The Effect of the Uruguay Round Multilateral Tariff Reduction on the Intensive and Extensive Margins of Trade

Ines Buono *

Guy Lalanne †

First version: June 2008. This version: February 2009.

Abstract

The aim of this paper is to decompose the effect of tariffs on the extensive and intensive margins of trade, by using a three-dimensional panel which allows us to control for the unobserved heterogeneity of trade flows. 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 there are more exporters where tariffs are the lower. However the decrease in tariffs, induced by the implementation of the Uruguay Round, did not push more firms into exporting. It rather induced incumbent exporters to increase their shipments. Two problems may affect our specification: tariffs change may be endogenous and 0-flows are not included. We address the former issue by instrumenting tariffs change with their pre-policy level. We include 0-flows in a variety of ways proposed in the literature. Our results reveal that the Uruguay Round agreement explained up to the 4.7% of French total export growth between 1993 and 2002.

*Correspondance: Banca d'Italia, via Nazionale 91, 00184, Rome, Italy. E-mail: ines.buono@upf.edu. The views expressed are those of the authors and do not necessarily reflect those of the Bank of Italy.

†Correspondance: INSEE, Timbre G220, 15 Boulevard Gabriel Peri, 92245 Malakoff cedex. E-mail: guy.lalanne@insee.fr. The views expressed are those of the authors and do not necessarily reflects those of INSEE.

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 reductions on the previous 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. Recent contributions (Bustos (2007)) have shown that, after a trade liberalization, new exporters tend to adopt a more efficient technology. This may create a new channel for productivity upgrading. Eaton et al. (2008) find that new Colombian exporters start exporting by shipping very low volumes. However those who survive expand very rapidly and, after a few years, they account for almost half of total export expansion in that country. Those findings suggest that, if a decrease in tariffs affects aggregate trade mainly through the extensive margin, its long run effect could be magnified.

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

The main novelty of our work is to use tariffs as a measure of variable trade costs in a micro data context. Thereby we can address interesting econometric as well as trade-related issues. First, considering tariffs instead of simply distance, the econometric specification becomes dynamic, since tariffs move through time, whereas 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 tariffs. Thus, the real parameter of interest is the elasticity of trade flows and trade margins to tariffs, rather than to distance. Third, all theoretical trade models introduce trade costs through tariffs and perform comparative static analyses by letting tariffs change. In this perspective our analysis is much closer to the theoretical literature than previous papers.

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 datasets which allow us to address this issue using a 3-dimensional panel. We have information on the export of French firms for 57 products to 147 destinations in a time-period ranging from 1993 to 2002. 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[1] *"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, from an average of 6.3% to 3.8%"*.

Merging the French firm-level dataset 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 dataset, which specifies the export destination by firm and product, allows us to precisely match a flow with its tariff.

While few studies did it on the import side[2], 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.

We use a gravity equation approach and we show in a gradual fashion how our results depart from the standard specification. We do this since, by using time-varying tariffs to measure variable trade costs, we can fully exploit the panel dimension of our dataset and control for many biases, which previous studies could not take into account.

First, we show that in a pooled cross-section analysis, both margins are negatively correlated with tariffs, with the extensive margin explaining almost 50% of the total effect on trade. Results are robust to the introduction of a full set of country and product unobserved heterogeneity effects as well as time macro-shocks. Second, we control for combined country-firm unobserved heterogeneity, by performing a within panel OLS regression. This is important to take comparative advantage into account. By considering separetely country and product unobserved heterogeneity one only controls for country (product) characteristics which jointly determine the *average* country tariffs and its import from France. However, 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

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

[2] Debaere and Mostashari (2007) measure the import extensive margin of US trade in the last decade and Romalis (2005) studies the change in US import intensive margin induced by the NAFTA. None of them use the variation of tariffs provided by the Uruguay Round concessions to identify the effects of tariffs on trade margins.

same product would be protected in the same way throughout the world.). It is much more likely that each country sets higher tariffs on the products it wants to protect more from French competition. With this specification the effect on the extensive margin disappears. We conclude that there are more exporters where tariffs are lower (pooled OLS). However the decrease in tariffs, induced by the implementation of the Uruguay Round, did not push more firms into exporting, while increasing the shipments of incumbent exporters.

We address two important potential biases which may affect previous results.

First, growth rate of tariffs may be endogenous. 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 French exports during our time-span. A way to control for this bias is to instrument the growth rate of tariffs. We claim that a good instrument for the growth rate in tariffs is its pre-policy (pre-UR) level interacted with a WTO participation dummy. In fact, tariffs decreased the more for product-country pairs in which they were higher before the policy event. Moreover pre-UR tariff levels do not affect the subsequent French export growth rate since they are predetermined. Those two considerations imply that the pre-UR tariffs level is a good instrument for its (negative) growth rate in subsequent years. Results do not change much.

Second, we discuss the incidence of the omission of zero trade flows in our results. We propose two different methodology to deal with it. The first is a within Tobit model which we perform using the Honore (1992) methodology to deal with the incidental parameter problem. This specification yields coefficients which are not precisely estimated. We discuss why this is the case and we turn to use the Poisson Pseudo Maximum Likelihood estimation, proposed by Santos-Silva and Tenreyro (2006). With this methodology we re-include the 0-flows observations and we take the potential heteroskedasticity of the error term into account. The extensive margin's coefficient is very low, albeit it becomes significant.

Final results suggest that the tariff reductions, mostly due to the Uruguay Round, is responsible for increases in aggregate French exports ranging from 3.4% to 4.7%, depending on the different econometric specifications. Moreover, it channels mainly through the intensive margin, the extensive margin coefficient being either insignificant or very low.

Our paper is mainly related to the 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 both margins. Bernard, Jensen, Redding and Schott (2007), 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) 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 dataset that contains this piece of information.

This paper also contributes 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 figure out what was driving these surprising findings. Recenlty, 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 instead of a membership dummy and relying directly on a well-defined policy change emanated by GATT/WTO. Clearly, our results refer to France only. Since the Uruguay Round affected mostly developing countries, the impact on world trade may be even bigger[3]. This analysis and its results are relevant as the discussion on the Doha Round is becoming crucial in the international policy debate. In fact, we prove how beneficial the previous multilateral tariffs reduction has been even for a developed economy.

The remainder of the paper is organized as follows. Section 2 sketches a standard model with

[3]Moreover it is well-known that the Uruguay Round mainly affected agricultural sectors which are excluded from our analysis, this sector receiving a particular treatment from the WTO.

heterogenous firms to state the decomposition of trade in both 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 the main econometric strategy. Section 5 deals with robustness checks. Section 6 concludes.

2 A standard model of trade with extensive and intensive margin

Hereafter we present a simplified version of the Chaney (2008) model incorporating firm heterogeneity and variable and fixed costs. We aim to underline how such a model generates extensive and intensive margins of trade. We follow Chaney (2008) 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 i or $j = 1, 2, ..., J$. 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 :

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

where q_0 denotes consumption of the numeraire good, q_{sj} is the demanded quantity of each good s from each country j, σ is the elasticity of substitution between varieties, assumed to be constant across sectors, and the μ's are the shares of expenditure 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 :

$$q_{ijs} = \frac{{p_{ijs}}^{-\sigma}}{{P_{js}}^{1-\sigma}} \mu_s Y_j \tag{2}$$

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 are active. These firms are heteregenous since they produce at different marginal costs a, which do not vary with quantities since (domestic) constant returns to scale are assumed. 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:

$$TC_{ijs}(a) = q(a)a\tau_{ijs} + f_{ij} \tag{3}$$

where a is the firm specific marginal cost, τ_{ijs} is the standard "iceberg" trade cost[4] 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 in a generic s sector 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:

$$p_j(a) = \frac{\sigma}{\sigma - 1} a\tau_j \tag{4}$$

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:

$$\pi_j(a) = \frac{\mu}{\sigma} \left(\frac{\sigma}{\sigma - 1} a \frac{\tau_j}{P_j} \right)^{1-\sigma} Y_j - f_j \tag{5}$$

Each firm will export if and only if export 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:

$$a_j^* = \phi_j \left(\frac{1}{f_j} \right)^{\frac{1}{\sigma-1}} \frac{1}{\tau_j} \quad \text{where} \quad \phi_j = \left(\frac{\mu}{\sigma} \right)^{\frac{1}{\sigma-1}} \frac{\sigma - 1}{\sigma} Y_j^{\frac{1}{\sigma-1}} P_j \tag{6}$$

The previous equation shows how the productivity level of the marginal exporter is a negative function of the variable and 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:

$$x_j(a) = \mu \left(\frac{\sigma}{\sigma - 1} a \frac{\tau_j}{P_j} \right)^{1-\sigma} Y_j \tag{7}$$

The previous formula suggests that the export values depends on the variable trade cost, but not

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

on the fixed trade costs. This is underlined by denoting the value of exports by $x_j(a, \tau_j)$.

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

$$X_j = \int_0^{a_j^*(f_j,\tau_j)} N x_j(a, \tau_j) f(a)\, da \tag{8}$$

where N is the exogenous total number of active firms.

Formula (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:

$$\begin{aligned} \frac{\partial X_j}{\partial \tau_j} &= \underbrace{x_j(a_j^*, \tau_j)}_{\text{Exports per new entrant}} \underbrace{\frac{\partial a_j^*(f_j, \tau_j)}{\partial \tau_j} N f(a_j^*)}_{\text{\# new entrants}} \\ &+ \underbrace{\int_0^{a_j^*} \frac{\partial x_j(a, \tau_j)}{\partial \tau_j} N f(a)\, da}_{\text{Increase in exports for old exporters}} \end{aligned} \tag{9}$$

.

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

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:

$$X_{j,s} = N_{j,s} * \frac{X_{j,s}}{N_{j,s}} \tag{10}$$

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 ($\frac{X_{j,s}}{N_{j,s}}$).

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[5].

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,

[5]See for instance Crozet and Koenig (2007), Mayer and Ottaviano (2007), Bernard, Redding and Schott(2006).

on average, than incumbent ones. Thus, our estimated intensive margin may actually underestimate the theoretical one.

To make the point clearer, let us consider the following way to further decompose the extensive margin of (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[6], our analysis under-estimates the trade cost elasticity on the theoretical intensive margin[7].

3 Data and descriptive analysis

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"[8]. 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;

[6]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 by exporting small quantities.

[7]A last concern remains. If we aggregate the model's results in order to obtain the margins in (10), the total average quantity is no longer a function of variable costs. This result comes from the specific density function used in aggregating firm-level data, the Pareto distribution. However, under more general density functions, variable costs still impact the intensive margin.

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

- 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. Since the establishment of GATT in 1948, international trade negotiations had resulted in tariff reductions of about 85%. However, significant barriers remained. The UR induced significant reforms of the GATT process and 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 the 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"*.

The timing of tariff reductions agreed upon by each Member was implemented in five equal rate reductions[9] from 1995 to 2000.

To measure the real extent of the UR tariff reductions faced by the European Union, we use the TRAINS-WTO database, which contains Effective Applied Ad-Valorem Tariffs[10,11] 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 2 years after its full implementation. 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 8 (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 9 (in the appendix) lists the products according to the 3-digit NES classification.

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

[10] 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 treat equally all other WTO members.

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

Figure 1 shows the change in tariffs induced by the UR plotted on their initial level in 1993-1994[12]. 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.

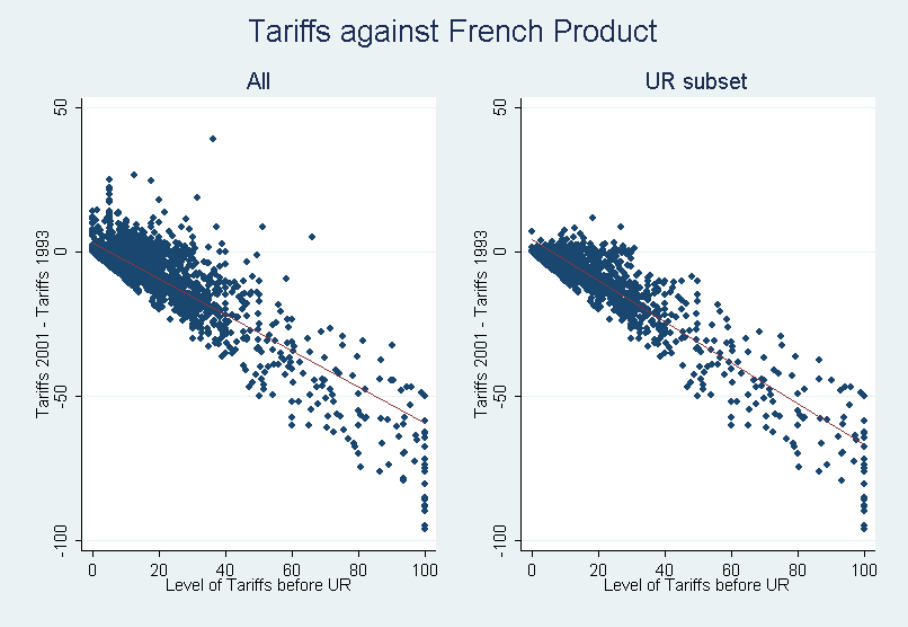


Figure 1: Reduction of tariffs vs their initial level

We observe interesting features. First, initial tariff levels show a high dispersion, ranging between 0 to a maximum of 100%, with the median observation being below 20%. Second, Figure 1 suggests a downward sloped relation between tariff 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 the European Union correlate among them much more at the end of the period than at the beginning. Moreover, this

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

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 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[13], concluding that a high level of escalation in this sector still remains 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 above-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 section 4.

Figure 2 shows a sector-aggregate version of Figure 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.

Figure 2 is also interesting since it 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 of textile fibres, weaving and finishing of textiles) and FG (Manufacture of knitted and crocheted fabrics and articles).

A more formal way to show the effect of the UR on world tariffs is provided by Table 1. This table reports the average tariffs before and after 1995 for countries which adopted or not the UR concessions (respectively countries in WTO in 1995 and outside WTO in that year). This table displays 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 cannot assume that the UR was the only responsible for tariff reductions in our sample, we have a clear indication of its influence on it.

Figure 3 shows that, once we average tariffs and their changes by sectors, we still find that tariff reductions were higher for those sectors which had high tariffs at the beginning.

The fact that tariffs were mostly reduced in countries participating in WTO and in those sectors where they were high suggests that the UR concession is a well-designed policy experiment. However,

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

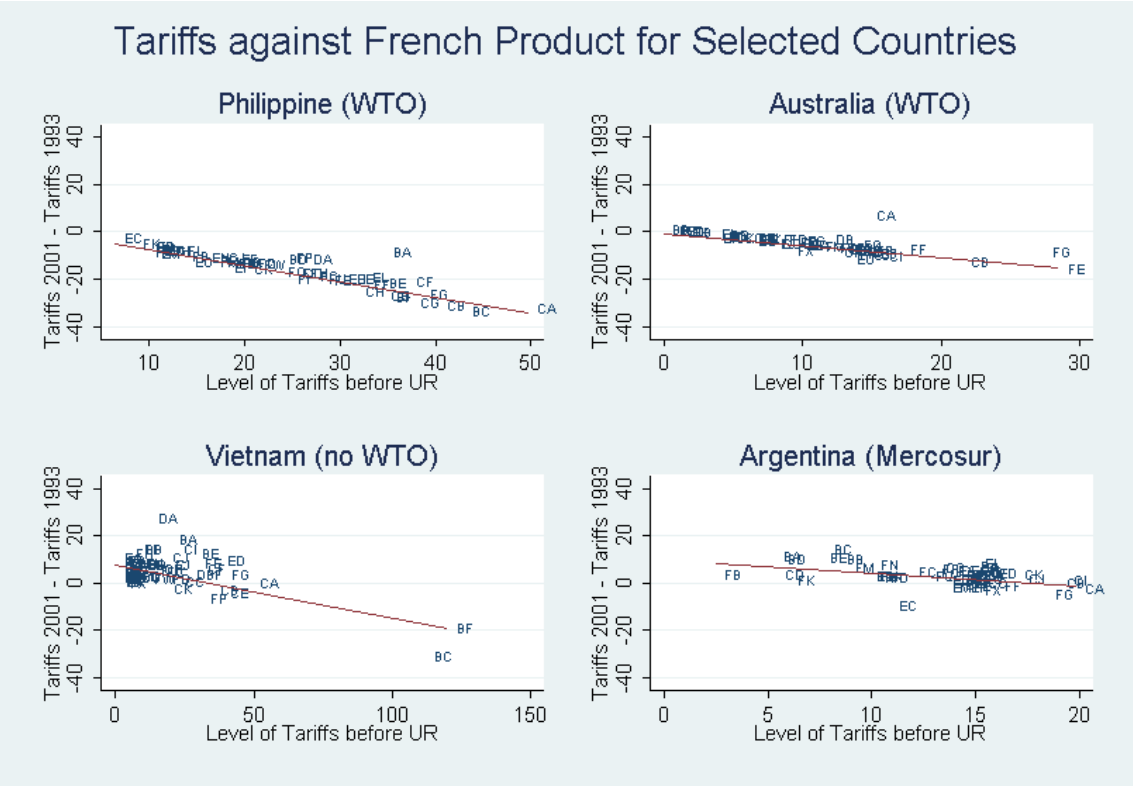


Figure 2: Average sectoral reduction of tariffs vs their initial level for selected countries

	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 1: Average tariffs by country-groups before and after UR

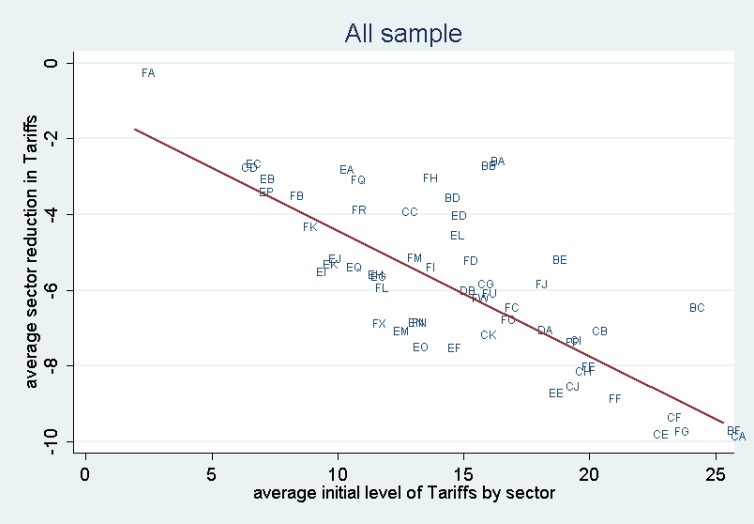


Figure 3: Average world sectoral reduction of tariffs vs their initial level

it may be that, even after the tariff reduction, the protection structure of each country remained unchanged. In figure 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 the European Union remained unchanged, then we should observe all the observations lying on a line going through the origin[14].

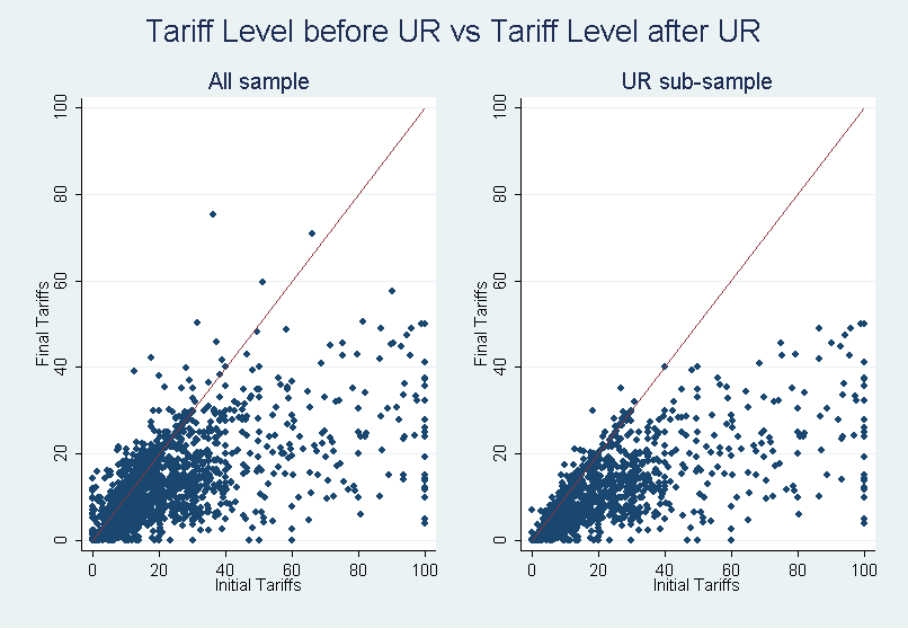


Figure 4: Initial and final level of tariffs

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

Figure 5 presents the same evidence for tariffs at the average product level. Even if, on average, tariffs decreased, the structure of protection by sector set by the average country against the European Union remained globally identical 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 seem to be endogenous. In fact, the reduction was chosen in such a way that it left the protection pattern roughly constant. These two problems will be addressed in the econometric analysis.

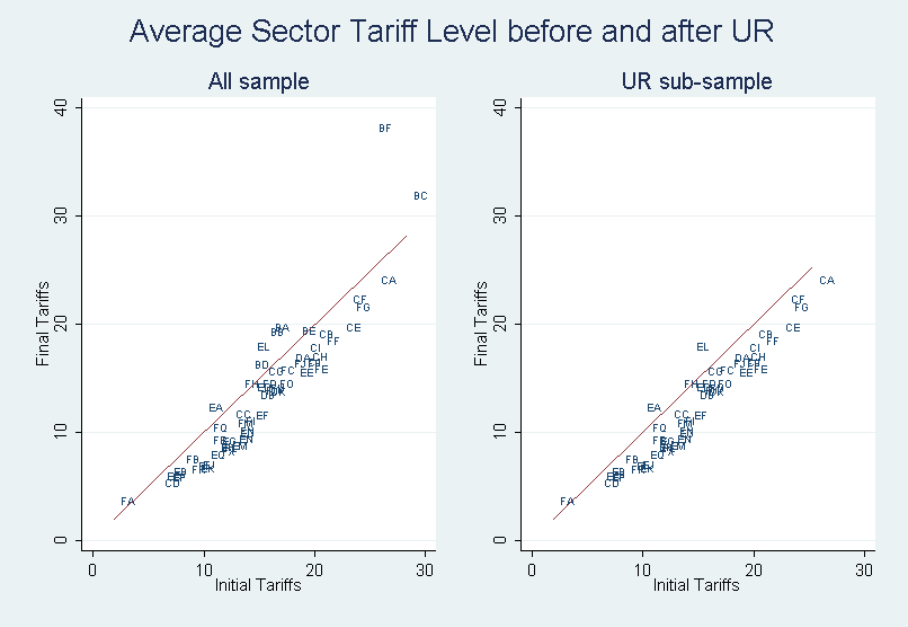


Figure 5: Sector average initial and final level of tariffs

Finally, Figure 6 displays the dispersion of tariff variations (in percentage points) between the beginning and the final period for various sub-samples. As expected, when we focus on the UR sub-sample, the dispersion on which our empirical analysis relies is higher[15].

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

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[16]).

Since we want to keep track of the type of product export by firms, our margins are constructed in a non standard way. For instance, Bernard, Jensen, Redding and Schott (2007) construct their

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

[16]This decomposition represents 60 manufacturing sectors.

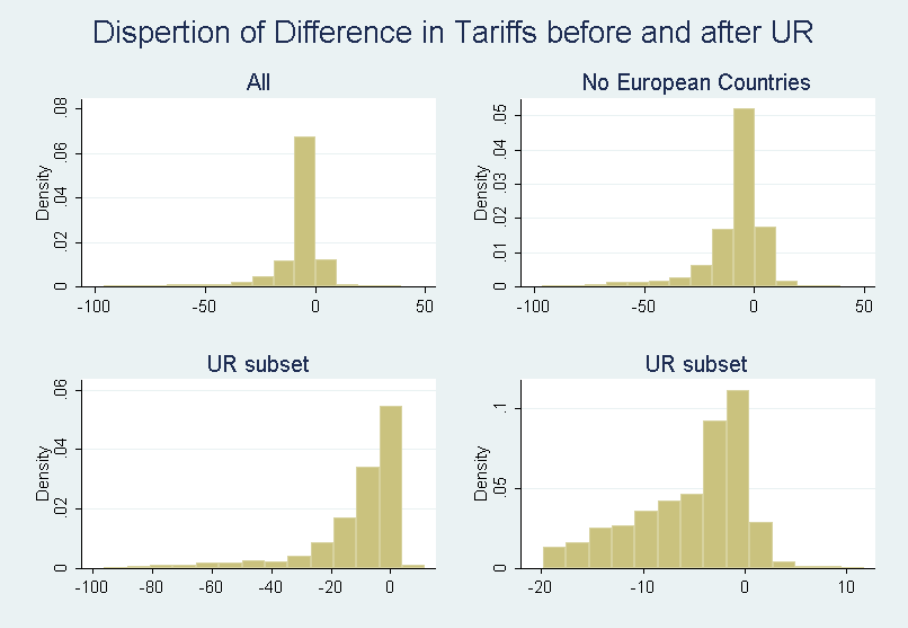


Figure 6: Dispersion of tariffs difference before and after UR

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[17]. However, 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[18]. 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[19].

After cleaning the data, we are left with 147 countries, 57 products and 13 years. The first thing to notice is that France does not export all products to all destinations. Figure 7 reports for each year the proportion of potential flows (product $\times$ country) that are strictly positive[20].

The share of zero-flows seems to be stable in French exports across our time-span, remaining at

[17]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.

[18]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.

[19]Bénéfices Réels Normaux. This base provides characteristics and balance-sheet data of firms for each year of the sample. BRN also reports export revenues. We keep only firms which are exporters according to both datasets. We will

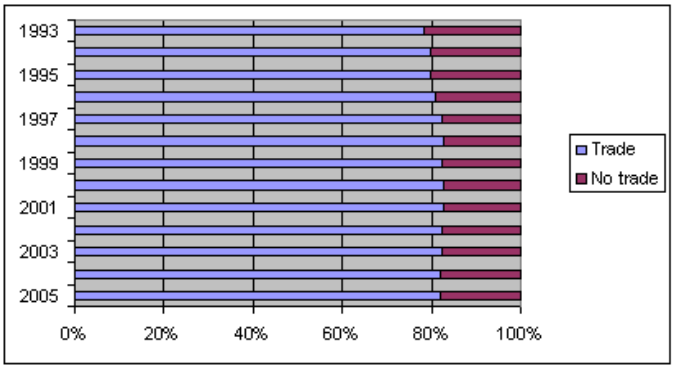


Figure 7: Macroeconomic extensive margin

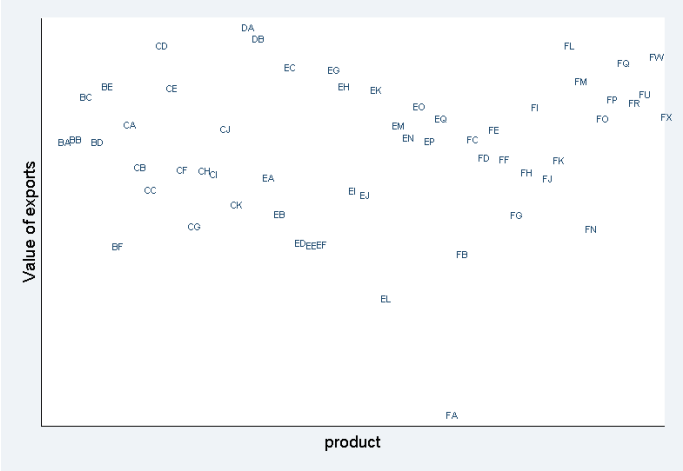


Figure 8: Total export value by sector (2002)

about 20 % of the potential flows.

We now turn to the descriptive analysis of the positive flows with respect to some of the main gravity determinants, GDP and distance. First, we present the total value of French exports (in logs) by sector (to all the countries of our sample).

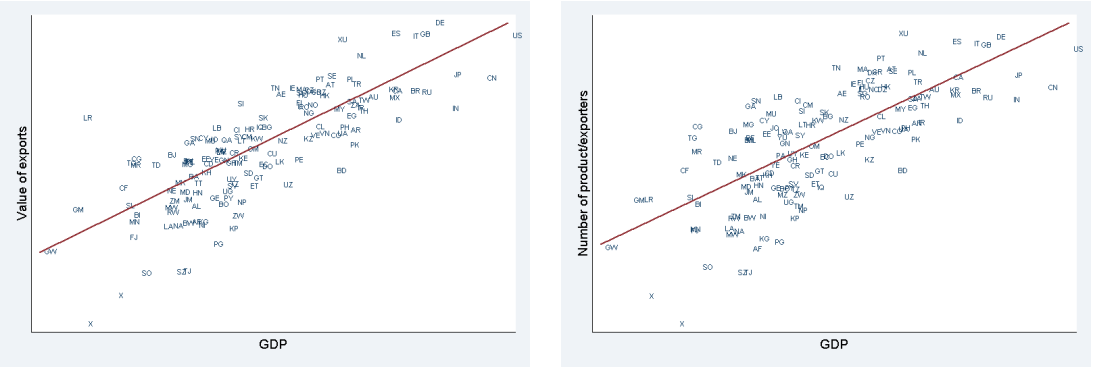
The sectors in which France exports to a larger extent are DA (Manufacture of motor vehicles, bodies and trailers) and DB (Manufacture of parts and accessories for motor vehicles). France also exports substantial amounts in sector CD (Manufacture of pharmaceuticals, medicinal chemicals and botanical products) and FL (Manufacture of basic organic chemicals). Conversely, exports of FA (Mining of metal ores), EL (Manufacture of weapons and ammunition)[21] and FB (Other mining and quarrying) are relatively small.

use this database in the extension to the firm-level analysis.

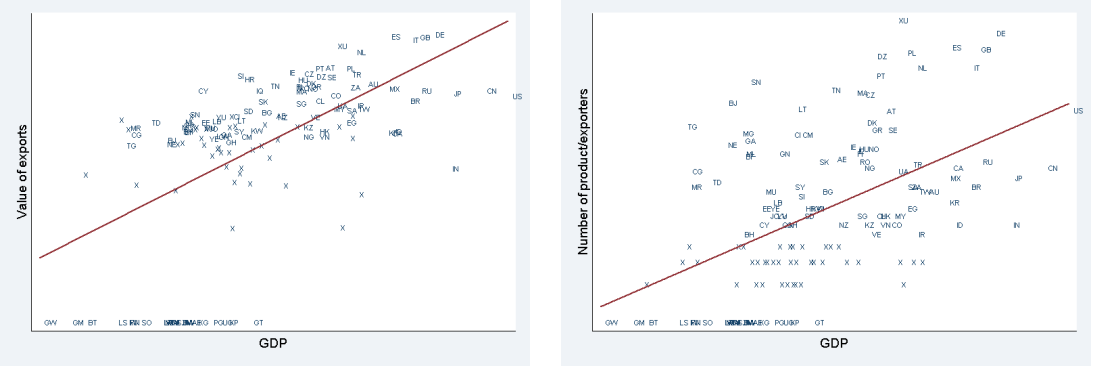
[20]To some extent, zero flows depend on the product disaggregation level and on the legal threshold for reporting a flow to the Douanes administration.

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

All sectors



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



Sector FB (Other mining and quarrying)

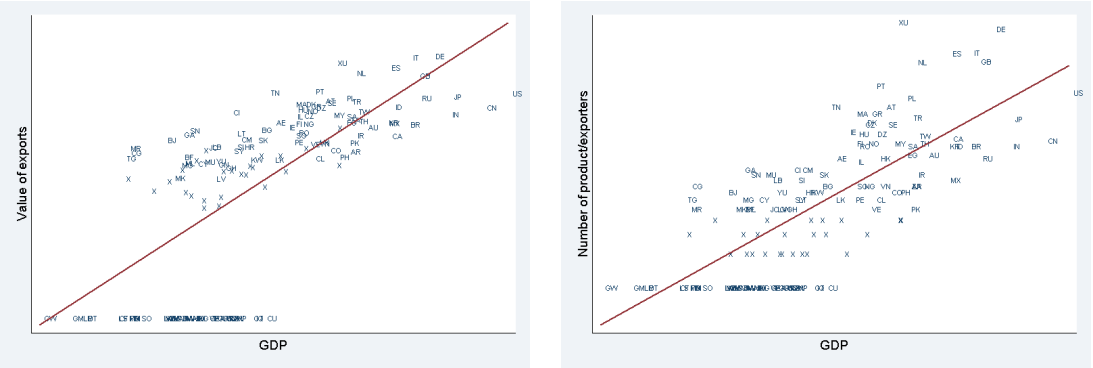


Figure 9: Total and extensive margins and GDP (2002)

To show that the main predictions of a gravity model apply to both trade margins, we plot them against GDP and distance (all is in log). Figure 9 and 10 show those graphs for every sector and for a "good performing" (DA) and a "bad performing" (FB) sector.

Gravity predictions work well. We conclude that our aggregated micro-data follow the usual pattern of macro trade flows. Reinforced by this evidence, we next turn to the econometric analysis.

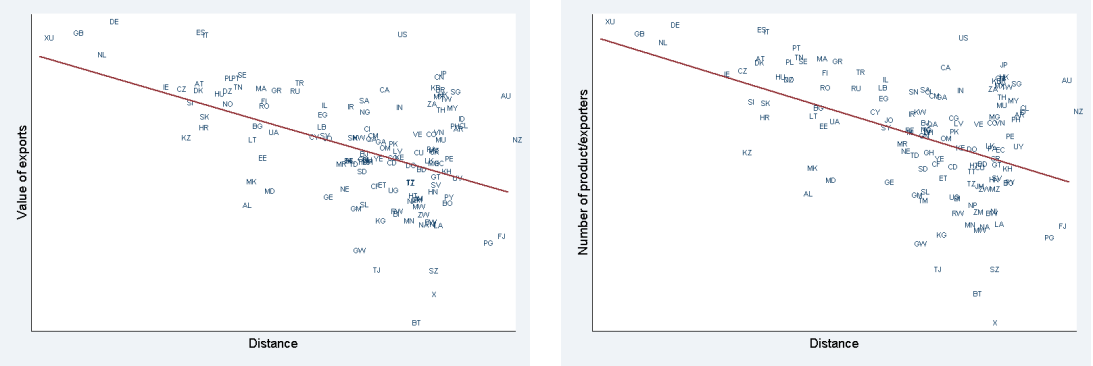


Figure 10: Total and extensive margins and distance (2002)

4 Econometric strategy and results

4.1 Basic regressions

We follow the decomposition defined in the theoretical section (equation 10), which is hereafter reported in logs and with all the corresponding subscripts:

$$x_{j,t,s} = n_{j,t,s} + \overline{x}_{j,t,s}$$

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

Let $\Lambda_{j,t,s}$ be our variable of interest (either x, n or $\overline{x}$). Previous literature that, using firm-level data, has used this same decomposition to obtain the effect of gravity determinants on trade margins[22], rely on the following regressions[23]:

$$\Lambda_{j,s,t} = \beta_0 + \beta_1 d_j + \beta_2 GDP_{j,t} + \beta_3 Z_j + \beta_4 Y_{j,t} + \delta_s + \delta_t + \epsilon_{j,t} \tag{11}$$

where j denotes partner country[24], s product and t time. The main variable of interest, the proxy for variable trade costs, is d_j which measures distance. As usual, the previous gravity equation includes the GDP of trading partners. The specification also includes a set of country-time and country-

[22] BJRS (2007) for US exports in 2000, Mayer & Ottaviano (2007) for a combined data set with Belgian and French exports in a single year and Crozet & Koenig (2007) for French exports between 1989 and 1992.

[23] We compare our strategy with Crozet & Koenig (2007) more than with BJRS (2007) and Mayer & Ottaviano (2007) since the latters 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 exports 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').

[24] 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.

specific covariates, $Y_{j,t}$ and Z_j, respectively[25]. The first set contains binary variables which indicate if the partner is a WTO member and if it benefits from the Generalized System of Preferences (GSP)[26]. Since countries joined WTO and obtained GSP status at various times, both variables are time-varying. 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 may also be "culturally" similar. Thus, distance may capture consumer tastes instead of trade costs. However, since there are no measure 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 exports to more specific sector-country costs.

In this paper our measure of trade costs is, thus, tariffs. It allows us to 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. Previous specification introducing tariffs becomes:

$$\Lambda_{j,s,t} = \beta_0 + \beta_1 \theta_{j,t,s} + \beta_2 d_j + \beta_3 GDP_{j,t} + \beta_4 Z_j + \beta_5 Y_{j,t} + \delta_s + \delta_t + \epsilon_{j,t} \tag{12}$$

where the main variable of interest, in our analysis, is $\theta_{j,t,s}$, the log of $(1 + t_{j,t,s})$[27], and $t_{j,t,s}$ is the tariff applied to products of type s at time t by country j.

Using the fact that our variable trade costs measure varies along three dimensions, we can further replace all time invariant country characteristics by country fixed effects, δ_j:

[25] The set of variables included in a gravity equation usually varies across studies. Since we are reporting this regression only for a comparison reason we allow for the usual controls, like in Rose (2004).

[26] GSP consists in a special unilateral tariff 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.

[27] 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.

$$\Lambda_{j,t,s} = \beta_0 + \beta_1 \theta_{j,t,s} + \beta_2 GDP_{j,t} + \beta_5 Y_{j,t} + \delta_j + \delta_s + \delta_t + \epsilon_{j,t,s} \tag{13}$$

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 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 French 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 agreement with France decreases total trade[28].

When we introduce tariffs (column (4) to (6)) we find that the elasticity of distance does not change much, and the elasticities to tariff are negative and significant at the 1% level. The effect of tariffs on exports channels slightly more through the extensive margin. All the coefficient estimates have similar magnitudes and signs except for the GSP, which is now positively related to the intensive margin[29]. 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 the TRAINS dataset many tariffs are not reported[30].

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 variable, which could be negatively linked with tariffs and positively with exports (for instance, diplomacy, tastes, preferences, ...). However, in this specification, WTO membership positively explains trade only through the extensive margin. 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%[31], the extensive margin by 1.57% and the intensive margin by 1.03% [32]. These coefficients imply that the contribution of tariffs in explaining the growth rate of total French exports is 2.2%.

[28] 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.

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

[30] We will discuss about this problem in section 5.2.

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

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

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 2: Gravity equation with tariffs and control variables

Reporting Table 2 is useful in order to compare our results with standard ones on gravity equations. However our main interest lies in getting unbiased coefficient for tariffs. In next sub-sections we discuss potential biases on the tariff coefficient in the baseline regression (13) and we exploit more intensively our 3-dimensional panel, as well as the timing of the UR implementation, to obtain reliable unbiased estimates.

4.2 Within regressions

Regression (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. 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. In what follow we address them in a gradual fashion, from the less to the most severe.

The first problem concerns omitted variables that can explain the level of exports and that may be spuriously correlated with the level 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 the WTO formation (for example since they are facing "financial integration" during the '90s). This would bias our results. The same argument holds for time-varying sector 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). To partially take those biases into account we add a full set of interactions between country and time as well as sector and time fixed-effects. Results do not change much: all three margins significantly increase as tariffs decrease, as it can be seen form Panel A of Table 3.

The second problem with regression (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 control 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 world. It is much more likely that each country sets higher tariffs on the products it wants to protect more from French (and European) competition.

To take this bias into account, we exploit the panel dimension of the dataset and run within regressions where the source of variation is the change of tariff level applied to France within each country-sector line. Results are reported in Panel B of Table 3[33]. Results of this regression suggest that no margin is significant. Although, at first sight, those results may seem puzzling, we suspect that they are driven by noise in the data. It is highly probable that the annual variation of tariff rates are not very meaningful for the export decisions. Exporters may react with some delay to changes in tariffs. Hence, it is not so surprising that annual tariff levels and annual export flows are so poorly related when one controls for most of the unobserved heterogeneity.

To obtain reliable "within" results, we perform our analysis on a sub-sample of our data considering the observations pre-UR and post-UR. Since the implementation of the UR concessions took 5 years starting from 1995 to 2000, we take all the observations in our data base for the pre-UR period (either 1993 or 1994) and those for the post-UR period (2001-2002). Our aim is to maximize the variation in the tariff dimension within each country-sector pair. Results for the cross-section and for the within regression for the pre-post subsample are reported in Panel C and D of Table 3. The cross-section version does not yield any surprise: the extensive margin explains the 50% of the total effect as in the specification without all the set of fixed effects (column (7) to (9) of Table 2). Moreover, results are very similar to those in Panel A [34]. In the "within" specification, instead, the extensive margin is no more significant and the whole effect of tariff reductions within a country-sector pair channels through the change in exported quantities. This means that even if there are more exporting firms where tariffs are lower, the decrease in tariffs does not push firms into exporting[35].

4.3 Endogeneity

In this subsection we discuss a last fundamental empirical concern in our basic specification analysis. As noticed in previous sections after the implementation of the UR, tariffs decreased without being completely eliminated (and without reaching a predetermined level). This means that, even if

[33]Note that in this regression $\delta_j * \delta_t$ has not been added since there was not enough variation in the data. However we guess this is not driving the result, as following analysis will clarify.

[34]These comparisons indicate that for the pre-post subsample results are in line with those of the full sample and that the omission of interacted fixed effects is not biasing the results.

[35]We also ran regressions in Panel C and D without $\delta_j * \delta_t$ and results do not change, thus we have a further indirect intuition that the full sample is noisy.

Dependent variable: Log of each trade margin

	Total	Extensive	Intensive	N. of observation
Panel A : Specification with Country-Year and Product-Year FE (not within), whole sample				
ln(tariffs)	-2.05***	-1.08***	-0.97***	30189
	(0.11)	(0.04)	(0.09)	
R^2	0.90	0.97	0.71	
Panel B : Specification with Product-Year and Country-Product FE (within), whole sample				
ln(tariffs)	-0.13	0.03	-0.16	30189
	(0.12)	(0.04)	(0.10)	
R^2	0.94	0.97	0.84	
Panel C : Specification with Country-Year and Product-Year FE (not within), pre and post UR sample				
ln(tariffs)	-2.42 ***	-1.22***	-1.19***	8800
	(0.28)	(0.12)	(0.24)	
R^2	0.79	0.90	0.58	
Panel D : Specification with Country-Product, Country-Year and Product-Year FE (within), pre and post UR sample				
ln(tariffs)	-1.99***	-0.18	-1.81***	8800
	(0.47)	(0.15)	(0.43)	
R^2	0.94	0.98	0.84	

***:significant at the 1% level; **:significant at the 5% level; *: significant at the 10% level.
All regressions include country dummies and sector duimmies
Robust standard errors are the ones reported. Constant and dummies coefficient are not reported.

Table 3: Gravity equation with tariffs: within regressions

the 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 imports 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 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 tariff levels should not affect the French *export growth rate* since they are predetermined. Those two considerations imply that the pre-UR tariff level is a good instrument for its (negative) growth rate in subsequent years.

This instrument has been first used in Goldberg and Pavcnik (2005) in their analysis on the effect of trade liberalization in Colombia on sectoral wage premia. 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

[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.

[38]The graphs showed the relation between the 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.

to address this issue. 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 tariff levels 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 the pre-reform level of tariffs or with its interaction with coffee price or exchange rate.

We follow them and estimate the regression in difference using a 2SLS procedure. As in the previous analysis, we considered the pre-post UR sub-sample[39]. In the first stage we instrument tariff changes with their pre-UR level, i.e. their level in 1993. Notice that, since we are running our regressions considering only two periods of time (pre and post-UR), the instrument and the variable to be instrumented have the same dimension since both change for country and sector.

To rely more on our specific policy change we also use a second instrument which has been constructed considering the countries and sectors to which UR concessions applied more tightly. The Uruguay Round, in fact, did not apply simultaneously to all countries and for all the products in the data. First of all, as we discussed, our dataset contains both countries that participated in the multilateral negotiations and countries that did not participate. Moreover some countries joined the WTO after the entry into force of the Uruguay Round concessions, thus for these members the tariff reduction path is postponed depending on their respective year of accession. Hence we obtain our results in the following way: we instrument the tariff growth rate (with the pre-UR tariff level) only for the countries which participated in the negotiations before 1995. We use as instrument a variable obtained by the interaction of a WTO-participation dummy and the pre-UR tariff level for each country and sector, in order to isolate the exogenous component of the variation in tariffs which is closely related to the implemantation of the UR concessions.

The regression we run is the following:

$$\Delta\Lambda_{j,s} = \beta_0 + \beta_1 \widehat{\Delta\theta_{j,s}} + \delta_j + \delta_s + \epsilon_{j,s} \tag{14}$$

where in the first stage regression $\Delta\theta_{j,t,s}$ is instrumented with either $\theta_{j,s}^{1993}$ (IV1), the pre-UR level of tariffs[40], or $\theta_{j,s}^{1993} * WTO_j$ (IV2), where WTO_j is a dummy equal to 1 when a country is in the GATT/WTO at the beginning of the period.

[39] We also tried a specification regressing bi-annual growth rate of export over bi-annual growth rate of tariffs, thus using all the time-variation in our data. Those specification however provided insignificant results since the differentiation results in a strong noise. For this reason we do not report them.

[40] It is the level in 1994 when the information about 1993 is not available in the data set.

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

Model	1st stage (1)	Total (2)	Extensive (3)	Intensive (4)	No obs (5)	First-stage F (6)
Panel A: OLS, eq 13		-1.79***	-0.94***	-0.85***	5052	
		(0.30)	(0.18)	(0.27)		
R^2		0.82	0.90	0.64		
Panel B: OLS, eq 14		-1.99***	-0.18	-1.81***	2526	
		(0.65)	(0.17)	(0.60)		
R^2		0.14	0.27	0.10		
Panel C: 2SLS, eq 14, IV1	-0.56***	-2.56***	-0.22	-2.43**	2526	F=140***
	(0.012)	(1.05)	(0.23)	(0.99)		
R^2	0.86	0.15	0.27	0.10		
Panel D: 2SLS, eq 14, IV2	-0.52***	-1.78*	0.19	-1.97**	2526	F=100***
	(0.27)	(1.06)	(0.99)	(0.95)		
R^2	0.81	0.15	0.27	0.10		

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

All regressions include country dummies and sector duimmies

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

Table 4: Gravity equation with tariffs: model in difference, IV regressions

Results for regression (14) performed with OLS and 2SLS are reported in Panels B-D of Table 4[41] while Panel A of the same Table reports the results of regression (13) for the same sub-sample[42].

Results in Panel B refer to the OLS regression for the differentiated model. First notice that the coefficients of this regression coincide with those of Panel D of Table 3, although the number of observations differ. The reason is that when we run the within regression with only the pre-post UR subsample, the coefficients are estimated on the observations for which we have tariffs in both periods (pre and post). Moreover, note that we are running regressions where t=2: thus both methods (adding fixed effects in level or differentiating), yield exactly the same results[43]. The column (2) of Panel B suggests that a reduction of tariffs by 1 p.p., starting from 10%, increases total French exports by 1.82%[44]. Moreover this is completely explained by the movement in the intensive margin of export, the extensive margin being insignificant[45].

In the second round of regressions we instrument the difference in tariffs with their initial level before the UR. As shown in column (1) which reports the result of the first stage regression, the initial level of tariffs significantly impacts their variation. The coefficient is negative and the R^2 is very high, 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 (reported in

[41] Notice that in these regressions the number of observations is 2526 while, in the descriptive part, we obtained Figure 1 using 2699 observations. The difference in the number of observations arises from the fact that 173 sector-country couples display 0-flows in the French export data (i.e. no firm exports in those sectors and to those countries and thus the dependent observation in regression (14) is not defined for those 173 observations).

[42] Our effort here is to enhance comparability of models and samples. Note that the first row has (2526*2=)5052 observations

[43] Basically in Panel D of Table 3 we run: $\Lambda_{j,s,t} = \beta_0 + \beta_1 + \theta_{j,s,t} + \delta_j * \delta_t + \delta_s * \delta_t + \delta_{j,s} + \epsilon_{j,s,t}$ with $t = 2$. While in column (1) of Table 4 we run the same regression specified in difference that is: $\Delta\Lambda_{j,s} = \beta_0 + \beta_1 + \Delta\theta_{j,s} + \delta_j + \delta_s + \epsilon_{j,s}$.

[44] The effect on the total margin, when tariffs go from 10% to 9% is computed as $[ln(1+0.09) - ln(1+0.10)] * (-1.99) = 0.0182$.

[45] Panel A further shows that the extensive margin is not significant because of the "within" part of the regression.

column (6)) is much higher than 10, suggesting that our instrument is not weak.

In the second-stage, we obtain negative estimates for the tariff elasticities instrumenting by IV1. The magnitude of the coefficent estimates is slightly higher than in previous regressions[46]. However the coefficient, like in the OLS two-period regressions, is significant only for the *intensive margin*. A reduction of tariffs by 1 p.p., starting from a level of 10%, increases the average exports of French products by 2.21% compared with the previous 1.82%.

Results obtained with the alternative instrument, IV2, are presented in Panel D of table 4. They confirm that most of the effect of tariff reductions induced by the UR channels through the intensive margin of trade, the average export flow increasing by 1.8% as tariffs decrease by 1 p.p., starting from a level of 10%.

We performed other robustness checks to the previous regressions, by replicating the results on the following sub-samples:

1. We eliminate countries in the European Customs Union (EU). The reason to perform this check is that their tariffs did not change before and after the UR, while their imports did.

2. We eliminate countries that were not included in what we defined as the UR-subset in the descriptive part, in order to consider only the countries and products to which the UR concessions fully apply.

3. We eliminate processed-food products for the same reason as before.

4. We eliminate weapon products, which, as we noticed, are likely to be misreported.

All the previous results still hold. We thus conclude that there are more exporters when the tariffs are lower, but decreasing tariffs, caused by the implementation of the Uruguay Round, did not push firms into exporting, but induced incumbent exporters to increase more their flows to that destination-sector in which tariffs decreased more.

5 Robustness checks

In this section we perform important robustness checks and we discuss the results obtained with different specifications.

[46]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 since we also capture part of that positive correlation between tariffs and export flows.

5.1 Zero flows

In the previous analysis we considered only positive flows, since 0-flows cannot be included in a log-log specification and since the intensive margin is not defined for sector-country pairs without trade. In this way we implicitely assume that export flows are strictly positive. This assumption, however, is likely to downward bias our estimates due to the usual censoring problem. Recently, many papers argued that, by not taking zero flows into account, estimation of the gravity equation can be biased[47].

In the literature, this censoring problem is usually addressed using a Tobit model. However, in order to apply this model to our panel fixed effect gravity equation, we have to overcome three main issues. First, in order to disentangle the effect of tariffs on both margins with a Tobit, we have to apply a proper decomposition since the intensive margin exists only conditionally on the positiveness of trade flows[48]. Second, we need to transform our dependent variables in order to include 0's in a log-log specification. Third, since our specification includes fixed effects, we have to take care of the usual incidental parameter problem affecting fixed-effect non-linear models like the Tobit.

To address the first issue we apply the following decomposition of elasticities:

$$\begin{aligned}\frac{\partial \mathbb{E}[x|Z]}{\partial \theta} = \quad & \frac{\partial \mathbb{E}[n|Z,X>0]}{\partial \theta}\mathbb{P}[X>0] && \text{Micro extensive margin} \\ & + \frac{\partial \mathbb{E}[\overline{x}|Z,X>0]}{\partial \theta}\mathbb{P}[X>0] && \text{Intensive margin} \\ & + \mathbb{E}[x|Z,X>0]\frac{\partial \mathbb{P}[X>0]}{\partial \theta} && \text{Macro extensive margin}\end{aligned}$$

where x is, as usual, the total flow, Z denotes the vector of covariates and $\mathbb{P}(X>0)$ is the probability of a flow to exist[49].

Estimating a Tobit model on the total and extensive margins allows us to obtain the full decomposition of the elasticity of trade to tariffs as described above. Therefore our basic specification is:

$$\begin{aligned}\Lambda^*_{j,t,s} &= \beta_0 + \beta_1 \theta_{j,t,s} + \delta_j * \delta_t + \delta_s * \delta_t + \delta_{j,s} + \epsilon_{j,t,s} \\ \Lambda_{j,t,s} &= \mathbb{1}[\Lambda^*_{j,t,s} > 0]\end{aligned}$$

where Λ denotes the total margin $x' = \ln(1+X)$ or the extensive margin $n' = \ln(1+N)$. Notice that

[47] Felbermayr & Kohler (2007), by allowing for zero-flows, overturned the results of Rose (2004) on the absence of effect of the WTO membership on bilateral trade; Santos-Silva and Tenreyro (2006) show that the elasticity of trade to distance changes dramatically once 0-flows are taken into account; Helpman, Melitz and Rubinstein (2008) argue that omitting 0-flows results in biased estimation of gravity equations.

[48] If the trade flow is nil, then the number of exporters is nil and the intensive margin is undefined.

[49] This is the actual proportion of non-zero trade flows in our data base which is around 80 %.

	Total Margin	Extensive margin
$ln(tariffs)$	-2.97**	-0.31*
	(1.41)	(0.18)
$Product-Country\ FE$	YES	YES
$Country-Year\ FE$	YES	YES
$Product-Year\ FE$	YES	YES
$Number\ observations$	5,398	5,398
Park Test p-value	0.00	0.00

*: significant at the 10% level, **: significant at the 5% level, ***: significant at the 1% level. FE = fixed effects.

Table 5: Tobit specification

the definition of the margins is slightly different than in previous section[50]. We add 1 to the margins to be able to address the second issue, i.e. including 0-flows in the log-log gravity. This "trick" has been used in the literature to perform a Tobit analysis with a log-log specification. We suggest this methodology to obtain results which are comparable to the within OLS specification, but take 0-flows into account[51].

The last issue regards the well-known incidental parameter problem. As we accurately discussed, country-sector fixed effects are necessary in our framework and provide different results once taken into account. On the other hand fixed effect Tobit provide biased coefficients. We address this problem the estimator in Honore (1992).

The estimates of this specification, reported in Table 5, have the expected signs although their significance is quite modest[52]. The coefficient estimates for the total margin are insignificantly different from the OLS estimates. The coefficient estimates for the extensive margin is hardly significant, suggesting a role for zero flows in channeling the growth of the extensive margin in response to tariff cuts. This is more accurately showed by the average effects of tariffs for the three margins in our decomposition, which are obtained using the algebra of appendix D. The elasticity of the total margin with respect to tariff is -2.97, which can be decomposed in -0.29 for the micro extensive margin, -2.67 for the intensive margin and -0.01 for the macro extensive margin.

The total margin has a higher elasticity to tariffs (in absolute value) compared to the within OLS model coefficient, thus suggesting that the latter is downward biased. A reason may be that the zero flows observations, ignored in previous OLS estimations, concern high tariffs. Thus OLS implicitly

[50] We underline this by calling the margins x' and n'.

[51] To check how the new definition of margins affect the results we performed the previous analysis with x' and n' and results are unchanged. We also performed this same Tobit analysis using an alternative specification for the dependent variable: we directly take the variable in logs for strictly positive flows and specify the censoring threshold to be equal to the lowest value in the sample. Results are unchanged.

[52] Note that the number of observations is now 5398, that is twice 2699 (=2526 positive flows +173 0-flows).

overweights observations with high tariffs and positive flows[53]. This, in turn, implies a spurious understatement of the negative relationship between tariffs and flows. The tariffs, as already noticed, have a modest impact on the micro extensive margin and an almost nil impact on the macro extensive one[54].

We conclude that the results obtained by introducing 0-flows are not very different from our main within OLS regressions of section 4. At our level of aggregation, the bias induced by ignoring zero flows is limited[55]: the effect of tariffs on the extensive margin is very weak, even after controlling for 0-flows.

As we anticipated, the Tobit specification is not the best way to assess the effect of zero flows on our results, at least three reasons:

1. As it is well-known, the introduction of many fixed effects in a Tobit specification is likely to bias the estimates if they are not conditioned out of the likelihood. We treat this problem by implementing the estimator of Honore (1992). However, it results in imprecisely estimated elasticities.

2. The threshold for censoring is obtained through a trick (using $\ln(1+M)$ or defining the threshold as the lowest value in the sample). This approach may be not fully satisfactory.

3. The estimation of a gravity equation in logs heavily rests on the homoskedasticity assumption. However, the presence of heteroskedasticity is strongly supported by the Park Test p-values reported for the Tobit model.

To solve these problems we follow Santos Silva & Tenreyro (2006) who first recognized the failure of the homoskedasticity assumption in gravity models in logs. Assume that the true model is:

$$\Gamma_{j,t,s} = \exp(\alpha Z_{j,t,s})\mu_{j,t,s}$$

where α is the vector of parameters to be estimated, $Z_{j,t,s}$ the vector of explanatory variables in logs and $\mu_{j,t,s}$ is the error term. If the error term is heteroskedastic, then $\mathbb{E}[\mu_{j,t,s}|Z_{j,t,s}] = 1$ and $\mathbb{V}[\mu_{j,t,s}|Z_{j,t,s}] = f(Z_{j,t,s})$. If the error term follows a log-normal distribution, then the error term of

[53] Exactly because it ignores observations with high tariffs and 0-flows.

[54] The decomposition of the extensive margin between the micro and macro extensive margins is nevertheless artificial since it depends on the aggregation level of the data. Here, since we use fairly aggregated data, most of the extensive margin becomes micro in the way we defined it.

[55] This is in line with the results in Helpman, Melitz & Rubinstein (2008) for their sample.

	Total Margin	Extensive margin
ln(tariff)	-2.31***	-0.44***
	(0.00)	(0.11)
Product-Year FE	YES	YES
Country-Year FE	YES	YES
Product-Country FE	YES	YES
N of observations	5,398	5,398

*: significant at the 10% level, **: significant at the 5% level, ***: significant at the 1% level. FE = fixed effects.

Table 6: Poisson regression model

the log equation is given by:

$$\epsilon_{j,t,s} = \ln(\mu_{j,t,s}) \quad \text{with} \quad \mathbb{E}[\epsilon_{j,t,s}|Z_{j,t,s}] = -\frac{1}{2}\ln(1 + f(Z_{j,t,s})^2).$$

Thus, estimating the equation in logs leads to an omitted variable bias.

Santos Silva & Tenreyro (2006) suggest to handle the problem by using Poisson Pseudo Maximum Likelihood (PPML) estimation. They also provide some specification tests. Following them we estimate the following Poisson model:

$$\Gamma_{j,t,s} = \exp\left(\beta_0 + \beta_1\theta_{j,t,s} + \delta_j * \delta_t + \delta_s * \delta_t + \delta_{j,s} + \epsilon_{j,t,s}\right)$$

where Γ denotes the total margin X (in level) or the extensive margin N (in level) .

Notice that in this way we solve at the same time the three above-mentioned concerns: fixed effects are not a problem in this context, 0-flows are included in the regression since we do not use a log specification, heteroskedasticity in the error term is taken into account.

The results are presented in Table 6. The elasticities we obtain are slightly higher than those in the within OLS benchmark regression. The main insight of this specification is the highly significant coefficient on the extensive margin. It is hard to state if it comes from the inclusion of zero flows or from the new conditional variance assumption on the residuals. The Tobit specification is performed in order to get an intermediate step between the within OLS and the Poisson specifications. We noticed that 0-flows did not give new insights in the extensive margin coefficient. Here, instead, this margin becomes significant. Although we cannot be sure of what is driving the result, we can consider these coefficient estimates as the upper bound of the effect of tariff on trade flows. However notice that extensive margin accounts at most for 19% of the total effect.

Finally we discuss another way to deal with 0-flows as suggested by Helpman, Melitz & Rubinstein (2008, HMR). Albeit this discussion is useful for the sake of completeness, we claim that we do not

need to pursue it.

HMR consider a bilateral gravity equation and use as dependent variable the log of export flows. They propose an Heckman selection model to deal with two corrections. By estimating the first step probit selection equation they obtain a proxy for the extensive margin[56] which they add as a regressor. They control for the number of exporters in order to find the effect of distance (and other covariates) on the intensive margin. Moreover they use the Mills-ratio obtained in the first step to correct for sample selection in the second step. In this way 0-flows are considered as arising from the decision of firms not to export.

This problem is not likely to arise in our total and extensive margins gravity equations since we observe censoring rather then selection. One can understand the point by thinking the latent variable as potential profits from exporting a product to a destination. If it is positive, the flow is observed and the sales and number of firms are linked to this potential profit. If it is negative, the profit is not observed and the flow does not take place. Hence the econometric problem we face is a usual censoring problem and not an incidental truncation problem as in HMR.

More seriously, HMR procedure may hinge on rather strong distributional assumptions as pointed out by Santos Silva & Tenreyro (2008a), since Heckman selection model does not take heteroskedasticity into account.

In any case their result suggest that while the bias induced by the 0-flows omission is quite weak, the one arising by the omission of the extensive margin as a regressor is severe. In this respect our exercise does not suffer of this problem. In fact we know the number of exporters and we fully use this piece of information by looking at the effect of gravity covariates (tariffs in our case) on the intensive margin directly[57].

5.2 Other robustness checks

The TRAINS dataset provides a significant amount of tariffs, albeit values are missing for many country-year-product observations. It is a concern that this sample selection may be endogenous. In fact the selection is likely to be driven by factors also affecting the size of the flows between countries. For instance tariffs may not be reported by the countries whose trade with France is insignificant due to prohibitive barriers to trade. Another explanation could be that less developed countries are more prone to have missing tariffs due to the bad quality of their statistical system. If this were the case, the dataset would be subject to incidental truncation. If tariffs are not reported for small flows,

[56] They do not have the information on the number of exporters in all countries.

[57] We do not regress the total margin on the extensive margin, but we run different regressions for each of them.

everything else being equal (including the values of tariffs), then the selection of observations leads to underestimating the elasticity of trade with respect to tariffs.

We tried to address this bias using a Heckman selection model. In order to be able to identify the elasticities without relying on the specific structure of the error term, we need to introduce an exclusion variable in the selection equation. Here, we consider the Generalized System of Preferences (GSP) dummy. GSP consists in a special unilateral tariff concession that industrialised countries grant to developing countries and which is not subject to the "Most Favoured Nation" (MFN) clause of WTO. These concessions are not reciprocal and are granted without any quantitative limitations. We claim that this variable is likely to affect the probability of reporting tariffs applied to France positively. Since the country is involved in an official trade agreement with the European Union, we expect it to be more careful in undertaking administrative duties, and reporting tariffs. Moreover, since GSP programs are not reciprocal, there is no reason to expect France to export more to these countries once we control for tariffs, for the level of development (as proxied by country-year fixed effects) and for the WTO membership (also proxied by country-year fixed-effects).

However, the results[58] do not show any evidence of sample selection since the inverse Mills ratio turns out to be insignificant. Sample selection may have disappeared since we already control for a significant amount of heterogeneity. But we cannot rule out that the weakness of our identification variable drives the insignificance of the Mills ratio.

5.3 Discussion of the results

Table 7 summarizes the tariff elasticities derived from the various econometric specifications.

By ignoring the panel dimension of our dataset, we obtain that 50% of the effect of tariff reductions channel through the extensive margin[59]. However, the results dramatically change when we control for unobserved heterogeneity. The magnitude of the total elasticity is now a bit lower, but almost all the effect now channels through the intensive margin, the extensive margin being insignificant in the benchmark within OLS regression.

Controlling for the endogeneity of tariffs has virtually no effect on the elasticities. However, the inclusion of zero flows again changes the results. It appears that the total magnitude of the elasticity is slightly higher, as censored data are likely to be subject to a downward bias. This downward bias seems to be partly due to the extensive margin which turns out to be significant in the Tobit and in

[58] Available upon request.

[59] A similar percentage has been found by Eaton, Kortum & Kramarz (2004) who consider the effect of distance on exports of a cross-section of French firms.

	Total	Extensive	Intensive	Number observations
OLS (Panel A, Table 4)	-1.79***	-0.94***	-0.85***	5052
OLS-within (Panel B, Table 4)	-1.99***	-0.18	-1.81***	2526
IV-within (Panel D, Table 4)	-1.78*	0.19	-1.97**	2526
Tobit-within (Table 5)	-2.97**	-0.31*	-2.66**	5398
Poisson-within (Table 6)	-2.31***	-0.44***	-1.87***	5398
Contribution (in %)	3.4-4.7	2.1-5.2	12.0-13.3	

Table 7: Summary of the main results : elasticity to tariffs

the Poisson specifications. This could indicate that the increase in the number of exporters[60] due to tariff reductions happens in flows that were inexistant at the beginning of our sample.

For the forthcoming discussion, we focus on the three main estimations, forgetting the pooled OLS results and the Tobit which yields imprecisely estimated results. Thus, the elasticity to tariff lies between -1.78 and -2.31 for the total margin, and between 0 and -0.44 for the extensive margin.

Table 7 also reports, for each margin, the share of the French export growth at current prices which can be attributed to tariff changes. According to our estimations, tariffs are a key variable, as they contribute to a range between 3.4% and 4.7% of the total French export growth between 1993 and 2002. Interestingly, when we split the effect into both margins, we find that tariffs have a much larger impact on average sales per firm, explaining between 12% and 13.3 % of the intensive margin growth. Our results suggest that tariffs affect only slightly the number of new exporters. Since some studies find virtuous effects of being an exporter on firm performance, this issue deserves further research in order to assess the reason why the number of exporters reacts so slightly to the significant reductions of worldwide tariffs, and whether this result is specific to France. If more firms could belong to the group of "superstars" and more varieties could be consumed all over the world, the welfare of countries could be positively affected.

6 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 exports per firm (intensive margin).

We find that, as expected, tariffs have a notable impact on exports: the estimated elasticity ranges

[60] In a product-destination cell. It is highly probable that the firms beginning to export to an unexplored product-destination cell already export to more common destinations.

between -1.78 and -2.31 and we can explain up to 4.7% of the total French export growth between 1993 and 2002.

The breaking down into margins reveals that tariff reductions, due to the implementation of the Uruguay Round concessions, increased aggregate exports mainly by inducing incumbent exporters to ship higher volumes to the countries and for the products for which tariffs decreased. The effect on the extensive margin is nil or barely different from zero.

Our conclusions are robust to many specifications which are meant to capture potentially detrimental biases in the baseline regression (endogeneity bias, zero-flows, biases stemming from the transformation of a level regression into a log one in the presence of heteroskedasticity).

Our findings also suggest that 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.

Even if our results seem reliable, there are some caveats that still need to be handled. The main one is linked to the way we break down the aggregate effects into both margins. In doing so, we follow the empirical literature on heterogenous firm models. However we are conscious that, by aggregating firm level predictions at sector level, both theoretically and empirically, we might incur the risk of an "aggregation bias".

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 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 exporter sales, using firm level data directly. The exercise conducted at the sector level in this paper undoubtedly shows the direction and robustness of the effects. However, more disaggregated analysis would further allow us to test the effects of tariff within each French firm. Nevertheless, this kind of firm-level analysis would also be subject to some drawbacks. Tariffs are defined at the product level and, we would need to work on a more broken up product classification in Douanes data, to better measure the tariffs actually faced by each firm in each year within our estimation period.

Since the Uruguay Round is probably the only major policy event which has affected the international trade exposition of France in last years[61], we plan to use the UR to answer further questions that have arisen recently in trade literature. A natural extension of the present paper would be to explore

[61] France has been an open economy since the 70's and Douanes data have been comparable since 1993. An alternative analysis could be focused on the formation of European Union which affected French trade with European countries. However Uruguay Round refers to 147 countries, providing a substantial variation for the empirical analysis.

whether the effect of tariffs is homogeneous in all sectors or, on the other hand, if 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)) may shape the response of exports to tariffs.

References

Bernard, Andrew, Jonathan Eaton, Bradford Jensen and Samuel Kortum (2003); Plants and Productivity in International Trade; *American Economic Review* 93(4),1268-1290.

Bernard, Andrew and Bradford Jensen (1999); Exceptional Exporter Performance: Cause, Effect or Both?; *Journal of International Economics* 47(1), 1-25.

Bernard, Andrew and Bradford Jensen (2004); Why Some Firms Export; *Review of Economics and Statistics* 86(2), 561-569.

Bernard, Andrew, Bradford Jensen, Stephen Redding and Peter Schott (2007); Firms in International Trade; *Journal of Economic Perspectives* 21(3), 105-130.

Bernard, Andrew, Stephen Redding and Peter Schott (2007); Comparative Advantage and Heterogeneous Firms; *Review of Economics Studies* 21(3), 105-130.

Besedes, Tibor and Thomas Prusa (2006); Ins, Outs and the Duration of Trade; *Canadian Journal of Economics* 39(1), 266-295.

Broda, Christian and David Weinstein (2004); Variety Growth and World Welfare; *American Economic Review* 94(2), 139-144.

Broda, Christian and David Weinstein (2006); Globalization and the Gains from Variety; *Quarterly Journal of Economics* 121(2), 541-585.

Bustos, Paula (2005); Impact of Trade on Technology and Skill Upgrading: Evidence from Argentina; UPF *Working Paper*.

Bustos, Paula (2007); Multilateral Trade Liberalization, Exports and Technology Upgrading: Evidence on the Impact of Mercosur on Argentinean Firms; UPF *Working Paper*.

Chaney, Thomas (2008); Distorted Gravity: The Intensive and the Extensive Margins of International Trade; *American Economic Review* 98(4), 1707-1721.

Clerides, Sofronis, Saul Lach and James Tybout (1998); Is Learning by Exporting Important? Micro-dynamic evidence from Colombia, Mexico and Morocco; *Quarterly Journal of Economics* 113(3), 903-947.

Crozet, Matthieu and Pamina Koenig (2007); Structural Gravity Equations with Intensive and Extensive Margins; *EconomiX Working Paper*, 2007-36.

Debaere, Peter and Shalah Mostashari (2007); Do Tariffs Matter for the Extensive Margin of International Trade? An Empirical Analysis; *mimeo*.

Eaton, Jonathan, Marcela Eslava, Maurice Kugler and James Tybout (2008); Exports Dynamics in Colombia: Firm-Level Evidence; *NBER Working Paper*, 13531.

Eaton, Jonathan and Samuel Kortum (2002); Technology, Geography and Trade; *Econometrica* 70(5), 1741-1779.

Eaton, Jonathan, Samuel Kortum and Francis Kramarz (2004); Dissecting Trade: Firms, Industries and Export Destinations; *American Economic Review* 94(2), 150-154.

Eaton, Jonathan, Samuel Kortum and Francis Kramarz (2008); An Anatomy of International Trade: Evidence from French Firms; *mimeo*.

Felbermayr, Gabriel and Wilhelm Kohler (2007); Does WTO Membership make a Difference at the Extensive MArgin of World Trade? *CESIFO Working Paper*, N. 1898.

Goldberg, Pinelopi and Nina Pavcnik (2005); Trade, Wages and the Political Economy of Trade Protection: Evidence from the Colombian Trade Reforms; *Journal of International Economics* 66(1), 75-105.

Helpman, Elhanan, Marc Melitz and Yona Rubinstein (2008); Estimating Trade Flows: Trading Partners and Trading Volumes; *Quarterly Journal of Economics* 123(2), 441-487.

Honore, Bo E. (1992); Trimmed LAD and Least Squares Estimation of Truncated and Censored Regression Models with Fixed Effects; *Econometrica* 60(3), 533-565.

Mayer, Thierry and Gianmarco Ottaviano (2007); The Happy Few: the Internationalisation of European Firms; *Bruegel Blueprint Series*.

Melitz, Marc (2003); The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity; *Econometrica* 71(6), 1695-1725.

Melitz, Marc and Gianmarco Ottaviano (2008); Market Size, Trade and Productivity; *Review of Economic Studies* 75(1), 295-316.

Nunn, Nathan (2007); Relation-Specificity, Incomplete Contracts and the Pattern of Trade; *Quarterly Journal of Economics* 122(2), 569-600.

Roberts, Mark and James Tybout (1997); The Decision to Export in Colombia: An Empirical Model of Entry with Sunk Costs; *American Economic Review* 87(4), 545-564.

Romalis, John (2005); NAFTA's and CUSFTA's Impact on International Trade; *NBER working paper*, 11059.

Rose, Andrew (2004); Do We Really Know That the WTO Increases Trade?; *American Economic Review* 94(1), 98-114.

Santos Silva, J.M.C and Silvana Tenreyro (2006); The Log of Gravity; *Review of Economics and Statistics* 88(4), 641-658.

Santos Silva, J.M.C and Silvana Tenreyro (2008a); Trading Partners and Trading Volumes: implementing the Helpman Melitz Rubinstein Model Empirically; *note, mimeo.*

Santos Silva, J.M.C and Silvana Tenreyro (2008b); Complete-Separation in Poisson Regression; *note, mimeo.*

A 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 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.

C 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 8: 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'en-registrement 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 9: 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 9: 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 9: 3-digit NES classification (continued)

D Elasticities from a Tobit regression

Let the full model be:

$$\text{(Tobit)} \quad \begin{cases} m^*_{j,t,s} = \alpha_0 + \alpha_1 \tau_{j,t,s} + \alpha_2 y_{j,t} + \gamma_j + \gamma_s + \gamma_t + \epsilon_{j,t,s} \\ m_{j,t,s} = \mathbb{1}[m^*_{j,t,s} > 0] \\ n^*_{j,t,s} = \beta_0 + \beta_1 \tau_{j,t,s} + \beta_2 y_{j,t} + \delta_j + \delta_s + \delta_t + \eta_{j,t,s} \\ n_{j,t,s} = \mathbb{1}[n^*_{j,t,s} > 0] \end{cases}$$

Hereafter the subscript i refers to an observation and summarizes the indices j, t and s. According to Wooldridge (2002), the marginal effect on the total margin is given by:

$$\frac{\partial \mathbb{E}[\ln(M_i)|Z_i]}{\partial \tau} = \alpha_1 \Phi\left(\frac{\alpha Z_i}{\sigma_\epsilon}\right)$$

where Z_i denotes the vector of independent variables and Φ is the normal cumulative distribution function. Let N_0 be the total number of observations, the average effect is given by:

$$\text{Total margin} = \alpha_1 * \left[\frac{1}{N_0} \sum_i \Phi\left(\frac{\alpha Z_i}{\sigma_\epsilon}\right)\right]$$

The effect on the micro extensive margin stems from:

$$\frac{\partial \mathbb{E}[\ln(N_i)|Z_i, M_i > 0]}{\partial \tau} = \beta_1 \left[1 - \lambda\left(\frac{\beta Z_i}{\sigma_\eta}\right)\left[\frac{\beta Z_i}{\sigma_\eta} + \lambda\left(\frac{\beta Z_i}{\sigma_\eta}\right)\right]\right]$$

and

$$\mathbb{P}[N_i > 0] = \Phi\left(\frac{\beta Z_i}{\sigma_\eta}\right)$$

where λ denotes the inverse Mills ratio. Hence, the micro extensive margin is given by:

$$\text{Micro extensive margin} = \beta_1 * \left[\frac{1}{N_0} \sum_i \left[1 - \lambda\left(\frac{\beta Z_i}{\sigma_\eta}\right)\left[\frac{\beta Z_i}{\sigma_\eta} + \lambda\left(\frac{\beta Z_i}{\sigma_\eta}\right)\right]\right] \Phi\left(\frac{\beta Z_i}{\sigma_\eta}\right)\right]$$

The macro extensive margin can be derived using:

$$\frac{\partial \mathbb{P}[M_i > 0|Z_i]}{\partial \tau} = \frac{\alpha_1}{\sigma_\epsilon} \phi\left(\frac{\alpha Z_i}{\sigma_\epsilon}\right)$$

and

$$\mathbb{E}[\ln(M_i)|Z_i, M_i > 0] = \alpha Z_i + \sigma_\epsilon \lambda\left(\frac{\alpha Z_i}{\sigma_\epsilon}\right)$$

The macro extensive margin is thus given by:

$$\text{Macro extensive margin} = \alpha_1 * \left[\frac{1}{N_0} \sum_i \left[\alpha Z_i + \sigma_\epsilon \lambda \left(\frac{\alpha Z_i}{\sigma_\epsilon} \right) \right] \frac{1}{\sigma_\epsilon} \phi \left(\frac{\alpha Z_i}{\sigma_\epsilon} \right) \right]$$

Finally, the intensive margin is obtained as the difference between the total margin and the macro and micro extensive margin.