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Abstract

By combining economic and financial data for Portuguese manufacturing firms with data on their exports and imports, we uncover some aspects of the relationship between international trade engagement and firms' performance. In line with recent theoretical and empirical developments in the international trade literature: (i) we testify that Portuguese international trade is highly concentrated, especially on the import side, and both in inter- and intra-sector terms; (ii) we corroborate previous studies and theses according to which two-way traders outperform only importers, only exporters and above all domestic firms; (iii) we find that the greater the diversification of markets and goods (especially with regard to imports), the better the performance achieved by internationalised firms; (iv) we notice that the higher the intensity of international trade of firms (especially imports), the better the performance of firms; (v) we also present evidence that destination markets, for exports, and, origin markets, for imports, are also important in explaining firm performance.

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1. Introduction

There is an emerging empirical literature examining international trade at firm level. This microeconomic international-trade literature, pioneered by Bernard and Jensen (1995) and Aw and Hwang (1995), recognises that international trade affects firm performance. Initial works began by studying the superior performance of exporters with regard to productivity, value added or wages (e.g., the International Study Group on Export and Productivity, 2007). The analysis was then extended to study the effects of importing activities (e.g., Kasahara and Lapham, 2008) and the connections with the advantages arising from exports. However, this literature has not yet fully studied exporter/importer heterogeneity in terms of their geographical diversification and the development level of the markets involved, the role of trade intensity or the importance of heterogeneity in the number of traded products.

Indeed, only a limited number of recent papers have undertaken such a study: Bernard et al. (2009) for the U.S.; Eaton et al. (2004) for France; Andersson et al. (2008) for Sweden; Muûls and Pisu (2007) for Belgium; Castellani et al. (2010) and Serti and Tomasi (2008) for Italy; Damijan et al. (2004) for Slovenia; Altomonte and Békés (2008) for Hungary; McCann (2009) and Lawless (2009) for Irish firms. These studies have confirmed that firms which are internationally engaged enjoy better results than the purely domestic ones.

At the theoretical level, the international trade general equilibrium models of Bernard et al. (2003) and Melitz (2003) show how the most productive firms self-select into export markets, but do not explain how they first achieve that productivity advantage; moreover, such models do not allow for intra-firm changes in productivity[1]. Recent theoretical models of heterogeneous firms and trade (e.g., Chaney, 2008; Lawless, 2009; Helpman et al., 2008) have tried to overcome those inabilities by considering that extensive and intensive margins change across markets, since bilateral trade is affected by trade costs. The latter then reflect market-specific fixed costs, which interact with firm heterogeneity in productivity. This indicates that firms with better results could trade with a larger number of countries and with markets denoting higher entry-costs.

Using a large database of Portuguese manufacturing firms from 1996 to 2003 that merges two distinct databases – one using economic, financial and structural data and the other using external trade data –, we aim to study the heterogeneity of Portuguese international firms' performance, connect it to their international trade engagement and test the main hypotheses of recent theoretical models relating trade and firm performance (e.g., Lawless, 2009). Moreover, an important objective of this paper is also to uncover the specificities of internationalised Portuguese firms.

We add three main contributions to this branch of literature. Firstly, we compare the international performance of Portuguese manufacturing firms with firms from other countries for which there are comparable studies (e.g., Sweden, France, the U.S., Italy, Ireland and Hungary). Secondly, we perform a panel-data analysis in which, differently from other studies, we include dynamic specifications to deal with the

[1] In most previous empirical works this limitation was mainly due to dataset limitations that blocked theoretical models from reaching the full spectrum of firms' trading activities.

problem of simultaneity bias as a source of endogeneity; in doing so, we expect to obtain much more reliable conclusions. Thirdly, we add the analysis of the intensive margin of exports and imports to the already known analysis of the importance of the extensive margin and market heterogeneity.

Operationally, we used both descriptive statistics and regression techniques, OLS pooled regressions, Fixed-Effects models (FE) and a dynamic panel data specification. In particular, the latter is justified in order to offset exogeneity problems of explanatory variables. Our main finding is that, on average, the growing commitment to international trade is associated with better firm performance, thus suggesting that import and export activities may be responsible for intra-firm gains. These gains could result from two non-mutually exclusive origins: (i) a self-selection origin, when better firms become exporters, probably related to a conscious effort to improve performance so as to internationalise and prepare for more demanding markets; and/or (ii) a learning ability obtained after the beginning of exports or imports and generated by superior competitive pressure and technological advantage of some foreign markets. However, this paper does not aim to assess such issues in detail given that they require econometric tools not used here.

In line with several studies – Muûls and Pisu (2007), on Belgium; Andersson et al. (2008), on Sweden; Vogel and Wagner (2010), on Germany; Altomonte and Békes (2009), on Hungary – we found that two-way traders (TWT), firms that export and import in the same year, outperform firms engaged only in importing (OI) or only in exporting activities (OE) and both of these groups outperform the purely domestic ones. This could be the result of complementarities between export and import premiums.

In addition, we found that: (i) firms which export or import more goods with more markets perform better, in line with Bernard et al. (2009), for US firms, Andersson et al. (2008), for Sweden, Mayer and Ottaviano (2007), for European firms, among others; (ii) firms trading (exporting and/or importing) with multiple markets presented a superior performance (as found by Serti and Tomasi, 2007).

Moreover, in a novel approach to these issues, we analyse the particular relevance of the intensity of trading and of the importance of trading with specific markets to Portuguese firm performance. In particular, we study the impact of trade with Spain and Germany (the two main markets for Portuguese firms), the impact of trade with Portuguese-speaking countries (PL) and with those countries which may be considered the most difficult markets for Portuguese firms. The results suggest that there is a significant correlation between the requirements and costs involved in trading with certain countries and the level of performance achieved by firms that actually trade in those markets.

The rest of the paper is organised as follows. Section 2 presents the database and some conceptual definitions. Section 3 provides evidence on trade propensity, intensity, persistency and concentration for Portuguese firms and compares it with the other available cases. Section 4 computes and relates international trade premiums with internationalisation levels and intensities and also with market heterogeneities. Section 5 summarises the main results and concludes the paper.

2. Data Description

The database merges two data sources developed by The Portuguese National Statistics Institute (INE): balance-sheet information (IAE) and external-trade information (ECE). The two databases are linked by firms' fiscal numbers.[2] From 1996 to 2003, IAE only used a survey sample,[3] which limits full integration with the ECE database. ECE provides information on all Portuguese exporters and importers over the 1996-2003 period, supplying data on trade volume (exports and imports), aggregated by year and country (destination of exports and origin of imports) and on several types of good/sector traded for each transaction.[4] There is also information on the volumes (kilograms) involved. We use as variables: number of employees, turnover, value added, labour cost, capital assets, foreign capital participation, workers devoted to R&D, investment or earnings.[5]

Firms are classified by their main activity, as identified by INE standard codes for sectoral classification of business activities (CAE rev. 2.1), which is highly correlated with the Eurostat NACE 1.1 taxonomy. Market entry and exit of firms over the period, the possibility that a firm is not surveyed during the whole period and missing values in some variables makes the dataset unbalanced and short. Indeed, the working database (containing only firms with regular information for variables of interest) represents an average of 4,500 firms per year.[6]

Moreover, since IAE includes a significant number of registers of individual firms and independent workers, for which only the turnover value was available, we defined an active-firm criteria, which includes three conditions: at least 2 employees, a global turnover of at least 1,000€ and a positive net fixed asset register. We also defined "exporter" as a firm that exports at least 1% of its turnover. Capital is proxied by tangible fixed assets at book value (net of depreciation). All nominal variables are measured in 1996 Euros.[7]

At another level, we measured firm-level productivity using two concepts: value-added per employee, Labour Productivity (LP) and Total Factor Productivity (TFP). Since productivity and input choices are likely to be correlated, TFP estimation involves endogeneity problems. In line with, e.g., Levinshon and Petrin (2003) and Maggioni (2009), our TFP measure is estimated by a semi-parametric method as the residual of a two-input (labour and capital) Cobb-Douglas production function, using as the proxy variable for unobserved productivity shocks, the firms' use of intermediate inputs (incorporated in the data as "supplies and external services" at book value). The production function is estimated for every 2-digit sector separately.

[2] The data was made available under the mandatory condition of censorship of any individual information. Data and its treatment (namely summary statistics) is available upon request.
[3] Before 2003, the INE uses the universe of firms employing more than 100 workers and a sample of all the others. Since 2004, the INE has changed its methodology and works with the entire universe of Portuguese manufacturing firms. However, for before 2003, we used the only data available. The INE ensures the representativeness of data for that period.
[4] Our data includes 18 different sectoral types of traded goods.
[5] We do not have other useful data, such as: firms' age, innovation output, labour composition (skilled and unskilled), educational level of labour force and information on foreign affiliates of Portuguese multinational firms.
[6] The non-treated database comprised about 10,000 firms per year.
[7] Variables are deflated using 2-digit sector-level price indices provided by the INE; for capital stock, we use a unique deflator.

3. Evidence of firms' heterogeneity in relation to international trade

In the period studied (1996-2003), Portugal went through a small cycle of acceleration in GDP growth until 1998, but in the following period there was constant GDP deceleration and even a recession in 2003. In terms of international trade, there was a constant increase in Portugal's external deficit, but the openness of the economy remained stable until 2003; after 2003, it rose considerably due to the acceleration in import growth.

3.1. International trade propensity, intensity and persistency

The propensity to export of the Portuguese firms studied is 63%, which is lower than their propensity to import, 69% (Table 1). Muûls and Pisu (2007) show that, in Belgium, the relative standing is similar. In contrast, results available for Italy (Castellani et al., 2010) and Sweden (Andersson et al., 2008) show a higher export than import propensity. Worldwide comparisons are complex, as propensity to trade relies on sample dimensions, which are quite large.[8] Thus, Portuguese firms seem to be at an intermediate level of internationalisation.

Table 1 – International trade participation rate

	Country						
	Portugal	France	Belgium	Hungary	Italy	Sweden	The US
% exporters	63	67	41	36	71	71	27
% Importers	69	.....	43	46	69	60	14
Time, Sources	2003, specific sample	2003, all firms	2007, all firms	2003, all firms	1997, > 20 employees	2004, > 10 employees	2002, all firms

Source: Own calculations, Castellani et al. (2010), Mayer and Ottaviano (2007).

Table 2 organises the exporting firms in our sample into seven groups, according to their exporting intensity, which is defined as the percentage of exports in the turnover. Only 14.3% (10.8%+3.5%) of 2003 Portuguese exporting firms had an export intensity which was higher than 90% of their turnover - we call them the "elite group". About one third of Portuguese exporting firms export less than 10% of their global turnover.

Table 2 – Distribution of Portuguese exporters by export intensity levels, *X* (%)

Year	% of Firms						
	Group 1 $X<10$	Group 2 $10<X<25$	Group 3 $25<X<50$	Group 4 $50<X<75$	Group 5 $75<X<90$	Group 6 $90<X<100$	Group 7 $X=100$
1996	33.9	14.9	14.7	11.3	9.0	11.7	4.5
2003	32.9	15.9	14.5	13.2	9.3	10.8	3.5

Source: Own calculations.

The export intensity of exporting firms is, on average, 52% of their global turnover for the 1996-2003 period, but this indicator fell persistently from 56% in 1996 to 51% in 2003; this may result from contrasting

[8] Castellani et al. (2010) present a survey on this issue showing that conclusions are highly dependent on the number of employees of firms in the sample.

behaviour between persistent and non-persistent exporting firms: persistent exporters show a higher average and also a higher median of export intensity (Table 3). Computing the time persistency of exporting firms, we conclude that, on average, they report exports for 3.8 out of 8 years of our sample data-time lag. Moreover, while 18% of all exporters exported for each year of the whole period, 25% of "persistent exporters", managed to export in each single year.[9]

Table 3 – Average and median export intensity of all exporting firms and of persistent exporting firms, %

		Year							
		1996	1997	1998	1999	2000	2001	2002	2003
Persistent exporters	Average	58.2	58.9	58.2	58.5	58.4	58.7	59.5	60.6
	Median	54.8	55.7	56.2	55.5	56.9	56.8	58.9	60.2
All exporters	Average	55.5	54.2	52.8	52.9	52.1	51.6	51.8	51.0
	Median	48.6	47.6	47.1	46.7	46.5	46.7	48.2	47.4

Source: Own calculations.

3.2. International trade concentration

Recent empirical evidence (e.g., Mayer and Ottaviano, 2007) has illustrated the general idea that trade is highly concentrated in a few firms, but those firms are much diversified, trading several goods with several countries.

Existing theories of firms and international trade consider concentration the result of several causes (e.g., Bernard et al., 2007): (i) a possible unequal distribution of productivity across firms that would lead to a similar unequal distribution of trade; (ii) a high elasticity of substitution between varieties of goods from distinct firms that would enable slight differences in productivity and prices to generate large differences in exports; (iii) the existence of economies of scale to overcome costs of international distribution; (iv) differences in sunk costs in specific markets, thus making it impossible for less productive firms to deal with those costs. On the other hand, concentration could also be the result of product differences in productivity demands as only more efficient producers could support a wider range of diversity.

3.2.1. Internationalisation for few firms

The concentration of trading activities arises since only a percentage of firms perform exports or imports (Table 1). Not only do the vast majority of exporters export a small share of their global sales, as seen in Table 2, but the majority of exports are also concentrated in a small group of firms. Table 4 shows that in 2003 the top 1% of the biggest exporters, the "superstar firms", was responsible for 40% of the entire value of exports (43% in 1996). Comparing Portugal with the 7 countries in the Mayer and Ottaviano (2007) study, the weight of Portuguese "superstar firms" is similar to other cases. Thus, exports of all these countries rely heavily on a small group of firms (Table 4).

Table 4 – Importance of "superstar firms" (2003)

[9] Moreover, almost 20% of our working database firms were "never exporters" during the 1996-2003 period.

Country	Share of exports' value for top 1% exporters – "superstar firms"	% of firms exporting more than 90% of turnover – "elite"
Portugal	40	14.3
Germany	59	1.0
France	44	1.4
UK	42	1.5
Italy	32	2.9
Hungary	77	11.1
Norway	53	1.3
Belgium	48	....

Source: Own calculations, Castellani et al. (2010) and Mayer and Ottaviano (2007).

Additionally, we also noticed that, in 2003, "superstar firms" presented an average export intensity of 81% and half of them also belong to the "elite group" of firms, showing the high correlation between the most important exporting firms (in terms of the value exported) and their superior export intensity. Thus, and unlike other countries (e.g., Mayer and Ottaviano, 2007), top Portuguese exporters also exhibit top export intensity. Moreover, 78% of "superstar firms" were continuous exporters from 1996 to 2003, showing the strong link between top exporters, trade intensity and trade persistency. In terms of size, exporters are larger than non-exporters. On average, firms on our database are mainly micro and small firms, as each group represents about 40% of all firms. However, the sub-sample of exporters involves mainly small and medium size firms; micro firms represent only 12.6% of all exporters.[10] The vast majority, 96%, of the top 1% of exporters are large. (Firms' classification is based on European Commission recommendation 2003/361/EC, May 6).

Regarding imports, we find that 88% of all "superstar firms" were always importers during the whole period. Additionally, in 2003, they represented 41% of the value of all imports, showing that there is also a high import concentration in Portuguese firms in general, and especially in those that also concentrate export values.

3.2.2. Concentration of international trade: intra- and inter-sectors

For Portuguese firms, international trade is clearly more concentrated than employment or sales; the same is true for Italy, the US and Belgium (e.g., respectively, Castellani et al., 2010; Bernard et al., 2007; and Muûls and Pisu, 2007). Using Theil indexes for the inequality assessment, we observed that trade concentration is even more marked than in Italy.[11] Table 5 also shows that Portuguese imports are more concentrated than exports. This suggests that only a certain group of firms are able to face the costs of both export and import activities.

Table 5 – Concentration of Portuguese firms' employees, sales and trade

Theil Index	1996	2003
Employees	0.71	0.66

[10] Moreover, of all large firms, only 13% are non-exporters – data available upon request.
[11] In our sample of Portuguese firms, the Theil index for trade is 55% higher than for sales. For Italian firms, that difference was 4% in 1993 and disappeared in 1997. Italy is (to our knowledge) the only study with the same methodology.

Sales	1.53	1.33
Exports	2.57	2.28
Imports	2.61	2.54
Total International Trade	2.41	2.22

Source: Own calculations.

Furthermore, unlike other cases (e.g., Belgium), trade concentration in Portuguese firms decreased over time as both export and import Theil indexes declined from 1996 to 2003. In terms of sectors, despite the natural heterogeneity, the higher concentration of international trade is evident for every Portuguese sector, in 2003. Additionally, in half the cases, Theil indexes of imports are higher than those of exports (see Appendix A).

At another level, trade concentration may be the result of two complementary forces: (i) inter-sector effect, when exports and imports are concentrated in few sectors; (ii) intra-sector effect, when within the sector, some firms account for most trade activities. To test the weight of each component, we computed the decomposition of the Theil index into inter- and intra-sector effects. Both Cowell and Jenkins (1995) and Castellani et al. (2010) assume that overall trade concentration can be explained by the simple sum of inter- and intra- concentration; the former assuming every firm within a certain sector replicates the average sector value of that variable and the latter being a weighted average of sectoral Theil indexes. Table 6 shows the concentration is mainly the result of a set of firms within each sector rather than the outcome of a sectoral specialisation.[12]

Table 6 – Concentration of Portuguese firms (average 1996-2003)

	Theil index	Theil decomposition (% inter)	Theil decomposition (% intra)
Employees	0.70	8.7	91.3
Sales	1.45	19.1	80.9
Exports	2.10	8.8	91.2
Imports	2.13	15.0	85.0
Total Trade	2.26	22.2	77.8

Source: Own calculations.

Despite the low weight of inter-sector share, it is clear that exporters concentrate predominantly in five sectors that represent around 50% of all exporters and 35% of the exported value: food and beverages, textiles, wearing apparel, machinery and metallic goods (see Appendix B).

3.2.3. Concentration along the extensive margins

Several authors (e.g., Eaton et al., 2004, for France; Muûls and Pisu, 2009, for Belgium), have claimed that trade concentration along the extensive margin reveals itself by the number of firms involved in trading activities and by the good and country diversification of each exporter. All those studies found a negative

[12] A more detailed explanation of these facts would involve the contribution of industrial organisation style models (e.g., Tirole, 2003); however such analysis is beyond the scope of this paper.

correlation between the number of markets and goods (exports and imports) and the number of firms able to act in those conditions.

Table 7 shows that in 2003, 16% of all exporters sold just one type of good to a single country. This is an inferior weight than for Hungary, 20%, in 1999 (Békes et. al, 2009) or for France, 30%, for the same year[13] (Mayer and Ottaviano, 2007). Moreover, the extensive margin of Portuguese firms seems to be highly stable, as the previous indicator in 2003 was quite similar to 1996.

Table 7.1 – Distribution of export firms (2003) by number of goods and destinations, %

Number of products	Number of countries			Total
	1	2-5	> 5	
1	16.3	15.1	9.5	41
2-5	5.7	18.6	30.7	55
> 5	0.3	0.5	2.7	4
Total	21.3	34.2	42.9	100

Source: Own calculations.

Table 7.2 – Distribution of export values (2003) by number of goods and destinations, %

Number of goods	Number of countries			Total
	1	2-5	>5	
1	1.4	3.1	7.5	12
2-5	1.2	7.2	58.1	67
>5	0.3	0.2	21.0	21
Total	2.9	10.5	86.6	100

Source: Own calculations.

On the import side (Table 8), a similar concentration is observed; 9% of all importing firms buying more than 5 goods from more than 5 markets represent 55% of all imported value. These results show the importance of top exporters and importers and their superior diversification performance, in goods traded and in markets linked.

Table 8.1 – Distribution of import firms (2003) by number of goods and destinations, %

Number of goods	Number of countries			Total
	1	2-5	>5	
1	11.5	10.1	8.0	30
2-5	10.1	20.0	9.5	41
>5	9.0	9.0	8.8	28
Total	32	38	27	100

Source: Own calculations.

[13] Even taking into account the fact that the breakdown of data is not comparable.

Table 8.2 – Distribution of import values (2003) by number of goods and destinations, %

Number of goods	Number of countries			Total
	1	2-5	>5	
1	0.6	1.0	2.1	4
2-5	1.5	2.4	28.7	33
>5	2.0	7.2	54.5	63
Total	4.1	10.6	85.3	100

Source: Own calculations.

3.2.4. Concentration along the intensive margin

In 2003, the ten markets with the highest value exported per exporter concentrated 35% of the total number of Portuguese exporters and 75% of all exported value.[14] In 1996, the corresponding group represented 39% of all exporting firms and 73% of all value exported. In both years, seven of the ten markets referred to (with superior exporter intensity) consisted of European Union (EU) partners (Appendix C).

The real growth (19%) of export values between 1996 and 2003 was mainly (75%) explained by the growth in the intensity of exports (average value exported by each exporter) rather than by the extensive margin (growth in the number of exporters). This seems to fit the main "predictions" of Melitz (2003) and Lawless (2009). One of those "predictions" is that there should be a "hierarchy" of markets with firms entering export markets in the order of some productivity cut-off points. Another "prediction" relates to how a firm's sales should grow as they enter more export markets. Thus, it is expected that firms will tend to sell progressively less in each additional market as they move towards more difficult markets. In addition, as productivity increases, it is more likely that firms will increase their sales in those complex markets. This means that export growth would more likely come from additional sales in existing markets than from new sales in new markets.

Our results are clearly in accordance with such "predictions". In 2003, with the exception of Angola, the ten most frequent destination markets of Portuguese exports[15] always present superior growth in the intensity of exports in comparison with extensive growth (Appendix D).

3.3. International trade status persistency

In line with other studies (e.g., Tucci, 2005, for India), we analysed firm heterogeneity in association with trade status, considering exporting and importing activities. For that purpose, in each year, all firms were classified into four mutually exclusive categories/groups: Non-Traders (NT), Only Exporters (OE), Only Importers (OI) and Two-Way Traders (TWT). In our database, around 74% of firms are engaged in international activities. As in the case of Italy, Castellanni et al. (2009), the large majority (68%) of internationalised Portuguese firms are TWT. To uncover the trading status dynamics, we computed the trade status transition matrix for two sub-periods: 1996-1999 (Table 9) and 2000-2003 (Table 10).

[14] With at least 100 firms exporting to that market (to exclude some operations involving one firm and a single transaction).
[15] Selected by the absolute number of firms exporting to each destination country.

Table 9 – Trade status transition matrix from 1996 to 1999, %

1996 \ 1999	NT	OE	OI	TWT
NT	82	6	8	3
OE	13	60	5	22
OI	12	1	38	50
TWT	1	4	6	89

Source: Own calculations.

Table 10 – Trade status transition matrix from 2000 to 2003, %

2000 \ 2003	NT	OE	OI	TWT
NT	84	5	8	3
OE	16	59	4	21
OI	8	1	61	31
TWT	1	1	5	93

Source: Own calculations.

In the whole period, 1996-2003, the degree of global engagement of Portuguese firms grew considerably. In 1996, TWT represented 45% of firms, but in 2003 they corresponded to 53%. Moreover, NT decreased their weight from 29% to 22%. Since the transition dynamics are similar in both periods, NT and TWT status appear to be highly stable, while the OE and OI status seem to be more unstable. This is in line with Altomonte and Békes (2008), who stated that OI and OE are not a steady-state equilibrium strategy of internationalised firms. Additionally, firms that are firstly OI or OE have a similar probability of remaining in that status or of changing to NT or TWT. Moreover, some firms have a transitory experience of trading (about 25% of firms trading at the beginning of the period are not trading in the final year), while others (mainly OI) tend to complete the full spectrum of the trading status: half of the OI firms, in 1996, became TWT in 1999, suggesting that imports are a pre-condition for an export experience.[16] At a sectoral level, the highest share of TWT firms are in radio, TV and communication, textiles, wearing apparel, leather, rubber and plastic, and electrical machinery (see Appendix C).

4. Measuring traders' *premium*

4.1. Trader status

In line with other studies, e.g., Andersson et al. (2008), Vogel and Wagner (2010), we found that increased international involvement is associated with better performance (Table 11). These results rely on: (i) non-traders are less productive, smaller in terms of sales, less capital intensive and pay smaller wages; (ii) among internationalised firms, two-way traders outperform firms only engaged in exporting or in importing activities;

[16] The discussion of the role imports may play in exports' performance is addressed by, for example, Serti and Tomasi (2008) and Silva et al. (forthcoming).

(iii) only importers outperform only exporters in all domains, namely in efficiency and capital intensity. In fact, the performance of only exporters is much closer to the outcome of domestic firms than that of only importers.

Table 11 – Trading status different average performances, 1996-2003 (values: 10^3 Euros)

	NT	TWT	OE	OI
LP	27.7	50.5	37.8	47.6
TFP	7.8	13,6	9.6	9.9
Sales	2,102	16,878	2,524	6,097
Wages	10.4	14.4	10.2	14.0
Capital intensity	49.6	95.6	58.4	83.0
% of firms	26	50	9	15
Number of employees	57	147	91	68

Source: Own calculations.

Note: Excluding the number of employees, variables in levels are measured in 10^3 Euros.

This positive relationship between trade engagement and firms' performance requires further analysis, as the unconditional differences shown could be due to a sectoral composition effect, in line with sectoral differences shown in Appendix C. Thus, and like other studies (e.g., Castellani et al., 2010), we estimated the relationship between firms' heterogeneous performance and internationalisation status by running the regression:

$$y_{it} = \alpha + \beta_1 D_{it}^{TWT} + \beta_2 D_{it}^{OI} + \beta_3 D_{it}^{OE} + \varphi\, controls + \upsilon_{it}, \quad (1)$$

where: (i) y_{it} measures in logarithms (*ln*) firms' labour productivity (LP), total factors productivity TFP, sales, capital intensity or number of employees; (ii) D_{it}^{TWT}, D_{it}^{OI} *and* D_{it}^{OE} denote, respectively, mutually exclusive dummy variables for a two-way trader, a firm engaged only in importing and a firm engaged only in exporting activities – the reference group (omitted in the regression) are the non-trading firms; (iii) *Controls* is a vector including the log of a firm's employment[17] together with five-digit sector codes, a dummy for the existence of foreign capital share, a dummy for the existence of workers in R&D activities and also year dummies.[18]

The results of the pooled OLS regression, in Table 12,[19] show a relevant degree of heterogeneity across firms with different degrees of internationalisation concerning all dependent variables, even after controlling for sector, foreign capital, time and dimension. It is clear that: (i) more internationally engaged firms are larger, more productive and more capital intensive than the less engaged ones; (ii) a hierarchy is observed between the internationalised firms, given the superiority of two-way traders, followed closely by only importers that outperform only exporters as in Muûls and Pisu (2009) for Belgian firms.

Table 12 – Firm heterogeneity and internationalised status, Pooled OLS (1996-2003)

	Dependent variable

[17] Except when the dependent variable is the log of firms' employees (this is applied in connected cases later on).
[18] There are important firm characteristics that would be appropriate to control for, such as firms' age, the share of the intra-firm trade (e.g., Haller, 2009), but they are not available in the database.
[19] Since the dependent variable is in logs and the independent variables are dummies, the exact percentage differentials are obtained by: $(e^{\beta}-1)$ x100.

	*ln*LP	*ln*TFP	*ln*Sales	*ln*Cap. intensity	*ln*Employees
TWT	0.28 (0.017)	0.182 (0.015)	0.42 (0.019)	0.328 (0.023)	0.792 (0.018)
OE	0.027^{+} (0.023)	0.025^{+} (0.022)	0.077 (0.028)	0.024^{+} (0.033)	0.282 (0.028)
OI	0.28 (0.025)	0,183 (0.021)	0.37 (0.027)	0.311 (0.032)	0.108 (0.027)
Observations	30,968	30,968	30,968	30,968	30,968
R squared	0.35	0.35	0.61	0.05	0.14

Source: Own calculations. Prob > F = 0 for all cases.

Notes: Since the dependent variable is in logs and the explanatory variables are dummies, the exact percentage differential is given by $(e^{\alpha}-1)$x10. Robust standard errors appear below the coefficient estimates in parentheses. * and ** mean statistical significance at 10% and 5%, respectively; $^{+}$ means not statistically significant; if nothing is mentioned, estimates are statistically significant at 1% level. Regressions include the log of employment, a dummy for foreign capital, a dummy for R&D workers, sector dummies and year dummies as controls. . Estimations obtained with Stata 10 software.

Meanwhile, as the decision to export or to import may be driven by firm specific (time invariant) fixed effects, in a self-selection situation it is wiser to test a Fixed-Effect model, FE, as an alternative to the pooled OLS. Estimates in Table 12 translate differences in productivity, size or capital intensity across firms with different trading status but ignore the role of firm specific effects. Thus, assuming there are unobservable factors that are correlated with the variables used in the regression, the use of FE estimation is recommended in order to deal with omitted variable bias.[20]

The FE estimation (Table 13) will now show a correlation between a change in the trade status (beginning with NT) and a change in the dependent variable, conditioned by fixed firm specific effects. Despite the conceptual superiority of the FE, a causal interpretation of the estimated coefficients by FE is still risky, since possible random shock at the firm level would, at the same time, generate a change in the international status and a variation in the dependent variable. Nevertheless, if differences in independent variable coefficients arise between both estimations, it suggests that firms' (time invariant) characteristics are correlated with their internationalisation status. Moreover, if estimates of coefficients of the FE model are not relevant, but were significant in pooled OLS, it may mean that correlations between international status and firms' performances are driven by self-selection mechanisms and do not reflect learning effects.

Nevertheless, if estimates of coefficients of the FE model are now less relevant, but they were significant in pooled OLS, it may mean that correlations between international status and firms' performances are mainly driven by firms' characteristics; in this line, the reduced ability of international status to explain firms' performance, in the FE model, (which would suggest a learning effect situation) leads to an increased possibility of a self-selection mechanism, in which better firms self-select to international trade and obtain better performances.

[20] However, given the simultaneity in the decisions on the dependent variable and on exporting/importing activities, an endogeneity problem may arise. These issues are discussed later on in subsection 4.4.3.

In addition, and in order to decide which model was the better choice, we computed two sequential tests. Firstly, the Breusch-Pagan (BP) test for the relevance of firm specific effects to be incorporated in a panel model. For all dependent variables, BP tests rejected the null hypothesis that the residuals are homoskedastic, thus rejecting the pooled OLS model. Then, we performed the Hausman test in order to understand whether the individual effects are correlated with the other regressors. Hausman tests clearly indicated that FE is the better choice. Besides, F tests in all FE estimations confirm that FE was the most appropriate model to use.

Table 13 – Firm heterogeneity and internationalised status, FE (1996-2003)

	Dependent variable				
	*ln*LP	*ln*TFP	*ln*Sales	*ln*Cap. intensity	*ln*Employees
TWT	0.043	0.04*	0.054	0.026	0.028
	(0.024)	(0.019)	(0.009)	(0.008)	(0.008)
OEXP	-0.002+	-0.004+	0.038	0.020	0.019*
	(0.029)	(0.029)	(0.012)	(0.009)	(0.010)
OIMP	-0.002+	-0.011+	0.016**	-0.015**	-0.005+
	(0.027)	(0.029)	(0.011)	(0.009)	(0.009)
Observations	30,968	30,968	30,968	30,968	30,968
R squared overall	0.22	0.52	0.59	0.03	0.05

Source: Own calculations. Prob > F = 0 for all cases.

Notes: see Table 12.

Since differences in performance between firms with different trading status sharply decline once time invariant firm heterogeneity is erased (Table 13) and only TWT status is still significant in explaining TFP changes, we concluded that firms' performances are mainly related to time invariant specific firm characteristics. This may suggest that the decision to enter international markets may be mainly a function of a firm's characteristics, in a self-selection type phenomenon. Nevertheless, as a firm changes its status from NT to TWT, an improvement in TFP and in LP can be observed, suggesting the existence of some learning effects and efficiency improvements through imports and/or exports.

4.2. Trader extensive margins

We found that firms which trade multiple goods with multiple markets perform better, in terms of productivity. Table 14 compares the performance, in terms of both TFP and LP of: i) TWT firms that trade one good versus TWT firms that trade ten goods and ii) TWT firms that trade with one market versus TWT firms that trade with thirty markets. The results show that more internationally involved firms present better levels of efficiency, especially in LP. These results are in line with several studies for exports (e.g., Bernard et al., 2007, for the US firms; Andersson et al., 2008, for Sweden; and Mayer and Ottaviano, 2007, for European firms).

Table 14 – LP and TFP superiority (%) of TWT with high extensive margins

	NSE	*NCE*	*NSI*	*NCI*
TFP ratio	17	15	23	17
LP ratio	79	114	209	100

Source: Own calculations.

Notes: *NSE, NSI, NCE* and *NCI* stand for the number of goods exported, the number of goods imported, the number of countries exported to, and the number of countries imported from.

However, these results are unconditional values, which may be affected by size, sectoral composition or time differences. Thus, in order to present more reliable results, we had to use parametric regressions where those aspects could be properly controlled.

$$y_{it} = a + \alpha_1 x_{it}^{nse} + \alpha_2 x_{it}^{nsi} + \alpha_3 x_{it}^{nce} + \alpha_4 x_{it}^{nci} + \beta controls + \upsilon_{it} \,. \quad (2)$$

In equation (2), the *x*'s denote, respectively, the number of sectors exported (*NSE*), number of sectors imported (*NSI*), number of countries to which exports are made (*NCE*) and number of countries from which imports are bought (*NCI*); *controls* is again a vector including the log of a firm's employment together with a dummy for foreign capital share, a dummy for R&D workers and a sector and year dummies. Each regression refers to the sample of firms which are TWT throughout the period, since we aim to analyse the effects of exporters' extensive margin increase. We estimate the previous regression either by pooled OLS (Table 14) or by the FE (Table 17). Applying the previous tests, we evaluate FE as the better choice. Estimated *α* measures the percentage increase in each of the dependent variables associated with a unit increase in sectors or countries.

Table 15 confirms that, after controlling for size, foreign capital, R&D workers, sector and time effect, more diversified firms are also larger, more productive and more capital intensive. In particular, diversification of imports (products/sectors) has the strongest association with firm heterogeneity. For example, an increase in one type of product imported (*NSI*) is associated with 2.5% higher LP, 1.4% higher TFP, 2.1% higher turnover and 13% higher capital intensity. Besides, since the coefficients for the capital intensity are positive and statistically significant especially for imports, it suggests that, in order to enter new import markets, firms need to have the ability to value, assimilate and apply new knowledge embodied in imports of high capital intensity.

Table 15 – Firm heterogeneity along sector and country extensive margins, Pooled OLS regressions

	Dependent variable				
	*ln*LP	*ln*TFP	*ln*Sales	*ln*Cap. intensity	*ln*Employees
NSE	0.011^{+}	0.016	0.007^{+}	0.008^{+}	0.054
	(0.036)	(0.004)	(0.007)	(0.019)	(0.006)
NCE	0.018	0.001**	0.021	0.091	0.028
	(0.042)	(0.0005)	(0.001)	(0.031)	(0.008)
NSI	0.025	0.014	0.021	0.131	0.153
	(0.003)	(0.001)	(0.001)	(0.031)	(0.017)
NCI	-0.181	0.055	0.041	0.110	0.032
	(0.001)	(0.003)	(0.002)	(0.015)	(0.004)
Observations	16,043	16,043	16,043	16,043	16,043
R squared	0.11	0.23	0.51	0.13	0.36

Source: Own calculations. Prob > F = 0 for all cases.

Notes: see Table 12.

Table 16 – Firm heterogeneity along sector and country extensive margins, FE

	Dependent variable				
	*ln*LP	*ln*TFP	*ln*Sales	*ln*Cap. intensity	*ln*Employees
NSE	0.007^{+}	0.004^{+}	0.009*	0.001^{+}	0.006
	(0.016)	(0.004)	(0.003)	(0.008)	(0.003)
NCE	0.012^{+}	-0.001^{+}	0.016	0.017	0.007
	(0.021)	(0.009)	(0.008)	(0.005)	(0.001)
NSI	0.147	-0.003^{+}	0.015	0.026	0.015
	(0.061)	(0.012)	(0.001)	(0.011)	(0.002)
NCI	-0.33	0.002	0.002*	0.014^{+}	-0.002^{+}
	(0.046)	(0.000)	(0.001)	(0.024)	(0.002)
Observations	16,043	16,043	16,043	16,043	16,043
R squared overall	0.05	0.06	0.41	0.003	0.23

Source: Own calculations. Prob > F = 0 for all cases.

Notes: see Table 12.

Using the FE model (Table 16), the estimated *premiums* fall substantially and in terms of TFP have almost no relevance. Nevertheless, we still find an effect on TFP of the number of countries from which imports are bought and on LP of the sector extensive margin of imports. Imports show greater significance explaining firms´ performances.

4.3. Trader intensive margin

As important as the number of countries or sectors traded, the international trade intensity may also be decisive in explaining productivity performances. It is possible that some firms operate in very few sectors or countries, but with an important trade volume in terms of their turnover. We argue that an increase in firms' export and import intensity may represent a higher involvement in international trade with positive effects on a firm's performance, namely productivity.

$$y_{it} = a + \alpha_1 \exp\text{int}_{it} + \alpha_2 imp\,\text{int}_{it} + B controls + \upsilon_{it} \,. \quad (3)$$

In equation (3), *exp*int and *imp*int denote, respectively, the percentage of a firm's turnover devoted to export and to imports; *controls* is a vector including the log of a firm's employment together with a dummy for foreign capital share, a dummy for R&D workers and a sector and year dummies. We estimate the previous regression either by pooled OLS (Table 17) or by the FE (Table 18). As usual, we evaluate FE as the better choice. Estimated *α* are elasticities measuring the premium of exporter and importer intensity. Table 18 shows that increases in import intensity may enhance TFP and LP; export intensity has no proven effect on TFP.

Table 17 – Firm heterogeneity along intensive margins, Pooled OLS regressions

	Dependent variable				
	*ln*LP	*ln*TFP	*ln*Sales	*ln*Cap. intensity	*ln*Employees
lnExp int	-0.062	-0.005^{+}	-0.004^{+}	-0.046	0.097
	(0.002)	(0.004)	(0.005)	(0.004)	(0.011)
lnImp int	0.122	0.091	0.177	0.086	0.098
	(0.052)	(0.001)	(0.010)	(0.006)	(0.018)
Observations	16,043	16,043	16,043	16,043	16,043
R squared	0.11	0.46	0.35	0.11	0.16

Source: Own calculations. Prob > F = 0 for all cases.

Notes: see Table 12.

Table 18 – Firm heterogeneity along intensive margins, Fixed Effects regressions

	Dependent variable				
	*ln*LP	*ln*TFP	*ln*Sales	*ln*Cap. intensity	*ln*Employees
lnExp int	0.009	0.0095^{+}	0.016	-0.002^{+}	0.01
	(0.004)	(0.009)	(0.004)	(0.004)	(0.002)
lnImp int	0.007	0.025	0.018	0.001^{+}	0.01
	(0.003)	(0.009)	(0.005)	(0.006)	(0.003)
Observations	16,043	16,043	16,043	16,043	16,043
R squared overall	0.06	0.42	0.33	0.001	0.10

Source: Own calculations. Prob > F = 0 for all cases.

Notes: see Table 12.

4.4. Trader market heterogeneity

Heterogeneity in the performance among traders also relies on the destinations of exports and on the origin of imports (e.g., Serti and Tomasi, 2008). Indeed, we can use two main arguments: (i) differences in each country of competitive pressures, income, distance, technological competences, language or institutional and legal structures that cause different sunk costs to access different markets; (ii) there may be differences between firms trading with the same countries but with different good composition. In this case, it may arise as an effect of different networks created or of different legal barriers, such as trade policies and differences in market structure.

4.4.1. Assessing traders' heterogeneity

To test how each firms' performance differs according to the type of market they trade with, we separated firms exporting status into 4 mutually exclusive groups of export destinations: (i.1) only to European Union countries (E_EU); (i.2) only to PL countries (E_PL); (i.3) only to other Developed countries (E_ODEV);[21] (i.4) only to Non-Developed countries (E_NDEV). Additionally, we considered firms that export to more than one

[21] In this group we included: the USA, Japan, Australia, New Zealand, South Korea, Singapore, Hong Kong, Canada, Israel, Taiwan, Switzerland, Kuwait, Oman, Qatar, UAE, Bahrain, Saudi Arabia.

group of markets, namely to: (ii.1) EU and PL countries (E_EU+PL); (ii.2) EU and ODEV countries (E_EU+ODEV); (ii.3) all other possible combinations of markets (E_Multiple).

For imports, we considered five groups: (i) only from EU countries (I_EU); (ii) only from ODEV countries (I_ODEV); (iii) only from PL countries (I_PL); (iv) only from NDEV countries (I_NDEV); (v) other possible combinations of countries (I_Multiple).

Then, we computed the means of the various performance measures for each of seven groups of exporting firms and for each of the five groups of importing firms; finally, we performed regressions for some performance variables on these groups of trade partners, controlling for the usual variables. Table 19 shows that exporters that sell to many types of countries (known as "Multiple") present the best performances.

Table 19 – Exporters' different average performance, 1996-2003 (values in 10^3 Euros)

	EU	PL	EU+PL	ODEV	EU+ODEV	NDEV	Multiple
LP	17.7	23.2	24.3	16.2	14.5	15.8	24.9
TFP	14.1	4.44	6.68	12.04	13.57	3.98	14.02
Sales	6,504	3,785	11,834	3,277	8,455	6,026	19,962
No. Employees	92	58	90	61	121	59	208
No. goods	1.8	1.9	2.4	1.6	2.0	1.9	2.8
No. countries	3.4	1.8	4.5	1.7	3.0	2.1	14.6
Earnings	73	115	169	4	58	-120	596
Cap. Intensity	50	47	79	42	37	38	80

Source: Own calculations.

In fact, in line with the theoretical models of Channey (2008), Lawless (2009) and Helpman et al. (2008), firms with higher productivity levels are better prepared to trade with a larger number of diversified countries and to face a larger sum of different sunk entry costs. According to those models, firms begin to export to markets with lower productivity than their own level; this argument would explain why firms with "low" productivity would be able to export only to a limited group of destinations. Moreover, the models referred to also assume that the alleged productivity thresholds (different sunk costs) vary across markets as a result of distance, income, language, historical familiarity, legal and institutional structures.

At another level, there are few studies connecting traders' features and extensive margin diversification in imports. In the case of Italian firms, Serti and Tomasi (2008) found that importers from EU countries had the highest performance levels. We also observed the same outcome for Portugal (Table 20).

Table 20 – Importers' performance differences (1996-2003) (values in 10^3 Euros)

	EU	ODEV	PL	NDEV	Multiple
LP	18.5	14.3	13.0	13.1	23.0
TFP	14.2	14.1	6.5	3.2	14.1
Sales	6,653	4,575	3,525	2,519	22,902
No. Employees	84	65	62	44	191

No. goods	2.8	1.7	1.5	1.4	4.2
No. countries	3.8	1.4	1.8	1.8	9.6
Earnings	401	-52	43	-60	459
Cap. intensity	52	35	33	32	69

Source: Own calculations.

Tables 19 and 20 seem to confirm these assumptions, as exporters to the more global group, classified as "Multiple", present the best performances for all indicators (but TFP) and importers from several sources (also classified as "Multiple") also present the best performances, followed by importers from EU countries. This could possibly support the thesis of the higher sunk entry costs in different countries, given the need to have a certain level of prerequisites. Besides, the moderate performance levels presented by exporters to the EU could be due to exports to a "local market" given the familiarity and short distance between Portugal and EU countries.[22] In addition, exports to PL countries are associated with better performance. This may be a consequence of the distance and of higher transaction costs that Portuguese firms face when trading with those markets. In fact, despite linguistic, cultural and historical proximity between Portugal and PL countries, there are greater geographical, economic and institutional differences to be overcome in order to reach those markets.

In order to present a more precise and detailed analysis (in line with Serti and Tomasi, 2008), it is imperative to perform regressions of the following type:

$$y_{it} = a + \alpha_1 E_{it}^{EU} + \alpha_2 E_{it}^{PL} + \alpha_3 E_{it}^{EU+PL} + \alpha_4 E_{it}^{ODEV} + \alpha_5 E_{it}^{NDEV} + \alpha_6 E_{it}^{EU+ODEV} + \\ + \alpha_7 E_{it}^{Multiple} + \alpha_8 I_{it}^{EU} + \alpha_9 I_{it}^{ODEV} + \alpha_{10} I_{it}^{NDEV} + \alpha_{11} I_{it}^{PL} + \alpha_{12} I_{it}^{Multiple} + \beta\, controls + \upsilon_{it} \quad (4)$$

where *E*'s and *I*'s denote the dummies for exporters and importers, respectively, trading with the categories of countries already mentioned. Each α translates the percentage premia for exporters or importers with the various markets and with respect to NT. As usual, we estimate the previous regression either by pooled OLS (Table 21) or by the FE model (Table 22) in order to compare both estimations. We also confirmed that the FE is the better choice given the methodology adopted.

These results confirm that: exporters to several groups of destinations ("Multiple") are the most (labour) productive, the biggest and the most capital intensive. Importers from the EU and from several groups of countries ("Multiple") present the best performances; moreover, imports from NDEV countries are not always relevant for the explanation of firms' performances. This means that high-tech capital goods are bought precisely from the EU countries (nearly 90% of the total imports of that type come from EU countries) and also from other developed countries, such as the US and Japan; importers must have developed a proper absorptive capacity to integrate such inputs and goods into their production. Moreover, weighting the number of relevant coefficients and their levels, imports matter more than exports in explaining traders' *premia*.

Table 21 – Trade premia by type of country development, 1996-2003; Pooled OLS

	Dependent variable				
	*ln*LP	*ln*TFP	*ln*Sales	*ln*Cap. intensity	*ln*Employees
$E^{EU} \equiv E1$	-0.175	-0.09	-0.074**	0.135	-0.289

[22] Especially with Spain, France and Germany, which are the main commercial partners and are near Portugal.

	(0.026)	(0.243)	(0.016)	(0.034)	(0.043)
$E^{PL} \equiv E2$	-0.016	0.052	-0.015*	-0.068+	-0.223
	(0.064)	(0.054)	(0.039)	(0.086)	(0.105)
$E^{EU+PL} \equiv E3$	0.081*	-0.016+	0.11	0.697	0.200
	(0.053)	(0.045)	(0.032)	(0.070)	(0.087)
$E^{DEV} \equiv E4$	-0.066*	0.003+	0.024*	-0.018+	-0.213
	(0.047)	(0.044)	(0.029)	(0.064)	(0.078)
$E^{NDEV} \equiv E5$	-0.002+	-0.009+	0.125	-0.11+	0.054+
	(0.091)	(0.078)	(0.055)	(0.110)	(0.147)
$E^{EU+DEV} \equiv E6$	-0.251	-0.124+	-0.217	0.345	-0.375
	(0.026)	(0.021)	(0.016)	(0.035)	(0.042)
$E^{Multiple} \equiv E7$	0.074	0.007+	0.058	0.645	0.195
	(0.023)	(0.020)	(0.014)	(0.030)	(0.038)
$I^{EU} \equiv I1$	0.239	0.011	0.116	0.256	0.397
	(0.023)	(0.020)	(0.014)	(0.031)	(0.038)
$I^{DEV} \equiv I2$	0.085*	0.047*	0.133	0.226*	0.093+
	(0.047)	(0.040)	(0.029)	(0.111)	(0.078)
$I^{PL} \equiv I3$	0.019+	-0.013+	-0.064+	0.111+	0.075+
	(0.126)	(0.118)	(0.078)	(0.171)	(0.212)
$I^{NDEV} \equiv I4$	0.037+	0.052+	-0.048*	0.046*	0.019+
	(0.084)	(0.078)	(0.051)	(0.111)	(0.132)
$I^{Multiple} \equiv I5$	0.354	0.185	0.169	0.65	0.489
	(0.022)	(0.019)	(0.013)	(0.027)	(0.035)
Observations	26,208	26,208	26,208	26,208	26,208
R squared	0.22	0.25	0.15	0.27	0.20

Source: Own calculations. Prob > F = 0 for all cases.

Notes: Since the dependent variable is in logs and the explanatory variables are dummies, the exact percentage differential is given by $(e^{\alpha}-1) \times 100$. See also Table 12.

In Table 22, once time invariant firm heterogeneity is removed, the differences between internationalised firms and non-traders are sharply reduced and in most cases become non-statistically relevant. Indeed, on the export side, the *premia* associated with destinations is not relevant, except for "sales" and for "multiple" type destinations, indicating that previous OLS *premia* in some exporting destinations may be mainly related to a self-selection phenomenon. In addition, looking at TFP regression, which could indirectly and roughly indicate the existence of learning effects associated with exports, all coefficients are not statistically relevant.

Table 22 – Trade premia by type of country development, 1996-2003; FE Model

	Dependent variable				
	*ln*LP	*ln*TFP	*ln*Sales	*ln*Cap. intens.	*ln*Employees
$E^{EU} \equiv E1$	0.012^{+}	-0.017^{+}	0.027*	0.007^{+}	0.127
	(0.042)	(0.043)	(0.019)	(0.047)	(0.043)
$E^{PL} \equiv E2$	0.055^{+}	0.027^{+}	0.040*	0.091*	0.050^{+}
	(0.056)	(0.061)	(0.030)	(0.063)	(0.050)
$E^{EU+PL} \equiv E3$	0.054^{+}	-0.045^{+}	0.711	0.027^{+}	0.257
	(0.056)	(0.062)	(0.027)	(0.063)	(0.055)
$E^{DEV} \equiv E4$	-0.016^{+}	0.037^{+}	0.033^{+}	-0.079^{+}	0.017
	(0.072)	(0.079)	(0.034)	(0.081)	(0.055)
$E^{NDEV} \equiv E5$	(0.061)$^{+}$	-0.039^{+}	0.057^{+}	0.023^{+}	0.009^{+}
	(0.112)	(0.134)	(0.057)	(0.132)	(0.127)
$E^{EU+DEV} \equiv E6$	0.030^{+}	0.051^{+}	0.042	-0.022^{+}	0.241
	(0.043)	(0.048)	(0.021)	(0.049)	(0.044)
$E^{Multiple} \equiv E7$	0.043^{+}	-0.046^{+}	0.059	0.014^{+}	0.267
	(0.040)	(0.045)	(0.042)	(0.046)	(0.042)
$I^{EU} \equiv I1$	0.011*	0.010^{+}	0.078	0.17	0.139
	(0.042)	(0.048)	(0.021)	(0.049)	(0.015)
$I^{DEV} \equiv I2$	-0.046^{+}	-0.014*	0.023^{+}	0.144*	0.117*
	(0.073)	(0.081)	(0.035)	(0.082)	(0.076)
$I^{PL} \equiv I3$	0.004^{+}	-0.040^{+}	-0.025^{+}	0.052^{+}	-0.19^{+}
	(0.146)	(0.16)	(0.071)	(0.167)	(0.154)
$I^{NDEV} \equiv I4$	0.050^{+}	-0.069^{+}	-0.001^{+}	-0.037^{+}	-0.033^{+}
	(0.152)	(0.168)	(0.072)	(0.177)	(0.159)
$I^{Multiple} \equiv I5$	0.108*	-0.011^{+}	0.077	0.21	0.191
	(0.044)	(0.049)	(0.021)	(0.051)	(0.046)
Observations	26,208	26,208	26,208	26,208	26,208
R squared	0.16	0.01	0.11	0.01	0.13

Source: Own calculations. . Prob. > F = 0 for all cases.

Notes: see Table 12 and Table 23 comments.

On the import side, OLS versus FE comparisons show the existence of a self-selection phenomenon in all markets, since all FE estimations are less statistically relevant. However, in EU markets and multiple origin markets, in most cases relevant coefficients can be observed in FE regressions. These facts advise the presence of learning-by-importing effects for imports from the EU and those multiple markets. In this line, the high OLS *premia* associated with EU and multiple imports could be explained by self-selection and by learning effects.

4.4.2. The particular case of exports (to Spain and to difficult countries)

Given the high weight of Portuguese exports to Spain, we create an additional sub-group to separate the firms exporting only to that country: (E_SPA) and accordingly we rearranged the previous sub-group for firms exporting only to other European Union countries (E_EU). At another level, the hardest destination markets for Portuguese firms are the most "distant" ones in terms of geography, politics, legal structure, economic structure, culture and language. Firms that trade with those markets may have to overcome the highest sunk costs of trade entry. In order to test this hypothesis, we classified as difficult countries (DC) those for which less than 50 Portuguese firms exported in 2003 (Appendix E). In 2003, there were 461 fearless firms (FF) in our working database that had managed to export to at least one of such type of markets[23]. Comparing those firms´ performances, in 2003, with the average of all the firms in our working database, we can observe a clear superiority of firms selling to those destinations (Table 23).[24]

Table 23 – Fearless firms superiority

2003	TFP	Employees	Investment	Capital	Sales
% premia	31	121	205	205	167

Source: Own calculations.

Looking for additional insight, we perform the usual comparison between estimates from OLS and from the FE model (Table 24). Firms that export to DC have a significant coefficient in OLS and a non significant coefficient in the FE regression, thus suggesting that those firms have high correlation with TFP as they "self-select" for those markets but do not "learn" from them. The highest coefficient levels are detected in firms exporting to more than one group of countries, to Spain and to both EU and PL. In the latter cases, it is reasonable to admit that any "learning effects" associated with exports to Spain and PL countries may be connected with firms of lower technological level.

Table 24 – Trade premiums by type of country development, 1996-2003; Pooled OLS and FE (Exports to Spain and to Difficult Countries are removed)

lnTFP	E^{DC}	E^{SPA}	*E*1	*E*2	*E*3	*E*4	*E*5	*E*6	*E*7	*I*1	*I*2	*I*3	*I*4	*I*5
OLS	.107	.068^{+}	-.06	.034^{+}	.041^{+}	-.01^{+}	-.04^{+}	.056*	.106	.15	.06^{+}	-.03^{+}	.00^{+}	.31
FE	0.03^{+}	0.12**	.02^{+}	.022^{+}	.121	.07^{+}	.05^{+}	.10*	.12	.07*	-.04^{+}	-.03^{+}	-.01^{+}	.08^{+}

Source: Own calculations.

Notes: see Table 12; Obs = 24,572; R sq = 0.14.

4.4.3. Dynamic specification

[23] In 2003 the exports to those countries represented 0.6% of all exported value and the firms involved accounted for 3% of all exporting firms.

[24] We have also studied the importance of imports from Germany and we found that they always keep their statistic relevance with positive premiums, even in the FE estimation. This suggests that imports from Germany, composed of technologically complex goods, machinery and similar inputs, need an adequate absorptive ability, which, in turn, requires higher TFP levels

Although previous empirical studies do not employ dynamic specifications, we decided to introduce a dynamic variant of the static model, since in this static model there may be issues with serial correlation of dependent variables and with endogeneity of some explanatory variables (e.g., the number of goods traded or the ability to export to "difficult countries" may cause changes in TFP, but the inverse causality is also possible). Moreover, in order to use the FE model, a strict exogeneity assumption is required, which implies that, conditional on a fixed effects term, the explanatory variables are not correlated at any period (contemporaneous or not) with the disturbance term. However, probably one of the most important factors in explaining productivity in a given period is the productivity in the previous period. In fact, all the dependent variables considered are likely to be highly persistent. Thus, the lagged dependent variable can be viewed as one omitted factor. It is a relevant factor in explaining its present value and can be correlated with other explanatory variables (since some firms will take their import/export decisions in a given period based on the shocks received in the past period). In this case, $y_{i,t-1}$ should be included in the model as an additional regressor. This yields to a dynamic specification in which the strict exogeneity assumption fails.

Then, in each of the four equations and for each dependent variable we included an additional explanatory variable: the one time lagged dependent variable, always controlling for the usual variables: We used the Blundell and Bond (2000) specification, with an autoregressive structure in the error term and using as instruments lags of the dependent variable and of the regressors; moreover, given the lack of unanimity on the Sargan test properties (e.g., Dahlberg et al., 2008) in dynamic panels,[25] we use as an alternative AR(1) and AR(2) tests confirming evidence of first-order autocorrelation in the first-differenced residuals, and no evidence of higher order correlation. The results obtained were clear as none coefficient revealed to be significant.

However, in the search for robustness we tested for more disaggregated analysis combining firms' dimension (fewer than and more than 50 workers) and sector. In fact, we aggregate the initial 23 two-digit codes and 201 five-digit codes (the original INE desegregation) into a five sectoral classification of industries based on technological sophistication (in line with Pavitt, 1984 - adapted): Group 1, Gr1, with the lower technical sophistication (Food & Beverages + Tobacco); Group 2, Gr2, (Textiles, Wearing apparel and Leather); Group 3, Gr3, (Wood, Pulp & Paper, Printing, Furniture); Group 4, Gr4, (Chemicals, Rubber & Plastic, Non metallic products, Basic metallic products, fabricated metallic products and Recycling industries); Group 5, Gr5, with the higher technical sophistication (Machinery, Office machines & Computers, Electrical machinery, Medical Instruments, Motor vehicles and other transport equipment).

By estimating dynamic panel systems for several combinations of sectoral groups and for each of the two dimension groups, we obtained significant coefficients and valid instruments for three of the four models, when using firms with more than 50 employees and pertaining to groups 1 and 2. As observed in Table 25, for such a sub-group of firms we can confirm: (i) the importance of the international status of firms, as becoming TWT (for NT) means increasing TFP by 13%; (ii) the relevance of firms´ country extensive margin, given the positive effect as firms expand the number of markets they import from and export to; (iii) and the significance of firms´ intensive margin of trade, as one can find a positive effect of import intensification on productivity, even if export intensification shows no proven effect on TFP. We argue that these results suggest that

[25] The hypothesis being tested with the Sargan test is that the instrumental variables are uncorrelated to some set of residuals, and therefore they are acceptable instruments.

international trade can create positive effects on firms´ productivity, when such firms present a certain dimension enabling them to leverage their absorptive capacities and also when their international trade involvement reaches a certain threshold. For all other sub-groups of firms no significant results were obtained.

Table 25 – Firm heterogeneity and internationalised status, Dynamic panel data models, Dependent variable: ln TFP

TWT	0.133**	*lnNSE*	0.01	*lnExp int*	-0.039+
	(0.065)		(0.01)		(0.024)
OEXP	0.022+	*lnNCE*	0.06*	*lnImp int*	0.035
	(0.082)		(0.03)		(0.023)
OIMP	-0.045+	*lnNCI*	0.04*		
	(0.079)		(0.02)		
		lnNSI	(0.006)		
			(0.01)		
Observations	2,716	Observations	2,716	Observations	16,043
Prob > Chi2 (Wald Test)	0.000		0.000		0.000
AR(1)	6.3895	AR(1)	5.5495	AR(1)	9.6505
Prob > z	0,0000	Prob > z	0,0000	Prob > z	0,0000

Source: Own calculations.

5. Conclusions

Exploiting a database that combines data on a representative sample of Portuguese firms' economic and financial performance with data on their exporting and importing activity, we present, for the first time for Portugal, a picture of firms that trade internationally for the period 1996 to 2003.

In line with some recent studies and theories, we confirm that: trade is highly concentrated in a small group of firms and that firms with different international-involvement levels have different performances in productivity, sales or labour and capital intensity. Generally, the stronger the firms' international engagement is, the better its performances are.

Using panel data linear static models and also, when possible, dynamic panel data analysis, our study evolved at four distinct levels: the international trading status, the extensive margin performance (both at country and product level), the intensive margin performance and the heterogeneity of markets involved in international activities.

First, with respect to trade status, we found that two-way traders are the best performers and that only importers outperform only exporters. Second, at the extensive level, we noticed that geographical and sectoral diversification, both in exports and imports, is positively correlated with firms' economic performance. Third, with regard to intensive level, we found evidence of better performance for firms trading more intensely. Fourth, in the domain of market heterogeneity, several striking conclusions arise: (i) we revealed that exporters selling only to European countries appear to reach the smallest advantage over the non-exporters;

(ii) we also testify the superior productivity of a limited number of firms managing to export to difficult markets. Finally, to show robustness and to more efficiently validate results, we divided our database according to sectoral groups of firms and also according to firms' dimension, aiming to expose even more specificities in the connections between trade involvement and firms' ability and efficiency.

To conclude, we consider that future research on the relationship between performance of firms and international trade involvement should take into consideration the specificities of the markets and of the goods.

References

Altomonte, C. and Békés, G. (2009). "Trade complexity and productivity". *KTI/IE Institute of economics, Hungarian Academy of Sciences Discussion papers*, 2009/14, July.

Andersson, M., Johansson, S. and Lööf, H. (2008). "Productivity and international trade: firm level evidence from a small open economy". *Review of world economics* 144(4): 744-801.

Aw, B. and Hwang, A.R. (1995). "Productivity and the export markets: a firm-level analysis". *Journal of Development Economics* 47(2): 313-332.

Bernard. A., Jensen, B. and Schott, P. (2009). "Importers, exporters and multinationals: a portrait of firms in the U.S. that trade goods". Published in NBER book *Producer dynamics: new evidence from micro data.* Chapter 14. Timothy Dunne, J. Bradford Jensen, and Mark J. Roberts, editors. January 2009.

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

Bernard. A., Eaton, J., Jensen, B., Kortum, S. (2003). "Plants and productivity in international trade". *American Economic Review* 93(4): 1268-1290.

Bernard. A., and Jensen, B. (1995). "Exporters, jobs and wages in U.S. manufacturing 1976-1987". *Brookings Papers on Economic Activity* 1995: 67-119.

Békés, G., Harasztosi, P. and Muraközy, B. (2009). "Firms and Products in International Trade: Data and Patterns for Hungary". *Institute of Economics, Hungarian Academy of Sciences, Discussion Papers* MT-DP - 2009/19.

Blundell, R. and Bond, S. (2000). "GMM estimation with persistent panel data: An application to production functions," *Econometric Reviews* 19(3): 321-340.

Castellani, D., Serti, F. and Tomasi, C. (2010). "Firms in international trade: importers' and exporters' heterogeneity in the Italian manufacturing industry". *World Economy* 33(3): 424-457.

Chaney, T. (2008). "Distorted gravity: the intensive and extensive margins of international trade". *American Economic Review* 98(4): 1707-21.

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

Dahlberg, M., Mork, E. and Tovmo, P. (2008). "Power properties of the Sargan test in the presence of measurement errors in dynamic models". Applied Economic Letters 15(5): 349-353

Damijan, J., Polanec, S. and Prasnikar, J. (2004). "Self-selection, export market heterogeneity and productivity improvements: firm-level evidence from Slovenia". *LICOS – Centre for Transition Economics Working Paper* 14804.

Eaton, J., Kortum, S. and Kramar, F. (2004). "Dissecting trade: firms, industries and exports destinations". *American Economic Review* 94(2): 150-154.

European Commission Recommendation 2003/361/EC, May 6.

Haller, S. (2009). "Exporting, importing, intra-firm trade and firm productivity". *Mimeo*, August.

Helpman, E., Melitz, M and Rubinstein Y. (2008). "Estimating trade flows: trading partners and trading values". *Quarterly Journal of Economics* 123(2): 441- 487.

Kasahara, H. and Lapham, B. (2008). "Productivity and the decision to import and export: theory and evidence". *CESIfo Working Paper No.2240.*

Lawless, M. (2009). "Firm export dynamics and the geography of trade". *Journal of International Economics* 77(2): 245-254.

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

Maggioni, D. (2009). "Learning by exporting: which channels? An empirical analysis for Turkey". *F.R.E.I.T. Working Papers* No.32, March 2009.

Mayer, T. and Ottaviano, G. (2007). *The happy few: the internationalisation of European firms*. Bruegel Blueprint 3.

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

McCann, F. (2009). "Importing, exporting and productivity in Irish manufacturing". *University College Dublin, School of Economics Working Papers* 200922.

Muûls, M. and Pisu, M. (2009). "Imports and exports at the level of the firm: evidence from Belgium". *World Economy* 32(5): 692-734.

Pavitt, K. (1984). Sectoral patterns of technical change: Towards a taxonomy and a theory". *Research Policy* 13: 33-45.

Serti, F. and Tomasi, C. (2008). "Firm heterogeneity: do destinations of exports and origin of imports matter?" *Review of World Economics* 144(4): 660-694.

Silva, A., O. Afonso and A. P. Africano (forthcoming). "Which manufacturing firms learn by exporting?" *Journal of International Trade and Economic Development*.

The International Study Group on Exports and Productivity (ISGEP). (2007), "Exports and productivity: comparable evidence from 14 countries". *Centre for Industrial Economics, Discussion Papers, 2007-11*.

Tirole, Jean (2003). *The theory of industrial organization.* The MIT Press: Cambridge, Massachusetts; London, England, fourteenth printing.

Tucci, A. (2005). "Trade, foreign networks and performance: a firm-level analysis for India". *Centro Studi Luca d´Agliano Development Studies Working Papers*, 199, March.

Vogel, A. and Wagner, J. (2010). "Higher productivity in importing German manufacturing firms: self-selection, learning by importing, or both?" *Review of World Economics* 145(4): 641-665.

Appendix

Appendix A – Sectoral Theil Index

Sector	Description	Employment	Sales	Exports	Imports	Total Int. Trade
15	Food & beverages	0.57	1.08	1.89	1.95	1.62
16	Tobacco	0.43	1.07	1.23	1.26	1.16
17	Textiles	0.59	0.73	1.32	1.27	1.17
18	Wearing apparel	0.37	0.63	0.85	1.54	0.91
19	Leather	0.70	0.74	1.20	1.64	1.41
20	Wood	0.51	0.94	1.59	2.01	1.52
21	Pulp, Paper	0.69	1.61	2.51	1.78	2.23
22	Printing	0.51	0.89	1.89	1.57	1.14
24	Chemicals	0.51	0.91	2.13	1.19	1.44
25	Rubber, plastic	0.48	0.96	2.17	1.59	1.80
26	Non-metallic mineral prod	0.58	1.36	1.62	2.19	1.60
27	Basic metals	0.49	1.12	1.50	1.65	1.38
28	Fabricated metal products	0.42	0.82	1.51	1.62	1.57
29	Machinery	0.51	0.88	1.68	1.85	1.52
30	Office machinery and computers	0.44	0.46	1.18	0.56	0.56
31	Electrical machinery	1.56	1.36	2.16	1.51	1.87
32	TV & Communication	0.87	1.27	1.64	1.69	1.59
33	Medical and optical instruments	0.56	0.79	1.25	1.23	1.13
34	Motor vehicles	1.01	2.13	2.85	2.25	2.45
35	Other transport equipment	1.10	1.38	1.97	1.95	1.85
36	Furniture	0.60	1.24	2.35	3.21	2.62
37	Recycling	0.12	0.43	1.16	1.22	0.95
Mean		0.70	1.45	2.10	2.13	2.28

Source: Own calculations.

Appendix B – Between sector concentration of exports and Trade participation rates

Description	Number of firms (% of each sector)	Value of exports (%of each sector)	Export intensity (%)	Share of TWT (%)	Share of NT (%)
Food & beverages	10.1	6.1	25	42	31
Tobacco	0.1	0.4	56	75	25
Textiles	12.6	9.2	47	68	13
Wearing apparel	9.6	5.8	63	73	9
Leather	5.5	4.2	54	73	11
Wood	5.1	4.9	42	45	29
Pulp, Paper	1.9	6.8	25	61	12
Printing	3.0	0.2	7	33	35
Chemicals	4.7	5.6	27	68	14
Rubber, plastic	4.1	4.4	34	72	11
Non-metallic mineral prod	8.5	4.4	42	40	29
Basic metals	2.2	1.7	31	69	20
Fabricated metal products	7.2	4.1	29	45	32
Machinery	8.3	4.9	36	44	31
Office machinery, comput.	0.3	0.1	24	60	40
Electrical machinery	2.9	7.6	38	76	15
TV & Communication	1.3	9.3	42	82	9
Medical and optical instr.	1.3	0.6	41	69	9
Motor vehicles	2.3	14.2	51	71	11
Other transport equipment	1.8	1.9	45	59	18
Furniture	6.3	3.5	25	49	28
Recycling	1.0	0.1	39	53	13
Total	100	100	36	56	22

Source: Own calculations.

Appendix C – Export intensive margin

Year 1996 Destination	1996: Value of export per firm (10^3 euros)	Year 2003 Destination	2003: Value of export per firm (10^3 euros)
Liberia	10,916	Botswana	1,768
Chad	1,664	Germany	1,278
Germany	1,086	Singapore	1,000
UK	770	Spain	979
France	562	UK	927
Spain	490	San Marino	918
Singapore	381	France	813
Italy	366	Belgium	629
Netherlands	357	Italy	521
Belgium and Luxembourg	337	USA	505

Source: Own calculations.

Appendix D – Export growth (1996-2003) to the 10 most frequent destinations

Country	Overall growth	Intensive growth (value exported per firm)	Extensive growth (number of firms)
Spain	159	98	31
France	46	45	1
Germany	2	18	-13
UK	43	38	3
USA	98	68	18
Angola	113	8	98
Netherlands	19	31	-9
Italy	107	61	28
Switzerland	-6	-4	-1
Belgium	68	87	-10

Source: Own calculations.

Appendix E Toughest markets for exports (Difficult countries – DC)

Congo, Ecuador, Syria, Vietnam, Serbia, Iran, Gabon, Pakistan, Qatar, Sri Lanka, Ghana, Guatemala, Guinea, Bermuda, Benin, Uruguay, Mali, Libya, Kenya, El Salvador, Burkina Faso, Mauritania, Togo, Madagascar, Bangladesh, Nicaragua, Barbados, Oman, Bosnia, Sudan, Chad, Macedonia, Moldavia, Barbados, Liberia, Central African Republic, Kyrgyzstan, Haiti, Ethiopia, Honduras, Albania, Paraguay, Yemen, Azerbaijan, Uganda, Swaziland, Belarus, Kazakhstan, Niger, Botswana, Cambodia, Turkmenistan, Armenia, North Korea, Djibouti, Somalia, Uzbekistan, Rwanda, Samoa, Guam, Tonga, Malawi, Bhutan, Laos, Nepal, Iraq, Myanmar, Mongolia.