A portrait of success: Uruguayan firms in international trade

Adriana Peluffo[1]

Abstract

This article provides a portrait of firm heterogeneity in connection with international activities. We analyse the impact of the extensive margins of exports and imports and of trade with different types of partners on firms' performance, using detailed national customs and manufacturing firm survey data from Uruguay for the period 1997–2005. This is the first study to use customs data and analyse the extensive margins of trade and types of partner for Uruguayan firms. In line with previous studies, we find that trade is highly concentrated and that firms which both export and import show a superior performance. Furthermore, the product extensive margin of imports and the country extensive margin of exports have positive effects on two key variables: total factor productivity and employment. Where trade is concerned, lastly, firms trading with both high-income countries and Southern Common Market (MERCOSUR) partners are the best performers.

Keywords

International trade, business enterprises, manufacturing enterprises, employment, productivity, sales, trade statistics, case studies, Uruguay

JEL classification

F14, F16, J23, O33

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I. Introduction

Analysis of the microeconomic evidence since the mid-1990s shows that exporting firms are more productive and capital-intensive and pay higher wages than non-exporters, indicating a high level of heterogeneity in the performance of firms even within the same industry. These empirical findings hold for both developed countries (Bernard, Bradford Jensen and Lawrence, 1995; Bernard and Bradford Jensen, 1999) and developing ones (Yan Aw, Chung and Roberts, 2000; for Taiwan; De Loecker, 2007, for Slovenia; Clerides, Lach and Tybout, 1998, for Morocco, Mexico and Colombia; Álvarez and López, 2005, for Chile).

Because the strong association between exports and productivity within the same narrowly defined industry could not be explained by assuming representative firms as in previous trade models, so-called "new-new" trade models incorporating heterogeneity in firms' productivity were developed (Melitz, 2003; Bernard and others, 2003; Yeaple, 2005; Bernard, Redding and Schott, 2007; Melitz and Ottaviano, 2008). In these models, free trade permits the expansion of the most productive firms, which thus demand more labour, and this greater demand pushes wages up, so that the least productive firms shrink or exit the market. Since firms must incur sunk costs to export, only firms with high productivity can make positive profits in international markets. Moreover, assuming that sunk costs are specific to individual products and destination markets could explain why most exporters sell only a few products to a few countries (Chaney, 2008; Helpman, Melitz and Rubinstein, 2008).

Melitz's pioneering work was followed by new theoretical models that extended it in several directions. For instance, Yeaple (2005) allows firms to use two different types of technology with different fixed costs, Melitz and Ottaviano (2008) introduce asymmetries between trading countries, Kasahara and Rodrigue (2008), Kasahara and Lapham (2012) and Amiti and Davis (2012) introduce imports of intermediate inputs, Costantini and Melitz (2008) incorporate research and development activities that make productivity endogenous, and Bernard, Bradford Jensen and Schott (2006) and Bernard, Redding and Schott (2011) analyse firms working with multiple products and with multiple destinations (exporters) or origins (importers). In summary, more recent models aim to make the heterogeneity between firms endogenous by incorporating decisions relating to vertical integration (outsourcing) and investments in new technology, adjustments to the production mix and workforce qualifications.

Recently, some authors have pointed out that exports are only one part of the story, and that import activities must also be analysed for the nature of the heterogeneity between different firms to be understood (Halpern, Koren and Szeidl, 2015;[2] Bernard, Bradford Jensen and Schott, 2009; Kasahara and Rodrigue, 2008; Vogel and Wagner, 2010). Thanks to the availability of detailed transaction data, researchers were able to start analysing the role of imports, combining information on both the import and export sides (Bernard and others, 2009; Muûls and Pisu, 2009; Andersson, Lööf and Johansson, 2008; Tucci, 2005). These studies find a positive association between imports and firms' productivity. The better performance of importing firms may be due to the higher quality of imported inputs or to the transfer of knowledge embodied in imports. Like exporters, firms wishing to import may need to incur sunk costs to research foreign markets and learn about customs procedures before they can begin doing so. These research and learning processes require the accumulation of technological capabilities, which means that the association between imports and productivity could be the result of a self-selection mechanism. It could also be a case of learning by importing, with productivity gains resulting from the transfer of knowledge embodied in intermediate inputs and capital goods.

At the same time, there is evidence regarding the concentration of exports and imports among a few firms and their geographical concentration or diversification (Eaton, Kortum and Kramarz, 2004;

[2] Halpern, Koren and Szeidl (2015) develop an empirical model which suggests that importers have to incur fixed costs to establish business relationships with foreign suppliers. In this model, firms buy foreign inputs when these goods generate productivity gains sufficient to cover the fixed costs of importing.

Eaton and others, 2007; Bernard and others, 2007 and 2011; Mayer and Ottaviano, 2008; Muûls and Pisu, 2009). These studies show that the bulk of export volumes are accounted for by a handful of firms which export many products to many countries, while the large majority of firms sell only a few products to a limited number of foreign countries.

There are a number of studies for Uruguay (Carballo, Ottaviano and Martincus, 2018; Barboni and others, 2012; Peluffo, 2012) , but there has been no analysis of the extensive margins of trade for either imports or exports or of links with different partners.

The present study contributes to this flourishing literature by providing a detailed picture of internationalized Uruguayan manufacturing firms and their characteristics over the period 1997–2005. The novelty of this study lies in its analysis of the extensive margins of trade and the distribution of trade between different regions. This analysis relies on a new database merging data from economic surveys with firm-level administrative data from the National Customs Directorate. We first describe the pattern of concentration of imports and exports across firms and compare our results with studies for other economies. We then analyse the country and product extensive margins of trade for both exports and imports, i.e., diversification in terms of products and geographical markets. We supplement this with information on the development level of origin and destination markets (high-income countries, Latin American countries and MERCOSUR partners in particular), analysing whether the performance premium differs across markets. This, then, is the first study on Uruguay to analyse the extensive margins of exports and imports and the impact of trade with different regions on a number of firm performance measures. For completeness, we also present findings for trade status.

Summing up, this study portrays the heterogeneity of firms associated with international activities, showing the ways in which they differ from firms oriented exclusively towards the domestic market and the impact of trade flows in several dimensions: trade status, extensive margins of exports and imports, and trade with different partner countries. We estimate ordinary least squares and fixed effects panel regressions, allowing the results obtained to be compared with the findings for other countries on which similar studies exist (Aw, Chen and Roberts, 2001, for Taiwan; Muûls and Pisu, 2009, for Belgium; Vogel and Wagner, 2010, for Germany; Castellani, Serti and Tomasi, 2010, for Italy).

The paper is structured as follows. After this introduction, section II presents the data. Section III provides evidence for the degree of concentration in the extensive margins of exports and imports. Section IV reports on the association between firms' performance and their internationalization status, looking at country and product extensive margins and different markets. Lastly, section V presents some concluding remarks.

II. Data description

1. Database

This study relies on a new dataset consisting of a panel of firms and their trade activity over the period 1997–2005 that combines two different sources of data, namely firm-level data and administrative customs data.

The firm-level data come from the Economic Activity Survey carried out by the National Institute of Statistics (INE) of Uruguay for the years from 1997 to 2005. The surveys cover manufacturing firms with more than five workers. Each firm has a unique identification number allowing it to be followed over time. For each firm, INE collects data on production, value added, sales, employment, wages, exports, investment, capital, depreciation, energy usage and foreign ownership of equity, among other variables. In addition, each firm is classified according to its main activity at the four-digit International

Standard Industrial Classification (ISIC) level. All variables are deflated by specific price indices with base year 1997.[3] The administrative data, which we merge with those from the INE database, come from the National Customs Directorate, which records firms' exports by value and destination country. Export and import data are recorded by the National Customs Directorate at the year, firm, product and country level, i.e., they provide information on trade flows at the 10-digit level of the MERCOSUR Common Nomenclature, equivalent to the Harmonized Commodity Description and Coding System product classification, which we classify in 8-digit level in order to make international comparisons. The export destination and import origin countries are classified by development level and geoeconomic region according to the World Bank classification[4] for each year.[5]

We obtain an unbalanced panel for the period 1997–2005 with 6,330 total observations and 971 manufacturing firms, of which 649 exported and 840 imported at least once in the period, according to the National Customs Directorate data.[6]

We estimate total factor productivity (TFP) by the methodologies of (Ackerberg, Caves and Frazer, 2015) (hereinafter the ACF technique) and Levinsohn and Petrin (2003) (hereinafter the LP technique), using value added and assuming a Cobb-Douglas production function.[7] Labour productivity is defined as value added over total employment, and we use two measures to proxy skilled labour: the white-collar share of total employment and the professional and technical share of total employment.

2. Some stylized facts

As table 1 shows, 56% of the firms in the pooled sample were exporters and 83% importers in the period 1997–2005. Table 1 also gives Gini index values for the different variables.[8] Thus, manufacturing firms in Uruguay, like those in Italy and Sweden, seem to be much more internationalized than United States firms and tend to import more. The country most similar to Uruguay in terms of openness seems to be Sweden.

Our results regarding concentration are similar to those of empirical studies on developed countries: trade is more concentrated than employment or sales. For Uruguay, exports are slightly more concentrated than imports, which could point to fixed costs being higher for exports than for imports. Lastly, Uruguay exhibits lower concentration indices than any of the earlier studies.

Table 2 presents shares of firms by internationalization status. We break down the sample into four categories: (i) non-trading firms (domestic), (ii) firms that import and export (two-way traders), (iii) firms that export but do not import (export-only) and (iv) firms that import but do not export (import-only).

We observe that a large share of firms are engaged in both export and import activities (more than 50%). In addition, nearly one third of firms import but do not export (29%), while only 3% of firms export but do not import. Thus, most exporters are also importers. We also note that a larger proportion of manufacturing firms are importers than exporters, which could indicate that sunk costs are smaller for importing than for exporting.

[3] The specific price indices were estimated and provided by Susana Picardo of the Department of Economics at the University of the Republic, Uruguay.

[4] Uruguay belonged to the group of medium-high-income countries over the period concerned.

[5] These data are strictly confidential but not exclusive. They can be used by researchers under a contract with INE. The code used for this study is available from the author on request.

[6] Annex A1 presents the number of firms by year.

[7] See annex A2 for more details on the estimation of TFP.

[8] The Gini index is a measure of statistical dispersion and is commonly used to represent the income distribution of a nation's residents. A Gini index of 0 expresses perfect equality in which all values are the same, while a Gini index of 1 expresses maximal inequality among values.

Table 1
International trade participation and concentration

	Uruguay	Italy	United States	Sweden	Belgium
Exporting firms *(Percentages)*	52.70	71	27	71	41.2
Importing firms *(Percentages)*	83.70	69	14	60	43.2
Gini of exports	0.82	0.825	0.972	n/a	0.959
Gini of imports	0.78	0.899	0.965	n/a	0.956
Gini of sales	0.73	0.807	0.916	n/a	0.873 (value added)
Source	This paper, using firm-level data for 1997 on manufacturers with 5 or more workers	Castellani, Serti and Tomasi (2010), using firm-level data for 1997 on manufacturers with 20 or more workers	Bernard and others (2007), using plant-level data for 2002 on all manufacturers	Andersson, Lööf and Johansson (2008), using firm-level data for 2004 on manufacturers with 10 or more workers	Muûls and Pisu (2009), using firm-level data for 1996 on all manufacturers
Gini of value added	0.898				
Gini of employment	0.549				

Source: Prepared by the author, on the basis of M. Andersson, H. Lööf and S. Johansson, "Productivity and international trade: firm level evidence from a small open economy", *Review of World Economics*, vol. 144, No. 4, 2008; A. B. Bernard and others, "Firms in international trade", *Journal of Economic Perspectives*, vol. 21, No. 3, 2007; D. Castellani, F. Serti and C. Tomasi, "Firms in international trade: importers' and exporters' heterogeneity in Italian manufacturing industry", *The World Economy*, vol. 33, No. 3, 2010; M. Muûls and M. Pisu, "Imports and Exports at the level of the firm: evidence from Belgium", *The World Economy*, vol. 32, No. 5, 2009; and data from the National Institute of Statistics and National Customs Directorate.

Table 2
Shares of firms by internationalization status, 1997–2005

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
Exporters	6 330	0.5517	0.4974	0	1
Importers of intermediates	5 553	0.4914	0.5000	0	1
Importers of intermediates, capital goods or both	6 330	0.8155	0.3879	0	1
Two-way traders	6 330	0.5253	0.4994	0	1
Export-only firms (do not import)	6 330	0.0299	0.1702	0	1
Import-only firms (do not export)	6 330	0.2902	0.4539	0	1
Domestic firms	6 330	0.1547	0.3616	0	1

Source: Prepared by the author, on the basis of data from the National Customs Directorate.

Since the Annual Survey of Economic Activities records firms' imported inputs by type, we can also distinguish importers of intermediate inputs. As expected, we find that the figure for these imports is lower than the overall figure, since imports may be of intermediate, capital or final goods.

Lastly, we find a slight decline in the proportion of import-only firms and two-way traders and a slight increase in that of domestic firms over the period 1997–2005. In 2005, however, the Uruguayan economy was only just returning to growth after the economic and financial crisis of 2002, so a longer period would be needed to accurately capture the evolution of firms' internationalization.

The distribution of the various types of trader varies between sectors. Table 3 presents the percentages of firms by trade status and by industry at the two-digit ISIC level. Great heterogeneity of status can be observed between the various sectors. For instance, if we take the food and beverage industry, a sector in which the country has traditional comparative advantages, nearly 50% of firms are two-way traders, 24% importers only and 24% domestic, while in the electrical machinery sector 45% of firms are two-way traders, 45% importers only and 6% exclusively domestic, and none are export-only firms.

Table 3
Trade status by sector, pooled sample, 1997–2005
(Percentages and number of firms)

Sector	Sector in International Standard Industrial Classification (ISIC), **revision 3**	Two-way traders[a]	Exporters only	Importers only	Exporters	Importers	Domestic[b]	Foreign-owned	Number of firms
Food and beverages	15	47.54	4.18	24.19	51.67	71.73	24.09	12.32	1 914
Tobacco	16	96.15	0.00	3.85	80.77	100.00	0.00	38.46	26
Textiles	17	70.57	3.12	22.03	73.10	92.59	4.29	6.35	513
Wearing apparel	18	59.57	1.49	28.94	60.21	88.51	10.00	2.84	470
Leather and allied products	19	73.86	6.25	14.20	78.41	88.07	5.68	15.19	176
Wood manufacturing	20	30.46	6.32	35.63	36.21	66.09	27.59	2.91	174
Paper and allied products	21	49.53	3.74	40.19	55.14	89.72	6.54	20.56	107
Printing and publishing	22	36.81	1.84	38.65	39.26	75.46	22.70	7.72	326
Chemical products	24	65.19	0.48	27.87	64.35	93.06	6.46	25.35	836
Rubber and plastics	25	58.48	2.42	28.79	60.30	87.27	10.3	11.65	330
Non-metallic mineral products	26	33.20	7.29	36.84	36.84	70.04	22.67	10.29	247
Basic metals	27	68.00	1.33	22.67	69.33	90.67	8.00	19.72	75
Metal products	28	31.39	2.59	44.98	35.28	76.38	21.04	6.83	309
Industrial machinery	29	51.39	0.00	36.81	54.17	88.19	11.81	18.11	144
Office machinery	30	57.14	0.00	42.86	57.14	100.00	0.00	14.29	7
Electrical machinery	31	49.66	0.00	44.83	49.66	94.48	5.52	11.81	145
Radio, television, etc.	32	64	0.00	32.00	68.00	96.00	4.00	24.00	25
Medical, precision and optical instruments	33	54.95	0.90	30.63	53.15	85.59	13.51	12.15	111
Motor vehicles	34	67.88	3.65	24.09	71.53	91.97	4.38	25.55	137
Other transport equipment	35	47.69	4.62	24.62	55.38	72.31	23.08	12.31	65
Furniture manufacturing	36	35.68	3.24	43.24	41.08	78.92	17.84	5.75	185
Recycling	37	100.00	0.00	0.00	100.00	100.00	0.00	0.00	7
Total		52.53	2.99	29.02	55.17	81.55	15.47	12.58	6 330

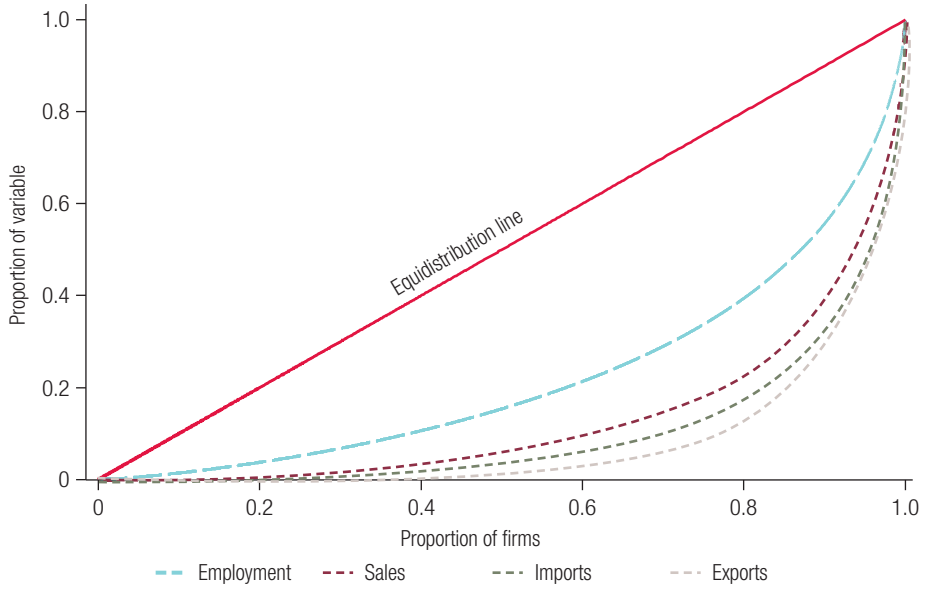
Source: Prepared by the author, on the basis of data from the National Customs Directorate.
[a] Firms that both export and import intermediate, capital or final goods.
[b] Firms that neither export nor import.

III. The concentration of international trading activities

The empirical evidence on international trade shows that a few firms account for a large volume of aggregate trade (Bernard and others, 2007, for the United States; Mayer and Ottaviano, 2008, for six European countries).[9] As table 1 showed, in line with previous empirical studies for developed countries, the international trade of Uruguayan firms, as measured by the Gini index, is more concentrated than employment or sales. In particular, Uruguayan exports are slightly more concentrated than imports at the firm level, which could point to fixed export costs being higher than fixed import costs. The concentration indices found for Uruguay are lower than those in the studies for the other countries.

Figure 1 presents the Lorenz curve for the pooled sample over the period 1997–2005. The Lorenz curve plots the shares of the cumulative value of given variables (in this case employment, sales, imports and exports) accounted for by a cumulative proportion of firms. The closer the Lorenz curve is to the equidistribution line, the lower the degree of concentration. It can be observed that trade is more concentrated than sales or employment, while exports are more concentrated than imports.

Figure 1
Lorenz curves for exports, imports, employment and sales, 1997–2005



Source: Prepared by the author, on the basis of data from the National Institute of Statistics and National Customs Directorate.

1. Concentration within and between industries

Trade concentration may be due to a between-industry effect (exports and imports are concentrated in a few sectors) or a within-industry effect (some firms within a sector account for the bulk of trade). The first effect exemplifies traditional comparative advantage theory, while the second exemplifies Melitz's model of trade in the presence of firm heterogeneity.

[9] Mayer and Ottaviano (2008) report that the top 5% of exporters account for more than 70% of exports in five out of six countries analysed.

Table 4 presents the Gini and Theil coefficients for Uruguayan manufacturing firms' exports, imports, sales and employment in 1997 and 2005 and for the whole period, table 5 presents them for the whole period by sector and table 6 presents the decomposition of the Theil index between and within sectors. An increasing concentration can be observed over the period for all four variables analysed, although exports and imports are much more concentrated than sales, and employment exhibits the lowest concentration.

Table 4
Gini and Theil coefficients for Uruguayan trade, employment and sales, 1997, 2005 and 1997–2005 averages

Variable	1997		2005		1997–2005	
	Gini	Theil	Gini	Theil	Gini	Theil
Exports	0.81328	1.44081	0.84257	1.60294	0.82085	1.47077
Imports	0.76104	1.24099	0.80675	1.46864	0.78738	1.36530
Employment	0.54440	0.58589	0.55058	0.61708	0.54830	0.59889
Sales	0.71558	1.12974	0.75008	1.21567	0.73079	1.14934

Source: Prepared by the author, on the basis of data from the National Institute of Statistics and National Customs Directorate.

Table 5
Theil coefficients for Uruguayan trade, employment and sales, by sector, 1997–2005 averages

Sector	Exports	Imports	Employees	Sales
Food and beverages	1.278	1.409	0.674	1.103
Tobacco	0.622	0.527	0.349	0.493
Textiles	0.925	0.890	0.493	1.026
Wearing apparel	0.827	0.840	0.333	0.535
Leather and allied products	1.128	1.324	0.573	1.116
Wood manufacturing	0.928	1.057	0.289	1.399
Paper and allied products	1.026	0.851	0.646	0.840
Printing and publishing	1.265	0.996	0.523	0.728
Chemical products	1.322	1.020	0.299	0.662
Rubber and plastics	1.533	1.244	0.540	0.946
Non-metallic mineral products	1.236	1.080	0.786	0.984
Basic metals	0.759	0.707	0.288	0.567
Metal products	1.902	1.448	0.312	0.669
Industrial machinery	1.235	1.142	0.269	0.648
Office machinery	0.210	0.928	0.230	0.383
Electrical machinery	0.942	0.738	0.413	0.585
Radio, television, etc.	0.364	1.134	0.226	0.913
Medical, precision and optical instruments	1.017	0.684	0.271	0.363
Motor vehicles	1.091	1.243	0.298	1.108
Other transport equipment	1.035	0.954	0.586	0.715
Furniture manufacturing	1.631	1.572	0.565	1.074
Recycling	0.998	0.126	0.419	1.101

Source: Prepared by the author, on the basis of data from the National Institute of Statistics and National Customs Directorate.

Table 6
Decomposition of the Theil index into between-sector and within-sector variations

	Theil coefficient		Between sectors *(Percentages)*		Within sectors *(Percentages)*	
	1997	2005	1997	2005	1997	2005
Exports	1.441	1.603	21.2	18.9	78.8	81.1
Imports	1.241	1.469	14.2	18.2	85.8	81.8
Employees	0.586	0.617	7.5	11.7	92.5	88.3
Sales	1.130	1.216	18.5	16.4	81.5	83.6

Source: Prepared by the author, on the basis of data from the National Institute of Statistics and National Customs Directorate.

We exploit the ability to decompose the Theil index into between-sector and within-sector components to ascertain whether trade concentration is due to sectoral trade specialization or is a feature that holds for each sector. We find that within-sector inequality explains much more than between-sector inequality, confirming that firms' heterogeneity is more important than sectoral differences, which provides support for the "new-new" trade theories.

2. Concentration along the extensive margin

It has been observed that international trade is concentrated not only at the level of firms, with a small number of firms accounting for most exports and imports, but also along the product and country extensive margins of trade.[10] These results have been confirmed for several countries, such as Slovenia (Damijan, Jaklič and Rojec, 2006), Belgium (Muûls and Pisu, 2009), Sweden (Andersson, Lööf and Johansson, 2008) and the United States (Bernard and others, 2007). These last three studies also analyse imports and find a negative relationship between the number of countries from which firms import (country extensive margin of imports) and the number of firms importing from those markets. Similar results have been found along the product extensive margin: many firms export (import) few products, while a small number of firms trade a variety of different products. These stylized facts are also found in the case of trading Uruguayan manufacturing firms.

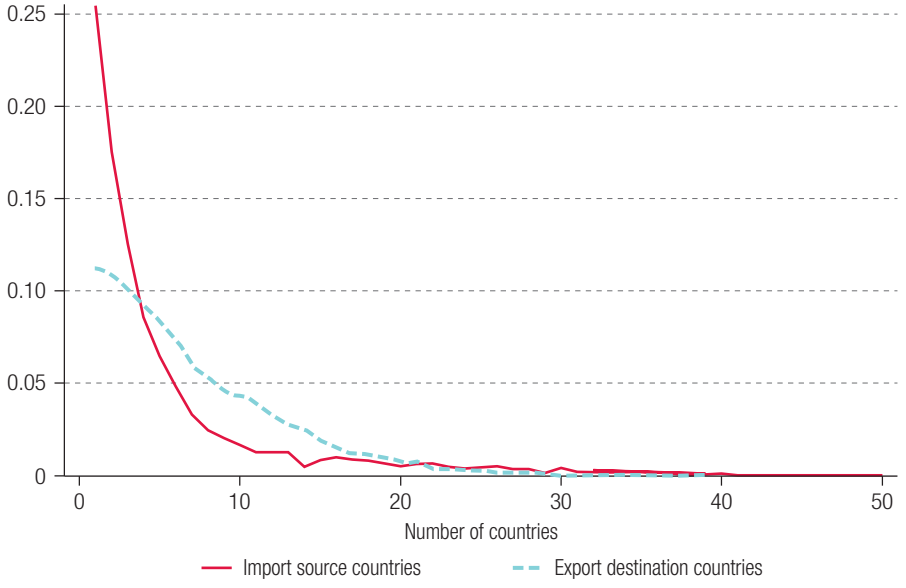
Figure 2 plots the frequency of firms against the number of destination countries for exports and the number of source countries for imports, i.e., the country extensive margins of exports and imports, respectively, for the period 1997–2005. As can be observed from the chart, the frequency of firms declines as the number of countries traded with increases, meaning that only a few firms trade with a number of countries while most firms trade with very few.

We then consider the number of products traded, i.e., the product extensive margins of exports and imports, identified using the MERCOSUR Common Nomenclature. The picture that emerges is that exports are much less diversified than imports (see figure 3).

By way of comparison with the international literature, Muûls and Pisu (2009) reported that the average Belgian firm exported 12 products and imported 34, while Bernard, Bradford Jensen and Schott (2006) reported that the average United States firm exported 8.9 products and imported 10.

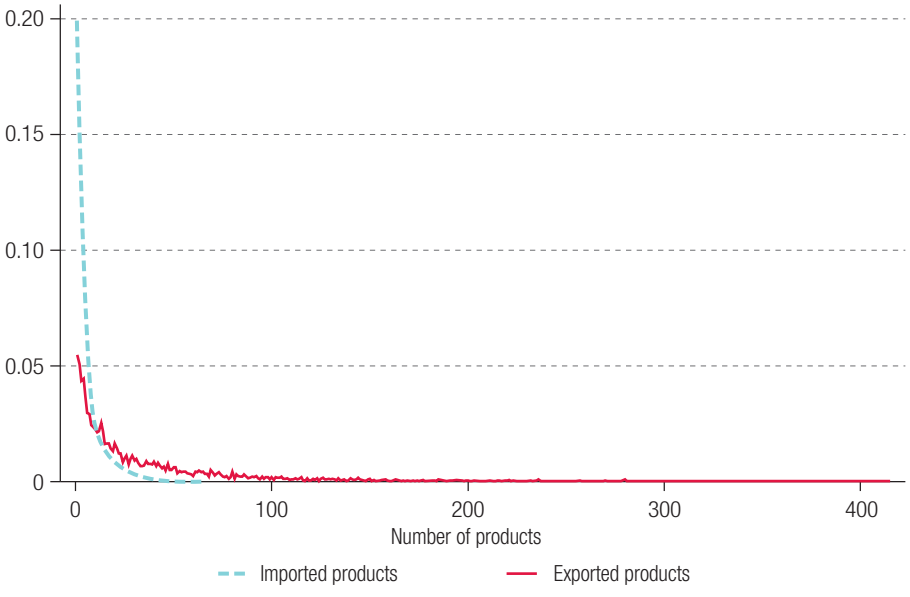
[10] The extensive margin of exports (imports) refers to the number of firms involved in exporting (importing), while the product and country extensive margins refer to the number of products and countries in and with which a firm trades and can be thought of as a measure of geographical and product diversification. Mayer and Ottaviano (2008) discuss this definition, and Bernard and others (2009) propose a different method of measurement.

Figure 2
Country extensive margins of exports and imports, 1997–2005



Source: Prepared by the author, on the basis of data from the National Institute of Statistics and National Customs Directorate.

Figure 3
Product extensive margins of exports and imports at the eight-digit level of the MERCOSUR Common Nomenclature, 1997–2005



Source: Prepared by the author, on the basis of data from the National Institute of Statistics and National Customs Directorate.

Thus, the number of products exported (product extensive margin of exports) in Uruguay is lower than in Belgium or the United States but higher than in France (Eaton and others, 2007). Regarding the number of products imported (product extensive margin of imports), the figure for Uruguay is lower than for Belgium and higher than for the United States.

IV. Firm heterogeneity and international trade

1. Firms' characteristics and internationalization status

Most empirical analysis of the characteristics of internationalized firms focuses on exporting firms, which have been shown to outperform non-exporters. The empirical evidence indicates that in most cases this could be the result of a self-selection effect whereby the best-performing firms are able to bear the sunk costs associated with exporting. More recently, some studies also show evidence of learning by exporting (Van Biesebroeck, 2007; Fernandes and Isgut, 2007; Lileeva and Trefler, 2010).

Firms' characteristics in relation to import behaviour have been less explored. Some authors (Castellani, Serti and Tomasi, 2010; Muûls and Pisu, 2009; Bernard, Redding and Schott, 2011) have shown that importers exhibit characteristics similar to those observed for exporters. The positive association between importing activities and firms' performance suggests the existence of fixed costs of entry into the import market. As in the case of exports, this could be a self-selection process whereby only the most efficient firms can afford to enter the import market.

Halpern, Koren and Szeidl (2015) developed an empirical model in which imports were associated with productivity improvements through two main channels: the higher quality of imported goods and imperfect substitution between foreign and domestic inputs. In this model, importers have to pay a fixed cost every time they buy a new foreign variety of intermediates, so they will buy those varieties only when the productivity gain outweighs the fixed cost of importing.

Table 7 provides some descriptive statistics for firms by internationalization status.

Table 7
Descriptive statistics for firms by internalization status, 1997–2005

	Two-way	Export-only	Import-only	Domestic	Total
Employment *(Average number of workers per firm)*	135.0	57.0	55.0	42.0	95.0
Sales *(Millions of constant pesos)*	136.0	25.4	26.1	19.8	83.8
Ln ACF TFP[a]	8.13	7.82	7.87	7.79	8.0
Ln LP TFP[b]	10.83	10.41	10.56	10.34	10.67
Capital intensity (capital over number of workers in firm) *(Thousands of constant pesos)*	312.73	193.68	156.74	111.46	235.82
Labour productivity (value added over total works in firm) *(Thousands of constant pesos)*	276.4	162.22	175.2	196.11	231.25
Multinational firms *(Percentages)*	20.14	2.23	4.43	3.07	12.58
Skilled labour: white-collar workers *(Share of total)*	0.245	0.188	0.3032	0.2903	0.2671
Skilled labour: professionals and technicians *(Share of total)*	0.078	0.0451	0.067	0.0604	0.0712

Source: Prepared by the author, on the basis of data from the National Institute of Statistics and National Customs Directorate, using the methodologies of D. A. Ackerberg, K. Caves and G. Frazer, "Identification properties of recent production function estimators", *Econometrica*, vol. 83, No. 6, 2015; and J. A. Levinsohn and A. Petrin, "Estimating production functions using inputs to control for unobservables", *The Review of Economic Studies*, vol. 70, No. 2, 2003.

[a] Natural logarithms of total factor productivity estimated using the Ackerberg, Caves and Frazer (2015) methodology.

[b] Natural logarithms of total factor productivity estimated using the Levinsohn and Petrin (2003) methodology.

In line with previous studies, we find that domestic firms are smaller in terms of employment and sales, are less capital-intensive and exhibit lower productivity than internationalized firms. Among the group of traders, two-way traders outperform firms engaged only in exporting or importing. Thus, increasing global involvement is associated with better performance. Furthermore, we observe that firms which only export are more productive, bigger and more capital-intensive than firms which only import.

The latter fall somewhere between export-only and domestic firms, being bigger in terms of employment and sales and presenting higher capital intensity and TFP than domestic firms. This may be explained by the fact that import-only firms sell domestically and import mostly from the region and from a relatively small number of source markets (see table 8). Regarding skilled labour, we observe that import-only and domestic firms employ the most white-collar workers, while two-way traders followed by import-only firms employee the largest shares of professionals and technicians. In addition, two-way traders include the largest proportion of multinational firms, as expected.

Table 8
Some features of firms that import without exporting, 1997–2005

Firms that only import	Ln ACF TFP[a]	Employment *(Average number of workers per firm)*	Number of products imported	Number of source countries	Share of imports from MERCOSUR partners	Share of imports from high-income countries (OECD)
0	8.06	111	45	9	0.4658	0.3790
1	7.87	55	16	4	0.5386	0.3313
Total	8.00	95	34	7	0.4917	0.3620

Source: Prepared by the author, on the basis of data from the National Institute of Statistics and National Customs Directorate.
[a] Natural logarithms of total factor productivity estimated using the Ackerberg, Caves and Frazer (2015) methodology.

2. Performance premiums and trading status

We shall now consider the association between trading status and firm heterogeneity in performance, i.e., the performance premium by trading status. To this end, we estimate the following equation:

$$y_{it} = \alpha_A + \beta_A D_{it}^{TW} + Y_A D_{it}^{IO} + \Phi_A D_{it}^{EO} + \Theta_A C_{it} + v_{it} \quad (1)$$

where y_{it} denotes the natural logarithm of sales, employment, TFP measured using the Ackerberg, Caves and Frazer (2015) and Levinsohn and Petrin (2003) methodologies, labour, and capital intensity. The dummy variables denote the internationalization status of firms, with D^{TW} being a dummy equal to one for two-way traders, D^{IO} standing for import-only firms and D^{EO} standing for export-only firms. C stands for controls and denotes a vector of firm characteristics: industry and year dummies and binary variables indicating whether firms are multinational, medium-sized or large.

Table 9 presents the results for the pooled ordinary least squares (OLS) estimation, while in table 10 we control for fixed effects by firm. The coefficients β_A, Y_A and θ_A tell us the average premiums of the three categories of internationalized firms relative to domestic ones. We note that these are just associations and do not have a causal interpretation.

Table 9
Performance premiums by trade status, pooled ordinary least squares estimations

Variable	(1) Ln ACF TFP	(2) Ln LP TFP	(3) Ln labour productivity	(4) Ln Sales	(5) Ln EMP	(6) Ln KINT	(7) SL1	(8) SL2
Two-way traders	0.194***	0.289***	0.568***	1.844***	1.003***	1.297***	-0.0272***	0.0172***
	(0.0293)	(0.041)	(0.0401)	(0.0512)	(0.0324)	(0.064)	(0.00989)	(0.00346)
Import-only firms	0.0573**	0.200***	0.371***	0.851***	0.382***	0.831***	0.0237**	0.00236
	(0.0274)	(0.0382)	(0.0367)	(0.0499)	(0.0318)	(0.0621)	(0.0101)	(0.0033)
Export-only firms	-0.0116	0.0945	0.225***	0.416***	0.146**	0.684***	-0.0733***	-0.00918*
	(0.0587)	(0.089)	(0.082)	(0.102)	(0.0664)	(0.118)	(0.014)	(0.00492)
Multinational firms	0.281***	0.407***	0.549***	0.872***	0.306***	0.523***	0.0398***	0.0359***
	(0.0265)	(0.0401)	(0.0413)	(0.0518)	(0.0353)	(0.047)	(0.00749)	(0.00422)
Medium-sized firms	0.0341*	0.155***	0.0187			0.0576	-0.0290***	-0.0261***
	(0.0194)	(0.0289)	(0.0287)			(0.0387)	(0.00663)	(0.00241)

Table 9 (concluded)

Variable	(1) Ln ACF TFP	(2) Ln LP TFP	(3) Ln labour productivity	(4) Ln Sales	(5) Ln EMP	(6) Ln KINT	(7) SL1	(8) SL2
Large firms	0.122***	0.288***	0.0880***			0.220***	-0.0495***	-0.0345***
	(0.0212)	(0.0309)	(0.0325)			(0.0409)	(0.00698)	(0.00312)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	7.893***	9.986***	10.95***	16.25***	3.953***	10.26***	0.186***	0.0491***
	(0.0377)	(0.0552)	(0.0529)	(0.0772)	(0.0525)	(0.0808)	(0.012)	(0.00408)
Observations	4 537	4 973	5 612	5 442	6 068	5 704	6 049	5 454
R-squared	0.271	0.301	0.377	0.445	0.296	0.354	0.173	0.237

Source: Prepared by the author, on the basis of data from the National Institute of Statistics and National Customs Directorate, using the methodologies of D. A. Ackerberg, K. Caves and G. Frazer, "Identification properties of recent production function estimators", *Econometrica*, vol. 83, No. 6, 2015; and J. A. Levinsohn and A. Petrin, "Estimating production functions using inputs to control for unobservables", *The Review of Economic Studies*, vol. 70, No. 2, 2003.

Note: Ln ACF TFP: natural logarithms of total factor productivity estimated using the Ackerberg, Caves and Frazer (2015) methodology; Ln LP TFP: natural logarithms of total factor productivity estimated using the Levinsohn and Petrin (2003) methodology; Ln labour productivity: natural logarithms of labour productivity; Ln Sales: natural logarithms of total sales per firm; Ln EMP: natural logarithms of total number of workers per firm; Ln KINT: natural logarithms of capital intensity; SL1: number of white-collar workers as a proportion of all workers; SL2: number of professionals and technicians as a proportion of all workers. Robust standard errors in parentheses; *** p < 0.01, ** p < 0.05, * p < 0.1.

Table 10
Performance premiums by trade status, estimations of fixed effects by firm

Variable	(1) Ln ACF TFP	(2) Ln LP TFP	(3) Ln labour productivity	(4) Ln Sales	(5) Ln EMP	(6) Ln KINT	(7) SL1	(8) SL2
Two-way traders	0.185***	0.184***	0.183***	0.519***	0.317***	0.0581	-0.0112	-0.00265
	(0.0282)	(0.0588)	(0.0537)	(0.0422)	(0.0271)	(0.0479)	(0.00831)	(0.00399)
Import-only firms	0.133***	0.133**	0.126***	0.276***	0.172***	0.0457	-0.00802	0.00184
	(0.0255)	(0.0521)	(0.047)	(0.0377)	(0.0241)	(0.0427)	(0.00736)	(0.00354)
Export-only firms	0.0308	0.127	0.166**	0.0865	0.109***	0.00558	-0.0129	-0.00825
	(0.0394)	(0.0819)	(0.0768)	(0.0611)	(0.0384)	(0.0673)	(0.0117)	(0.00574)
Multinational firms	0.0278	-0.0124	0.00149	0.0344	-0.0106	0.00639	-0.0165	-0.00916*
	(0.0318)	(0.0712)	(0.0663)	(0.0504)	(0.0332)	(0.0558)	(0.0101)	(0.00475)
Medium-sized firms	0.0107	0.0374	-0.178***			-0.285***	-0.0341***	-0.0168***
	(0.0191)	(0.04)	(0.0365)			(0.0316)	(0.00558)	(0.0027)
Large firms	0.0431	0.136**	-0.304***			-0.593***	-0.0795***	-0.0290***
	(0.0282)	(0.0607	(0.0559)			(0.0474)	(0.00842)	(0.00405)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	8.124***	10.39***	11.56***	16.90***	3.727***	11.79***	0.293***	0.0812***
	(0.144)	(0.597)	(0.471)	(0.218)	(0.146)	(0.244)	(0.0445)	(0.0205)
Observations	4 537	4 973	5 612	5 442	6 068	5 704	6 049	5 454
Number of firms	822	869	918	927	929	912	928	928

Source: Prepared by the author, on the basis of data from the National Institute of Statistics and National Customs Directorate, using the methodologies of D. A. Ackerberg, K. Caves and G. Frazer, "Identification properties of recent production function estimators", *Econometrica*, vol. 83, No. 6, 2015; and J. A. Levinsohn and A. Petrin, "Estimating production functions using inputs to control for unobservables", *The Review of Economic Studies*, vol. 70, No. 2, 2003.

Note: Ln ACF TFP: natural logarithms of total factor productivity estimated using the Ackerberg, Caves and Frazer (2015) methodology; Ln LP TFP: natural logarithms of total factor productivity estimated using the Levinsohn and Petrin (2003) methodology; Ln labour productivity: natural logarithms of labour productivity; Ln Sales: natural logarithms of total sales per firm; Ln EMP: natural logarithms of total number of workers per firm; Ln KINT: natural logarithms of capital intensity; SL1: number of white-collar workers as a proportion of all workers; SL2: number of professionals and technicians as a proportion of all workers. Robust standard errors in parentheses; *** p < 0.01, ** p < 0.05, * p < 0.1.

The results for the pooled OLS regressions show significant heterogeneity in productivity, size and capital intensity between firms with different degrees of internationalization. Firms with international linkages are more productive, larger and more capital-intensive than domestic firms. Furthermore, there is a hierarchy among traders: two-way traders are the firms with the highest premiums, followed by importers and exporters. With regard to skilled labour, the evidence is mixed. On the one hand, there is a negative association between two-way trading and the share of white-collar workers in total employment (SL1), but on the other hand there is a positive association between two-way trading and the share of professionals and technicians in total employment (SL2).

When we consider the regressions with fixed effects by firm, the differences between internationalized firms and domestic ones are smaller (see table 7). Nevertheless, two-way traders continue to show the highest premiums in respect of productivity, employment and sales.

Thus, we have shown that a few firms account for the vast bulk of trade, and that these firms are larger, more productive and more capital-intensive than others. While two-way traders are the best performers, both importers and exporters show a better performance than domestic firms. Also, there is some evidence that export entry costs are higher than import entry costs: the proportion of exporters is small, but at the same time the regressions seem to show that importers have a higher productivity premium. However, this higher productivity could also be the result of learning by importing. More research is needed on the issue.

3. Performance premiums and the extensive margins of trade

We shall now analyse firm heterogeneity along the country and product extensive margins of trade. To this end, we estimate the following equation:

$$y_{it} = \alpha + \lambda_1 x_{it}^{EME} + \lambda_2 x_{it}^{EMI} + \phi \mathrm{C}_{\mathrm{it}} + \upsilon_{it} \quad (2)$$

where y_{it} is a measure of productivity, size or capital intensity in natural logarithms. We present the results for the extensive margins of trade (exports and imports) calculated as the product of the product and market extensive margins of imports expressed in natural logarithms. For exports, we also take the interaction of the number of products and markets as the extensive margin of exports, following Bernard and others (2009).[11] C is a vector of controls that includes foreign ownership of capital, firm size, and industry and time dummies.

When we express our dependent and explanatory variables (EME is the extensive margin of exports and EMI the extensive margin of imports) in logarithms, the estimates are the elasticities, which are the premiums due to the extensive margins of exports and imports.[12]

Table 11 reports the results for pooled OLS.

Even after controlling for firm size, foreign ownership of equity, industry and year effects, we observe a positive premium for the extensive margin of imports on all the performance variables considered except the share of white-collar workers. For the extensive margin of exports, we find a positive association with productivity, sales, total employment and capital intensity, a negative association with the share and number of white-collar workers, and no significant association with the share of professionals and technicians.

Table 12 presents the results after controlling for fixed effects by firm, i.e., for unobserved time-invariant heterogeneity.

[11] We also calculated the extensive margins as logarithms of the number of products exported (NPE), the number of products imported (NPI), the number of countries exported to (NCE) and the number of countries imported from (NCI), as in Castellani, Serti and Tomasi (2010). Results are available upon request.

[12] To obtain the elasticity for skilled labour (SL1 and SL2), we have to calculate $(1-exp^{\alpha})$.

Table 11
Performance premiums along the extensive margins, pooled ordinary least squares estimations

Variable	(1) Ln ACF TFP	(2) Ln LP TFP	(3) Ln labour productivity	(4) Ln Sales	(5) Ln EMP	(6) Ln KINT	(7) Ln SL1	(8) Ln SL2	(9) Ln WC	(10) Ln P&T
Extensive margin of imports	0.0503***	0.0756***	0.107***	0.254***	0.142***	0.0975***	0.0442***	-0.00982	0.107***	0.0767***
	(0.00583)	(0.0101)	(0.0102)	(0.00968)	(0.00708)	(0.0112)	(0.00643)	(0.0109)	(0.00771)	(0.0114)
Extensive margin of exports	0.0627***	0.0384***	0.0433***	0.205***	0.105***	0.0803***	-0.0732***	-0.0126	-0.0280***	0.0548***
	(0.00474)	(0.00756)	(0.00782)	(0.00814)	(0.00598)	(0.00869)	(0.00526)	(0.00848)	(0.00635)	(0.00896)
Multinational firms	0.145***	0.202***	0.306***	0.285***	0.0189	0.390***	0.0396	0.456***	0.0158	0.400***
	(0.0279)	(0.0493)	(0.0495)	(0.0465)	(0.0383)	(0.0533)	(0.0331)	(0.0552)	(0.0379)	(0.0565)
Medium-sized firms	-0.0510*	0.0407	-0.0722			0.0233			0.661***	0.317***
	(0.0296)	(0.0498)	(0.0501)			(0.0547)			(0.0371)	(0.0561)
Large firms	-0.0757**	0.0707	-0.180***			-0.105*			1.461***	0.880***
	(0.0322)	(0.055)	(0.0576)			(0.0586)			(0.0429)	(0.0619)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	6.796***	8.518***	9.229***	12.04***	1.860***	9.925***	-1.814***	-4.002***	0.794***	-1.382***
	(0.0987)	(0.177)	(0.174)	(0.166)	(0.123)	(0.185)	(0.118)	(0.176)	(0.138)	(0.194)
Observations	2 184	2 223	2 439	2 491	2 814	2 663	2 738	1 579	2 738	1 579
R-squared	0.373	0.379	0.468	0.653	0.424	0.399	0.346	0.382	0.539	0.413

Source: Prepared by the author, on the basis of data from the National Institute of Statistics and National Customs Directorate, using the methodologies of D. A. Ackerberg, K. Caves and G. Frazer, "Identification properties of recent production function estimators", *Econometrica*, vol. 83, No. 6, 2015; and J. A. Levinsohn and A. Petrin, "Estimating production functions using inputs to control for unobservables", *The Review of Economic Studies*, vol. 70, No. 2, 2003.

Note: Ln ACF TFP: natural logarithms of total factor productivity estimated using the Ackerberg, Caves and Frazer (2015) methodology; Ln LP TFP: natural logarithms of total factor productivity estimated using the Levinsohn and Petrin (2003) methodology; Ln labour productivity: natural logarithms of labour productivity; Ln Sales: natural logarithms of total sales per firm; Ln EMP: natural logarithms of total number of workers per firm; Ln KINT: natural logarithms of capital intensity; SL1: number of white-collar workers as a proportion of all workers; SL2: number of professionals and technicians as a proportion of all workers; Ln WC: natural logarithms of the number of white-collar workers; Ln P&T: natural logarithms of the number of professionals and technicians. Robust standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 12
Performance premiums along the extensive margin, fixed effects estimations by firm

Variable	(1) Ln TFP ACF	(2) Ln TFP LP	(3) Ln labour productivity	(4) Ln Sales	(5) Ln EMP	(6) Ln KINT	(7) Ln SL1	(8) Ln SL2	(9) Ln WC	(10) Ln P&T
Extensive margin of imports	0.0360***	0.0520***	0.0640***	0.108***	0.0566***	0.0266**	0.0130	0.000565	0.0508***	0.0550***
	(0.00740)	(0.0127)	(0.0131)	(0.0124)	(0.00722)	(0.0113)	(0.00870)	(0.0133)	(0.00862)	(0.0133)
Extensive margin of exports	0.0461***	0.0381***	0.0425***	0.133***	0.0591***	0.0443***	-0.0479***	-0.0106	-0.00445	0.0396***
	(0.00706)	(0.0104)	(0.0115)	(0.0119)	(0.00947)	(0.0117)	(0.00850)	(0.0116)	(0.00791)	(0.0118)
Multinational firms	0.0991**	0.159**	0.235***	0.212***	0.0453	0.228***	0.00639	0.210***	0.0486	0.236***
	(0.0400)	(0.0685)	(0.0712)	(0.0542)	(0.0368)	(0.0740)	(0.0510)	(0.0663)	(0.0574)	(0.0678)
Medium-sized firms	-0.00501	0.101	-0.0726			-0.237***			0.470***	0.275***
	(0.0322)	(0.0647)	(0.0705)			(0.0639)			(0.0456)	(0.0729)
Large firms	-0.0235	0.149*	-0.191**			-0.410***			0.917***	0.652***
	(0.0434)	(0.0787)	(0.0893)			(0.102)			(0.0613)	(0.0858)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	7.092***	8.671***	9.868***	15.05***	3.218***	11.16***	-1.648***	-3.643***	1.492***	-0.454*
	(0.143)	(0.223)	(0.228)	(0.230)	(0.177)	(0.233)	(0.179)	(0.239)	(0.165)	(0.244)
Observations	2 184	2 223	2 439	2 491	2 814	2 663	2 738	1 579	2 738	1 579
Number of firms	547	566	598	613	620	603	610	382	610	382

Source: Prepared by the author, on the basis of data from the National Institute of Statistics and National Customs Directorate, using the methodologies of D. A. Ackerberg, K. Caves and G. Frazer, "Identification properties of recent production function estimators", *Econometrica*, vol. 83, No. 6, 2015; and J. A. Levinsohn and A. Petrin, "Estimating production functions using inputs to control for unobservables", *The Review of Economic Studies*, vol. 70, No. 2, 2003.

Note: Ln TFP ACF: natural logarithms of total factor productivity estimated using the Ackerberg, Caves and Frazer (2015) methodology; Ln TFP LP: natural logarithms of total factor productivity estimated using the Levinsohn and Petrin (2003) methodology; Ln labour productivity: natural logarithms of labour productivity; Ln Sales: natural logarithms of total sales per firm; Ln EMP: natural logarithms of total number of workers per firm; Ln KINT: natural logarithms of capital intensity; SL1: number of white-collar workers as a proportion of all workers; SL2: number of professionals and technicians as a proportion of all workers; Ln WC: natural logarithms of the number of white-collar workers; Ln P&T: natural logarithms of the number of professionals and technicians. Robust standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

We observe that the within-industry estimation reduces the estimated premium but still find positive and significant effects from the extensive margins of imports and exports on TFP, labour productivity, sales and total employment. We observe a non-significant association between the extensive margin of imports and the shares of white-collar workers and of professionals and technicians, but a positive one between this and the numbers of white-collar workers and professionals and technicians. For the extensive margin of exports, we observe a negative and significant association with the share of white-collar workers, a non-significant one with the share of professionals and technicians and the number of white-collar workers, and a positive and significant one with the number of professional and technicians. We note with regard to skilled labour that its share may be affected by the fact that exporters and also importers are bigger than domestic firms, and since the country specializes in agro-industrial goods the increase is larger for blue-collar workers than for skilled labour, for we find a positive effect when we observe the absolute number of white-collar workers and professionals and technicians.

Thus, trading more products with more countries has a positive association with two key variables: productivity and employment.

4. Performance premiums and geoeconomic regions

Recent empirical analyses have estimated gravity equations for the aggregate value of exports to a given destination, distinguishing between the contributions made by the number of firms (extensive margin) and the average value of exports per firm (intensive margin) (Bernard and others, 2007; Andersson, Lööf and Johansson, 2008; Mayer and Ottaviano, 2008). These studies have shown that the effects of distance on income and bilateral trade flows operate mainly through adjustments in the extensive margin rather than the intensive margin.

In what follows, we analyse the performance premium across markets. To this end, we identify exporters to high-income countries only, exporters to MERCOSUR partners only, exporters to the region only, and exporters to both high-income countries and less developed countries. We perform the same exercise for imports, identifying importers from high-income countries only, importers from MERCOSUR only, importers from the region only and importers from both high-income countries and less developed ones (MERCOSUR and the region).

We estimate the following equation:

$$y_{it} = \alpha + \gamma_1 E_{it}^{HI} + \gamma_2 E_{it}^{LD} + \gamma_3 E_{it}^{BOTH} + \gamma_4 I_{it}^{HI} + \gamma_5 I_{it}^{LD} + \gamma_6 I_{it}^{BOTH} + \theta C_{it} + \varepsilon_{it} \quad (3)$$

where y_{it} are the performance variables of productivity, size, capital intensity and share of skilled labour. E stands for exports and I for imports. HI denotes high-income countries only, LD less developed countries (those of the region and MERCOSUR) and BOTH firms that export and import to and from both high-income countries and less developed ones (MERCOSUR and the region). C is a vector of controls that includes foreign ownership of capital, firm size, and industry and time dummies. Industry dummies are defined at the three-digit ISIC level.

Developed countries may require higher levels of productivity, since product differentiation and market competition are stronger and consumers are more demanding. However, less developed neighbouring countries can be important for gaining trading experience and attaining scale economies, i.e., for "learning to trade". Barboni and others (2012) found for the Uruguayan case that there was a pattern of firms first exporting to neighbouring countries and then starting to export to more distant and developed countries once they had gained experience.

Table 13 presents the results for pooled OLS. Since trade flows with MERCOSUR partners account for most trade with the region, only the results for these are presented.

Table 13
Performance premium by market, pooled ordinary least squares estimations

Variable	(1) Ln ACF TFP	(2) Ln LP TFP	(3) Ln labour productivity	(4) Ln Sales	(5) Ln EMP	(6) Ln KINT	(7) SL1	(8) SL2
Exporters to high-income countries only	0.0127	0.101*	0.119**	0.212***	0.126***	0.198***	-0.0495***	0.0104**
	(0.0411)	(0.0533)	(0.0599)	(0.078)	(0.0471)	(0.0742)	(0.0129)	(0.00489)
Exporters to MERCOSUR only	-0.143***	0.00825	0.04	-0.484***	-0.323***	0.00103	0.0157**	-0.00760**
	(0.0204)	(0.0331)	(0.0335)	(0.0445)	(0.032)	(0.0416)	(0.00647)	(0.00312)
Exporters to both high-income countries and MERCOSUR	0.193***	0.0465	0.137***	1.084***	0.666***	0.493***	-0.0694***	0.0172***
	(0.0214)	(0.0358)	(0.0359)	(0.0446)	(0.0309)	(0.043)	(0.00762)	(0.00296)
Importers from high-income countries only	0.0494	0.119**	0.241***	0.429***	0.221***	0.605***	0.00356	0.0056
	(0.0391)	(0.053)	(0.0488)	(0.0721)	(0.047)	(0.0829)	(0.0135)	(0.00451)
Importers from MERCOSUR only	-0.137***	-0.236***	-0.304***	-0.813***	-0.544***	-0.143***	-0.0305***	0.00617*
	(0.0279)	(0.0428)	(0.043)	(0.0508)	(0.0322)	(0.0535)	(0.00958)	(0.00368)
Importers from both high-income countries and MERCOSUR	0.131***	0.281***	0.478***	1.234***	0.647***	0.849***	0.0425***	0.00579*
	(0.0267)	(0.0381)	(0.0369)	(0.0477)	(0.0313)	(0.0577)	(0.00903)	(0.00297)
Multinational firms	0.279***	0.396***	0.531***	0.792***	0.264***	0.500***	0.0389***	0.0367***
	(0.0268)	(0.04)	(0.0411)	(0.051)	(0.0341)	(0.0472)	(0.00749)	(0.00423)
Medium-sized firms	0.0226	0.137***	-0.00822			0.0324	-0.0313***	-0.0255***
	(0.0194)	(0.0289)	(0.0287)			(0.0388)	(0.00663)	(0.00241)
Large firms	0.0794***	0.250***	0.0346			0.164***	-0.0524***	-0.0338***
	(0.0214)	(0.0319)	(0.0336)			(0.042)	(0.00729)	(0.00323)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	7.862***	10.01***	10.99***	16.12***	3.856***	10.31***	0.186***	0.0436***
	(0.0363)	(0.0544)	(0.0521)	(0.0709)	(0.049)	(0.0763)	(0.0113)	(0.00389)
Observations	4 537	4 973	5 612	5 442	6 068	5 704	6 049	5 454
R-squared	0.284	0.307	0.385	0.498	0.347	0.358	0.176	0.236

Source: Prepared by the author, on the basis of data from the National Institute of Statistics and National Customs Directorate, using the methodologies of D. A. Ackerberg, K. Caves and G. Frazer, "Identification properties of recent production function estimators", *Econometrica*, vol. 83, No. 6, 2015; and J. A. Levinsohn and A. Petrin, "Estimating production functions using inputs to control for unobservables", *The Review of Economic Studies*, vol. 70, No. 2, 2003.

Note: Ln ACF TFP: natural logarithms of total factor productivity estimated using the Ackerberg, Caves and Frazer (2015) methodology; Ln LP TFP: natural logarithms of total factor productivity estimated using the Levinsohn and Petrin (2003) methodology; Ln labour productivity: natural logarithms of labour productivity; Ln Sales: natural logarithms of total sales per firm; Ln EMP: natural logarithms of total number of workers per firm; Ln KINT: natural logarithms of capital intensity; SL1: number of white-collar workers as a proportion of all workers; SL2: number of professionals and technicians as a proportion of all workers. Robust standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

We observe that firms exporting exclusively to high-income countries exhibit a higher premium for labour productivity, size (in terms of sales and employment), capital intensity and the share of professionals and technicians in the workforce than firms exporting exclusively to MERCOSUR countries. Furthermore, we find that the best-performing firms are those that export to and import from both high-income and MERCOSUR countries. Exporters and importers to and from both high-income and MERCOSUR countries are found to present the largest premiums in productivity and size (in terms of workers and sales), be more capital-intensive and have a higher share of professionals and technicians

in their workforces. Exporters to both regions present higher ACF TFP, labour productivity, sales and employment than importers from only high-income or MERCOSUR markets, but lower capital intensity. They also present a higher share of professionals and technicians in their workforces, but the association with the share of white-collar workers is negative, whereas it is positive and significant for importers from both markets.

Table 14 reports the results for fixed effects by firm. As expected, some variables lose significance once we control for constant unobserved effects by firm. Employment and capital intensity are positive and significant for firms exporting exclusively to high-income countries, while firms importing only from high-income countries evince greater ACF TFP and size (sales and employment). Importers from MERCOSUR partners only show lower ACF TFP and size in terms of sales and employment.

Table 14
Fixed effects by firm

Variable	(1) Ln ACF TFP	(2) Ln LP TFP	(3) Ln labour productivity	(4) Ln Sales	(5) Ln EMP	(6) Ln KINT	(7) SL1	(8) SL2
Exporters to high-income countries only	-0.0152	0.0448	0.0622	0.0830*	0.0769***	0.0854*	0.00435	0.000452
	(0.0285)	(0.0605)	(0.0571)	(0.0442)	(0.0286)	(0.0492)	(0.00876)	(0.00417)
Exporters to MERCOSUR only	0.0041	0.0518	0.0556	-0.0237	-0.0226	-0.0623**	0.0063	-0.00255
	(0.0169)	(0.0374)	(0.0358)	(0.0276)	(0.0179)	(0.0305)	(0.00549)	(0.00261)
Exporters to both high-income countries and MERCOSUR	0.0584***	0.0221	0.0296	0.264***	0.164***	0.038	-0.0107	-0.00416
	(0.0211)	(0.0452)	(0.043)	(0.0333)	(0.0215)	(0.0368)	(0.0066)	(0.00316)
Importers from high-income countries only	0.130***	0.0785	0.0736	0.226***	0.144***	0.0453	-0.00279	-0.00184
	(0.0306)	(0.062)	(0.0571)	(0.0459)	(0.0289)	(0.0508)	(0.00888)	(0.00433)
Importers from MERCOSUR only	-0.0600***	-0.0358	-0.027	-0.203***	-0.120***	-0.012	0.00498	0.00977***
	(0.0204)	(0.0444)	(0.042)	(0.0322)	(0.0208)	(0.0357)	(0.00636)	(0.00305)
Importers from both high-income countries and MERCOSUR	0.172***	0.141***	0.121**	0.449***	0.256***	0.0577	-0.00818	-0.00101
	(0.0248)	(0.0525)	(0.0482)	(0.0373)	(0.0241)	(0.0425)	(0.00741)	(0.00354)
Multinational firms	0.0291	-0.0104	0.00459	0.0358	-0.00927	0.00323	-0.0165	-0.00921*
	(0.0318)	(0.0712)	(0.0663)	(0.05)	(0.0331)	(0.0558)	(0.0101)	(0.00475)
Medium-sized firms	0.00984	0.0352	-0.180***			-0.285***	-0.0340***	-0.0165***
	(0.019)	(0.04)	(0.0365)			(0.0316)	(0.00558)	(0.0027)
Large firms	0.0402	0.133**	-0.309***			-0.593***	-0.0788***	-0.0283***
	(0.0282)	(0.0607)	(0.056)			(0.0475)	(0.00843)	(0.00405)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	8.083***	10.40***	11.58***	16.73***	3.641***	11.78***	0.297***	0.0847***
	(0.144)	(0.597)	(0.471)	(0.216)	(0.146)	(0.244)	(0.0446)	(0.0205)
Observations	4 537	4 973	5 612	5 442	6 068	5 704	6 049	5 454
Number of firms	822	869	918	927	929	912	928	928

Source: Prepared by the author, on the basis of data from the National Institute of Statistics and National Customs Directorate, using the methodologies of D. A. Ackerberg, K. Caves and G. Frazer, "Identification properties of recent production function estimators", *Econometrica*, vol. 83, No. 6, 2015; and J. A. Levinsohn and A. Petrin, "Estimating production functions using inputs to control for unobservables", *The Review of Economic Studies*, vol. 70, No. 2, 2003.

Note: Ln ACF TFP: natural logarithms of total factor productivity estimated using the Ackerberg, Caves and Frazer (2015) methodology; Ln LP TFP: natural logarithms of total factor productivity estimated using the Levinsohn and Petrin (2003) methodology; Ln labour productivity: natural logarithms of labour productivity; Ln Sales: natural logarithms of total sales per firm; Ln EMP: natural logarithms of total number of workers per firm; Ln KINT: natural logarithms of capital intensity; SL1: number of white-collar workers as a proportion of all workers; SL2: number of professionals and technicians as a proportion of all workers. Robust standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Furthermore, we find that productivity and size in terms of employment and sales are positive and significant for exporters to and importers from both types of market. Thus, for exports and imports, firms trading with both types of country outperform firms trading with only one type, although imports from high-income countries have a positive impact on productivity, sales and employment, while exports to high-income countries only have a positive impact on ACF TFP, employment and sales. This is in line with the stylized fact that firms trading with multiple markets have a superior performance. On the other hand, the impact on skilled labour is usually not significant except for importers from MERCOSUR, which present a positive effect for professionals and technicians.

V. Concluding remarks

We have presented a portrait of Uruguayan manufacturing firms, using a rich database that combines information on firms' structural characteristics with customs data on exporting and importing activities. We find evidence consistent with the "new-new" trade models incorporating firm heterogeneity.

Our results are in line with evidence for developed countries showing that exports and imports are more concentrated than employment and sales and that most international firms trade only a few products with a small number of countries, while a small number of diversified firms account for most trade flows. Furthermore, firms engaged in international activities are more productive, larger in terms of employment and sales and more capital-intensive than firms oriented exclusively towards the domestic market (non-traders), while results for the share of skilled labour are inconclusive.

Additionally, we observe a hierarchy among traders: firms engaged in both import and export activities (two-way traders) are the best-performing firms. They outperform both export-only firms and import-only firms. With regard to export and import extensive margins, they have a positive effect on productivity and total employment.

Lastly, when trade flows with high-income markets alone and with MERCOSUR partners alone are considered, firms trading with high-income countries are found to exhibit a better performance; in particular, they are more productive and bigger. However, firms that trade with both regions evince the highest TFP and employment.

The policy recommendation that emerges seems to favour trade (imports and exports) in a diversified basket of products with several markets in order to enhance productivity and employment. Moreover, it seems advisable to trade not only with MERCOSUR partners but also with high-income countries.

Regarding the research agenda, it would be of interest to analyse export and import trade costs and to look for causal relationships using econometric techniques that circumvent the endogeneity problem usually present in this type of study.

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Annex A1

Table A1.1
Number of matched firms

Year	Frequency	Share *(Percentages)*
1997	778	12.29
1998	696	11.00
1999	682	10.77
2000	642	10.14
2001	675	10.66
2002	672	10.62
2003	706	11.15
2004	724	11.44
2005	755	11.93
Total	6 330	100.00

Source: Prepared by the author, on the basis of data from the National Institute of Statistics and National Customs Directorate.

Annex A2

Total factor productivity estimation

We use two methods to estimate total factor productivity (TFP): the Levinsohn and Petrin (2003) method, henceforth LP, and the Ackerberg, Caves and Frazer (2015) method, henceforth ACF.

LP suffers from multicollinearity and uses a proxy variable for the unknown of productivity, usually composed of variable intermediate inputs such as energy, electricity, materials, etc.

More recently, Ackerberg, Caves and Frazer (2015) have proposed a way of circumventing the collinearity issue of LP, basically by assuming that the labour supply does not change easily in response to rigidities in the labour market. Ackerberg, Caves and Frazer (2015) provide a good explanation of the methodology and an empirical example.

In this study, we use both LP and ACF to estimate TFP. To estimate TFP by LP, we take value added as the dependent variable and materials as a proxy variable. We discriminate between skilled and unskilled labour. Capital and investment are recorded at the firm level. All variables are expressed in natural logarithms. Because of the small number of observations by industry-year, we estimate TFP for the full sample.

There is a command in Stata called "levpet" which we used for our estimation by LP. We then estimated TFP by the ACF methodology, using value added as the dependent variable and intermediate inputs as a proxy variable. To estimate ACF, we used the Stata code provided by Professor Jagadeesh Sivaradan of Michigan University.

The results LP and ACF results are reported in tables A2.1 and A2.2.

Table A2.1
Total factor productivity estimation by the Levinsohn and Petrin method, using materials as a proxy for productivity

Ln Value added	Coefficient	Standard error
Ln Skilled labour	0.3242927	0.0217121
Ln Unskilled labour	0.1332878	0.0327134
Ln Capital	0.1764043	0.0321291

Source: Prepared by the author.

Table A2.2
Total factor productivity estimation by the Ackerberg, Caves and Frazer method, using materials as a proxy for productivity

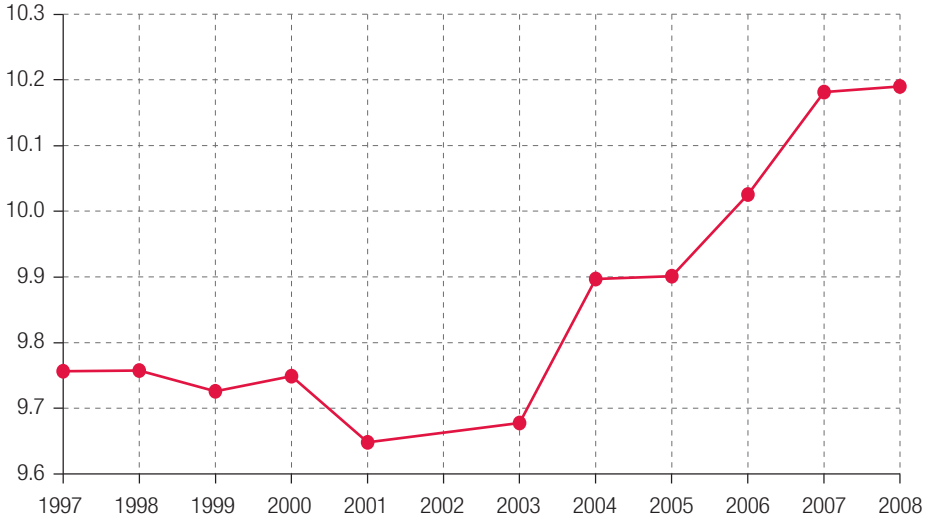
Ln Value added	Coefficient	Standard error
Ln Skilled labour	0.271960	0.00135
Ln Unskilled labour	0.348800	0.00122
Ln Capital	0.288854	0.00458

Source: Prepared by the author.

We find that the elasticities are in line with those reported in Ackerberg, Caves and Frazer (2015), ranging from 0.18 to 0.37 for capital and from 0.87 to 1.09 for labour, depending on the industry considered.

Regarding the evolution of TFP (see figure A2.1), it can be seen that this is stable at the beginning of period and until the economic crisis of 2002, when it falls, before recovering quickly from 2004 onward.

Figure A2.1
Natural logarithms of total factor productivity estimated by the Ackerberg, Caves and Frazer methodology



Source: Prepared by the author.