The World Economy

The World Economy (2010)
doi: 10.1111/j.1467-9701.2010.01262.x

Firms in International Trade: Importers' and Exporters' Heterogeneity in Italian Manufacturing Industry

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1. INTRODUCTION

THE empirical and theoretical literature has emphasised the importance of firm heterogeneity in trade. It has been shown that exporters are larger and exhibit significant performance premia relative to non-exporting firms (see ISGEP, 2008, for an international comparison). Two different theoretical interpretations have been proposed to explain these premia: the self-selection hypothesis and post-entry mechanisms.

Recently it has been stressed that exporting is only part of the story. On the one hand, some authors have started arguing that importing activities should also be taken into account in order to understand the nature of heterogeneity across different plants (Halpern et al., 2005; Bernard et al., 2007; Kasahara and Lapham, 2008; Vogel and Wagner, 2008). According to this view, empirical

This work was funded by the Italian Ministry of Research (FIRB 2004 project on: Research and entrepreneurship in the knowledge-based economy). Financial support from the Laboratory of Economics and Management (LEM) at Scuola Superiore S.Anna of Pisa, Italy, is also gratefully acknowledged. We are grateful to Roberto Monducci, Andrea Mancini, Alessandro Zeli and Roberto Sanzo at the Industrial Statistics Office of Italy's National Bureau of Statistics (ISTAT). We also thank Giovanni Dosi, Angelo Secchi and Marco Grazzi at LEM for providing access to firm-level data under a confidentiality agreement. We thank Antonello Zanfei for some useful discussions at an earlier stage of this research. Comments from the participants at seminars and workshops in Pisa, Perugia, Nottingham and Madrid, as well as from two anonymous referees, are gratefully acknowledged. The usual disclaimers apply.

investigation should move forward by considering the engagement of firms in international transactions, either by means of exports, imports or a combination of the two. On the other hand, new empirical evidence regarding the degree of concentration of both exports and imports and the product and geographical diversification of trading firms has been provided (Eaton et al., 2004; Bernard et al., 2007; Mayer and Ottaviano, 2007; Muuls and Pisu, 2007). These suggest that, in order to understand heterogeneity across firms and its influence on aggregate productivity levels, one should further explore the characteristics of traders in their geographical and sectoral diversification.

The goal of the paper is to contribute to a better understanding of how internationalised firms differ. We investigate firms' heterogeneity on the import and the export side, as well as diversification of trading activities. Combining data on structural characteristics and economic performance with data on exporting and importing activity on approximately 12,000 Italian firms over the 1993–97 period, we spur further empirical research into firms and trade by presenting a new set of stylised facts. These data, which contain detailed information on the variety and the numbers of countries and sectors in which a firm trades, allow us to know a great deal more about the firm's international activity than just its trading status. We first describe the patterns of concentration of imports and exports, and compare it with concentration of employment and sales. Then, we tackle the issue of the intensive and extensive margins by offering a comprehensive view of both the number of traders, the intensity of their activities and their diversification both in terms of products and geographical markets. Finally, we convey a picture of firm heterogeneity associated to trade activities by showing how internationalised firms' characteristics differ from those of domestic firms by considering both their trade status (we differentiate firms involved in both trading activities, the '*two-way traders*', from firms that only export and from those that only import) and the diversification of their activities (the number of sectors and geographical markets in which they trade).

Our results are in line with evidence on the US and other European countries, showing that exports and imports are more concentrated than employment, and that the bulk of international firms trade only a few products with a few countries, but a handful of diversified traders account for the majority of exports and imports. We also confirm that firms engaged in international activities are larger, more productive and more capital intensive. Such large differences, estimated with pooled OLS regressions (controlling for sector, size, region and time effects), reduce, but remain positive and significant, once time-invariant firm-specific heterogeneity is taken into account (FE model). Combining our findings using pooled OLS and FE models, our evidence suggests that the advantage of firms involved in trade is the result of a self-selection mechanism, but some post-entry effects cannot be ruled out. In

addition, a sort of hierarchy emerges among traders: firms engaged in both import and export outperform both non-trading firms and firms involved in either importing or exporting only. However, firms involved in importing but not in exporting outperform those engaged only on the export side, but this premium vanishes once we control for fixed effects. We submit that this result is consistent with the idea that self-selection may be stronger in the case of import than export. This interpretation is further reinforced by an analysis on *ex ante* differences: future importers are larger, more productive and more capital intensive than non-traders and future exporters even three years prior to the initiation of their trading activities. We also find that importers tend to diversify less in terms of countries of origin than exporters, and that a higher diversification on the import side is strongly associated with higher productivity.

The rest of the paper is organised as follows. In Section 2 we briefly review the existing literature. In particular, Section 2*a* discusses the empirical and theoretical contributions on export and firm heterogeneity, while in Section 2*b* we focus on the empirical and theoretical analyses regarding the relationship between imports and firm heterogeneity. Section 3 explains the data. Section 4 provides evidence on the degree of concentration both within and between sectors and along the country- and sector-extensive margin of imports and exports. Section 5 reports results on the association between the degree of firms' internationalisation (also along the country- and sector-extensive margins) and their size, productivity and capital intensity. Section 6 concludes.

2. BACKGROUND LITERATURE

a. Exporting and Firm Heterogeneity

Starting from Bernard and Jensen (1999) a large number of micro-level studies have highlighted that differences in firm performances within sectors are strongly correlated with the firm decision to engage in international transactions. These studies have mainly examined the relationship between export activity and firms' characteristics and have found that exporters are larger and exhibit significant performance premia relative to non-exporting firms. Two different, but not mutually exclusive, hypotheses have been put forward. On the one hand, the existence of sunk costs, such as transport costs or expenses related to establishing a distribution channel, induces a self-selection of more productive firms (Roberts and Tybout, 1997; Bernard and Jensen, 1999). On the other hand, it has been noted that firms can become more efficient after they begin exporting through learning or economies of scale effects (Clerides et al., 1998). Empirical evidence has provided rather robust support to the first

hypothesis, while less widespread evidence has been found in favour of the post-entry mechanisms.[1] However, some recent investigations conclude that learning by exporting may also occur under specific circumstances (Greenaway and Kneller 2004; Van Biesebroeck, 2006; Isgut and Fernandes, 2007; Lileeva and Trefler, 2007; Serti and Tomasi, 2008).

Firm heterogeneity also entered the empirical literature with some new evidence regarding the degree of concentration of export and the product and geographical diversification of trading firms. Bernard et al. (2007) find, for the US, that export volumes are accounted for by a handful of firms, which export many products in many countries, while the large majority of firms sell only a few products in a limited number of foreign countries. Moreover, firms that trade many products with many countries are larger than other internationalised firms. Muuls and Pisu (2007) provide evidence of a positive relationship between labour productivity and geographical and product diversification using data on Belgium firms. Similarly, Andersson et al. (2008) show that in the case of Sweden, the productivity of exporters is increasing in the number of traded products and markets served. Mayer and Ottaviano (2007), using information for different countries, find aggregate exports are determined by few exporting firms which supply several foreign markets with several differentiated products.

All these findings point to new theoretical challenges. They are in fact clearly at odds with traditional theories of trade based on comparative advantages and differentiated products, which predict that all firms in a given sector would be either exporters or non-exporters.[2] In response to the failure to accommodate the new stylised facts, recent theoretical models have removed the assumption of representative firms. For example, Melitz (2003) combines firm heterogeneity with a monopolistic competition framework. This assumes that exporters incur sunk costs, so only some firms (i.e. those with a sufficiently high level of productivity) can make positive profits in international markets. To the extent that the productivity distribution is very skewed and/or there is high elasticity of substitution between firm varieties, this framework explains why few firms may account for the bulk of exports (see Bernard et al., 2007, for details). By further assuming that sunk costs are specific to individual geographical destinations (Helpman et al., 2007; Chaney, 2008) and to individual exported products (Bernard et al., 2006) this augmented model is able to explain why most exporters would sell only few products to few countries and, in general, the high inequality that is detected in the distribution of exports across firms.

[1] See Greenaway and Kneller (2007) and Wagner (2007) for a review of the literature.
[2] See Bernard et al. (2007) for a more detailed analysis on the predictions of these models and a comparison with recent empirical evidence.

b. Importing and Firm Heterogeneity

While substantial work has been done on firm heterogeneity and exports, much less attention has been devoted to the import behaviour and firms' characteristics. Even fewer analyses consider both import and export activities. This is unfortunate, given the strong interconnection between importing and exporting and the key role of imports in the global economy. As a matter of fact, around 20 per cent of total exports are due to intermediate inputs being used for further processing (Hummels et al., 2001). Only recently, the availability of detailed transaction data has spurred new empirical research on firm heterogeneity and trade, combining information on both the import and export sides.

In line with the results found for exports, these point to a positive correlation between imports and firms' productivity. More generally, importers display similar characteristics as those observed for exporters. Bernard et al. (2005) consider exporters and importers in the US, showing that both are associated with better performance. These results further reinforce the idea that firm heterogeneity can be better captured by analysing trade flows in greater details. Focusing only on the import side, Halpern et al. (2005), Amiti and Konings (2007) and Kasahara and Rodrigue (2008) find evidence of substantial heterogeneity and a high level of productivity among importers. Similarly, Muuls and Pisu (2007), using Belgian data, provide evidence of a positive relationship between firm productivity and both imports and exports, while Altomonte and Bekes (2009) investigate Hungarian firms, finding that most of the productivity premium of exporters, is in fact due to the fact that they are also importers. Vogel and Wagner (2008) estimate significant export and import productivity premia among German firms. Like Altomonte and Bekes (2009), they find part of the productivity premium of exporting firms is due to the fact that they are also importing.

How does the literature explain the positive relationship between importing activity and firm performance? In which direction does causality go? In principle, as in the export case, both post-entry and self-selection effects could underlie the observed relationship.

Theoretical models have recognised that imports of intermediate and capital goods can raise productivity via several channels: learning, variety and quality effects (Markusen, 1989; Grossman and Helpman, 1991; Eaton and Kortum, 2001; Acharya and Keller, 2007). Productivity gains could arise because of learning effects from embodied foreign technology. Positive productivity effects could be due to access to more varieties of intermediate inputs and a better match between input mix and technology or product characteristics. Alternatively, importers may purchase abroad higher quality inputs which may, in turn, increase their productivity. On the empirical side, Amiti and Konings (2007) and Kasahara and Rodrigue (2008) find that importing enhances firms' productivity. Halpern

et al. (2005) reach the same result and attribute two-thirds of the increase in plant productivity to an increase in variety and the remaining one-third to an increase in quality.

Very limited research has been done on the self-selection hypothesis. Kasahara and Lapham (2008) have a model where heterogeneous final good producers simultaneously decide whether to export and to import. Both activities require paying a fixed cost in any period and in any market they choose to be active. The presence of fixed costs induces only the most productive firms to start importing.[3] In this respect, it should be mentioned that while the sunk costs hypothesis of the sunk costs of exporting is well received in the literature and is justified on the basis of costs related, for example, to acquiring information on foreign markets, setting up distribution channels and adapting products, it is not obvious that the same type of costs would apply to importing. Kasahara and Lapham (2008) do not propose any specific motivation for introducing sunk costs into importing and do not have any prior on whether they should be higher than the sunk costs of imports. Kraay et al. (2002) submit that prior to importing, firms may incur sunk costs related to the search for foreign suppliers and to the learning and acquisition of customs procedures. While this is certainly a possible outcome, it is a bit odd to assume that both sellers (exporters) bear fixed costs to find their buyers (importers) and vice versa. We are inclined to think that this kind of cost would be higher for seller than buyer, but this may depend on market structure, and in particular on the relative market power in upstream and downstream markets. However, importers may incur other types of fixed costs (which need not be sustained by exporters). For example, firms may need to accumulate complementary assets (which we may call absorptive capacities) in order to integrate imported inputs into their production process. This is more likely to occur when firms import knowledge-intensive capital goods or very specific and high quality intermediate inputs, than in the case of standardised low-price/quality inputs.

But sunk costs are not the only source of self-selection. As we know from the export literature, the productivity threshold required to make profits in international markets may depend on the size and distance of home and host market, as well as the price (Chaney, 2008). In the case of imports, the literature has discussed in particular the role of trade liberalisation and imported input prices. On the one hand, firms may substitute domestic inputs with cheaper foreign ones. This would also allow firms with relatively low productivity to enter the market. On the other hand, trade liberalisation may widen the scope of previously

[3] In another empirical model, Halpern et al. (2005) suggest that importers may sustain fixed costs due to establishing business relationships with foreign suppliers. Thus, firms would buy foreign inputs only to the extent that these goods would determine a productivity gain high enough to cover the fixed cost (Halpern et al., 2005). The model, however, does not predict any self-selection effect into import.

unavailable inputs (Goldberg et al., 2009). This can increase firms' ability to produce new products, but also induce self-selection. In fact, as suggested by Kugler and Verhoogen (2008), complementarities between input quality and plant productivity may generate higher output quality. Then, we would observe that more-productive plants are larger, use higher-quality inputs and produce higher-quality products. To the extent that trade liberalisation allows importing of a larger variety of goods, more productive firms would self-select into import of high-quality inputs and this would lead to a positive correlation between importing and productivity. Kugler and Verhoogen (2009) support their hypothesis by showing that importers are indeed the high-productivity firms and that imported inputs purchased by Colombian plants are higher quality than domestic inputs purchased by the same plant.

3. DATA DESCRIPTION

This paper relies on a dataset which combines two different sources of data developed by Italy's Bureau of Statistics (ISTAT), namely MICRO1 and COE.[4] MICRO1 contains longitudinal data on a panel of 38,771 firms representing the entire universe of Italian manufacturing companies with 20 employees or more over the 1989–97 period. Entry and exit over the period covered by the data, as well as the existence of missing values, makes MICRO1 an unbalanced panel, containing information for an average of around 20,000 firms per year. Firms are classified according to their main activity, as identified by ISTAT's standard codes for sectoral classification of business activities (Ateco), which correspond, to a large extent, to Eurostat's NACE 1.1 taxonomy. The database contains information on a number of variables appearing in a firm's balance sheet. For the purpose of this work we utilise: number of employees, turnover, value added, capital, labour cost, intermediate inputs cost, capital assets, industry and geographical location (Italian regions).[5] Capital is proxied by tangible fixed assets at book value (net of depreciation). All the nominal variables are measured in millions of 1995 Italian lire and they are deflated using two-digit industry-level price indices provided by ISTAT.

To measure firm-level productivity we use two indicators: labour productivity (LP), which has been computed as value added per employee, and total factor productivity (TFP), following the Levinsohn and Petrin (2003)

[4] The data have been made available under the mandatory condition of censorship of any individual information.

[5] The information at our disposal comes from firms' balance sheets. Unfortunately, we do not have access to other types of data such as R&D investments, innovation and information on multinational firms or employees' level of education. As regards the workforce composition, the only information available regards the distinction between production and non-production workers.

methodology. The scale of operation is measured by total shipments (sales) and by total employment. We define the capital intensity variable as the capital stock over the total number of employees. A firm is defined as foreign owned when some of the shares are owned by non-Italian firms.[6]

The MICRO1 database has been merged with ISTAT's external trade register (COE),[7] which provides firm-level information on exports and imports over the 1993–97 period. For each of the about 17,000 firms surveyed on average in the observation period, COE supplies data on trade status and volume of trade. Moreover, data are available on the destination (origin) of exports (imports), the number of sectors in which a firm exports (imports) (labelled NSE (NSI)) and number of destinations served (for exports) and number of countries from which firms import (labelled NCE and NCI, respectively).[8] Due to the lack of a complete overlap, merging MICRO1 with COE reduces the sample, to about 12,100 firms, covering (with missing values) the period 1993 to 1997. Table 1 presents the number of firms active within the manufacturing sector, for the original MICRO1 database and for the database obtained after the merge with COE (merged database). The size of the sample stemming from the merger with COE trading data corresponds to approximately 60 per cent of the sample obtained from MICRO1.[9]

TABLE 1
Number of Firms

Years	*MICRO1*	*MICRO1–COE (Merged)*
1989	19,922	
1990	21,208	
1991	19,740	
1992	21,301	
1993	22,076	14,579
1994	21,720	14,036
1995	20,004	12,320
1996	17,231	10,512
1997	15,532	9,215
Mean	19,859	12,132

[6] In the empirical analysis we use different (more restrictive) criteria for the construction of this dummy but the results do not change.
[7] Detailed information on the COE database on foreign trade statistics is available at http://www.coeweb.istat.it.
[8] The number of sectors is counted according to the four-digit NACE classification system. Unfortunately, no detail is available on the individual sectors where firms trade.
[9] Chi-squared tests (available from the authors upon request) support the hypothesis that the selected sample obtained by merging MICRO1 and COE is consistent with the original dataset, both in the terms of sectoral and size distribution.

TABLE 2
Participation Rate and Concentration: A Comparison between Countries

	Italy	*United States*	*Sweden*	*Belgium*
% Exporters	70.6 (62.9)*	27	71	41.2
% Importers	69.3 (45.4)*	14	60	43.2
Gini Exports	0.825	0.972	..	0.959
Gini Imports	0.899	0.965	..	0.956
Gini Sales	0.807	0.916	..	0.873 (value added)
Sources	This paper	Bernard et al. (2007)	Andersson et al. (2008)	Muuls and Pisu (2007)
	Firm-level 1997 20 empl. or more manufacturing	Plant level 2002 All firms manufacturing	Firm level 2004 10 empl. or more manufacturing	Firm level 1996 All firms manufacturing

Note:
*In parentheses are participation rates obtained considering only extra-EU exports and imports.

As reported in Table 2 slightly less than three-quarters of Italian manufacturing firms are internationalised: 70.6 per cent were exporting goods in 1997, and 69.3 per cent were importing. Compared to the stylised facts reported for the US (Bernard et al., 2007) noteworthy differences emerge: in 1997 importers and exporters were, respectively, 14 per cent and 27 per cent of US manufacturing firms. Italian firms are not only much more internationalised, but they also appear relatively more prone to import. These differences may have to do with the fact that US firms enjoy a larger internal market.[10] We try to control for this by reporting the share of firms trading with non-EU countries. Indeed, the share of Italian trading firms drops to 62.9 per cent for exporters and 45.4 per cent for importers. Interestingly, the share of importing firms drops relatively more (from 69.3 per cent to 45.4 per cent). This suggests that 14 per cent of firms import exclusively from EU countries. We will come back to this issue later. Still, significant differences remain between the propensity to trade of US and Italian firms. We submit that a part of this may be explained by the different size distribution of the two samples. In the case of the US, all firms have been considered, while in Italy only firms with more than 20 employees enter the sample.

Since, in the presence of sunk costs to export (and import), small firms should be less likely to trade, a higher share of exporters should be found in a sample consisting of larger firms. According to the figures reported by Ferragina and Quintieri (2000) for a stratified sample representative of the whole universe of Italian manufacturing firms (Mediocredito Centrale) the average

[10] Results on six EU countries (Germany, France, UK, Italy, Hungary and Norway) reported by Mayer and Ottaviano (2007) are consistent with this view: exporting is 'rare' only in the UK (only 28.3 per cent of medium–large firms are exporters), but is relatively common in other countries.

export participation rate of the period 1995–97 was of about 40 per cent. This conjecture is confirmed for the case of Sweden (Andersson et al., 2008, reported in Table 2). The participation rates for Sweden are in line with Italian ones (71 per cent for export and 60 per cent for import) in the sample of firms with 10 employees or more, but drop to values much closer to the US (36 per cent and 27 per cent) in the whole sample. Similarly, in the case of Belgium, exporters (importers) are 41.2 (43.2) per cent of all firms in the whole sample (Muuls and Pisu, 2007), while in the sample restricted to firms with 20 or more employees (International Study Group on Export and Productivity (ISGEP), 2008) the participation rate of exporters reaches 84 per cent.

While the distinction between exporters and importers is relevant, it is also interesting to observe that the two sides of trade are strongly interconnected. In Table 3 we break down our sample into four categories: (i) firms that do not trade; (ii) firms that both import and export (*two-way traders*); (iii) firms that export but do not import (*only exporters*); and (iv) firms that import but do not export (*only importers*). Among the internationalised firms, the large majority are engaged in both import and export (on average, over the 1993–97 period, 65.4 per cent of all firms are two-way traders). These are the more engaged in international trade activities and we expect that a proportion of the import–export activity is linked to international fragmentation of production both within and across firm boundaries. Unfortunately, we have no data that allow us to single out these firms from the group of two-way traders. It is worth mentioning, however, that the share of two-way traders is relatively higher in sectors where multinational firms are also particularly active (such as Chemical Products, Rubber and Plastics, Motor Vehicles, Medical Instruments). About 10 per cent of all firms are engaged in either only export or only import activities, but significant sectoral heterogeneity exists. The last two rows of Table 3 show that along the five years covered by our data the percentage of traders has slightly decreased, but this has been the result of a composition effect. In fact, the share of one-way traders dropped, while the share of non-traders and two-way traders grew. Therefore, the distribution of Italian manufacturing firms becomes more polarised. On the one hand, the number of firms engaged in more articulated and complex internationalisation strategies that combine exporting with importing increased (e.g. global sourcing, international partnerships and FDI, as documented by other studies on Italy), but, on the other hand, other firms shut down their international contacts.

4. CONCENTRATION OF INTERNATIONAL TRADE ACTIVITIES

Recent evidence documents that few firms account for large volumes of aggregate trade. Bernard et al. (2007) report that international trade is a

TABLE 3
Trade Participation Rates of Italian Manufacturing Firms, by Sector (1993–97)

Sector	*Two-way Traders*	*Only Exporter*	*Only Importer*	*Non-traders*	*Exporters*	*Importers*
Food, Beverages	57.9	5.2	12.1	24.8	63.1	70.0
Tobacco	61.9	8.3	8.3	21.4	70.2	70.2
Textiles	65.9	3.6	5.1	25.3	69.5	71.1
Wearing, Apparel	41.1	3.1	2.4	53.4	44.2	43.5
Leather, Allied Product	67.5	7.8	1.1	23.6	75.3	68.6
Wood Manufacturing	55.8	2.9	18.6	22.7	58.7	74.4
Paper, Allied Product	75.1	4.7	8.1	12.1	79.8	83.2
Printing, Publishing	48.9	7.3	10.5	33.3	56.2	59.4
Coke and Petroleum	35.2	2.6	16.9	45.3	37.8	52.1
Chemical Products	88.6	3.2	3.8	4.4	91.8	92.4
Rubber, Plastics	83.3	4.5	3.4	8.8	87.8	86.8
Non-Met. Min. Products	48.7	6.9	5.6	38.9	55.6	54.3
Basic Metals	76.5	4.4	4.9	14.2	80.9	81.4
Metal Product	52.7	6.9	5.1	35.3	59.6	57.8
Industrial Machinery	83.0	5.8	1.5	9.7	88.8	84.5
Office Machinery	69.4	1.9	6.4	22.3	71.3	75.8
Electrical Machinery	63.4	3.8	4.9	27.9	67.2	68.3
Radio, TV, etc.	66.7	3.2	7.9	22.2	69.8	74.6
Med., Prec., Opt. Instr.	77.6	3.7	4.0	14.7	81.3	81.6
Motor Vehicles	78.7	4.4	5.1	11.7	83.1	83.8
Other Transp. Equip.	64.1	3.7	6.2	26.0	67.8	70.4
Furniture Manufacturing	73.6	9.0	3.1	14.3	82.5	76.7
Recycling	35.3	7.8	5.4	51.5	43.1	40.7
Manufacturing	65.4	5.4	5.0	24.1	70.9	70.5
(excl. firms trading only within-EU)	59.9	4.8	1.6	33.7	60.7	43.2
Manufacturing 1993	61.6	8.0	6.9	23.6	69.6	68.5
(excl. firms trading only within-EU)	54.4	5.1	1.8	38.7	54.4	38.0
Manufacturing 1997	63.9	6.6	5.4	24.1	70.6	69.3
(excl. firms trading only within-EU)	59.9	5.2	1.5	33.4	62.9	45.4

relatively rare phenomenon among US firms (see the discussion in Section 3) and is highly concentrated in a few firms. This is largely confirmed also in Europe, even if export is relatively more common among EU firms. Mayer and Ottaviano (2007) report that the top 5 per cent of exporters account for more than 70 per cent of exports in five out of six countries considered (Italy is the least concentrated). In Table 2 we compare concentration of export, import and sales for the US, Belgium and Italy using the Gini index. Consistently with the finding of Mayer and Ottaviano (2007) concentration in Italy is lower, but still trade is more concentrated than sales.

a. Concentration Within and Between Industries

The fact that trade is more concentrated than employment may reflect both a between-industry effect (export and import are concentrated in fewer sectors) or a within-industry effect (some firms within a sector account for the bulk of trade). The former would be consistent with traditional trade theories, which predict that countries specialise into specific sectors and trade liberalisation determines concentration of imports in some industries and exports in others. By contrast, theories of trade based on firm heterogeneity predict that trade liberalisation favours the most productive firms, inducing concentration of trade in fewer firms.

To answer the question of whether concentration of trade is due to sectoral trade specialisation or it is a feature that holds within each sector, we first compute concentration for each sector and then exploit a property of the Theil index, which can be decomposed in its between sectors and within sectors components.[11] In Table 4 we report the Gini and Theil coefficients of exports, imports, total trade and, for comparison, of employment and total sales for Italian manufacturing in 1993 and in 1997.[12] As anticipated, for both years we confirm trade is more concentrated than sales and employment, even if for employment and sales the concentration is increasing.[13] Sectoral Theil

TABLE 4
Concentration of Italian Trade, Employment and Sales Between and Within Sectors

	Gini		*Theil*		*% Between Sectors**		*% Within Sectors**	
	1993	*1997*	*1993*	*1997*	*1993*	*1997*	*1993*	*1997*
Exports	0.822	0.825	2.106	2.210	13.0	15.3	87.0	84.7
Imports	0.900	0.899	2.751	2.657	25.5	23.1	74.5	76.9
Total Trade	0.839	0.840	2.262	2.301	17.5	17.2	82.5	82.8
Employees	0.638	0.661	1.437	1.507	15.4	16.3	84.6	83.7
Sales	0.780	0.807	2.180	2.448	25.4	25.4	74.6	74.6

Note:
* The *Between* and *Within* components refer to the Theil index.

[11] We use the Theil index because the Gini index is not exactly decomposable in a within and a between component.
[12] In order to purge the confounding effect of the propensity from the actual concentration of trade flows among trading firms, and to give lower bound estimates of the concentration of trade, concentration indices for total trade, export and import are computed on positive values of these variables.
[13] All the indices of inequality and concentration that respect the four principles of symmetry, population, size independence, mean independence and the Pigou–Dalton criterion, would order these distributions in the same way.

coefficients across the period (not shown, but available from the authors), show that in all sectors concentration is very high (with the minor exception of Recycling), even if there is still some heterogeneity, and the higher concentration in trade (and imports in particular) with respect to sales and employment holds in virtually every sector. This result is reinforced by the decomposition of the index into within and between sector components, reported in Table 4. The former is a weighted average of the sectoral Theil indices (where the weights are sectoral shares of the aggregate value of the considered variable), while the between component is derived assuming every firm within a given sector displays the average sectoral value of the relevant variable. Cowell and Jenkins (1995) show that the within- and between-group components of concentration, defined as above, can be related to overall concentration in the simplest possible way: $C_b + C_w = C$. They then suggest an intuitive summary measure, R_b, of the amount of inequality explained by differences between groups with a particular characteristic or set of characteristics, $R_b = C_b/C$. Table 4 reports the percentage of aggregate concentration that is explained by the between sectors component of the Theil index in 1993 and 1997. For all variables, the within-industry component explains most of the overall concentration. In the period 1993–97 the importance of the between-sector component of concentration grew for exports and decreased for imports, while it remained stable for employment and sales.

In sum, we find that Italian trade is less concentrated than in other countries but, consistent with cross-country evidence for other countries, trade is more concentrated across firms than sales and employment. Interestingly, we find that, especially for exports, this is mainly the result of concentration of trade activities in a handful of firms within each industry, as predicted by the new literature on firm heterogeneity and trade, rather than the outcome of sectoral specialisation, as predicted by traditional trade theories. In the case of imports, which on average are more concentrated than exports, the between-sector component plays a relatively more important, though still minor, role.

b. Concentration Along the Extensive Margins

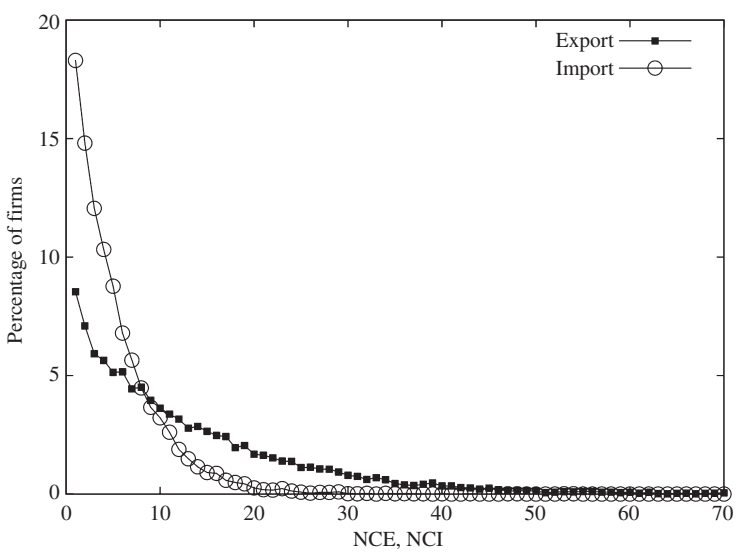
Concentrations of trade have been observed not only across firms but also along the product and country extensive margins.[14] Eaton et al. (2004) show that, in the case of France, most exporting firms served only a few markets, so that a negative relationship exists between the number of destinations served

[14] The extensive margin of export (import) refers to the number of firms involved in exporting (importing) activities, while the product- and country-extensive margins refer to the number of products and countries in/with which a firm trades goods, and can be thought as a measure of geographical and product diversification. See for example Mayer and Ottaviano (2007) for a discussion of this definition.

by each firm and number of firms that exported to those destinations. The same pattern has been found for Slovenia (Damijan et al., 2004), Belgium (Muuls and Pisu, 2007), Sweden (Andersson et al., 2008) and the US (Bernard et al., 2007). The last three studies also provide evidence of a negative relationship between the number of countries from which firms import (country-extensive margin of imports) and number of firms that imports from those markets. A similar pattern has been found along the product-extensive margin: many firms export (import) few products, and a handful of firms trade in several different products.

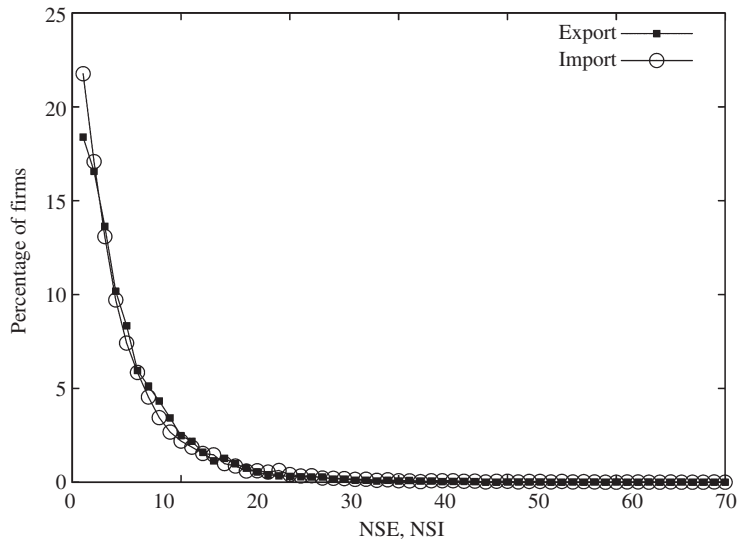
These stylised facts are confirmed also in the case of Italian manufacturing. In Figure 1 we depict the country-extensive margins of exports and imports (labelled as NCE and NCI, respectively) and percentage of firms actually observed along these dimensions. The number of firms declines monotonically with the country-extensive margin, for both importers and exporters, but is lower in the case of the former. In 1993, about 8 per cent of exporting firms exported to only one country and about 18 per cent of importing firms imported from only one country and the percentage of importing firms declines more steeply with respect to that of exporting firms: from eight countries onwards the percentage of exporting firms is greater than the percentage of importing firms. The same picture emerges looking at the average number of exporting/importing countries, which is 13.0 in the case of exports and 5.3 in

FIGURE 1
Number of Importers (exporters) Along the Country-extensive Margin (1993)



Note:
The support for export goes from 0 to 134. It has been cut in order to improve readability.

FIGURE 2
Number of Importers (Exporters) Along the Sector-extensive Margin (1993)



Note:
The support for export goes from 0 to 66, for imports from 0 to 65.

the case of imports. Moreover the support of NCI is smaller than the one of NCE: the former is in the interval [0; 54] while the latter is in [0; 134].[15]

Let us now consider the product/sector[16] extensive margins (Figure 2). Substantial concentration also emerges along this dimension: about 18 per cent of exporting firms, in 1993, traded products in only one four-digit sector, while about 22 per cent of importing firms sourced in only one sector from abroad. The average number of sectors in which each firm exported goods was 5.2 in 1993 and 5.9 in 1997, while the average number of sectors in which firms imported goods was 5.2 in 1993 and 6.1 in 1997. According to Muuls and Pisu (2007), Belgian internationalised manufacturing firms on average exported 12 products and imported 34 products, while Bernard et al. (2005) report that in 2000 on average exporters sold 8.9 products and importers sourced 10 products. Thus, the product-extensive margin may appear lower in Italy than elsewhere. However, international comparisons are difficult here, since our data refer to the number of four-digit sectors in which firms trade rather than the number of products actually traded, as in the case of Belgium and the US.

[15] The high degree of concentration is broadly confirmed in 1997, although one can observe an increase in the average NCE and NCI (to 18.1 and 6.3, respectively).
[16] Since our data allow us to identify the number of four-digit sectors in which firms trade, we more appropriately refer to the sector, rather than product, extensive margin.

TABLE 5
Sector- and Country-extensive Margins and the Concentration of Export: 1993

		NCE				
		1–5	*6–10*	*11–20*	*21+*	*Total*
% of exporting firms						
NSE	1–5	30.0	16.6	15.2	5.2	67.1
	6–10	1.9	4.1	7.5	7.8	21.3
	11–20	0.4	0.9	2.4	5.9	9.5
	21+	0.0	0.1	0.3	1.6	2.1
	Total	32.3	21.7	25.4	20.6	100.0
% of export value						
NSE	1–5	3.0	5.1	8.5	7.0	23.5
	6–10	0.5	2.0	5.9	14.8	23.3
	11–20	0.2	0.8	2.9	16.9	20.8
	21+	0.0	0.5	1.1	30.9	32.5
	Total	3.7	8.3	18.4	69.6	100.0

By combining information on the extensive margins, the number of firms and volumes of traded goods, we shed some further light on one result which we illustrated in the previous section: trade is concentrated in very few firms, which are very diversified. The upper panel of Table 5 plots the share of exporting firms by number of export markets (NCE) and number of sectors in which goods are exported, and shows that 30 per cent of exporters sell in up to five countries and (four-digit) sectors, while only 1.6 per cent of exporters operate in more than 20 sectors and countries. The lower panel shows that this small share of firms accounts for 30.9 per cent of overall exports. These stylised facts are consistent with theoretical models in which exporters incur sunk costs in every product/sector and geographical market in which they sell (as Bernard et al., 2006; Chaney, 2008). However, the same dynamic holds even more true for imports. Table 6 shows that 56.4 per cent of all importers (active in fewer than five markets and sectors) account for only 5.9 per cent of all imports, while the more diversified importers (which are less than 1 per cent of the total) account for 32.8 per cent of overall imports. This raises the theoretical question on whether there are sunk costs on the import side as well. We will provide some evidence in this direction in the next section.

5. FIRM HETEROGENEITY AND INTERNATIONAL TRADE ACTIVITIES

a. Firm Characteristics and the International Trade Status

Although evidence is not as extensive as in the case of exports, some empirical works have documented that importers tend to outperform firms that do

TABLE 6
Sector- and Country-extensive Margins and the Concentration of Import: 1993

		NCI				*Total*
		1–5	*6–10*	*11–20*	*21+*	
% of importing firms						
NSI	1–5	56.4	10.3	2.3	0.1	69.1
	6–10	6.5	8.8	3.3	0.2	18.7
	11–20	1.3	4.1	3.6	0.4	9.5
	21+	0.1	0.5	1.5	0.6	2.7
	Total	64.3	23.8	10.7	1.3	100.0
% of import value						
NSI	1–5	5.9	5.3	2.8	0.3	14.4
	6–10	2.7	4.5	5.4	0.9	13.5
	11–20	0.9	5.5	12.4	2.7	21.6
	21+	0.1	2.0	15.6	32.8	50.5
	Total	9.7	17.3	36.1	36.8	100.0

not trade (Halpern et al., 2005; Bernard et al., 2007; Muuls and Pisu, 2007; Kasahara and Rodrigue, 2008; Vogel and Wagner, 2008; Kugler and Verhoogen, 2009).

In this section we convey a picture of firm heterogeneity associated with trade activities, considering both the importing and exporting activities. We estimate productivity differentials, as well as differences in size and capital intensity, between internationalised and non-internationalised firms. Among the former group, we will follow the distinction made in Section 3 and distinguish firms involved in both importing and exporting activities (*two-way traders*) and firms involved in either exporting or importing only.[17]

Table 7 provides some basic descriptive statistics. We find that non-traders are smaller (in terms of both total sales and number of employees) and less productive than internationalised firms. Among this latter group, two-way traders outperform firms engaged in only importing or exporting, in line with Muuls and Pisu (2007) on Belgium, Andersson et al. (2008) on Sweden, and Vogel and Wagner (2008) on Germany. Firms engaged only in importing or exporting activities lie in between non-internationalised firms and two-way traders both in terms of number of employees and productivity

[17] In this respect this paper is closer to Muuls and Pisu (2007) and Vogel and Wagner (2008) than to Bernard et al. (2007), since the former single out two-way traders from firms involved only in importing (exporting) activities, while the latter focus on the aggregate of exporting and importing firms. Since, as we have seen in Section 3, most international firms are engaged on both sides of trade, we believe it is more accurate to keep two-way traders aside. Unfortunately, we do not have, unlike, Bernard et al. (2005), information on multinational firms, which are most likely part of the two-way trader group and would allow us to make a finer distinction.

TABLE 7
Differences between Non-traders and Other Trading Categories (Average Values, 1993–97)

	Non-traders	*Only Exporter*	*Only Importer*	*Two-way Traders*	*Exporters*	*Importers*
Labour productivity	53.8	65.9	74.4	83.9	82.5	83.2
TFP	101.9	125.8	130.5	178.9	174.8	175.5
Sales	6,927	57,618	19,338	50,257	50,736	48,129
No. of employees	40	78	59	132	129	127
Capital intensity	82.5	94.3	139.9	121.2	119.3	122.7

(measured as labour productivity and TFP). The comparison of the two categories of one-way traders yields interesting results. Only exporters are larger (both in terms of sales and number of employees) than only importers, but the latter are more productive (both in terms of labour productivity and TFP). Finally, it is worth noting that capital intensity is very high among only importers, so that on average they are even more capital intensive than two-way traders. However, it should also be borne in mind that these unconditional differences may well reflect a sectoral composition effect. In the case of imports, for example, Table 3 shows that only importers are relatively more likely in some capital-intensive industries, such as Food and Beverages, Tobacco, Wood products, Printing and publishing, Petroleum refining, and Radio and TV equipments. In Tables 8 and 9 we account for this, by running regressions which control for sector, size, region and time effects.

In particular, we estimate the relationship between internationalisation status and firm heterogeneity in performance by running the following regression:

$$y_{it} = \alpha_A + \beta_A D_{it}^{twoway} + \gamma_A D_{it}^{imponly} + \phi_A D_{it}^{exponly} + \theta_A controls_{it} + v_{it}, \qquad (1)$$

where y_{it} denotes the logarithm of either total revenue, number of employees, labour productivity, TFP and capital intensity, D_{it}^{twoway}, $D_{it}^{onlyimp}$ and $D_{it}^{onlyexp}$ are (mutually exclusive) dummy variables denoting whether firm i at time t is, respectively, a two-way trader, a firm engaged in importing or exporting activities only. The omitted (reference) group is the non-trading firms. *Controls* denotes a vector of characteristics including the log of employment, calendar year dummies, two-digit sector dummies and regional dummies[18] and an indicator taking value 1 for foreign-owned firms.[19] Our interest lies in the value of the coefficients β_A, γ_A and ϕ_A that tell us the average premium of the three

[18] We will omit the control for size when using the logarithm of the number of employees and the logarithm of sales as a dependent variable.
[19] Results are robust to different (more restrictive) criteria for the construction of this dummy.

TABLE 8
Firm Heterogeneity and Internationalisation Status, Pooled OLS Regressions (1993–97)

Dependent Variable	*Labour Productivity*	*TFP*	*Sales*	*No. empl.*	*Capital Intensity*
Two-way traders	0.329***	0.241***	1.468***	0.606***	0.693***
	(0.007)	(0.007)	(0.017)	(0.011)	(0.020)
Import only	0.234***	0.162***	0.735***	0.185***	0.594***
	(0.012)	(0.011)	(0.024)	(0.017)	(0.029)
Export only	0.156***	0.090***	0.652***	0.145***	0.431***
	(0.012)	(0.011)	(0.025)	(0.017)	(0.027)
Foreign ownership	0.013	0.032**	1.394***	1.269***	−0.159
	(0.018)	(0.020)	(0.064)	(0.502)	(0.035)
No. of observations	60,661	59,987	60,652	60,662	60,031
R-squared	0.344	0.448	0.411	0.198	0.338

Notes:
Standard errors in parentheses below the coefficients. Asterisks denote significance levels (***: $p < 1\%$; **: $p < 5\%$; *: $p < 10\%$). All regressions include the log of employment (except regressions where the dependent variable total sales of the number of employees), as well as sector, region and year dummies as controls.

TABLE 9
Firm Heterogeneity and Internationalisation Status, Fixed-effect Regressions (1993–97)

Dependent Variable	*Labour Productivity*	*TFP*	*Sales*	*No. empl.*	*Capital Intensity*
Two-way traders	0.051***	0.044***	0.116***	0.036***	0.060**
	(0.015)	(0.014)	(0.019)	(0.009)	(0.027)
Import only	0.035***	0.033***	0.047***	0.022***	0.029
	(0.011)	(0.010)	(0.012)	(0.005)	(0.021)
Export only	0.038***	0.032***	0.076***	0.019**	0.039
	(0.016)	(0.016)	(0.019)	(0.010)	(0.032)
Foreign ownership	0.0157	0.014	0.044**	0.027*	−0.020
	(0.020)	(0.020)	(0.017)	(0.015)	(0.037)
No. of observations	60,661	59,987	60,652	60,662	60,031
R-squared	0.862	0.887	0.907	0.983	0.907
Hausman test [*p*-value]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Breusch/Pagan test [*p*-value]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]

Notes:
Standard errors in parentheses below the coefficients. Asterisks denote significance levels (***: $p < 1\%$; **: $p < 5\%$; *: $p < 10\%$). All regressions include the log of employment (except regressions where the dependent variable total sales of the number of employees) and year dummies as controls.

categories of internationalised firms with respect to the non-internationalised firms.[20]

[20] Since the dependent variable is in logs and the explanatory variable are dummy variables, the exact percentage differential is given by $(e^{\beta} - 1) \cdot 100$.

In Table 8 we estimate equation (1) using pooled OLS, and in Table 9 we control for individual fixed effects, which wipes out all the time-invariant firm heterogeneity (FE model).[21] In Table 8 the estimated β_A, γ_A and ϕ_A coefficients can be interpreted as conditional differences in size, productivity and capital intensity across firms with different exposure to international markets. To the extent that firm-specific (time-invariant) fixed effects are the main driver of the decision to enter international markets, results from Table 9 may have a 'more causal' interpretation of the estimated coefficients, since they basically estimate a correlation between a change in the trade status and a change of the dependent variables under analysis. Differences between OLS and FE coefficients may thus emerge if time-invariant firm characteristics are correlated with the internationalisation status. Nevertheless, one should be careful when giving a strictly causal interpretation of the coefficients estimated with the FE regression. For example, it might well be that a shock contemporaneously determines a higher probability of switching into exporting (or importing) and a variation in the dependent variable under analysis.

The results of the pooled OLS regressions reported in Table 8 show that even controlling for sector, time region and foreign-ownership differences, significant heterogeneity remains in productivity, size and capital intensity across firms with different degrees of internationalisation. In particular, it is clear that internationalised firms are larger, more productive and more capital intensive than non-internationalised firms. Moreover, the coefficients attached to the different internationalisation status suggest that a sort of hierarchy exists also between two-way traders and firms engaged in either only importing or only exporting. For example, if one considers TFP differences, two-way traders are about 27 per cent more productive than non-internationalised firms (once differences due to foreign ownership, size, sectors, region and time are accounted for), while only importers and only exporters are 17 per cent and 9 per cent more productive, respectively. By comparing coefficients, one gathers that only importers are almost twice as productive as only exporters, and in turn two-way traders are 50 per cent more productive than only importers. Similar orders of magnitude are obtained by looking at other characteristics. For all the regressions we run the *F*-tests for the statistical difference between the two-way trader and the one-way trader coefficients ($\hat{\beta}_A$ vs $\hat{\gamma}_A$ and $\hat{\phi}_A$) and between the only importer and the only exporter coefficients ($\hat{\gamma}_A$ vs $\hat{\phi}_A$). In all cases we

[21] We perform both the Breusch/Pagan test for the relevance of firm-specific effects to be incorporated in a panel model and the Hausman test for the orthogonality of the individual specific effects and the regressors (Table 9 and Table 13). The Breusch/Pagan test rejects the null hypothesis of no unobserved heterogeneity, while the Hausman test rejects the null hypothesis that the individual effects are uncorrelated with the other regressors. Hence, based on these two tests we conclude that the fixed effects estimator is the better choice among the two estimators.

reject the hypothesis of equality between the estimated parameters (see Table A1 in the Appendix).

Once we wipe out the time-invariant firm heterogeneity, differences between internationalised and non-internationalised firms sharply decline. As reported in Table 9, the TFP premium of two-way traders drops to less than 5 per cent and the premia of only importers and only exporters shrink accordingly. This suggests most of the differences in performance are due to a firm-specific time-invariant effect. It is rather interesting that, once this effect is controlled for, differences between firms engaged only in import and those engaged only in export activities reduce significantly. Moreover, after controlling for fixed effects we cannot reject the hypothesis of equality between $\hat{\gamma}_A$ and $\hat{\phi}_A$. This is true also when comparing the coefficients between two-way traders and one-way traders, with the only exception of the regression where sales is the dependent variable.[22]

This can be interpreted as indirect evidence that self-selection is stronger for only importers than for only exporters. In other words, assuming that selection into trading is due only to firm-specific fixed effects, results from Tables 8 and 9 would signal that productivity is probably a more stringent precondition for being an only importer than for being an only exporter.[23]

b. Self-selection into Importing?

Another possible and more conservative way to test self-selection is to compare the characteristics of firms that start trading with those of non-traders, some years before entry. This methodology has been largely applied to test the hypothesis of selection into export (Bernard and Jensen, 1999; Wagner, 2007; International Study Group on Export and Productivity (ISGEP), 2008). In this section, we follow the same approach.

As a first step we distinguish between three different groups of firms, according to their foreign market participation pattern. First, *import starters*, firms that do not trade between $t-3$ and $t-1$, start importing in year t and keep on importing in the following period. Similarly, *export starters* is made up of firms that do not trade between $t-3$ and $t-1$, start exporting in year t and keep on exporting in the following period. As the third group we select firms that serve exclusively the domestic market for the entire period, the *non-traders*.

Since the database covers five years, from 1993 to 1997, we can create two cohorts of import and export starters, those that begin in 1996 and in 1997.

[22] Tables A2 and A3 in the Appendix show the analogue to regressions in Tables 8 and 9, using the two non-mutually exclusive dummies of importers and exporters. Results are qualitatively similar.

[23] Kugler and Verhoogen (2009) give a similar interpretation when comparing the OLS and FE coefficients, when they analyse the relationship between imported intermediate inputs and plant's productivity.

TABLE 10
Export and Import Starters by Year

	1996	*1997*	*Total*
Number of import starters	208	116	324
Number of export starters	94	48	142
of which:			
Number of two-way traders	38	19	57

Table 10 reports number of starters in each cohort: we obtain in total 324 firms that enter into the import market and 142 into the export markets.[24] Our control group, i.e. the non-trader, is made of 2,914 firms. We regress the (log) value of various firms' characteristics at time $t - \rho$ on a dummy variable indicating if a firm is an import (export) starter at time t and on a set of controls.

$$\ln(y_{it-\rho}) = \alpha_B + \beta_B ImpStarters + \gamma_B ExpStarters + \theta_B controls_{it-\rho} + v_{it}, \text{ with } 1 \leq \rho \leq 3, \quad (2)$$

where *ImpStarters* (*ExpStarters*) are dummy variables taking value one if firm i starts to import (export) in t (columns A (B) of Table 11), and zero for non-trading firms. *Controls* includes dummies for year, sectoral and regional effects.

Results, reported in column B of Table 11, show that firms that will start exporting are *ex ante* larger, more productive and more capital intensive than firms that will never trade. For example, the estimated γ_B coefficient suggests that three years before entering the export market, starters are already approximately 9 per cent more productive than non-traders,[25] supporting the evidence on self-selection of better exporters, already reported in a wealth of empirical studies. When we compare import-starters and non-traders (columns A), the estimated coefficients are also statistically significant and positive, and are even higher than in the case of export starters (columns B), at $t - 1$, $t - 2$ and $t - 3$. For example, three years before starting importing, firms are about 20 per cent more productive than their non-trader counterparts (both in terms of LP and

[24] A small number of firms (57) start trading with both importing and exporting activities. Considering them as a separate category, as we did in the previous section, would yield very imprecise estimates for this group, so we choose to skip this category from the present analysis and focus on the two (non-mutually exclusive) categories of exporters and importers. However, results including the dummies only-export starters, only-import starters are not significantly different, and are available from the authors upon request. For the sake of comparison the reader can refer to (A2) and (A3) in the Appendix where we estimate equation (1) using pooled OLS and FE, using the two partially overlapping dummies importer/exporter.

[25] The advantage of future exporters is less pronounced in terms of number of employees.

TABLE 11
Self-selection into Importing and Exporting

	$t-3$			$t-2$			$t-1$		
	A	*B*	*C*	*A*	*B*	*C*	*A*	*B*	*C*
Labour Prod.									
Imp. starter	0.188***		0.181***	0.231***		0.221***	0.206***		0.199***
	(0.031)		(0.032)	(0.029)		(0.030)	(0.030)		(0.030)
Exp. starter		0.109***	0.042		0.145***	0.062*		0.122***	0.042
		(0.040)	(0.040)		(0.039)	(0.039)		(0.038)	(0.037)
No. of obs.	5,895	5,782	5,947		5,290	5,476		4,351	4,577
TFP									
Imp. starter	0.172***		0.168***	0.200***		0.191***	0.158***		0.156***
	(0.032)		(0.032)	(0.020)		(0.039)	(0.029)		(0.029)
Exp. starter		0.087**	0.025		0.134***	0.063*		0.077***	0.015
		(0.037)	(0.037)		(0.038)	(0.038)		(0.040)	(0.040)
No. of obs.	5,887	5,774	5,939	5,441	5,281	5,467	4,499	4,340	4,566
Sales									
Imp. starter	0.398***		0.377***	0.482***		0.449***	0.492***		0.458***
	(0.054)		(0.055)	(0.052)		(0.054)	(0.047)		(0.048)
Exp. starter		0.264***	0.126*		0.373***	0.205***		0.384***	0.200***
		(0.072)	(0.072)		(0.071)	(0.076)		(0.064)	(0.066)
No. of obs.	5,894	5,781	5,946	5,419	5,289	5,475	4,503	4,344	4,570
No. Empl.									
Imp. starter	0.102***		0.103***	0.107***		0.103***	0.071**		0.074**
	(0.034)		(0.034)	(0.034)		(0.035)	(0.030)		(0.031)
Exp. starter		0.033*	−0.004		0.056	0.017		0.011	−0.019
		(0.039)	(0.040)		(0.039)	(0.041)		(0.034)	(0.036)
No. of obs.	5,895	5,782	5,947	5,420	5,290	4,576	4,510	4,351	4,577
Cap. Int.									
Imp. starter	0.444***		0.426***	0.515***		0.506***	0.644***		0.609***
	(0.073)		(0.075)	(0.071)		(0.072)	(0.068)		(0.070)
Exp. starter		0.255**	0.097		0.222**	0.037		0.420***	0.179**
		(0.100)	(0.106)		(0.103)	(0.108)		(0.090)	(0.096)
No. of obs.	5,894	5,781	5,946	5,418	5,288	5,474	4,505	4,346	4,572

Note:
Standard errors in parentheses below the coefficients. Asterisks denote significance levels (***: $p < 1\%$; **: $p < 5\%$; *: $p < 10\%$). All regressions include sector, region and year dummies as controls.

TFP). The *ex ante* advantages of import starters are even more pronounced in terms of size (sales and number of employees) and capital intensity. Indeed, these findings confirm the indirect evidence that we had in the previous section, comparing POLS and FE estimates of importers' and exporters' premia, about a stronger self-selection mechanism in the case of importing activities.

Even more interestingly, when we include both import and export starters (columns C), the β_B remain virtually unchanged while the γ_B lowers significantly in all regressions and often turns non-significantly different from zero.[26] This suggests that exporters' *ex ante* advantages estimated in columns B may actually be related to the fact that the larger, most productive and capital-intensive exporters are those that start to import, as well as to export.[27]

c. Self-selection into Importing

The evidence presented in this section and in the previous one is consistent with the conclusion that 'good' firms become importers. Several years before they start trading, these firms exhibit some advantages with respect to those that do not trade (and also with respect to future export-starters). As noted earlier, theoretical works able to replicate this fact have appeared only recently and the mechanisms through which self-selection into import may occur are not yet established. In particular, there are two different stories: (i) importing entails sunk costs, so only the more productive firms would start buying inputs from abroad (Kasahara and Lapham, 2008); and (ii) assuming that input quality and productivity are complementary to obtain higher-quality output, and that importing offers choice among a wide variety of inputs, more productive firms would have more incentives to exploit the opportunity to buy higher-quality inputs from abroad, thus they would self-select into importing (Kugler and Verhoogen, 2009).

Our results do not allow us to discriminate between competing explanations, but they help in some way. In particular, we offer convincing evidence that the *ex ante* productivity premium of future importers is larger than the premium for future exporters. So, if we embrace an explanation based on sunk costs, we would conclude that these entry costs are larger in the case of imports than in exports. This brings us to why the sunk costs of importing might be higher than for exporting. The existing literature is not of much help here. Kasahara and

[26] Altomonte and Bekes (2009) find a similar pattern of results in the case of Hungarian traders.

[27] We have also experimented with a specification in which we introduce the interaction between the dummies export-starter and import-starter, in order to capture the *ex ante* advantage of two-way traders. As we discussed earlier, only a few firms fall into this category, so the coefficient associated with the interaction term is never precisely estimated. Since results on the main effect of import and export starters remain qualitatively unaltered, we do not show these results, which are available upon request.

Lapham (2008) simply assume some fixed costs of importing exist, but do not provide any economic rationale for them. Kraay et al. (2002) posit that importers may need to bear the cost of searching for suppliers and learning customs procedures. But this is exactly the same type of costs that exporters have to bear. So, either the two parties are making very ineffective investments, or the market is doing a very poor job in matching supply and demand! Indeed, we are inclined to think that the seller (exporter) should be making the larger effort to find its buyer (importer), so we expect fixed costs and self-selection.

Thus, if we want to explain the higher *ex ante* productivity of importers, we need to think of other explanations. Here we submit that importers may need to invest in some complementary assets (or absorptive capacity) to effectively use imported inputs in their production process. Admittedly, this is likely to be the case for imported technologies (capital goods) or for high-quality intermediate inputs. A closer look at our data provides some useful insights. From Table 3 one can derive that the majority of only importers trade only with EU countries. In fact, over the 1993–97 period, 5 per cent of firms are only importers, but if we exclude firms trading only with EU partners the share of only importers drops to 1.6 per cent. To appreciate how sizeable this is, consider that the share of only exporters slides only from 5.4 per cent to 4.8 per cent, suggesting only a small portion of exporters serve only the EU market. A closer look at the origin of imports reveals that 92 per cent of only importers source from at least one Western European market (including EU15 and EFTA countries) and Germany is the largest source country (17 per cent of only importers buy goods only from Germany and, considering also firms sourcing from France and EFTA countries (and a combination of them) this share reaches about 50 per cent of only importers).[28]

The fact that only importers buy mainly from EU countries makes the argument of fixed costs related to learning customs procedures rather weak in our case, and it is also hard to believe that within the EU, firms have to bear significant costs to gather information about sellers. Instead, it is likely that Italian only-importers buy technology-intensive inputs from their major European counterparts. For example, they have a relatively high propensity to import capital goods, such as machine tools, and high-tech intermediate goods, such as chemical compounds or electronic components from Germany, Switzerland, France and the UK.[29]

[28] To save space, we do not show detailed tables on the data reported above, but they are available from the authors upon request.

[29] Some role of absorptive capacity in the relation between imports and firms' productivity has also been recently established in a recent empirical work on a sample of Spanish firms (Augier et al., 2009). In particular, it has been found that absorptive capacity, proxied by the firm's skill intensity, significantly enhances the effect of importing intermediate goods on firms' productivity.

d. Firm Heterogeneity Along the Extensive Margins

In this section, we further develop our analysis of firm heterogeneity and international trade, by assessing the relationship between the sector- and country-extensive margins and characteristics of the international firm. We will focus on two-way traders, in order to be able to assess the relative importance of the association between firm characteristics and the intensive margins, both on the import and export side.[30] It is worth mentioning that previous studies on importers and exporters did not explore this dimension as thoroughly as we do here.

First, we will show some non-parametric multivariate kernel regressions. As in a standard parametric regression, the aim of this is to estimate the conditional expectation of a dependent variable, y, given other explanatory variables, x and z. However, in this case we do not assume the relationship between the dependent and the independent variables is linear. We instead estimate non-parametrically by multivariate kernel methods the conditional expectation of y given the observed combinations of the explanatory variables x and z, i.e. $E(y \mid x;\ z)$. This is a non-parametric method which does not impose any *a priori* structure on the data (Pagan and Ullah, 1999; Hardle et al., 2004).

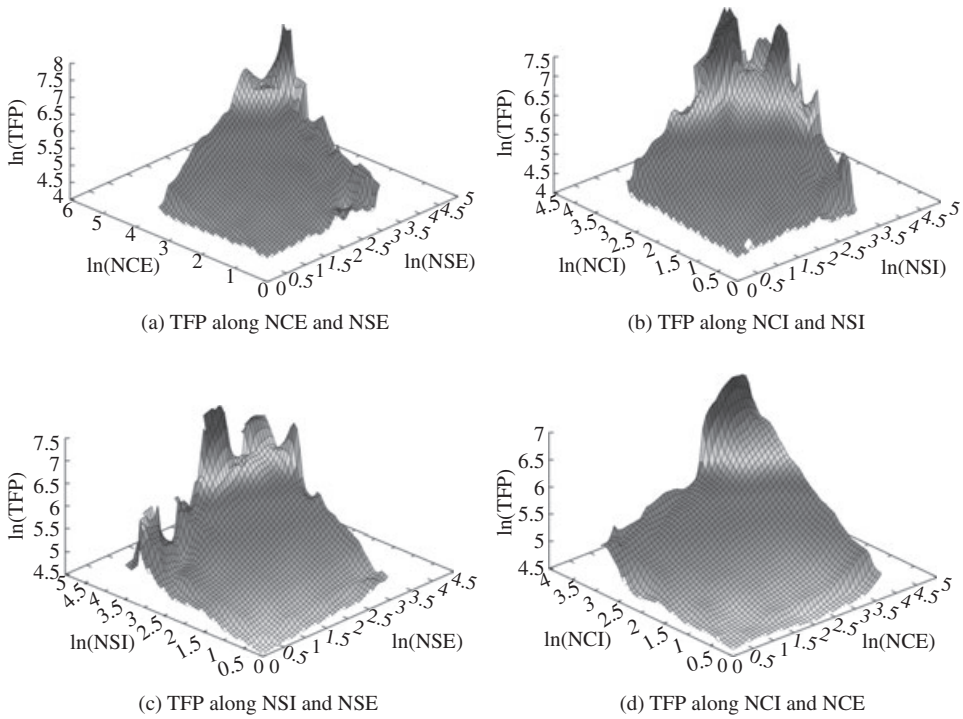
Using the kernel estimation technique, smooth surfaces can be obtained from the observed triples $\{x,\ z,\ y\}$. In Figure 3 we plot the kernel density estimate of the logarithm of TFP, on the log of our measures of sector- and country-extensive margins.[31] In other words, for a given combination of NCE and NSE on the horizontal plane, the vertical height of the surface represents the estimated conditional expectation of TFP. In the upper-left panel, x and z are, respectively, the logarithm of the number of countries where a firm exports (NCE) and the number of sectors where a firm exports (NSE).[32] In the upper-right panel we depict the country- and sector-extensive margins for imports (NCI and NSI), while in the lower panels we look at the association between TFP and extensive margins for import and export (sector-extensive margins in the lower-left panel and country-extensive margins in the lower right). The main message of this analysis is that firms with the highest productivity are very diversified both in terms of sectors and countries (see Figures 3a and 3b). In fact, as the number of markets and sectors increases, the vertical height of the

[30] The analyses reported in this section have been carried out also for the aggregate of exporters and importers, and for only importers and only exporters, but results do not change significantly.

[31] The kernel density estimates shown in this work were performed using gbutils, a package of programs for parametric and non-parametric analysis of panel data, distributed under the General Public Licence and freely available at http://www.cafed.eu/gbutils. If not otherwise specified, density estimation is performed using Epanenchnikov kernel and setting the bandwidth following the 'rules' suggested in Section 3.4 of Silverman (1981).

[32] Using the same database, Castaldi et al. (2006) find evidence of a positive (but less than proportional) relationship between firm size and diversification levels.

FIGURE 3
TFP Along Country (NC) and Sector (NS) Extensive Margin for Import and Export, Two-way Traders (1993)



(a) TFP along NCE and NSE

(b) TFP along NCI and NSI

(c) TFP along NSI and NSE

(d) TFP along NCI and NCE

surface grows. This suggests that firms' TFP is an increasing function of the number of products and countries with which it trades. This holds quite robustly for all independent variables both on the export side (NCE, NSE) and import side (NCI, NSI).[33] Comparing diversification on the import and export side (Figures 3c and 3d), one notices that firms with a high degree of sectoral diversification of imports have a relatively high productivity, even when their sectoral diversification of export is relatively low.

In Section 4*a* we found that few very diversified firms account for the bulk of trade. The results of the multivariate kernel regressions additionally highlight that these superstars are the most productive, the larger and the more capital intensive among two-way traders. Furthermore, firms with the highest productivity tend to be relatively more diversified on the import than export side. However, one should keep in mind that these results are unconditional expectations, which may be affected by the sectoral (as well as regional and size) distribution of firms. To shed more light on the relative importance of the

[33] All the kernel density estimates that are not reported here are available upon request.

different extensive margins and take into account simultaneously all the dimensions of firms' diversification in international trade activities we resort to parametric regressions where we control for additional sources of heterogeneity, by estimating the following equation:

$$y_{it} = \alpha + \lambda_1 x_{it}^{nse} + \lambda_2 x_{it}^{nsi} + \lambda_3 x_{it}^{nce} + \lambda_4^{nci} + \theta controls + v_{it}, \quad (3)$$

where y_{it} is a measure (in logarithms) of either firm productivity, size or capital intensity, the x's denote the logarithm of NSE, NSI, NCE and NCI, while *controls*, as usual, is a vector including the log of firm's employment together with sector, region and year dummies. Each regression refers to the sample of firms which are two-way traders throughout the period. This selection is needed to ensure that NCE, NSE, NCI and NSI have non-zero values, and allow us to express them in logs and interpret the estimated λ coefficients as elasticities, which we call the 'diversification premium of internationalised firms'. For example, we interpret λ_1 as the average percentage premium associated with an increase in the number of export destinations by 1 per cent. In Table 12, we estimate equation (3) by pooled OLS regressions, while in Table 13 we apply the within-group transformation, in order to purge any individual (time-invariant) effect.

Results from Table 12 support the idea that, even controlling for size, sector, region and time, more diversified firms are also larger, more productive and more capital intensive. It is worth noting that diversification of imports has the strongest association with firm heterogeneity. For example, a 10 per cent increase in NCI is associated with 1.2 per cent higher labour productivity and TFP, 4.2 per cent higher turnover and 1.4 per cent higher capital intensity. The

TABLE 12
Firm Heterogeneity Along the Sector- and Country-extensive Margins, Pooled OLS Regressions (1993–97)

Dependent Variable	*Labour Productivity*	*TFP*	*Sales*	*No. Empl.*	*Capital Intensity*
ln NSE	0.016**	0.036***	0.078***	0.062***	−0.065***
	(0.006)	(0.006)	(0.012)	(0.010)	(0.012)
ln NSI	0.046***	0.023***	0.373***	0.424***	0.089***
	(0.006)	(0.007)	(0.013)	(0.012)	(0.013)
ln NCE	0.035***	0.019***	0.206***	0.174***	0.000
	(0.005)	(0.005)	(0.011)	(0.009)	(0.011)
ln NCI	0.117***	0.119***	0.416***	0.142***	0.149***
	(0.007)	(0.007)	(0.013)	(0.011)	(0.014)
No. of obs.	35,328	35,099	35,328	35,329	35,114
R-squared	0.243	0.403	0.508	0.420	0.267

Notes:
Standard errors in parentheses below the coefficients. Asterisks denote significance levels (***: $p < 1\%$; **: $p < 5\%$; *: $p < 10\%$). All regressions include the log of employment (except regressions where the dependent variable total sales of the number of employees) as well as sector, region and year dummies as controls.

TABLE 13
Firm Heterogeneity Along the Sector- and Country-extensive Margins, Fixed-effects Regressions (1993–97)

Dependent Variable	*Labour Productivity*	*TFP*	*Sales*	*No. Empl.*	*Capital Intensity*
ln NSE	−0.004	−0.004	0.015***	0.005*	0.001
	(0.006)	(0.006)	(0.005)	(0.003)	(0.009)
ln NSI	0.017***	0.016***	0.030***	0.020***	0.026***
	(0.007)	(0.007)	(0.006)	(0.004)	(0.011)
ln NCE	0.025***	0.021***	0.075***	0.044***	0.033***
	(0.009)	(0.009)	(0.009)	(0.006)	(0.014)
ln NCI	0.014**	0.014**	0.048***	0.022***	−0.007
	(0.007)	(0.007)	(0.007)	(0.004)	(0.01)
No. of obs.	35,328	35,099	35,328	35,329	35,114
R-squared	0.819	0.869	0.976	0.985	0.878
Hausman test [*p*-value]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Breusch/Pagan test [*p*-value]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]

Notes:
Standard errors in parentheses below the coefficients. Asterisks denote significance levels (***: $p < 1\%$; **: $p < 5\%$; *: $p < 10\%$). All regressions include the log of employment (except regressions where the dependent variable total sales of the number of employees) as well as sector, region and year dummies as controls.

premia associated with NSI are smaller, but still sizeable and higher than those associated with NCE and NSE. Moreover, the fact that the coefficients for the capital-intensity variable are positive and statistically significant only for the import side gives support to the argument that, to enter the import markets, firms need to have the ability to value, assimilate and apply new knowledge. Controlling for individual unobserved heterogeneity reduces the estimated premia substantially, but we still find a significant effect of the country- and sector-extensive margin on firm heterogeneity in most cases. Results, reported in Table 13, suggest that premia associated with imports drop more than those associated with exports. This is consistent with the idea that the difference between the premia associated to NCI and NSI and those associated to NCE and NSE is mainly the result of self-selection into more diversified importing activities. Conversely, our evidence suggests that an increase in diversification of export markets (measured by NCE) is associated with larger firm size, capital intensity and productivity.

6. CONCLUSIONS

Exploiting a rich dataset which combines data on firms' structural characteristics and economic performance with data on their exporting and importing

activity, we uncover evidence supporting recent theories on firm heterogeneity and international trade, together with some new facts. We have three sets of findings.

First, we document that trade is more concentrated than employment and sales. This is the result of a few firms accounting for a large share of trade volumes and appears to be mainly occurring within rather than between sectors. This supports recent theories of trade with heterogeneous firms against traditional theories based on comparative advantages. Furthermore, we find significant concentration along the sector- and country-extensive margins: few firms serve trade in many sectors and with many countries, but these firms account for a larger share of import and export. Finally, we show that import is more concentrated than export, especially along the sector- and country-extensive margins.

Second, we confirm that firms with different exposure to international markets have different performance, in terms of size, capital intensity and productivity. In particular, we support the idea that firms more engaged in international activities (i.e. those involved in both importing and exporting) are the best performers, but we also find that firms involved only in importing perform better than those involved only in exporting. Our results suggest the importers' premium exists prior to engaging in trading activities and this is consistent with self-selection. We provide some evidence that the fixed cost related to learning customs procedures is rather weak, while the results are consistent with the fact that only-importers buy mainly high-quality capital and intermediate inputs from major European countries. To the extent that these goods incorporate advanced knowledge and technologies, they may entail sunk costs which importers have to incur to accumulate absorptive capacity needed to use those goods in production. However, we cannot rule out that, as proposed by Kugler and Verhoogen (2009), this self-selection stems from a complementarity between high-quality inputs and productivity in firms producing higher-quality output.

Third, the degree of geographical and sectoral diversification is positively correlated with firm size and productivity. However, diversification premia with respect to capital intensity are connected only to the import side. In particular, we have evidence that, on the one hand, larger, more capital-intensive and more productive firms are able to import a large number of products from a larger number of countries, and, on the other hand, firms exporting into a larger number of countries are more likely to experience a performance boost.

APPENDIX

TABLE A1
F-Tests for Equality between Coefficients

Coefficients	*Results for OLS Regression*				
	LP	*TFP*	*Sales*	*No. Empl.*	*CI*
Two-way traders = only importer	$F(1,20335) = 57.28$ Prob > $F = 0.0000$	$F(1,20197) = 45.00$ Prob > $F = 0.0000$	$F(1,20332) = 822.47$ Prob > $F = 0.0000$	$F(1,20335) = 482.44$ Prob > $F = 0.0000$	$F(1,20213) = 12.11$ Prob > $F = 0.0005$
Two-way traders = only exporter	$F(1,20335) = 279.41$ Prob > $F = 0.0000$	$F(1,20197) = 208.84$ Prob > $F = 0.0000$	$F(1,20332) = 1201.70$ Prob > $F = 0.0000$	$F(1,20335) = 789.83$ Prob > $F = 0.0000$	$F(1,20213) = 134.38$ Prob > $F = 0.0000$
Only exporter = only importer	$F(1,20335) = 26.06$ Prob > $F = 0.0000$	$F(1,20197) = 24.31$ Prob > $F = 0.0000$	$F(1,20332) = 6.77$ Prob > $F = 0.0093$	$F(1,20335) = 3.05$ Prob > $F = 0.0809$	$F(1,20213) = 22.91$ Prob > $F = 0.0000$
Coefficients	*Results for FE Regression*				
	LP	*TFP*	*Sales*	*No. Empl.*	*CI*
Two-way traders = only importer	$F(1,20335) = 1.11$ Prob > $F = 0.2920$	$F(1,20197) = 0.58$ Prob > $F = 0.4457$	$F(1,20332) = 12.61$ Prob > $F = 0.0004$	$F(1,20335) = 2.20$ Prob > $F = 0.1383$	$F(1,20213) = 1.32$ Prob > $F = 0.2510$
Two-way traders = only exporter	$F(1,20335) = 2.08$ Prob > $F = 0.1493$	$F(1,20197) = 1.49$ Prob > $F = 0.2223$	$F(1,20332) = 20.71$ Prob > $F = 0.0000$	$F(1,20335) = 8.88$ Prob > $F = 0.0029$	$F(1,20213) = 1.28$ Prob > $F = 0.2576$
Only exporter = only importer	$F(1,20335) = 0.03$ Prob > $F = 0.8540$	$F(1,20197) = 0.00$ Prob > $F = 0.9919$	$F(1,20332) = 2.35$ Prob > $F = 0.1251$	$F(1,20335) = 0.07$ Prob > $F = 0.7931$	$F(1,20213) = 0.11$ Prob > $F = 0.7357$

TABLE A2
Firm Heterogeneity and Internationalisation Status (Importers and Exporters), Pooled OLS Regressions (1993–97)

Dependent Variable	*Labour Productivity*	*TFP*	*Sales*	*No. Empl.*	*Capital Intensity*
Importer	0.201*** (0.008)	0.156*** (0.008)	0.780*** (0.017)	0.337*** (0.012)	0.412*** (0.018)
Exporter	0.126*** (0.009)	0.085*** (0.009)	0.693*** (0.019)	0.285*** (0.014)	0.263*** (0.021)
For. Own.	0.013 (0.018)	0.032 (0.021)	1.396*** (0.064)	1.275*** (0.059)	−0.018 (0.035)
No. of Obs.	60,661	59,987	60,652	60,662	60,031
R-squared	0.344	0.448	0.411	0.196	0.337

Notes:
Standard errors in parentheses alongside the coefficients. Asterisks denote significance levels (***: $p < 1\%$; **: $p < 5\%$; *: $p < 10\%$). All regressions include the log of employment (except regressions where the dependent variable total sales of the number of employees), as well as sector, region and year dummies as controls.

TABLE A3
Firm Heterogeneity and Internationalisation Status (Importers and Exporters), Fixed Effects Regressions (1993–97)

Dependent Variable	*Labour Productivity*	*TFP*	*Sales*	*No. Empl.*	*Capital Intensity*
Importer	0.023*** (0.007)	0.021*** (0.007)	0.043*** (0.007)	0.019*** (0.004)	0.024* (0.014)
Exporter	0.027* (0.014)	0.021 (0.014)	0.073*** (0.018)	0.016* (0.009)	0.035 (0.026)
For. Own.	0.016 (0.020)	0.014 (0.020)	0.044** (0.017)	0.027* (0.015)	−0.021 (0.037)
No. of Obs.	60,661	59,987	60,652	60,662	60,031
R-squared	0.8620	0.088	0.979	0.983	0.907

Notes:
Standard errors in parentheses alongside the coefficients. Asterisks denote significance levels (***: $p < 1\%$; **: $p < 5\%$; *: $p < 10\%$). All regressions include the log of employment (except regressions where the dependent variable total sales of the number of employees) and year dummies as controls.

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