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FIRM PERFORMANCE AND INTERNATIONAL TRADE

- evidence from a small open economy

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Abstract

This paper presents a comprehensive description and analysis of the international trading activities of firms based on novel detailed Swedish data. As a small open economy with a limited domestic market, Sweden constitutes an interesting contrast to existing evidence. We show that much of the stylized facts from large countries (specifically the US) about firms' participation in international trade also pertain to a small open economy. We provide robust evidence of selection operating from market to market which is consistent with that low productive firms are confined to markets with low productivity thresholds. We further show that selection also applies to number of products traded. Both export and import productivity premiums increase in number of markets and number of products traded, respectively. There is a substantial heterogeneity among exporters and importers in terms of the number of markets they trade with and in terms of the number of products they trade.

Keywords: international trade, exports, imports, firm heterogeneity, productivity, import premium, export premium
JEL: F23, F14, D21, D24

1. INTRODUCTION

Since the seminal work by Bernard and Jensen (1995) a series of papers on how different characteristics of individual firms affect their export activities have emerged (see Wagner 2007, Greenaway and Kneller 2007, Tybout 2003 for surveys). Several studies from different countries show that exporters are larger, more productive and have higher skill- and capital-intensity.[1] In short, firms engaged in international trade show better performance than firms operating solely on domestic markets.

Although the literature is vast the current knowledge about the relationship between firms' participation in international markets and other firm characteristics is based on quite limited information. First, the bulk of papers on selection on export markets rely on export indicators in the form of exporter dummy variables or aggregate figures on total exports. The heterogeneity among exporters in terms of the geographical scope and number of products that firms trade is typically not analyzed.[2] Yet, Eaton et al. (2004) remark that such data are necessary to unravel the nature of entry costs and to what extent they differ among markets. Existing evidences are based on data from very few countries, notably the US (Bernard et al. 2007) and France (Eaton et al. 2004). Second, the majority of studies are restricted to exports. Little is known about firms' import behavior though it constitutes a significant part of firms' trade. Imports are particularly interesting in view of the literature on international technology diffusion (see e.g. Keller 2004, Acharya and Keller 2007). This literature points to 'learning-by-importing' and advances imports of capital goods as a channel for knowledge and technology diffusion which boosts sector-wide productivity. Such findings imply that the productivity level in sectors is linked to the import behavior of firms in the sectors, warranting studies of firm characteristics and import behavior.

This paper contributes to the literature by presenting a comprehensive description and analysis of the international trading activities of Swedish firms. The data material used in the paper provides detailed information on the characteristics of each firm and how much each firm exports and imports to (from) each and every market. As a small open economy with a limited domestic market and adjacent countries (with similar language and culture) to which Swedish firms presumably face low entry costs (cf. Andersson 2007), Sweden constitutes an interesting case. We replicate parts of the presentations in Bernard et al. (2007) and Eaton et al. (2004) on the Swedish data and contrast the US and French results with those of a small open economy.

[1] These findings have *inter alia* inspired novel perspectives on the relationship between trade and aggregate productivity. Melitz (2003) introduces heterogeneous firms (marginal cost heterogeneity) in the general Dixit and Stiglitz (1977) framework and shows how exposure to trade leads to reallocations towards firms with high productivity. In this model gains from trade come from selection effects (the least productive firms are out competed) rather than scale effects (firms increase their production and materialize scale economies) from trade liberalizations.

[2] There are simply few datasets that provide the pertinent information.

Our regression analyses are based on over 50 000 firm-level observations over eight years (1997-2004). Controlling for an extensive set of firm attributes, we estimate export and import productivity premiums using various indicators of firms' participation in international trade. Besides usual controls, the data allow us to control for four different ownership structures: (i) non-affiliate (independent) firm, (ii) domestic corporation, (iii) domestic multinational and (iv) foreign multinational. We also extend the analysis and test for productivity differences between firms trading different number of products and trading with different number of markets.

The empirical analysis reveals a substantial heterogeneity among exporters and importers in terms of geographical scope of their trading activities and in terms of the number of products they trade. Although the Swedish economy is distinct from the US and the French in several respects, there are interesting similarities between the countries. Our estimates show that export and import productivity premiums are significant and of similar magnitude. We further provide evidence of selection operating from market to market where low productive firms are confined to markets with low productivity thresholds.[3] Productivity premiums increase in both number of markets and number of products traded. Differences in productivity between firms that trade with different number of markets and different numbers of products are at least as large as those between trading and non-trading firms. Results are robust and remain when acknowledging potential endogeneity between productivity and exports and imports, respectively.

The remainder of the paper is organized in the following fashion: Section 2 presents our theoretical framework. In Section 3 we present our data and provide a set of descriptive statistics which are compared with data from the US and France. Section 4 describes and motivates the estimation methodologies and presents the results of the estimations. Summary and concluding remarks are presented in Section 5.

2. FIRM PERFORMANCE, SELECTION AND INTERNATIONAL TRADE

It is a stylized fact that exporting firms show better performance than non-exporting ones. Two alternative but not mutually exclusive explanations for the observed differences between exporters and non-exporters have been advanced (Wagner 2007). The first is that the most productive firms self-select into foreign markets because they are in a better position to recover sunk costs associated with foreign sales. Such a self-selection hypothesis has been suggested by Clerides et al. (1998), Bernard and Jensen (1999) and Aw et al. (1998). The second is that firms active on international markets acquire knowledge and technology such that exporting activities have positive feedback effects on firms' knowledge and technology

[3] These results support models with heterogeneous firms and asymmetric countries separated by asymmetric sunk costs of entry as in Chaney (2007) and Helpman et al. (2007).

accumulation. Although there are studies pointing to 'learning-by exporting' – e.g. Castellani (2002), Castellani and Zanfei (2003), Criscuolo et al. (2004) – the predominant finding in the literature is self-selection, i.e. *ex ante* productivity advantages (Bernard et al. 2007). Hence, within-industry variations in export participation across firms are explained by a combination of sunk costs of entry on international markets and heterogeneity in the underlying characteristics of firms (Greenaway and Kneller 2007). Whilst the empirical literature accounts for several firm characteristics, the theoretical literature focuses exclusively on productivity. In view of the weak evidence for 'learning-by-exporting' virtually all theoretical models incorporate self-selection, such that exports require *ex ante* productivity advantages.[4]

Alongside new empirical evidence of heterogeneity among exporters in terms of the geographical scope of firms' exports, models of exports with asymmetric countries and asymmetric sunk costs of entry have been developed (see e.g. Chaney 2007 and Helpman et al. 2007). In such models self-selection naturally occurs from market to market. Firms will enter all markets whose productivity threshold is lower than their own productivity level. Because of this, firms enter markets according to a hierarchy where firms with low productivity serve a limited number of markets of low order, i.e. low productivity thresholds, whereas firms with higher productivity can export to a larger number of markets (of higher order).

There are several reasons why productivity thresholds vary across markets. Obvious rationales are cross-country variations in market-size and variations in transport costs between country-pairs.[5] Sunk costs of entry emanating from search processes for potential suppliers, inspection of goods, negotiation and contract formulation, etc., are also likely to be market-specific and depend on the familiarity and affinity with the foreign market in question (cf. Andersson 2007). If productivity thresholds among markets differ substantially and certain destination are associated with low productivity thresholds, differences among firms which exports to different destinations can potentially be much larger than overall differences between non-exporters and exporters. However, there is only limited evidence of productivity differences among firms exporting to different number of markets.

Although the existing literature is primarily concerned with exports, much of the theoretical underpinnings for firms' export behavior plausibly also apply to their import behavior. An importing firm has by definition established exchange agreements with foreign suppliers. Standard transaction-costs theory suggests that the establishment of exchange agreements is associated with sunk costs (Williamson

[4] Bernard et al. (2003) present a model that builds on Eaton & Kortum (2002) with Ricardian differences in technological efficiency between firms. Melitz (2003) develops a dynamic monopolistic competition model with heterogeneous firms and sunk costs of exporting and derives intra-industry reallocation effects of trade.

[5] Larger markets have lower productivity thresholds, because sales are larger in larger markets. All else equal, higher transport costs require higher productivity for sufficient volume of sales.

1979),[6] and it is reasonable to assume that both parties incur such costs. Moreover, the magnitude of the cost incurred by the importing firm certainly depends on characteristics of the foreign country and the overall familiarity and affinity with it. Imports are thus expected to also be subject to market-specific productivity thresholds.

In contrast to the weak evidence of 'learning-by-exporting', however, there is ample empirical evidence of 'learning-by-importing'. The literature on international technology diffusion (surveyed in Keller 2004) advances imports as an important vehicle for knowledge and technology transfers. The conceptual framework for this literature is derived from R&D-based models of growth and trade in which technology and knowledge is embodied in differentiated intermediate capital goods, see e.g. Romer (1990), Grossman and Helpman (1991), Rivera-Batiz and Romer (1991), Kortum (1997), Eaton and Kortum (1999, 2002). New intermediate goods are outcomes from investments in R&D. Domestic firms can then access foreign R&D by importing the intermediate goods produced in the foreign country. The analyses in Keller (2002), Acharya and Keller (2007) and Lööf (2007) provide recent evidence that imports of intermediate capital goods from foreign countries are a source of domestic firms' productivity. It follows from this literature that firms' productivity is related to their import of intermediaries. Learning and self-selection are hence likely to operate simultaneously for imports.

In the subsequent section we present a comprehensive description of Swedish firms' participation in international trade. We estimate export and import productivity premiums using various indicators of firms' participation in international trade and control for potential endogeneity between productivity and export and imports, respectively. We also test for productivity differences between firms trading different number of products and trading with different number of markets and contrast the findings to models based on heterogeneous firms and asymmetric countries separated by asymmetric trade barriers.

3. SWEDISH FIRMS IN INTERNATIONAL TRADE

3.1 Data

The empirical analysis presented in this paper is based data material which describes Swedish firms' export and import activities on a yearly basis between 1997 and 2007. Four sources of data have been matched based on a unique identification number of each firm. All data originates from the Swedish

[6] An exchange agreement is typically preceded by a search process for potential suppliers, inspection of goods, negotiation and contract formulation, etc. These activities are associated with costs that are irrevocably committed, i.e. sunk.

customs office and Statistics Sweden. In all data sources a firms is defined as a legal entity. The first set of data provides information of the how much each firm is exporting and importing to and from each country by product and year. Products are distinguished from each other based on an 8-digit classification code according to the combined nomenclature (CN). Exports and imports by product, country and year are measured in values and volumes (kilogram). The second set of data contains balance-sheet information for each and every firm and includes information on employment, value-added, sales, gross investments, short- and long-run debts, etc. The third data source is the Swedish employment database (RAMS) which provide information on the education structure of each firm's employees. The fourth data source is a database of the ownership structure of firms. These data provide information on whether a firm is an independent firm or belongs to a domestic corporation, a domestic multinational or a foreign multinational. A firm belongs to either one of the three categories if it is owned by 50 %.

In the subsequent presentations we present data based on all firms with at least one employee and only firms with at least 10 employees. The reason for this is twofold. First, most existing papers only have information on firms with at least 10 employees. Comparison with other sets of data is thus easier for the reader if we present separate figures. Second, the quality of the balance-sheet information is better for larger firms.

We limit the present study to only cover manufacturing in the manufacturing sector (NACE-15-36). With all firms with at least one employee we have an unbalanced panel of over 197,000 firm-level observations 1997-2004 and when we restrict our analysis to firms with at least 10 employees we get an unbalanced panel of over 56,000 firm-level observations. The regression analysis presented in Section 5 is based on the latter panel, but results on the larger panel is available form the authors upon request.

3.2 Swedish firm's participation in international trade

Based on US data Bernard et al. (2007) writes "…engaging in international trade is an exceedingly rare activity: of the 5.5 million firms operating in the United States in 2000, just 4 percent were exporters. Among these exporting firms, the top 10 percent accounted for 96 percent of total U.S. exports". The US is a large country which constitutes a significant part of the world market and whose. How does the participation in international trade of firms' in a small open economy (like Sweden) compare to the US and other countries?

The Swedish economy is an interesting case. The domestic market is small and Sweden has a common border with other Scandinavian countries to which Swedish firms presumably face low entry costs. Theory suggests that the combination of scale economies in production, limited domestic market

and a common border with countries to which sunk costs of entry are presumably low imply relatively high participation rates in international trade.

Table 1 presents the fraction of Swedish firms with at least 1 and 10 employees, respectively, engaged in international trade. Larger firms have higher participation rates (a typical finding in the literature). However, the ordering of the figures in the table are unaffected by the whether we study all firms or restrict attention to firms with less than 10 employees. The overall participation rate, measured as the fraction of firms that export, import or are engaged in both, amounts to 76 % among firms with at least 10 employees and 40 % across all firms. Moreover, the fraction of firms that export is 71 % and 36 % for each respective group. Exporting is a more frequent phenomenon than importing, though the majority of exporters also import (55 % and 22 %).

Compared to the stylized facts in the US reported in Bernard et al. (2007), Swedish firms have higher participation rate. Bernard's et al. (2007) figures for 1997 show that 27 % of US manufacturing firms are exporters whereas 14 % are importers.[7] About 11 % of the firms were concurrently involved in both export and import activities. Although the level of the participation rates is lower, the ordering is the same in both the US and Sweden; exporting is most frequent and both exporting and importing is least.

Table 1. Percent of firms that are and are not engaged in international trade in 2004

	Fraction of firms 2004 (%)	
	≥10	*≥1*
Non-trading firm	24	60
Exporter	71	36
Importer	60	27
Exporter and Importer	55	22
Importer (no exports)	5	5
Exporter (no imports)	16	13
Trading firms (exporter, importer or both)	**76**	**40**

Notes: ≥10 denotes firms with at least 10 employees and ≥1 firms with at least one employee, i.e. all firms in Sweden (excl. single-person firms). The first group comprises 6,829 firms and the second 24,368 in 2004. Only firms in the manufacturing sector (NACE 15-36).

Export participation varies substantially across industries. Table 2 presents export participation and exports as a fraction of sales across Swedish in 2004. The 3rd column reports the average share of export in sales across firms, i.e. an unweighted average, whereas the 4th column reports the same fraction based on

[7] These figures are based on firms that appear in two different sets of data (see Bernard et al 2007 for details).

industry totals. Export participation ranges from 75 % in *Pulp and Paper* to 20 % in *Food and Beverages* when all firms are considered. The corresponding figure for firms with at least 10 employees is 93 % and 43 %, respectively.

Table 2. Export participation and exports as a fraction of sales across Swedish in 2004.

Industry	**Percent of firms that export**		**Export as a fraction of sales** (averages across firms)		*Export as a fraction of sales* ***(total industry exports divided by total industry sales)***	
	≥10	*≥1*	*≥10*	*≥1*	*≥10*	*≥1*
Pulp and Paper	93	75	33	22	61	60
Petroleum and Chemical	93	67	40	23	62	62
Plastic and Rubber	92	59	25	12	37	34
Non-metallic mineral	92	37	17	7	17	16
Textiles and Apparel Leather	90	47	30	10	55	47
Transportation	81	46	23	10	43	42
Furniture and Related Products	81	41	17	7	25	22
Computers and Electronic	79	43	27	11	60	58
Machinery and Equipment	78	46	29	13	43	42
Wood Products	68	27	19	6	35	32
Fabricated Metal products	62	27	11	4	26	22
Printing	61	25	3	1	3	3
Basic Metal	59	61	37	21	63	62
Food and Beverages	43	20	7	3	13	13
Aggregate manufacturing	***71***	***36***	***19***	***7***	***43***	***41***

Notes: ≥10 denotes firms with at least 10 employees and ≥1 firms with at least one employee, i.e. all firms in Sweden (excl. single-person firms). The first group comprises 6,829 firms and the second 24,368 in 2004. Only firms in the manufacturing sector (NACE 15-36).

Firms typically export a small fraction of their sales. The average export share in manufacturing is 7 % across all firms and 19 % across firms with at least 10 employees. Even in sectors with high participation rate, firms export a relatively small share of their total sales. For instance, in *Pulp and Paper* where 75 % of all firms export the average firm exports 20 % of its sales. Interestingly these figures correspond to US data. Bernard et al. (2007) show that average export share of manufacturing firms in the US amounts to 14 %. The highest average export share across firms is in *Computer and Electronic Products* where firms on average export 21 % of their sales (see Appendix A). Despite a higher export participation rate by Swedish

firms, the average share of exports in total sales is lower than in the US when all firms are considered. This pattern is consistent with that Swedish manufactures face low sunk costs of entry to certain markets, such as other Scandinavian countries and the Baltic States (cf. Andersson 2007). Low sunk costs of entry can be recouped with low export sales volumes.

Table 2 also illustrates that when export shares are computed based on industry totals the picture change. About 40 % of total manufacturing sales are shipped to foreign markets. The discrepancy between the average based on industry totals and the average across firms illustrate strong within-industry heterogeneity across firms in terms of export shares. Such heterogeneity can be related to that a few large multinationals with established trade networks to foreign markets dominate.[8]

Table 3 presents the ownership structure of Swedish firms in 2004. The largest group is non-affiliate firms 69 % followed by domestic firms belonging to a group with only domestic affiliates, i.e. a domestic corporation (19 %). 12 % of all Swedish firms belong to a multinational. This figure is about three times as large when looking at the share of firms with at least 10 employees.

Table 3. Distribution of firms across ownership structure in Sweden 2004.

	Fraction of firms by ownership structure 2004 (%)	
	$\geq$10	*$\geq$1*
Non-affiliate firm	33	69
Domestic corporation	33	19
Domestic multinational	19	7
Foreign multinational	15	5

Notes: $\geq$10 denotes firms with at least 10 employees and $\geq$1 firms with at least one employee, i.e. all firms in Sweden (excl. single-person firms). The first group comprises 6,829 firms and the second 24,368 in 2004. Only firms in the manufacturing sector (NACE 15-36).

Firms belonging to multinationals are responsible for virtually all of Swedish trade. Appendix B shows that the multinationals account for over 90 % of Sweden's total exports and imports. Moreover, the average firm belonging to a multinational export and import significantly more products and are active on much more markets, i.e. higher geographical scope of export and import activities.

Exports and imports are also highly concentrated to a few firms. The 20 biggest manufacturing firms in Sweden accounted for 39 % of Sweden's export in 2004 and 34 % of export (see Appendix B). In the US where the top 1 % of trading firms accounts for over 80 % of total trade and the top 10 % accounts for over 95 %.

[8] Multinationals constitute a significant share of world trade flows (Markusen 2002).

Bernard et al. (2007) lists several explanations for the observed concentration of exports to a few large firms. One is that sunk costs of entry and profitability vary across markets. More productive firms will then export to a larger set of markets, which augments differences in exports between low- and high-productive firms (see e.g. Chaney 2007 and Helpman et al. 2007) compared to a case in which all firms export to all markets. Another is that different products are associated with different sunk costs and profitability for firms. In this case more productive firms will export a larger set of products, which will also magnify differences in export sales across firms with different productivities.

In Appendix B we can indeed observe that larger firms have higher export intensity (exports as a share of total sales), export a larger number of export products and export to a larger set of destination markets. This indicates that firm-level export growth is associated with increased product variety and entry in a growing number of markets.

Table 4 presents the share of exporting firms that export different number of product and export to different number of destinations. The table compares Sweden and the US. The US data are from Bernard et al. (2007) and pertain to 2000 whereas the Swedish data are from 2004.

Table 4. Distribution of exporting firms across number of products and number of destinations.

Number of Products				*Number of Countries*			
Products	USA	Sweden		**Countries**	USA	Sweden	
		≥10	*≥1*			*≥10*	*≥1*
1	42	13	24	**1**	63	23	37
2	16	11	15	**2**	13	10	13
3	9	9	11	**3**	6	6	7
4	6	7	7	**4**	4	5	5
5+	26	59	43	**5+**	14	56	38

Notes: The US data are from Bernard et al. (2007) and pertain to 2000. The Swedish data are from 2004. ≥10 denotes firms with at least 10 employees and ≥1 firms with at least one employee, i.e. all firms in Sweden (excl. single-person firms). The first group comprises 6,829 firms and the second 24,368 in 2004. Only firms in the manufacturing sector (NACE 15-36).

The fraction of Swedish firms exporting at least five products is larger than in the US regardless of whether one studies all firms or firms with at least 10 employees. The same applies to number of destinations. Among firms with at least 10 employees in Sweden, the majority export at least five products and export to at least five destination countries. This is a further reflection of Sweden as a small open economy which faces relatively low sunk costs of entry to a number of adjacent countries.

Figures 1ab and 2ab illustrate a substantial heterogeneity among exporting and importing firms, respectively, in terms of the number of export and import products and the geographical scope of their export and import activities (number of destination and origin countries). The figures are akin to those presented in Eaton et al. (2004) on French firm-level export data. They report the frequency with which

firms trade different number of products and with different number of markets. The vertical axis in each figure measures the log of number of firms and the horizontal axis measures the log of number of countries and products, respectively.

Starting with the frequency with which Swedish firms are exporting and importing different number of products, it is observed from Figures 1a and 1b that for both export and imports, the number of firms decline quite smoothly as the number of products increases. The elasticity by which the number of firms falls of as number products increase is about -1.4 in the case of both exports and imports.

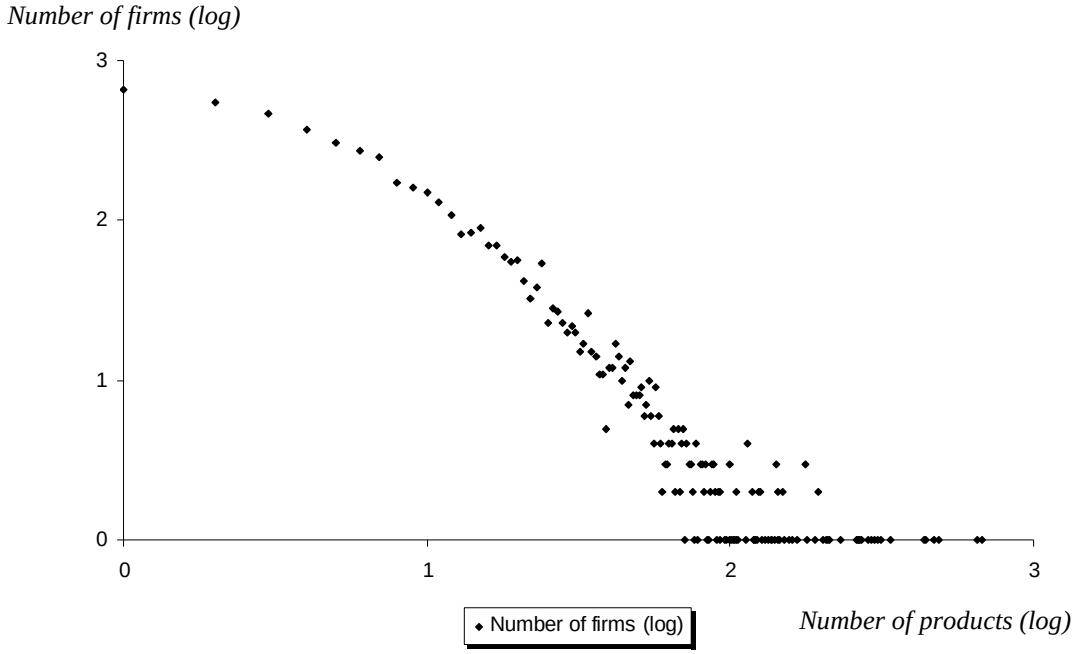

Figure 1a. Frequency by which Swedish firms in manufacturing sectors export different number of products (Each dot represents the number of firms that export a given number of products. The figure shows that most firms export a limited set of products).

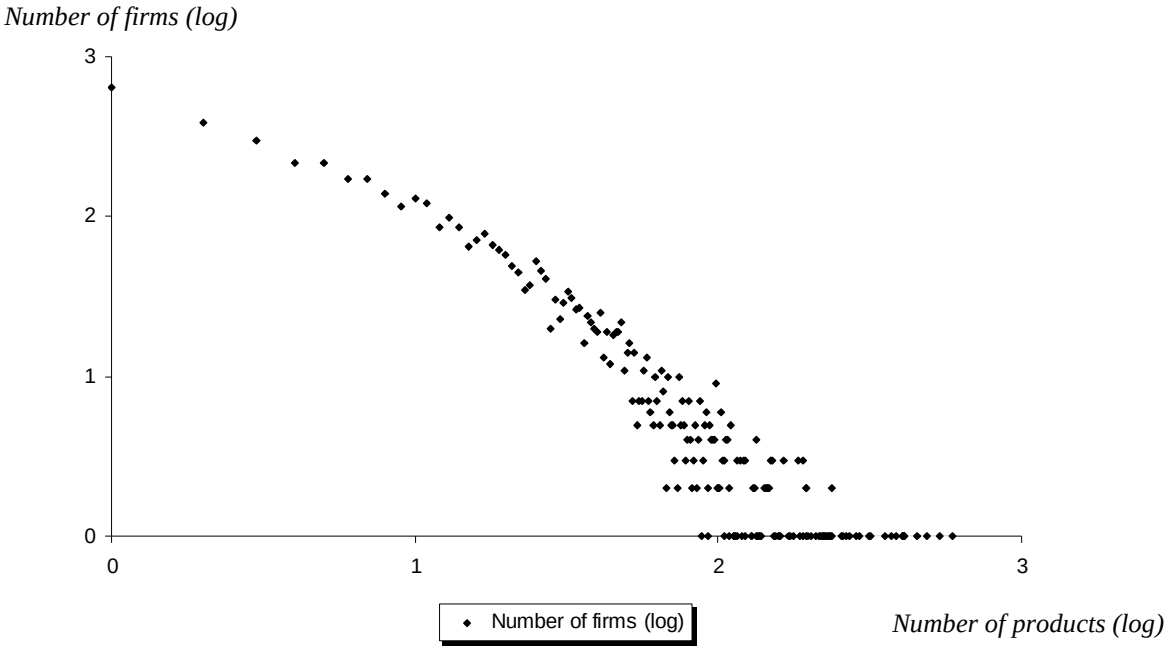

Figure 1b. Frequency by which Swedish firms in manufacturing sectors import different number of products. (Each dot represents the number of firms that import a given number of products. The figure shows that most firms export a limited set of products).

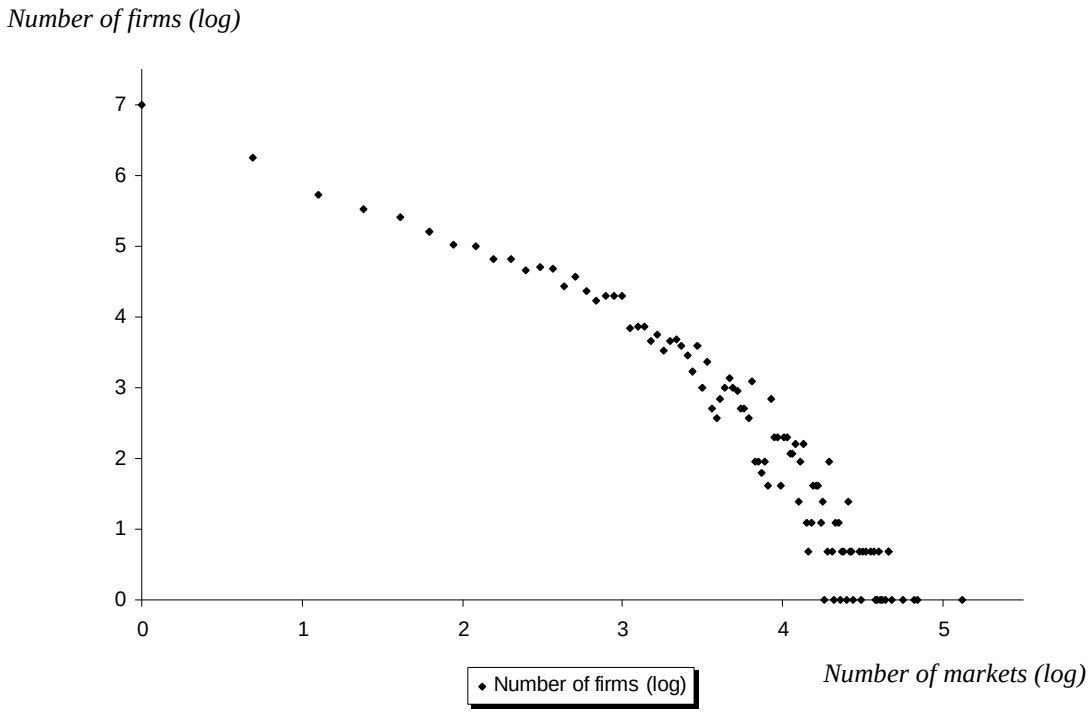

Figure 2a. Frequency by which Swedish firms in manufacturing sectors export to different number of markets. (Each dot represents the number of firms that export to a given number of markets. The figure shows that most firms export to a limited set of destination countries).

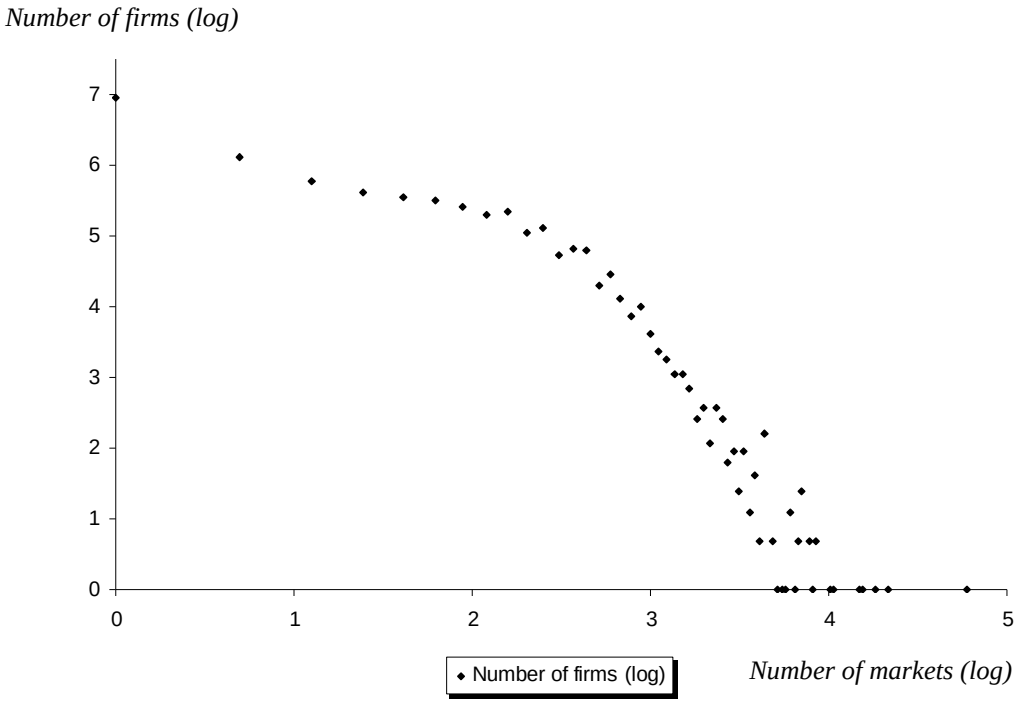

Figure 2b. Frequency by which Swedish firms in manufacturing sectors import from different number of markets. (Each dot represents the number of firms that import from a given number of markets. The figure shows that most firms import from a limited set of origin countries).

Figures 2a and 2b presents the frequency with which Swedish firms are exporting to and importing from different number of markets. As is illustrate in the figures, the heterogeneity among trading firms in terms of geographical scope of their export and import activities is substantial. Most firms export to and import from a limited number of markets. As in the previous figures, the number of firms decline monotonically with number of destinations and origins, respectively. The elasticity by which the number of firms falls of as number countries increase is about -1.7 for exports and -2.0 for imports. Eaton et al. (2004) report an elasticity of -2.5 based on French firm-level export data.

It is well known that exporters differ from non-exporter in terms of several characteristics. Given the observed differences between US and Swedish firms as regards export participation, it is an interesting exercise is to compare exporter premiums in the countries. The figures for U.S. in Table 5 are presented by Bernard et al. (2007) and are based on data in 2002. In order to contrast the Swedish economy with the US, we have replicated Bernard's et al. (2007) estimation on Swedish data. All results are based on OLS regressions. Colum 1 reports the association between a dummy variable indicating whether or not a firm is exporting and 6 different dependent variables without any additional covariates. Column two includes industry dummies and in column three the log of firm size is added.

The first conclusion from the table is that in accordance with numerous previous studies (see the surveys in Greenaway and Kneller 2007 and Wagner 2007), there are significant differences between exporters and non-exporters in Sweden that remain when controlling for industry fixed effects and size. This holds for in the case of all firms and firms with at least 10 employees. Exporters are larger in terms of both employment and sales, have higher labor productivity and wages, higher capital and skill intensity. The second conclusion is that differences between exporters and non-exporters are in general much larger when studying all firms compared to firms with at least 10 employees.

Table 5. Exporter premiums: a comparison between Sweden and the US.

Dependent variable	**(1)**			**(2)**			**(3)**		
	US	**Sweden**		**US**	**Sweden**		**US**	**Sweden**	
		≥10	*≥1*		*≥10*	*≥1*		*≥10*	*≥1*
Employment (log)	1.19	0.74	1.52	0.97	0.69	1.52	-	-	-
Sales (log)	1.48	1.15	2.03	1.08	1.08	2.21	0.08	0.33	0.42
Labor productivity (log)	0.26	0.16	0.31	0.11	0.14	0.30	0.10	0.10	0.14
Wage per worker (log)	0.17	0.08	0.39	0.06	0.06	0.39	0.06	0.03	0.04
Capital per worker (log)	0.32	0.36	1.15	0.12	0.39	1.20	0.04	0.23	0.33
Skill per worker (log)	0.19	0.05	1.83	0.11	0.04	1.79	0.19	0.02	0.77
Additional controls	None			Industry Fixed Effects			Industry Fixed Effects and employment (log)		

Notes: The U.S. figures are from Bernard et al. (2007) and are based on Data for 2002 from the U.S. Census of Manufactures. The Swedish data are from 2004. ≥10 denotes firms with at least 10 employees and ≥1 firms with at least one employee, i.e. all firms in Sweden (excl. single-person firms). The first group comprises 6,829 firms and the second 24,368 in 2004. Only firms in the manufacturing sector (NACE 15-36). We have replicated the Bernard et al. (2007) estimation using Swedish data. All results are based on OLS regressions. Colum 1 reports the association between a dummy variable indicating whether or not a firm is exporting and 6 different dependent variables. The results show that the exporter premium on manufacturing is 1.19 for the U.S. firms and 0.74 for the Swedish firms with at least 10 employees and 1.52 when all firms are included. The U.S exporter premium is 1.48 on sales and the corresponding figure for Sweden is 1.15 and 2.03 respectively, and so on. Columns two and three include industry dummies plus control for (log) firm size. Wage is wage per worker in Sweden and this variable is not defined in Bernard et al. (2007). Skill is the fraction of workers with a university education in Sweden, while skill is not defined in Bernard et al. (2007). Capital is capital stock (U.S) and flow (Sweden) per employee. All results are significant at the 1-percent level in both U.S. and Sweden.

Since Sweden supposedly face low sunk entry costs to several adjacent countries and is an open economy it can be expected that exporter premiums are relatively lower in Sweden compared to the US. In contrast the results in the table reveal that the export premium on labor productivity is surprisingly similar in the

US and Sweden (around 0.10). The premium on capital per worker is higher in Sweden whereas the premium on wages is somewhat lower. Moreover, the premium on sales is much higher in Sweden than in the US. This result is consistent with that the Swedish domestic market is small and exporters in general exports to a large set of export markets relative to the US (Table 4).

In the subsequent sections we estimate export and import premiums on the Swedish data using with various indicators of firms' export and import participation, controlling for an extensive set of firms characteristics.

4. EXPORT AND IMPORT PRODUCTIVITY PREMIUMS

4.1 Empirical model and estimation strategy

In the regression analyses we restrict attention to firms with at least 10 employees. This leaves us with 56,957 observations. We first conduct seven regressions where the sensitivity of labor productivity with respect to different trade variables is estimated by employing the random effects specification of the Generalized Least Square Estimator (GLS). In these estimations firm characteristics, such as human and physical capital, corporate ownership structure and firm size are controlled for along with industry and time specific effects.

The very general model used in the analysis is the following:

$$(1) \qquad y_{it} = \alpha_{it} + x_{it}^{'}\beta_{it} + u_{it,} \qquad i =,...,N,\ t = 1,...,T$$

where y_{it} is a scalar dependent variable, x_{it} is a K *1 vector of independent variables, u_{it} is a scalar distributed term, i indexes firm in a cross section t indexes time. The random effects model that will be applied assumes that the unobservervable individual effects are random variables that are distributed independently of the regressors:

$$(2) \qquad y_{it} = \alpha_{i} + x_{it}^{'}\beta + \varepsilon_{it,} \qquad i =,...,N,\ t = 1,...,T$$

where and α_i are random variables that capture unobservable heterogeneity ε_{it} is iid over i and t, assumed to be independent of x, and β is a K*1 column vector to be estimated.

The dependent variable (y_i) is log value added per employee, or labor productivity. The relationships between export and productivity on the one hand, and import and productivity on the other hand, are analyzed separately. We use the following trade variables:

- a dummy variable indicating whether or not the firm is an exporter respectively and importer
- log of trade (export or import) value per employee
- log of trade (export or import) volume per employee
- a set of dummy variables for the number of traded products according to four different classes
- a set of dummy variables for the number of countries with which the firm trade according to four classes

In addition to observations of trading activities, we control for a large set of firm attributes that theoretical and empirical literature suggests will influence the labor productivity, i.e. human capital, physical capital, firm size and corporate ownership structure. Human capital is measured as the fraction of the workers with a university degree and the physical capital variables are measured as the log of the gross investment per employee. The corporate ownership structure is defined according to the four different categories described above and firm size is controlled for by dummy variables reflecting four different size classes. In order to control for industry effects and time trend we include 14 industry indicators and 8 year dummies in the model. Descriptive statistics for the variables in (2) over the whole period (1997-2004) are presented in Appendix C and correlations between the variables are presented in Appendix D.

To deal with possible simultaneity we apply the instrumental-variable estimator. To derive consistent estimates of (2) in the presence of endogeneity we must find and instrumental variable that must be uncorrelated with the disturbances and highly correlated with the endogenous regressor. We follow Baum (2006) and instrument the trade variables with lags and use robust regressions that cause the 2-step GMM estimator to compute efficient estimates. Test statistics inform us that the second and third lag of the trade variable in general fulfils this requirement. In some case we have to extend the lag structure to the forth lag. The drawback here is that the observations in our unbalanced panel are reduced to 26,640-19,542 observations depending on the lag structure.

4.2 Results

This section presents the regression estimates from the GLS estimator and the two-step GMM procedure. The results from the 28 regressions estimated by GLS and GMM respectively are summarized in Table 6 (export) and Table 7 (import). Appendix E provides the complete output results of all regressions for exports whereas Appendix F provides the corresponding results for imports. Both appendices include test statistics.

Focusing initially on the relationship between exporting activities and labor productivity the results of these regressions are summarized in Table 6. In column (1) the GLS estimates are presented whereas column (2) shows the GMM-estimates. The main message from Table 6 is that exporters are more productive, irrespective of export indicator and model specification. All estimates are highly significant and both models (GLS and GMM) produce more or less identical results.

Row 1 in Table 6 reports the elasticity of labor productivity with respect to the dummy variable indicating whether or not the firm is engaged in export activities. On average, exporters have 5 percent higher labor productivity than non-exporters, which is consistent with a vast body of previous empirical findings based on firm-level data. The results in row 2 and 3 indicate that the productivity premium of exporters is lower when the export-related explanatory variables are defined in terms of export intensity. A one percent increase in export value per employee predicts a productivity premium of 2 percent whereas a one percent increase in export quantity per employee suggests a modest productivity premium of one percent.

The coefficients estimates reported in row 4 and downwards show that the export premium is increasing in the number of products that firms are exporting. A firm that export 1 to 3 products have in average 4 percent higher labor productivity than a non-exporting firm whereas the typical firm that sell 4 to 8 products on foreign markets have a productivity that are 6.6 percent higher than the average firm that only operates on the domestic market. Firms which foreign sales contain 9 or more products have a productivity premium over non-exporters of 10.2 percent. These results are obtained with the GMM-estimator (column 3) give similar results; firms that export 8 products or more have 7.3 percent higher labor productivity than firms exporting between 0 and 7 products.[9] This result is consistent with that the production of different products is associated with different levels of fixed costs and profitability for firms, such that low-productive firms produce a few products associated with low levels of fixed costs.

[9] In order to specify the GMM estimation in an appropriate way we use another classification then in the GLS estimation.

Table 6. The relationship between log value-added per employee and exports. GLS Random effects model and 2-step GMM-model.

Equation	GLS, RE Obs 56, 607	GMM Obs 26,640 – 19,542
1. Export dummy	0.049 (0.005)***	0.051 (0.008)*** L.3
2. Log export value per employee	0.022 (0.000)***	0.021 (0.001)*** L.3
3. Log export volume per employee	0.011 (0.000)***	0.011 (0.001)*** L.3
4. Number of export products		
0	Reference	-
1-3	0.040 (0.005)***	-
4-8	0.066 (0.006)***	-
9 -	0.102 (0.007)***	-
0-7	-	Reference
8-	-	0.073 (0.012) *** L4
5. Number of export destination		
0	Reference	-
1-4	0.041 (0.005)***	-
5-13	0.082 (0.007)***	-
13-	0.153 (0.008)***	-
0-7	-	Reference
8-	-	0.098 (0.008)***
Covariates	Included	Included

Notes: (L.3) Instrumented by 2-3 lags and using 26,640 observations, (L.4) Instrumented by the 2-4 lags and using 19,542 observations. Appendix E presents the complete results for the regression results summarized in Table 6.

The estimated parameters associated with the export dummy variables for different destination countries show that the export premium for labor productivity is increasing in the number of countries which firms export to. According to the GLS estimates, productivity is 4 % larger for firms that export to 1-4 countries compared to non-exporters. The same figure for firms exporting to 4-8 countries is 7 %, whereas it is 15 % for firms exporting to at least 13 countries. With GMM estimator we find that the average firm that trade with 8 or more countries has 10 percent higher labor productivity than a reference group consisting firms with 0-7 export products. These results provide strong support for models of exports with asymmetric countries and asymmetric sunk costs of entry (as in e.g. Chaney 2007 and Helpman et al. 2007). In such models self-selection occurs from market to market. Firms will enter all markets whose productivity threshold is lower than their own productivity level. Because of this, firms enter markets according to a hierarchy where firms with low productivity serve a limited number of markets of low order, i.e. low productivity thresholds, whereas firms with higher productivity can export to a larger number of markets

(of higher order). These models predict the pattern observed in Table 6. Results thus show that productivity is key for both number of export products and number of destination countries.

Turning the attention to the relationship between productivity and import behavior, Table 7 presents the results from estimations of the regressions of labor productivity on import indicators and firm characteristics. The covariates are the same as in the regressions including export variables above. Overall the results for imports correspond to those obtained for exports. Labor productivity is 4.4 percent higher for importers compared to non-importers. Taking into account that productivity and import might be simultaneously determined – as suggested by the literature on international technology diffusion (Keller 2004) – and employing an instrumental variable estimator (GMM), the size of the coefficient estimate for the import indicator is 8.6 %. This difference is much larger than that for exports and indicates that simultaneity is important to control for in the case of imports. Also, a one-percent higher import value per employee is estimated to imply a 1.5 % (GLS) and 2.7 % (GMM), respectively, higher labor productivity. The elasticity of labor productivity with respect to import volume per employee is about 1 percent in both model specifications.

Furthermore, as in the case of exports, the import premium is increasing in the number of import products as well as in the number of import countries. A manufacturing firm that imports 9 or more products is predicted to have about 13 percent higher labor productivity than a non-importing firm according to the GLS estimates and the GMM estimate yield a corresponding coefficient of 8 percent where the reference is firms that import 0-7 products.

Similar to exports, the productivity premium of importers with respect to labor productivity increases more with expansions in geographical scope than with extensions in number of import products. The GLS estimates imply that the productivity premium is almost three times larger for firms importing from 5-13 countries than for firms importing from 1-4 foreign markets. For firms importing from 13 markets or more the estimated productivity mark-up over non-importing firms is 17.5 percent. The GMM estimates with a three year lag structure for the instruments shows that a firm which imports from 8 or more countries is expected to have 9.8 percent higher labor productivity than firms that imports from 0-7 countries.

Table 7. The relationship between log value-added per employee and imports. GLS Random effects model and 2-step GMM-model.

Equation	GLS, RE Obs 56, 607	GMM Obs 26,640
1. Import dummy	0.044 (0.004)***	0.086 (0.009)*** L.3
2. Log import value/ per employee	0.015 (0.000)***	0.027 (0.001)*** L.3
3. Log import volume per employee	0.010 (0.000)***	0.011 (0.000)*** L.3
4. Number of import products	0.001 (0.000)***	0.001 (0.000)*** L.3
0	Reference	-
1-3	0.033 (0.004)***	-
4-8	0.076 (0.006)***	-
9 -	0.133 (0.008)***	-
0-7	-	Reference
8 -	-	0.080 (0.008) *** L.3
5. Number of import countries		
0	Reference	-
1-4	0.044 (0.005)***	-
5-13	0.119 (0.007)***	-
13-	0.175 (0.009)***	-
0-7	-	Reference
8 -	-	0.098 (0.008)*** L.3
6. Log import (value/product) per emp.	0.016 (0.000)***	0.020(0.001)*** L.3
7. Log import value/destination per emp.	0.015 (0.000)***	0.017(0.000)*** L.3
Covariates	Included	Included

Notes: (L.3) Instrumented by 2-3 lags and using 26,640 observations. Appendix F presents the complete results for the regression results summarized in Table 7.

Addressing the estimated influence of the control variables on labor productivity, the tables in Appendix E and F show that the estimated parameters associated with the control variables are almost identical in the export and import regressions. Not surprisingly, human capital and physical capital have a significant positive impact on labor productivity. Foreign-owned MNEs have in average a higher productivity than domestic MNEs. MNEs have on average higher productivity than firms belonging to a domestic corporation and non-affiliated firms. Moreover, firms in the largest size class (more than 250 employees) have a higher labor productivity firms in lower size classes.

Taken together the results presented in Table 6 and 7 show that there is a strong and significant positive relationship between trade and productivity levels at firm-level. In both export and import activities productivity premiums is growing with the variety in traded goods and trading markets.

5. SUMMARY AND CONCLUSIONS

There is a growing preference for shifting the attention from the study of international trade at the aggregate and industry level to the firm and product level. This paper contributes to the existing firm-level literature in two distinct respects. First, it adds to the still rare descriptive statistics on the heterogeneity among trading firms by contrasting new firm-level data from Sweden – a small open economy – against data for the U.S. and France. Second, it conducts a rigorous analysis of a panel over eight years comprising over 56 000 firm level observations with extensive firm characteristics, such as human capital physical capital, corporate ownership structure, number of products each firms trade and the number of countries each firm trade with. It estimates exports and import premiums, controlling for possible simultaneity between trade and productivity.

The analyses have yielded a number of key results on firms' participation in international trade. There are striking similarities between small and large economies. The export premium with respect to labor productivity and wages in the US and Sweden is almost identical. As expected the fraction of firms engaged in international trade in Sweden is larger than in the US. In Sweden, 40 % of all firms in manufacturing are engaged in international trade. However, the average share of exports in total sales across firms in the manufacturing sector is roughly similar. Moreover, the Swedish, US and French data demonstrate a similar heterogeneity among firms in terms of the number of markets they trade with and the number of products they.

Export and import productivity premiums are significant and of similar magnitude. Exporting firms have about 5 % higher productivity than non-exporting ones. The corresponding figure for imports ranges between 4 % and 9 %. An important finding is that productivity premiums increase in both number of markets and number of products traded. The export productivity of firms that export at least 9 products is more than double that of firms exporting 1-4 products. Similarly, the export productivity premium for firms exporting to at least 13 destinations is more than three times as large as that of firms exporting to 1-4 destinations. The pattern for imports is similar.

Differences in productivity between firms that trade with different number of markets and different numbers of products are at least as large as those between trading and non-trading firms. Selection operates across markets and across products.

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APPENDIX A

Export participation and average fraction of export of sales across firms in the US 2002.

Industry	Percent of firms that export	Export as a fraction of sales
Computer and Electronic Product	38	21
Electrical Equipment, Appliance	38	13
Chemical manufacturing	36	14
Machinery Manufacturing	33	16
Primary Metal Manufacturing	30	10
Transport Equipment	28	13
Textile Mills	25	13
Leather and Allied Product	24	13
Paper Manufacturing	24	9
Beverage and Tobacco Product	23	7
Petroleum and Coal Products	18	12
Fabricated metal Product	14	12
Food and manufacturing	12	15
Textile Product Mills	12	12
Nonmetallic Mineral products	9	12
Apparel Manufacturing	8	14
Wood Product Manufacturing	8	19
Furniture and Related Product	7	10
Printing and related Support	5	14
Miscellaneous manufacturing	2	15
Aggregate Manufacturing	**18**	**14**

Source: Bernard et al. (2007)

APPENDIX B

Descriptive Statistics Exports

Panel B1: Export by corporate ownership structure 1997 and 2004

	Exporters		Fraction of sales		No of products		No of destinations	
	1997	2004	1997	2004	1997	2004	1997	2004
Dom. owned NAF	60.5	55.6	11.2	9.7	4.3	3.3	3.9	3.1
Dom. owned MNE	86.6	88.5	30.1	31.8	21.3	19.8	16.6	17.0
For. owned MNE	92.7	92.6	36.3	36.9	27.0	21.5	22.5	19.2
Dom. owned UNI	68.4	66.3	13.4	11.2	4.9	4.7	4.8	4.5
Aggregate manufact,	**70.2**	**71.1**	**17.3**	**18.6**	**9.4**	**9.7**	**8.0**	**8.7**

Panel B2: Fraction of total manufacturing export, by corporate ownership structure 1997 and 2004

	Firms	Firms	Emp	Emp	Export value	Export value	Export volume	Export volume
Year	1997	2004	1997	2004	1997	2004	1997	2004
Dom. owned NAF	43.8	33.0	14,4	8,3	5.6	2.6	5.8	2.8
Dom. owned MNE	19.7	19.5	54,1	38,5	69.2	45.7	63.2	41.2
Foreign owned MNE	7.0	15.1	18,6	37,4	20.7	48.9	21.7	50.9
Dom. owned UNI	29.5	32.4	12,9	15,9	4.5	2.8	9.4	5.1
Aggregate	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Panel B3: Export by firm size 1997 and 2004

	Exporters		Fraction of sales		No of products		No of destinations	
	1997	2004	1997	2004	1997	2004	1997	2004
10-25	56.9	58.6	9.9	10.7	3.1	3.7	2.9	3.4
26-50	78.8	77.6	18.1	19.9	7.0	7.6	6.4	8.1
51-100	89.0	88.2	26.9	28.9	11.7	12.7	12.2	13.3
101-250	90.9	94.4	34.3	37.3	21.0	21.4	19.7	20.8
251-	98.4	97.0	41.0	42.0	51.5	55.4	35.9	35.5
20 largest firms	100.0	95.0	43.0	34.5	252.8	238.1	62	63
Aggregate manufact,	**70.2**	**71.1**	**17.3**	**18.6**	**9.4**	**9.7**	**8.0**	**8.7**

Panel B4: Fraction of total manufacturing exxport, by size classes 1997 and 2004

	Firms	Firms	Emp	Emp	Export value	Export value	Export volume	Export volume
Year	1997	2004	1997	2004	1997	2004	1997	2004
10-25	54.1	53.9	9.1	9.5	2.0	1.9	2.9	2.8
26-50	20.1	20.5	7.7	8.2	2.9	3.0	4.8	4.0
51-100	12.3	12.6	9.5	9.9	5.7	5.8	7.2	6.9
101-250	7.9	7.7	13.7	13.6	10.7	10.5	11.2	19.4
251-	5.5	5.3	60.0	58.8	78.7	78.8	73.8	67.0
20 largest firms	0.3	0.3	19.4	23.5	36.4	38.6	8.8	8.9
Aggregate	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Descriptive Statistics Import

Panel B5: Import by corporate ownership structure 1997 and 2004

	Importers		Fraction of sales		No of products		No of origins	
	1997	2004	1997	2004	1997	2004	1997	2004
Dom. owned NAF	50.2	47.0	5.8	4.6	5.8	3.9	2.2	1.7
Dom. owned MNE	83.4	86.4	10.7	12.1	28.1	25.0	8.1	8.8
For. owned MNE	92.9	91.9	17.9	18.7	42.1	35.0	11.5	10.7
Dom. owned UNI	59.0	57.7	5.5	5.2	6.4	6.1	2.6	2.6
Aggregate manufact,	**62.3**	**64.9**	**7.5**	**8.4**	**12.9**	**13.4**	**4.2**	**4.8**

Panel B6: Fraction of total manufacturing import, by corporate ownership structure 1997 and 2004

	Firms	Firms	Emp	Emp	Import value	Import value	Import volume	Import volume
Year	1997	2004	1997	2004	1997	2004	1997	2004
Dom. owned NAF	43.8	33.0	14.4	8.3	4.1	3.4	4.4	3.4
Dom. owned MNE	19.7	19.5	54.1	38.5	61.1	56.3	47.5	41.1
Foreign owned MNE	7.0	15.1	18.6	37.4	25.6	37.3	38.5	49.2
Dom. owned UNI	29.5	32.4	12.,9	15.9	9.1	3.1	9.5	6.3
Aggregate	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Panel B7: Import by firm size 1997 and 2004

	Importers		Fraction of sales		No of products		No of destinations	
	1997	2004	1997	2004	1997	2004	1997	2004
10-25	45.6	49.0	4.7	5.5	3.4	4.1	1.6	1.9
26-50	69.4	72.5	8.3	8.8	8.4	9.6	3.5	4.3
51-100	86.8	88.8	11.2	12.7	16.5	17.7	6.4	7.4
101-250	94.6	94.2	13.4	15.4	31.0	31.8	10.2	11.5
251-	98.7	97.3	15.4	15.9	87.8	84.8	18.2	19.0
20 largest firms	100.0	100.0	19.2	15.0	257.5	273.2	28.4	36.7
Aggregate manufact,	**62.3**	**64.9**	**7.5**	**8.4**	**12.9**	**13.4**	**4.2**	**4.8**

Panel B8: Fraction of total manufacturing import, by size classes 1997 and 2004

	Firms	Firms	Emp	Emp	Import value	Import value	Import volume	Import volume
Year	1997	2004	1997	2004	1997	2004	1997	2004
10-25	54.1	53.9	9.1	9.5	2.4	3.0	2.0	2.1
26-50	20.1	20.5	7.7	8.2	3.5	3.8	4.1	4.4
51-100	12.3	12.6	9.5	9.9	6.7	7.7	8.9	8.3
101-250	7.9	7.7	13.7	13.6	11.5	12.1	10.8	20.2
251-	5.5	5.3	60.0	58.8	75.8	73.5	74.3	65.0
20 largest firms	0.3	0.3	19.4	23.5	35.7	33.7	12.5	12.2
Aggregate	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

APPENDIX C

Summary statistics. Swedish manufacturing firms with 10 or more employees observed during the period 1997-2004. Number of observation 56,957

	Mean	Std. Dev	Min	Max
Nace code			15 111	36 630
Exporters a fraction of firms	71	45	0	100
- Only exporter as a fraction of firms	13	34	0	100
- Exporters and importers as a fraction of firms	58	49	0	100
Importers as a fraction of firms	64	48	0	100
- Only importers as a fraction of firms	7	25	0	100
Export as a fraction of sales (average across firms)	18	26	0	100
Import as a fraction of sales (average across firms)	8	14	0	100
Number of export products among exporters	14	30	1	162
Number of export countries among exporters	12	16	1	168
Number of import products among importers	20	37	1	593
Number of import countries among importers	7	7	1	118
Employment, firms participating in international trade	109	497	10	23,321
Employment, firms not participating in int.trade	22	57	10	3,824
Log labor productivity, 10.000 Euro, int.trade	3.84	0.46	-5.19	8.19
Log labor productivity, 10.000 Euro, non int. trade	3.66	0.44	-4.19	7.51
Log gross investment/emp, 10.000 Euro, int.trade	0.96	1.32	-7.02	8.86
Log gross investment/emp, non int. trade.	0.54	1.37	-5.02	5.74
University educated/employment, int trade	15	15	0	100
University educated/employment, non int. trade	10	14	0	100
Domestic Non affiliated firm	38			
Domestic Multination	19			
Foreign Multination	12			
Domestic Uninational	31			
Firm size 10-25 employees	54			
Firm size 26-50	20			
Firm size 51-100	12			
Firm size 101-250	8			
Firm size 251-	6			

Notes: Foreign MNE is a firm in Sweden which is owned by a foreign company by more than 50 percent.

APPENDIX D

Correlation matrix. Number of observations 56,607. Period 1997-2004

Log lab prod	1.00										
Exp dum	.08	1.00									
Imp dum	.08	.47	1.00								
Log exp val/emp	.21	.32	.30	1.00							
Log imp val/emp	.18	31	.24	.50	1.00						
Log exp vol/emp	.19	.60	.36	.81	.44	1.00					
Log imp vol /emp	.17	.39	.55	.50	. 81	.63	1.00				
Numb exp prod	.13	.17	.15	.30	.29	.19	.19	1.00			
Numb imp prod	.17	.19	.21	.30	.40	.20	.29	.82	1.00		
Numb exp countr.	.24	.29	.26	.56	.37	.42	.32	.61	.57	1.00	
Numb imp countr.	.19	.30	.34	.45	.55	.30	.41	.66	.74	.77	1.00

Notes: All correlations are significant at the 1- percent level.

APPENDIX E

The elasticity of log value added per employee with respect to Export. Generalized least square, random effects. Period 1997-2007 Number of observations 56,607

Equation	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1. Export premia	.049(.005)a						
2. Log export value/emp		.022(.000)a					
3. Log export volume/emp			011(.000)a				
4. Number of export products							
- 0 product				Ref			
- 1/3 products				.040(.005)a			
- 4/8 products				.066(.006)a			
- 9 or more products				.102(.007)a			
5. Number of export dest.							
- 0 dest.					Ref		
- 1/5 dest.					.041(.005)a		
- 5/13 dest.					.082(.007)a		
- 14 or more dest.					.153(.008)a		
6. Log (exp value/product)/emp						.017(.000)a	
7. Log (exp value/dest.)/emp							.015(.000)a
Human capital $^{\beta}$	.127(.020)a	.108(.020)a	.127(.020)a	.119(.020)a	.094(.020)a	.118(.020)a	.121(.020)a
Log physical capital per emp	.036(.001)a	.035(.001)a	.036(.001)a	.036(.001)a	.036(.001)a	.035(.001)a	.035(.001)a
Non affiliate firms	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Domestic MNE	.034(.007)a	.022(.007)a	.025(.007)a	.028(.007)a	.023(.007)a	.025(.007)a	.026(.007)a
Foreign MNE	.046(.008)a	.031(.008)a	.034(.008)a	.040(.008)a	.031(.008)a	.035(.008)a	.036(.008)a
Domestic UNI	.013(.005)b	.011(.005)b	.011(.005)c	.013(.005)b	.012(.005)b	.011(.005)b	.011(.005)b
10-25 emp	Ref	Ref	Ref	Ref	Ref	Ref	Ref
26-50 emp	.001(.005)	-.004(.005)	-.006(.005)	-.003(.005)	-.006(.005)	-.009(.005)c	-.0079(.005)
51-100 emp	-.008(.008)	-.002(.008)	-.025(.008)a	-.021(.008)b	-.037(.008)a	-.033(.008)a	-.033(.008)a
101-250 emp	.002(.010)	-.002(.010)	-.020(.010)b	-.017(.011)	-.056(.011)a	-.034(.011)a	-.030(.011)a
251- emp	.061(.014)a	.032(.014)b	.031(.014)b	.034(.015)b	.024(.015)b	.009(.015)	.013(.015)
Industry dummies	Incl	Incl	Incl	Incl	Incl	Incl	Incl
Year dummies	Incl	Incl	Incl	Incl	Incl	Incl	Incl

Notes: The table displays the elasticity of log value added per employee (labor productivity) with respect to (1) Export (dummy variable), (2) log export value per employee, (3) log export volume per employee, (4) number of export product, (5) number of export destinations, (6) log export value per exported product and (7) log export value per export destination. (β) Employees with a university education as a fraction of total employment. Significant at the 1 percent (a), 5 percent (b) and 10 percent (c) level of significance.

The elasticity of log value added per employee with respect to Export.

2-Step GMM estimation. Period 1997-2007 Number of observations 19,542-26,640 depending on the lag structure of the instruments.

Equation	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1. Export premia	.051(.008)a						
2. Log export value/emp		.021(.001)a					
3. Log export volume/emp			.011(.000)a				
4. Number of export products							
- Less than 8 products				Ref			
- 8 or more products				.080(.010)a			
5. Number of export dest.					Ref		
- Less than 8 dest					073(.008)a		
- 8 or more dest.							
6. Log (exp value/product)/emp						.015 (0,001)	
7. Log (exp countr./product)/emp							.014(.001)a
Human capital	.469(.020)a	.428(.028)a	.470(.028)a	.450(.029)a	.459(.033)a	.458(.0233a	.464(.033)a
Log physical capital/emp	.085(.002)a	.081(.002)a	.081(.002)a	.085(.002)a	.083(.002)	.079(.002)a	.080(.002)a
Non affiliate firms	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Domestic MNE	.082(.008)a	.057(.008)a	.063(.008)a	.073(.008)a	.073(.008)a	.065(.008)a	.067(.010)a
Foreign MNE	.099(.009)a	.070(.009)a	.070(.009)a	.089(.009)a	.089(.009)a	.079(.011)a	.081(.011)a
Domestic UNI	.028(.005)a	.024(.005)a	.023(.005)a	.029(.005)a	.034(.005)a	.031(.005)a	.031(.005)a
10-25 emp	Ref	Ref	Ref	Ref	Ref	Ref	Ref
26-50 emp	-.024(.006)a	-.034(.006)a	-.035(.006)a	-.027(.006)a	-.025(.006)a	-.037(.007)a	-.035(.007)a
51-100 emp	-.016(.007)b	-.035(.007)a	-.035(.007)a	-.027(.008)a	-.027(.009)a	-.042(.009)a	-.038(.009)a
101-250 emp	-.010(.010)	-.033(.010)a	-.031(.010)a	-.031(.011)a	-.038(.013)a	-053(.012)a	-049(.012)a
251- emp	.075(.014)a	.046(.014)a	.053(.014)a	.047(.014)a	.056(.016)a	.036(.016)b	.039(.016)b
Industry dummies	Incl	Incl	Incl	Incl	Incl	Incl	Incl
Year dummies	Incl	Incl	Incl	Incl	Incl	Incl	Incl
Lag structure	L3	L3	L3	L.4	L4	L3	L4
Underidentification test	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Overidentification test	0.124	0.148	0.115	0.408	0.234	0.461	0.163

Notes: The table displays the elasticity of log value added per employee (labor productivity) with respect to (1) Export (dummy variable), (2) log export value per employee, (3) log export volume per employee, (4) number of export product, (5) number of export destinations, (6) log export value per exported product and (7) log export value per export destination. The underidentification test is Anderson canon corr. The null hypothesis is underidentification and a Chi-square P-value = 0.000 rejects the null hypothesis. (L.3) Instrumented by 2-3 lags and using 26,640 observations, (L.4) Instrumented by the 2-4 lags and using 19,542 observations. The overidentification test of the instruments is Hansen J Statistics. A Chi-square P-value above 0.10 rejects the hypothesis on overidentification. Thus, if the underidentification test is 0 or close to zero and the overidentification test is above 0.10 the test statistics is satisfactory. Significant at the 1 percent (a), 5 percent (b) and 10 percent (c) level of significance.

APPENDIX F

The elasticity of log value added per employee with respect to Import.

Generalized least square, random effects. Period 1997-2007 Number of observations 56,607

Equation	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1. Export premia	.044(.004)a						
2. Log export value/emp		.015(.001)a					
3. Log export volume/emp			.010(.001)a				
4. Number of Import products							
- 0 product				Ref			
- 1/4 products				.033(.044)a			
- 5/12 products				.076(.006)a			
- 13 or more products				.133(.008)a			
5. Number of Import origins							
- 0 countries					Ref		
- 1/5 countries					.044(.005)a		
- 6/11 countries					.119(.007)a		
-12 or more countries					.175(.009)a		
6. Import value/product						.016(001)a	
7. Import value/country.							.015(.001)a
Human capital $^{\beta}$	.123(.020)a	.130(.020)a	.125(.020)a	.112(.020)a	.102(.020)a	.120(.020)a	.119(.020)a
Log physical capital per emp	.036(.001)a	.035(.001)a	.035(.001)a	.035(.001)a	.035(.001)a	.035(.001)a	.035(.001)a
Non affiliate firms	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Domestic MNE	.034(.007)a	.032(.007)a	.028(.007)a	.026(.007)a	.024(.007)a	.027(.007)a	.027(.007)a
Foreign MNE	.045(.008)a	.038.008)a	.034(.008)a	.034(.008)a	.031(.008)a	.035(.008)a	.035(.008)a
Domestic UNI	.014(.005)b	.015(.005)a	.013(.005)b	.013(.005)b	.013(.005)b	.013(.005)b	.013(.005)b
10-25 emp	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
26-50 emp	.001(.005)	.005(.005)	-.003(.005)	-.006(.005)	-.008(.005)	-.006(.005)	-.006(.005)
51-100 emp	-.009(.010)	-.005(.008)	-.022(.008)	-.030(.008)a	-.036(.008)a	-.028(.008)a	-.029(.008)a
101-250 emp	.001(.010)	.001(.010)	-.019(.010)	-.034(.008)a	-.049(.011)a	-.030(.011)a	-.032(.011)a
251- emp	.060(0.014)a	.061(0.014)a	.037(.014)b	.011(.014)a	-.012(.015)	.019(.015)	.014(.015)
Industry dummies	Incl	Incl	Incl	Incl	Incl	Incl	Incl
Year dummies	Incl	Incl	Incl	Incl	Incl	Incl	Incl

Notes: The table displays the elasticity of log value added per employee (labor productivity) with respect to (1) Import (dummy variable), (2) log import value per employee, (3) log import volume per employee, (4) number of import product, (5) number of import destinations, (6) log import value per imported product and (7) log import value per import country.

(β) Employees with a university education as a fraction of total employment. Significant at the 1 percent (a), 5 percent (b) and 10 percent (c) level of significance.

The elasticity of log value added per employee with respect to Import.

2-Step GMM estimation. Period 1997-2007. Number of observations 26,640 and 3 years lag structure of the instruments

Equation	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1. Import premia	.086(.009)a						
2. Log import value/emp		.027(.001)a					
3. Log import volume/emp			.011(.001)a				
4. Number of Import products							
- Less than 8 products				Reference			
- 8 or more products				0.070(.009)a			
5. Number of Import origins							
- Less than 8 countries					Reference		
- 8 or more countries					.077(.010)a		
6. Log (import value/prod.)/emp						.020(.001)a	
7. Log (import value/country)/emp							.017(.001)a
Human capital $^{\beta}$	.445(.028)a	.443(.028)a	.460(.028)a	.447(.028)a	.458(.028)a	.452(.033)a	.445(.028)a
Log physical capital/emp	.080(.002)a	.083(.002)a	.082(.002)a	.085(.002)a	.085(.002)a	.079(.002)a	.082(.002)a
Non affiliate firms	Ref	Ref	Ref	Ref	Ref	Ref	Ref
Domestic MNE	.076(.008)a	.067(.008)a	.065(.008)a	.075(.008)a	.078(.008)a	.064(.009)a	.066(.008)a
Foreign MNE	.092(.009)a	.067(.009)a	.072(.009)a	.088(.009)a	.092(.009)a	.070(.010)a	.072(.009)a
Domestic UNI	.026(.005)a	.030(.005)a	.025(.005)a	.029(.005)a	.031(.005)a	.031(.005)a	.026(.005)a
10-25 emp)	Ref	Ref	Ref	Ref	Ref	Ref	Ref
26-50 emp	-.032(.006)a	-.022(.006)a	-.035(.006)a	-.026(.006)a	-.024(.006)a	-.038(.007)a	-.039(.006)a
51-100 emp	-.031(.008)a	-.022(.007)a	-.041(.008)a	-.028(.008)a	-.028(.008)a	-.050(.009)a	-.049(.008)a
101-250 emp	-.024(.010)b	-.024(.010)b	-.040(.010)a	-.030(.011)a	-.035(.010)a	-.064(.013)a	-.056(.011)a
251- emp	.063(.014)a	.064(.014)a	.049(.014)a	.052(.015)a	.041(.015)a	.028(.017)c	.016(.015)
Industry dummies	Incl	Incl	Incl	Incl	Incl	Incl	Incl
Year dummies	Incl	Incl	Incl	Incl	Incl	Incl	Incl
Lag structure	L3	L3	L3	L3	L3	L3	L3
Underidentification test	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Overidentification test	0.633	0.440	0.634	0.799	0.297	0.187	0.233

Notes: The table displays the elasticity of log value added per employee (labor productivity) with respect to (1) Import (dummy variable), (2) log import value per employee, (3) log import volume per employee, (4) number of import product, (5) number of import destinations, (6) log import value per imported product and (7) log import value per import country. The underidentification test is Anderson canon corr. The null hypothesis is underidentification and a Chi-square P-value = 0.000 rejects the null hypothesis. (L.3) Instrumented by 2-3 lags and using 26,640 observations. The overidentification test of the instruments is Hansen J Statistics. A Chi-square P-value above 0.10 rejects the hypothesis on overidentification. Thus, if the underidentification test is 0 or close to zero and the overidentification test is above 0.10 the test statistics is satisfactory. Significant at the 1 percent (a), 5 percent (b) and 10 percent (c) level of significance.