those sectors which had high tariffs at the beginning. A caveat applies: while sector or country graphs may seem appealing, it is noteworthy that TRAINS data are far from being complete, thus averages are not always meaningful.

The fact that tariffs were reduced mostly in countries participating in WTO and in those sectors where they were high suggests that the UR concession is a nice policy experiment to analyze. However, it may be that, even after the tariff reduction, the

	No WTO	WTO	
Before UR	17.57 (16.70)	14.38 (20.11)	3.19** (1.47)
After UR	16.48 (12.55)	8.01 (9.53)	8.47*** (0.72)
	1.09 (1.49)	6.37*** (0.44)	-5.28*** (0.11)

Table 3.1: Average tariffs by country-groups before and after UR

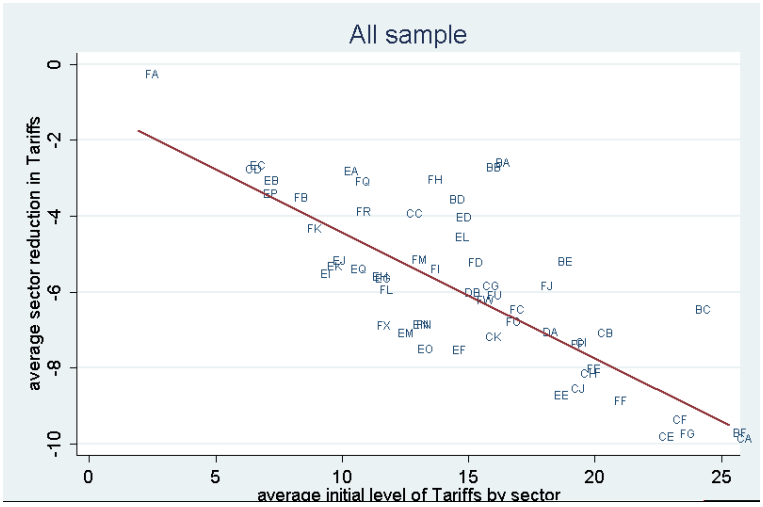


Figure 3.3: Average world sectoral reduction of tariffs vs their initial level

protection structure of each country remained unchanged. In figure 3.4, we investigate this issue by plotting initial and final tariffs for the entire sample and for the UR sub-sample. If, after the application of the UR concession, the world protection scheme against France remained unchanged, then we should observe all the observations lying on a line going through the origin[15].

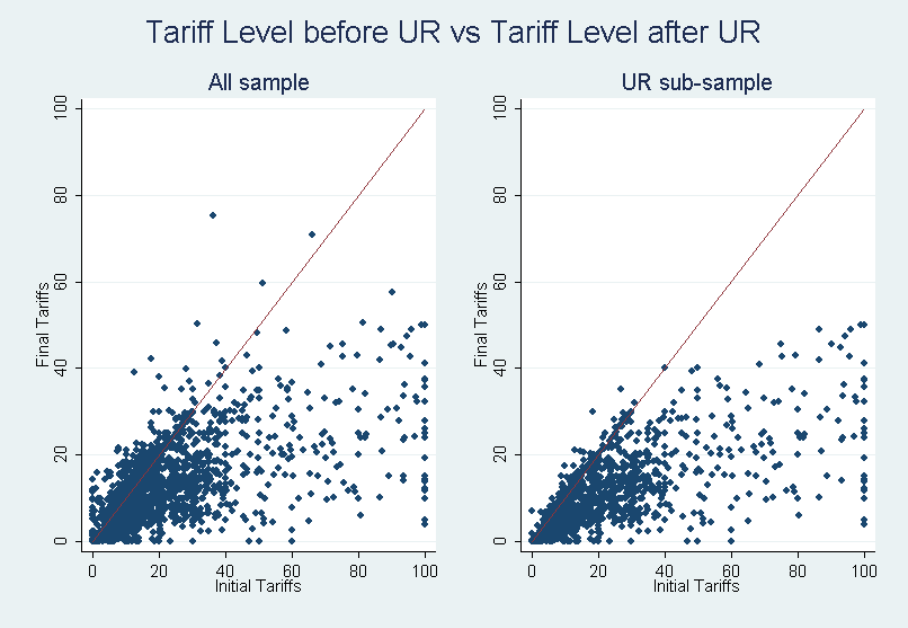


Figure 3.4: Initial and final level of tariffs

Figure 3.5 presents the same evidence for tariffs at the average product level. Even if, on average, tariffs decreased, sector protection structure set by the average country against France remained unchanged after this tariff reduction round. This may give rise to a problem, since not only tariff levels in each period are endogenous, but also tariff changes through time seems to be endogenous. In fact, the reduction was chosen in such a way that it left the protection pattern unchanged. These two problems will be addressed in the econometric analysis.

Finally, Figure 3.6 shows the dispersion of tariff variations (in percentage points) between the beginning and the final period for different sub-samples. As expected, when we focus on the UR sub-sample, the dispersion on which our empirical analysis relies is higher[16].

Having described the patterns of Uruguay Round on world tariffs against France, we next turn to describe French exports in our sample.

[15]In other words, if most of the observations lie on a line going through the origin, then tariffs correlation across time is high.

[16]Notice that all the things discussed in this section hold if we measure tariffs by their logarithm, as we do in the econometric section.

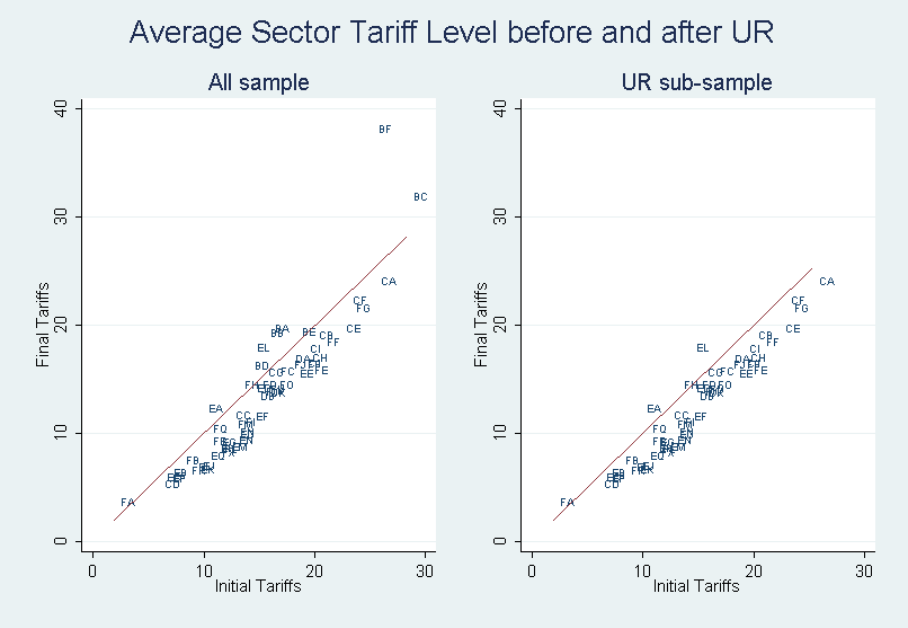


Figure 3.5: Sector average initial and final level of tariffs

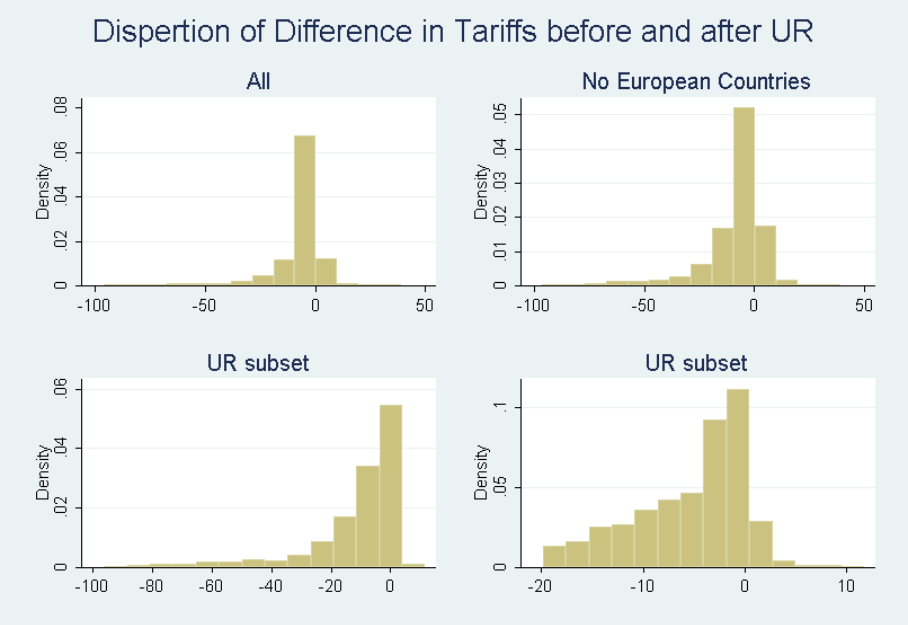


Figure 3.6: Dispersion of tariffs difference before and after UR

3.3.2 French exports

We use data from the Douanes database. The latter reports import and export flows of French firms by partner country, year, firm and product (at the 3-digit NES level[17]).

Since we want to keep track of the type of product exported by firms, our margins are constructed in a non standard way. For instance, Bernard, Jensen, Redding and Schott (2007) construct their margins such that a firm exporting two different products counts twice in the extensive margin. Here, it also counts twice but in two different sectors, so that our extensive margin is more narrowly defined.

Douanes data contain all flows which are above 1,000 euros for extra-EU trade and above 200 euros for intra-EU trade[18]. However, the total reported flows must cover more than 97% of the value of the national trade. Hence, we do not believe that these characteristics of the data are likely to bias the results in a systematic way.

We have restricted our sample to manufacturing products, excluding agricultural ones, which are often treated as special cases in tariffs setting and multilateral discussions[19]. Services are also excluded since trade strategies may differ substantially from those in manufacturing sectors.

Finally, because we want to be very careful about the data, we keep only those firms which are considered as exporters in both Douanes and BRN data bases[20].

After merging the data, we are left with 147 countries, 57 products and 13 years.

We now turn to describe some characteristics in these data.

The first thing to notice is that France does not export all products to all destinations. Figure 3.7 reports for each year the proportion of potential flows (product $\times$ country) that are strictly positive[21].

The share of zero-flows seems to be stable in French exports across our time-span, remaining at about 20 % of the potential flows. This pattern confirms how numerous zero-flows are: even a developed country like France does not export all its product to all its trade partners.

Figure 3.8 shows the total value of French exports (in logs) by sector (to all the countries of our sample).

The sectors in which France exports to a larger extent are DA (Manufacture of motor vehicles, bodies and trailers) and DB (Manufacture of parts and accessories for motor vehicles). France also exports substantial amounts in sector CD (Manufacture

[17]This decomposition represents 60 manufacturing sectors.

[18]These are the actual data requirements according to Eurostat. They have been subject to changes during the period but we control for these changes in the empirical analysis by introducing time fixed effects. The number of exporters is understated because small flows are not reported.

[19]Uruguay Round is indeed the first tariff reducing round in which agricultural issues have been seriously taken into account. This big shock in agricultural sector could be the main issue of a companion paper.

[20]Bénéfices Réels Normaux. This base provides balance-sheet data of French firms for each year of the sample. BRN also reports exports revenues. We keep only those firms which are exporters according to both data sets. We will use this database in the extension to the firm-level analysis.

[21]To some extent, zero flows depend on the product disaggregation level and on the legal threshold for reporting a flow to the Douanes administration.

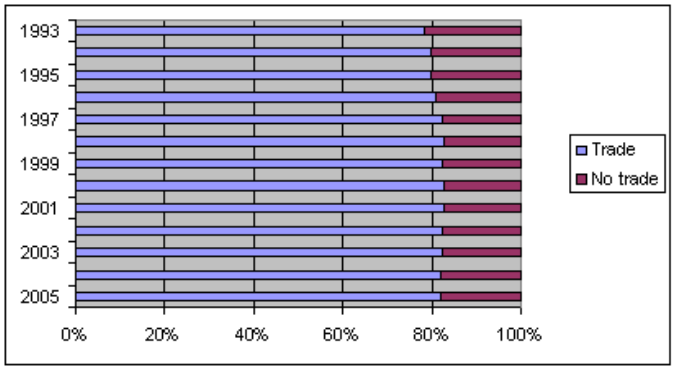


Figure 3.7: Macroeconomic extensive margin

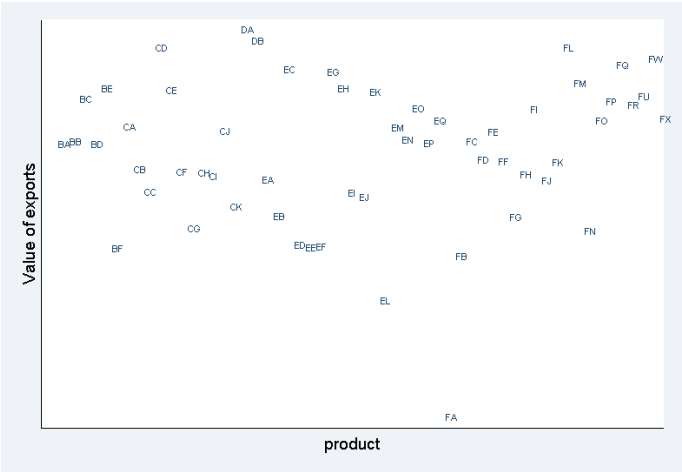


Figure 3.8: Total export value by sector (2002)

of pharmaceuticals, medicinal chemicals and botanical products) and FL (Manufacture of basic organic chemicals). Conversely, exports of FA (Mining of metal ores), EL (Manufacture of weapons and ammunition)[22] and FB (Other mining and quarrying) are relatively small.

Figures 3.9 and 3.10 finally show the relation between the positive flows and the main gravity determinants, trade-partner GDP and distance (both in logs). The first relation is plotted for every sector and for a "good performing" (DA) and a "bad performing" (FB) sector, while the second one is plotted only on average.

Gravity predictions work well. We conclude that our aggregated micro-data follow the usual pattern of macro trade flows. Encouraged by this evidence, we next turn to explore in a more formal way the relation between trade flows and gravity determinants, considering tariffs as the main trade barrier.

3.4 Econometric strategy

We follow the decomposition defined in the theoretical section (equation 3.10), which is hereafter reported in logs and with all the corresponding subscripts:

$$m_{j,t,s} = n_{j,t,s} + \overline{m}_{j,t,s}$$

where m is the log of total export, n is the log of the number of exporters and $\overline{m}$ is the log of average exports per firm.

Let $x_{j,t,s}$ be our variable of interest (either m, n or $\overline{m}$). Previous literature that, using firm-level data, has used this same decomposition to obtain the effect of gravity determinants on trade margins[23], rely on the following regression[24]:

$$x_{j,s,t} = \beta_0 + \beta_1 d_j + \beta_2 GDP_{j,t} + \beta_3 Z_j + \beta_4 Y_{j,t} + \delta_s + \delta_t + \epsilon_{j,t} \tag{3.11}$$

where j denotes partner country[25], s product and t time. The main variable of interest, the proxy for trade cost, is d_j which measures distance. As usual, being the previous one a gravity equation, it includes $GDP_{j,t}$ of trading-partners. The specification also includes a set of country-time and country-specific covariates, $Y_{j,t}$

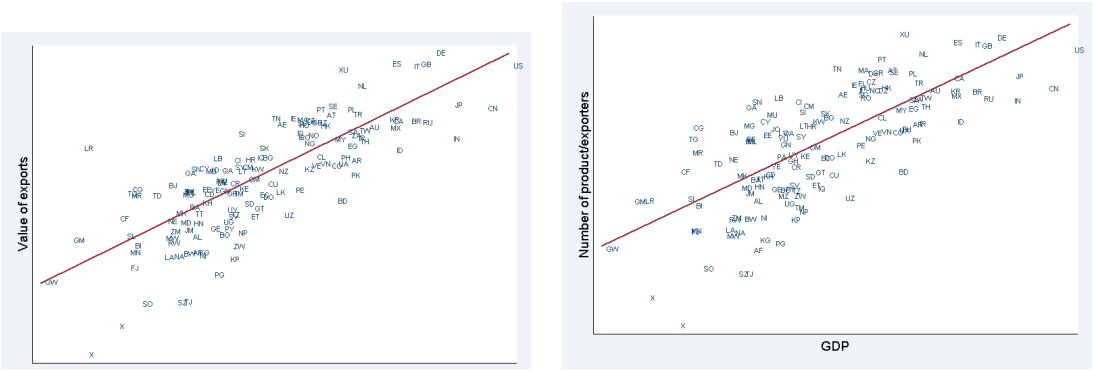
[22] We suspect that exports are under-reported in this sector, since it is subject to declaration exemptions.

[23] BJRS (2007) for US export in 2000, Meyer-Ottaviano (2007) for a combined data set with Belgian and French export in a single year and Crozet and Koenig (2007) for French export between 1989 and 1992

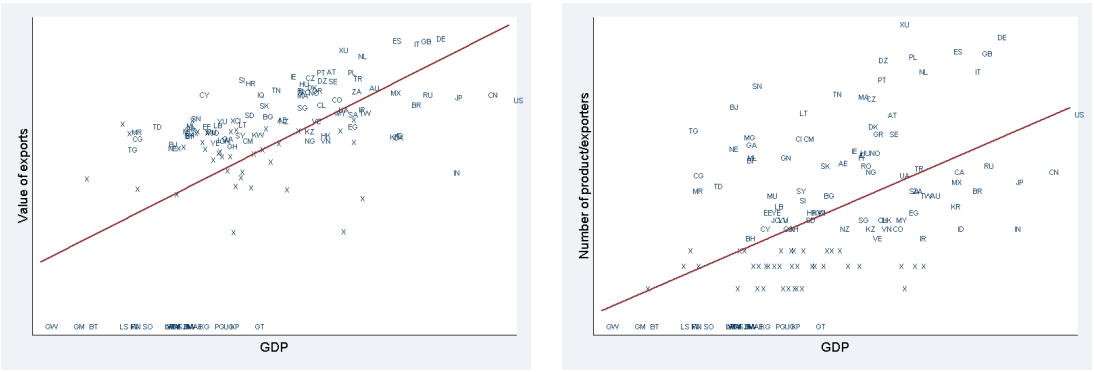
[24] We compare our strategy with Crozet and Koenig (2007) ones more than with BJRS (2007) and Meyer-Ottaviano (2007) since they use this framework only to give a broad description of the way trade margins move with GDP and distance, more than to estimate the elasticity of export to trade cost. They thus use aggregate data at the country level (not at the sector one) for one year, and they further decompose the intensive margin into the number of exported products (the 'product-extensive margin') and the average product-export by firm (their 'intensive margin').

[25] Notice that it is not possible to carry out this analysis using bilateral trade between countries, unless one relies on firm-level data which are comparable across countries. HMR (2008) could do it because they *estimate* the number of exporters in each country.

All sectors



Sector DA (Manufacture of motor vehicles, bodies and trailers)



Sector FB (Other mining and quarrying)

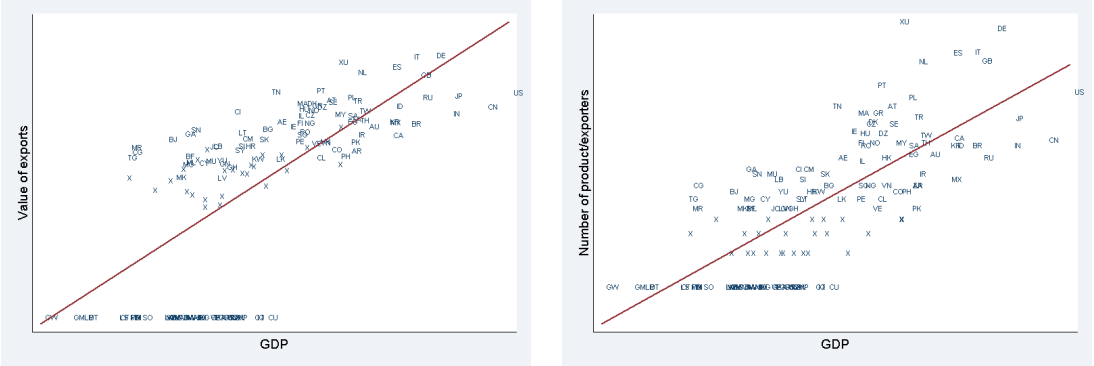


Figure 3.9: Total and extensive margins and GDP (2002)

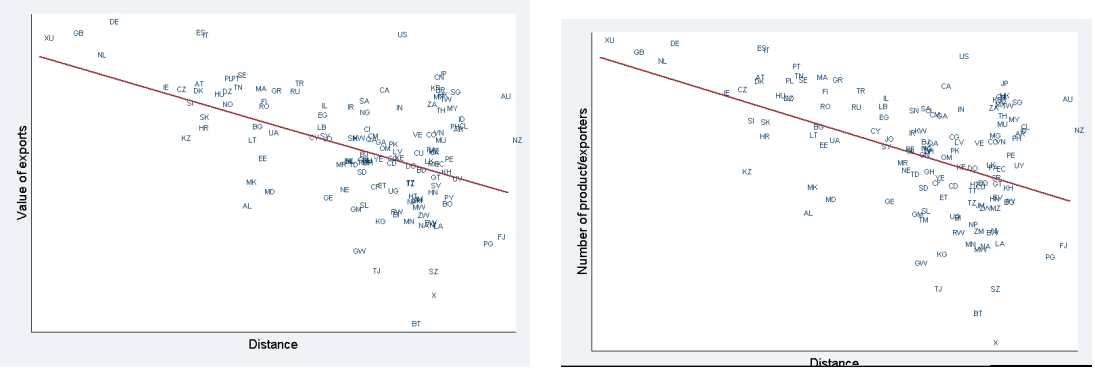


Figure 3.10: Total and extensive margins and distance (2002)

and Z_j, respectively[26]. The first set contains a binary variables which indicate if the partner is a WTO member and if it benefits from the Generalized System of Preferences (GSP)[27]. Since countries joined WTO and obtained GSP at various times, both these variables are time-variant. The second set of controls contains a dummy for former colonies of France, a dummy for islands and another one for landlocked countries. Finally product and time fixed effects are included. Notice that since only flows involving France are included, French GDP is collinear to the time fixed effects δ_t. Thus, it is omitted in the regressions.

The main problem in interpreting the distance coefficient as the elasticity of trade to variable trade costs is that one is not allowed to control for country fixed effects along with distance. Thus, the distance coefficient may take all the effects coming from any country time-invariant covariate which is not included in the regression. For instance, countries which are close to France are also "culturally" similar to it. Thus, distance may capture consumer tastes instead of trade costs. However, since there are no measures of consumer tastes, this cannot be included in the estimation. The second problem is that distance is a geographic proxy for trade cost, but it does not give information on the response of export to more specific sector-country costs.

In this paper our measure of trade costs is, thus, tariffs. Not only using tariffs one can obtain the elasticity of trade (and/or of its margins) on a more proper (policy) variable, but, since tariffs are sector-country and time specific, one can control, to start with, for unobserved country-specific fixed effect.

[26]The set of variables included in gravity equation usually change in different analysis. Since we are reporting this regression only for comparison reason we allow for the usual controls, like in Rose(2004)

[27]GSP consists in a special unilateral tariffs' concession that industrialized countries grant to developing countries and which is not subject to the "Most Favored Nation" (MFN) clause of the WTO. Thus GSP exempts WTO member countries from MFN for the purpose of lowering tariffs for the least developed countries without having to do so for richer ones. The idea of tariff preferences for developing countries was discussed within UNCTAD in the 1960s. Among other concerns, developing countries claimed that MFN was creating a disincentive for richer countries to reduce and eliminate tariffs with enough speed to benefit developing countries. Finally these concessions are not reciprocal and they are granted without any quantitative limitations.

Previous specification introducing tariffs becomes:

$$x_{j,s,t} = \beta_0 + \beta_1 \theta_{j,t,s} + \beta_2 d_j + \beta_3 GDP_{j,t} + \beta_4 Z_j + \beta_5 Y_{j,t} + \delta_s + \delta_t + \epsilon_{j,t} \qquad (3.12)$$

where the main variable of interest, in our analysis, is $\theta_{j,t,s}$, the log of $1 + t_{j,t,s}$[28], and $t_{j,t,s}$ is the tariff applied to products of type s at time t by country j.

Just as discussed,using the fact that our trade-cost measure vary along more dimensions, we can further substitute all time-invariant country characteristics by country fixed effect, δ_j:

$$x_{j,t,s} = \beta_0 + \beta_1 \theta_{j,t,s} + \beta_2 GDP_{j,t} + \beta_5 Y_{j,t} + \delta_j + \delta_s + \delta_t + \epsilon_{j,t,s} \qquad (3.13)$$

For a matter of comparison we report results for each of the 3 previous specifications (without tariffs, with tariffs, with tariffs and country fixed-effect) and for each of the margin (total, extensive and intensive) in turn in table 3.2.

First, in columns (1) to (3) we find the usual results of gravity equation for total trade, as well as for intensive and extensive margins. These results are in line with expectations: partner GDP has a positive effect on French trade, while distance has a negative impact on it. Being an ex-French colony or an island increases exports, while being landlocked decreases them. The WTO membership dummy coefficient is positive and significant, like in Mayer & Ottaviano (2007) and in HMR (2008). Interestingly, having a GSP with France decreases total trade[29].

When we introduce tariffs (column (4) to (6)) we find that the elasticity of distance does not change much, and the result on tariffs are negative and significant at the 1%. The effect of tariffs goes slightly more through the extensive margin. All the variables have similar magnitude and signs except for the GSP, which now is positively related to the intensive margin [30]. Finally notice that in this specification the R^2 is higher (since we are including a significant variable) but the number of observations is definitely lower since in TRAINS data set many tariffs are not-reported[31].

Once we control for country-fixed effects, in columns (7) to (9), tariff coefficients are still negative and significant but of lower magnitude. The reason may be that we are now controlling for the effect of some omitted country level variables, which could be negatively linked with tariffs and positively with exports (for instance, diplomacy, tastes, preferences, ...). In this specification WTO membership positively explains trade only through the extensive margin. Finally notice that in these set of regressions GSP is not included. The reason is that GSP vary mainly across countries (while the

[28]The parameter that enters multiplicatively in the model, $\tau_{j,t,s}$ is equal to $1 + t_{j,t,s}$ where t denotes the ad-valorem tariff. When ad valorem tariffs are "0" then $\tau_{j,t,s}$ is 1 and the price paid abroad coincides with the domestic one in formula 3.4.

[29]This seems to be the case because GSP is a good proxy for less developed countries. When we run the same regression considering GDP per capita, the effect on GSP becomes positive for the total and the intensive margin and not significant for the extensive one

[30]As before, if we include GDP per capita then the effect of GSP on total and intensive margin is positive, while it becomes insignificant for the extensive one.

[31]We will discuss about this problem in a further section.

variation across time is very reduced), thus in this specification it becomes collinear to the country fixed-effect. This is the reason why GSP will not be included in further regressions, as well.

Results in columns (7) to (9) suggest that a reduction of tariffs of 1 p.p. from 10% to 9% increases total trade by 2.62%[32], the extensive margin by 1.57% and the intensive margin by 1.03% [33]. These coefficients imply that the contribution of tariffs in explaining the growth rate of total French export is 2.2%.

Reporting Table 3.2 is useful to compare our results with standard ones on gravity equations. In next section, we turn to focus the analysis on our variable of interest, tariffs, and discuss the potential biases on its coefficient in the baseline regression 3.13.

[32]The effect on the total margin, when tariffs goes from 10% to 9% is calculating as $[ln(1+0.09) - ln(1+0.10)] * (-2.87) = 0.0262$.

[33]The magnitude of the results do not change if we perform the same regressions using $ln(\tau_{j,s,t})$ instead. The only difference is that, in this case, we loose all the observations for which tariffs are 0 (since the logarithm of 0 is not defined), like the ones on intra-EU trade.

Dependent variable: Log of each trade margin

Margin	Total	Extensive	Intensive	Total	Extensive	Intensive	Total	Extensive	Intensive
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
ln(tariffs)				**-2.87*** **	**-1.73*** **	**-1.13*** **	**-1.59*** **	**-0.85*** **	**-0.73*** **
				(0.13)	**(0.07)**	**(0.09)**	**(0.12)**	**(0.06)**	**(0.10)**
ln(GDP)	0.98***	0.54***	0.44***	1.02***	0.55***	0.46***	1.14***	0.63***	0.51***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.13)	(0.05)	(0.11)
ln(distance)	-1.12***	-0.71***	-0.40***	-1.05***	-0.65***	-0.40***			
	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)			
WTO	1.01***	0.83***	0.17***	1.07***	0.89***	0.17***	0.32***	0.22***	0.09
	(0.01)	(0.01)	(0.01)	(0.03)	(0.01)	(0.02)	(0.08)	(0.04)	(0.06)
GSP	-0.20***	-0.18***	-0.02***	-0.20***	-0.27***	0.06***			
	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)			
Colony	1.32***	1.20***	0.11***	1.65***	1.44***	0.21***			
	(0.01)	(0.01)	(0.01)	(0.03)	(0.01)	(0.02)			
Island	0.90***	0.62***	0.28***	0.62***	0.37***	0.24***			
	(0.02)	(0.01)	(0.01)	(0.03)	(0.02)	(0.02)			
Landlocked	-0.98***	-0.66***	-0.32***	-0.91***	-0.62***	-0.28***			
	(0.02)	(0.01)	(0.01)	(0.03)	(0.01)	(0.02)			
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Product FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	NO	NO	NO	NO	NO	NO	YES	YES	YES
R^2	0.66	0.73	0.48	0.74	0.80	0.57	0.83	0.90	0.60
N obs	60,359	60,359	60,359	27,057	27,057	27,057	30,189	30,189	30,189

***:significant at the 1% level; **:significant at the 5% level; *: significant at the 10% level.

Robust standard errors are the ones reported. Constant and dummies coefficient are not reported.

Table 3.2: Gravity equation with tariffs and control variables

3.5 Addressing the biases

Regression (3.13) controls for one-dimension fixed effects on country, sector and time. Country-specific fixed effects control for all country characteristics which may jointly determine the average country tariffs and its imports from France. Product fixed effects capture everything at the product level which may influence both tariffs and exports, for example a world shock on a specific sector (suppose France is the best wine producer in the world, then both French wine exports as well as, to some extent, tariffs on French wine will depend on this). Finally, time fixed effects control for all macro-shocks which can explain French exports and which can be spuriously correlated with tariffs. However some concerns remain.

The first problem with regression (3.13) is that it controls for sector and country fixed effects separately. In other words it captures the effect of variables that influence average setting of tariffs in a given country or in a given sector. However it does not controls for unobserved variables at the country-product level that may explain both the setting of tariffs and the imports from France, which is what really matters in shaping the level of tariffs set in each period by French trade-partners in each sector.

This term mainly captures comparative advantage. One of the main ideas in trade literature is that trade patterns are determined by the structure of comparative advantage. Also the way protection policies are chosen is mainly dependent on it. It is implausible that a country would set high tariffs to all its products, or that the same product would be protected in the same way throughout the whole world. Much more reliable is the hypothesis that each country sets higher tariffs on those products it wants to protect more from French competition.

Replacing $\delta_{j,s}$ instead of $\delta_j+\delta_s$ is feasible by running regression (3.13) in difference:

$$\Delta x_{j,t,s} = \beta_0 + \beta_1 \Delta\theta_{j,t,s} + \beta_2 \Delta y_{j,t} + \delta_t + \epsilon_{j,t,s} \tag{3.14}$$

where the term $y_{j,t}$ contains both $GDP_{j,t}$ and a dummy capturing the (time-varying) WTO-membership.

Results of this specification, for the total margin, are reported in column (1) of Table 3.3. Notice that the dependent variable is now the bi-annual growth of export and the main regressor is the bi-annual (negative) growth of tariffs. Coefficient on tariffs has the expected sign, but it is not significant. Moreover the magnitude is very small. The results on the extensive and the intensive trade margins (which we do not report) mirror the ones on total trade, being negative, small and not-significant.

Dependent variable: Bi-annual growth rate of each trade margin: Δm, Δn, $\Delta \hat{m}$

Model	Δ	Δ + trends	Δ+ trends				Δ+ trends			
Technique	OLS	OLS	2SLS, short instrument				2SLS, long instrument			
Margin	total	total	1st stage	Total	Extensive	Intensive	1st stage	Total	Extensive	Intensive
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$\Delta ln(tariffs)$	**-0.05**	**-0.086**		**-3.71**	**-2.59****	**-1.11**		**-2.60**	**-3.29*****	**0.68**
	(0.17)	**(0.17)**		**(3.07)**	**(1.23)**	**(2.88)**		**(1.93)**	**(0.96)**	**(1.81)**
$\Delta ln(GDP)$	2.77***	3.14***	-0.07***	2.61***	1.10***	1.50***	-0.06***	2.69***	1.04***	1.65***
	(0.25)	(0.35)	(0.01)	(0.47)	(0.20)	(0.43)	(0.10)	(0.44)	(0.20)	(0.40)
WTO	-0.04	-0.04	-0.013***	-0.27	-0.15**	-0.11	-0.01***	-0.26	-0.16**	-0.09
	(0.09)	(0.10)	(0.003)	(0.22)	(0.07)	(0.19)	(0.003)	(0.21)	(0.07)	(0.19)
Initial level of tariffs			-0.06***							
			(0.004)							
Initial level of tariffs$*\delta_{1994}$							0.02***			
							(0.01)			
Initial level of tariffs$*\delta_{1995}$							-0.09***			
							(0.01)			
Initial level of tariffs$*\delta_{1996}$							0.06***			
							(0.01)			
Initial level of tariffs$*\delta_{1997}$							-0.03***			
							(0.01)			
Initial level of tariffs$*\delta_{1998}$							0.08***			
							(0.01)			
Initial level of tariffs$*\delta_{1999}$							0.03***			
							(0.01)			
Initial level of tariffs$*\delta_{2000}$							0.03***			
							(0.01)			
Initial level of tariffs$*\delta_{2001}$							0.03***			
							(0.01)			
Initial level of tariffs$*\delta_{2002}$							0.03***			
							(0.01)			
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Product-Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Product trend	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
Sector trend	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
Instrument	NO	NO		$\theta_{j,s}^{1993}$	$\theta_{j,s}^{1993}$	$\theta_{j,s}^{1993}$		$\theta_{j,s}^{1993}\delta_t$	$\theta_{j,s}^{1993}\delta_t$	$\theta_{j,s}^{1993}\delta_t$
F			17.31				18.25			
No obs	17,621	17,621	12,364	12,364	12,364	12,364	12,364	12,364	12,364	12,364
R^2	0.02	0.04	0.13	0.03	0.02	0.02	0.14	0.03	0.0004	0.02

***:significant at the 1% level; **:significant at the 5% level; *: significant at the 10% level.

Robust standard errors are the ones reported. Constant and dummies coefficient are not reported.

Table 3.3: Gravity equation with tariffs: model in difference, IV regressions

This specification improves the baseline one, but there are still concerns. We are doing quite a good job in controlling for variables that are correlated with the levels of tariffs. However we are not allowing for any control that can explain the growth rate of exports and that may be spuriously correlated with the growth rate of tariffs.

Suppose for example that France is starting to export more to middle-income countries and that these are exactly the countries that are reducing by more their average tariffs for a reason which is not specific to WTO formation (for example since they are facing "financial integration" during the '90s). This would bias our results. By controlling for country time-varying covariates (like GDP and WTO-membership) we are certainly mitigating this worry. However, to take the bias into account more carefully, we add country trends in our level regression, which is equivalent to add country fixed-effect, δ_j in regression (3.14)[34].

The second concern regards sector-time specific omitted variables. Suppose, for example, that France is growing more in a specific sector (and this is the reason why it is exporting more in this sector) and this is exactly the sector where average world tariffs are decreasing by more (for unobservable reasons). We control for it by adding sector-trends in our baseline regression, which show up in a sector fixed-effect in regression (3.14)[35].

The specification with trends becomes:

$$\Delta x_{j,t,s} = \beta_0 + \beta_1 \Delta\theta_{j,t,s} + \beta_2 \Delta y_{j,t} + \delta_j + \delta s + \delta_t + \epsilon_{j,t,s} \tag{3.15}$$

and results, for the total margin, are reported in column (2) of Table 3.3. Also in the model with trends we find a negative, slightly higher (in absolute values) but still insignificant, coefficient for tariffs.

Before providing a discussion on these insignificant results, we turn to discuss a last fundamental empirical concern.

As noticed in previous sections after the implementation of UR tariffs decreased without being completely eliminated (and without reaching a predetermined level). This means that, even if tariffs reduction was induced by the UR implementation, we cannot be sure that this was the only reason for their reduction. In other words, we cannot rule out the hypothesis that unobservable joint country-sector time-varying characteristics are simultaneously affecting tariff formation and import from France (here we have in mind the perspective of French trade-partners) in our time-span[36].

A way to control for this bias is to instrument the *growth rate of tariffs*[37]. The

[34]Notice that, since we have more than two time periods, trend and macro-shock do not coincide. To fully control for country macro-shock we should add a $\delta_{j,t}$ in the equation in difference. However this is unfeasible given the big number of fixed effect. We add a trend, instead.

[35]See previous note

[36]Suppose, for example, that the pattern of comparative advantage is changing through time in our sample. If this were the case, then both the import from France and the way tariffs are set against French products may vary, partially, for that reason.

[37]If all the tariffs after the UR had dropped to zero, then the initial level would have been the measure of the change in tariffs. In this case, by controlling for all the variables which determine the level of tariffs we would have addressed our concern. See Bustos (2007) for a policy change in which this scenario happens.

descriptive analysis displayed in the first section clearly indicates a variable that affects the *growth rate in tariffs*: the *pre-UR level* of tariffs [38]. Moreover pre-UR tariffs level should not affect the French *export growth rate* since it is predetermined. Those two considerations imply that the pre-UR tariffs level is a good instrument for their (negative) growth rate in subsequent years.

This instrument has been first used by Goldberg and Pavcnik (2005) in their analysis on the effect of trade liberalization in Colombia on sectoral wage premium. As they clarify in their paper, political economy models explain the patterns of protection only in a static framework and not in a dynamic one. Thus there is no suggestion, on the theoretical side, on the kind of instrument one should use to solve this problem. Like us, they have many periods of time and they show how the change in tariff between the initial and final period in their sample is strongly correlated with the initial one. Moreover, they argue that in each period Colombian government sets the tariffs level looking at some time-varying macroeconomic variables like the world price of coffee or the exchange-rate. Thus they instrument the change of tariffs with pre-reform level of tariffs or with its interaction with coffee price or exchange rate.

We follow them and estimate the regression in difference with trends using a 2SLS procedure. In the first stage we instrument tariff changes with their pre-WTO level, that is their level in 1993.

The regression we run is thus the following one:

$$\Delta x_{j,t,s} = \beta_0 + \beta_1 \widehat{\Delta\theta_{j,t,s}} + \beta_2 \Delta y_{j,t} + \delta_j + \delta_s + \delta_t + \epsilon_{j,t,s} \tag{3.16}$$

where $\Delta\theta_{j,t,s}$ is instrumented with $\theta_{j,s}^{1993}$ in this first stage regression:

$$\Delta\theta_{j,t,s} = \alpha_0 + \alpha_1 \theta_{j,s}^{1993} + \alpha_2 \Delta y_{j,t} + \delta_j + \delta_s + \delta_t + \xi_{j,t,s} \tag{3.17}$$

Results are reported in columns (3) to (6) of Table 3.3. It the first stage, the initial level of tariffs significantly impacts their variation. The coefficient is negative, as we were expecting: we already noticed that sector-country pairs which had higher tariffs in 1993 are those who experienced the largest cuts. Moreover the F-statistic of the first stage is higher than 10, suggesting that our instrument is not weak.

It the second-stage, we obtain negative estimates for the tariffs, whose magnitude is substantially higher than in the baseline case [39]. However the coefficient is significant only for the *extensive margin*. A reduction of tariffs by 1 p.p. starting from a level of 10% increases the number of French exporter by 2.36%.

The underlying assumption in previous 2SLS regression is that the initial level of tariffs (the instrument) affects their growth rate in the same way throughout all the sample. As discussed earlier Goldberg and Pavcnik (2005) take into account what

[38] The graphs showed the relation between initial level of tariffs and their change. Graphs hold if we consider the relation between the log of initial level of tariffs and their growth rate between 1993 and 2002

[39] The reason may be that protection is more likely to occur in sectors and countries where the import penetration is high, according to the endogenous protection literature. When we do not control for reverse causality, our negative relationship is thus downward biased to zero since we also capture part of that positive correlation between tariffs and export flows.

they consider to be time-varying determinants of Colombian tariffs like the coffee price or Colombian exchange rate. In our case, finding a similar variable, which is simultaneously meaningful for each country, is more difficult, since we cannot be sure that the macro determinants to set tariffs against France are the same for all countries. At the same time we conceptually think that allowing for a time variation of our instrument is the right framework.

We thus propose a second instrumental variable which consists in the interaction between the pre-WTO level of tariffs in each country-sector pair and a generic time dummy. Using such an instrument is feasible given the data set dimension and, we think, is the broadest one, since it captures all world macro-shocks which may be relevant for each country in setting their tariffs year after year. In other words, the logic for this instrument is to allow the initial level of tariffs to affect its change in different way through time[40]. Results are reported in last four columns of Table 3.3. The use of this instrument does not affect basic results[41].

We now do a step backward and we try to investigate the reason why tariffs' coefficient is small and of not-significant in the first two columns of Table 3.3 compared to their relative IV counterparts. First, it may be that the inclusion of European countries is responsible of this pattern. The reason may be that tariffs among European countries are "0" throughout our entire sample. This means that in the difference equation these observations will associate a "0" change in tariffs to a potential big change in export flows (since European countries are the main French trade-partners). This may down-bias tariffs coefficient in regressions (3.14) and (3.15). At the same time European Union countries observations are not essential in the IV regressions, since the identification on the tariffs‘ coefficient in the IV first stage, relies only on their change with respect to their initial level (and European tariffs did not change). To investigate this issue, we tried all the previous set of regressions excluding European Union countries. Results did not change. In particular the OLS estimation provides small and insignificant coefficients for the three margins.

A second reason for this result may be the difference in sample-size between OLS in levels, OLS in difference and 2-SLS regression in difference. By running our regression in difference we loose not only all the observations of the first period, but also all those observations for which TRAINS data does not provide tariffs for two consecutively years. Thus we reduce our sample from $30,189$ observations (in column (7) of Table 3.2) to $17,621$ (in column (1) and (2) of Table 3.3). When we use the 2-SLS procedure we further loose those observations for which, even if we have tariffs for a couple of subsequent years, we do not have them for 1993. To check if the result depend on the sample size we perform regression (3.13) on the reduced sample of 17,621 observations

[40]Basically we allow growth rate in tariffs not to have always the same slope w.r.t. the initial level.

[41]There is something more about the policy change that we could use in the construction of our instrument. We could, for example, try to impose the timing of the reform in a more structural way. A direction could be to construct an instrument that allows the tariffs of those countries that subscribed the UR to depend on their pre-UR level while leaving the tariffs of those countries outside WTO (and thus which did not subscribe UR concessions) to change according to their previous year level.

and regressions (3.14) and (3.15) on the reduced sample of 12,364 observations for which tariffs are available in 1993. Results do not change substantially.

A third reason for this pattern may be that the bi-annual time-variation in tariffs for each country-sector pair in our sample is not sufficiently high. By converse, the time-variation in tariffs with respect to the *initial pre-WTO level*, seems to be sufficiently high to capture the effect of tariffs on the export flows[42]. A way to check if this is indeed the case is to increase the time-variation of tariffs in our data. For clarity of exposition, we propose a way to perform this robustness check in the following sub-section.

3.5.1 Robustness check

A robustness check for our results consist in increasing the size of the data set with the main aim of allowing a higher variation of tariffs through time in each country-sector pair. A way to do it is to use French import data, as well. The same data base that provides detailed export from French firms to each destination in each year, provides also the same information on the import side. We thus know how many French firms import a given product from each country in a given year. On the other side we use the same TRAINS data recovering the tariffs that France applies in a given product, towards each country in a given year. By doing this, we are dramatically increasing the number of usable observations, since France reports tariffs for almost all its trade-partners, thus the sample-size in this data is more than doubled. Regressions (3.14) and (3.15) are now performed on 47,322 observations instead than 17,621 ones and IV specifications rely on 41,756 observations instead than on 12,364 ones. Specifications do not change, except for the fact that we allow for an import dummy that capture the direction of each flows[43].

Results, reported in Table 3.4, mirror the ones in Table 3.3 with the "increased" data set. The tariffs' coefficient in the OLS regressions (first two columns) are now negative, significant, and much higher in magnitude that their correspondents in Table 3.3. This indirectly confirm our suspicions on the scarce time-variation in bi-annual tariffs for each country-sector pair in previous regressions. Another main difference is that the coefficient on GDP has drastically decreased. The reason may be that French exports and imports have different elasticities to country sizes [44]. The negative import dummy coefficient indicates that France is a net exporter in our time-span. Columns (3) to (6) and (7) to (10) report results with the 2SLS procedure (and the same instrument as before[45]). The patterns we found with the export data still apply. The

[42]It worths reporting, moreover, that when we run the difference regression on a subset which contains only the countries to which UR applies (those countries and sector which we defined the UR subset in the descriptive analysis) and for which the information on tariffs in 1993 is available, tariffs coefficient becomes significant. This indirectly confirm that the problem in the equation in difference stems from the scarce time-variation of tariffs in each country-sector pairs for the all data set.

[43]This dummy is 1 if the flow is an import one and 0 otherwise.

[44]In fact by performing the regressions on import data only GDP coefficient is even lower the the one in Table 3.4.

[45]The same logic we discussed for the choice of the instrument applies also to tariffs set by France

difference is that magnitude slightly decrease and the effect of tariffs on the *total margin* is significant in one specification. GDP and being part of WTO, instead, turn out to be not significant anymore.

As we discussed in the beginning of this subsection the reason to perform this robustness check is that this big data set allows us to identify results since it provides a bigger bi-annual tariffs variation inside each country-sector pair. However, the interpretation of the tariffs' coefficient is not straightforward as before. While the extensive margin of trade on the export side is well rationalized by the kind of model we report in the first section of this paper, its counter-part on the import side does not arise from that model. Which are the firms that import and which costs they have to bear to do it are still not clear concepts in theoretical literature. However, it is true that, in the French case, those firms who export tend also to be the ones that import, thus we may interpret the coefficient of tariffs on the number of exporters or importers just in the same way as before. In any case, to be fully consistent with the model, we consider the findings in Table 3.4 as only a robustness check of the previous ones.

on its trade-partner products.

Dependent variable: Bi-annual growth rate of each trade margin: Δm, Δn, $\Delta \hat{m}$ (Data set with exports and imports)

Model	Δ	Δ + trends	Δ+ trends				Δ+ trends			
Technique	OLS	OLS	2SLS, short instrument				2SLS, long instrument			
Margin	total	total	1st stage	Total	Extensive	Intensive	1st stage	Total	Extensive	Intensive
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
$\Delta ln(tariffs)$	**-0.52*** **	**-0.45*** **		**-1.86**	**-1.80*** **	**-0.05**		**-2.34***	**-2.45*** **	**0.10**
	(0.18)	**(0.17)**		**(1.67)**	**(0.73)**	**(1.55)**		**(1.39)**	**(0.68)**	**(1.19)**
$\Delta ln(GDP)$	0.63***	0.59***	-0.006**	0.20	0.09	0.11	-0.006**	0.20	0.08	0.12
	(0.19)	(0.22)	(0.003)	(0.24)	(0.08)	(0.21)	(0.003)	(0.24)	(0.08)	(0.21)
WTO	0.016	0.014	-0.001	-0.03	0.02	-0.05	-0.0005	-0.03	0.02	-0.05
	(0.06)	(0.07)	(0.001)	(0.07)	(0.02)	(0.07)	(0.0009)	(0.07)	(0.02)	(0.07)
import (dummy)	-0.037***	-0.07***	-0.001***	-0.09***	-0.07***	-0.02	-0.001***	-0.09***	-0.07***	-0.02
	(0.01)	(0.01)	(0.0002)	(0.010)	(0.004)	(0.009)	0.0002	(0.01)	(0.004)	(0.009)
Initial level of tariffs			-0.054***							
			(0.001)							
Initial level of tariffs$*\delta_{1994}$							-0.06***			
							(0.004)			
Initial level of tariffs$*\delta_{1995}$							-0.06***			
							(0.006)			
Initial level of tariffs$*\delta_{1996}$							-0.18***			
							(0.006)			
Initial level of tariffs$*\delta_{1997}$							-0.11***			
							(0.004)			
Initial level of tariffs$*\delta_{1998}$							-0.019***			
							(0.004)			
Initial level of tariffs$*\delta_{1999}$							-0.08***			
							(0.004)			
Initial level of tariffs$*\delta_{2000}$							-0.05***			
							(0.004)			
Initial level of tariffs$*\delta_{2001}$							-0.02***			
							(0.003)			
Initial level of tariffs$*\delta_{2002}$							-0.02***			
							(0.003)			
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Product-Country FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Product trend	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
Sector trend	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
Instrument	NO	NO		$\theta_{j,s}^{1993}$	$\theta_{j,s}^{1993}$	$\theta_{j,s}^{1993}$		$\theta_{j,s}^{1993}\delta_t$	$\theta_{j,s}^{1993}\delta_t$	$\theta_{j,s}^{1993}\delta_t$
F			17.56				21.15			
No obs	0.03	0.03	0.08	0.04	0.01	0.009	0.10	0.04	0.15	0.009
R^2	47,322	47,322	41,756	41,756	41,756	41,756	41,756	41,756	41,756	41,756

***:significant at the 1% level; **:significant at the 5% level; *: significant at the 10% level.

Robust standard errors are the ones reported. Constant and dummies coefficient are not reported.

Table 3.4: Gravity equation with tariffs: model in difference, IV regressions, Export and Import

3.6 Further Econometric Issues

3.6.1 Reporting tariffs

The TRAINS data set provides a significant amount of tariffs, but many country-year-product observations are missing. If tariffs were an exogenous variable and the selection was random then results with OLS would be unbiased. However tariffs may be endogenous, as we discussed in previous section, and we cannot exclude the possibility that sample selection is non-random.

If sample selection were driven by factors that also affect the size of French export flows, then sample-selection and the dependent variable are correlated and the OLS coefficient are biased. This situation could happen if selection occur for a given level of export (suppose for example that tariffs are not reported by those countries whose trade with France is insignificant due to prohibitive barriers to trade) [46].

To have an indication of the existence of non-random truncation, we regressed each trade margin on an indicator for "tariffs-reporting" as well as on the other usual covariates. All the margins are significantly higher when tariffs are reported. Thus, it's most probable that the kind of observations which are truncated in the data set are of the "low-flows" - "high-tariffs" type.

Addressing the issue of incidental truncation is, though, quite complicated in our case, since we have to treat it at the same time that the biases previously discussed. Moreover we need to identify an exclusion variable which explain tariffs' reporting without directly affecting the export flows. A variable which may satisfy this condition is the General System of Preferences dummy. The reason is that country which are granted by a GSP concession are involved in an official trade agreement with the European Union, thus we expect them to be more careful in undertaking administrative duties, and reporting tariffs. On the other hand, since GSP programs are not reciprocal, there is no reason to expect France to export more to those countries, once we control for usual characteristics.

We tried the simple Heckman procedure on our baseline regression (3.13) and a more sophisticated Heckman procedure on the 2-SLS regression in difference ((3.17) and (3.16)). Results on the selection equation (the one in which we use GSP to estimate the inverse Mills-ratio) are however not clear. In some cases GSP explains positively the tariffs reporting (as we would expect if our economic intuition above is correct) while in other cases in the selection regression GSP has the opposite sign. We suspect that this may happen because GSP does not vary too much across time, thus it is almost collinear to country fixed effects.

We are aware that this issue will need more investigation. However it worth noticing that the robustness check performed in last section could help us in relaxing the severity of the potential incidental-truncation bias. The reason is that when

[46] In this case OLS results are biased. Let's write our model as $y = \beta x + u$ where u is the error term, y export flows and x tariffs. Suppose we don't observe tariffs if export flows are very small. Then if s is an indicator of selection and c is the export flow threshold below which tariffs are not reported, we have that $s = 1$ when $y < c$, which is equivalent to say that $s = 1$ when $u < c - x\beta$. Last line means that s and u are correlated: $E(sx, u) = 0$ does not hold and OLS are biased.

we consider only tariffs set by trade-partners to France, the percentage of reported tariffs is 37.96%. While when we consider the data set with import and exports the percentage of reported tariffs substantially increase, being almost 60% [47]. In the "increased" data set thus, the potential bias originating by not-reporting of tariffs is, at least, reduced.

3.6.2 Log-log specification and zero flows

All regressions reported before are log-log regressions. Recent contributions discuss the biases linked to this kind of specification and the way to improve it.

The first problem with a log-log regression is that, as Santos-Silva and Tenreyro (2006) (SS-T hereafter) have shown, in the presence of heteroskedasticity in the error term of the multiplicative model, the estimation of its log-linearized version may be biased since the assumption of orthogonality between the error term and the regressor is violated. They thus propose to estimate the gravity equation directly in its multiplicative form using a pseudo-maximum likelihood (PML) estimation.

This methodology could also solve the second problem with the log-log specification of a gravity equation: the presence of "0-flows". Recent empirical contributions have shown that many trade partners do not export to each other, thus many trade flows are actually nil. By excluding those observations from the standard gravity equation, results may drastically change (excluding a set of information from a data set is for sure inefficient and it may create biases). Of course, if we perform the gravity equation in logarithms, the 0-flows are "mechanically" not considered since the logarithm of zero is not defined. This is also the case in our previous specifications, since, by following literature, we used a standard specification in logs.

The PML methodology proposed by SS-T solves also this problem because logarithm do not play any role in their specification. They apply their methodology to a gravity model and compare their results using five methods: a log-log specification with log(M)[48] as dependent variable, run with OLS and without taking account for zeros; a log-log gravity equation, taking account for zeros by defining the dependent variable as ln(1+M) and using a OLS estimator; a log-log specification, taking account for the zeros like before and performed using a Tobit specification[49], the Poisson estimate using only positive flows and the Poisson estimate including the 0-flows. After performing various test, they conclude that specifications different from the Poisson pseudo-maximum-likelihood are the ones that perform better. Among other results, with their methodology they find that the elasticity of trade to geographic proximity is significantly smaller.

A second way to take the 0-flows into account is to transform the dependent variable, M, into (1+M), take the logarithms and then treat them using a Tobit specification. The methodology has been used recently by Felbermayr & Kohler (2007),

[47] France report the 68.6% of its tariffs against trade-partners products.

[48] where M are export or import flows.

[49] We describe this methodology in next lines, by citing a recent paper that uses it.

which, in turn, followed Eichengreen (1995) and Eichengreen & Irwin (1997) in transforming the dependent variable in this way[50].

The logic for "recouping" the zeroes by using such transformation is that for high values of M, this transformation does not create biases (since $ln(M) \approx ln(M+1)$) and for low values of M, $ln(1+M) \approx M$ thus coefficients should be interpreted as semi-elasticities. A robustness check for this transformation is to choose threshold which are different than 1. Most importantly, the logic of using the Tobit estimation, as well as the logic to use the Poisson PML one, is that these authors consider the 0-flows as derived from a model with *a corner-solution response*.

Stated this, both models have advantaged and disadvantages. The PML model for example is less straightforward than the Tobit model but it simultaneously solve the 0-flows and the problem of the heteroskedasticity in level. On the other hand the Tobit model has a simple specification, but it required a transformation of the dependent variable hat may not seem appealing[51].

Helpman, Melitz & Rubinstein (2008) treat the 0-flows in a gravity equation in a completely different way. Their main objective is to estimate the effect of the gravity determinants on the *intensive margin* of trade without knowing the number of exporters in any country. They propose the following way to do it. First, they estimate the number of exporters (*the extensive margin*) in each country using a selection equation derived in their standard model[52]. Then, they add this term as a new regressor in the usual gravity equation (which, thus, becomes different from the one used by SS-T for example). Finally they use a Heckman procedure to estimate their model. The reason for this is that they do not observe the intensive margin when there are no exporters (since the intensive margin is *not defined* in this case). Their regression has a problem of "incidental truncation" since the intensive margin is not defined when the exporters are zero, and this in turn happens when no firm decides to export.

To run their specification with a Heckman procedure they use a proxy for the fixed cost of export as the "exclusion variable" : as suggested by their model the fixed costs of export affect the decision of each firm to export or not, but, ones it is paid (and the firm has became an exporter) it does not affect the shipment value. Theoretically the use of this exclusion variable is very convincing since it explains the dependent variable only through its effect on the selection.

Moreover, it should be noticed that, by using this procedure, HMR (2008) could use the log-log specification without any further problem since the zeroes are treated as missing-values. In the first step of their procedure they run a probit estimation

[50] Another way is to perform the gravity equation in a semi-log specification, using the dependent variable in levels and the explanatory variables in logarithms. This strategy has been followed by Eaton and Tamura (1994). However this solution is probably the less efficient since theory leads to a multiplicative form of the gravity equations (which in turn imply a log-log specification) and empirical trials on the semi-log gravity specifications have been shown that it perform quite badly.

[51] Again this is feasible because in the Tobit model the pile of observations on the "0" are the results of a corner-solution, thus transforming those "0" in very low values do not change the structure of the data.

[52] which is similar to the Chaney (2008) version of the Melitz (2003) model.

to uncover the probability that 2 countries trade (thus their dependent variable is an indicator variable on the existence of trade relationship). After estimating an inverse Mills-ratio they run the usual gravity equations in logs on the positive observed flows (including the Mills-ratio as well). Thus, they do not have to insert 0-flows in the second step, because the intensive margin is not defined for those flows.

The difference in the techniques adopted in the literature mainly rely, as far as we understood, on the difference in the regression models: Santos-Silva & Tenreyro (2006) and Felbermayr & Kolher (2007) provides estimates for the *total margin* of trade and propose to take into account the 0-flows albeit in different ways; Helpman, Melitz & Rubinstein (2008), on the other hand, provides an estimate for the *intensive margin* of trade.

In our paper, we provide an estimation for all the margins since differently from previous cited analysis, we use flows from one country, for which we know the extensive margin, to the rest of the world. Having the information on the number of exporters we can directly calculate a measure for the intensive margin and by using the additive property of the OLS, we can obtain the estimation of tariffs on the intensive margin as a difference between their effect on the total and on the extensive margin. Moreover the main biases of our estimation should be treated, as explained before, using the regression in difference. In this specification the dependent variable represents a growth rate and a zero could be obtained even in the presence of positive export flow which do not change across time[53].

These problematics, which are emerging in last years, are, in any case, complicated to nest with our empirical strategy. An issue, this, that deserve further research in this paper. In practical terms, however, the number of 0-flows in our data set is very small. Even if, as shown in the descriptive section, almost the 20% (precisely the 18%) of product-country relations are nil, when we consider also the observations for which we do not have tariffs, the number of zeroes dramatically drop to 1.9%. This is the case because in the 89% of the cases a tariff is not reported for those product in those countries where France do not export[54].

3.7 Conclusion

In this paper we studied the response of French exports to the tariff reductions implemented after the Uruguay Round in 1995. Following recent literature on firm level heterogeneity and trade, we break down that effect into the component induced by the increase in the number of exporters (extensive margin) and the one induced by the increase in the average export per firm (intensive margin).

In the baseline regression we find that when tariffs decrease by 1 p.p (starting

[53]Moreover being growth rate also negative, we are prevented to use a PML methodology or a Tobit one on the specification in difference.

[54]Over the total 83,790 potential observations in the data, 13,863 correspond to observations where tariffs are not reported and flows are zero; 1616 are those with reported tariffs and 0-flows; for 38,122 observations tariffs are not reported and flows are positive; finally for 30,189 observations (the ones we used for example in our baseline regression) tariffs are reported and flows are positive.

from a level of 10%) total trade increases by 2.62%, the extensive margin by 1.57% and the intensive margin by 1.03%. Tariffs are able to explain up to 2.2% of the actual growth rate of French export between 1993 and 2002. When we take potential biases into account, however, we find that only the extensive margin is significantly explained by the variation in tariffs. Since some studies find virtuous effects of being an exporter on firm performance, we should conclude that reducing tariffs is a policy change which government should go on to invoke. If more firms could belong to the group of "superstars" and more varieties could be consumed all over the world, the welfare of countries would be positively affected.

We discuss two further econometric issues that need to be taken into account. The first stems from the potential incidental truncation which may derive from the fact that tariffs are non-reported in the majority of the observations. The second concerns the treatment of the 0-flows which refer to those pair of product-country for which the French export is nil.

Even if results suggest the importance of tariffs for trade (at least for its extensive margin) we are conscious that, by aggregating firm-level predictions at the sector-level, we might incur in the risk to introducing an "aggregation bias", which could be both theoretically and empirically relevant. Theoretically, such a bias comes from the choice of a specific distribution function for firms. When we consider the Pareto one, for instance, it can be shown that, for its specific properties, the effect of tariffs on average exports (which is our measure of intensive margin) is, indeed, nil. Empirically, this bias can arise as long as the determinants of firm heterogeneity correlate somehow with explanatory variables like tariffs. Both problems may be addressed by measuring the effect of tariffs on firm export participation and incumbent export sales, using firm-level data directly. The exercise conducted at the sector level in this paper shows the direction of the effects. However, more disaggregated analysis would further allow us to test the effects of tariff within each French firm. Nevertheless, a drawback applies. Tariffs are defined at the product level, thus we would need to work on a more broken up product classification than the one in Douanes data, to better measure the tariffs faced by each firm in each year within our estimation period.

Our findings also suggest that the WTO has an influential role in affecting world trade. In the lively debate on this issue, we are the first, up to our knowledge, to provide evidence by using a continuous variable which varies as a consequence of a policy change event. Since the Uruguay Round is probably the only major policy change which has affected the international trade exposition of France in last years[55], we plan to use the UR to answer further questions that have recently arisen in trade literature. A natural extension of the present paper would be to explore whether the effect of tariffs is homogeneous in all sectors or, on the other hand, if

[55]France has been an open economy since the 70's and Douanes data are available only in last two decays. There are, of course, policy changes which strongly affected French trade in last years, like the formation of European Union, the common currency or the entry of Eastern-European countries in the European Customs Union. However, the Uruguay Round remains the only worldwide multilateral trade policy event since it induced the decrease of tariffs in 123 countries at the same time. This provides a substantial variation in our empirical analysis.

characteristics such as sector comparative advantage (Bernard, Redding and Jensen (2007)), contract specificity (Nunn (2006)) or the degree of product diversification (Broda and Weinstein (2004)) shape the response of exports to tariffs.

Chapter 4

The Micro Dynamics of Exporting Firms

with Harald Fadinger[1] and Stefan Berger[2]

4.1 Introduction

This paper investigates the dynamics of trade relations across destinations using a panel of almost 19.000 French exporters that includes information on firm's export destinations over the five-year period 1995-1999. We define an "export-relation"[3] as a (positive) shipment by a specific firm to a specific country in a specific year. We describe how these export-relations evolve over time and present a number of stylized fact, many of which are completely novel. Finally, we relate our findings to the existing firm-level trade literature.

Our results show that export-status is less volatile than export-relations. In a typical year 27 % of all relations are newly created, and 21 % are destroyed (leaving a net creation of around 6%) while 12% of firms begin to export and 9% cease to do it. Moreover, export flows associated with specific trade-relations fluctuate a lot. The same firm increases export flows to some destinations while decreases them to other destinations. To see how this affect the aggregate French export growth rate we did the following exercise. We select two subsequent years and we divide export-relations in four groups: created relations (observed whenever a firm does not export to a destination the previous year but it exports there the year after), destroyed relations (observed in the opposite case), continuing relations for which the export flows increased between the two years and continuing relations for which the export flows decreased. We then calculate the contribution of each group of export-relations on French export growth rate between the two selected years. We find that the contri-

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[3]or "trade-relation" or simply "relation"

bution of newly created relations is of 7.3%, the contribution of destroyed relations is 3.6%, flow-increasing incumbent relations contribute for 48.1% and flow-decreasing incumbent relations contribute up to 41%. This decomposition suggests two facts. First, the net export growth rate at the aggregate level hides a lot of flows relation-specific dynamics (since increasing and decreasing flows mostly cancel out). Second, most of the change in export flows occurs within existing trade relations (*intensive margin*), with newly created or destroyed ones (*extensive margin*)[4] contributing very little to changes in export values. Moreover, since a big fraction of trade relations is created or destroyed every year, this implies that newly created/destroyed relations involve very small values. We take a closer look at them and show how small these values are. The 10th smallest percentile of the flow in a newly created (or destroyed) relation is less than 1000 euros on average and this finding is broadly consistent across sectors and countries. This feature of data will be particularly important in the discussion on the way trade models fit our findings.

We then separate the firms according to their size and apply the previous decomposition. We find that the *extensive margin* is more relevant for small exporters since a larger fraction of their flows-change, between to consecutively years, is explained by those relations which are newly created or terminated. By doing the same decomposition for different groups of countries we further find that the *extensive margin* is also more relevant for less popular countries[5] since a larger fraction of the French export change, between two consecutively years, is explained by relations which are not continuous. We perform all previous analysis for different couple of years and for each French sector: previous pattern hold in all cases.

A simple dummy regression reveals that most of the dynamic we described is mostly explained by firm-specific shocks (as opposed to country-specific ones).

Nevertheless, we argue that a great amount of the trade dynamics at the relation level seems to be due to relation-specific shocks. In fact a typical firm *simultaneously* creates trade relations with some destinations while destroying trade relations with others. At the same time a typical destination experiences *simultaneous* entry of some firms and exit of others. More formal econometric analysis reveals that most of the dynamics at the relation level cannot be explained by a combination of firm-specific and country-specific shocks but are due to exporter-destination specific shocks.

Even if around 30% of relations are created or terminated, the majority of them (the remaining 70%) are stable. We thus turn to describe them. We find that the probability for a firm to export to a specific destination conditional on having exported there last year is much larger than the probability to export to this destination for a random firm. This means that export relations are persistent. While persistence (fraction of firms that export in a destination in two following years) is stable across sectors, we find that it is positively correlated with destination market size (GDP, per capita GDP and population) and negatively correlated with destination distance.

[4]In the chapter we use the Chaney (2008) definition of extensive and intensive margin. The former is given the flows with which relations are created or terminated while the latter is given by flows at existing relation.

[5]The ones to which France export less.

Having described the micro-dynamics of export relations and flows, we turn to contrast the uncovered facts with theoretical model on firm-level trade. We first consider the standard theoretical framework provided by the Melitz(2003)-Chaney(2008) model. Many findings may be compatible with an augmented-shock version of that model (where shocks are aimed at explaining the creation and destruction of relations). Others findings however seem hard to square with such a model. First, exporter-destination specific shocks seem to play a large role in explaining entry and exit and these remain unexplained in such a model. Second, the large amount of starting trade relations that involve only small values are not compatible with a model where exporters face important sunk costs to export [6].

As an alternative, we may think to a context where trade is relationship specific and exporters need to find a distributor in each destination. Since the quality of the partner is initially uncertain, trade relations start small and are unstable in the beginning, which provides a micro-foundation for exporter-destination specific shocks. In this context, moreover, both persistence of trade relations and small export values could be easily rationalized as well.

The findings of this paper are related to recent contributions which aim to estimate the magnitude of the fixed-cost to export. Starting with the contributions of Roberts and Tybout (1997) and Bernard and Jensen (2004) a line of empirical work that is based on the idea of sunk fixed costs to export (Baldwin and Krugman (1989), Dixit(1989)), has investigated the dynamics of firms' exporting status. These papers use firm level data sets which provide information on aggregate export values per firm but not on the destinations to which firms export nor on the value shipped to each destination. The general finding is that firms' export status is very persistent. Roberts, Tybout and Das (2007) structurally estimate a model with heterogeneous firms and sunk costs to export using a panel of Columbian exports and provide numbers for the estimated sunk fixed costs to export of approximately 400,000 U.S. dollars for these firms.

Eaton, Kortum and Kramarz (2004) and Eaton, Kortum and Kramarz (2007)(from now on EKK (2004) and EKK (2007)) use a cross section of the same French firm-level data set to describe export patterns across destinations. In Eaton, Kortum and Kramarz (2004) they find that most exporters sell to only one destination, and these tend to be the popular ones, while few firms export to many destinations, which also include the unpopular ones. Eaton, Kortum and Kramarz (2007) fit a quantitative version of the Melitz (2003) model of heterogeneous firms to the cross section of French firms to assess how well this model performs in explaining export patterns across market.

The papers most closely related to ours are the simultaneous contributions by Eaton, Eslava, Kugler and Tybout (2007), who study the dynamics of Colombian exporters across destinations, and Lawless (2007), who investigates the export pat-

[6] Unless the structure of those costs are such that a firm pay them only to being an exporter and not to export to each destination. However these costs are intended to be the cost to explore the market, to find partnership and so on, so it is implausible that they are not specific to a trade relation.

terns of a sample of Irish exporting firms across destinations and time. While many of their findings are in line with ours, they focus on somewhat different aspects of export relation dynamics. Eaton, Eslava, Kugler and Tybout's analysis is centered on the observation that most new entrants in a destination sell initially very small values and only few survive in the long run. Those, which do survive, however, grow very fast and contribute a fair amount to aggregate Columbian export growth. Lawless is interested in the simultaneous entry and exit of firms in a given destination, the gradual fashion in which exporters expand the number of destinations to which they export and the small contribution of new relations to aggregate export growth. The rest of the paper is organized as follows: section 2 describes the data; section 3 to section 5 describe the dynamics of trade relations and trade flows, uncovering ten new facts; in section 6 we provide a discussion of the findings relating them to different models; section 7 concludes.

4.2 Data set

The main data source in our analysis is the Douane data base, available at the French Statistical Agency (INSEE), which contains all French Customs data. For each firm it allows us to precisely observe its exports to any destination in a given year. Each firm is assigned to a sector using the 3-digit NES classification system, which, excluding agriculture and services, defines up to 60 sectors.

Douane data report the 97% of the value of the national trade. However, according to the requirement of Eurostat, Doaune data should contain all flows which are above 1,000 euros for extra-EU trade and above 200 euros for intra-EU trade. This is not always the case in the original data set where also much smaller flows are reported. This may be the consequence of a misreporting problem [7].

We consider only those firms which are exporters according to both Douane and BRN [8] data bases. Finally we take only those firms which export in at least one year in the time-span we are analyzing (thus we abstract from those firms which are non-exporters in the whole time period we consider).

Our final data is a panel of almost 19.000 French manufacturing firms which may export up to 146 destinations[9] from 1995 to 1999 .

[7] The analysis we present takes care of this problem: all the results are robust to the exclusion of the 5th and the 10th percentile of smallest flows.

[8] We use the Bénéfices Réels Normaux data base, also available at INSEE, which provides information on the total export for each French firm, to select only those firms which are exporters according to both data bases.

[9] Countries' names and codes are reported in the appendix of this chapter.

Table 4.1: Fluctuations in export status

year	number of firms	new exporters	as percentage	no-more exporters	as percentage	net entry into export market	as percentage
1995	18382	-	-	-	-	-	-
1996	18986	2263	12%	1659	9%	604	3%
1997	19513	2299	12 %	1772	9%	527	3%
1998	19950	2164	11%	1727	9%	437	2%
1999	19996	2003	10%	1957	10%	46	0.2%

4.3 Dynamics of export-relations and export-flows

As the literature has pointed out, the aggregate value of exports can increase either because more relations are created[10], or because export flows at existing relations increase. In the context of our study an export-relation is indicated by a positive export flow by a specific French firm to a specific destination. When a relation is created or destroyed, the value of exports change through the *extensive margin*. By converse, when flows change within an existing relation then trade is moving through its *intensive margin*.

In this section we study two phenomena in turn. First, the creation and the destruction of trade relations through entry and exit of firms in different destinations. Second, the dynamics of export values through the *intensive* and *extensive margin*.

4.3.1 Trade-relations dynamics

We first describe fluctuations in export status, i.e. participation in export activity, that is the margin of adjustment analyzed by Bernard & Jensen (2004)[11]. From one year to the other almost 9% of exporters cease to export; conversely, a slightly higher percentage of 12% exporters, start to export. This is reported in Table 4.1, where we observe for each year the number of exporters in the sample, the number of firms which cease to and those who begin to export in the subsequent year. In the period we are considering there is a net increase in the number of exporters, which - aggregating entries and exits into export activity - turn out to be relatively small (3%)[12].

A similar pattern, but much larger in magnitude, can be found if we investigate the dynamics of trade relations. Entry into and exit from specific export destinations

[10] At the macro-level a relation is created when two countries begin to export. At the micro-level a relation is created when a firm begins to export to a new destination

[11] Bernard & Jensen (2004) use a data set which allow them to know if a firm is an exporter or not. In our case we also know in which destination a firm exports, thus we can separately analyze the export-status and export-relations of each firm. In our case a firm is, thus, an exporter if it has at least 1 export-relation, that is if it exports in at least 1 destination.

[12] Moreover, a part of the new exporters are firms that in one of the subsequent year will cease again to export. This finding suggests that there is a percentage of exporters which we could consider as *single-year exporters*, that is firms which export only from time to time.

Table 4.2: Trade relations created and destroyed

year	relations	created	as percentage	destroyed	as percentage	net creation	as percentage
1995	157558	-	-	-	-	-	-
1996	167279	43629	27.7%	33908	21.5%	9721	6.2%
1997	177513	45715	27.3%	35481	21.2%	10234	6.1%
1998	183595	44721	25.1%	38639	21.7%	6082	3.4%
1999	185849	43394	23.6%	41140	21.4%	2254	1.2%

are very frequent phenomena. In the first column of table 4.2 we report for each year the number of active relations in the sample [13].

Columns (3) through to (5) report the number of destroyed and created relations year by year. We find that each year around 25% of all firm-destination relationships are newly created, while around 21% of relationships are destroyed, with the difference being positive net creation of trade relationships. This suggests that there is a lot of trade micro-dynamics which remains hidden when we aggregate statistics. This is true across years and across sectors[14]. Finally, it worth noticing that around 50% of the destroyed relations are re-created in at least one subsequent year and around 70% of created relations are destroyed in at least one subsequent year in the sample.

We can conclude that: **export status is less volatile than export relations; there are both *single-year* exporters and *single-year* relations (FACT 1).**

4.3.2 Export-relations by firm and country

In this subsection we analyze previous patterns considering firms and countries separately.

The creation and destruction of trade relations is related to firm size. In Figure 4.1 we plot for each firm the share of entered and exited destinations against the size of firm (measured by firms' total export value in log). Small firms enter and exit a larger fraction of their export destinations [15]. This is also more formally confirmed by a regression of the fraction of created/destroyed relations on firms' total exports:

$$\frac{N_{i,enter}}{N_i} = \beta_0 + \beta_1 Exports_i \tag{4.1}$$

and

[13]Since the total number of destinations in the data is 146 and in 1995 we have 18.382 exporters, the average number of destinations to which French firms export is roughly eight. As EKK (2004) have shown the number of export destinations is very skewed, with very few firms exporting to almost all destinations and the majority of them exporting only to 1 destination.

[14]We do not report all the sectoral analysis in the paper since all the findings hold for different sectors.

[15]We report the graph without the 5th biggest percentile to show that the correlation is not driven by few "big" observations. For bigger firms that export to many countries, the share of exited/entered destinations could be very small by constructions. The same of course could happen for very small exporters that export only to 1 destination. The correlation is still negative eliminating the smallest 5th or 10th percentile.

$$\frac{N_{i,exit}}{N_i} = \beta_0 + \beta_1 Exports_i \tag{4.2}$$

where N_i is the total number of destinations served by a given firm in a year, $N_{i,enter}$ ($N_{i,exit}$) is the number of destinations a firm begin (cease) to export and $Export_i$ are the total export flows by a firm (in logs). β_1 is negative and very significant in both cases[16]. Evaluating the regressions at the mean, they imply that an average exporter creates around 36% of its relations and destroys around 31%.

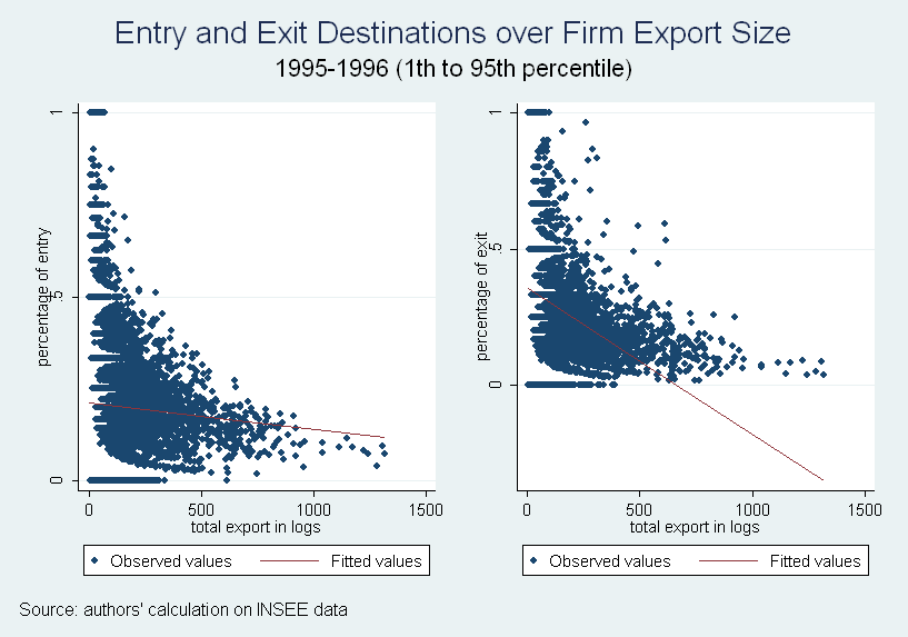

Figure 4.1: Share of entered and exited destinations over firm export size

If we focus the analysis at the destination level, we find that the fraction of trade relations created and destroyed is higher in less popular destinations (measured by total French exports to that destination). This can be seen from Figure 4.2 and is also confirmed when regressing the fraction of created and destroyed relations in each country on the total exports to that country:

$$\frac{N_{c,enter}}{N_c} = \beta_0 + \beta_1 Exports_c \tag{4.3}$$

$$\frac{N_{c,exit}}{N_c} = \beta_0 + \beta_1 Exports_c \tag{4.4}$$

[16]For entries: $\beta_1 = -0.00029^{***}$ $R^2 = 0.02$, $n = 16723$. For exits: $\beta_1 = -0.00047^{***}$ $R^2 = 0.04$, $n = 18382$.

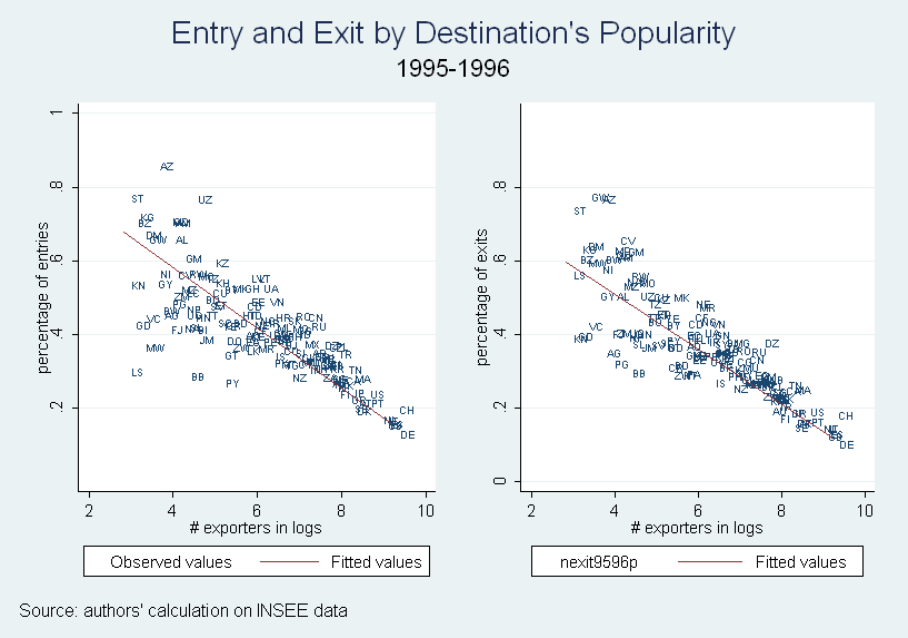

Figure 4.2: Fraction of firms entering/leaving vs. total French exports by country

where c refers to a country. These confirm that total exports to a country have a very significant negative impact on the fraction of entering and exiting firms[17].

Notice that, even if, in a given year, the number of exporters to Germany (DE) is higher than the number of exporters to Azerbadjan (AZ), this does not imply that in the following year the share of entrants in Germany is smaller than in the share of entrants in Azerbadjan. In fact only half of the exporters in the data set export to Germany, thus in principle the share of entrants in this country could be much higher than 10%.

We conclude that **creation and destruction of trade relations is more frequent for small firms and small destinations (FACT 2).**

4.3.3 Trade-flows dynamics

Is the phenomenon discussed in last subsection relevant in terms of export values? Do newly created/destroyed relations involve high flows? In this subsection we address this issue by considering the adjustment in export values that can be attributed to newly created/destroyed relations (*extensive margin*) or to existing ones (*intensive margin*).

We indicate with Q_t the aggregate French export value (given by the sum of the flow of each existing relation in a year q_{ict}), and index firms by i, countries by c and years by t. Then we have

[17]For entries: $\beta_1 = -2.92^{(***)}$, $R^2 = 0.52$ n=146. For exits: $\beta_1 = -2.08^{(***)}$, $R^2 = 0.56$ n=146

$$Q_t = \sum_{i \in I} \sum_{c \in C} q_{ict}. \tag{4.5}$$

We consider growth in export value using the mid-point growth rates[18]:

$$G_t = \sum_{c \in C} \sum_{i \in I} g_{ict} s_{ict} \tag{4.6}$$

where s_{ict} is the average export share of firm i in country c in total French exports:

$$s_{ict} = \frac{q_{ict} + q_{ict-1}}{Q_t + Q_{t-1}}, \tag{4.7}$$

and g_{ict} is the midpoint-growth rate of export value of firm i in country c:

$$g_{ict} = \frac{q_{ict} - q_{ict-1}}{1/2\left(q_{ict} + q_{ict-1}\right)}. \tag{4.8}$$

To see to what extent adjustments in export values are due to the *extensive margin* and to the *intensive margin*, we separate all trade-relations into four subsets: *entry* - the newly formed relations (those for which $q_{ict-1} = 0$ and $q_{ict} > 0$), *exit* - the destroyed relations (for which $q_{ict-1} > 0$ and $q_{ict} = 0$), *increase* - the continuing relations for which the export flows increase ($0 < q_{ict-1} < q_{ict}$), and *decrease* - the continuing relations for which the export flows decrease ($q_{ict-1} > q_{ict} > 0$). We can thus write:

$$G_t = \sum_{ic \in entry} g_{ict} s_{ict} + \sum_{ic \in exit} g_{ict} s_{ict} + \sum_{ic \in increase} g_{ict} s_{ict} + \sum_{ic \in decrease} g_{ict} s_{ict} \tag{4.9}$$

To get a better sense of the magnitudes and the relative contributions of each of the four terms we take the absolute values of the mid-point growth rates of all firm-destination relations, and aggregate them to obtain the gross export growth rate, $\widehat{G}_t$:

$$\widehat{G}_t = \sum_{ic \in entry} |g_{ict}| s_{ict} + \sum_{ic \in exit} |g_{ict}| s_{ict} + \sum_{ic \in increase} |g_{ict}| s_{ict} + \sum_{ic \in decrease} |g_{ict}| s_{ict} \tag{4.10}$$

Table 4.3 reports the gross (mid-point) growth rate, the contribution of each of the four components of decomposition (4.10) as well as the aggregate net growth rate for different years. The net midpoint growth rate of exports was roughly 1%, while the gross midpoint growth rate was almost 10%. This difference indicates that export flows as well are very volatile. The contribution of newly-created and destroyed relations are respectively 7.3% and 3.6%. The intensive margin explains the rest, with

Table 4.3: Mid point growth rates by year. Percentages explained by components.

	gross	net	enter	exit	increase	decrease
1996	0.100	0.011	7.3%	3.6%	48.1%	41.0%
1997	0.102	0.038	6.4%	2.7%	62.2%	28.8%
1998	0.097	0.016	5.0%	3.7%	53.4%	37.9%
1999	0.095	0.002	4.7%	3.5%	46.4%	45.4%

increasing flows within existing relations explaining 48% and decreasing flows within existing relations explaining 41%.

This pattern is very similar across different years and for all the sectors as shown in Figure 4.3.

We conclude that **flows are very volatile and most changes in value occur at the intensive margin (FACT 3)**. Thus while creation and destruction of trade relations is very frequent, it involves shipments of small values.

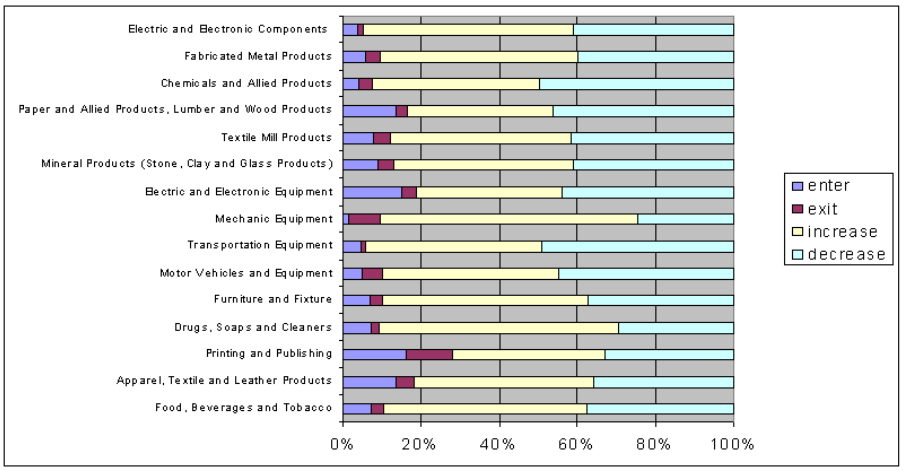

Figure 4.3: Intensive and Extensive margin contributions to export growth by sector

4.3.4 Small quantities

We next take a closer look to the actual level of flows involved in starting relations. In Table 4.4 we report the average and median export values for all relations, relations that were definitely created (terminated) in 1996, relation that were occasionally created (occasionally terminated) in 1996[19]. Relations that are created or destroyed concern very small values. Moreover relations that start in 1996 and last for all the 5

[18]This overcomes the problem that we would have with ordinary growth rates. The latter, in fact, are not defined for created/destroyed relations. Note that the mid-point growth rate lies in the interval [-2,2] and takes the value -2 in the case of exit and 2 in the case of entry.

[19]We already noticed that some relations are only occasional across the sample.

Table 4.4: Average and median exports flows (in euros)

1995-1996	average	median
All relations in 1995	640,997	28,084
Destroyed relations from 1996 on	45,213	4,871
Occasionally destroyed relations (for 1996 only)	42,038	6,131
All relations in 1996	630,214	27,796
Created relations from 1996 on	146,961	13,266
Occasionally created relations (for 1996 only)	36,281	6,595

years in the sample, concern higher average values than occasional relations (146,961 vs 36,281 euros).

Even if we consider each country separately we find that entry and exit quantities are indeed very small. Figure 4.4 reports the minimum entry and exit quantities for each country (in a given year) plotted against the market size of that country (measured by the log of GDP). We notice how quantities with which an average firm enter or exit a market can be very small.

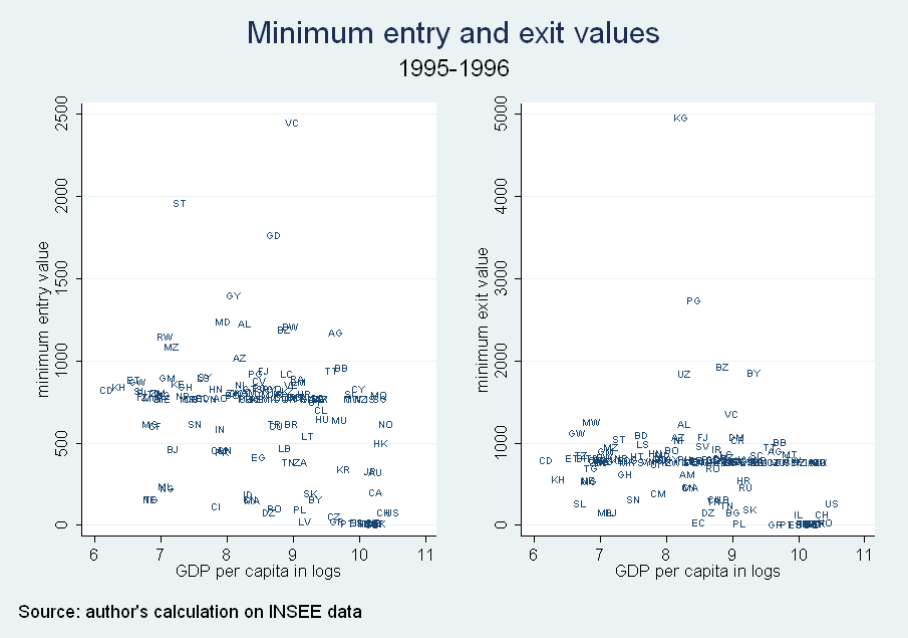

Figure 4.4: Minimum entry and exit quantities by country

Small quantities may be a result of measurement errors. To show this is not the case we consider the 10th smallest percentile of entry quantities [20] and we plot them against the usual country market size (log of GDP) (Figure 4.5). There is a group

[20] Exit quantities behave similarly, even though they are smaller than entry ones

of countries, European ones, for which the 10th percentile is smallest than for other countries. This may derive from different report threshold Douane database should be subjected to. This implies that actual export flows could be even lower than the ones reported here.

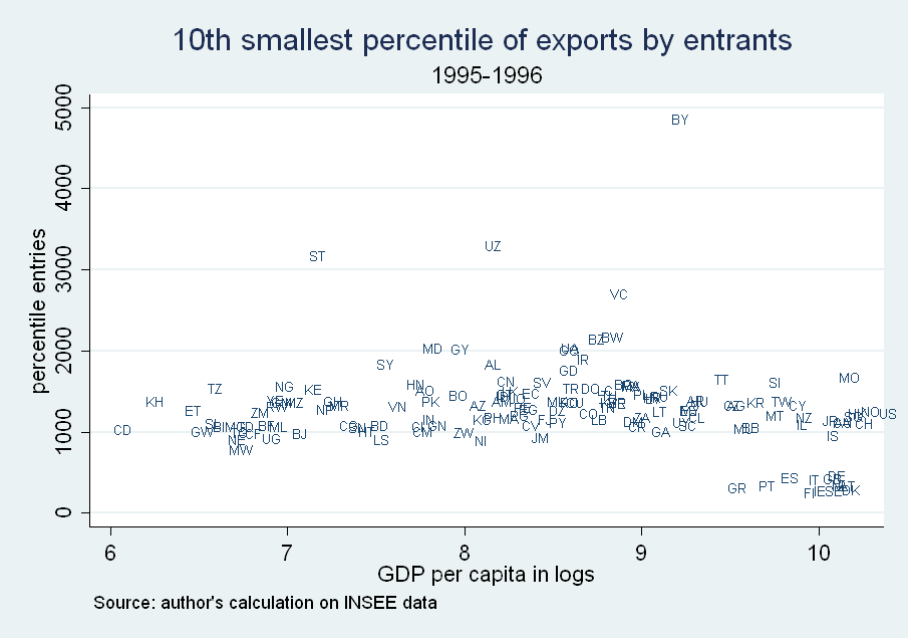

Figure 4.5: 10th percentile of entry quantities by country

The aggregation at the country level does not take into account the fact that small quantities could be different depending from the product each firm exports. To investigate this issue we consider different percentiles of export at newly-created relations for each of the 60 sectors in the French NES classification. Figure 4.6 report the 10th smallest percentile for entry and exit flows for each of the 2-digit sector[21] showing that in each of them relations start small.

Table 4.5 finally directly shows the percentiles by sectors. The first 10th percentile vary from 659 euros in the "Printing and Publishing sector" to 1095 euros in the "Drugs" sector. Even in the most disaggregated classifications things do not change.

The message is clear: **(FACT 4) an average firm enter an average country with very small flows**.

4.3.5 Trade-flows dynamics by firm and country

In order to see how intensive and extensive margin relate to firm and destination size, we report decomposition 4.10 for different sub-samples. First, we divide the sample along the firm dimension considering small exporters (whose export flows

[21] At the more disaggregated 3-digit classification the patterns do not change.

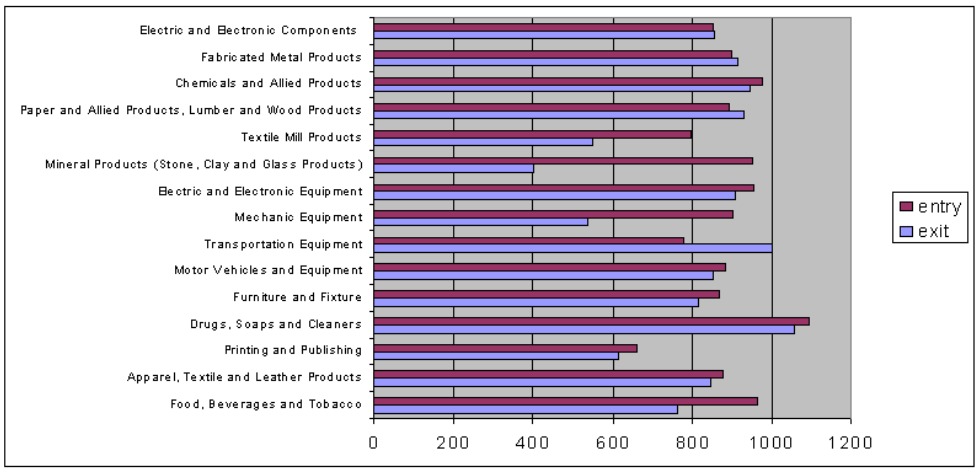

Figure 4.6: 10th percentile of entry/exit quantities by sector

Table 4.5: Entry flows by their percentile for each 2-digit NES sector

sectors	Entry flows by different percentiles				
	10st	30th	50th	70th	90th
Food, Beverages and Tobacco	963	2911	6522	15314	56098
Apparel, Textile and Leather Products	876	1878	3999	9497	40973
Printing and Publishing	659	1497	3129	8583	41376
Drugs, Soaps and Cleaners	1095	3201	7359	19742	84750
Furniture and Fixture	866	1877	3927	9783	36942
Motor Vehicles and Equipment	882	2577	6715	16362	85082
Transportation Equipment	777	2148	5119	19330	163883
Mechanic Equipment	902	2378	5530	14620	63692
Electric and Electronic Equipment	955	2470	5793	13980	52484
Mineral Products (Stone, Clay and Glass Products)	953	2347	5971	14779	60394
Textile Mill Products	797	2263	4868	11697	40935
Paper and Allied Products, Lumber and Wood Products	892	2928	6636	14695	62439
Chemicals and Allied Products	979	2456	5723	14023	54882
Fabricated Metal Products	898	1986	4514	10224	38354
Electric and Electronic Components	854	1953	5151	14729	63951

Table 4.6: Contribution of components by firm size percentiles

percentile	enter (%)	exit (%)	increase (%)	decrease (%)	total (%)
1-25	95.8	0.7	3.4	0.1	2.1
25-75	20.6	12.5	41.7	25.2	4.8
75-100	4.7	3.2	49.4	42.7	93.1
all	7.3	3.6	48.1	41.0	100

is in the first 25th percentile of the aggregate French export), medium (25th-75th percentile) and large (above 75th percentile) ones.

Table 4.6 shows the results for growth rates between 1995 and 1996. The extensive margin is much more important for small exporters. These exporters contribute by 2.1% to the aggregate export growth rate and the 96.5% of their contribution comes from movements along the extensive margin. For big exporters instead, movements along the extensive margin account only 7.7%. Also note that 93% of the changes in export values come from the 25 percent largest exporters.

The fact that the extensive margin is more relevant for small firms can also be seen from Figure 4.7. It plots for each firm the fraction of export flows gross changes coming from newly formed or destroyed relations against the value of its total exports (in logs). The correlation is negative and statistically very significant[22].

Figure 4.7: fraction of change in quantities to entered/exited destinations vs. total firm exports

[22]enter: $\beta_{q_i} = -0.042^{(***)}$ $R^2 = 0.15$ $n = 16723$; exit: $\beta_{q_i} = -0.063^{(***)}$ $R^2 = 0.23$, $n = 18382$.

Table 4.7: Contribution of components by country size percentiles

percentile	enter (%)	exit (%)	increase (%)	decrease (%)	total (%)
1-25	30.6	20.5	28.2	20.6	4
25-75	15.5	7.0	44.9	32.5	13.4
75-100	6.0	3.0	48.6	42.4	86.2
all	7.3	3.6	48.1	41.0	100

Next, we divide the sample in small (1st to 25th percentile of export values), medium (25th-75th percentile) and large (above 75th percentile) export destinations and perform the same analysis. From table 4.7 we observe that the fraction of export growth rate explained by those firms that newly entered or exit from a given market is larger in less popular export destinations.

This can also be seen from Figure 4.8, which plots the contribution of the *extensive margin* (in its two components) against total exports to country c (in logs) [23].

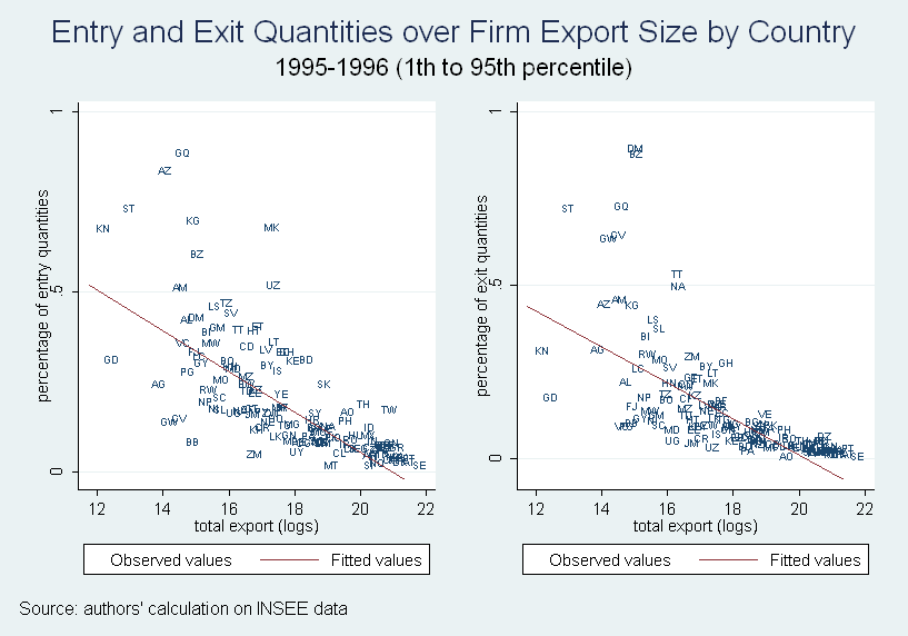

Figure 4.8: Extensive margin over total exports by country

Again, we observe a large and statistically very significant negative correlation[24].

We conclude that **the extensive margin is more relevant for small exporters and small destinations (FACT 5)**.

[23] All the figures in this section, obtained without eliminating smallest or largest percentile are similar.

[24] For enter: $beta_{q_c} = -0.05^{(***)}$ $R^2 = 0.52$ $n = 146$. For exit: $beta_{q_c} = -0.04^{(***)}$ $R^2 = 0.45$,n=146

Table 4.8: Explaining changes in quantities

Period	95-96	95-96	96-97	96-97
sample	all	staying	all	staying
observations	201,187	123,650	212,994	131,798
% of error variance due to δ_i	0.96	0.92	0.96	0.93
R^2 (including only δ_j)	0.0008	0.0009	0.0015	0.0016
R^2 (including δ_j and δ_i)	0.74	0.69	0.75	0.69

4.3.6 Explaining trade-flows dynamics

At this point it seems interesting to get an idea of what drives the changes in export values of firms across destinations. Are changes due to firm-specific shocks, to country-specific shocks or to those shocks that hit a specific trade relation (country-firm specific shocks)?

We regress the mid-point export growth rates for each firm in each served destination between two years, g_{ic} on a set of firm (δ_i) and country (δ_c) dummies:

$$g_{ic} = \delta_i + \delta_c + \epsilon_{ic} \tag{4.11}$$

where the dummies are mentioned to capture (supply) firm-level shocks and (demand) country-level shocks respectively.

We find that most changes in exports are explained by firm effects δ_i.

Looking at table 4.8 we find that roughly 74% of flow growth rate at the firm-destination level are due to idiosyncratic firm-level shocks (as measured by the R^2 in the regression with both country and firm dummies). Country demand shocks, on the other hand, explain virtually nothing of g_{ic} . This is also confirmed by the fact that the fraction of the error variance explained by δ_i in the regression (4.11) is around 96%.

Supply shocks continue to explain around 70% of the mid-point export flows growth rate if we exclude entries and exits from the regression (which take on extreme values) and if we consider different couple of years.

We thus conclude that: **the export flow volatility is mostly explained by firm-specific shocks (FACT 6)**.

4.4 Simultaneity

4.4.1 Firm level

The big amount of destroyed and created relations we observed in the second section may be the result of two different firms' micro-behavior: it may be that some firms destroy relations and some firm create new ones or that each firm *simultaneously* creates and destroys relations. To investigate this we look the behavior of each firm. Figure 4.9 plots for each firm i the number of destinations it entered against the number of destinations it left between 1995 and 1996. If a firm incurs in new relations

without destroying any of the existing ones, then this observation lies on the x-axes (viceversa if a firm destroys relations without creating new ones, then it lies on the y-axes).

We observe that, indeed, many observations lie off the axes thus indicating that exit and entries are simultaneous at the firm level. Moreover, the correlation among the two is positive: firms that create more relations tend to also simultaneously destroy a larger number of them.

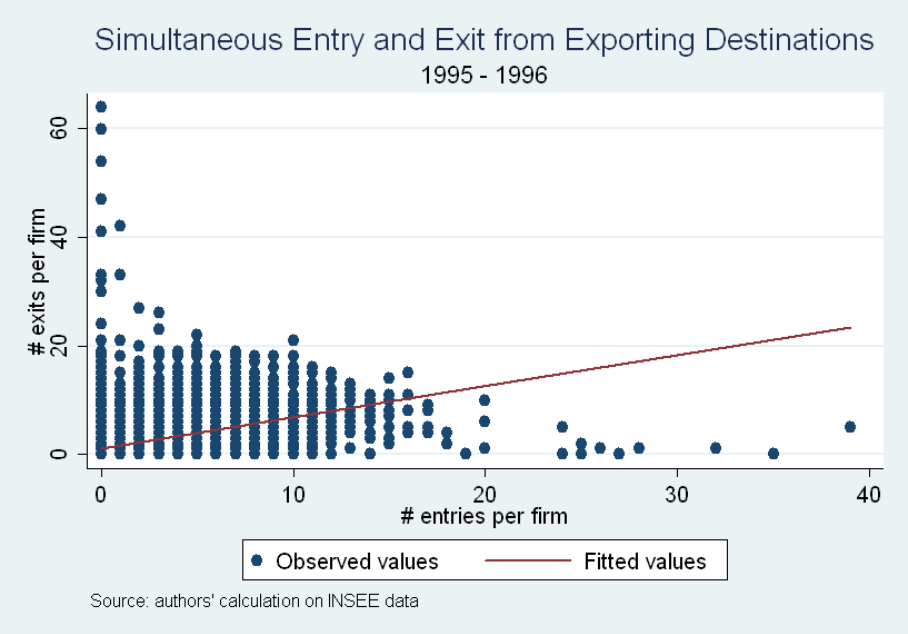

Figure 4.9: Number of entered vs. exited destinations

This observation holds regardless of the total number of destinations that firm i is exporting to. Figure 4.10 plots the fraction of destinations entered against the fraction of destinations from which the firm exits and again we observe a positive relationship confirming that firms enter some destinations while simultaneously leaving others. The correlation between the fraction of destinations entered and the ones left is 0.53 for the entire sample and similar across sectors[25].

We conclude that **relations are *simultaneously* created and destroyed by each firm (FACT 7)**.

4.4.2 Country level

We can perform a different exercise and aggregate created and destroyed relations at the country level. Again two scenarios may be possible. If (demand) country-specific shocks are important in driving the formation of relations, then most of the

[25]The correlation between fraction of entered and exited destinations range between 0.44 in "Food, Beverages and Tobacco" sector and 0.62 of "Transportation Equipment" sector.

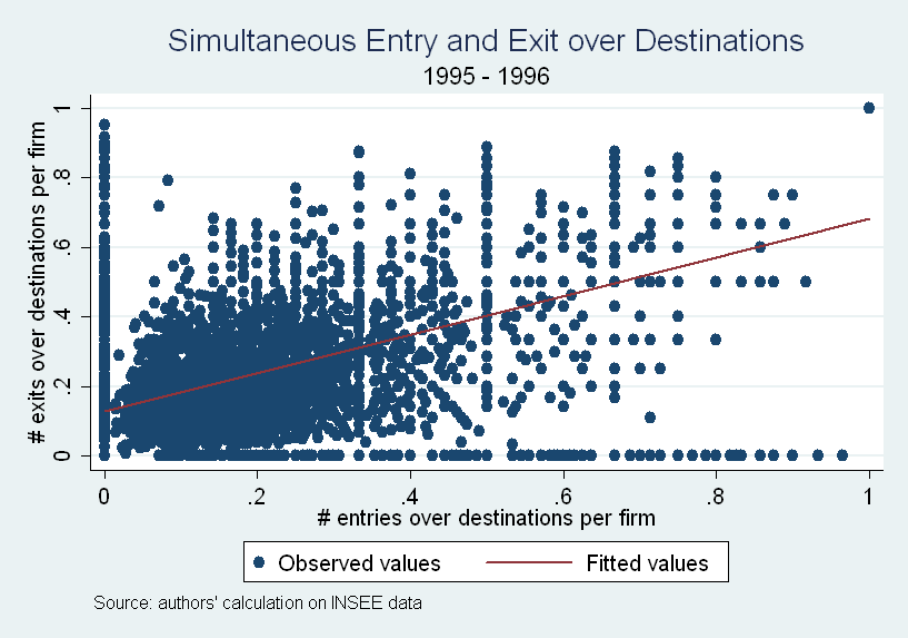

Figure 4.10: Fraction of entered vs. exited destinations

firms should create (destroy) relations with countries which experience a positive (negative) shock. In other words we should observe that newly-created and destroyed relations are negatively correlated at the country level. Alternatively, the findings in section 3, may be the consequence of a simultaneous creation and destruction of relations for each country.

In Figure 4.11 we thus plot for each country the share of created relations (entered exporters) against the share of destroyed ones (exited exporters)[26].

This Figure clearly shows that *simultaneity* holds also at the country-level. Moreover, we can see that European countries like Germany ("DE"), Denmark ("DK") or Netherlands ("NL") are the ones for which entry and exit are a relatively small fraction of total trade relations compared to faraway and small countries such as Azerbaidjan ("AZ"), Sao Tomè and Principe ("ST") and Guinea-Bissau ("GW").

We conclude that **relations are *simultaneously* created and destroyed at the country level (FACT 8)**.

4.4.3 Explaining export-relations dynamics

We can do an analogous exercise of a previous section to uncover if the choice of French firms to enter and exit from various destinations is more explained by firm-level shocks or by country-level ones. We thus run the following regression

[26]The first share is calculated with respect to the number of exporters in 1995 and the second is calculated with respect to the number of exporters in 1996.

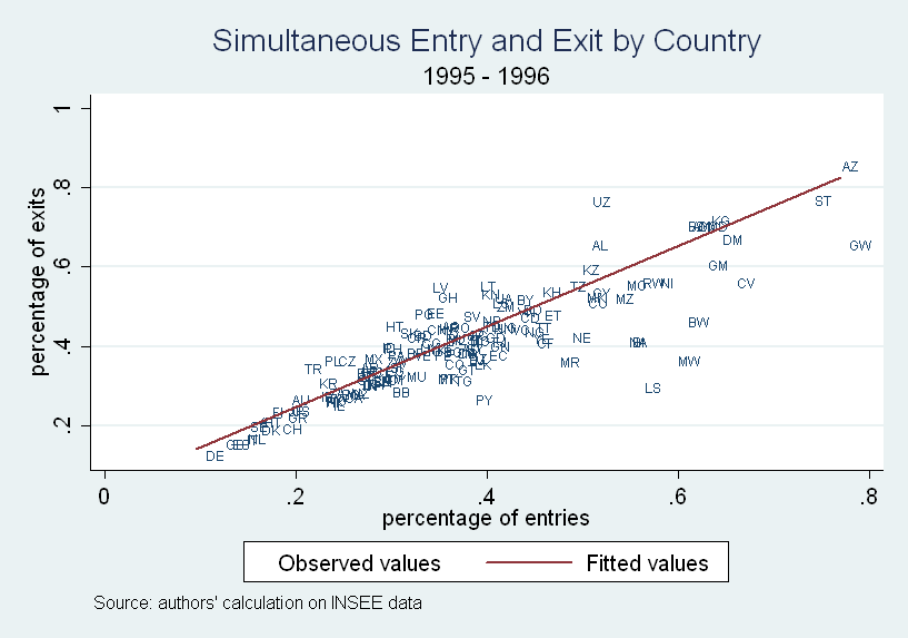

Figure 4.11: Fraction of entered vs fraction of exited firms by country

$$C_{ic} = \delta_i + \delta_c + \epsilon_{ic} \tag{4.12}$$

where the dependent variable C_{ic} is a dummy which refers to the choice of a firm to enter in a given destination (in which case it is equal to 1) between two periods of time, to exit from a given destination (in which case it is equal to -1) or to continue exporting (in this case it takes the value of 0).

Results are reported in Table 4.9. The first column shows that by introducing only (demand) country-level characteristics we explain only the 0,5% of the variation in the dependent variable. By introducing also (supply) firm-level characteristics we manage to explain only up to 19% of it. Thus the main part of the variation remains unexplained by additive country- and firm-specific shocks. Trade-relation variation, differently from trade-flows growth rate, thus seem to be more related to factors which are *jointly* determined at the firm-country level.

This pattern hold for different years and for a sub-sample in which we exclude those countries for which a given firm exports consecutively in the two years (column (2) and column (4) respectively for 1995-1996 and 1996-1997).

We thus conclude that: **the variation in trade relations is mostly explained by (country-firm) relation-specific shocks (FACT 9)**.

Table 4.9: Explaining export-relation dynamics

Period	95-96	95-96	96-97	96-97
sample	all	only entry/exits	all	only entry/exits
observations	201,187	77,537	212,994	81,196
% of error variance due to δ_i	0.41	0.37	0.41	0.37
R^2 (including only δ_j)	0.005	0.009	0.005	0.009
R^2 (including δ_j and δ_i)	0.19	0.30	0.17	0.29

4.5 Persistence

As the first section of this paper has shown, firms tend to create and destroy a significant fraction of their trade relations. However most of the relations are stable during years. In this section we turn to describe them.

First, we use a transition matrix to investigate persistence as well as the patterns of creation and destruction of trade relations in more detail. Each row of table 4.10 refers to firms which export to a given number of destinations, "0", "1", "2" and so on in 1995. Each cell reports the frequency with which firms that exported to a given number of destinations in 1995, transit to any of the column categories in the following year [27]. This means that the rows sum up to 100. The last row reports the frequency of exporters in each category in 1996[28]. Notice that almost 60% of all the firms export up to 4 destinations only [29].

Differently from the finding of Eaton & all. (2007) we obtain a diagonal dominant matrix. This means that, given any initial number of export destinations, the probability to continuing exporting to that number of destinations is higher than the probability to change.

Non-exporters tend to integrate into the export market gradually, by typically entering in one destination only (27.66%) and firms that exported to only one destination tend to add or drop only a single one the year after. Indeed this observation holds for all the considered categories: either firms continue to export to the same number of destinations, or they transit to the nearest category to the left or to the right.

The previous table shows that there is persistence in the number of relations, since the probability of a relation to survive is much larger than the probability to be created or destroyed. However, the transition matrix does not allow us to determine if the identity of active relations is actually the same over time[30].

[27] The last 3 columns and rows aggregate the number of export destinations in a somewhat arbitrary way. However, results are robust if we define intervals differently.

[28] Notice that, as explained in the description of the data set, here we are considering those firms which export to at least one destination in at least one year in the time-span of our sample. Thus the total number of French non-exporters is much bigger that 22.62% reported here.

[29] As in EKK(2004) only few exporters ship their products to many destinations

[30] It may be that the number of export destinations remains constant but that the identity of export destinations changes. For example a firm may export to Spain and Italy in 1995 and to Germany and Russia in 1996: in this case the transition matrix would report this observation in the diagonal

Table 4.10: Transition matrix between 1995 and 1996

1995/1996	0	1	2	3	4	5	(6 to 10)	(11 to 25)	25 or more
0	**63.23**	27.66	5.54	1.75	0.71	0.19	0.47	0.29	0.15
1	27.26	**49.74**	14.07	5.45	2.13	0.67	0.61	0.08	0.00
2	9.30	26.30	**32.62**	17.29	7.37	3.81	2.97	0.34	0.00
3	3.65	11.65	21.88	**27.86**	18.55	8.33	7.68	0.33	0.07
4	1.72	3.53	11.21	21.81	**24.91**	16.55	19.31	0.95	0.00
5	0.81	1.39	4.75	13.66	17.01	**21.64**	38.54	2.08	0.12
(6 to 10)	0.31	0.66	1.04	2.60	4.33	9.53	**62.94**	18.39	0.21
(11 to 25)	0.00	0.03	0.09	0.13	0.19	0.32	9.89	**81.64**	7.71
25 or more	0.00	0.07	0.00	0.00	0.00	0.21	0.07	6.49	**93.17**
exporters (in%)	22.62	20.53	9.59	6.80	4.80	3.79	11.97	13.34	6.57

Table 4.11: Fraction of stable relations

	95-96	96-97	97-98	98-99	95-97	95-98	95-99
Total Economy	0.78	0.79	0.78	0.78	0.69	0.63	0.58
Food, Beverages and Tobacco	0.80	0.81	0.80	0.81	0.71	0.65	0.60
Apparel, Textile and Leather Products	0.77	0.77	0.76	0.75	0.66	0.59	0.54
Printing and Publishing	0.72	0.72	0.72	0.72	0.61	0.54	0.49
Drugs, Soaps and Cleaners	0.84	0.84	0.84	0.84	0.76	0.71	0.67
Furniture and Fixture	0.77	0.78	0.77	0.75	0.68	0.61	0.56
Motor Vehicles and Equipment	0.77	0.79	0.80	0.77	0.69	0.63	0.58
Transportation Equipment	0.77	0.77	0.76	0.75	0.67	0.61	0.56
Mechanic Equipment	0.76	0.76	0.76	0.75	0.67	0.61	0.56
Electric and Electronic Equipment	0.77	0.76	0.76	0.76	0.67	0.61	0.56
Mineral Products	0.80	0.80	0.79	0.79	0.71	0.65	0.61
Textile Mill Products	0.79	0.80	0.80	0.79	0.71	0.64	0.60
Paper and Allied Products, Lumber and Wood	0.77	0.79	0.77	0.77	0.68	0.61	0.56
Chemicals and Allied Products	0.82	0.82	0.81	0.81	0.73	0.67	0.62
Fabricated Metal Products	0.78	0.79	0.78	0.77	0.69	0.63	0.58
Electric and Electronic Components	0.80	0.80	0.80	0.79	0.72	0.67	0.63

We thus fix a firm-destination relationship and follow it over time. Table 4.11 reports the fraction of relations that survive from one year to the next for the total economy and for each 2-digit NES sector. The first row shows that 78% are still maintained in the next year and 58% survive throughout the entire sample period from 1995-1999. If relationships where destroyed completely randomly, since every year around 22% of trade relations are destroyed, the fraction of relations that survive four years should be roughly 37% ($= 0.78^4$)[31]. The fraction of stable relations is similar across time and sectors.

We finally turn to investigate if persistence of relations is systematically related to

since the number of active relations does not change from one year to the other.

[31]When we calculate the same numbers weighting each firm for its size (in terms of total served destinations) we find very similar pattern and slightly small numbers. This is the case because for bigger firms the number of stable relations is higher, as we already noticed by looking at the broken relations.

country characteristics. Figure 4.12 shows the share of stable relations (by country) plotted against countries' characteristics like GDP, GDP per capita, distance, population, and popularity (measured in terms of number of French exporters in logs). There is a clear positive relation between our proxy for persistence and countries' proxies for market size. The relation becomes negative when we consider distance, instead.

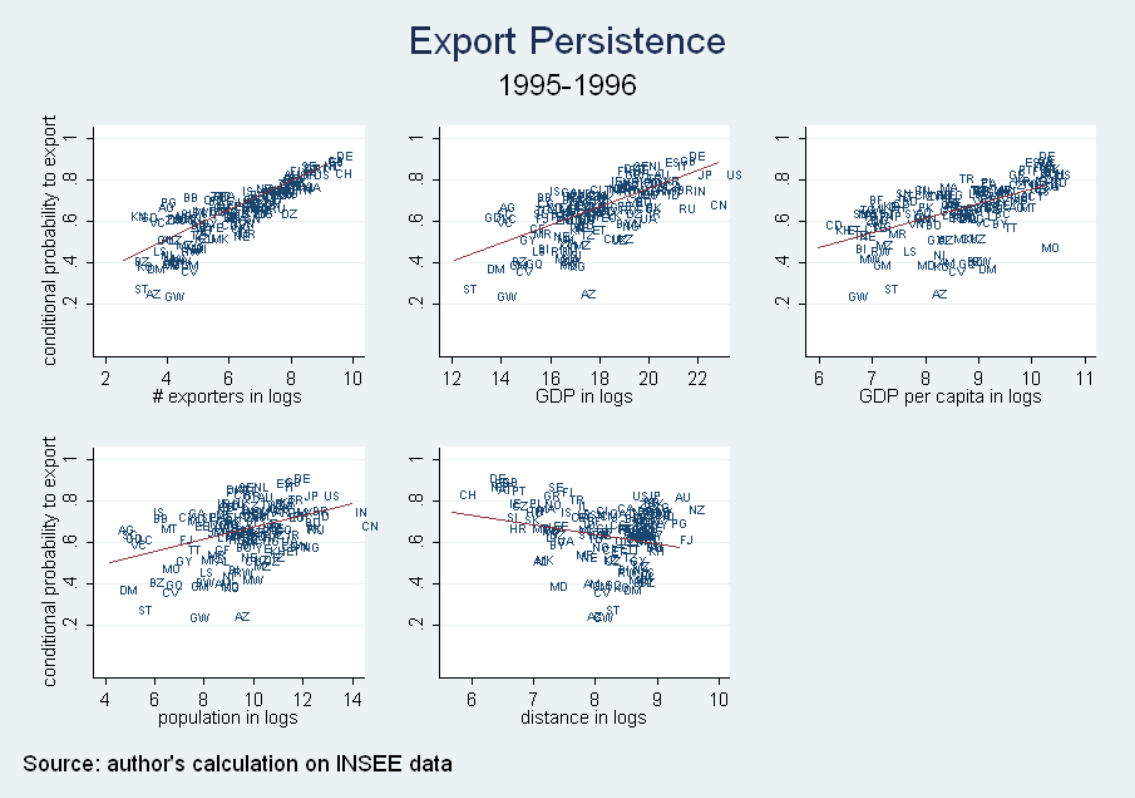

Figure 4.12: Persistence vs countries' characteristics

Even if the Figure 4.12 shows interesting patterns, a caveat applies. Our measure of persistence, the share of continuing exporters to a given destination, could indeed capture the fact that a destination is *chosen* by a random firm in two consecutively years just because it is an easy destination to export to. In other words since decision to export are not random, this figure does not show that a firm export to a country in a given year *since* it was exporting there in the previous one.

We are aware that a formal econometric analysis, that could control for firm and country characteristics which are stable across time, would be needed to be sure of the interpretation of previous findings. However this is outside the purely descriptive scope of this analysis. In leaving more formal analysis for future work, we take these findings as indicative of this phenomenon.

We conclude that **there is a large amount of persistence (FACT 10)** and

that **this seems to be related to market characteristics (FACT 11)**.

4.6 Discussion

This paper presented new evidence related to the micro-dynamic of firms' exports. In this section we try to relate our findings to the theoretical literature. We first contrast our findings with a standard firm-heterogeneity trade model (Melitz(2003)). We argue that, even though many of our findings could be rationalized in this framework, others are more difficult to explain since this model does not provide a micro-foundation for analyzing the dynamic behavior of firms. We thus turn to contrast our results with another class of models that emphasize the relation-specific nature of trade at the micro-level.

Consider a standard Melitz (2003) model of trade with monopolistic competition, heterogeneous firms ranked by an exogenous productivity level drawn from a Pareto distribution function, and fixed costs to export which need to be paid for each destination. In this model a firm exports to a destination only if its export revenues (which are a function of its productivity level) are sufficient high to cover the relative fixed cost. This, in turn, implies that for each export market there exists a cutoff-productivity level such that only firms with a productivity above that cutoff-level export to it. Then very unproductive firms do not export, less productive exporters enter only in those destinations with a low cut-off (the most popular ones) and "superstar" firms export to many destinations, among which to the less popular ones (for which the cut-off level is substantially high). Moreover, while less productive firms lie closer to the export cut-off (since their productivity is just marginally higher than that), more productive firms are far away from such cutoffs (for most of the countries where they export).

In order to discuss our findings in this framework we need to incorporate (productivity) firm-specific as well as (demand) country-specific shocks along the lines of EKK(2007) to allow for a source of dynamic in the model. Moreover we consider the fixed-costs to enter at least partially sunk. In this context many of our findings could be rationalized. In fact relations are dynamic and extensive and intensive margins have a different role for bigger firms and for smaller ones. The latter, whose productivity lies close to the destination-specific cutoff, are likely to exit/enter when they are hit by demand- or productivity shock. The former, which are far away from cutoffs, rather adjust their export values along the intensive margin when hit by a shock.

The observation that exporters simultaneously create and destroy relations and that countries are simultaneously involved in newly-created and destroyed relations is, on the contrary, more difficult to explain in this context. The reason is that a firm that is hit by a positive shock should create relations without destroying the active ones, and in the same fashion, countries that are hit by positive shocks should be involved only in newly-created relations. Our intuition is confirmed by the fact that variation in relations seem to be scarcely explained by additive country and firm-shock. Thus it seem plausible that they depend on (joint firm-country) relation-shocks.

We also find very small starting export flows, persistence in relations and an indication of a positive relation between persistence and market size. In the context of the Melitz model persistence could be explained by the presence of sunk-costs. Empirical literature that, in more formal framework, find high persistence in export status, usually interpret this finding as an evidence for the existence of high sunk start-up costs to export (Bernard & Jensen (2004) for example). Das, Roberts & Tybout provide an estimation for such costs using a structural estimation for Colombian firms. They find that these costs are quite substantial, being on average around 400,000 dollars. They thus conclude that producers do not begin to export unless the present value of their future export stream is large. In the context of our findings, the initial export level should thus be an indicative estimation of those present value, which in turn is a proxy for the sunk cost of export. What is difficult to explain is thus the presence of high persistence (which indicate the existence of high sunk costs) and the very small quantities (no matter the kind of exported product) with which a relation usually begins[32].

Since our analysis rather suggests that export-relations have a more important role in explaining the dynamic of trade at the micro-level, we discuss another class of models which emphasize how trade is very relationship specific and how information externality may play a crucial role in the decision of a firm to export. In Segura-Cayuela & Vilarrubia (2008) there is uncertainty in the export outcome since a firm does not know ex-ante the cost it will face once exporting in the foreign market. This uncertainty, which in their model could be attenuated by observing the success or failure of incumbent exporters in each market, could explain why trade-relations are so dynamics. Rauch and Watson (2003) develop a model that explains how incomplete information can induce buyers in industrialized countries to start trade relations with firms located in developing countries with small orders and how this leads to trade flows that increase over time as the quality of the partner is revealed. Most exporters, in fact, do not sell their products directly to consumers but need to rely on a local distributor in each destination. Finding a suitable distributor is difficult and involves ex ante uncertainty about the quality of the match. Araujo and Ornelas (2007) focus on the effect of contract enforcement on firm level trade dynamics in a setting where the quality of the distributor is initially unknown and needs to be learned from observed profits.

This class of model can explain why trade relations are so dynamic, why most of the changes in the value of shipments occur at the intensive margin, why the extensive margin is related to small quantities. Trade relations tend to start small and are more likely to break up in the beginning of the relation because of uncertainty about quality

[32]Even if we consider a model a la Melitz in which destination-specific export costs are fixed but not sunk, explaining small quantities is not so easy. If the discrimination between exporters and not-exporters come from the existence of those fixed costs, then the small quantities with which a relation begins are difficoult to explain. EKK(2007) show that in order to match the fraction of firms exporting to each destination, fixed costs to export need to be on average higher in larger destinations. In order to fit the large amount of small export values they need to give small exporters better chances to draw a small fixed costs, even if average fixed costs are large.

of match.

A matching model can also explain why the extensive margin is more important in unpopular destinations. Since the value of any match is lower in smaller destinations because profits are lower, matches are more likely to be separated by a given shock.

This class of models also provides a micro-foundation for firm-country specific shocks and explains why firms simultaneously create some trade relations while destroying others, since not every attempt to enter a market is successful. It is also consistent that overall most changes in quantities are due to firm specific shocks. Once a relationship is established and revenues have become large, standard mechanisms apply.

Also the presence of persistence can easily be explained. Having a partner has positive value, since searching for another one requires time and potentially resources, which implies an opportunity cost of foregone profits that leads to persistence of export relations. The fact that persistence is positively related to market size can also be rationalized by the fact that foregone profits are larger in larger markets potentially leading to more persistence of export relations.

Finally, small export values are not a problem for this theory either, since there is no need to rely on per period destination specific fixed costs to explain why not all firms export to all destinations.

4.7 Conclusion

This paper documents new stylized facts on the dynamic of export relations and export flows. A typical French exporter often changes its export destinations and the quantities with which it enters or leaves destinations are small. The large variation in quantities shipped by firms to different destinations occurs above all within existing export destinations, with new entries or exits accounting only for a small fraction in quantity adjustments. Larger exporters have more stable export relations and do the bulk of their changes at the intensive margin, while small exporters enter and leave a larger fraction of their export markets from one period to the other. Trade relations are also much more stable in more popular export destinations to which more French firms export. Finally entry involves very small quantities, sometimes less than 1000 euros.

We argue that, even though a shock-augmented version of the Melitz(2003)-Chaney(2008) model may take into account many of our findings, some of them rather suggest that export involve relationship-specific dynamics. We thus argue that those trade models which provide a micro-fundation for the formation of export-relations are more suitable to account for all our findings.

Finally we are aware that the calculation presented in this chapter are only an indication of the phenomenon we describe. A more formal econometric analysis would be needed to convincingly state many of our findings.

Appendix A

Appendix for Chapter 2

A.1 Predictions of the model

Starting from equation 2.16 we obtain the following predictions:

$$\frac{\partial \varphi_{i,x,F}}{\partial \tau_{i,T}} = \left(\frac{SP_F}{SP_T}\right)^{\beta_i} D_{i,T} = \frac{\varphi_{i,x,F}}{\tau_{i,T}} > 0$$

$$\frac{\partial \varphi_{i,x,F}}{\partial \beta_i} = \tau_{i,T} D_{i,T} \frac{\partial \left(\frac{SP_F}{SP_T}\right)^{\beta_i}}{\partial \beta i} = \tau_{i,T} D_{i,T} \left(\frac{SP_F}{SP_T}\right)^{\beta_i} ln\left(\frac{SP_F}{SP_T}\right) = \varphi_{i,x,F} ln\left(\frac{SP_F}{SP_T}\right) < 0$$

which holds given that Skill Premium is lower in France than in Turkey.
The cross derivative is simply:

$$\frac{\partial^2 \varphi_{i,x,F}}{\partial \tau_{i,T} \partial \beta_i} = D_{i,T} \left(\frac{SP_F}{SP_T}\right)^{\beta_i} ln\left(\frac{SP_F}{SP_T}\right) = \frac{\varphi_{i,x,F}}{\tau_{i,T}} ln\left(\frac{SP_F}{SP_T}\right) < 0$$

Starting from equation 2.15 we obtain the following predictions:

$$\frac{\partial r_{i,x,F}(\varphi)}{\partial \tau_{i,T}} = (1-\sigma)\tau^{-\sigma} \left(\frac{SP_F}{SP_T}\right)^{\beta_i(1-\sigma)} \varphi^{\sigma-1} F_{i,T} < 0$$

which holds since $\sigma > 1$ and

$$\frac{\partial r_{i,x,F}(\varphi)}{\partial \beta_i} = (1-\sigma) ln\left(\frac{SP_F}{SP_T}\right) \left(\frac{SP_F}{SP_T}\right)^{\beta_i(1-\sigma)} \varphi^{\sigma-1} F_{i,T} \tau_{i,F}^{1-\sigma} = r_{i,x,F}(\varphi)(1-\sigma) ln\left(\frac{SP_F}{SP_T}\right) > 0$$

which holds given that Skill Premium is lower in France than in Turkey. Finally the cross derivative is the following:

$$\frac{\partial^2 r_{i,x,F}(\varphi)}{\partial \tau_{i,T} \partial \beta_i} = (1-\sigma)^2 \tau^{-\sigma} ln\left(\frac{SP_F}{SP_T}\right) \left(\frac{SP_F}{SP_T}\right)^{\beta_i(1-\sigma)} \varphi^{\sigma-1} F_{i,T} < 0$$

A.2 Threshold and mass effect

What are model predictions if we aggregate the results at the sector level? Suppose we don't observe the productivity of each firm in each sector but we know only the firm productivity distribution and we estimate the extensive margin looking at the number of exporter in each sector. In this case the change in tariffs could be decomposed in a mass and a threshold effect, which, as I will show, move in opposite direction when the productivity distribution is skewed toward the left as the Pareto[1]one.

The total number of exporters is given by the area lying below the productivity distribution on the right of the export-threshold:

$$N_x = \int_{\varphi_x(\tau)}^{h} N\mu(\varphi)d\varphi$$

where N is the mass of active firms, $\mu(\varphi)$ is a generic distribution function, the threshold $\varphi_x(\tau)$ is indicated as a function of tariffs and the upper limit of integration h changes according to the distribution function we choose. The underlined hypothesis of the formula above is that the productivity distribution of firms does not change with tariffs (which is a good hypothesis for French data). Pareto distribution function is given by the following formula and it's defined between $[k, \infty)$

$$Pareto(pdf) = \mu^P(\varphi) = \frac{ak^a}{\varphi^{a+1}}$$

thus h for Pareto is infinity. In this case we could better express the number of exporters N_x in the following way (where P stays for Pareto):

$$N_x = \int_k^{\infty} N\mu^P(\varphi)d\varphi - \int_k^{\varphi_x(\tau)} N\mu^P(\varphi)d\varphi = N\left(1 - \int_k^{\varphi_x(\tau)} \mu^P(\varphi)d\varphi\right)$$

where the first integral sum up to N since $\mu(\varphi)$ is a density function.

Using Leibnitz's rule for derivation we have:

$$\frac{\partial N_x}{\partial \tau} = -N\left(\mu(\varphi_x)\frac{\partial \varphi_x(\tau)}{\partial \tau} - \varphi_x(\tau)\frac{\partial \mu(\varphi)}{\partial \tau} \mid_k^{\varphi_x(\tau)}\right) = -N\mu(\varphi_x)\frac{\partial \varphi_x(\tau)}{\partial \tau}$$

where the last equality derives from the fact that the productivity distribution is not a function of tariffs and the first term is the generic distribution function evaluated at $\varphi_x(\tau)$. Last formula exactly separates the distribution effect from the threshold one. Let's consider for example the effect of a tariff reduction on the total amount of firms when their productivity is distributed according to a uniform distribution

[1]The Pareto distribution has been extensively used in empirical studies on this literature since it describes rather well the actual size distribution of firms which, in model a la Melitz, is also a description of firms' exogenous productivity distribution.

compared to a Pareto one. The results are the following respectively for the uniform [2] and the Pareto distribution:

$$\frac{\partial N_x}{\partial \tau} = -\frac{1}{b-a}\frac{\partial \varphi_x(\tau)}{\partial \tau}N$$
$$\frac{\partial N_x}{\partial \tau} = -\frac{ak^a}{(\varphi_x)^{a+1}}\frac{\partial \varphi_x(\tau)}{\partial \tau}N$$

From results in previous section of the appendix we know that the threshold effect with respect to tariffs is always positive (if tariffs decreases the export threshold decreases as well), but now it's clear that the way firms' productivity is distributed may have a role as well. In fact with a Pareto distribution function the marginal effect of tariffs on the number of exporters depends on the starting level of the threshold . In fact if we derive last expressions also w.r.t. comparative advantage (indicated by CA) we find:

$$\underbrace{\frac{\partial^2 N_x}{\partial \tau \partial CA}}_{(-)} = \underbrace{\frac{1}{b-a}}_{\text{distribution effect; threshold effect (-)}}\underbrace{\frac{\partial^2 \varphi_x}{\partial \tau \partial CA}}_{\text{distribution effect; threshold effect (-)}}N \tag{A.1}$$

$$\underbrace{\frac{\partial^2 N_x}{\partial \tau \partial CA}}_{(+)} = Nak^a\left(\underbrace{\frac{\partial\left[(\varphi_x)^{-(a+1)}\right]}{\partial CA}\frac{\partial \varphi_x(\tau)}{\partial \tau}}_{\text{distribution effect(+)}} + \underbrace{\frac{ak^a}{(\varphi_x)^{a+1}}\frac{\partial^2 \varphi_x}{\partial \tau \partial CA}}_{\text{threshold effect (-)}}\right) \tag{A.2}$$

In both previous expressions we can separate a distribution effect (which is constant for Uniform distribution function and positive for the Pareto distribution function) and a threshold effect (which is negative in both cases). With the Pareto distribution function we can moreover show that the positive effect dominates. Thus empirically we need to test for the actual firm productivity distribution function to uncover the effect of tariffs reduction on the probability to export for firms in heterogeneous sectors.

[2] Notice that with uniform distribution $h = b$ because the function is defined between a and b, but calculus are the same since the integral over the total support is 1 being a probability function.

Appendix B

Appendix for Chapter 3

B.1 Countries' specific variables

Country specific variables mainly comes from the Rose database. In particular we use the following variables as controls:

- Trade partner's GDP (ln GDP)
- Distance of trade partner capital from Paris (ln dist)
- A binary variable equal to unity if the trade partner is a GATT or WTO member (WTO)
- A binary variable equal to unity if the trade partner is a French former colony (Colony)
- A binary variable equal to unity if the trade partner is an island (Island)
- A binary variable equal to unity if the trade partner is landlocked (landlocked)
- A binary variable equal to unity if the trade partner is benefits from a Generalyzed System of Preferences (GSP)

B.2 List of countries

We report all the countries in the analysis and, for each of them, we specify a "Tariff Coverage" indicator which is set to YES if the information on tariffs before and after the Uruguay Round is available for that country, and set to NO if tariffs data are available after the Uruguay Round only. When nothing is specified it means that we do not have any information on tariffs but the country is a French commercial partner, since export flows at least for some firms in some products are different from 0.

B.3 List of sectors

All the manufacturing sectors are included in the analysis except sectors FS, FT and FV because tariffs are never reported for these sectors in the TRAINS-WTO database.

Country code	Country name	Tariff cov.	Country code	Country name	Tariff cov.
AE	United Arab Emirates		LK	Sri Lanka	yes
AF	Afghanistan		LR	Liberia	
AL	Albania	no	LS	Lesotho	
AR	Argentina	yes	LT	Lithuania	no
AT	Austria	yes	LV	Latvia	no
AU	Australia	yes	MA	Morocco	yes
BA	Bosnia and Herzegovina	no	MD	Moldova	no
BD	Bangladesh	yes	MG	Madagascar	no
BF	Burkina Faso	yes	MK	Macedonia, FYR	no
BG	Bulgaria	no	ML	Mali	no
BH	Bahrain	no	MN	Mongolia	
BI	Burundi	no	MR	Mauritania	no
BJ	Benin		MU	Mauritius	no
BO	Bolivia	yes	MW	Malawi	yes
BR	Brazil	yes	MX	Mexico	no
BT	Bhutan		MY	Malaysia	yes
BW	Botswana	no	MZ	Mozambique	yes
CA	Canada	yes	NA	Namibia	no
CD	Congo, Dem. Rep.		NE	Niger	no
CF	Central African Rep.	yes	NG	Nigeria	yes
CG	Congo, Rep.	yes	NI	Nicaragua	no
CI	Cote d'Ivoire	no	NL	Netherlands	yes
CL	Chile	yes	NO	Norway	yes
CM	Cameroon	yes	NP	Nepal	yes
CN	China	yes	NZ	New Zealand	yes
CO	Colombia	yes	OM	Oman	no
CR	Costa Rica	no	PA	Panama	no
CU	Cuba	yes	PE	Peru	yes
CY	Cyprus	no	PG	Papua New Guinea	no
CZ	Czech Republic	no	PH	Philippines	yes
DE	Germany	yes	PK	Pakistan	no
DK	Denmark	yes	PL	Poland	no
DO	Dominican Republic	no	PT	Portugal	yes
DZ	Algeria	yes	PY	Paraguay	yes
EC	Ecuador	yes	QA	Qatar	no
EE	Estonia	no	RO	Romania	no
EG	Egypt, Arab Rep.	no	RU	Russian Federation	yes
ES	Spain	yes	RW	Rwanda	yes
ET	Ethiopia	no	SA	Saudi Arabia	yes
FI	Finland	yes	SD	Sudan	no
FJ	Fiji		SE	Sweden	yes
GA	Gabon	no	SG	Singapore	no
GB	United Kingdom	yes	SI	Slovenia	no
GE	Georgia	no	SK	Slovak Republic	no
GH	Ghana	yes	SL	Sierra Leone	
GM	Gambia, The		SN	Senegal	no
GN	Guinea		SO	Somalia	
GR	Greece	yes	SV	El Salvador	no
GT	Guatemala	no	SY	Syrian Arab Republic	no
GW	Guinea-Bissau	no	SZ	Swaziland	
HK	Hong Kong, China		TD	Chad	no
HN	Honduras	no	TG	Togo	no
HR	Croatia	no	TH	Thailand	yes
HT	Haiti		TJ	Tajikistan	
HU	Hungary	no	TM	Turkmenistan	no
ID	Indonesia	yes	TN	Tunisia	no
IE	Ireland	yes	TR	Turkey	yes
IL	Israel	no	TT	Trinidad and Tobago	no
IN	India	no	TW	Taiwan, China	no
IR	Iran, Islamic Rep.	no	TZ	Tanzania	yes
IQ	Iraq		UA	Ukraine	no
IT	Italy	yes	UG	Uganda	yes
JM	Jamaica	no	US	United States	yes
JO	Jordan	no	UY	Uruguay	no
JP	Japan	yes	UZ	Uzbekistan	no
KE	Kenya	yes	VE	Venezuela	no
KG	Kyrgyz Republic	no	VN	Vietnam	yes
KH	Cambodia	no	XU	Belgium & Luxemburg	yes
KP	Korea, Dem. Rep.		YE	Yemen	no
KR	Korea, Rep.	no	YU	Yugoslavia	no
KW	Kuwait	no	ZA	South Africa	yes
KZ	Kazakhstan	no	ZM	Zambia	yes
LA	Lao PDR	no	ZW	Zimbabwe	no
LB	Lebanon	no			

Table B.1: List of countries

BA	Industrie des viandes	Production, processing and preserving of meat and meat products
BB	Industrie du lait	Manufacture of dairy products
BC	Industrie des boissons	Manufacture of beverages
BD	Travail du grain ; fabrication d'aliments pour animaux	Manufacture of grain mill products, starches and starch products, prepared animal feeds
BE	Industries alimentaires diverses	Manufacture of other food products
BF	Industrie du tabac	Manufacture of tobacco products
CA	Industrie de l'habillement et des fourrures	Manufacture of wearing apparel; dressing and dyeing of fur
CB	Industrie du cuir et de la chaussure	Manufacture of leather and leather products and footwear
CC	Edition, imprimerie, reproduction	Publishing, printing and reproduction of recorded media
CD	Industrie pharmaceutique	Manufacture of pharmaceuticals, medicinal chemicals and botanical products
CE	Fabrication de savons, de parfums et de produits d'entretien	Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations
CF	Fabrication de meubles	Manufacture of furniture
CG	Bijouterie et fabrication d'instruments de musique	Manufacture of jewellery and musical instruments
CH	Fabrication d'articles de sport, de jeux et industries diverses	Manufacture of sports goods, games, toys and others n.e.c.
CI	Fabrication d'appareils domestiques	Manufacture of domestic appliances
CJ	Fabrication d'appareils de réception, d'enregistrement et de reproduction (son, image)	Manufacture of television and radio receivers, sound or video recording or reproducing apparatus and associated goods
CK	Fabrication de matériel optique et photographique, horlogerie	Manufacture of optical instruments, photographic equipment, watches and clocks
DA	Construction automobile	Manufacture of motor vehicles, bodies and trailers

Table B.2: 3-digit NES classification

DB	Fabrication d'équipements automobiles	Manufacture of parts and accessories for motor vehicles
EA	Construction navale	Building and repairing of ships and boats
EB	Construction de matériel ferroviaire roulant	Manufacture of railway and tramway locomotives and rolling stock
EC	Construction aéronautique et spatiale	Manufacture of aircraft and spacecraft
ED	Fabrication de cycles, motocycles, matériel de transport n.c.a.	Manufacture of motorcycles, bicycles and other transport equipment n.e.c.
EE	Fabrication d'éléments en métal pour la construction	Manufacture of structural metal products
EF	Chaudronnerie, fabrication de réservoirs métalliques et de chaudières	Manufacture of tanks, reservoirs, containers of metal ; manufacture of central heating radiators and boilers and steam generators
EG	Fabrication d'équipements mécaniques	Manufacture of machinery for the production and use of mechanical power
EH	Fabrication de machines d'usage général	Manufacture of other general purpose machinery
EI	Fabrication de machines agricoles	Manufacture of agricultural and forestry machinery
EJ	Fabrication de machines-outils	Manufacture of machine tools
EK	Fabrication d'autres machines d'usage spé-cifique	Manufacture of other special purpose machinery
EL	Fabrication d'armes et de munitions	Manufacture of weapons and ammunition
EM	Fabrication de machines de bureau et de matériel informatique	Manufacture of office machinery and computers
EN	Fabrication de moteurs, génératrices et transformateurs électriques	Manufacture of electric motors, generators and transformers
EO	Fabrication d'appareils d'émission et de transmission	Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy
EP	Fabrication de matériel médicochirurgical et d'orthopédie	Manufacture of medical and surgical equipment and orthopaedic appliances
EQ	Fabrication de matériel de mesure et de contrôle	Manufacture of industrial process control equipment, instruments and appliances for measuring, checking, testing, navigating

Table B.2: 3-digit NES classification (continued)

FA	Extraction de minerais métalliques	Mining of metal ores
FB	Autres industries extractives	Other mining and quarrying
FC	Fabrication de verre et d'articles en verre	Manufacture of glass and glass products
FD	Fabrication de produits céramiques et de matériaux de construction	Manufacture of ceramic goods, products for construction purposes and other non-metallic mineral products
FE	Filature et tissage	Preparation and spinning of textile fibres, weaving and finishing of textiles
FF	Fabrication de produits textiles	Manufacture of textile articles, except apparel
FG	Fabrication d'étoffes et d'articles maille	Manufacture of knitted and crocheted fabrics and articles
FH	Travail du bois et fabrication d'articles en bois	Manufacture of wood and wood products
FI	Fabrication de pâte papier, de papier et de carton	Manufacture of pulp, paper and paperboard
FJ	Fabrication d'articles en papier ou en carton	Manufacture of articles of paper and paperboard
FK	Industrie chimique minérale	Manufacture of basic inorganic chemicals
FL	Industrie chimique organique	Manufacture of basic organic chemicals
FM	Parachimie	Manufacture of agro-chemical products, paints and other chemical products
FN	Fabrication de fibres artificielles ou synthétiques	Manufacture of man-made fibres
FO	Industrie du caoutchouc	Manufacture of rubber products
FP	Transformation des matières plastiques	Manufacture of plastic products
FQ	Sidérurgie et première transformation de l'acier	First processing of iron and steel
FR	Production de métaux non ferreux	Manufacture of basic precious and non-ferrous metals
FS	*Fonderie*	*Casting of metals*
FT	*Services industriels du travail des métaux*	*Industrial services for treatment of metals*
FU	Fabrication de produits métalliques	Manufacture of fabricated metal products
FV	*Rcupération*	*Recycling*
FW	Fabrication de matériel électrique	Manufacture of electrical equipments and apparatus n.e.c.
FX	Fabrication de composants électroniques	Manufacture of electronic valves, tubes and other electronic components

Table B.2: 3-digit NES classification (continued)

Appendix C

Appendix for Chapter 4

C.1 List of countries

Country code	Country name	Country code	Country name
AG	Antigua et Barbuda	LC	Saint-Lucy
AL	Albania	LK	Sri Lanka
AM	Armenia	LR	Liberia
AO	Angola	LS	Lesotho
AR	Argentina	LT	Lithuania
AT	Austria	LV	Latvia
AU	Australia	MA	Morocco
AZ	Azerbadjan	MD	Moldova
BB	Barbade	MG	Madagascar
BD	Bangladesh	MK	Macedonia
BF	Burkina Faso	ML	Mali
BG	Bulgaria	MO	Macao
BI	Burundi	MR	Mauritania
BJ	Benin	MT	Malta
BO	Bolivia	MU	Mauritius
BR	Brazil	MW	Malawi
BW	Botswana	MX	Mexico
BY	Belarus	MY	Malaysia
BZ	Belize	MZ	Mozambique
CA	Canada	NA	Namibia
CD	Congo, Dem. Rep.	NE	Niger
CF	Central African Republic	NG	Nigeria
CG	Congo, Rep.	NI	Nicaragua
CH	Switzerland	NL	Netherlands
CI	Cote d'Ivoire	NO	Norway
CL	Chile	NP	Nepal
CM	Cameroon	NZ	New Zealand
CN	China	PA	Panama
CO	Colombia	PE	Peru
CR	Costa Rica	PG	Papua New Guinea
CU	Cuba	PH	Philippines
CY	Cyprus	PK	Pakistan
CZ	Czech Republic	PL	Poland
DE	Germany	PT	Portugal
DK	Denmark	PY	Paraguay
DM	Dominique	RO	Romania
DO	Dominican Republic	RU	Russian Federation
DZ	Algeria	RW	Rwanda
EC	Ecuador	SC	Seychelles
EE	Estonia	SE	Sweden
EG	Egypt, Arab Rep.	SG	Singapore
ES	Spain	SI	Slovenia
ET	Ethiopia(excludes Eritrea)	SK	Slovak Republic
FI	Finland	SL	Sierra Leone
FJ	Fiji	SN	Senegal
GA	Gabon	ST	Sao Tome and Principe
GB	United Kingdom	SV	El Salvador
GD	Grenade	SY	Syrian Arab Republic
GH	Ghana	TD	Chad
GM	Gambia, The	TG	Togo
GN	Guinea	TH	Thailand
GQ	Equatorial Guinea	TN	Tunisia
GR	Greece	TR	Turkey
GT	Guatemala	TT	Trinidad and Tobago
GY	Guyana	TW	Taiwan
GW	Guinea-Bissau	TZ	Tanzania
HK	Hong Kong, China	UA	Ukraine
HN	Honduras	UG	Uganda
HR	Croatia	US	United States
HT	Haiti	UY	Uruguay
HU	Hungary	UZ	Uzbekistan
ID	Indonesia	VC	Saint-Vincent and the Grenadines
IE	Ireland	VE	Venezuela
IL	Israel	VN	Vietnam
IN	India	YE	Yemen
IR	Iran, Islamic Rep.	ZA	South Africa
IS	Island	ZM	Zambia
IT	Italy	ZW	Zimbabwe
JM	Jamaica		
JO	Jordan		
JP	Japan		
KE	Kenya		
KG	Kyrgyz Republic		
KH	Cambodia		
KN	Saint-Kitts and Nevis		
KR	Korea, Rep.		
KZ	Kazakhstan		
LB	Lebanon		

Table C.1: List of countries

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