Laboratory of Economics and Management

Sant'Anna School of Advanced Studies
Piazza Martiri della Libertà, 33 - 56127 PISA (Italy)
Tel. +39-050-883-343 Fax +39-050-883-344
Email: lem@sssup.it Web Page: http://www.lem.sssup.it/

LEM

Working Paper Series

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

Davide Castellani† Francesco Serti‡ Chiara Tomasi§

†University of Perugia, ‡ Scuola Superiore S.Anna and University of Alicante, § Scuola Superiore S.Anna and University of Urbino

2008/04 **March 2008**

ISSN (online) 2284-0400

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

Davide Castellani† Francesco Serti‡ Chiara Tomasi§

January 29, 2008

PRELIMINARY DRAFT

Abstract

This paper offers a portrait of Italian firms that trade goods. Combining 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. In particular, we find that importing can be as important as exporting as a source of firm heterogeneity. *First*, we document that trade is more concentrated than employment and sales, and we show that import is even more concentrated than export both within sectors and along the sector and country extensive margins. *Second*, while supporting the fact that firms involved in both importing and exporting (*two-way traders*) are the best performers, we also find that firms involved only in importing activities perform better than those involved only in exporting. We submit that this may have to do with being mainly importers of high-tech capital goods. *Third*, the performance premia of internationalized firms correlate relatively more with the degree of geographical and sectoral diversification of imports.

JEL codes: F10, F16, J21

Keywords: heterogeneous firms; exports; imports

*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 and Andrea Mancini at the Industrial Statistics Office of Italy's National Bureau of Statistics (ISTAT) and 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 his suggestions at the earliers stage if this research. The usual disclaimers apply.

†University of Perugia

‡Scuola Superiore S.Anna and University of Alicante

§Scuola Superiore S.Anna and University of Urbino

1 Introduction

Recent empirical and theoretical literature has emphasized the importance of firm heterogeneity in international trade. Empirical research have highlighted that exporters are larger and exhibit significant performance premia relatively to non-exporting firms (see The International Study Group on Export and Productivity (2007) for an international comparison). Two different, but not mutually exclusive, hypotheses about how firms' performances are related to the export status have been put forward. On the one hand, it has been postulated that 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 is rather robust on the first hypothesis, while results on post-entry effects of export is less univocal (see the recent reviews of the empirical literature in Wagner (2007) and Greenaway and Kneller (2007)).

Firm heterogeneity entered the empirical literature on international trade also with some new evidence regarding the degree of concentration of export and the product and geographical diversification of trading firms (see Bernard et al. (2007) for evidence on the U.S. and Mayer and Ottaviano (2007) for comparative evidence on European countries). Accordingly, export volumes are accounted by a handful of firms, which export many products in many countries, while the large majority of firms sell only few products in a limited number of foreign countries. These facts are clearly at odd with the traditional of theories of international trade based on comparative advantages and differentiated products framework, which assumed a representative firm and predicted that all firms in a given sector would be either exporters or importers.[1]

In response to the failure to accommodate the new stylized facts, recent theoretical models have removed the assumption of representative firms. For example the theoretical framework proposed by Melitz (2003) combines firm heterogeneity with a monopolistic competition framework. This model 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. This relates firms' decision to export to their productivity level. Given differences in productivity levels, the relative magnitude of fixed and variable costs determines the export status of firms. Firms that are sufficiently productive to bear the fixed cost needed to start exporting will self-select into the export market, while less productive firms will restrict their activity to their home market. To the extent that the productivity distribution is very skewed across firms, and/or there is high elasticity of substitution between firm varieties, this framework also 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 products and destinations in different markets, this framework also explains why most exporters would sell only few products to few countries (Chaney (2007), Helpman et al. (2007)).

While substantial work has been done on firm heterogeneity and exports, the empirical literature has largely neglected the import behavior and characteristics of firms involved in international trade. This is unfortunate, given the strong interconnection between

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

importing and exporting and the key role of imports in the global economy. As a matter of fact, around 20% 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 have spurred new empirical research on firm heterogeneity and international trade, combining information on both the import and export sides.[2] In line with the results found for exports, these studies point to the existence of a positive correlation between import and firms' productivity. As in the export case, both learning and self-selection effects could in principle underlie the observed relationship. On the one hand, importers may improve their performances by using higher quality foreign inputs or by extracting technology embodied in imported intermediate material and capital goods. On the other hand, prior to importing, firms may incur sunk costs related to the search for foreign suppliers and to the learning and acquisition of customs procedure (Kraay et al. (2002)). In addition, before entering the import markets firms may need to accumulate absorptive capabilities in order to be able to make use of the imported technologies and successfully implement them into their production process. Hence, the correlation between import and productivity could arise as a result of a self-selection mechanism.

Substantial emphasis of both theoretical and empirical literature have been placed on the "learning-by-importing" hypothesis, according to which importing would enhance firms' productivity through international technology and knowledge transmission. Empirical works on imports, mainly conducted at the aggregate level, find that imports work as a vehicle for diffusion (Acharya and Keller (2007), Eaton and Kortum (2001)).[3] Indeed, theoretical models of trade have recognized for a long time that import of intermediate and capital goods can spur embodied technology transfer and learning, as well as increase productivity, through higher input quality and better match between input mix and the desired technology or product characteristics (Ethier (1982), Grossman and Helpman (1991), Markusen (1989)).

Less attention has been given to the possible self-selection mechanisms related to the importing activities. A recent empirical model of import and productivity suggests 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)). This model however does not seem to predict any self-selection of better firms into importing. Furthermore, it is worth noting that the model does not make any explicit distinction between importing intermediate inputs or capital goods, which may reveal crucial in this context. Indeed, it should be born in mind that firms that import materials and other intermediate inputs, incur mainly variable costs, while when import involves capital goods, firms incur mainly fixed costs. Then, to the extent that firms import capital goods, the argument for self-selection may be reinforced.[4]

[2] In particular, Bernard et al. (2005) analyze the case of the U.S., Muuls and Pisu (2007) the case of Belgium, Andersson et al. (2007) the case of Sweden and Tucci (2005) the case of India. MacGarvie (2006) addresses the relationship between import-export and learning, using patent data from French firms.

[3] Only few empirical research tested the importance of imports for technology diffusion using micro-level data. Sjoholm (1996) used citation in patents to investigate whether Swedish firms learn about foreign technology through the import activity and he finds a positive correlations between Swedish patent citations of foreign patents and bilateral imports. MacGarvie (2006) exploits information on patent citations, exports and imports for France. She finds that firms are likely to cite more foreign patents after they start importing.

[4] Similarly, one might expect higher and stronger technology transfer effects related with imports of

This paper contributes to this expanding literature by giving a detailed picture of international trade activities of Italian firms at a microeconomic level, using comprehensive data on approximately 20.000 firms over the 1993-1997 period. In particular, we first describe the patterns of concentration of imports and exports across firms, and compare it with concentration of employment and sales. Then, we tackle the issue of the intensive and extensive margins in Italian international trade 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 in terms of geographical markets. Finally we convey a picture of firm heterogeneity associated to trade activities by showing how internationalized firms' characteristics differ from those of domestic firms by considering simultaneously their trade status (only importers, only exporters and two-way traders) and the diversification of their activities (number of products and geographical markets in which they trade).

Our results are in line with evidence on the U.S. 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 export and import. We also confirm that firms engaged in international activities are larger, more productive and more capital intensive than non-trading firms. 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). We submit that, combining our findings using Pooled OLS and FE models, our evidence suggests that the advantage of firms involved in international trade over the non traders can be explained both by self-selection mechanisms and post-entry effects. In addition, a sort of hierarchy emerges also among traders: firms engaged in both import and export (*two-way traders*) outperform both non-trading firms and firms involved in either importing or exporting only. The results for the three categories of internationalized firms are again consistent with both self-selection and post-entry effects. Indeed, the OLS and FE regressions give positive and statistically significant coefficients for all the three categories and the productivity and size variables considered. However, firms involved in importing but not in exporting activities outperform those engaged only on the export side, but this premium vanishes once we control for fixed effects. This result suggests that self-selection mechanism may be stronger in the case of import than in the cas of export. Importers seem to face higher sunk costs with respect to only exporters. This idea is further reinforced by other stylized facts. A focus on only importers supports the view that these firms may be sourcing mainly high-tech capital goods from producers based in the major European countries (such as Germany, France and Switzerland). Furthermore, importers tend to diversify less in terms of countries of origin than exporters do (in terms of destination markets), and a higher diversification on the import side is strongly associated with higher productivity at the level of the firm.

The rest of the paper is structured as follows. Section 2 illustrates the data. Section 3 provides evidence on the degree of concentration both within and between sectors and along the country and sector extensive margin of imports and exports in the Italian manufacturing industry. Section 4 reports results on the association between firms' degree of internationalisation (also along the country and sector extensive margins) and their size, productivity and capital intensity. Section 5 concludes.

capital goods than with imports of intermediate (Sjoholm (1997).

2 Data description

This paper relies upon a dataset which combines two different sources of data developed by Italy's Bureau of Statistics (ISTAT), namely MICRO 1 and COE.[5] MICRO 1 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 of firms over the period covered by the data, as well as the existence of missing values, makes of MICRO 1 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 utilize the following pieces of information: number of employees, turnover, value added, capital, labour cost, intermediate inputs cost, industry and geographical location (Italian regions). Capital is proxied by tangible fixed assets at book value (new of depreciation). All the nominal variables are measured in millions of 1995 Italian liras and they are deflated using 2 digit industry-level price indices provided by ISTAT.

The MICRO1 database has been merged with ISTAT's external trade register (COE)[6], which provides firm-level information on exports and imports over the 1993-1997 period. For each of the about 17,000 firms surveyed on average in the observation period, COE supplies data on firms' trade status and their 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 the number of destination served (for exports) and the number of countries from which firms import (labelled NCE and NCI, respectively).[7] Due to the lack of a complete overlap, merging MICRO1 with COE reduces the size of the sample, to about 12.100 firms, covering (with missing values) the period between 1993 and 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 merge with COE trading data corresponds to approximately 60% of the sample obtained from MICRO1.[8]

Let us now illustrate the propensity to trade in our sample, and compare it with results obtained for other countries. As reported in Table 2, slightly less than three-fourth of Italian manufacturing firms are internationalized: 70.6% were exporting goods in 1997, and 69.3% were importing. Compared to the stylized facts reported for the US (Bernard et al. (2007)), shrinking differences emerge: in 1997 importers and exporters were, respectively, 14% and 27% of US manufacturing firms. Italian firms are not only much more internationalized than U.S. ones, but they also appear relatively more prone

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

[6]Detailed information on the the COE database on foreign trade statistics are available at http://www.coeweb.istat.it

[7]The number of sectors are counted according to the 4-digit NACE classification system. Unfortunately, no detail is available on the individual sectors where firms trade.

[8]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 original dataset, both in the terms of sectoral and size distribution. The low value of the chi-square statistics, does not reject the hypothesis that the two samples are drawn from the same sectoral and size distribution.

Table 1: Number of firms

Years	Micro1	Micro1-COE (merged)
1989	19922	
1990	21208	
1991	19740	
1992	21301	
1993	22076	14579
1994	21720	14036
1995	20004	12320
1996	17231	10512
1997	15532	9215
Mean	19859	12132

to import. These differences may have to do with the fact that U.S. firms enjoy a larger internal market, so they may have lower incentives/need to source their inputs/sell their product from/to foreign markets.[9] We try to control for this fact by reporting the share of firms trading with non-EU countries. Indeed, the share of Italian trading firms drops to 62.9% for exporters and 45.4% for importers. Interestingly enough, the share of importing firms drops relatively more (from 69.3% to 45.4%). This suggests that 14% 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 U.S. and Italian manufacturing firms. We submit that a part of this difference may be explained by the different size distribution of the two samples. In the case of the U.S., all firms have been considered, while in the case of 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 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 export participation rate of the period 1995-1997 was of about 40%. This conjecture is confirmed for the case of Sweden (Andersson et al. (2007) reported in Table 2). The participation rates for Sweden are in line with Italian ones (71% for export and 60% for import) in the sample of firms with 10 employees or more, but they drop to values much closer to the U.S. (36% and 27%) in the whole sample. Similarly, in the case of Belgium exporters (importers) are 41.2 (43.2) percent of all firms in the whole sample (Muuls and Pisu (2007)), while in the sample restricted to firms with 20 or more employees (The International Study Group on Export and Productivity (2007)) the participation rate of exporters reaches 84%.

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 of firms: (i) firms that do not trade, (ii) firms that

[9]Results on 6 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% of medium-large firms are exporters), but is relatively common in other countries.

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. (2007)	Muuls and Pisu (2007)
	Firm-level, 1997	Plant-level, 2002	Firm-level, 2004	Firm-level, 1996
	20 empl. or more manufacturing	All firms manufacturing	10 empl. or more manufacturing	all firms manufacturing

* In brackets are participation rates obtained considering only Extra-UE exports and imports

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% of all firms are two-way traders). These firms 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 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% 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 have 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 polarized. On the one hand, the number of firms engaged in more articulated and complex internationalization 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 their international contacts down.

3 Concentration of international trade activities

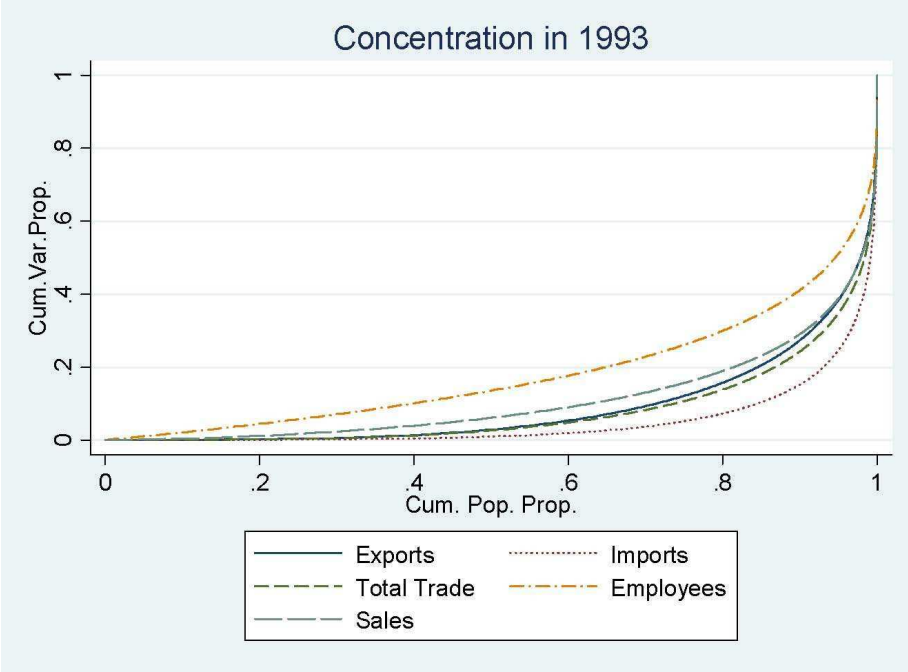
Recent empirical evidence on firms in international trade document that a few firms accounting large volumes of aggregate trade. Bernard et al. (2007) report that international trade is a relatively rare phenomenon among US firms (see the discussion in Section 2) and trade is highly concentrated in a few firms. This fact is largely confirmed also in Europe, even if export is relatively more common among EU firms. Mayer and Ottaviano (2007) report that the top five percent of exporters account for more than 70% of exports in five out of six countries considered (Italy is the less concentrated). In Table 2 we compare

Table 3: Trade participation rates of Italian manufacturing firms, by sector (1993-97)

Sectors	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	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	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	67.8	70.4
Forniture Manufacturing	73.6	9	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	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	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

concentration of export, import and sales for the U.S., 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. Figure 1, which reports the Lorenz curve for exports, imports, total trade, employees and sales in our sample of Italian firms clearly supports this view. It is worth recalling that the Lorenz curve plots the share in the cumulated value of a given quantity (which, in our case, would be employment, sales, import, export and total trade) accounted for by the cumulated proportion of firms. In other words, Figure 1 tells us that, for example, 80% of firms account for about 30% of total employment and less than 10% of imports. The closer the Lorenz curve is to the equidistribution line, the lower is the degree of concentration. Figure 1 clearly supports the view that trade is more concentrated in few firms than is employment, and among trade quantities, import is significantly more concentrated than exports.

Figure 1: Lorenz Curve for Employment, Sales, Export, Import and Total Trade in Italy (1993)



3.1 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 effect would be consistent with traditional trade theories, which predict that countries would specialize into specific sectors and trade liberalization would determine concentration of import in some industries and exports in others. On the contrary, theories of international trade based on firm heterogeneity would predict that trade liberalization would favor the most productive firms in each industry, inducing concentration of trade in fewer firms. In Table 4 we report the Gini and Theil coefficients of exports, imports, total trade and, as a mean of comparison, of employment and total sales for Italian manufacturing in 1993 and in 1997.[10] As expected, for both years we confirm that international trade is more concentrated than sales and employees, even if for employees and sales the concentration is increasing.[11] In order to answer the question whether concentration of trade is due to sectoral trade specialization or it is a feature that holds within each sector, we first compute concentration for each sectors and then exploit a property of the Theil index, which can be

[10] 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 indexes for total trade, export and import are computed on positive values of these variables.

[11] All the indexes 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.

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

decomposed in its between sectors and within sectors components.[12] Table 5 reports the average sectoral Theil coefficients across the period 1993-1997. In all sectors concentration is very high (with the minor exception of Recycling), even if there is still some heterogeneity across sectors, and the higher concentration in trade (and import in particular) with to sales and employment holds in virtually every sector. This result is further reinforced by the decomposition of the Theil index into the within and between sector components. The within component is a weighted average of the sectoral Theil indexes (where the weights are the sectoral shares of the aggregate value of the considered variable), while the between component is derived assuming every firm within a given sector display 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 the variables, the within-industry component explains most of the overall concentration. In fact, the between sector component of concentration accounts at most for one fourth of concentration in the case of import. Thus, even if in virtually every sector imports are more concentrated than exports (see Table 5), sectoral specialization matters more in explaining imports concentration than in explaining export concentration. Between 1993 and 1997 the importance of the between sector component of concentration grew for exports and decreased for imports, while it remained rather stable for employment and sales.

In sum, we find that Italian trade is less concentrated than in other countries but, consistently with cross-country evidence for other countries, trade is more concentrated across firms than sales and employement. 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 international trade, rather than the outcome of sectoral specialization, 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.

[12] We use the Theil index because the Gini Index is not exactly decomposable in a within and a between component.

Table 5: Concentration

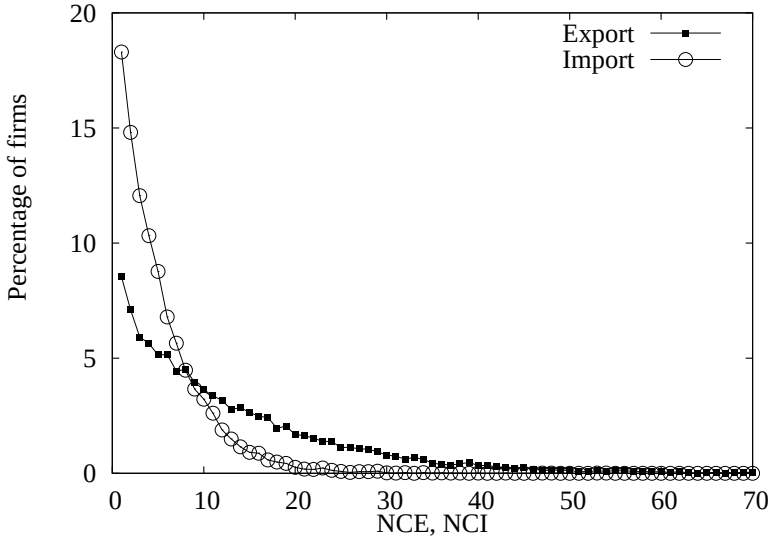
Average Theil 93-97	Exports	Imports	Total trade	Employees	Sales
Food, Beverages	1.580	1.822	1.572	0.907	1.103
Tobacco	0.525	1.072	0.747	0.274	0.474
Textiles	1.178	1.391	1.183	0.762	0.903
Wearing, Apparel	2.057	1.972	1.983	0.677	1.891
Leather, Allied Product	0.869	1.410	0.923	0.502	0.725
Wood Manufacturing	1.013	0.962	0.927	0.342	0.630
Paper, Allied Product	1.947	1.970	1.936	1.001	1.392
Printing, Publishing	1.602	1.446	1.419	0.801	1.421
Coke and Petroleum	2.284	2.388	2.463	2.072	3.222
Chemical Products	1.632	1.658	1.540	1.275	1.495
Rubber, Plastics	1.662	2.423	1.863	1.060	1.156
Non Met. Min. Products	1.168	1.377	1.152	0.675	0.862
Basic Metals	1.141	1.460	1.190	0.982	1.018
Metal Product	0.973	1.458	1.028	0.409	0.694
Industrial Machinery	1.628	2.425	1.698	1.076	1.367
Office Machinery	2.461	2.633	2.589	2.226	2.633
Electrical Machinery	1.039	1.632	1.116	0.805	1.019
Radio, TV, etc.	2.184	2.417	2.298	2.081	2.152
Med., Prec. ,Opt.Instr.	1.072	1.457	1.048	0.570	0.763
Motor Vehicles	3.534	3.379	3.522	3.114	3.350
Other Transp. Equip.	1.956	2.081	1.987	2.056	2.355
Forniture Manufacturing	1.344	1.856	1.389	0.367	0.852
Recycling	0.611	0.732	0.733	0.915	0.514

3.2 Concentration along the extensive margins

Concentration of international trade have been observed not only across firms (i.e. few firms accounting for the bulk of imports and exports) but also along the product and country extensive margins.[13] Eaton et al. (2004) show that, in the case of France, most exporting firms served only a few markets, so that a negative relationship existed between the number of destinations served by each firm (the market extensive margin) and the number of firms that exported to those destinations. The same pattern has been found for Slovenia (Damijan et al. (1998)), Belgium (Muuls and Pisu (2007)), Sweden (Andersson et al. (2007)) and the US (Bernard et al. (2007)). The last three studies provided also evidence of a negative relationship between the number of countries from which firms import (country extensive margin of imports) and the number of firms that imports from those markets. A similar pattern have been found along the product extensive mar-

[13]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.

Figure 2: Number of importers (exporters) along the country extensive margin (year 1993)



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

gin: many firms export (import) few products, and a handful of firm trade in a several different products.

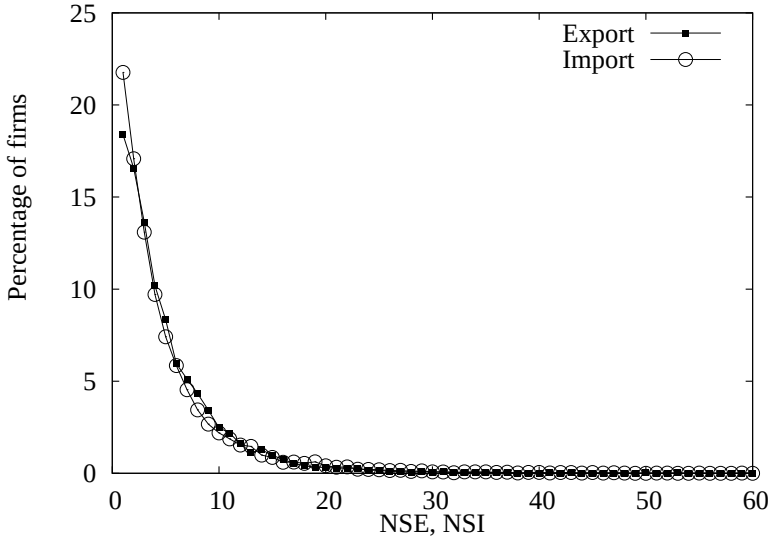
These stylized facts are confirmed also in the case of Italian manufacturing. In Figure 2 we depict the country extensive margins of exports and imports (labelled as NCE (and NCI)) and the percentage of firms that are actually observed along these dimensions. The number of firms declines monotonically with the country extensive margin, for both importers and exporters, but is lower in the case of the former. In 1993, about 8% of exporting firms exported to only one country and about 18% of importing firms imported from only one country and the percentage of importing firms declines more steeply with respect that of exporting firms: from 8 countries onwards the percentage of exporting firms is greater than the percentage of importing firms. The same picture emerge looking at the average number of exporting/importing countries, which is 13.0 in the case of exports and 5.3 in the case of imports. Moreover the support of NCI is smaller than the one of NCE: the former goes from $[0; 54]$ while the latter from $[0; 134]$.[14]

Let us now consider the product/sector[15] extensive margins (Figure 3). Substantial concentration emerges also along this dimension: about 18% of exporting firms, in 1993, traded products in only one 4-digit sector, while about 22% 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 internationalized manufacturing firms on average exported 12 products and imported 34 products, while Bernard et al. (2005) report that in 2000 on average exporters

[14]The high degree of concentration is broadly confirmed in 1997, although one can observe an increase in NCE and NCI (to 18.1 and 6.3 respectively).

[15]Since our data allow to identify the number of 4-digit sectors in which firms trade, we would better refer to the sector, rather than product, extensive margin.

Figure 3: Number of importers (exporters) along the sector extensive margin (year 1993)



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

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 4-digit sectors in which firms trade rather than the number of products actually traded, as in the case of Belgium and the U.S..

By combining information on the extensive margins, the number of firms and the volumes of traded goods, we shed some further light on one results which we illustrated in the previous section: trade is concentrated in very few firms, which are very diversified. The upper panel of Table 6 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% of exporters sell in up to 5 countries and (4-digit) sectors, while only 1.6% of exporters operate in more than 20 sectors and countries. The lower panel of Table 6 shows that this small share of firms account for 30.9% of overall exports. These stylized facts, are consistent with theoretical models in which exporters incur sunk cost in every product/sector and geographical market in which they sell goods (as Bernard et al. (2003) and Chaney (2007)). However, the same dynamics holds even more true for imports. Table 7 shows that 56.4% of all importers (active in less than 5 markets and sectors) account for only 5.9% of all imports, while the more diversified importers (which are less than 1% of the total) account for 32.8% 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, where we will investigate whether importing and exporting firms exhibit significant differences in productivity and other characteristics as opposed to non internationalized ones, and if these differences are related also to the degree of sectoral and country diversification.

Table 6: 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

Table 7: Sector and country extensive margins and the concentration of import: 1993

		NCI				
		1-5	6-10	11-20	21+	Total
% 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

4 Firm heterogeneity and international trade activities

4.1 Firm characteristics and the international trade status

As discussed in the introduction, the bulk of the empirical analysis on the characteristics of internationalized firms has focused just on exporting firms and has shown that they are "better" than non-exporters. Evidence has convincingly shown that in most cases this has to be attributed to a self-selection effect, which induces only the best performing firms to bear the sunk cost associated with exporting (see The International Study Group on Export and Productivit (2007) and Mayer and Ottaviano (2007) for international comparative evidence and Wagner (2007) and Greenaway and Kneller (2007) for surveys of empirical studies). However, some recent investigations conclude that learning by exporting may also occur under specific circumstances (Van Biesebroeck (2006); Isgut and Fernandes (2007); Lileeva and Trefler (2007); Serti and Tomasi (2007)).

Much less work has been done on import behavior and firm characteristics. A step forward in this direction has been conducted only recently by some empirical studies (Bernard et al. (2007), Muuls and Pisu (2007)) which have shown that importers display similar characteristics as those observed for exporters. Most of the empirical and theoretical literature have focused mainly on the "learning-by-importing" effects (Keller (2004)), the self-selection hypothesis have not been followed out. However, the positive relationship between importing activities and firms' performances induced to consider the existence of fixed costs required not only to enter the export, but also the import markets. More general, there could be a self-selection process according to which only the most efficient firms, among the set of potential entrants, begin to import.

Halpern et al. (2005) develop an empirical model where imports are associated with productivity improvements through two main channels: the higher quality of imported goods and imperfect substitution of foreign and domestic inputs. In their model, importers have to pay a fixed cost every time they buy a new foreign variety of intermediate good, so they would buy those varieties where the improvement in productivity compensate for the fixed cost. This model does not differentiatiate between the case of import of materials and capital goods, but, as a matter of fact, is consistent with both stories. The cost of importing intermediate materials is not fixed per se, as the more output produced, the more intermediate inputs are needed, but some sunk costs may be associated with establishing business relationships and organizing the flow of goods (for example in the case of import as a part of vertical fragmentation of production). The nature of fixed costs associated with imports is instead apparent when firms source capital goods (such as machinery and equipment, or knowledge capital, for example in the form of patents and licenses). These costs are also consistent with a feature of the model of Halpern et al. (2005) where firms incur fixed costs for every new imported variety. The model however does not predict any self-selection effect of productivity into import, which would occur if some of the fixed costs associated to imports induce only the more productive firms to decide to buy foreign inputs. We submit that this can be the case of firms buying foreign (more-advanced) technology which require some absorptive capacity to be utilized in the importing firm. In this case, we would find both a productivity enhancement effect of imports (as described by Halpern et al. (2005)) and a self-selection of better firms into importing.

In the following we will investigate this issue further, by estimating productivity differ-

Table 8: Differences between non-traders and other trading categories (average values 1993-1997)

	Neither Exp. nor Imp.	Only Exp	Only Imp	Two way Traders	Exporters	Importers
Absolute value						
Labour Productivity	53.8	65.9	74.4	83.9	82.5	83.2
TFP	103.5	130.1	132.3	180.1	176.4	176.
Sales	6927	57618	19338	50257	50736	48129
N. Employees	40	78	59	132	129	127
Capital Intensity	82.5	94.3	139.9	121.2	119.3	122.7
*Relative value**						
Labour Productivity	100	124.9	138.4	155.7	153.5	154.7
TFP	100	125.7	127.8	174.0	170.4	170.9
Sales	100	831.8	279.2	725.5	732.4	694.8
N. Employees	100	207.0	150.2	333.7	323.7	320.5
Capital Intensity	100	114.3	169.6	147.0	144.6	148.8

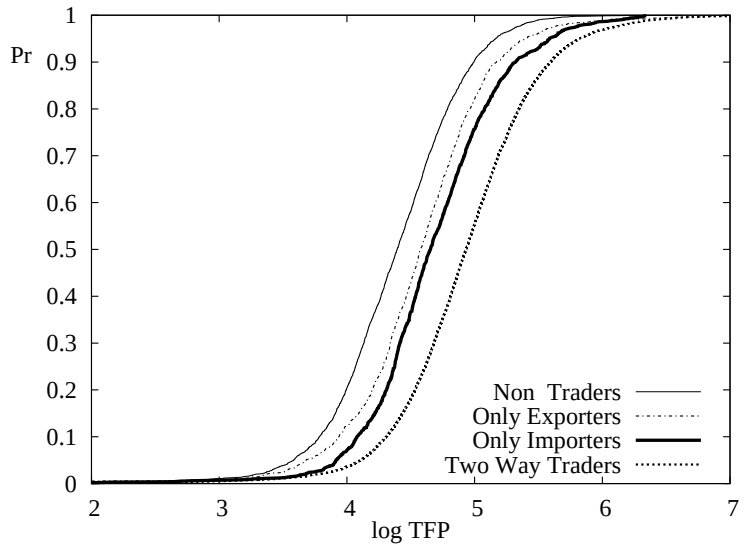
* 100 = Neither Exporters nor Importers

entials (as well as differences in size and capital intensity) between internationalized and non-internationalized firms. Among the former group, we will follow the distinction made in section 2 and distinguish firms involved in both importing and exporting activities (*two-way traders*) and firms involved in either exporting or importing only.[16] Table 8 provides some basic descriptive statistics on the sample firms. Consistently with other studies, we find that non traders are smaller (in terms of both total sales and number of employees) and less productive than internationalized firms. Among this latter group, two-way traders outperform firms engaged in only importing or exporting activities. This is in line with findings of Muuls and Pisu (2007) on Belgium and Andersson et al. (2007) on Sweden and is consistent with previous evidence showing that increasing global engagement of firms is associated with better performances.[17] Firms engaged only in importing or exporting activities lie in between non-internationalized firms and two-way traders both in terms

[16]In this respect this paper is closer to Muuls and Pisu (2007) and Andersson et al. (2007) than to Bernard et al. (2007), since the former single out two-way traders from firms involved only importing (exporting) activities, while the latter focus on the aggregate of exporting and importing firms. Since, as we have seen in Section 2, most international firms are engaged on both sides of trade, we believe it is more accurate to keep two-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 to make a finer distinction

[17]Among others, Greenaway et al. (2005) and Castellani and Zanfei (2007) find that both in the U.K and in Italy, domestic multinational firms outperform (non-multinational) exporters. Unfortunately, our data do not allow to identify multinational firms among exporters, but we expect that it would be unlikely that a multinational firm would not be engaged in any export to some market, and, to the extent that multinationals tend to fragment at least part of their production internationally, they would also be importing goods. Thus, we expect that, if we had the data, we would find multinational firms in the two-way traders group.

Figure 4: Cumulative Distribution Function: Total Factor Productivity (1993)



of number of employees and productivity (measured as labour productivity and TFP).[18] 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), and, as illustrated by the comparison of the cumulative distributions of TFP (in Figure 4), this holds not only at the mean: the whole TFP distribution of only importers lies at the right of the distribution of only exporters. 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. One explanation for this fact is that firms internationalized only from the import side source mainly capital goods from abroad. However, it should also borne in mind that these unconditional differences may well reflect a sectoral composition effect. In the case of import 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 9 and 10 we account for this, by running regressions which control for sector, size, region and time effects.

In particular, we estimate the relation between internationalization status and firm heterogeneity in performance (the so-called performance premia), by running the following regression

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

where y_{it} denotes the logarithm of either total revenue, number of employees, labour productivity, TFP and capital intensity, D_{it}^{twoway}, $D_{it}^{imponly}$ and $D_{it}^{exponly}$ are (mutually

[18] Labour productivity has been computed as the value added per worker, while TFP is the residual of a two inputs (capital and labour) Cobb-Douglas production function estimated using the semiparametric method proposed by Levinsohn and Petrin (2003)

Table 9: Firm heterogeneity and internationalization status, Pooled OLS regressions (1993-1997)

Dependent variable	Labour productivity	TFP	Sales	N. empl.	Capital Intensity
Two-way traders	0.329***	0.241***	1.452***	0.591***	0.693***
	(0.007)	(0.007)	(0.017)	(0.011)	(0.020)
Import only	0.234***	0.162***	0.732***	0.182***	0.594***
	(0.012)	(0.011)	(0.024)	(0.016)	(0.029)
Export only	0.156***	0.090***	0.647***	0.141***	0.431***
	(0.012)	(0.011)	(0.025)	(0.050)	(0.027)
Foreign Ownership	0.013	0.036**	1.329***	1.257***	0.021
	(0.015)	(0.017)	(0.054)	(0.502)	(0.030)
N. observations	60,661	59,987	60,652	60,662	60,031
R-squared	0.344	0.448	0.420	0.215	0.338

Note: Standard Errors in parenthesis 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.

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. *Controls* denotes a vector of firm characteristics including the log of employment, calendar year dummies, two-digits sector dummies and regional dummies[19] and an indicator taking value 1 for foreign-owned firms.[20] 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 categories of internationalized firms with respect to the non-internationalized firms.[21]

In Table 9 we will estimate equation (1) using Pooled OLS, and in Table 10 we control for individual fixed effects, which wipe out all the time invariant firm heterogeneity (FE model). While in Table 9 the estimated $\hat{\beta_A}$, $\hat{\gamma_A}$ and $\hat{\phi_A}$ coefficients can be interpreted as conditional differences in size, productivity and capital intensity across firms with different exposure to international markets, results from Table 10 may have a "more causal" interpretation of the estimated coefficients, since they basically estimates a correlation between a change in the trade status and a change of the dependent variables under analysis. Differences between OLS and FE may thus emerge if time invariant firm characteristics are correlated with the internationalization status. Nevertheless, we 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 9 show that even con-

[19] 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.

[20] We define as foreign-owned, firms where some of the shares are owned by non-Italian firms. Result are robust to different (more restrictive) criteria for the construction of this dummy.

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

Table 10: Firm heterogeneity and internationalization status, Fixed-effect regressions (1993-1997)

Dependent variable	Labour productivity	TFP	Sales	N. empl.	Capital Intensity
Two-way traders	0.051***	0.046***	0.116***	0.036***	0.060**
	(0.154)	(0.010)	(0.019)	(0.009)	(0.027)
Import only	0.034***	0.034***	0.047***	0.022***	0.029
	(0.011)	(0.010)	(0.012)	(0.005)	(0.021)
Export only	0.038***	0.033***	0.076***	0.019**	0.039
	(0.163)	(0.018)	(0.019)	(0.010)	(0.032)
Foreign Ownership	-0.0001	0.0006	0.0006	0.037***	0.009
	(0.018)	(0.018)	(0.018)	(0.012)	(0.030)
N. obs.	60,661	59,987	60,652	60,662	60,031
R-squared	0.862	0.887	0.907	0.983	0.907

Note:Standard Errors in parenthesis 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.

trolling for sector, time region and foreign-ownership differences, significant heterogeneity remain in productivity size and capital intensity across firms with different degrees of internationalization. In particular, it is rather clear that international firms are larger, more productive and more capital intensive than non-internationalised firms. The coefficients attached to the different internationalization status also suggest that a sort of hierarchy exist also between two-way traders, and firms engaged in either only importing or only exporting activities. For example, if one considers TFP differences, two-way traders are about 27% 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% and 9% more productive, respectively. By comparing coefficients, one gathers that only importers are almost twice as productive than only exporters, and in turn two-way traders are 50% more productive than only importers. Similar orders of magnitude are obtained by looking at other characteristics.

Once we wipe out the time invariant firm heterogeneity, differences between internationalised and non-internationalised firms sharply decline. As reported in Table 10, the TFP premium of two-way traders drops to less than 5% and the premia of only importers and only exporters shrink accordingly. This suggests that most of the differences in performance between internationalised and non internationalised firms is due to a firm specific time invariant effect. To some extent, we can argue that this factor is the main driver of the decision to internationalism (i.e. which determines the self-selection 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, so that we cannot reject the hypothesis of equality between $\hat{\gamma_A}$ and $\hat{\phi_A}$. We submit that this finding can be interpreted as indirect evidence that the self-selection effect is stronger in the case 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 9 and 10

Table 11: Transition matrix in internationalisation status, 1993-1997

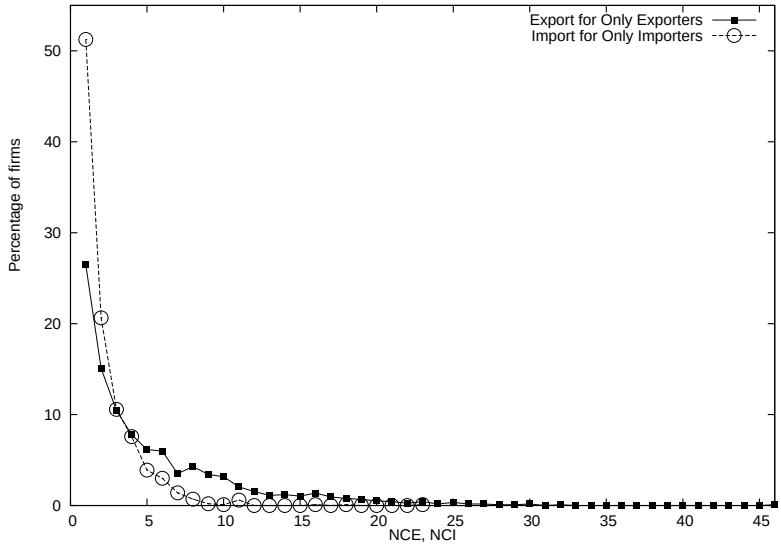
	1997					
1993	N. Exp. nor Imp.	Only Exporters	Only Importers	Two-way traders	Total	N° Firms
N. Exp. nor Imp.	83.32	2.78	9.90	4.00	17.32	1151
Only Exporters	8.79	32.14	2.20	56.87	5.48	364
Only Importers	27.63	2.69	48.66	21.03	6.16	409
Two-way traders	1.44	5.32	0.47	92.78	71.05	4721
Total	17.63	6.20	5.20	70.97	100.00	6645
N° Firms	1172	411	343	4719	6645	

would signal that productivity is probably a more stringent precondition for being an only importer than for being an only exporter. This has interesting implications for theory, since most recent theoretical works have stressed the role of sunk costs to export which determine self-selection into exporting. These results would probably raise the issue of sunk costs to import. As noted earlier, this would probably be consistent with a situation where firms need to accumulate absorptive capacity in order to be able to benefit from imported goods used in production. We speculate here that this is more likely to occur when firms import capital goods, which may incorporate advanced technologies, rather than materials and other intermediate inputs. In the following we will investigate this issue further, by providing scattered evidence on only importers, supporting the idea that this group of firms is mainly importing high-tech capital goods. First, from Table 3 one can derive that most firms internationalised only through imports trade only with EU countries. In fact, over the 1993-1997 period, 5% of firms are only importers, but if we exclude firms trading only with EU partners the share of only importers drops to 1.6%. To appreciate how sizable this slip is, one can consider that the share of only exporters slides only from 5.4% to 4.8%, suggesting that only a small portion of exporters serve only the EU market. A closer look to the origin of imports reveals that 92% of only importers source from at least one Western European market (including EU15 and Efta countries) and Germany is the largest source country (17% 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% of only importers).[22] Further, geographical diversification is very low in the case of only importers: as documented in Figure 5, 50% of only importers source from only one country and 90% from less than 5 countries. As a comparison, one may consider that the share of only exporters serving one country is 26% and 60% serve up to 4 countries. Finally, looking at the transition matrix from 1993 to 1997 reported in Table 11 one can appreciate that import is less persistent than export: a relatively high share of firms engaged only in import in 1993 did not keep importing in 1997 (27.6% became non traders, and 2.7% ended up being only exporters), and, conditional on changing status, firms which were two-way traders in 1993 are more likely to end-up being only exporters (thus stopping importing activities) than only importers.

We believe that this scattered evidence is consistent with the idea that only importers

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

Figure 5: Country extensive margin of export and import for one-way traders, 1993



are mainly buying high-tech capital goods from few major EU and Efta countries which are among the world's largest producers of industrial machinery and electronic equipments (such as Germany, France and Switzerland). These goods would require significant fixed costs every time a firms completes a transaction and, this would determine that firms do not buy machinery every year, and show a relatively less persistent pattern. Altogether, to the extent that buying high-tech capital goods require the accumulation of absorptive capacity, these facts would contribute to explain the significant productivity premium that we estimated for this group of firms.

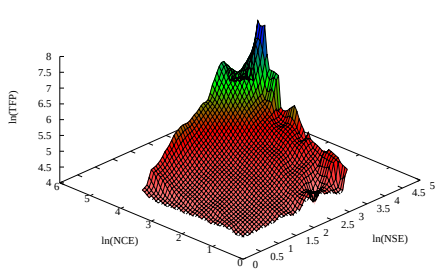
4.2 Firm heterogeneity along the extensive margins

In the previous sections we have shown that a few firms account for the bulk of trade, that those few firms are rather diversified in terms of markets and sectors they trade with, and that the more internationalised firms tend to be also the largest and the most productive firms. The evidence provided so far also suggests that these patterns may be stronger in the case of imports than for exports. 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 the 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.[23] It is worth mentioning that previous studies on importers and exporters, did not explore this dimension as thoroughly as we do here.

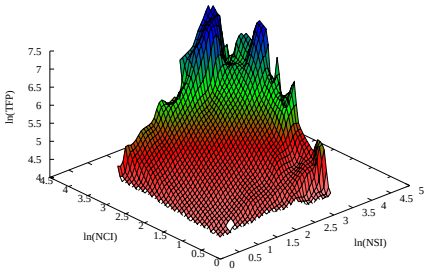
First, we will show some non-parametric multivariate kernel regressions. As in a standard parametric regression, the aim of this technique is to estimate the conditional expectation of a dependent variable, y, given other explanatory variables, x and z. However in

[23]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.

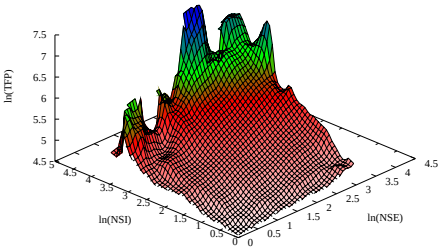
Figure 6: TFP along country (NC) and sector (NS) extensive margin for import and export, two-way traders (1993)



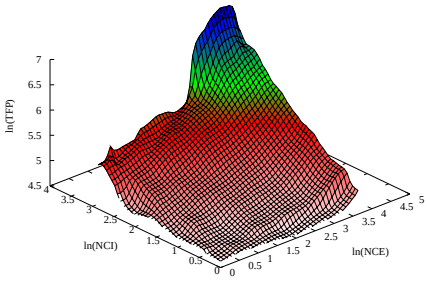
(a) TFP along NCE and NSE



(b) TFP along NCI and NSI



(c) TFP along NSI and NSE



(d) TFP along NCI and NCE

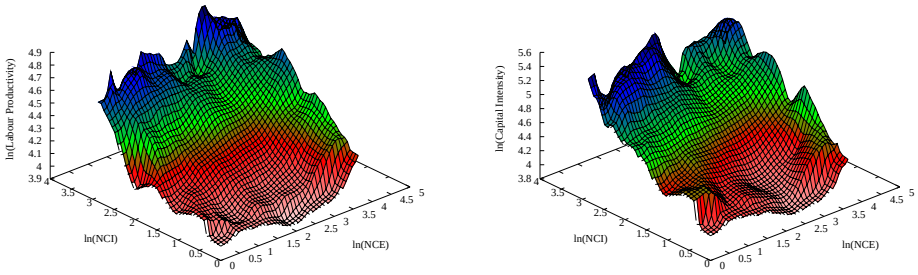
this case we do not assume that the relationship between the dependent and the independent variables is linear. We instead estimate non parametrically by multivariate kernel methods the conditional expectation of y given the observed combinations of the explanatory variables x and z, i.e. $E(y|x;z)$. This is a non-parametric method which does not impose any a priori structure on the data (Pagan and Ullah (1999), Härdle et al. (2004)).

Using the kernel estimation technique, smooth surfaces can be obtained from the observed triples $\{x, z, y\}$. In Figure 6 we plot the kernel density estimate of the logarithm of TFP, on the log of our measures of sector and country extensive margins.[24] 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).[25] 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

[24] The kernel density 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 License and freely available at *http://www.cafed.eu/gbutils*. If not else specified, density estimation is performed using Epanenchnikov kernel and setting the bandwidth following the "rules" suggested in Section 3.4 of Silverman (1981).

[25] 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 7: Labour productivity and capital intensity along the country extensive margin for import and export, two-way traders (1993)



(a) Labour productivity along NCI and NCE (b) Capital Intensity along NCI and NCE

import and export (sector extensive margin 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 the Figure 6 (a) and (b)). In fact, as the number of markets and sectors increases, the vertical height of the surface grows. This suggests that firms' TFP is an increasing function of the number products and countries with which a firm trades. Comparing diversification on the import and export side (Figure 6 (c) and (d)), 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. This patterns is evident when looking at labour productivity. In Figure 7 (a) one notices that labour productivity increases mainly along the NCI axis. However, since this combines with a similar pattern for the capital labour ratio, the kernel density for TFP (Figure 6 (d)), has a more 'regular' shape.

In Section 3.1 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 on the 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. In order to shed more light on the relative importance of the different extensive margins and to 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:

$$y_{it} = \alpha + \lambda_1 x_{it}^{nse} + \lambda_2 x_{it}^{nsi} + \lambda_3 x_{it}^{nce} + \lambda_4 x_{it}^{nci} + \phi controls + \upsilon_{it}, \tag{2}$$

where y_{it} is a measure of either firm productivity, size or capital intensity, the xs denote the logarithm of NSE, NSI, NCE and NCI, while *controls*, as usual, is 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 in order 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

Table 12: Firm heterogeneity along the sector and country extensive margins, Pooled OLS regressions (1993-1997)

Dependent variable	Labour productivity	TFP	Sales	N. 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)
N. obs.	35328	35099	35328	35329	35114
R-squared	0.243	0.403	0.508	0.420	0.267

Note: Standard Errors in parenthesis 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.

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 increased in the number of export destinations by 1%. In Table 12, we estimate equation (2) by pooled OLS regressions, while in 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 effect, the 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% increase in NCI is associated with 1.2% higher labour productivity and TFP, 4.2% higher turnover and 1.4% higher capital intensity. The premia associated with NSI are smaller, but still sizable 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 give support to the argument that, in order 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 premia associated with export diversification. This is consistent with the idea that the premia associated with NCI and NSI is the result of self-selection of better firms into more diversified importing activities. Conversely, our evidence suggests that diversification of export markets (measured by NCE) determines the greater effect on firm's size, capital intensity and productivity. However, even if the relatively higher imports diversification premia (detected in Table 12) are mainly a by-product of time constant heterogeneity, we also uncover signals of performance improvement connected to import diversification.

Table 13: Firm heterogeneity along the sector and country extensive margins, Fixed-effects regressions (1993-1997)

Dependent variable	Labour productivity	TFP	Sales	N. 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
N. obs.	35328	35099	35328	35329	35114
R-squared	0.819	0.869	0.976	0.985	0.878

Note: Standard Errors in parenthesis 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.

5 Conclusions

This paper offers a portrait of Italian manufacturing firms that trade goods. 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 few firms accounting for a large share of trade volumes and appears to be mainly occurring within rather than between sectors. This fact supports recent theories of international 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 share of import and export. Finally, we show that import is more concentrated than export, especially between sectors and along the sector and country extensive margins.

Second, we confirm that firms with different exposure to international markets have different performances, in terms of size, capital intensity and productivity. In particular, we support the idea, as in a wealth of recent studies, 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 activities perform better than those involved only in exporting. Our results suggest that the importers' premium is more the result of a self-selection process than a productivity enhancement due to import of capital and intermediate inputs. We provide some evidence that this may have to do with the fact that only importers buy mainly capital goods from major European countries. To the extent that these capital goods incorporate advanced knowledge, they may entail sunk

costs which the importers have to incur to accumulate the absorptive capacity needed to use those goods in production.

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.

References

Acharya, R. and W. Keller (2007). Technology transfer through imports. Working Paper 13086, NBER.

Andersson, M., S. Johansson, and H. Loof (2007). Firm performance and international trade - evidence from a small open economy. Electronic Working Paper Series 99, CESIS.

Bernard, A., J. Eaton, B. Jensen, and S. Kortum (2003). Plants and productivity in international trade. *American Economic Review 93*, 1268–1290.

Bernard, A. and B. Jensen (1999). Exceptional exporter performance: cause, effect, or both? *Journal of international economics 47*(1), 1–25.

Bernard, A., B. Jensen, S. Redding, and P. Schott (2007). Firms in international trade. *Journal of Economic Perspectives 21*(3), 105–130.

Bernard, A., B. Jensen, and P. Schott (2005). Importers, exporters, and multinationals: A portrait of firms in the U.S. that trade goods. Working Paper 05-10, Institute for International Economics.

Castaldi, C., M. Milakovic, and A. Secchi (2006). Scale and technological factors in the diversification structure of business firms. *Economics Letters 91*, 117–121.

Castellani, D. and A. Zanfei (2007). Internationalisation, innovation and productivity: how do firms differ in italy? *The World Economy 30*(1), 156–176.

Chaney, T. (2007). Distorted gravity: the intensive and extensive margins of international trade. Working paper, University of Chicago.

Clerides, S., S. Lach, and J. Tybout (1998). Is learning by exporting important? micro-dynamic evidence from Colombia, mexico, and morocco. *Quarterly Journal of Economics 113*, 903–948.

Cowell, F. and S. Jenkins (1995). How much inequality can we explain? a methodology and an application to the USA. *The Economic Journal 105*(429), 421–430.

Damijan, J., S. Polanec, and J. Prasnikar (1998). Self-selection, export market heterogeneity and productivity improvements: firm-level evidence from Slovenia. Working Paper 14804, LICOS- Centre for Transition Economics.

Eaton, J. and S. Kortum (2001). Trade in capital goods. *European Economic Review 45*, 1195–1235.

Eaton, J., S. Kortum, and F. Kramarz (2004). Dissecting trade: firms, industries and export destinations. *American Economic Review 94*, 150–154.

Ethier, W. (1982). National and international returns to scale in the modern theory of international trade. *American Economic Review 72*(3), 389–405.

Ferragina, A. and B. Quintieri (2000). Caratteristiche delle imprese esportatrici italiane. un'analisi su dati Mediocredito e Federmeccanica. *ICE, Quaderni di Ricerca 14*, 1–37.

Greenaway, D. and R. Kneller (2007). Firm heterogeneity, exporting and foreign direct investment: A survey. *Economic Journal 117*, F134–F161.

Greenaway, D., R. Kneller, and M. Pisu (2005). Exports versus fdi: An empirical test. *World Economics/Weltwirtschaftliches Archiv 141*(2), 193–218.

Grossman, G. and H. Helpman (1991). *Innovation and Growth in the Global Economy*. MIT Press, Cambridge, MA.

Halpern, L., M. Koren, and A. Szeidl (2005). Imports and productivity. Working Paper 5139, CEPR.

Helpman, E., M. Melitz, and Y. Rubinstein (2007). Estimating trade flows: trading partners and trading values. Working Paper 12927, NBER.

Härdle, W., M. Müller, S. Sperlich, and A. Werwatz (2004). *Nonparametric and Semiparametric Models*. Springer.

Hummels, D., J. Ishii, and K. Yi (2001). The nature and growth of vertical specialization in world trade. *Journal of International Economics 54*(1), 75–96.

Isgut, A. and A. Fernandes (2007). Learning-by-exporting effects: Are they for real? Working Paper 3121, MPRA.

Keller, W. (2004). International technology diffusion. *Journal of Economic Literature 42*, 752–782.

Kraay, A., I. Soloaga, and J. Tybout (2002). Product quality, productive efficiency, and international technology diffusion: Evidence from plant-level panel data. Policy Research Working Paper 2759, World Bank.

Levinsohn, J. and A. Petrin (2003). Estimating production functions using inputs to control for unobservables. *Review of Economic Studies 70*, 317–342.

Lileeva, A. and D. Trefler (2007). Improved access to foreign markets raises plant-level productivity. Working Paper 13297, NBER.

MacGarvie, M. (2006). Do firms learn from international trade. *Review of Economics and Statistics 54*(1), 46–60.

Markusen, J. (1989). Trade in producer services and in other specialized intermediate inputs. *American Economic Review 79*(1), 85–95.

Mayer, M. and G. Ottaviano (2007). The Happy Few: the internationalisation of European firms new facts based on firm-level evidence. Working Paper Volume 3, Bruegel Blueprint Series.

Melitz, M. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica 71*(6), 1695–1725.

Muuls, M. and M. Pisu (2007). Imports and exports at the level of the firm: evidence from belgium. Working Paper 114, National Bank of Belgium.

Pagan, A. and A. Ullah (1999). *Nonparametric Econometrics*. Cambridge, University Press.

Roberts, M. J. and J. Tybout (1997). The decision to export in Colombia: An empirical model of entry with sunk costs. *American Economic Review 87*(4), 545–564.

Serti, F. and C. Tomasi (2007). Self-selection and post-entry effects of exports. Evidence from italian manufacturing firms. Working paper, Laboratory of Economics and Management.

Silverman, B. (1981). *Density Estimation for Statistics and Data Analysis*. London, Chapman and Hall.

Sjoholm, F. (1996). International transfer of knowledge: the role of international trade and geographic proximity. *World Economics/Weltwirtschaftliches Archiv 132*, 97–115.

Sjoholm, F. (1997). Exports, imports and productivity: Results from indonesian establishment data. Working Paper Series in Economics and Finance 183, Stockholm School of Economics.

The International Study Group on Export and Productivity (2007). Exports and productivity. Comparable evidence for 14 countries. Working Paper Series 39, Department of Economics, Finance and Statistics, University of Perugia.

Tucci, A. (2005). Trade, foreign networks and performance: a firm-level analysis for india. Working Paper 8418, Centro Studi Luca d'Agliano.

Van Biesebroeck, J. (2006). Exporting raises productivity in Sub-Saharan African manufacturing plants. *Journal of International economics 67*(2), 373–391.

Wagner, J. (2007). Exports and productivity: A survey of the evidence from firm-level data. *The World Economy 30*(1), 60–82.