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## **Manufacturing Firms' Performance in a Trade Liberalization Process: The Case of Uruguay**

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## **Abstract**

We evaluate the impact of trade liberalization and regional integration on the performance of Uruguayan manufacturing firms, analyzing how firms have responded to the trade policy changes implemented in Uruguay since the 1970s. Making use of a firm-level panel for the period 1983-2005, we apply robust techniques to estimate firms' productivity and evaluate the effects of trade policy on productivity and survival probabilities. In order to assess whether these impacts differ across firms with different trade orientation, we classify firms according to their main destination market and the trade orientation of the industry they belong to. The results obtained suggest wide differences in productivity performance and trade policy impacts among firm classes (both within and between classification criteria), showing the relevance of counting with detailed firm-level data on destination markets in order to evaluate the differential effects that policy changes may have on each firm class.

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## 1. Introduction

Since the 1970s Uruguay has been engaged in a trade openness and regional integration process that has involved the adoption of reciprocal and unilateral measures. The creation of the Southern Common Market (MERCOSUR) in 1991 seemed to offer Uruguay a way to overcome its size disadvantage, benefiting from preferential access to large regional markets and opportunities for exploiting economies of scale and specialization and developing productive complementarities. Two decades after the establishment of MERCOSUR, and in a context of dissatisfaction with the progress of the integration process, some questions arise regarding the impact of trade openness and (imperfect) regional integration on the Uruguayan economy.

Traditionally, this issue has been assessed by means of macro-level analyses which may not capture some important effects of the trade liberalization and integration processes. Ottaviano (2008) argues that, surprisingly, MERCOSUR seems to have had little impact on the aggregate economic behavior of its member states -apart from increased regional bias in trade-, since other policy reforms have been implemented in parallel to trade liberalization. The full impact of trade openness and regional integration is hard to detect at the macro level, calling for a microeconomic approach. A firm-based study of these processes allows capturing some relevant mechanisms through which trade can enhance productivity and promote economic growth. These mechanisms, related to the reallocation effects of trade liberalization, are often missed in the macro-level analyses.

In the case of Uruguay, few studies on the impacts of trade policies are based on firm-level data. Casacuberta, Fachola and Gandelman (2004) provide a first microeconomic analysis of the effect of trade openness on labor and capital flows and productivity in the Uruguayan manufacturing sector. They find a significant enhancing effect of trade liberalization on productivity in the period 1988-1995, associated with capital and labor reallocations within sectors.

Casacuberta and Zaclicever (2010) analyze the effect of trade protection on Uruguayan manufacturing firms' productivity in the period 1988-2005. Following Amiti and Konings (2007), they evaluate the productivity gains that may arise from reducing tariffs on final goods separately from those that may arise from reducing tariffs on

intermediate inputs. They compute firm-specific output and input protection measures, tracking more closely each firm's relevant markets. They find a positive effect of lower output protection on productivity, while the effect of reducing input tariffs, when significant, is negative, which would be related to the overall change in effective protection (Corden, 1971).

Peluffo (2010) uses various methodologies to analyze the impact of trade liberalization on key variables postulated by the literature. She examines, for the Uruguayan case, the effect of trade related R&D spillovers on productivity at the industry level (period 1988-1995), the technology/productivity spillovers through trade, foreign direct investment (FDI) and learning by exporting at the firm level (period 1997-2001), and the impact of increased exposure to trade on plants' productivity, mark-ups and scale (period 1988-1995). The results obtained would indicate that "*trade liberalization could enhance the manufacturing performance of Uruguay, through the various channels analyzed*".

Our study builds partly on these previous works. Making use of a firm-level panel for the period 1983-2005 we analyze the impact of trade openness and regional integration on Uruguayan manufacturing firms' performance. In order to assess whether there are identifiable winners and losers of these processes, we study the relationship between trade policy, productivity and firm's survival, distinguishing firms according to their trade orientation.

The paper is organized as follows. In section 2 we present a brief overview of the trade policies implemented in Uruguay along the last decades. In section 3 we discuss the methodology applied to estimate firms' productivity and evaluate the impact of trade policy on productivity and firms' survival. In section 4 we describe the data used. In section 5 we present the results of our estimations, and in section 6 we end with some concluding remarks.

## 2. Trade policy in Uruguay

The Uruguayan economic openness process started in the mid-1970s. In those years a first phase of trade reforms took place, accompanied by a financial liberalization process. Uruguay evolved from an inward-looking economy towards an outward-looking one, from import substitution policies (adopted in the early 1930s with the intention of favoring the industrialization process) to export promotion policies and unilateral opening.

A description of the Uruguayan trade liberalization process can be found in Vaillant (2001). According to this author, the trade policy in Uruguay at the beginning of the 1970s was “*the legacy from a long process of import substitution. The set of rules and regulations was vast and not always coherent, making the protection in each case the result of the mere superimposition of instruments created for different purposes (fiscal reasons, external ones, protectionism in particular sectors, etc.)*.” He distinguishes five stages in the process of trade reform until the end of the 1990s, organized in three periods: 1) exports promotion (1974-1978) and unilateral opening (1979-1984), 2) continuity in the trade reform (1985-1989) and deepening of the trade liberalization process (1990-1994), and 3) convergence to the Trade Common Policy in the MERCOSUR process (1995-1998).

In the first period two bilateral agreements played an important role, contributing to attenuate the negative effects of the liberalization process: the *Convenio Argentino Uruguayo de Cooperación Económica* (CAUCE, signed with Argentina in 1975) and the *Protocolo de Expansión Económica* (PEC, signed with Brazil in 1976)<sup>1</sup>. These bilateral agreements, that were extended at the beginning of the 1980s, helped many firms to make their initial attempts to export and would have allowed the less competitive to survive (Vaillant, 2001).

In the 1990s the deepening of the trade liberalization process combined a gradual unilateral tariff reduction (that lowered protection and tariff dispersion) with the

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<sup>1</sup> CAUCE and PEC, like other bilateral agreements signed since the early 1980s within the Latin American Integration Association (LAIA) framework, were basically structured as positive lists of products that obtained tariff preferences (with variable preference margins), and were exempted from non-tariff barriers (Estevadeordal, Goto and Saez, 2000).

creation of MERCOSUR. The Asuncion Treaty -signed in 1991 by Argentina, Brazil, Paraguay and Uruguay- laid the foundations for this regional integration agreement, establishing a schedule of gradual intra-zone tariff reduction (with national lists of temporary excepted items) and the commitment to eliminate non-tariff barriers among bloc members. Later, the Ouro Preto protocol established the gradual adoption of a Common External Tariff (CET), from 1995 onwards, also with exception lists<sup>2</sup>. The process would lead to the creation of a perfect free trade area by January, 2000 (which implied that no exceptions to intra-regional free trade would be allowed), and a customs union would be completed in 2006 (with a CET without exceptions).

Additionally, in 1994 the Uruguay Round Agreements were ratified by the Uruguayan parliament. Along with MERCOSUR, these multilateral trade agreements reduced significantly the government's margin for providing discretionary protection to particular industries. As a result, several sectors that had previously been isolated from the liberalization process, thanks to their ability to exert pressure on the government, began to be exposed to foreign competition.

The trade policy changes implemented in Uruguay since the mid-1970s led to a gradual reduction in the number and the level of country's most-favored-nation (MFN) tariffs (see figure 1). The average tariff rate fell from around 35 percent in 1985 to 9 percent in 2005. The downward trend is clear until 1995, when MERCOSUR began to operate as an imperfect customs union, and reverses in 1998 due to a temporary increase in the CET agreed by the bloc members<sup>3</sup>. The adoption of the CET, and the many exceptions allowed, impacted on tariffs dispersion: the variation coefficient shows that the dispersion of rates, which had reduced significantly until 1993, increased sharply in 1995<sup>4</sup>.

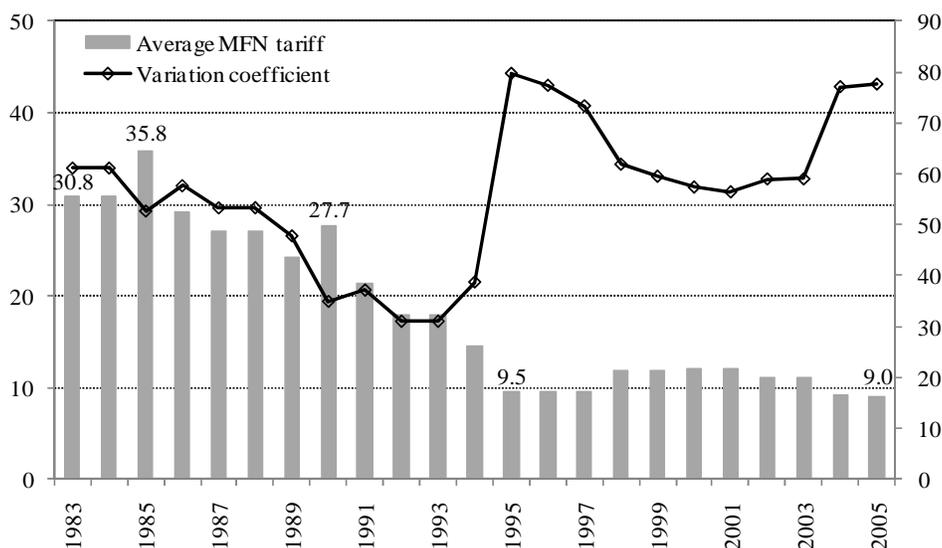
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<sup>2</sup> For the goods included in each country's list of exceptions, the national MFN tariffs continued to be applied. These tariffs were to converge gradually and linearly to the CET. On the other hand, the sugar and automotive industries were completely exempted from intra-regional trade liberalization and from the common trade policies.

<sup>3</sup> The temporary increase, applied between 1998 and 2003 to most products, implied an addition to CET of 3 percent in 1998-2000, 2.5 percent in 2001 and 1.5 percent in 2002-2003.

<sup>4</sup> The maximum level of tariffs declined from 60 percent in 1985 to 24 percent in 1993, and the number of tariff levels was reduced from 11 to 5 in this period (see table A1.5 in the appendix). Originally, the CET had 11 levels, ranging from 0 to 20 percent (0-12 percent for intermediate goods, 12-16 percent for capital goods, and 18-20 percent for finished goods), with an average of 11 percent.

**Figure 1**  
**Uruguay: Evolution of average MFN tariff 1983-2005**



Source: Authors' elaboration based on LAIA Secretariat and MERCOSUR Secretariat data.

Exceptions and convergence to intra-zone zero tariffs are captured by the evolution of Uruguay's bilateral residual tariffs with the largest MERCOSUR partners, Argentina and Brazil, which are highly correlated (see table 1).

**Table 1**  
**Uruguay: Bilateral residual tariffs vis-à-vis Argentina and Brazil 1991-2004**  
*(In percentages)*

Year	With Argentina		With Brazil		Correlation
	Simple average*	Median	Simple average*	Median	
1991	12.0	10.6	12.5	10.6	0.92
1992	8.4	6.6	8.8	6.6	0.94
1993	6.6	4.3	6.8	4.3	0.97
1994	3.5	1.7	3.5	1.7	0.99
1995	2.0	0.0	2.0	0.0	1.00
1996	1.8	0.0	1.8	0.0	1.00
1997	1.4	0.0	1.4	0.0	1.00
1998	0.9	0.0	0.9	0.0	1.00
1999	0.5	0.0	0.5	0.0	1.00
2000	0.0	0.0	0.0	0.0	1.00
2001	0.0	0.0	0.0	0.0	1.00
2002	0.0	0.0	0.0	0.0	1.00
2003	0.0	0.0	0.0	0.0	1.00
2004	0.0	0.0	0.0	0.0	1.00

\* Bilateral residual tariffs averaged across 8-digit Harmonized System classes  
Source: Authors' calculations based on MERCOSUR Secretariat data.

A distinguishing feature in the development of MERCOSUR has been the simultaneous reduction of non-discriminatory MFN tariffs and intra-zone preferential tariffs (Estevadeordal, Goto and Saez, 2000). Although the internal liberalization was more ambitious, it has not been large relative to each member's unilateral liberalization, initiated earlier. The comparison of the evolution of Uruguay's MFN tariff and its preferential tariffs with MERCOSUR partners shows that: 1) until 1995 both tariffs were drastically reduced, hence bilateral preferences did not change significantly; 2) between 1995 and 2000, convergence to the CET led MFN tariff to remain fairly constant or even increase, while bilateral tariffs declined sharply, leading to an increase in bilateral preferences; 3) after 2000, intra-zone tariffs fell to nearly zero while the CET (MFN tariff) changed very little.

Since the beginning of the liberalization process, Uruguay experienced a significant growth in both intra-regional and extra-regional trade. The openness coefficient, measured in current prices, rose from an average of 0.27 in 1955-1973 to 0.40 in 1974-1984, and stabilized around this value (Vaillant, 2001)<sup>5</sup>.

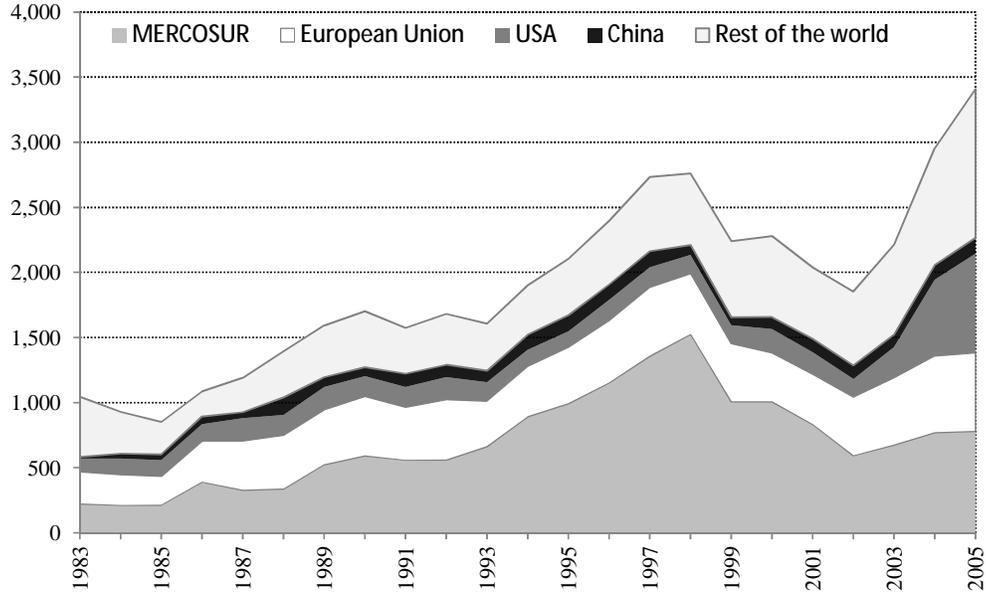
Along the period under study, flows from and to MERCOSUR partners, mainly Brazil and Argentina, increased their share in Uruguay's total trade. The proportion of intra-MERCOSUR exports rose from around 20 percent in 1983 to 35 percent in 1991 -when the trading bloc was established-, reaching a maximum of 55 percent in 1998. Since then, the flows to MERCOSUR countries have reduced significantly their share in total exports, returning in 2005 to the 1983 levels (see figures 2 and 3).

The evolution of intra-MERCOSUR trade has been driven partly by the liberalization process; however, trade preferences have been strongly affected by countries' macroeconomic instability and changes in their real exchange rates, which distort intra-zone competition conditions. The application of non-tariff barriers (NTBs) has also affected intra-MERCOSUR trade.

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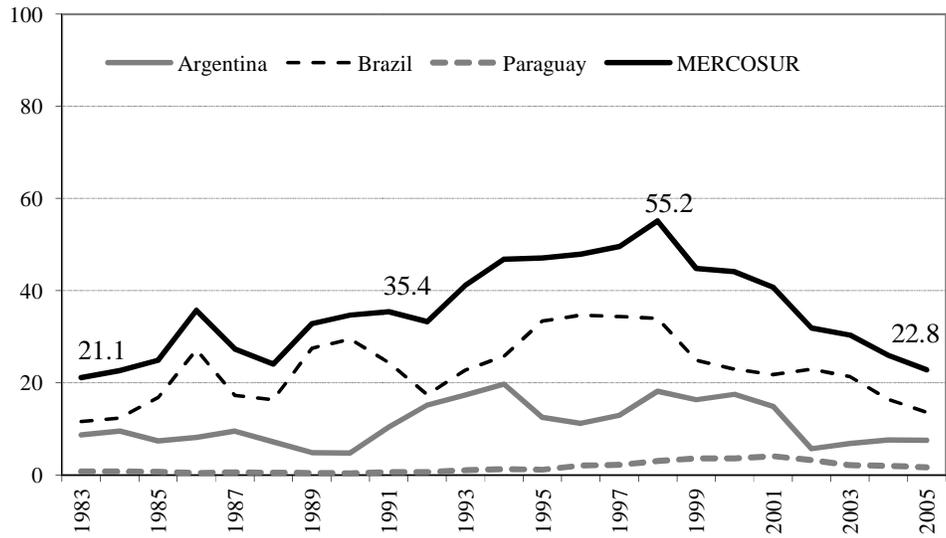
<sup>5</sup> According to Casacuberta and Vaillant (2002), the relatively stable evolution of the trade openness coefficient at current prices results from the balance of two forces: the increase in trade flows, and the counteracting effect of the exchange rate appreciation produced by the stabilization policies pursued in Uruguay in the 1990s. They compute trade openness coefficients at constant prices, which show a steady growth between the mid-1980s and the mid-1990s.

**Figure 2**  
**Uruguay: Exports of goods by destination region 1983-2005**  
*(In millions of current dollars)*



Source: Authors' elaboration based on data from customs office.

**Figure 3**  
**Uruguay: Share of exports to MERCOSUR partners 1983-2005**  
*(In percentages)*



Source: Authors' elaboration based on data from customs office.

Despite the growth in intra-regional trade, it has been argued that, for the smaller countries (Paraguay and Uruguay), the expected gains from increased regional integration have not been achieved. Two decades after the establishment of MERCOSUR, the regional bloc has failed to materialize as a customs union, and even its functioning as a free trade area has been hampered by the adoption of discretionary measures on the part of its members (mainly Argentina and Brazil). Exceptions to the CET, non-harmonized special import regimes (like temporary admission, drawback and rules of origin), and intra-zone NTBs persist. Asymmetries among MERCOSUR countries (in terms of economic size, production and trade specializations) are considered one of the greatest obstacles to deeper integration, since they may impede the required policy harmonization.

In this context, the redefinition of the regional integration process and, more generally, of the insertion of Uruguay in the global economy, has been under discussion in several spheres. By analyzing how manufacturing firms have performed in the face of the trade policy changes implemented in Uruguay since the 1970s, and assessing whether there are differences across firms with different trade orientation, this study may contribute to shed new light on these issues.

### 3. Methodology

To evaluate the effects of trade liberalization and regional integration on the performance of Uruguayan manufacturing firms, and assess whether these impacts differ across firms with different trade orientation, we follow a three-step estimation strategy. First, we estimate firms' productivity using methodologies that address the simultaneity problem, which usually arises when dealing with empirical estimation of production functions at the micro level. Secondly, we regress our productivity estimates on firm-specific protection measures to assess the impact of changes in trade policy on firms' productivity. Finally, we examine the determinants of firms' survival and evaluate the effect of trade policies on survival probabilities.

#### 3.1 Productivity estimation

We assume a Cobb-Douglas production function that, transformed into natural logarithms to allow linear estimation, gives us the following equation:

$$y_{it} = b_0 + b_l l_{it} + b_k k_{it} + b_m m_{it} + u_{it} \quad (1)$$

where  $y_{it}$  is output,  $l_{it}$  labor,  $k_{it}$  capital stock and  $m_{it}$  materials (all in logarithms) of firm  $i$  at time  $t$ . The residual of this equation is the logarithm of total factor productivity (TFP) of firm  $i$  at time  $t$ , retrieved from the estimated coefficients as:

$$tfp_{it} = y_{it} - \hat{b}_l l_{it} - \hat{b}_k k_{it} - \hat{b}_m m_{it} \quad (2)$$

The empirical estimation of firms' productivity as the residual of the production function involves some econometric difficulties. One of the main problems, referred to as the simultaneity bias, arises when firms anticipate the productivity shocks (observe at least part of its TFP) before choosing the optimal quantity of inputs. That is, firms' input choices may respond to productivity shocks, making the error term of the production function to be correlated with the right-hand side variables. Under these conditions, the ordinary least squares (OLS) method yields biased and inconsistent parameter estimates and, consequently, biased estimates of productivity. There may also exist other unobservable variables (known to the firm but not to the econometrician)

that affect the current input choice (such as entrepreneurial ability), worsening the bias in OLS estimates.

To get around the simultaneity problem we estimate firms' productivity using the Levinsohn and Petrin (2003) methodology. This semi-parametric estimator addresses the bias induced by the endogeneity of input demands by using firm's intermediate inputs (materials or energy) to proxy unobserved productivity shocks. The method is very close to the one developed by Olley and Pakes (1996), which uses investment as a proxy rather than intermediate inputs.

One of the main drawbacks to the Olley-Pakes method relates to the so-called monotonicity condition (that also must be met in the Levinsohn-Petrin case). This condition requires the existence of a strictly monotonous relationship between the proxy and output, which in the Olley-Pakes case implies that, for the correction to be valid, any observation with zero investment has to be dropped from the dataset<sup>6</sup>. In the Levinsohn-Petrin case the number of observations that has to be discarded is considerably smaller, since usually datasets contain significantly less zero observations in materials or energy than in investment. In the firm-level panel used in this study (see section 4) the proportion of zero values in both materials and energy is about 2 percent, while zero observations in investment accounts for 42 percent of total observations. Notwithstanding this, we use also the Olley-Pakes method to estimate firms' productivity in order to evaluate the robustness of the results obtained from Levinsohn-Petrin.

### **3.2 Trade policy and productivity**

We evaluate the impact of trade liberalization and regional integration on firms' productivity by regressing our TFP estimates on firm-specific output and input protection measures<sup>7</sup>.

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<sup>6</sup> In the Olley-Pakes method the monotonicity condition implies that profit maximizing behavior must lead more productive firms to invest more (i.e. optimizing firms have investment functions that are strictly increasing in the unobserved productivity shock). In the Levinsohn-Petrin case, the condition implies that, conditional on capital, more productive firms use more intermediate inputs (Levinsohn and Petrin, 2003).

<sup>7</sup> Like Casacuberta and Zaclicever (2010), we follow the approach of Amiti and Konings (2007) evaluating the effects of final goods tariffs and input tariffs separately.

The baseline estimated equation is:

$$tfp_{it} = g_0 + a_i + g_1 tariff_{it}^{FG} + g_2 tariff_{it}^{II} + g_x X_{it} + e_{it} \quad (3)$$

where  $tariff_{it}^{FG}$  is the average tariff on final goods for firm  $i$  at time  $t$ ,  $tariff_{it}^{II}$  is the average tariff on intermediate inputs for firm  $i$  at time  $t$ ,  $X_{it}$  is a set of control variables, and  $a_i$  are firm fixed effects to control for unobserved heterogeneity at the firm level.

The firm-specific output and input protection measures were computed by defining an output and an input basket for each firm. The output basket contains all the goods produced by the firm over the sample years (except 2002, for which neither output nor input disaggregated information were recorded in the manufacturing survey), and remains fixed. The specific relevant output tariff for firm  $i$  at time  $t$  is the simple average of the Harmonized System (HS) four-digit tariffs corresponding to the goods that enter in the firm's output basket<sup>8</sup>:

$$tariff_{it}^{FG} = \frac{\sum_{h=1}^{N_i^{output}} tariff_{hit}}{N_i^{output}} \quad (4)$$

where  $tariff_{hit}$  is the HS four-digit tariff corresponding to product  $h$  at time  $t$ , and  $N_i^{output}$  is the number of goods included in the firm's output basket.

Similarly, the input basket contains all the goods used as inputs by the firm across the sample years (except 2002) and remains fixed. The specific input tariff for firm  $i$  at time  $t$  is computed as the simple average of the HS four-digit tariffs corresponding to the goods comprised in the firm's input basket:

$$tariff_{it}^{II} = \frac{\sum_{h=1}^{N_i^{input}} tariff_{hit}}{N_i^{input}} \quad (5)$$

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<sup>8</sup> We use the HS-ISIC correspondence assembled by Casacuberta and Zaclicever (2010).

where  $tariff_{hit}$  is the HS four-digit tariff corresponding to input  $h$  at time  $t$ , and  $N_i^{input}$  is the number of goods encompassed in the firm's input basket.

A reduction in final goods tariffs would boost productivity ( $g_1 < 0$ ), since import competition would compel domestic firms to increase their efficiency (or exit the market). Regarding input tariffs, there might be two views on their effect. On one hand, a reduction in input tariffs could increase effective protection, reducing firms' incentives to shift to more efficient production techniques (i.e. lowering productivity,  $g_2 > 0$ ) (Corden, 1971)<sup>9</sup>. On the other hand, lower input tariffs may lead to productivity gains ( $g_2 < 0$ ) due to access to a larger variety of inputs or higher-quality inputs, or learning effects (from the technology embodied in foreign inputs).

Additionally, we interact input tariffs with an indicator of the import status of the firm ( $IS_{it}$ , a dummy variable that takes the value of one if the firm imported intermediate inputs in period  $t$ ). A negative (and significant) coefficient on this interaction term ( $IS_{it} * tariff_{it}^H$ ) is to be expected if input importing firms reap larger direct benefits from lower input tariffs than non-importers.

The set of control variables includes export propensity (share of exports in firm's total sales), firm size (proxied by real sales), the value added/gross output ratio, and an exit dummy (equal to one if the firm is present at time  $t$  and not present in  $t + 1$  and beyond). We also include time dummies to control for omitted time-varying factors that may affect all firms (like macroeconomic policies, external shocks, changes in the institutional environment, and so forth), and sectoral dummies to control for unobserved time invariant industry characteristics that may affect firms belonging to a particular sector<sup>10</sup>.

<sup>9</sup> The effective protection reflects the net effect of tariffs on final goods and tariffs on intermediate inputs. A lower output tariff reduces the protection that firms receive, whereas a lower input tariff increases this protection by reducing the cost of final goods production. A lower effective protection -generated by lower output tariffs, higher input tariffs or changes in input intensity- would increase productivity, while a higher protection would have the opposite effect.

<sup>10</sup> Sectors, defined at the four-digit ISIC3 level, correspond for each firm to the product with the highest share in annual sales (thus, firm's sector of activity may change over time).

To give a comprehensive picture of the impact of trade policy changes, we evaluate the effects of MFN tariffs and preferential tariffs (applied to MERCOSUR partners) separately. Additionally, we analyze the impact of NTBs by considering two indicators based on a product-level revealed protection index. This index, computed following Durán and Ferreira-Coimbra (2010), takes into account the most common effects that protection has on trade flows, identifying products that present marginal levels of exports, marginal levels of imports, non-competitive domestic production along with competitive regional production. It also considers the level of world imports (in order to discard products without significant international trade levels), and the level of domestic production (to focus on those products for which protection could have had a positive impact on domestic production).<sup>11</sup>

For those products identified with the revealed protection index, we studied the normative in force in Uruguay in 1983-2005 in order to detect the measures that could have operated as NTBs during this period (compensatory rights, exports restrictions, import licenses, tax discrimination, sanitary, phytosanitary and technical barriers, among others). Then we defined a dummy variable ( $DNTB_t$ ) that takes the value of one for those products affected at time  $t$  by one or more NTB measures (i.e. those products for which we identified at least one non-tariff protection measure in force at time  $t$ )<sup>12</sup>. Finally, we computed two firm-level NTB indicators: 1)  $NTB1_{it}$ : a dummy variable equal to one if the firm's (fixed) output basket contains at least one product affected at time  $t$  by some NTB measure (i.e. there is at least one product in firm's output basket for which  $DNTB_t=1$ ), and 2)  $NTB2_{it}$ : the number of products in firm's (fixed) output basket affected at time  $t$  by some NTB measure (i.e. number of firm's products for which  $DNTB_t=1$ )<sup>13</sup>.

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<sup>11</sup> The indicators considered in the construction of the revealed protection index are presented in section A.2 of the appendix.

<sup>12</sup> For the period 1983-1996 firm-level product data (from surveys' "product sheets") are based on the ISIC revision 2 classification, while for 1997-2005 they are based on the ISIC revision 3. We worked with these product classifications, separating the period 1983-2005 into two.

<sup>13</sup> Due to restrictions in data availability, the revealed protection index could only be calculated for 1990-2005 (except 2002). However, the NTB indicators were computed for the whole period 1983-2005, considering the years during which the measures were in force.

### 3.3 Survival analysis

The last step in our estimation strategy is the evaluation of the determinants of firms' survival (exit) and the impact of trade policies on survival (exit) probabilities. We analyze the reallocation effect of policy changes using our protection and productivity measures and a set of firm characteristics, to assess the impact of tariffs and NTBs on exit probabilities.

In order to deal with the problem of right-censoring of survival times<sup>14</sup> -which, if ignored, may lead to inconsistent estimates-, we use survival or duration methods to estimate exit functions conditional on firm characteristics and trade policy variables. These methods model survival times indirectly, via the so-called "hazard rate", a concept related to chances of making a transition out of the current state at each time period, conditional on survival up to that point (Jenkins, 2005).

In practice, it is hard to assume that all sources of individual variation in the hazard rate are captured by the observed explanatory variables included in the model. Mistakenly ignoring the existence of an unobserved individual propensity to experience the event (individual heterogeneity) will bias the estimates of duration dependence (i.e. how the hazard varies with survival times) and hazard parameters: 1) the degree of negative (positive) duration dependence in the hazard will be over-estimated (under-estimated), and 2) positive (negative) hazard parameters will be under-estimated (over-estimated) (Jenkins, 2005)<sup>15</sup>.

Since our panel contains grouped duration data (i.e. survival times are grouped into number of years)<sup>16</sup>, we consider discrete-time duration models. Specifically, we estimate the following hazard function with unobserved heterogeneity:

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<sup>14</sup> The presence of right-censored observations is generated because most firms are not observed from entry to exit; rather, the sample period generally ends before the relevant event (firm exit) has occurred. Consequently, the total length of time between entry to and exit from the market is unknown.

<sup>15</sup> The bias in duration dependence is the result of a selection process. In the case of negative duration dependence, firms with high unobserved propensity to exit leave the market first, other things equal. Consequently, as time goes by survivors are increasingly composed of firms with relatively low values of unobserved propensity, which implies lower hazard rates (i.e. spurious negative duration dependence).

<sup>16</sup> Although the underlying transition process (firm exit) occurs in continuous time, the data are observed annually, so we know the interval during which transition has occurred but not the exact moment of transition.

$$h(t, X_{it}|v_i) = h_0(t) + \mathbf{b}' X_{it} + u_i \quad (6)$$

where  $v_i$  is a time invariant unobservable firm effect,  $u_i \equiv \log(v_i)$ ,  $h_0(t)$  is the baseline hazard function<sup>17</sup>, and  $X_{it}$  are firm characteristics and firm-specific trade policy indicators.

We consider a set of firm characteristics that includes firm age, firm size (total employment), capital intensity (capital/labor ratio), skill intensity (proxied by average real wages), export status (a dummy variable that takes the value of one if the firm exports in period  $t$ ), and heterogeneity of firm's output (number of products). We also include our TFP (Levinsohn-Petrin) estimates, and firm-specific tariff and non-tariff variables to evaluate the effect of trade policy on exit risk.

Taking into account that estimates of duration dependence and hazard parameters ( $\mathbf{b}$ ) are sensitive to the choice of the distributional form for  $v$ , for the sake of robustness we consider two alternative (discrete-time) models: 1) a proportional hazard (complementary log-log) model with Gamma-distributed unobserved heterogeneity, and 2) a logistic hazard model with log-normal distribution of  $v$ .

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<sup>17</sup> The baseline hazard function summarizes the pattern of duration dependence, assumed to be common to all firms.

## 4. Data

### *Manufacturing data panel*

We use a firm-level panel for the period 1983-2005, constructed using data from the manufacturing surveys conducted by the Uruguayan statistical office, the *Instituto Nacional de Estadística* (INE). The panel contains annual data on output, materials, energy, employment, capital and other expenditures, deflated using detailed price indices (base year 1997). For output and materials we computed firm-specific deflators as the weighted average of the four-digit ISIC price indices corresponding to all the items produced/used as input each year by the firm.

In the panel construction we have taken into account several methodological changes introduced in the manufacturing surveys over these years, particularly those related with the surveys' sampling unit and the valuation criteria. These changes had limited previous firm-based studies to markedly shorter time spans, since it was difficult to merge data recorded in different ways. In section A1 of the appendix we provide more details about the panel construction and its data sources.

Our (unbalanced) manufacturing data panel contains 1,799 different firms present at least in two periods (see Table A1.1 in the appendix)<sup>18</sup>. We have an average of 730 firms per year, with a total of 16,801 firm-year observations. There are 491 firms starting in 1983, of which only 161 make it to 2005. On average, each firm has around 13 observations; and only 104 firms are present in all sample years (i.e. have 23 observations).

### *Firms' trade orientation*

In order to classify firms according to their trade orientation we used data from two sources: the manufacturing surveys and the customs office databases. The manufacturing surveys include a "product sheet" that contains annual data on firms' sales, disaggregated by product and destination market (domestic or export). The customs office databases contain firm-level information on annual export flows,

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<sup>18</sup> We discarded firms that were only present in the Economic Censuses (i.e. 1988 and/or 1997).

including data on values, quantities and destination countries by product. Using the “product sheet” data we computed the firm’s export propensity (share of exports in total sales), by sample year. Then, from the customs office data we determined the major export destination region (MERCOSUR or extra-MERCOSUR), also by sample year, for those firms with non-zero export shares.

We characterize each firm in terms of its trade orientation as being domestic-market-oriented, when its export propensity is below the panel’s median (20 percent), or export-oriented, when its export propensity exceeds the median. Then we sub-classify export-oriented firms into MERCOSUR-oriented (those whose main export destination region is MERCOSUR) and extra-MERCOSUR-oriented (those whose main export destination are not MERCOSUR countries). The classification criterion considered was the firm’s average main destination market, based on export propensities and export destination shares averaged for each firm across all sample years.

In Table 2 we present the number of firms and observations falling into each trade-orientation class: 74.8 percent of the firms are classified as domestic-market-oriented (71.6 percent of total observations) and 25.2 percent are export-oriented (28.4 percent of total observations); 44.6 percent of the exporting firms are MERCOSUR-oriented (11.3 percent of total firms and 13.6 percent of total observations), and 49.7 percent are extra-MERCOSUR-oriented (12.5 percent of total firms and 13.6 percent of total observations)<sup>19</sup>.

**Table 2**  
**Firm classification by average main destination market**

Firm class	Firms		Observations	
	Number	Percentage	Number	Percentage
Domestic-market-oriented	1,342	74.8	12,020	71.6
Export-oriented	453	25.2	4,762	28.4
MERCOSUR	202	11.3	2,285	13.6
Extra-MERCOSUR	225	12.5	2,279	13.6
Total	1,795		16,782	

Source: Authors' elaboration.

<sup>19</sup> 4 firms could not be classified according to their trade orientation because of the lack of survey data regarding their destination market (domestic or export), while 26 exporting firms could not be classified into MERCOSUR-oriented or extra-MERCOSUR-oriented due to lack of information from the customs office databases.

The analysis of the customs office data shows that 89 percent of firms classified as MERCOSUR-oriented also exported to non-MERCOSUR countries at least one year in the period 1983-2005; however, for this group of firms the average share of MERCOSUR as destination region is 84 percent. Similarly, although 86 percent of extra-MERCOSUR-oriented firms also exported to MERCOSUR countries at least once, the average share of extra-MERCOSUR markets is 86 percent. On the other hand, from those firms that exported to MERCOSUR countries at least once and are present in the panel since before 1991, 77 percent started to export to this region before the establishment of MERCOSUR (the proportion is 87 percent for MERCOSUR-oriented firms and 85 percent for those extra-MERCOSUR-oriented).

Firms' trade orientation has been relatively stable along the period under study. As can be seen in Table A1.3 of the appendix, most of the firms classified as domestic-market-oriented show the same trade orientation when considering their initial main destination market (i.e. main destination market in firm's first sample year) or their final main destination market (i.e. main destination market in firm's last sample year). Less than 10 percent of firms classified as initially domestic-market-oriented changed their status by their final sample year: 4.3 percent became MERCOSUR-oriented and 4.0 percent turned into extra-MERCOSUR-oriented.

The MERCOSUR-oriented class exhibits larger (relative) changes over the period: the comparison of firms' initial main destination market with their final main destination market shows that around 40 percent of firms classified as initially MERCOSUR-oriented became domestic-market-oriented, while 15 percent grew into extra-MERCOSUR-oriented. Finally, the extra-MERCOSUR-oriented class also shows larger (relative) changes than the domestic-market-oriented one: around 20 percent of firms falling into the extra-MERCOSUR-oriented class according to their initial main destination market changed into domestic-market-oriented by their final sample year, and around 9 percent turned into MERCOSUR-oriented. These changes in firms' trade orientation reflect those experienced by Uruguay's export flows, analyzed in section 2.

### ***Industry trade orientation***

Alternatively, we classified firms according to the trade orientation of the industry they belong to. The trade orientation of each industry was determined at a four-digit ISIC revision 3 level on the basis of two indicators: the share of exports over total output and the share of imports over total output. These shares were calculated, by year, using data from the United Nations Commodity Trade Statistics Database (COMTRADE) (total exports and imports by ISIC sector) and the INE (total production by ISIC sector).

Following Peluffo (2010), we defined four industry groups: export-oriented, import-competing, intra-trade and non-tradable. We characterize an industry as export-oriented when the export/output ratio averaged over the period 1983-2005 is equal or greater than 0.20 (20 percent) and the average import/output ratio is lower than 0.20, as import-competing if the average import/output ratio is equal or greater than 0.20 and the average export/output ratio is lower than 0.20, as intra-trade when both average ratios are equal or greater than 0.20, and as non-tradable if both average ratios are lower than 0.20<sup>20</sup>. In Table 3 we present the number of firms and observations falling into each of the four classes defined.

**Table 3**  
**Firm classification by industry trade orientation**

<b>Industry class</b>	<b>Firms</b>		<b>Observations</b>	
	Number	Percentage	Number	Percentage
Non-tradable	339	18.8	3,128	18.6
Tradable	1,460	81.2	13,673	81.4
Export-oriented	399	22.2	3,885	23.1
Import-competing	577	32.1	5,341	31.8
Intra-trade	484	26.9	4,447	26.5
<b>Total</b>	<b>1,799</b>		<b>16,801</b>	

Source: Authors' elaboration.

In Table 4 we present the distribution of firms from each industry class by average main destination market (i.e. combining both firm classification criteria). We observe that more than 90 percent of firms belonging to non-tradable industries are classified as domestic-market oriented, while only 50 percent of firms from export-oriented industries fall into the export-oriented firm class (moreover, 35 percent of firms

<sup>20</sup> The resulting industry classification is presented in Table A1.4 of the appendix.

belonging to this industry class have zero exports all sample years). This shows the relevance of counting with firm-level data on destination markets in order to evaluate the differential effects that trade policy may have on each firm class.

**Table 4**  
**Firm classification by industry trade orientation and average main destination market**  
*(In percentages of industry class totals)*

Industry class	Firm class			
	Domestic-market-oriented	Export-oriented		Total
		MERCOSUR-oriented	Extra-MERCOSUR-oriented	
Non-tradable	92.2	5.7	2.1	7.8
Tradable	72.1	12.8	15.2	27.9
Export-oriented	49.6	15.9	34.5	50.4
Import-competing	87.5	8.4	4.0	12.5
Intra-trade	72.0	15.4	12.6	28.0

Source: Authors' elaboration.

### *Tariffs*

We used a detailed tariff database compiled by the MERCOSUR Secretariat for 1991-2004. It includes MFN tariffs by eight-digit trade classification (LAIA for 1991-1994 and MERCOSUR for 1995-2004), and a six-digit HS classification common to the whole period. It also includes bilateral residual tariffs by item with all three MERCOSUR partners for 1991-1994, and the (common) intra-zone tariffs between 1995 and 2004. For 1983-1990 and 2005 we used data on MFN tariffs from the LAIA Secretariat.

## 5. Results

### 5.1 Productivity estimation

The coefficients obtained from the estimation of the production function using the gross revenue version of the Levinsohn-Petrin methodology are reported in Table A3.1 of the appendix. We ran this estimation separately for the whole sample and for each firm class considered<sup>21</sup>. We also undertook OLS and Olley-Pakes estimations. As expected, due to the simultaneity bias, in the OLS case the estimated labor and materials coefficients are in general higher and those of capital somewhat smaller than the ones obtained from Levinsohn-Petrin and Olley-Pakes<sup>22</sup>.

To analyze the evolution of manufacturing TFP we computed an aggregate productivity measure as the output-weighted average of our firm-level productivity estimates:

$$tfp_t = \sum_i s_{it} tfp_{it}$$

where  $s_{it}$  is firm  $i$ 's share in total manufacturing output at time  $t$ , and  $tfp_{it}$  is firm  $i$ 's productivity at time  $t$ .

We also computed aggregate productivity measures by group of manufacturing firms (domestic-market-oriented, export-oriented, MERCOSUR-oriented, and extra-MERCOSUR-oriented):

$$tfp_{jt} = \sum_i s_{ijt} tfp_{ijt}$$

where  $tfp_{jt}$  is the weighted average productivity of group  $j$  at time  $t$ ,  $s_{ijt}$  is the share of firm  $i$ 's output in the total production of group  $j$  at time  $t$ , and  $tfp_{ijt}$  is the TFP estimated for firm  $i$  from group  $j$  at time  $t$ .

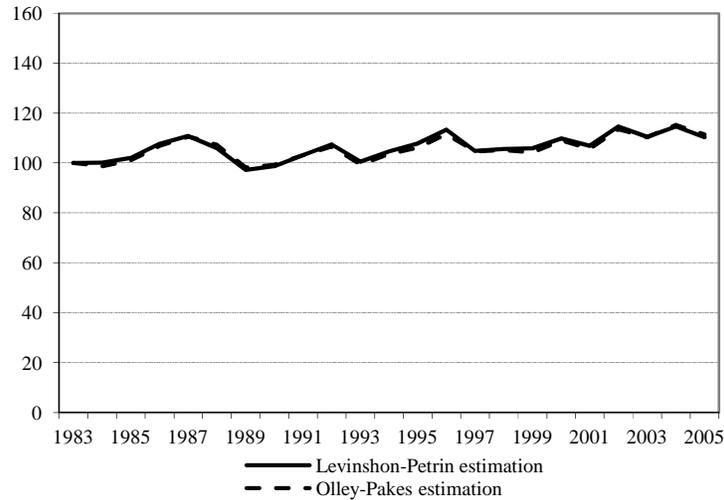
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<sup>21</sup> We first ran the estimation separating domestic-market-oriented firms from export-oriented, then we separated exporting firms into MERCOSUR-oriented and extra-MERCOSUR-oriented running an estimation for each firm class.

<sup>22</sup> The upward bias in the OLS estimates is what can be expected if labor, materials and productivity shocks are positively correlated.

Taking the differences in (mean) logarithms of TFP as growth rates, we constructed aggregate productivity indices (base year 1983). Figure 4 presents the evolution of average manufacturing TFP in the period 1983-2005, showing a slightly increasing path with some fluctuations.

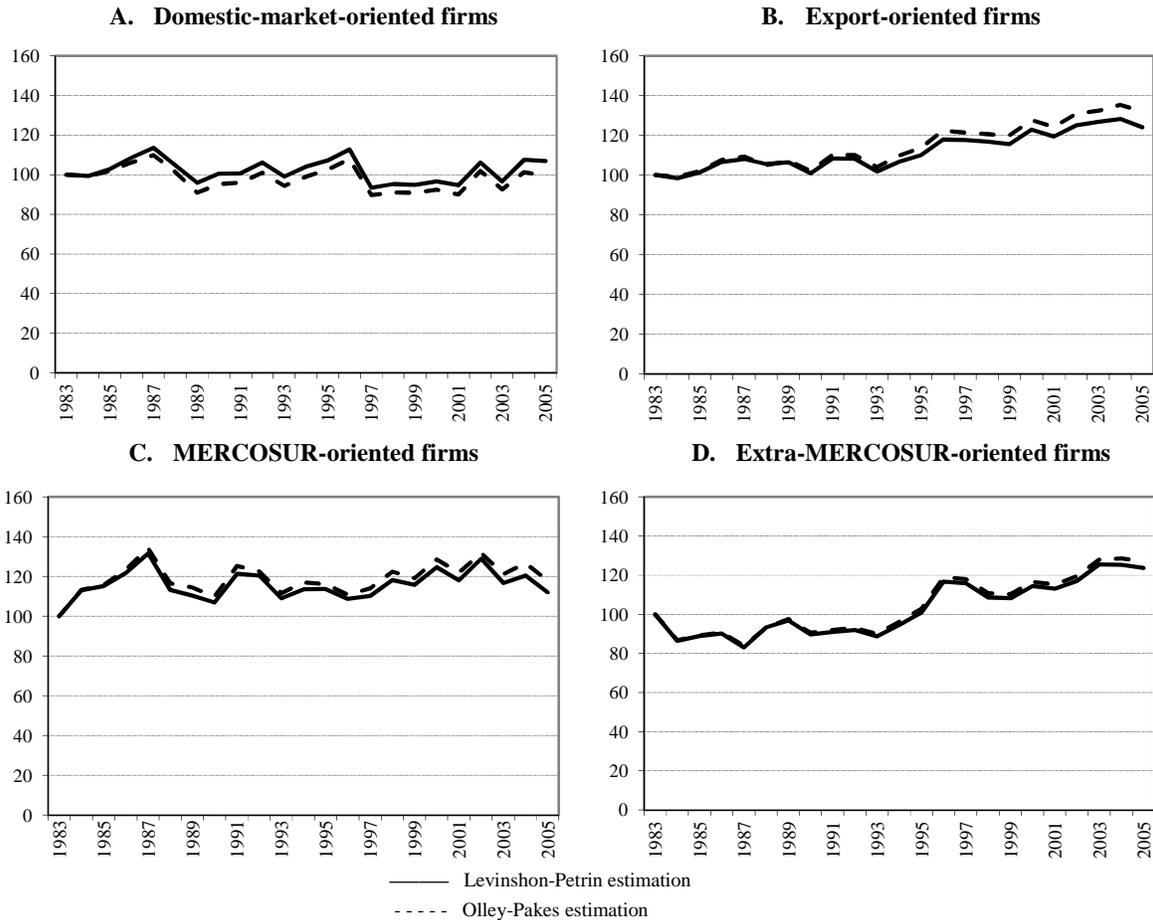
**Figure 4**  
**Average manufacturing TFP index 1983-2005 (1983=100)**



Source: Authors' estimations.

The growth pattern of average manufacturing TFP has resulted from the evolution of domestic-market-oriented firms' productivity -which remained almost stagnant (comparing the end of the period with the beginning), though exhibiting several fluctuations-, and that of export-oriented firms -which experienced a significant growth since the early 1990s, when the trade openness process was deepened- (see Figure 5). Within export-oriented firms, the MERCOSUR-oriented group shows a fluctuating productivity trajectory until the mid-1990s (with strong ups and downs), followed by a slight increase that reverts from the early 2000s. On the other hand, extra-MERCOSUR-oriented firms present a larger increasing trend from the early 1990s, which slows by the end of the period. As can be seen from figures 4 and 5, the Levinsohn-Petrin and Olley-Pakes estimates show a similar evolution pattern.

**Figure 5**  
Average TFP index 1983-2005 (1983=100), by manufacturing firm class



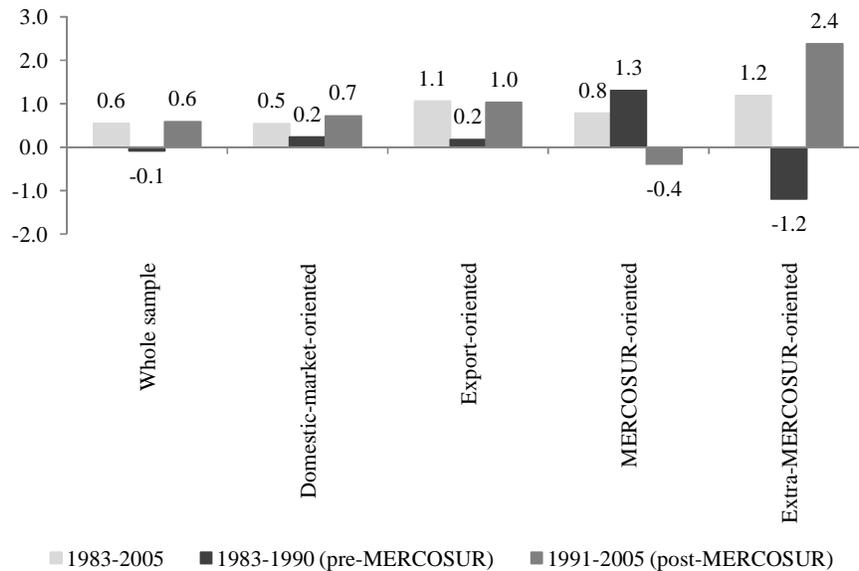
Note: Firms classified according to their average main destination market.

Source: Authors' estimations.

The annual average TFP growth rates show as well important differences in productivity performance among firm classes (see Figure 6). According to our estimates, along the period 1983-2005 export-oriented firms experienced a considerably higher growth than firms oriented to the domestic market, which is explained by their performance after 1990. Within export-oriented firms, those classified as extra-MERCOSUR-oriented present a higher overall average growth rate than the MERCOSUR-oriented ones, although there are wide differences when considering the pre-MERCOSUR and post-MERCOSUR periods separately. MERCOSUR-oriented firms show a positive productivity growth in the first period (with an annual average rate of 1.3 percent), while after 1990 they experienced a negative annual average variation (-0.4 percent, although for 1991-2002 the average growth rate is 0.7 percent). On the other hand, extra-MERCOSUR-oriented firms present a negative average growth rate in 1983-1990

(-1.2 percent) and a high positive variation in the post-MERCOSUR period (2.4 percent).

**Figure 6**  
Annual average TFP growth 1983-2005, by manufacturing firm class  
(In percentages)



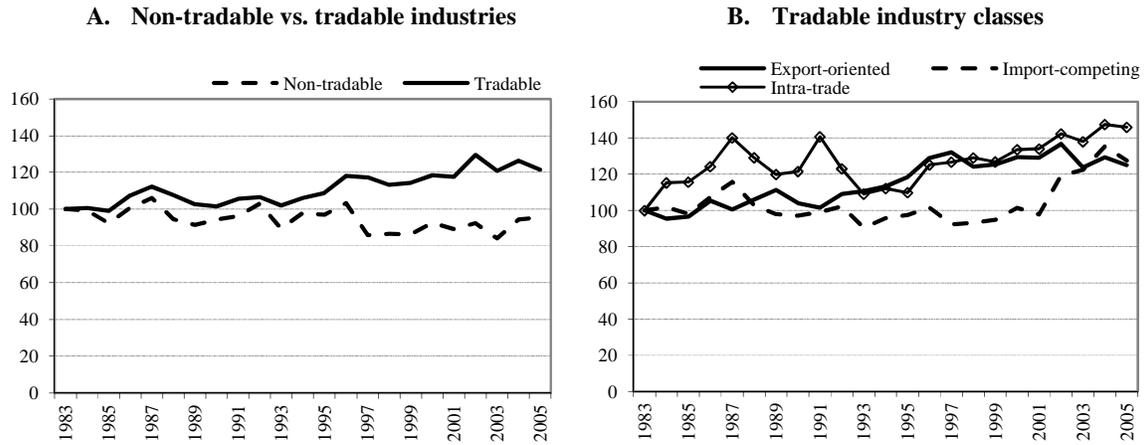
Note: Firms classified according to their average main destination market.  
Source: Authors' estimations.

Figure 7 presents the evolution of average productivity by groups of firms classified according to the trade orientation of the industry they belong to. While until the early 1990s the non-tradable and tradable industry groups show a rather similar stagnation in their average productivities (though with some fluctuations), since the mid-1990s it is possible to distinguish two clearly different growth patterns: firms belonging to tradable industries show a significant increase in their productivities until 2002, while the average productivities of firms belonging to non-tradable industries exhibit a somewhat downward trend until the early 2000s (ending by 2005 with a TFP level that is roughly the same as that of 1983). The performance of the first group of firms would be expected, according to what theory suggests, from industries with a more active participation in foreign markets or more exposed to import competition.

Firms belonging to intra-trade industries experienced a higher annual average TFP growth in 1983-2005 than those belonging to the other two groups of tradable industries

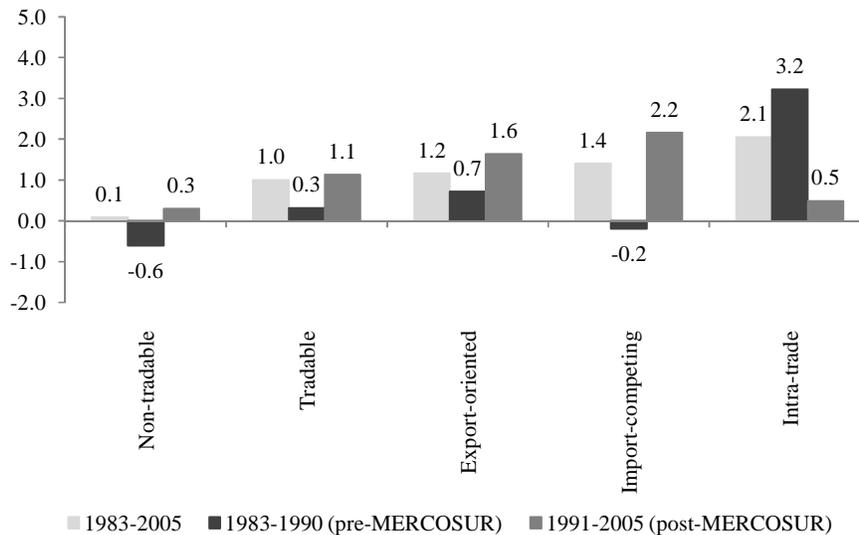
(see Figure 8). Nevertheless, when considering the pre-MERCOSUR and post-MERCOSUR periods separately, we observe important differences among these firm classes. In the first period firms from intra-trade industries performed markedly better than the others (particularly compared to firms from import-competing industries), however, in 1991-2005 their productivity growth was clearly lower (being firms from import-competing industries the top performers).

**Figure 7**  
Average TFP index 1983-2005 (1983=100), by industry class



Note: Tradable industries include the export-oriented, import-competing and intra-trade groups.  
Source: Authors' (Levinsohn-Petrin) estimates.

**Figure 8**  
Annual average TFP growth 1983-2005, by industry class  
(In percentages)



Note: Tradable industries include the export-oriented, import-competing and intra-trade groups.  
Source: Authors' estimations.

## 5.2 Trade policy and productivity

### 5.2.1 MFN tariffs

We carried out firm-level regressions of TFP (estimated using Levinsohn-Petrin) on firm-specific output and input tariffs and NTB indicators, for the whole sample and for each of the firm classes considered.<sup>23</sup> In tables A3.2 to A3.8 of the appendix we report the results obtained for the period 1983-2005 from estimating equation (3) including only MFN tariffs as protection measures (i.e. without considering bilateral residual tariffs with MERCOSUR partners).

Column 1 of Table A3.2 shows that a reduction in output tariffs has a positive effect on Uruguayan manufacturing firms' productivity: a fall in final goods tariffs of 10 percentage points increases productivity by around 6 percent. When we include control variables (export share, import status, firm size and exit dummy) the output tariff coefficient's sign and significance are not affected, although its value decreases slightly (see column 3 of Table A3.2). In contrast, the effect of input tariffs is not significant in any of the specifications considered. Nevertheless, for input importing firms there would be a productivity gain from reducing input tariffs, since the coefficient on the interactive term (*IS\*MFN input tariff*) is negative and significant, showing that a 10 percentage point fall in input tariffs increases these firms' productivity by around 3 percent (see columns 2 to 5 of Table A3.2). Regarding the NTB indicators (*NTB1* and *NTB2*), their inclusion does not affect any of the other variables (coefficients' values experience small changes, while their signs and significance are unaffected), and they show a negative impact of non-tariff measures on productivity (see columns 4 and 5 of Table A3.2). The coefficient on *NTB1* indicates that firms affected by some NTB measure are on average around 2 percent less productive than those not affected.

The results reported in tables A3.3 to A3.6 show that the impact of MFN tariffs on firms' productivity differs considerably among firm classes. For the domestic-market-oriented firms the results on output tariffs are similar to those obtained for the whole sample, although when we control for the size and the exit of firms the effect is

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<sup>23</sup> We dropped from the analysis a small number of firms with outlying TFP levels: 1) whole sample: 6 firms (75 observations), 2) domestic-market-oriented: 4 firms (44 observations), 3) export-oriented: 4 firms (39 observations), 4) MERCOSUR-oriented: 1 firm (1 observation), and 5) extra-MERCOSUR-oriented: 1 firm (21 observations).

considerably smaller: a fall in tariffs of 10 percentage points increases productivity by around 3 percent (the statistical significance is also lower, see Table A3.3). On the other hand, the impact of input tariffs is not significant. The result on the variable *NTBI* shows a significant negative effect of non-tariff measures: firms affected by some NTB are on average around 2 percent less productive than other domestic-market-oriented firms (see column 4 of Table A3.3).

Except for input importing firms, which enjoyed productivity gains from lower input tariffs, the group of export-oriented firms does not seem to have experienced productivity improvements attributable to trade liberalization during the period 1983-2005 (the coefficients on both output and input tariffs are not significant in any of the specifications considered) (see Table A3.4). However, we did find a significant negative effect of NTBs on export-oriented firms, related to the number of products affected by non-tariff measures (variable *NTB2*).

Our estimates show important differences across export-oriented firm classes. For MERCOSUR-oriented firms the impact of final goods tariffs is significant but negative (a 10 percentage point fall in output tariffs reduces firms' productivity by around 9 percent), while input tariffs have a significant positive effect of a little higher magnitude (see columns 3 to 5 of Table A3.5). There is also an additional strong effect from input tariffs for importing firms: the coefficient on the interactive term shows that a fall in tariffs of 10 percentage points increases these firms' productivity by 12 percent. The positive and significant coefficient on the import status dummy also indicates that foreign inputs have a positive direct effect on importing firms' productivity. The results suggest as well a negative impact of NTBs for these firms, reflected in the significant negative coefficient on the variable *NTB2*.

On the other hand, for extra-MERCOSUR-oriented firms we found no evidence of an impact of trade policy on productivity (see Table A3.6). The effect of MFN (output and input) tariffs is not significant (after controlling for size and exit), and there is not either an impact from input tariffs for importing firms. Unlike the other firm groups, our results show no significant effect of NTBs on these firms' productivity.

When considering the groups of firms classified according to the trade orientation of the industry they belong to, it is also possible to distinguish different impacts of MFN tariffs (see tables A3.7 and A3.8 of the appendix). For firms belonging to non-tradable industries we found a positive effect of reducing output tariffs (a fall in tariffs of 10 percentage points increases productivity by around 5 percent), and a negative impact of lower input tariffs (a 10 percentage point fall in tariffs reduces these firms' productivity by around 9 percent). On the other hand, our results show no significant additional effect from input tariffs for importing firms, as well as no significant impact of non-tariff measures (see columns 1 to 3 of Table A3.7).

Among firms belonging to tradable industries, output tariffs show a significant enhancing effect on productivity (a fall in tariffs of 10 percentage points increases productivity by around 3 percent), while the impact of input tariffs is not significant. However, the coefficient on the interactive term (*IS\*MFN input tariff*) indicates that there is a significant positive effect of lower input tariffs for importing firms (a 10 percentage point fall in tariffs increases these firms' productivity by around 3 percent). The results on the NTB indicators show no significant impact of non-tariff measures (see columns 4 to 6 of Table A3.7).

Within tradable industries, the impact of MFN tariffs and non-tariff measures differs considerably across industry classes (see Table A3.8). The results on output tariffs show a significant negative effect for firms belonging to export-oriented industries, and a significant positive effect for those belonging to import-competing industries. On the other hand, the impact of reducing input tariffs is significant and positive for both groups of firms. In the case of firms belonging to export-oriented industries, we also found evidence of an additional positive impact of lower input tariffs for importing firms, and a significant negative effect of NTBs. On the contrary, firms from intra-trade industries show no significant impact of tariff or non-tariff measures on their productivity.

When comparing the results obtained for export-oriented firms with those of firms belonging to export-oriented industries we find important differences, explained by the different composition of these groups (see section 4). While for export-oriented firms the impact of MFN tariffs is not significant, the group of firms from export-oriented

industries -which includes many non-exporting firms- shows a significant effect of both output and input tariffs. On the other hand, the positive impact of lower input tariffs for importing firms is significantly higher for the first group.

### 5.2.2 MFN and preferential tariffs

In tables A3.11 to A3.14 of the appendix we present the results obtained when adding into equation (3) output and input bilateral residual tariffs with Brazil (the sample period is now 1991-2004, due to restrictions in data availability)<sup>24</sup>.

In order to assess whether changing the sample period affects coefficients' sign, value or significance, we ran initially the same regressions reported in tables A3.2 to A3.8 (i.e. considering only MFN tariffs) for the period 1991-2004. The results obtained (not reported in detail) show several changes compared to those analyzed in the previous section (see tables A3.9 and A3.10 of the appendix):

- the effect of MFN output tariffs remains significant only for the whole sample and (not robustly) for firms from non-tradable and import-competing industries, and becomes significant for extra-MERCOSUR-oriented firms (at the 1 percent level, with a coefficient value of around -1.0)
- the impact of MFN input tariffs remains significant only for firms belonging to import-competing industries
- the additional effect of input tariffs for importing firms (captured by the interactive term  $IS*MFN$  input tariff) only remains significant for firms belonging to tradable industries, and becomes significant for domestic-market-oriented firms (at the 5 percent level, with a coefficient value of around -0.4)
- the impact of NTBs becomes insignificant for the whole sample, domestic-market-oriented firms and MERCOSUR-oriented firms, remains significant for export-oriented firms and firms from export-oriented industries, and becomes significant for extra-MERCOSUR-oriented firms ( $NTB2$ , significant at the 5 percent level, with a coefficient value of -0.05), firms from non-tradable industries ( $NTB1$ , significant at the 10 percent level, with a coefficient value of -0.03), firms from tradable

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<sup>24</sup> Bilateral residual tariff data are only available for 1991-2004. Since Uruguay's bilateral tariffs with Argentina and with Brazil were highly correlated during this period (see Table 1), we considered only one of them in our regressions.

industries (*NTB2*, significant at the 10 percent level, with a coefficient value of around -0.02), and firms belonging to import-competing industries (*NTB2*, significant at the 1 percent level, with a coefficient value of around -0.03).

The inclusion of bilateral tariffs in our regressions does not affect in general the sign or significance of other trade policy variables, except for the changes summarized in tables A3.9 and A3.10. Regarding bilateral tariffs themselves, our estimates indicate that a reduction in output bilateral tariffs has an enhancing productivity effect for export-oriented firms, extra-MERCOSUR-oriented firms, and firms belonging to intra-trade industries; in all other cases the impact of these tariffs is not significant (see tables A3.11 to A3.14). On the other hand, the effect of lower bilateral input tariffs is positive and significant for the whole sample, firms oriented to the domestic market, firms belonging to tradable industries, and those from intra-trade industries. For firms belonging to non-tradable industries the impact of reducing bilateral input tariffs is negative. We also found evidence of a positive effect of lower bilateral input tariffs for importing firms in the case of the whole sample and export-oriented firms (captured by the interactive term *IS\*Bilateral input tariff*).

Again, we observe differences between the results obtained for export-oriented firms and for firms belonging to export-oriented industries. In this case, firms from export-oriented industries show no significant impact of bilateral tariffs on their productivity, while for export-oriented firms we found a significant positive effect of output tariffs and, for importing firms, also input tariffs.

### **5.2.3 Endogeneity of trade policy**

An important issue in the empirical analysis of the impact of trade policy on firms' productivity is the potential endogeneity of policy measures, since low-productivity firms/industries may lobby for protection. In the case of Uruguay, although the signature of international treaties in the 1990s (MERCOSUR and World Trade Organization) significantly curtailed the government's ability to provide discretionary protection to particular sectors, at least in the form of output tariffs, before 1991 firms may have influenced protection levels.

To address this potential problem, we instrumented for our tariff and non-tariff indicators using their lagged values. In tables A2.15 and A2.16 of the appendix we present the results obtained, for firms classified according to their average main destination market, when considering each policy variable lagged three periods (although we experimented with three to five lags).

Regarding MFN tariffs, our estimates for the whole sample and for export-oriented firms show no difference, in terms of coefficients' sign and significance, with those analyzed in section 5.2.1 (see Table A2.15). For domestic-market-oriented firms the impact of output tariffs is no longer significant (except when the variable is lagged five periods), while the effect of input tariffs remains insignificant in all specifications. On the other hand, the coefficient on the interactive term becomes significant, showing a positive impact of input tariffs on importing firms. In the case of MERCOSUR-oriented-firms, the (negative) effect of lower output tariffs is no longer significant, while the impact of input tariffs remains significant (at least for importing firms). Finally, for extra-MERCOSUR-oriented firms the only change observed is that of output tariffs, which show a significant positive effect on these firms' productivity in all the specifications considered.

The results on NTBs show wider changes. While for the whole sample, domestic-market-oriented firms and MERCOSUR-oriented firms the impact of non-tariff measures becomes not significant (regardless of the number of lags considered), for export-oriented and extra-MERCOSUR-oriented firms it turns into positive. However, these results should be interpreted with caution, since they are sensitive to changes in the sample composition.

Although the endogeneity of trade policy could be an issue in the case of some firm classes, and should be further investigated, our estimates point to an impact of policy changes on firms' productivity. In most cases, trade liberalization has had an enhancing productivity effect, although the instrument differs across firm classes. Even though, in some cases, the gains from lower tariffs seem to have been enjoyed only by input importing firms, these represent an important proportion of our sample, particularly in the case of export-oriented firms (74 percent, 84 percent for MERCOSUR-oriented and 66 percent for extra-MERCOSUR-oriented, although many are not regular importers).

### 5.3 Survival analysis

The last step in our evaluation of the impact of trade policy on firms' performance is the analysis of the reallocation effect of policy changes. The results obtained from the estimation of the duration model 2 (logistic model) are presented in tables A3.17 to A3.20 of the appendix.

Our estimates show that the risk of exit decreases with firm age (except in the case of MERCOSUR-oriented firms, extra-MERCOSUR-oriented firms and firms from import-competing industries, for which the effect is not statistically significant). On the other hand, hazard rates are negatively associated with firm size (larger firms are more likely to survive). These results are in line with other empirical studies on firms' survival.

The other firm characteristics considered are positively associated with survival probabilities (negatively associated with hazard rates), as it would be expected. Firms with larger capital-labor ratios and those with relatively skilled workers are more likely to survive (although the impact is not significant for all firm classes). For some groups of firms we also find evidence of a negative association between risk of exit and number of products made by the firm (the hazard rate is lower for multi-product firms). On the other hand, the results on the export status of the firm show, for some groups, a significant positive effect of export activity on survival times (exporting firms are less likely to exit than non-exporters). We observe as well a positive association between productivity and survival probabilities, significant for all firm classes.

Regarding trade policy variables, the results obtained show no significant impact of MFN tariffs on firms' exit, except in the case of extra-MERCOSUR-oriented firms. For this group we find evidence of a positive effect of lower input tariffs on survival probabilities (i.e. lower tariffs reduce the risk of exit). In contrast, our estimates indicate a significant positive association between non-tariff protection and survival times, except for extra-MERCOSUR-oriented firms and firms belonging to export-oriented industries. Our findings suggest that, for most firm classes, the reallocation effect of tariffs would have operated indirectly via firms' productivity, while non-tariff protection would have had a direct impact on survival probabilities.

The results obtained with the proportional hazard model (model 1) do not differ significantly from those of model 2. Particularly, our findings about the impact of trade policy on firms' survival are the same with both models.

## 6. Concluding remarks

We evaluated the impact of trade liberalization and regional integration on the performance of Uruguayan manufacturing firms in the period 1983-2005, analyzing how firms have responded to the trade policy changes implemented in Uruguay since the 1970s. In order to assess whether this impact differs across firms with different trade orientation, we classified firms according to their average main destination market and the trade orientation of the industry they belong to.

Based on detailed firm-level data, we have been able to distinguish firms oriented to the domestic market from those export-oriented and, within this last group, those whose average main destination region was MERCOSUR from those mainly oriented to extra-MERCOSUR markets. Additionally, using sector-level trade and production data we classified firms into industry classes (non-tradable, export-oriented, import-competing, and intra-trade).

Our estimates show wide differences in productivity performance among firm groups. Export-oriented firms experienced a considerably higher average TFP growth along the period 1983-2005 than firms oriented to the domestic market (and those little exposed to foreign competition), particularly since the 1990s when the trade liberalization process was deepened. Within export-oriented firms, those classified as extra-MERCOSUR-oriented present a higher overall average growth than the MERCOSUR-oriented ones, although we find important differences when considering the pre-MERCOSUR and post-MERCOSUR periods separately. Particularly, MERCOSUR-oriented firms exhibit a poorer average performance along the second period, even though until 2002 they present an increasing TFP trajectory.

The impact of trade policy on productivity also differs considerably among firm classes. The results for the period 1983-2005 suggest a significant positive effect of lowering MFN output tariffs on domestic-market-oriented firms. In contrast, firms oriented to MERCOSUR show a negative impact of these tariffs, while the effect is not statistically significant for extra-MERCOSUR-oriented firms. On the other hand, the impact of input protection is only significant for MERCOSUR-oriented firms, which show a

productivity enhancing effect of lower input tariff. The evidence on non-tariff protection indicates a significant negative impact, except for extra-MERCOSUR-oriented firms.

According to our estimates for the period 1991-2004, bilateral output tariffs vis-à-vis the MERCOSUR partners would not have had a statistically significant effect on firms' productivity, except in the case of extra-MERCOSUR-oriented firms (which show a positive impact of tariff reductions). On the other hand, lower bilateral input tariffs would have had an enhancing effect on the productivity of domestic-market-oriented firms. In contrast, firms oriented to MERCOSUR do not seem to have experienced any productivity effect attributable to trade policy during this period.

Finally, the analysis of firm survival shows more regularities across firm classes. On one hand, our findings indicate that productivity reduces the risk of exit (more productive firms have lower hazard rates). This reveals the existence of an underlying selection process by which inefficient (low-productivity) firms exit the market. We also found that, for most firm classes, the effect of tariffs on survival probabilities is not statistically significant, while non-tariff protection has a significant positive impact on firms' survival. In both cases the exception are extra-MERCOSUR-oriented firms, which show a significant negative association between lower input tariffs and the risk of exit, and no significant effect of NTBs.

Traditionally, the impact of trade openness and regional integration on the Uruguayan economy had been assessed by means of macro-level analyses. This study adds to the more recent literature on microeconomic approaches, with some data and methodological contributions. The use of a complete firm-level database allowed us to analyze firms' performance based on detailed data on their destination markets, as well as firm-specific tariff and non-tariff protection measures. The differences observed in the impact of trade policy across firm classes (both within and between classification criteria) show the relevance of counting with this type of data in order to evaluate the differential effects that policy changes may have on each firm class.

Another important contribution of this study is related to the methods used to analyze the determinants of firm survival, which present several improvements with respect to traditional econometric techniques (particularly, their appropriateness for dealing with

the right-censoring and unobserved heterogeneity problems), and had not been applied before in Uruguay to this type of study.

Our findings contribute to better understand the determinants of Uruguayan manufacturing firms' performance in the face of the trade policy changes implemented in the country along the last three decades. However, some issues remain for future research. Further investigation is required on the differences in productivity performance and trade policy impacts among firm classes (particularly, between MERCOSUR-oriented and extra-MERCOSUR oriented firms), exploiting the richness of our firm-level database. On this respect, it would be important to incorporate pre-1991 bilateral tariffs with Argentina and/or Brazil in order to evaluate the impact of these tariffs along the whole period 1983-2005 (since our data show that most firms that exported to MERCOSUR countries along this period started to export to this region before the trade bloc was established in 1991). On the other hand, the potential endogeneity of trade policy should be further investigated, as our estimates suggest that this could be an issue in the case of some firm classes. Additionally, it would be important to evaluate separately the impact of the exchange rate policy, taking into account its implications in terms of protection levels and competitiveness.

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## Appendix

### A1. Manufacturing data panel

The manufacturing data used to construct our firm-level panel were obtained from the following surveys conducted by the INE: the *Encuesta Industrial Trimestral* (EIT, Quarterly Manufacturing Survey) and the *Encuesta Industrial Anual* (EIA, Annual Manufacturing Survey) for 1983-1987, the III Economic Census (1988), the EIAs 1989-1996 (that differ from the EIAs 1983-1987), the IV Economic Census (1997), and the *Encuesta de Actividad Económica* (EAE, Economic Activity Survey) for 1998-2005<sup>25</sup>.

The main methodological changes introduced in the manufacturing surveys along the period 1983-2005 are related with the sampling unit and the valuation criteria. Between 1983 and 1987 the sampling unit was the plant (named establishment): those firms with more than one plant (belonging to the same ISIC sector or to different sectors) had more than one record in the survey annual dataset (one for each plant). In 1988-1996 the sampling unit was the *Unidad de Clase de Actividad* (UCA), which comprised all the firm's plants belonging to the same ISIC sector: a firm with two or more activities had two or more UCAs and a corresponding number of records in each annual dataset. Finally, in 1997-2005 the data were recorded globally at the firm level, not being possible to discriminate the different firm's activities (which might include not only manufacturing, as in 1983-1996, but also commerce and services). The construction of a homogeneous firm-level panel for the whole 1983-2005 period required the split of data from 1997-2005, in order to separate manufacturing from the other firm's activities, and the aggregation of the 1983-1996 data by firm<sup>26</sup>. With regards to valuation, the data from 1983-1996 were valued including the value added tax (VAT) while the 1997-2005 data did not; the criterion applied to obtain a consistent panel was subtracting this tax from the 1983-1996 data.

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<sup>25</sup> Data collection was affected by the economic crisis of 2002 and the INE was able to obtain the 2002 data only in 2004, along with the 2003 survey. Records for 2002 are sometimes incomplete and only aggregate variables are available at the firm level. In order to obtain disaggregate data we used the 2003 variables' structure.

<sup>26</sup> The firm-level data from 1997-2005 were initially split into UCAs following a set of criteria suggested by the INE. Then the data from the manufacturing UCAs were aggregated by firm.

The different surveys capture formal firms with five or more employees. In the period 1983-1996 all manufacturing firms with 100 or more employees were surveyed, while for the group of firms with a number of employees between 5 and 99 a probabilistic sample was drawn. In 1997-2005 the firms compulsorily included in the sample were those with 50 or more employees, and the firms subject to random sampling were those with 5 to 49 employees. The INE periodically revises the sample coverage and includes new firms, when it is required, though these are not necessarily newborn firms. In general, once a firm enters into the survey it is followed until its death; therefore, when we have no more data for a particular firm, this is interpreted as a firm closure (exit).

### *Firm-level capital stock series*

The surveys' capital stock information, corresponding to the assets' book values reported by the firms, is only available for 1988, 1990 and 1997-2005. To construct a firm-level capital stock series for the whole 1983-2005 period we used the perpetual inventory method (PIM), which estimates capital stock by accumulating past purchases of assets over their service lives.

For each firm  $i$ , the constant price stock of asset  $j$  (buildings and structures, machinery and equipment, or other assets) at time  $t$  is given by:

$$K_{ijt} = K_{ijt_0} (1 - d_j)^{t-t_0} + \sum_{s=t_0+1}^t (I_{ijs} / IP_{js}) (1 - d_j)^{t-s} \quad \text{for } t > t_0 \quad (A1)$$

$$K_{ijt} = \frac{K_{ijt_0}}{(1 - d_j)^{t_0-t}} - \sum_{s=t+1}^{t_0} \frac{(I_{ijs} / IP_{js})}{(1 - d_j)^{s-t}} \quad \text{for } t < t_0 \quad (A2)$$

where  $K_{ijt_0}$  is the initial stock of asset  $j$  for firm  $i$  (at constant prices),  $d_j$  is the asset-specific depreciation rate,  $I_{ijs}$  is the current price investment of firm  $i$  in asset  $j$  at time  $s$  (gross capital formation computed from survey data),  $IP_{js}$  is the asset-specific deflator, and  $t_0$  denotes the initial stock's year.<sup>27</sup>

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<sup>27</sup> The depreciation rate applied to each type of asset, based on Oulton and Srinivasan (2003), was: buildings and structures 2.5 percent, machinery and equipment 12.5 percent, and other assets 12.5 percent.

For each asset type  $j$ , we took as initial stock the asset's book value of the first year available for the firm, and applied the equation (A1) forward in time and the equation (A2) backward (when necessary) to obtain the firm's asset stock series. For those firms with no data on assets' stocks we considered as starting point the first non-zero investment available, taking it forward.

**Table A1.1**  
**Manufacturing data panel 1983-2005**  
**Number of firms, entries and exits by year**

Year	Number of firms	Entries	Exits
1983	491		
1984	492	12	0
1985	482	9	3
1986	485	2	5
1987	462	0	7
1988	1,031	542	10
1989	695	0	82
1990	669	0	22
1991	675	7	32
1992	677	14	43
1993	645	5	36
1994	621	2	31
1995	610	3	28
1996	575	2	38
1997	1,204	503	43
1998	897	68	218
1999	876	3	18
2000	823	7	57
2001	872	43	68
2002	892	72	137
2003	891	6	7
2004	875	8	28
2005	861	0	25
Total	16,801	1,308	938
Average			
1983-1987	482	6	4
1988-1996	689	64	36
1997-2005	910	79	67
1983-2005	730	59	43

Source: Authors' elaboration.

**Table A1.2**  
**Manufacturing data panel 1983-2005**  
**Descriptive statistics by firms' trade orientation**

Trade orientation		Gross output	Value added	Labor	Capital	Materials
Whole sample	Mean	16.47	15.51	3.75	13.82	15.29
	Std dev.	1.77	1.83	1.30	2.42	1.96
	Median	16.49	15.57	3.76	13.95	15.31
Domestic-market-oriented	Mean	16.13	15.26	3.49	13.35	14.87
	Std dev.	1.69	1.83	1.19	2.34	1.79
	Median	16.18	15.32	3.53	13.44	14.93
All	17.34	16.16	4.39	15.00	16.36	16.31
	1.66	1.69	1.33	2.22	1.98	1.96
	17.41	16.22	4.44	15.03	16.41	16.35
Export-oriented	MERCOSUR-oriented	17.30	16.27	4.27	15.18	16.25
	1.60	1.64	1.25	2.19	1.85	1.81
	17.36	16.27	4.29	15.01	16.27	16.24
Extra-MERCOSUR-oriented	17.51	16.16	4.64	14.97	16.62	16.56
	1.67	1.69	1.36	2.17	2.03	2.01
	17.60	16.28	4.74	15.17	16.73	16.68

Notes: i) All variables are in logarithms. ii) Capital corresponds to the stock of machinery and equipment.

Source: Authors' calculations

**Table A1.3**  
**Evolution of firms' main destination markets**  
**Percentage of firms falling into each trade orientation class**

	Initial main destination market		
	Domestic- market- oriented	MERCOSUR- oriented	Extra- MERCOSUR- oriented
<b>Average main destination market</b>			
Domestic-market-oriented	98.7	0.7	0.5
MERCOSUR-oriented	46.0	43.5	10.5
Extra-MERCOSUR-oriented	19.8	4.5	75.7
	Final main destination market		
	Domestic- market- oriented	MERCOSUR- oriented	Extra- MERCOSUR- oriented
<b>Average main destination market</b>			
Domestic-market-oriented	97.6	1.3	1.1
MERCOSUR-oriented	35.8	50.2	13.9
Extra-MERCOSUR-oriented	18.8	4.1	77.1
	Final main destination market		
	Domestic- market- oriented	MERCOSUR- oriented	Extra- MERCOSUR- oriented
<b>Initial main destination market</b>			
Domestic-market-oriented	91.8	4.3	4.0
MERCOSUR-oriented	41.1	43.9	15.0
Extra-MERCOSUR-oriented	19.5	8.9	71.6

Source: Authors' elaboration.

**Table A1.4**  
**4-digit ISIC3 industry trade orientation**

<b>Sector</b>	<b>Trade orientation</b>	<b>Sector</b>	<b>Trade orientation</b>
1511	Export-oriented	2320	Import-competing
1512	Export-oriented	2330	Import-competing
1513	Import-competing	2411	Intra-trade
1514	Import-competing	2412	Import-competing
1520	Export-oriented	2413	Intra-trade
1531	Export-oriented	2421	Intra-trade
1532	Export-oriented	2422	Non-tradable
1533	Import-competing	2423	Import-competing
1534	Export-oriented	2424	Import-competing
1541	Non-tradable	2429	Import-competing
1542	Import-competing	2430	Export-oriented
1543	Import-competing	2511	Intra-trade
1544	Non-tradable	2519	Intra-trade
1549	Non-tradable	2520	Import-competing
1551	Import-competing	2610	Intra-trade
1552	Non-tradable	2691	Non-tradable
1553	Export-oriented	2692	Intra-trade
1554	Non-tradable	2694	Non-tradable
1600	Non-tradable	2695	Non-tradable
1711	Intra-trade	2699	Intra-trade
1712	Export-oriented	2700	Intra-trade
1713	Export-oriented	2811	Import-competing
1720	Intra-trade	2812	Import-competing
1730	Intra-trade	2890	Import-competing
1810	Export-oriented	2910	Intra-trade
1820	Intra-trade	2920	Intra-trade
1911	Export-oriented	2930	Import-competing
1912	Intra-trade	3000	Intra-trade
1920	Intra-trade	3100	Import-competing
2010	Import-competing	3200	Intra-trade
2021	Import-competing	3300	Intra-trade
2029	Import-competing	3400	Intra-trade
2101	Intra-trade	3510	Export-oriented
2102	Import-competing	3530	Intra-trade
2109	Import-competing	3590	Import-competing
2211	Non-tradable	3610	Intra-trade
2212	Non-tradable	3691	Intra-trade
2230	Non-tradable	3699	Import-competing
2310	Import-competing	3700	Non-tradable

Note: Industries were classified according to export/output and import/output ratios averaged over the period 1983-2005.

Source: Authors' elaboration based on data from COMTRADE (trade data) and the INE (total output).

**Table A1.5**  
**Uruguay: MFN tariff 1983-2005**

<b>Year</b>	<b>Average tariff rate</b>	<b>Minimum tariff rate</b>	<b>Maximum tariff rate</b>	<b>Median</b>	<b>Number of items</b>	<b>Variation coefficient</b>
1983	30.8	10.0	55.0	20.0	7,655	61.1
1984	30.8	10.0	55.0	20.0	7,655	61.1
1985	35.8	5.0	60.0	25.0	7,669	52.7
1986	29.2	5.0	50.0	20.0	7,665	57.6
1987	27.0	5.0	45.0	20.0	7,680	53.3
1988	27.0	5.0	45.0	20.0	7,681	53.3
1989	24.1	5.0	40.0	20.0	7,694	47.8
1990	27.7	15.0	40.0	25.0	7,720	34.9
1991	21.4	0.0	30.0	20.0	6,522	37.1
1992	18.0	0.0	24.0	17.0	6,522	31.0
1993	18.0	0.0	24.0	17.0	6,522	31.0
1994	14.4	0.0	20.0	15.0	6,522	38.7
1995	9.5	0.0	45.0	10.0	9,099	79.8
1996	9.5	0.0	30.0	10.0	9,112	77.4
1997	9.5	0.0	27.0	10.0	9,306	73.4
1998	11.8	0.0	24.0	13.0	9,346	61.9
1999	11.9	0.0	23.0	13.0	9,376	59.5
2000	12.1	0.0	23.0	13.0	9,391	57.4
2001	11.9	0.0	55.0	12.5	9,414	56.4
2002	11.1	0.0	55.0	11.5	9,622	59.0
2003	11.1	0.0	55.0	11.5	9,622	59.0
2004	9.1	0.0	55.0	10.0	9,752	77.1
2005	9.0	0.0	55.0	10.0	9,748	77.6

Note: Variation coefficient = (standard deviation/mean)\*100

Source: Authors' calculations based on LAIA Secretariat and MERCOSUR Secretariat data.

## A2. Revealed protection index

The revealed protection index, used to identify the products potentially subject to some NTB measure, was computed using product-level production and trade data from the INE and the COMTRADE database, respectively. Due to restrictions in data availability, the index could only be calculated for the period 1990-2005 (except 2002).

Following Durán and Ferreira-Coimbra (2010), we considered four conditions:

1) *Marginal exports*: 
$$\frac{X_{it}/Z_{it}}{X_t/Z_t} < a_t$$

2) *Marginal imports (i), non-competitive domestic production and competitive regional production (ii to v)*:

i) 
$$\frac{M_{it}/Z_{it}}{M_t/Z_t} < b_t$$

ii) 
$$RCD_{it} = \frac{M_{it}/M_t}{M_{it}^w/M_t^w} > 1$$

iii) 
$$RCA_{it}^k = \frac{X_{it}^k/X_t^k}{X_{it}^w/X_t^w} > 1 \quad \text{for some country } k$$

iv) 
$$\frac{X_{it}^{kR}}{X_{it}^k} \geq g_t \quad \text{for some country } k$$

v) 
$$\frac{\sum_k X_{it}^k}{Z_{it}} > 1$$

A product satisfies condition 2 if:

- (i), (iii) and (v) hold; or
- (i), (iv) and (v) hold; or
- (ii), (iii) and (v) hold; or
- (ii), (iv) and (v) hold

3) *Tradable product*:  $M_{it}^W > q_t$

4) *Significant domestic production*:  $Z_{it} > f_t$

where:

$X_{it}$	Uruguay's exports of product $i$ at time $t$
$X_t$	Uruguay's total exports at time $t$
$X_{it}^W$	world exports of product $i$ at time $t$
$X_t^W$	world total exports at time $t$
$X^{kR}_{it}$	country $k$ 's exports to the region of product $i$ at time $t$ (with $k =$ Argentina, Bolivia, Brazil, Chile, Paraguay) <sup>28</sup>
$X_{it}^k$	country $k$ 's total exports of product $i$ at time $t$
$M_{it}$	Uruguay's imports of product $i$ at time $t$
$M_t$	Uruguay's total imports at time $t$
$M_{it}^W$	world imports of product $i$ at time $t$
$M_t^W$	world total imports at time $t$
$Z_{it}$	Uruguay's production of product $i$ at time $t$
$Z_t$	Uruguay's total production at time $t$
$RCD_{it}$	revealed comparative disadvantage of Uruguay in product $i$ at time $t$
$RCA^k_{it}$	revealed comparative advantage of country $k$ in product $i$ at time $t$ (with $k =$ Argentina, Bolivia, Brazil, Chile, Paraguay)
$a_t, b_t, g_t, q_t, f_t$	threshold levels defined by means of frequency distribution analyses (see Table A2.1).

<sup>28</sup> Region includes Argentina, Bolivia, Brazil, Chile and Paraguay.

Based on the indicators defined above, we constructed our revealed protection index ( $RPI_{it}$ ) as a dummy variable that takes the value one if product  $i$  satisfies conditions 1 to 4 at time  $t$ .

**Table A2.1**  
**Threshold values for revealed protection indicators**

<b>Year</b>	<i>a</i>	<i>b</i>	<i>g</i>	<i>q</i> (millions of dollars)	<i>f</i> (thousands of dollars)
1990	0.5	0.6	0.8	100-200	500-700
1991	0.6	0.6	0.8	100-200	500-700
1992	0.6	0.6	0.8	100-200	500-700
1993	0.5	0.6	0.8	100-200	500-700
1994	0.5	0.6	0.8	100-200	500-700
1995	0.5	0.6	0.8	100-200	500-700
1996	0.4	0.6	0.8	100-200	500-700
1997	0.1	0.6	0.9	100-200	500-750
1998	0.7	0.6	0.9	100-200	500-750
1999	0.7	0.6	0.9	100-200	500-750
2000	0.5	0.6	0.9	100-200	500-750
2001	0.5	0.6	0.9	100-200	250-500
2003	0.3	0.6	0.9	100-200	500-750
2004	0.3	0.6	0.9	100-200	500-750
2005	0.2	0.6	0.9	100-200	500-750

Source: Authors' elaboration.

## A3. Estimation results

**Table A3.1**  
**Estimates of production functions 1983-2005**

		Whole sample	Domestic-market-oriented	Exporters		
				All	MERCOSUR-oriented	Extra-MERCOSUR-oriented
Levinsohn-Petrin	Labor	0.391*** (0.0156)	0.489*** (0.0178)	0.225*** (0.0231)	0.287*** (0.0206)	0.202*** (0.0280)
	Capital	0.0700** (0.0327)	0.100** (0.0503)	0.120*** (0.0393)	0.100* (0.0567)	0.130** (0.0663)
	Materials	0.580*** (0.0532)	0.420*** (0.1350)	0.600*** (0.0617)	0.610*** (0.0785)	0.600*** (0.1040)
	Observations	16,404	11,731	4,654	2,241	2,227
Ordinary Least Squares (OLS)	Labor	0.428*** (0.0166)	0.482*** (0.0185)	0.324*** (0.0304)	0.383*** (0.0333)	0.279*** (0.0502)
	Capital	0.0646*** (0.0059)	0.0631*** (0.0065)	0.0636*** (0.0112)	0.0599*** (0.0134)	0.0547*** (0.0162)
	Materials	0.556*** (0.0136)	0.530*** (0.0147)	0.588*** (0.0285)	0.586*** (0.0308)	0.601*** (0.0483)
	Observations	16,404	11,731	4,654	2,241	2,227
Olley-Pakes	Labor	0.365*** (0.0205)	0.487*** (0.0226)	0.216*** (0.0306)	0.264*** (0.0247)	0.195*** (0.0384)
	Capital	0.125*** (0.0300)	0.0732*** (0.0250)	0.0828* (0.0454)	0.121*** (0.0410)	0.112*** (0.0428)
	Materials	0.540*** (0.0154)	0.521*** (0.0171)	0.575*** (0.0243)	0.555*** (0.0334)	0.594*** (0.0365)
	Observations	9,264	6,137	3,113	1,559	1,474

Notes: i) Dependent variable is gross output. All variables are in logarithms. ii) Capital corresponds to the stock of machinery and equipment. iii) Levinsohn-Petrin and Olley-Pakes: standard errors in parentheses; OLS: robust standard errors in parentheses; \*\*\* significant at 1 %, \*\* significant at 5%, \* significant at 10%.

Source: Authors' estimations.

**Table A3.2**  
**Fixed effects firm-level regressions on firm-specific MFN tariffs 1983-2005**  
**Whole sample**

	(1)	(2)	(3)	(4)	(5)
MFN output tariff	-0.566*** (0.160)	-0.572*** (0.160)	-0.561*** (0.134)	-0.545*** (0.134)	-0.549*** (0.134)
MFN input tariff	-0.107 (0.197)	-0.016 (0.197)	0.007 (0.175)	-0.033 (0.177)	-0.039 (0.177)
Export share		-0.026 (0.033)	-0.271*** (0.033)	-0.275*** (0.033)	-0.276*** (0.033)
IS		0.0696*** (0.018)	-0.003 (0.017)	-0.003 (0.017)	-0.002 (0.017)
IS*MFN input tariff		-0.366*** (0.093)	-0.323*** (0.082)	-0.322*** (0.082)	-0.325*** (0.082)
Size (log real sales)			0.285*** (0.009)	0.285*** (0.009)	0.285*** (0.009)
Value added/gross output			0.0298*** (0.008)	0.0290*** (0.009)	0.0290*** (0.009)
Exit			0.0935*** (0.014)	0.0956*** (0.014)	0.0954*** (0.014)
NTB1				-0.0195* (0.011)	
(log) NTB2					-0.0187** (0.008)
Time dummies	yes	yes	yes	yes	yes
Sector dummies	yes	yes	yes	yes	yes
Observations	16,113	15,867	15,867	15,821	15,821

Notes: i) Dependent variable is log TPF. ii) IS=1 for input importing firms. iii) Exit=1 if firm exits in  $t+1$ . iv) Robust standard errors in parentheses; \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10%.

Source: Authors' estimations.

**Table A3.3**  
**Fixed effects firm-level regressions on firm-specific MFN tariffs 1983-2005**  
**Domestic-market-oriented firms**

	(1)	(2)	(3)	(4)	(5)
MFN output tariff	-0.647*** (0.187)	-0.670*** (0.187)	-0.344** (0.139)	-0.310** (0.139)	-0.310** (0.139)
MFN input tariff	-0.404* (0.232)	-0.378 (0.232)	-0.209 (0.185)	-0.291 (0.187)	-0.279 (0.187)
Export share		-0.0882 (0.076)	-0.302*** (0.075)	-0.293*** (0.075)	-0.296*** (0.075)
IS		0.0786*** (0.021)	-0.0282 (0.018)	-0.0284 (0.018)	-0.0283 (0.018)
IS*MFN input tariff		-0.264** (0.112)	-0.139 (0.089)	-0.125 (0.090)	-0.127 (0.090)
Size (log real sales)			0.385*** (0.010)	0.385*** (0.011)	0.385*** (0.011)
Value added/gross output			0.0226*** (0.005)	0.0213*** (0.005)	0.0213*** (0.005)
Exit			0.0933*** (0.015)	0.0934*** (0.015)	0.0936*** (0.015)

**Table A3.3 (continued)**

	(1)	(2)	(3)	(4)	(5)
NTB1				-0.0224**	
				(0.011)	
(log) NTB2					-0.0115
					(0.009)
Time dummies	yes	yes	yes	yes	yes
Sector dummies	yes	yes	yes	yes	yes
Observations	11,530	11,339	11,339	11,308	11,308

Notes: i) Dependent variable is log TPF. ii) IS=1 for input importing firms. iii) Exit=1 if firm exits in  $t+1$ . iv) Robust standard errors in parentheses; \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10%.

Source: Authors' estimations.

**Table A3.4**  
**Fixed effects firm-level regressions on firm-specific MFN tariffs 1983-2005**  
**Export-oriented firms**

	(1)	(2)	(3)	(4)	(5)
MFN output tariff	0.258	0.401	-0.0716	-0.0601	-0.049
	(0.282)	(0.274)	(0.205)	(0.205)	(0.206)
MFN input tariff	0.189	0.314	0.100	0.104	0.112
	(0.344)	(0.336)	(0.274)	(0.275)	(0.274)
Export share		0.0597*	-0.129***	-0.129***	-0.133***
		(0.031)	(0.032)	(0.032)	(0.032)
IS		0.152***	0.0783***	0.0781***	0.0792***
		(0.035)	(0.029)	(0.029)	(0.029)
IS*MFN input tariff		-0.771***	-0.741***	-0.743***	-0.746***
		(0.169)	(0.149)	(0.149)	(0.150)
Size (log real sales)			0.247***	0.248***	0.249***
			(0.017)	(0.017)	(0.017)
Value added/gross output			0.333**	0.333**	0.332**
			(0.140)	(0.139)	(0.139)
Exit			0.0627***	0.0636***	0.0638***
			(0.024)	(0.024)	(0.024)
NTB1				-0.00549	
				(0.017)	
(log) NTB2					-0.0350**
					(0.015)
Time dummies	yes	yes	yes	yes	yes
Sector dummies	yes	yes	yes	yes	yes
Observations	4,575	4,520	4,520	4,505	4,505

Notes: i) Dependent variable is log TPF. ii) IS=1 for input importing firms. iii) Exit=1 if firm exits in  $t+1$ . iv) Robust standard errors in parentheses; \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10%.

Source: Authors' estimations.

**Table A3.5**  
**Fixed effects firm-level regressions on firm-specific MFN tariffs 1985-2005**  
**MERCOSUR-oriented firms**

	(1)	(2)	(3)	(4)	(5)
MFN output tariff	1.366*** (0.444)	1.740*** (0.428)	0.909** (0.359)	0.927** (0.360)	0.930*** (0.360)
MFN input tariff	-1.121* (0.625)	-0.815 (0.590)	-1.083** (0.518)	-1.075** (0.516)	-1.053** (0.516)
Export share		0.0718 (0.044)	-0.0660* (0.038)	-0.0634* (0.038)	-0.0685* (0.038)
IS		0.243*** (0.052)	0.180*** (0.046)	0.179*** (0.046)	0.178*** (0.046)
IS*MFN input tariff		-1.083*** (0.290)	-1.199*** (0.248)	-1.201*** (0.246)	-1.197*** (0.247)
Size (log real sales)			0.197*** (0.014)	0.198*** (0.014)	0.201*** (0.014)
Value added/gross output			0.240*** (0.083)	0.240*** (0.082)	0.239*** (0.082)
Exit			0.0217 (0.038)	0.0226 (0.038)	0.0231 (0.038)
NTB1				-0.00499 (0.024)	
(log) NTB2					-0.0382** (0.019)
Time dummies	yes	yes	yes	yes	yes
Sector dummies	yes	yes	yes	yes	yes
Observations	2,240	2,224	2,224	2,211	2,211

Notes: i) Dependent variable is log TPF. ii) IS=1 for input importing firms. iii) Exit=1 if firm exits in  $t+1$ . iv) Robust standard errors in parentheses; \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10%.

Source: Authors' estimations.

**Table A3.6**  
**Fixed effects firm-level regressions on firm-specific MFN tariffs 1985-2005**  
**Extra-MERCOSUR-oriented firms**

	(1)	(2)	(3)	(4)	(5)
MFN output tariff	-0.523 (0.387)	-0.516 (0.376)	-0.183 (0.219)	-0.181 (0.219)	-0.169 (0.222)
MFN input tariff	1.296*** (0.475)	1.456*** (0.458)	0.325 (0.303)	0.325 (0.304)	0.328 (0.304)
Export share		0.0549 (0.047)	-0.103*** (0.037)	-0.105*** (0.037)	-0.106*** (0.037)
IS		0.0651 (0.047)	-0.0223 (0.030)	-0.0222 (0.030)	-0.0203 (0.030)
IS*MFN input tariff		-0.570*** (0.215)	-0.204 (0.131)	-0.205 (0.131)	-0.211 (0.130)
Size (log real sales)			0.225*** (0.023)	0.225*** (0.023)	0.225*** (0.023)
Value added/gross output			0.961*** (0.058)	0.961*** (0.058)	0.962*** (0.058)
Exit			0.0391 (0.026)	0.039 (0.027)	0.0396 (0.026)

**Table A3.6 (continued)**

	(1)	(2)	(3)	(4)	(5)
NTB1				0.00372 (0.019)	
(log) NTB2					-0.0199 (0.018)
Time dummies	yes	yes	yes	yes	yes
Sector dummies	yes	yes	yes	yes	yes
Observations	2,184	2,146	2,146	2,144	2,144

Notes: i) Dependent variable is log TPF. ii) IS=1 for input importing firms. iii) Exit=1 if firm exits in  $t+1$ . iv) Robust standard errors in parentheses; \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10%.

Source: Authors' estimations.

**Table A3.7**  
**Fixed effects firm-level regressions on firm-specific MFN tariffs 1983-2005**  
**Non-tradable and tradable industries**

	Non-tradable industries			Tradable industries		
	(1)	(2)	(3)	(4)	(5)	(6)
MFN output tariff	-0.458*** (0.156)	-0.448*** (0.157)	-0.455*** (0.157)	-0.296** (0.129)	-0.271** (0.129)	-0.273** (0.129)
MFN input tariff	0.905*** (0.249)	0.893*** (0.248)	0.917*** (0.247)	-0.186 (0.169)	-0.204 (0.170)	-0.206 (0.170)
Export share	-0.0412 (0.077)	-0.0387 (0.077)	-0.0406 (0.077)	-0.238*** (0.029)	-0.241*** (0.029)	-0.241*** (0.029)
IS	-0.022 (0.024)	-0.024 (0.024)	-0.022 (0.024)	-0.013 (0.017)	-0.012 (0.017)	-0.011 (0.017)
IS*MFN input tariff	-0.0654 (0.111)	-0.0565 (0.111)	-0.0662 (0.113)	-0.264*** (0.084)	-0.267*** (0.084)	-0.270*** (0.085)
Size (log real sales)	0.407*** (0.013)	0.407*** (0.013)	0.406*** (0.013)	0.425*** (0.009)	0.425*** (0.009)	0.425*** (0.009)
Value added/gross output	0.576*** (0.073)	0.574*** (0.073)	0.575*** (0.074)	0.0225*** (0.006)	0.0216*** (0.006)	0.0217*** (0.006)
Exit	0.0467** (0.019)	0.0482** (0.019)	0.0484** (0.019)	0.0684*** (0.014)	0.0695*** (0.014)	0.0694*** (0.014)
NTB1		-0.0077 (0.013)			-0.0157 (0.011)	
(log) NTB2			0.00213 (0.011)			-0.010 (0.009)
Time dummies	yes	yes	yes	yes	yes	yes
Sector dummies	yes	yes	yes	yes	yes	yes
Observations	3,007	3,001	3,001	12,822	12,782	12,782

Notes: i) Firms classified according to the trade orientation of the industry they belong to. ii) Dependent variable is log TPF. iii) IS=1 for input importing firms. iv) Exit=1 if firm exits in  $t+1$ . v) Robust standard errors in parentheses; \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10%.

Source: Authors' estimations.

**Table A3.8**  
**Fixed effects firm-level regressions on firm-specific MFN tariffs 1983-2005**  
**Export-oriented, import-competing and intra-trade industries**

	Export-oriented industries			Import-competing industries			Intra-trade industries		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
MFN output tariff	0.848*** (0.201)	0.860*** (0.202)	0.875*** (0.203)	-0.827*** (0.210)	-0.723*** (0.214)	-0.726*** (0.214)	0.0904 (0.178)	0.073 (0.179)	0.0716 (0.179)
MFN input tariff	-0.820*** (0.296)	-0.832*** (0.300)	-0.832*** (0.297)	-1.108*** (0.294)	-1.188*** (0.297)	-1.198*** (0.297)	-0.111 (0.301)	-0.056 (0.302)	-0.057 (0.302)
Export share	-0.0627* (0.032)	-0.0648** (0.032)	-0.0672** (0.032)	-0.139*** (0.049)	-0.135*** (0.049)	-0.137*** (0.049)	-0.0928** (0.041)	-0.0959** (0.042)	-0.0972** (0.042)
IS	-0.007 (0.021)	-0.007 (0.021)	-0.004 (0.021)	-0.0740*** (0.026)	-0.0744*** (0.026)	-0.0741*** (0.027)	-0.031 (0.030)	-0.026 (0.030)	-0.026 (0.030)
IS*MFN input tariff	-0.223** (0.101)	-0.220** (0.101)	-0.233** (0.102)	0.0975 (0.146)	0.126 (0.148)	0.125 (0.149)	-0.0483 (0.139)	-0.094 (0.139)	-0.0901 (0.139)
Size (log real sales)	0.170*** (0.015)	0.171*** (0.015)	0.171*** (0.015)	0.471*** (0.015)	0.470*** (0.015)	0.471*** (0.015)	0.508*** (0.011)	0.509*** (0.011)	0.509*** (0.011)
Value added/gross output	0.922*** (0.046)	0.920*** (0.046)	0.919*** (0.046)	0.0169*** (0.003)	0.0154*** (0.003)	0.0154*** (0.003)	0.163*** (0.038)	0.162*** (0.037)	0.162*** (0.037)
Exit	0.0297 (0.019)	0.0304 (0.019)	0.0309 (0.019)	0.0871*** (0.021)	0.0867*** (0.021)	0.0865*** (0.021)	0.0265 (0.022)	0.0309 (0.022)	0.031 (0.022)
NTB1		-0.0196 (0.016)			-0.0182 (0.017)			0.0141 (0.017)	
(log) NTB2			-0.0377** (0.016)			-0.0159 (0.013)			0.0006 (0.015)
Time dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
Sector dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	3,610	3,608	3,608	5,087	5,058	5,058	4,125	4,116	4,116

Notes: i) Firms classified according to the trade orientation of the industry they belong to. ii) Dependent variable is log TPF. iii) IS=1 for input importing firms. iv) Exit=1 if firm exits in  $t+1$ . v) Robust standard errors in parentheses; \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10%.

Source: Authors' estimations.

**Table A3.9**  
**Fixed effects firm-level regressions on firm-specific tariffs, by manufacturing firm class**  
**Summary of estimation results 1983-2005 and 1991-2004**

	<b>Period</b>		<b>MFN output tariff</b>	<b>MFN input tariff</b>	<b>IS*MFN input tariff</b>	<b>NTB1</b>	<b>(log) NTB2</b>
Whole sample	1983-2005	only MFN tariffs	Negative significant	Not significant	Negative significant	Negative significant	Negative significant
	1991-2004	only MFN tariffs	Negative significant	Not significant	Not significant	Not significant	Not significant
	1991-2004	MFN & bilateral tariffs	Negative significant	Positive not robustly significant	Not significant	Not significant	Not significant
Domestic-market-oriented	1983-2005	only MFN tariffs	Negative significant	Not significant	Not significant	Negative significant	Not significant
	1991-2004	only MFN tariffs	Not significant	Not significant	Negative significant	Not significant	Not significant
	1991-2004	MFN & bilateral tariffs	Not significant	Not significant	Not significant	Not significant	Not significant
Export-oriented	1983-2005	only MFN tariffs	Not significant	Not significant	Negative significant	Not significant	Negative significant
	1991-2004	only MFN tariffs	Not significant	Not significant	Not significant	Not significant	Negative significant
	1991-2004	MFN & bilateral tariffs	Negative not robustly significant	Not significant	Positive significant	Not significant	Negative significant
MERCOSUR-oriented	1983-2005	only MFN tariffs	Positive significant	Negative significant	Negative significant	Not significant	Negative significant
	1991-2004	only MFN tariffs	Not significant	Not significant	Not significant	Not significant	Not significant
	1991-2004	MFN & bilateral tariffs	Not significant	Not significant	Not significant	Not significant	Not significant
Extra-MERCOSUR-oriented	1983-2005	only MFN tariffs	Not significant	Not significant	Not significant	Not significant	Not significant
	1991-2004	only MFN tariffs	Negative significant	Not significant	Not significant	Not significant	Negative significant
	1991-2004	MFN & bilateral tariffs	Negative significant	Not significant	Not significant	Not significant	Negative significant

Source: Authors' estimations.

**Table A3.10**  
**Fixed effects firm-level regressions on firm-specific tariffs, by industry class**  
**Summary of estimation results 1983-2005 and 1991-2004**

	Period		MFN output tariff	MFN input tariff	IS*MFN input tariff	NTB1	(log) NTB2
Non-tradable	1983-2005	only MFN tariffs	Negative significant	Positive significant	Not significant	Not significant	Not significant
	1991-2004	only MFN tariffs	Negative not robustly significant	Not significant	Not significant	Negative significant	Not significant
	1991-2004	MFN & bilateral tariffs	Negative significant	Not significant	Not significant	Negative significant	Not significant
Tradable	1983-2005	only MFN tariffs	Negative significant	Not significant	Negative significant	Not significant	Not significant
	1991-2004	only MFN tariffs	Not significant	Not significant	Negative significant	Not significant	Negative significant
	1991-2004	MFN & bilateral tariffs	Negative significant	Positive significant	Not significant	Not significant	Not significant
Export-oriented	1983-2005	only MFN tariffs	Positive significant	Negative significant	Negative significant	Not significant	Negative significant
	1991-2004	only MFN tariffs	Not significant	Not significant	Not significant	Not significant	Negative significant
	1991-2004	MFN & bilateral tariffs	Not significant	Not significant	Not significant	Not significant	Not significant
Import-competing	1983-2005	only MFN tariffs	Negative significant	Negative significant	Not significant	Not significant	Not significant
	1991-2004	only MFN tariffs	Negative not robustly significant	Negative significant	Not significant	Not significant	Negative significant
	1991-2004	MFN & bilateral tariffs	Negative significant	Negative not robustly significant	Not significant	Not significant	Negative significant
Intra-trade	1983-2005	only MFN tariffs	Not significant	Not significant	Not significant	Not significant	Not significant
	1991-2004	only MFN tariffs	Not significant	Not significant	Not significant	Not significant	Not significant
	1991-2004	MFN & bilateral tariffs	Not significant	Not significant	Not significant	Not significant	Not significant

Source: Authors' estimations.

**Table A3.11**  
**Fixed effects firm-level regressions on firm-specific MFN and bilateral residual tariffs 1991-2004**  
**Whole sample, domestic-market-oriented firms and export-oriented firms**

	Whole sample			Domestic-market-oriented			Export-oriented		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
MFN output tariff	-0.848*** (0.208)	-0.843*** (0.209)	-0.817*** (0.209)	-0.277 (0.233)	-0.264 (0.232)	-0.272 (0.232)	-0.523* (0.291)	-0.537* (0.294)	-0.449 (0.294)
MFN input tariff	0.590* (0.348)	0.588* (0.353)	0.568 (0.352)	0.571 (0.365)	0.562 (0.368)	0.567 (0.367)	-0.352 (0.556)	-0.322 (0.554)	-0.381 (0.555)
Bilateral output tariff	-0.0289 (0.146)	-0.0282 (0.146)	-0.0467 (0.146)	0.0204 (0.161)	0.0141 (0.161)	0.0171 (0.161)	-0.426* (0.232)	-0.417* (0.233)	-0.452* (0.234)
Bilateral input tariff	-0.658** (0.290)	-0.656** (0.292)	-0.651** (0.291)	-1.083*** (0.307)	-1.077*** (0.307)	-1.082*** (0.308)	0.191 (0.529)	0.184 (0.529)	0.196 (0.529)
Export share	-0.0707* (0.038)	-0.0713* (0.038)	-0.0732* (0.038)	-0.0571 (0.081)	-0.0563 (0.081)	-0.0571 (0.081)	0.0137 (0.024)	0.0147 (0.024)	0.0104 (0.024)
IS	-0.0516* (0.027)	-0.0518* (0.027)	-0.0513* (0.027)	-0.0050 (0.031)	-0.0042 (0.031)	-0.0048 (0.031)	-0.0971** (0.039)	-0.0970** (0.039)	-0.0979** (0.039)
IS*MFN input tariff	0.248 (0.236)	0.250 (0.236)	0.244 (0.236)	-0.159 (0.268)	-0.166 (0.268)	-0.161 (0.268)	0.700** (0.341)	0.703** (0.341)	0.699** (0.342)
IS*Bilateral input tariff	-0.386* (0.218)	-0.387* (0.218)	-0.371* (0.218)	-0.214 (0.258)	-0.203 (0.257)	-0.211 (0.258)	-0.880** (0.433)	-0.902** (0.436)	-0.842* (0.434)
Size (log real sales)	0.172*** (0.013)	0.172*** (0.013)	0.173*** (0.012)	0.287*** (0.014)	0.287*** (0.013)	0.287*** (0.013)	0.185*** (0.010)	0.184*** (0.010)	0.186*** (0.010)
Value added/gross output	0.657*** (0.145)	0.657*** (0.145)	0.657*** (0.145)	0.429*** (0.112)	0.429*** (0.112)	0.429*** (0.112)	1.028*** (0.039)	1.028*** (0.039)	1.029*** (0.039)
Exit	0.0602*** (0.013)	0.0601*** (0.013)	0.0597*** (0.013)	0.0640*** (0.015)	0.0638*** (0.015)	0.0639*** (0.015)	0.0465** (0.021)	0.0466** (0.021)	0.0464** (0.021)
NTB1		-0.000205 (0.012)			-0.00559 (0.012)			0.0119 (0.016)	
(log) NTB2			-0.0094 (0.009)			-0.00167 (0.009)			-0.0242** (0.012)

**Table A3.11 (continued)**

	Whole sample			Domestic-market-oriented			Export-oriented		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Time dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
Sector dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	10,489	10,487	10,487	7,527	7,527	7,527	2,955	2,953	2,953

Notes: i) Dependent variable is log TPF. ii) IS=1 for input importing firms. iii) Exit=1 if firm exits in  $t+1$ . iv) Robust standard errors in parentheses; \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10%.

Source: Authors' estimations.

**Table A3.12**  
**Fixed effects firm-level regressions on firm-specific MFN and bilateral residual tariffs 1991-2004**  
**MERCOSUR-oriented firms and extra-MERCOSUR-oriented firms**

	MERCOSUR-oriented			Extra-MERCOSUR-oriented		
	(1)	(2)	(3)	(4)	(5)	(6)
MFN output tariff	0.218 (0.498)	0.143 (0.507)	0.289 (0.501)	-1.021*** (0.376)	-0.981*** (0.380)	-0.937** (0.383)
MFN input tariff	-1.115 (0.937)	-0.987 (0.939)	-1.197 (0.935)	0.467 (0.765)	0.436 (0.767)	0.599 (0.768)
Bilateral output tariff	-0.0172 (0.329)	-0.0049 (0.330)	-0.0293 (0.329)	-0.926** (0.400)	-0.931** (0.402)	-0.940** (0.403)
Bilateral input tariff	0.733 (1.035)	0.661 (1.041)	0.774 (1.036)	-0.092 (0.597)	-0.119 (0.601)	-0.217 (0.604)
Export share	0.0233 (0.032)	0.0249 (0.032)	0.0209 (0.032)	0.0161 (0.041)	0.0143 (0.042)	0.00939 (0.042)
IS	-0.0594 (0.055)	-0.0584 (0.054)	-0.0602 (0.055)	-0.0953 (0.061)	-0.0980 (0.061)	-0.097 (0.061)
IS*MFN input tariff	0.655 (0.483)	0.652 (0.481)	0.652 (0.484)	0.547 (0.547)	0.565 (0.547)	0.566 (0.546)
IS*Bilateral input tariff	-1.231 (0.886)	-1.262 (0.888)	-1.200 (0.884)	-0.638 (0.517)	-0.613 (0.518)	-0.624 (0.518)

**Table A3.12 (continued)**

	MERCOSUR-oriented			Extra-MERCOSUR-oriented		
	(1)	(2)	(3)	(4)	(5)	(6)
Size (log real sales)	0.147*** (0.013)	0.145*** (0.013)	0.149*** (0.013)	0.191*** (0.018)	0.191*** (0.018)	0.192*** (0.018)
Value added/gross output	1.092*** (0.051)	1.094*** (0.050)	1.090*** (0.051)	0.975*** (0.061)	0.977*** (0.062)	0.981*** (0.063)
Exit	0.0550* (0.031)	0.0543* (0.031)	0.0555* (0.031)	0.0379 (0.033)	0.0361 (0.033)	0.0379 (0.033)
NTB1		0.0244 (0.021)			-0.0317 (0.023)	
(log) NTB2			-0.0192 (0.016)			-0.0595*** (0.023)
Time dummies	yes	yes	yes	yes	yes	yes
Sector dummies	yes	yes	yes	yes	yes	yes
Observations	1,521	1,521	1,521	1,329	1,327	1,327

Notes: i) Dependent variable is log TPF. ii) IS=1 for input importing firms. iii) Exit=1 if firm exits in  $t+1$ . iv) Robust standard errors in parentheses; \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10%.

Source: Authors' estimations.

**Table A3.13**  
**Fixed effects firm-level regressions on firm-specific MFN and bilateral residual tariffs 1991-2004**  
**Non-tradable and tradable industries**

	Non-tradable industries			Tradable industries		
	(1)	(2)	(3)	(4)	(5)	(6)
MFN output tariff	-0.513** (0.247)	-0.429* (0.246)	-0.494** (0.249)	-0.567** (0.248)	-0.547** (0.248)	-0.515** (0.249)
MFN input tariff	0.0637 (0.442)	0.0593 (0.444)	0.0752 (0.443)	0.720** (0.342)	0.703** (0.345)	0.681** (0.346)
Bilateral output tariff	-0.0313 (0.201)	-0.0263 (0.202)	-0.0379 (0.202)	-0.0512 (0.167)	-0.0585 (0.168)	-0.0797 (0.168)
Bilateral input tariff	1.636*** (0.454)	1.694*** (0.454)	1.653*** (0.455)	-1.528*** (0.316)	-1.516*** (0.318)	-1.512*** (0.318)
Export share	-0.077 (0.079)	-0.0663 (0.080)	-0.0758 (0.080)	-0.0739** (0.030)	-0.0750** (0.031)	-0.0770** (0.031)
IS	-0.00219 (0.053)	0.00218 (0.053)	-0.0028 (0.053)	0.0040 (0.028)	0.0042 (0.028)	0.00494 (0.028)
IS*MFN input tariff	-0.219 (0.467)	-0.300 (0.467)	-0.228 (0.465)	-0.311 (0.237)	-0.312 (0.237)	-0.316 (0.237)
IS*Bilateral input tariff	-0.159 (0.399)	0.021 (0.405)	-0.115 (0.405)	0.104 (0.237)	0.110 (0.237)	0.117 (0.237)
Size (log real sales)	0.409*** (0.020)	0.409*** (0.020)	0.409*** (0.020)	0.339*** (0.012)	0.340*** (0.012)	0.340*** (0.012)
Value added/gross output	0.452*** (0.074)	0.448*** (0.073)	0.450*** (0.074)	0.451*** (0.110)	0.451*** (0.110)	0.451*** (0.110)
Exit	0.0639*** (0.022)	0.0609*** (0.022)	0.0630*** (0.022)	0.0358*** (0.013)	0.0357*** (0.014)	0.0355*** (0.014)
NTB1		-0.0367** (0.015)			-0.00644 (0.011)	
(log) NTB2			-0.00916 (0.014)			-0.0141 (0.010)

**Table A3.13 (continued)**

	Non-tradable industries			Tradable industries		
	(1)	(2)	(3)	(4)	(5)	(6)
Time dummies	yes	yes	yes	yes	yes	yes
Sector dummies	yes	yes	yes	yes	yes	yes
Observations	2,079	2,079	2,079	8,384	8,382	8,382

Notes: i) Firms classified according to the trade orientation of the industry they belong to. ii) Dependent variable is log TPF. iii) IS=1 for input importing firms. iv) Exit=1 if firm exits in  $t+1$ . v) Robust standard errors in parentheses; \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10%.

Source: Authors' estimations.

**Table A3.14**  
**Fixed effects firm-level regressions on firm-specific MFN and bilateral residual tariffs 1991-2004**  
**Export-oriented, import-competing and intra-trade industries**

	Export-oriented industries			Import-competing industries			Intra-trade industries		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
MFN output tariff	-0.142 (0.287)	-0.118 (0.291)	-0.049 (0.296)	-0.935** (0.429)	-0.892** (0.429)	-0.810* (0.427)	-0.0576 (0.504)	-0.0334 (0.503)	-0.0325 (0.504)
MFN input tariff	0.0797 (0.407)	0.0682 (0.413)	0.0306 (0.411)	-0.899 (0.659)	-0.952 (0.654)	-1.078* (0.653)	-0.0743 (0.758)	-0.046 (0.755)	-0.0611 (0.756)
Bilateral output tariff	0.0467 (0.303)	0.0437 (0.304)	0.0031 (0.309)	0.430 (0.272)	0.398 (0.273)	0.338 (0.272)	-0.880*** (0.304)	-0.881*** (0.304)	-0.885*** (0.304)
Bilateral input tariff	-0.351 (0.483)	-0.340 (0.489)	-0.273 (0.492)	-0.794 (0.688)	-0.773 (0.684)	-0.756 (0.683)	-1.051** (0.468)	-1.117** (0.466)	-1.121** (0.471)
Export share	0.0215 (0.035)	0.0218 (0.036)	0.0206 (0.036)	0.0347 (0.054)	0.0342 (0.054)	0.0278 (0.054)	-0.055 (0.043)	-0.0576 (0.044)	-0.058 (0.044)
IS	-0.0185 (0.035)	-0.0192 (0.036)	-0.0170 (0.035)	-0.0519 (0.046)	-0.0522 (0.046)	-0.0508 (0.046)	-0.0342 (0.062)	-0.0335 (0.062)	-0.0336 (0.062)
IS*MFN input tariff	-0.0556 (0.293)	-0.0497 (0.295)	-0.0628 (0.294)	0.242 (0.436)	0.257 (0.435)	0.257 (0.435)	0.0398 (0.489)	0.0315 (0.489)	0.0296 (0.489)

Table A3.14 (continued)

	Export-oriented industries			Import-competing industries			Intra-trade industries		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
IS*Bilateral input tariff	-0.258 (0.390)	-0.261 (0.388)	-0.256 (0.389)	-0.427 (0.487)	-0.452 (0.487)	-0.453 (0.486)	0.250 (0.383)	0.289 (0.386)	0.290 (0.385)
Size (log real sales)	0.165*** (0.012)	0.165*** (0.012)	0.165*** (0.012)	0.381*** (0.014)	0.382*** (0.014)	0.383*** (0.014)	0.457*** (0.014)	0.458*** (0.014)	0.458*** (0.014)
Value added/gross output	0.862*** (0.038)	0.861*** (0.038)	0.862*** (0.038)	0.279*** (0.105)	0.278*** (0.105)	0.276*** (0.105)	0.436*** (0.052)	0.437*** (0.052)	0.437*** (0.052)
Exit	0.0415* (0.022)	0.0413* (0.022)	0.0422* (0.022)	0.0603*** (0.020)	0.0596*** (0.020)	0.0590*** (0.020)	0.01 (0.022)	0.00954 (0.022)	0.00941 (0.022)
NTB1		-0.000635 (0.016)			-0.0211 (0.016)			-0.0213 (0.018)	
(log) NTB2			-0.0185 (0.014)			-0.0304*** (0.012)			-0.0204 (0.016)
Time dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
Sector dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	2,436	2,434	2,434	3,305	3,305	3,305	2,643	2,643	2,643

Notes: i) Firms classified according to the trade orientation of the industry they belong to. ii) Dependent variable is log TPF. iii) IS=1 for input importing firms. iv) Exit=1 if firm exits in  $t+1$ . v) Robust standard errors in parentheses; \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10%.

Source: Authors' estimations.

**Table A3.15**  
**Fixed effects firm-level regressions on lagged firm-specific tariff and non-tariff indicators 1983-2005**  
**Whole sample, domestic-market-oriented firms and export-oriented firms**

	Whole sample			Domestic-market-oriented			Export-oriented		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
MFN output tariff lagged 3 periods	-0.639*** (0.151)	-0.536*** (0.140)	-0.536*** (0.140)	-0.288* (0.168)	-0.239 (0.160)	-0.229 (0.160)	-0.141 (0.169)	-0.146 (0.169)	-0.140 (0.169)
MFN input tariff lagged 3 periods	0.109 (0.202)	0.179 (0.192)	0.174 (0.191)	-0.032 (0.225)	0.034 (0.219)	0.060 (0.218)	-0.328 (0.253)	-0.303 (0.253)	-0.326 (0.253)
IS*MFN input tariff lagged 3 periods	-0.279*** (0.097)	-0.332*** (0.091)	-0.329*** (0.091)	-0.156 (0.112)	-0.239** (0.103)	-0.243** (0.103)	-0.312** (0.129)	-0.325** (0.129)	-0.311** (0.129)
NTB1 lagged 3 periods		0.0070 (0.013)			-0.0031 (0.013)			0.0348** (0.017)	
(log) NTB2 lagged 3 periods			0.00367 (0.010)			0.00831 (0.011)			0.0114 (0.014)
Export share	-0.288*** (0.045)	-0.246*** (0.045)	-0.246*** (0.045)	-0.230*** (0.083)	-0.203** (0.083)	-0.204** (0.083)	-0.0430 (0.027)	-0.0454 (0.028)	-0.0451 (0.028)
IS	0.012 (0.021)	0.021 (0.020)	0.021 (0.020)	-0.007 (0.023)	0.007 (0.022)	0.007 (0.022)	0.024 (0.028)	0.028 (0.028)	0.024 (0.028)
Size (log real sales)	0.266*** (0.010)	0.229*** (0.013)	0.229*** (0.013)	0.364*** (0.012)	0.334*** (0.013)	0.334*** (0.013)	0.198*** (0.011)	0.197*** (0.011)	0.197*** (0.011)
Value added/gross output	0.0745*** (0.027)	0.304*** (0.094)	0.304*** (0.094)	0.0548*** (0.016)	0.203*** (0.058)	0.203*** (0.058)	1.004*** (0.043)	1.006*** (0.043)	1.004*** (0.043)
Exit	0.104*** (0.016)	0.0814*** (0.016)	0.0814*** (0.016)	0.102*** (0.017)	0.0837*** (0.017)	0.0840*** (0.017)	0.0400 (0.025)	0.0383 (0.025)	0.0387 (0.025)
Time dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
Sector dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes
Observations	10,350	10,323	10,323	7,199	7,186	7,186	3,141	3,127	3,127

Notes: i) Dependent variable is log TPF. ii) IS=1 for input importing firms. iii) Exit=1 if firm exits in  $t+1$ . iv) Robust standard errors in parentheses; \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10%.

Source: Authors' estimations.

**Table A3.16**  
**Fixed effects firm-level regressions on lagged firm-specific tariff and non-tariff indicators 1983-2005**  
**MERCOSUR-oriented firms and extra-MERCOSUR-oriented firms**

	MERCOSUR-oriented			Extra-MERCOSUR-oriented		
	(1)	(2)	(3)	(4)	(5)	(6)
MFN output tariff lagged 3 periods	0.0220 (0.295)	0.0321 (0.296)	0.0388 (0.296)	-0.374* (0.214)	-0.413* (0.216)	-0.404* (0.216)
MFN input tariff lagged 3 periods	-0.860* (0.444)	-0.871* (0.446)	-0.865* (0.445)	0.226 (0.284)	0.310 (0.290)	0.241 (0.285)
IS*MFN input tariff lagged 3 periods	-0.638** (0.289)	-0.658** (0.289)	-0.641** (0.289)	0.0039 (0.129)	-0.0012 (0.129)	0.0304 (0.128)
NTB1 lagged 3 periods		0.0368 (0.024)			0.0622*** (0.024)	
(log) NTB2 lagged 3 periods			0.0176 (0.019)			0.0452** (0.020)
Export share	-0.0107 (0.039)	-0.0151 (0.039)	-0.0132 (0.039)	-0.0786* (0.042)	-0.0822* (0.043)	-0.0823* (0.043)
IS	0.081 (0.051)	0.0863* (0.051)	0.082 (0.051)	-0.025 (0.036)	-0.024 (0.036)	-0.033 (0.036)
Size (log real sales)	0.162*** (0.016)	0.161*** (0.016)	0.161*** (0.016)	0.211*** (0.016)	0.210*** (0.016)	0.211*** (0.016)
Value added/gross output	1.118*** (0.054)	1.123*** (0.054)	1.120*** (0.054)	0.928*** (0.061)	0.927*** (0.061)	0.925*** (0.061)
Exit	0.0512 (0.037)	0.0479 (0.038)	0.0476 (0.038)	0.0441 (0.032)	0.0424 (0.032)	0.0434 (0.032)
Time dummies	yes	yes	yes	yes	yes	yes
Sector dummies	yes	yes	yes	yes	yes	yes
Observations	1,587	1,578	1,578	1,465	1,460	1,460

Notes: i) Dependent variable is log TPF. ii) IS=1 for input importing firms. iii) Exit=1 if firm exits in  $t+1$ . iv) Robust standard errors in parentheses; \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10%.

Source: Authors' estimations.

**Table A3.17**  
**Logistic hazard models with unobserved heterogeneity 1983-2005**  
**Whole sample, domestic-market-oriented firms and export-oriented firms**

	Whole sample			Domestic-market-oriented					Export-oriented			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Age	-0.051*** (0.015)	-0.058*** (0.016)	-0.070*** (0.019)	-0.072*** (0.019)	-0.027** (0.012)	-0.029** (0.012)	-0.040** (0.016)	-0.044** (0.017)	-0.121** (0.051)	-0.119** (0.049)	-0.133** (0.053)	-0.130** (0.053)
Size (log employment)	-1.722*** (0.229)	-1.809*** (0.246)	-2.039*** (0.258)	-2.096*** (0.254)	-1.490*** (0.228)	-1.489*** (0.231)	-1.785*** (0.264)	-1.908*** (0.268)	-2.355*** (0.566)	-2.228*** (0.534)	-2.328*** (0.548)	-2.271*** (0.557)
(log) Capital intensity	-0.282*** (0.080)	-0.305*** (0.084)	-0.357*** (0.096)	-0.376*** (0.099)	-0.225*** (0.071)	-0.233*** (0.072)	-0.280*** (0.088)	-0.305*** (0.095)	-0.735** (0.294)	-0.646** (0.273)	-0.687** (0.286)	-0.678** (0.285)
(log) Average real wage	-0.509*** (0.149)	-0.401** (0.156)	-0.446*** (0.171)	-0.470*** (0.176)	-0.300** (0.133)	-0.229 (0.140)	-0.293* (0.164)	-0.330* (0.176)	-0.771* (0.414)	-0.396 (0.413)	-0.397 (0.433)	-0.383 (0.432)
(log) Number of products	-0.376*** (0.134)	-0.385*** (0.138)	-0.337** (0.153)	-0.23 (0.159)	-0.303** (0.130)	-0.288** (0.129)	-0.264* (0.151)	-0.161 (0.162)	-0.364 (0.404)	-0.398 (0.383)	-0.318 (0.404)	-0.238 (0.404)
Export status	-0.315 (0.230)	-0.35 (0.236)	-0.515** (0.260)	-0.560** (0.268)	-0.427 (0.260)	-0.455* (0.260)	-0.549* (0.290)	-0.593* (0.304)	-0.660 (0.638)	-0.663 (0.610)	-0.792 (0.640)	-0.763 (0.637)
(log) TFP	-0.645*** (0.173)	-0.689*** (0.177)	-0.720*** (0.196)	-0.697*** (0.202)	-0.752*** (0.174)	-0.781*** (0.175)	-0.873*** (0.205)	-0.886*** (0.217)	-1.031** (0.500)	-1.076** (0.483)	-1.048** (0.510)	-1.046** (0.506)
MFN output tariff		1.414 (2.801)	1.812 (3.198)	1.665 (3.333)		2.845 (2.550)	3.269 (3.098)	3.173 (3.359)		0.941 (7.893)	1.579 (8.364)	1.508 (8.273)
MFN input tariff		1.873 (3.095)	1.138 (3.538)	0.918 (3.686)		-2.327 (2.892)	-3.226 (3.525)	-3.288 (3.828)		8.587 (8.079)	7.952 (8.555)	7.493 (8.475)
NTB1			-1.490*** (0.291)				-1.242*** (0.292)				-1.612** (0.786)	
(log) NTB2				-1.540*** (0.262)				-1.313*** (0.265)				-1.785** (0.802)
Observations	16,022	15,917	15,872	15,872	11,453	11,379	11,349	11,349	4,561	4,530	4,515	4,515

Notes: i) Dependent variable is Exit (=1 if firm exits in  $t+1$ ). ii) Standard errors in parentheses; \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10%.

Source: Authors' estimations.

**Table A3.18**  
**Logistic hazard models with unobserved heterogeneity 1983-2005**  
**MERCOSUR-oriented firms and extra-MERCOSUR-oriented firms**

	MERCOSUR-oriented				Extra-MERCOSUR-oriented			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age	-0.109 (0.080)	-0.109 (0.077)	-0.121 (0.085)	-0.114 (0.081)	-0.0111 (0.009)	-0.0119 (0.010)	-0.0118 (0.010)	-0.0119 (0.010)
Size (log employment)	-3.037*** (1.132)	-3.216*** (0.957)	-3.222*** (1.078)	-3.124*** (1.032)	-0.247*** (0.091)	-0.267*** (0.093)	-0.266*** (0.093)	-0.266*** (0.093)
(log) Capital intensity	-0.326 (0.375)	-0.256 (0.375)	-0.25 (0.386)	-0.251 (0.379)	-0.168** (0.071)	-0.182** (0.072)	-0.182** (0.072)	-0.182** (0.072)
(log) Average real wage	-1.614* (0.868)	-1.033 (0.775)	-1.01 (0.845)	-0.976 (0.824)	-0.0157 (0.110)	0.175 (0.150)	0.174 (0.151)	0.176 (0.151)
(log) Number of products	-0.074 (0.650)	-0.183 (0.661)	-0.0875 (0.676)	0.0323 (0.673)	-0.144 (0.163)	-0.147 (0.167)	-0.153 (0.175)	-0.142 (0.177)
Export status	-1.475 (0.958)	-1.337 (0.932)	-1.48 (0.965)	-1.429 (0.953)	0.292 (0.390)	0.225 (0.390)	0.227 (0.399)	0.211 (0.399)
(log) TFP	-2.112** (0.875)	-2.226** (0.890)	-2.163** (0.930)	-2.171** (0.915)	-0.671*** (0.247)	-0.653*** (0.251)	-0.651*** (0.251)	-0.649*** (0.251)
MFN output tariff		16.96 (16.06)	16.91 (16.53)	16.68 (16.24)		-2.312 (2.202)	-2.364 (2.255)	-2.292 (2.221)
MFN input tariff		5.750 (15.97)	4.585 (16.45)	4.169 (16.29)		5.503** (2.389)	5.537** (2.404)	5.488** (2.400)
NTB1			-2.433 (1.511)				0.0199 (0.258)	
(log) NTB2				-2.131* (1.293)				-0.0267 (0.227)
Observations	2,230	2,230	2,217	2,217	2,163	2,150	2,148	2,148

Notes: i) Dependent variable is Exit (=1 if firm exits in  $t+1$ ). ii) Standard errors in parentheses; \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10%.

Source: Authors' estimations.

**Table A3.19**  
**Logistic hazard models with unobserved heterogeneity 1983-2005**  
**Non-tradable and tradable industries**

	Non-tradable industries				Tradable industries			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age	-0.103*	-0.129*	-0.135*	-0.143*	-0.0366**	-0.0433***	-0.0515***	-0.0507***
	(0.061)	(0.073)	(0.075)	(0.074)	(0.015)	(0.016)	(0.018)	(0.019)
Size (log employment)	-3.568***	-4.123***	-4.116***	-4.184***	-1.621***	-1.692***	-1.892***	-1.918***
	(1.158)	(1.269)	(1.278)	(1.184)	(0.225)	(0.235)	(0.255)	(0.251)
(log) Capital intensity	-0.287	-0.350	-0.371	-0.418	-0.317***	-0.342***	-0.387***	-0.397***
	(0.244)	(0.272)	(0.284)	(0.292)	(0.090)	(0.094)	(0.107)	(0.110)
(log) Average real wage	-0.527	-0.308	-0.165	-0.113	-0.482***	-0.342**	-0.392**	-0.413**
	(0.535)	(0.642)	(0.651)	(0.670)	(0.149)	(0.156)	(0.173)	(0.177)
(log) Number of products	-0.417	-0.483	-0.715	-0.584	-0.406***	-0.414***	-0.343**	-0.240
	(0.555)	(0.619)	(0.662)	(0.664)	(0.142)	(0.145)	(0.160)	(0.165)
Export status	-0.844	-0.979	-0.761	-0.793	-0.390	-0.425*	-0.615**	-0.651**
	(0.857)	(0.930)	(0.920)	(0.938)	(0.245)	(0.249)	(0.277)	(0.283)
(log) TFP	-1.277*	-1.559*	-1.653**	-1.749**	-0.493***	-0.533***	-0.577***	-0.567***
	(0.737)	(0.837)	(0.842)	(0.842)	(0.109)	(0.113)	(0.126)	(0.128)
MFN output tariff		6.349	7.336	8.722		2.542	2.553	2.097
		(10.89)	(11.04)	(11.50)		(3.039)	(3.455)	(3.558)
MFN input tariff		2.738	-1.145	-4.745		1.225	1.059	1.231
		(13.51)	(13.70)	(14.14)		(3.310)	(3.772)	(3.882)
NTB1			-1.633**				-1.502***	
			(0.806)				(0.319)	
(log) NTB2				-2.139***				-1.494***
				(0.749)				(0.285)
Observations	2,991	2,991	2,985	2,985	12,991	12,886	12,847	12,847

Notes: i) Firms classified according to the trade orientation of the industry they belong to. ii) Dependent variable is Exit (=1 if firm exits in  $t+1$ ). iii) Standard errors in parentheses; \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10%.

Source: Authors' estimations.

**Table A3.20**  
**Logistic hazard models with unobserved heterogeneity 1983-2005**  
**Export-oriented, import-competing and intra-trade industries**

	Export-oriented industries				Import-competing industries				Intra-trade industries			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Age	-0.0176 (0.012)	-0.0206** (0.010)	-0.0206** (0.010)	-0.0202** (0.010)	-0.00577 (0.011)	-0.00961 (0.011)	-0.0107 (0.014)	-0.0104 (0.016)	-0.0561* (0.033)	-0.0573* (0.032)	-0.0775* (0.045)	-0.0684 (0.042)
Size (log employment)	-0.481** (0.209)	-0.503*** (0.135)	-0.505*** (0.137)	-0.488*** (0.138)	-0.985*** (0.220)	-1.042*** (0.237)	-1.277*** (0.284)	-1.363*** (0.305)	-1.575*** (0.388)	-1.556*** (0.393)	-2.024*** (0.514)	-1.935*** (0.483)
(log) Capital intensity	-0.176** (0.076)	-0.158*** (0.060)	-0.158*** (0.060)	-0.156*** (0.058)	-0.227*** (0.085)	-0.232*** (0.089)	-0.300*** (0.113)	-0.329*** (0.125)	-0.303* (0.174)	-0.361** (0.172)	-0.409* (0.229)	-0.369* (0.219)
(log) Average real wage	-0.0389 (0.094)	0.133 (0.122)	0.135 (0.122)	0.124 (0.122)	-0.0894 (0.115)	-0.0183 (0.143)	-0.035 (0.170)	-0.061 (0.182)	-0.635* (0.339)	-0.368 (0.333)	-0.562 (0.425)	-0.497 (0.399)
(log) Number of products	-0.0797 (0.116)	-0.109 (0.115)	-0.112 (0.125)	-0.0796 (0.131)	-0.425*** (0.158)	-0.416** (0.163)	-0.365* (0.189)	-0.294 (0.202)	-0.234 (0.280)	-0.22 (0.271)	-0.182 (0.334)	-0.124 (0.326)
Export status	0.269 (0.265)	0.221 (0.221)	0.224 (0.230)	0.179 (0.234)	-0.0904 (0.285)	-0.165 (0.297)	-0.34 (0.340)	-0.379 (0.357)	-1.025** (0.477)	-0.971** (0.463)	-1.332** (0.574)	-1.315** (0.560)
(log) TFP	-0.686*** (0.223)	-0.726*** (0.218)	-0.723*** (0.219)	-0.733*** (0.216)	-0.615*** (0.179)	-0.639*** (0.185)	-0.632*** (0.215)	-0.594*** (0.227)	-1.590*** (0.369)	-1.664*** (0.368)	-1.887*** (0.448)	-1.842*** (0.435)
MFN output tariff		0.213 (2.267)	0.186 (2.280)	0.187 (2.229)		-0.618 (2.929)	-1.766 (3.645)	-2.192 (3.970)		3.524 (5.287)	2.595 (6.778)	2.515 (6.552)
MFN input tariff		3.111 (2.330)	3.152 (2.374)	2.961 (2.336)		2.979 (3.564)	3.492 (4.407)	4.222 (4.793)		-0.469 (6.311)	1.979 (8.298)	1.374 (7.959)
NTB1			0.011 (0.201)				-1.443*** (0.404)				-2.172*** (0.710)	
(log) NTB2				-0.0679 (0.143)				-1.042*** (0.320)				-2.742*** (0.736)
Observations	3,656	3,627	3,625	3,625	5,141	5,121	5,093	5,093	4,194	4,138	4,129	4,129

Notes: i) Firms classified according to the trade orientation of the industry they belong to. ii) Dependent variable is Exit (=1 if firm exits in  $t+1$ ). iii) Standard errors in parentheses; \*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10%.

Source: Authors' estimations.