Exporting and productivity: the effects of multi-market and multi-product export entry

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Abstract

Empirical studies on the micro-level effects of exporting on productivity pay usually little attention to the potentially heterogeneous effects of the different modes of export market entry. We show that the early stage entry into several export markets or with several products leads to higher growth in productivity, compared with entry into only one foreign market or with only one product. This implies significant benefits from experimentation with different markets and different products. Our analysis is based on detailed export data from full population of firms in Estonia, disaggregated for each firm by export markets and individual products.

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I. Introduction

Most of the empirical papers on learning-by-exporting at firm level have concentrated on the effects of exporting in general rather than on the potentially heterogeneous effects of different methods of entering an export market. These papers seldom find evidence that exporting affects productivity of firms. Instead, they almost always show selection into exporting based on productivity: that only firms with relatively high productivity start exporting (Bernard and Jensen 1999, Bernard and Jensen 2004). See, for example, Wagner (2007) or Greenaway and Kneller (2007) for an overview of the literature.

The shortage of evidence on learning-by-exporting suggests that researchers should look more at the effects of different types of export activities. It also suggests that research in the field should examine the mechanisms of the learning-by-exporting process. Our paper addresses the first of these issues in particular. The novelty of our empirical paper stems from analysing the effects of multi-market and multi-product export market entry on firm performance. We investigate the role of extensive margins of trade at product and market-level in the learning effects of exporting. Previous related studies on the role of destination markets in the learning effects of exporting concentrate on a different issue: these compare exporting to higher income countries with exporting to lower income countries (De Loecker 2007, Pisu 2008).

The general term 'exporting' can include many different ways of entering foreign markets. One distinction is number of markets and products. Entry can involve only one product and one foreign market, or a larger number of products and several markets. Theoretical rationalizations of the choice of the 'breadth' of export entry are available in Rauch and Watson (2003) and Albornoz *et al.* (2010). Arguably, the choice of the number of markets and the number products will depend on the firm's characteristics; these include productivity (Bernard *et al.* 2011a, 2011b), access to external and internal finance (Damijan *et* *al.* 2011), and the overall experience of the firm's owners and employees in the international marketplace.

At the same time, we can also expect that the different export market entry modes can result in different effects on performance of firms. Simultaneous entry into several markets may have a greater effect on a firm's productivity compared with entry into a single foreign market. This is because there is more scope for learning and the transfer of knowledge when several foreign partners are involved.

We investigate whether simultaneous entry into several foreign markets by a new exporter has a greater effect on productivity compared with the easier option of entry into only a single foreign market. That is, we study whether there is evidence of stronger learning-by-exporting effects in the case of multi-market export entry. Similarly, we compare the learning effects of multi-product and single-product export entry; the two modes are distinguished according to the number of products at CN (Combined Nomenclature) 8-digit product code level exported during the first year of exporting. In doing so, we investigate empirically an implication related to recent multi-product firm models of international trade (Eckel and Neary 2010, Bernard *et al.* 2011a, Mayer *et al.* 2011).

Our empirical study is based on detailed product-, market- and firm-level data on foreign trade of Estonia's manufacturing industry from 1995 to 2003. The advantage of our dataset compared with datasets from other countries—for example, those on US and Mexico in Bernard *et al.* (2010) or Iacovone and Javorcik (2010)—is that it covers the full population of exporters. We observe the exports of each Estonian firm to every destination country, broken down by CN 8-digit level products. In addition, we observe productivity and other firm-level variables of exporters and non-exporters.

Recently, there has been an increase in the availability of detailed transaction and firm-level export data and thus an increase in the number of related papers that investigate and describe the determinants of export patterns of firms. For example, these include Iacovone and Javorcik (2010) using data from Mexico, Freund and Pierola (2010) from Peru, Bernard *et al.* (2010) from the USA, Albornoz *et al.* (2010) from Argentina, Görg *et al.* (2011) from Hungary, Damijan *et al.* (2011) from Slovenia and Defever *et al.* (2010) from China.

Our empirical approach in the study of Estonia's product-market and firm-level data relies mainly on the application of propensity score matching (PSM). We find that entry into a larger number of export markets has a significantly greater effect on growth in productivity. Our results suggest that simultaneous entry into multiple markets (wider experimentation with entry) has a stronger learning-by-exporting effect, compared with the more sequential approach of initial entry into only one foreign destination. We also find that export entry with several products is associated with stronger improvements in productivity, compared with entry with a single product.

II. Multi-market and multi-product export entry and performance of firms

The empirical literature that investigates the relationship between productivity and exporting supports the implications from Melitz (2003) or other heterogeneous firm trade models: that there are sunk costs associated with entry, and only the most productive firms are able to cover these sunk costs and export their goods (see, for example, Bernard and Jensen 1999, 2004; Bernard *et al.* 2003; Clerides *et al.* 1998, Wagner 2007).

The causal relationship can of course run from exporting to the subsequent increase in performance and productivity: firms might learn as a result of exporting (Bernard and Jensen 2004, De Loecker 2007). Exporters could benefit from the transfer of technology from their foreign clients and they might need to upgrade the quality of their product to better match the demands of their international clients. Improvements in productivity may also simply stem from the scale effect of a larger market (Falvey and Yu 2005). The effects may also be the result of exposure to tougher international competition, which may increase the incentives of exporters to innovate, to reduce managerial slack and to reduce X-inefficiency at the firm.[2]

Notably, firm-level empirical analysis of the causal effect of exporting on productivity most often does not find statistically significant estimates of the learning effects (Wagner *et al.* 2007). Some papers that do find exporting having a significant effect on productivity are by De Loecker (2007) for Slovenia, Blalock and Gertler (2004) for Indonesia, van Biesebroeck (2005) for sub-Saharan Africa and Albornoz and Ercolani (2007) for Argentina. It has been suggested that there might be more learning-by-exporting in countries with a lower level of development (Blalock and Gertler 2004), as those exporters may have more scope for learning from their export markets (owing to significant gaps in productivity and technology compared with the export destinations).

In relation to the choice of export destinations, De Loecker (2007) provides some evidence that in Slovenia the gains in productivity, as a result of exporting, have been higher for firms that sell their goods to foreign countries with high levels of income. At the same time, Pisu (2008) comes up with a different result; this is based on firm-level panel data from Belgium. He shows that the larger productivity advantage of firms in Belgium from exporting to developed economies seems to be only due to self-selection.

New multi-product theoretical models of trade, which describe product-level and market-level entry decisions, have been recently proposed in Bernard, Redding and Schott (2010), Eckel and Neary (2010) and Albornoz *et al.* (2010). According to the multi-product oligopolistic competition model of trade developed by Eckel and Neary (2010) or the monopolistic competition models of trade put forward by Bernard *et al.* (2011a) and Mayer *et*

[2] For example, the effects of competition on the performance of firms and on their incentives to innovate are discussed in detail in Aghion and Griffith (2005). The effects of competition on the work effort of employees and on managerial or worker slack are discussed in Vickers (1995). The effects on X-inefficiency of firms in general are discussed in Leibenstein (1966).

al. (2011), globalisation and exposure to tougher international competition would induce exporters to concentrate on their 'core competence' products. Core competence means that a firm produces one product, or a variety of products, more efficiently than others. These are the products where it has the lowest unit costs. Reallocating the production and exports to these core competence products results in an increase in productivity within the firm. Note that, to achieve this result, firms that increase their product mix are assumed to face diseconomies of scope and cost heterogeneities (as assumed in the trade model developed by Eckel and Neary 2010). A more intense product-level selection process within the firm is a new type of gain from trade (Eckel and Neary 2010); it is not present in Melitz (2003) or in older models of trade.

Rauch and Watson (2003) have provided some theoretical justification why exporters would be expected to start with small export scope and intensity. They argue that this is because of the uncertainty related to building exporter-importer relationships. Uncertainty about foreign demand and the firm's ability to export is alleviated only once the firm has started to export; only then can it learn 'how good it is at exporting'. It takes time to build confidence and trust between foreign partners (and to reduce the likelihood of non-performance and a lack of ability to provide suitable goods in large enough quantities). Therefore, new exporters tend to start by exporting only small quantities, exporting those goods to only one foreign market (or just a few) and only sequentially expand their export activities (Rauch and Watson 2003, Albornoz *et al.* 2010, Eaton *et al.* 2008).

Empirical evidence shows that growth in exports does indeed tend to be sluggish. This has been shown in detailed export transaction data from Slovenia (Damijan *et al.* 2011), Colombia (Eaton *et al.* 2008) and Argentina (Albornoz *et al.* 2010). Although most of the firms enter foreign markets sequentially, some firms enter several foreign markets simultaneously when they begin to export.[3]

Simultaneous entry to several markets could result in stronger effects on productivity, compared with entry into a single foreign market. This may be because there is more scope for learning and the transfer of knowledge from a number of different foreign partners.[4] For example, such a conclusion can be drawn from the management literature on the benefits of wider external knowledge sourcing by firms. The potential benefits of this have been outlined by Chesbrough (2006) and Laursen and Salter (2006).

Laursen and Salter (2006) show the significant role of breadth of external knowledge linkages in determining the innovation performance of firms. The number of knowledge linkages with foreign firms is likely to be larger in the case of simultaneous entry into several markets than in the case of the less risky option of entry into only a single foreign market. Larger number of knowledge linkages can have positive effects on firm performance through their impact on firm's innovation activities (see, for example, Chesbrough 2006, Laursen and Salter 2006) and, more generally, through more knowledge transfer.

Of course, simultaneous entry into a larger number of foreign markets also entails higher sunk costs for the firm. Firms use this mode of entry if they expect the rewards from entry to be high. Albornoz *et al.* (2010) point out that firms that simultaneously enter more markets or enter with more products (compared with others) obviously have to be more optimistic about their success (i.e. the size of potential demand). Only the most productive firms (Bernard *et al.* 2011a) with good access to financing (Damijan *et al.* 2011) are able to self-select the multi-product or multi-market entry mode. Empirical analysis therefore needs

[3] For example, according to Damijan *et al.* (2011), about 40 % of Slovenia's firms enter more than one market when they begin exporting.
[4] The advantages of having several 'weak linkages' rather than a few 'strong' linkages with partners (the firms in our case) have been outlined in Granovetter (1973).

to differentiate between the selection effects and the learning effects of multi-product and multi-market entry.

Important theoretical implications about the potentially different effects of entry to exporting with different product scope of can be inferred from recent trade models that allow for multi-product firms: Bernard *et al.* (2011), Eckel and Neary (2010) and Mayer *et al.* (2011). For our analysis, an indirect implication from the oligopolistic competition trade model of Eckel and Neary (2010) is that export entry with a smaller number of products may be more beneficial for the firm, as it would concentrate on production of its core products, where its unit production costs are the lowest. Production and export of a larger number of different products means that firm would also concentrate on producing peripheral products, where it has less competence and therefore higher unit costs and a lower level of productivity. This would have adverse effects on the firm's aggregate level of productivity.

Notably, the negative effect of a lack of specialisation may be offset by the positive effects of 'wider' export entry. Positive effects include:

i) Economies from a wider product scope: as production inputs can be shared between product lines and there may be cost-related complementarities between different product lines (Panzar and Willig 1981, 1975; Teece 1982);

ii) Greater transfer of knowledge owing to links with a larger number of diverse partners abroad.

Consequently, the net effect of multi-product entry compared with single-product export entry is in fact ambiguous. The net effect can be positive if the firm has knowledge linkages and can benefit from intensive learning from abroad.[5]

[5] Our analysis of the effects of different types of export entry is also related to the international business literature. There has been substantial discussion about the peculiarities of the internationalization of 'born global' firms or 'international new ventures' that do not follow the standard sequential pattern of the Uppsala internationalization model of Johanson and Vahlne (1977); instead they simultaneously enter a large number of foreign markets and do it very early in their lifespan (McKinsey & Co 1993, Madsen and Servais 1997, Moen and Servais 2002). These firms are international right from birth. We note here that there seems to be a dearth of

III. Data and methods

We use detailed product-level and market-level foreign trade data of the full population of exporting firms in Estonia, covering the period from 1995 to 2003. In the case of descriptive statistics, we can also cover the 2004–8. Because of the changes in the collection of data on intra-EU export statistics since Estonia joined the EU in May 2004, and the resulting break in time series, we restrict our propensity score matching analysis to 1995–2003. Until May 2004, all the trade flows were recorded in the customs statistics. After entry to the EU, all extra-EU trade flows were recorded as customs data. However, in the case of intra-EU trade, after May 2004, only trade transactions by firms with an annual value of intra-EU trade of more than 100,000 euros were automatically collected by the national statistics authority.

An advantage of the detailed trade data from Estonia is the good coverage of firms. For example, in the study on Mexico by Iacovone and Javorcik (2010), only establishments of more than 100 employees were automatically included in the sample. In our case (until 2004), all small firms are included in the export dataset.

Estonia's dataset includes for each firm information about exports by product (defined based on the CN 8-digit code) and by destination. For econometric analysis, the variables have been aggregated to a yearly format. Examples of products at the CN 8-digit level include milk with a fat content of less than 1 % packed in a container not exceeding two litres (CN code 04011010), specific types of fertilizers (e.g. ammonium nitrate in aqueous solution: 31023010), specific types of fibreboard (e.g. 44111210 and 44111290), white chocolate (17049030), sunglasses with plastic lenses (90041091, all sunglasses 900410), skiing suits, etc. In the case of alcoholic drinks, beer and wine as general products are defined at the 4-digit level: 2203 for beer and 2204 for wine.

similar representative and detailed econometric studies about the effects of multi-product and multi-market export entry on productivity in the international business literature.

It has to be acknowledged that there have been some changes in the CN classification over time. For example, some CN 8-digit product-level codes have been merged into one while others have been split. However, we observe that these changes do not significantly affect the key treatment variables that we use in our analysis. Our results on how the different modes of export entry affect productivity are not driven by the changes in the CN product codes.

We have merged the detailed export dataset with firm-level information about performance indicators and other firm-level controls (such as size, age, liquidity ratio, capital-labour ratio and location of the firm). This firm-level information is from dataset of the overall population of Estonia's firms: Estonia's Business Registry database. The Business Registry's firm-level dataset includes the annual reports (balance sheets and profit and loss statements) for all Estonian firms. We use this dataset to calculate the different productivity variables (labour productivity, total factor productivity), using the standard variables of production inputs (labour, capital, intermediate inputs). We use the semi-parametric method (Levinsohn and Petrin 2003) to estimate the total factor productivity (TFP) of firms, with value added as a dependent variable in the production function. The Levinsohn-Petrin approach (Levinsohn and Petrin 2003) attempts to account for the endogeneity of inputs in the production function by using information on variation of expenditures on material inputs as proxies for productivity shocks. It is by now a standard approach of TFP estimation at the micro level. A detailed description of this method can be found in Levinsohn and Petrin (2003). In estimating TFP, we allow each NACE 2-digit level sector to have different coefficients of capital and labour in the production function. Capital and value added are deflated by using the corresponding deflators of Statistics Estonia.

We differentiate here between the effects of four broad modes of export market entry. Firstly, we differentiate according to the number of markets (foreign destination countries) entered during the firm's first year of exporting:

i) Initiating exports with entry into only one foreign market ('single-market entry mode') is denoted by the dummy variable $M_{it}^{1} = (0,1)$, which takes the value of 1 after entry for firm *i* that enters only one foreign market. The value is 0 for non-exporters. The subscript *t* denotes year.

ii) Simultaneous entry to several foreign markets during a firm's first year of exporting ('simultaneous multi-market entry mode') is denoted by the dummy variable $M_{it}^{2} = (0,1)$, which takes the value of 1 after entry for firms that enter several foreign markets in their first year of exports. The value is 0 for non-exporters.

We also differentiate between the effects of export entry resulting from the different number of products exported (at the CN 8-digit product code level):

iii) Entry with only one product ('single-product entry mode') is denoted by the dummy variable $M_{it}^{3} = (0,1)$, which takes the value of 1 after entry for firm *i* that starts exporting with only one product. The value is 0 for non-exporters.

iv) Entry with a number of different products ('multi-product entry mode') is denoted by the dummy variable $M_{it}^{4} = (0,1)$, which takes the value of 1 after entry for firm *i* that starts exporting with more than one export product. The value is 0 for non-exporters.

These four modes of entry into export markets are seen in our analysis as four different 'treatments', denoted as M^{N}, where *N=(1, 2, 3, 4)*. Note that the control group in each of these four treatments is based on the sample of non-exporting firms.[6]

In order to determine the extent of the effects of these export entry modes we use a

[6] Alternatively, as a robustness test we also estimate the effects of multi-market entry when the control group is composed of single-market entrants; and the effects of multi-product entry when the control group is composed of single-product entrants.

propensity score matching (PSM) approach. A detailed overview of the method and a discussion about the assumptions it makes to identify causal effects are provided in Caliendo and Kopeinig (2008).

Empirical analysis of the effects of entry into exporting in general or an analysis of the effects of the different entry modes presents a number of methodological problems. We need to build a 'counterfactual': what would have happened to the firms in the treatment group if they had not received the 'treatment'—if they had not started exporting (Rosenbaum and Rubin 1983, Caliendo and Kopeinig 2008).

However, firms that did not start exporting during the year the subject started exporting are unlikely to form a suitable control group. Comparing the post-treatment outcome variable(s) of the treatment group's firms with all non-exporters may not show the effect of a particular export mode, as the two groups could differ significantly even before export entry. Consequently, we would not know if the differences revealed later on were because of export entry or because of some other observable (or unobservable) variable. One such unobserved factor could be differences in managerial ability.[7] In general, we can conclude that the allocation into each of the four studied treatments is probably non-random.

The core idea of PSM is that the bias arising from differences in the characteristics of the treated group (firms that start exporting to several markets) and the control group (non-exporters) is reduced if the comparison of outcomes (productivity in this case) uses only those firms in the control group that are as similar as possible to those in the treatment group in terms of the observed relevant characteristics X (and pre-treatment productivity) before or when the firms began exporting. The identifying assumption of this approach is that participation in the treatment is determined by observable firm characteristics X.

[7] For example, Bloom and Van Reenen (2007) show that the role of management practices is an important determinant of productivity. Better management practices may raise both productivity and the likelihood that the firm will start exporting, or that it will choose the more difficult export entry modes: multi-market and multi-product entry.

The PSM method provides a way to summarise a number of pre-treatment indicators and other exogenous characteristics of firms (such as age) into a single variable of probability of treatment: the propensity score (Rosenbaum and Rubin 1983). In the case of each of our four treatments, the propensity score for each firm *i* at year *t* is estimated with a probit model, where the dependent variable is a dummy M_{it}^{N} indicating for each firm *i* whether the firm starts exporting their goods in year *t* with that particular export entry mode (*N*). Explanatory variables include the vector of observable pre-treatment control variables (X_{it}) and pre-treatment productivity (π_{it}), which may affect the selection into this mode of export entry:

$$\Pr\left(M_{it}^{N}=1\right)=f(X_{it},\pi_{it}) \tag{1}$$

In each of the *N=(1, 2, 3, 4)* probit models, the propensity score is computed both for firms belonging to the *N*th treatment group and for the control group of non-exporters. Based on the propensity scores, we then pair each firm in each treatment group with 2 or 5 of its nearest neighbour(s) in the pool of potential controls, in terms of their estimated propensity score of *N*-th treatment. This is the *nearest neighbour matching* algorithm (see Caliendo and Kopeinig 2008). This approach allows us to create a proxy for the unobserved counterfactual for each of the export market entry modes.[8]

As the control group in each of the four treatments comprises non-exporters, we can compare the differences in the effects of multi-market versus single-market entry or multi-product versus single-product entry simply by comparing the estimated average treatment effects of the different export entry modes.

In our empirical analysis the explanatory variables in the probit model in Equation (1) include the following determinants of export market entry: log of the firm's level of

[8] We apply the common support condition in the matching approach. This means also dropping new entrants whose propensity score is higher than the maximum or lower than the minimum propensity score of the full control group.

productivity, size (log of employees), age in years, age squared, cash-to-assets ratio,[9] log of capital-labour ratio, sector dummies at the 2-digit level and a dummy for firms located in the capital region of Estonia. The sunk costs of entry vary according to entry modes; they are higher in the case of multi-market or multi-product export entry modes. Consequently, higher productivity, larger size and better liquidity are likely to be needed in order to start exporting to several markets or with several export products. Firms in Estonia's capital region may also be more likely to start exporting, or to export to a larger number of markets or to export more products. The reasons for that could be higher levels of productivity and better access to financing of firms in the capital region; it may also be owing to the geographic proximity of Tallinn region to some of the main markets for Estonia's exports, good access to export infrastructure, and spillovers in the form of export-related know-how.

After matching of the firms in the treatment group with suitable control units, the average treatment effect on treated firms (*ATT*) in period *t* is calculated separately for each of the *N=(1,2,3,4)* treatments (Caliendo and Kopeinig 2008) and for the after-treatment periods *t=(1, 2, 3, 4)*, as given in Equation (2).

$$ATT^{N} = \sum_{i \in N} (\Delta\pi_i - \sum_{j \in C_N} w_{ij} \Delta\pi_j), \tag{2}$$

Here C_N denotes the set of control units that are matched with the *i*-th treated firm, *j* denotes the individual control units and w_{ij} denotes the weights generated by the matching algorithm. In the case of nearest neighbour matching, this weight is equal to $1/Q$, where Q is the number of non-exporting firms that have been matched to the treated firm *i*.

[9] This variable is used to capture the firm's ability to finance (in the short term) the sunk costs of export entry by using internal funds.

IV. Descriptive statistics

According to Bernard *et al*. (2011b, p. 2): ‘One of the most striking features of the microdata is that firm participation in international trade is exceedingly rare.’ In large countries, exporters and importers represent a small share of all producers (Bernard *et al*. 2007, Bernard *et al*. 2011b). However, this does not apply in the case of open and small economies like Estonia. **Error! Reference source not found.** provides the first look at the firm-level and product-level export data used in this study. In Estonia the total number of exporting firms represents a rather high proportion of all active firms in the manufacturing industry: in 2003 it was 49.1 %. This number is high in an international comparison. For example, Bernard *et al.* (2007) show that exporters account for only about 4 % of all firms in the US manufacturing industry (based on figures from 2000).

TABLE 1

Number of firms and export varieties, manufacturing industry

Year	*Number of exporting firms*	*Share of exporters in all active firms*	*Number of products, (CN 8-digit level)*	*Average number of products per exporter (CN 8-digit level)*	*Average number of products per exporter (CN 5-digit level)*	*Average number of product-market combinations (CN 8-digit level)*	*Average number of export markets*
1997	1,740	57.5	11,305	6.5	6.5	9.4	2.9
2003	2,388	49.1	20,979	8.8	7.1	13.7	3.3
2008	1,425	23.9	13,208	9.3	7.5	17.7	4.5

Notes: Calculations hereafter are based on the foreign trade database of Statistics Estonia.

In Estonia’s case, the average number of products that a firm exports is growing. Table 1 shows that the average number of export products of a firm was 6.5 in 1997, 8.8 in 2003 and 9.3 in 2009. This reflects the increased diversification of production by Estonia’s exporters. The average number of export markets (countries) that each firm exports to has also grown:

2.9 in 1997, 3.3 in 2003 and 4.5 in 2009. During the same period, the average number of export-product combinations increased from 9.4 to 17.7.

TABLE 2

Average number of firms and varieties by exporting status, manufacturing industry

	Share in number of exporters		*Number of products (CN 8-digit level)*		*Number of markets*	
Year	*Continuing exporter*	*New exporter*	*Continuing exporter*	*New exporter*	*Continuing exporter*	*New exporter*
1997	73%	27%	8.4	2.9	3.1	1.7
2003	94%	6%	9.4	2.8	3.6	1.6
2008	64%	36%	9.9	3.0	4.8	1.8

Table 2 presents similar statistics, broken down by new and continuing exporters. New exporters are defined as firms that are exporting for the first time. New exporters constitute about 6–36 % of all exporters in a year. Their share in relation to the total number of exporters fluctuates a lot over time. In Estonia, similarly to a recent study by Iacovone and Javorcik (2010) on Mexico, the average number of product varieties is higher among continuing exporters than among new exporters. Continuing exporters (firms that have been exporting for at least one year) sell their goods to larger number of export markets. A continuing exporter has on average 3.6 foreign markets, while a new exporter has 1.6 (in 2003, see Table 2). These findings support the view of sequential entry into export markets (as suggested in Albornoz *et al.* 2010, Rauch and Watson 2003). On average, firms only gradually expand the number of markets over time. In all the years that were studied, new exporters started with a relatively small number of different products and markets. The key export markets for Estonia's firms are Finland, Sweden, Latvia, Russia and Lithuania. These are the markets that Estonian firms enter during the earlier stages of their export activities. Expansion into other European countries takes more time.

TABLE 3

Distribution of new exporters according to number of products and markets at the time of entering export markets

Number of products or markets on 1st year of exporting	*Markets*		*Market-product (CN 8-digit) combinations*		*Products (CN 8-digit level)*	
	Proportion of all new exporters	*Average export volume, '000 EEK*	*Proportion of all new exporters*	*Average export volume, '000 EEK*	*Proportion of all new exporters*	*Average export volume, '000 EEK*
1	70%	618	43%	293	47%	365
2	18%	1,166	19%	589	20%	846
3	6%	2,907	9%	1,217	9%	1,376
4	3%	6,254	7%	1,511	7%	3,849
5	3%	17,098	14%	2,871	12%	3,396
10 or more	0%	25,223	8%	8,937	5%	8,254

Notes: 1 EUR = 15.6466 EEK.

As our focus is on the effects of export entry, we provide additional statistics about the 'breadth' of export activities of new exporters. We already saw that, on average, new exporters start with a relatively small number of different products and markets. However, the data in Table 3 show that there is significant heterogeneity among new exporters: 43 % export only one product and serve only one foreign market. At the same time, there are a number of firms that start with more than 10 product-market combinations. Starting with more than one export market is not uncommon in Estonia: such firms account for 30 % of new exporters. Firms that start exporting with more than one product make up 53 % of all new exporters. On average, firms that start exporting to a small number of export markets or with small number of products have much lower average export volume per destination and per product, compared with businesses that export to several destinations or export several products. We can also conclude (from the information in Table 3) that there are enough observations in our dataset to allow us to study multi-market and multi-product entrants.

Exporters are generally found to be very different from other firms. This has been shown in the case of a number of characteristics, especially productivity (see, for example, Wagner 2007, Bernard *et al.* 2007). Data from Estonia confirms that there are additional productivity differences (including in TFP) between multi-product and single-product entrants, and between multi-market and single-market entrants.[10] These differences exist at the time of entry and they are there also several years later. The differences in TFP are depicted in Figure 1, which shows the kernel density of the log of the TFP of the different types of entrants, in the year before export entry and five years after. The graph shows that there is persistent TFP-premium among entrants that opt for a wider entry strategy; the difference is evident not only in the mean of the distribution but also in other quantiles as well.

The regular instances of higher performance by multi-market or multi-product entrants can also be seen in labour productivity. This difference between firms may be the result of selection effects, as more productive firms are able to expand their export markets and number of products faster, or it may be the result of learning effects gained from wider entry. Table A1 in Appendix A shows that one significant finding is that multi-market and multi-product entry are both associated with higher level of labour productivity in subsequent periods, compared with the performance by non-exporters. Compared with non-exporters, a significantly larger proportion of multi-market (or multi-product) entrants experience increases in productivity. This applies immediately after export entry and three to four years after entry. Table A1 also shows how the average level of labour productivity has changed among exporters compared with non-exporters, both in absolute terms and compared with the year before entry. It is clear that during the years after entry, multi-market and multi-product entrants improve their level of productivity faster than non-exporters do. Of course, the full sample of non-exporters does not constitute a suitable ‘control group’ for different types of export entrants. It is most likely that these groups and non-exporters would have been on very different trajectories in terms of productivity, even if the new exporters had not started to export.

[10] For example, Elliott and Virakul (2010) use data from Thailand to show that multi-product firms have a higher level of TFP than other firms.

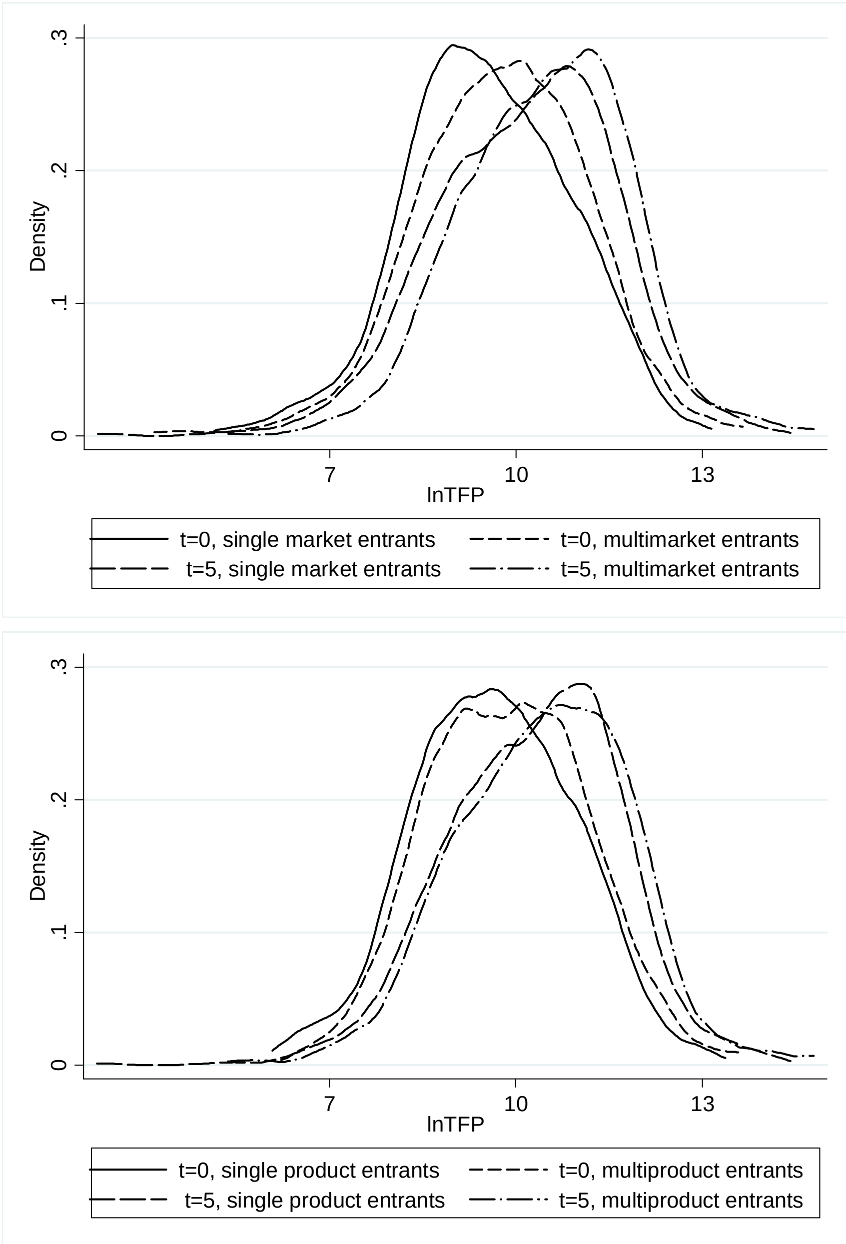

Figure 1 Distribution of log of TFP for different export market entrants
Notes: sample of export-market entrants in Estonia's manufacturing industry,1995–2003. Kernel density of log of TFP. Period '0' indicates the year before entry. Period '5' indicates the fifth year after entry.

V. Results of propensity score matching

We use a pooled probit model to construct the propensity score of each treatment for each firm. Based on this propensity score, we constructed a control group for the firms that choose a particular method of entry. All the control variables were measured either before entry to the export market or at the point of entry. Many firms in Estonia started exporting very early; that is, in the year after the firm was established. We therefore report the results gleaned from an analysis of the control variables at the point of entry. Otherwise, a large number of new exporters would be excluded from the analysis. We have checked the general (qualitative) robustness of our findings by using a probit model with lagged explanatory variables in the first stage of the PSM (see also Appendix C for the effects on the level of productivity).

TABLE 4

Probit models for various modes of entry into exporting

Variable	*Entry*	*Multi-market entry*	*Single-market entry*	*Multi-product entry*	*Single-product entry*
Ln(TFP)	0.093	0.151	0.073	0.084	0.106
	(3.30)***	(3.30)***	(2.32)**	(2.30)**	(2.99)***
Size (log of employment)	0.280	0.542	0.218	0.398	0.204
	(4.98)***	(5.71)***	(3.34)***	(5.50)***	(2.66)***
Size squared	-0.054	-0.071	-0.057	-0.057	-0.062
	(-5.00)***	(-4.28)***	(-4.25)***	(-4.34)***	(-3.82)***
Age (years)	-1.205	-1.363	-0.993	-1.293	-0.808
	(-11.78)***	(-8.92)***	(-8.63)***	(-10.30)***	(-6.05)***
Age squared	0.165	0.160	0.140	0.147	0.117
	(4.28)***	(2.63)***	(3.27)***	(2.96)***	(2.38)**
Cash/assets	0.149	0.124	0.136	0.153	0.111
	(4.13)***	(2.13)**	(3.62)***	(3.69)***	(2.41)**
Ln(K/L)	0.023	0.052	0.012	0.046	0.000
	(1.54)	(2.24)**	(0.71)	(2.43)**	(0.01)
FDI dummy	-0.188	-0.256	-0.123	-0.070	-0.336
	(-2.72)***	(-2.40)**	(-1.57)	(-0.87)	(-3.18)***
Capital region	0.004	-0.000	-0.000	0.051	-0.041
	(0.09)	(-0.01)	(-0.00)	(0.90)	(-0.73)
Number of obs.	12,131	11,632	11,867	11,799	11,655
Log-likelihood	-2310.691	-849.900	-1820.179	-1348.345	-1359.817
Pseudo R-squared	0.158	0.235	0.121	0.216	0.099

Notes: coefficients from probit model. * significant at 10%; ** significant at 5%; *** significant at 1%. z-statistics in parentheses. Panel data of firms from the manufacturing industry. Period: 1995–2003. K/L: capital-labour ratio.

Table 4 shows the result of probit models for the different modes of entry. Even after accounting for other confounding factors, more productive firms are still more likely to start exporting (Column 1 in Table 4). Even higher levels of productivity are needed if a firm is to be able to simultaneously enter several foreign markets, or to enter export markets with several products (rather than just one). Estimates from the probit model suggest that there are sunk costs related to entry to exporting. We find that the level of productivity needed for multi-product entry is significantly lower than for multi-market entry. As expected, the sunk costs related to entering a foreign market are higher than the sunk costs at the product level.[11]

Other variables that predict a higher probability of multi-market or multi-product entry (compared with single-market or single-product entry) include the size and age of the firm (larger and younger) and a higher cash-to-assets ratio. Once we account for differences in productivity then foreign ownership of the firm or the firm being located in the Tallinn area in northern Estonia (the dominating region in business activities) appears not to be associated with a higher probability of choosing the multi-market mode of entry.

Next, the probit models are used to construct the propensity for each of the four export entry modes. Our matching approach is based on the two or five neighbours nearest to each treated unit, in terms of their propensity score. After matching, the pre-exporting variables need to be similar in the treatment group and the matched control group. Only then can we draw conclusions about the effects of treatment (Caliendo and Kopeinig 2008). We test the significance of differences in productivity and the determinants of productivity (the balancing property test) at the time of treatment between entrants and the matched non-entrants.

We show the findings from the balancing property test in Appendix B in Table B1. It appears that the matching approach has enabled to construct for each *N* treatment group a control group that is similar to the treated units at the time of treatment, in terms of the key characteristics of firms. Before matching, the differences of mean values of key variables (including productivity at the time of treatment) between the treatment group and the pool of

[11] Note that the coefficients in Table 4 show the within-industry 'effects' as we include 3-digit industry controls in the regression model. We find that entry into exporting is associated with a higher level of capital intensity before entry only in the case of multi-market and multi-product entry. Significant within-sector correlations between exporting and capital intensity have been, for example, outlined in the case of the USA (e.g. Bernard *et al.* 2007) and Chile (Alvarez and Lopez 2005). Based on data from Estonia, such a correlation with capital intensity seems to be due to firms that opt for the 'wider' export entry.

controls are statistically significant. Once propensity score matching has been implemented, these differences are no longer statistically significant.

Tables 5 and 6 below present the estimated average treatment effect of exporting on TFP and on the growth of labour productivity. Note that non-exporters that start exporting later on during the studied periods are left out of the control group. That way we can be sure that the differences witnessed in the future (for example, three years after treatment) between the treatment group and control group are not affected by the subsequent treatment (export entry) of some firms in the control group.

TABLE 5

Results of propensity score matching: effects of export entry on TFP growth

Treatment variable	*Matching algorithm*	*Period 2*		*Period 3*		*Period 4*	
Multi-market entry	NN5	12.107	(3.96)***	4.725	(1.77)*	4.631	(1.73)*
	NN2	14.250	(4.16)***	3.808	(1.25)	4.244	(1.42)
	Unmatched	10.476	(5.27)***	8.792	(5.27)***	7.460	(4.11)***
Single-market entry	NN5	6.599	(3.51)***	3.541	(1.2)	2.721	(0.99)
	NN2	7.222	(3.44)***	2.063	(0.56)	2.233	(0.76)
	Unmatched	6.720	(4.91)***	15.655	(8.59)***	11.314	(6.15)***
Multi-product entry	NN5	11.067	(4.54)***	3.913	(1.98)**	4.884	(2.28)**
	NN2	12.239	(4.4)***	5.767	(2.65)***	4.587	(1.89)*
	Unmatched	11.924	(7.79)***	9.762	(7.76)***	8.235	(5.95)***
Single-product entry	NN5	9.003	(1.54)	2.016	(0.59)	2.761	(0.82)
	NN2	3.759	(1.59)	3.062	(0.75)	2.581	(0.66)
	Unmatched	15.682	(4.51)***	8.741	(4.07)***	9.031	(3.99)***

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. t-statistics in parentheses. NN5: nearest neighbour matching with 5 matches; NN2: nearest neighbour matching with 2 matches; ATT: Average Treatment Effect on the Treated (ATT), t-statistics are in parentheses. Period 0: period before exports began. Panel data of firms from the manufacturing industry. Period: 1995–2003. Matching based on values of variables at the time of export market entry.

As we can conclude from the Table 5, the positive effect on TFP emerges in the case of multi-market entry two years after entry. There are additional positive effects on TFP growth (compared with non-exporters and single-market entrants) in the third and fourth year after multi-market entry. However, these later effects are significant only in the case of matching with five nearest neighbours. Two years after entry to export markets, firms that entered at least two markets are already having TFP growth that is about 12–14 percentage points higher than that experienced by non-entrants, or about 5–7 percentage points higher than that seen by entrants to only one foreign market. The benefits of multi-market entry are great. This extra effect of 'wide' export entry is especially evident, as single-market entry seems to make only a one-time positive contribution on growth; which occurs relatively soon after entry. Since the estimated effect is statistically significant and positive in the case of multi-product entry, but not in the case of single-product entry, it appears there are no clear benefits from concentrating on only a small range of products for export, as one could have expected from a multi-product trade model with diseconomies of scope (see, for example, Eckel and Neary 2010).

Table 6 shows the robustness test carried out on the results, using the growth in the level of labour productivity (value added per employee) as the outcome variable. These results confirm that there are stronger benefits from wider export entry, in terms of a higher rate of growth in productivity. However, in this case, the effect of multi-market entry seems to be a one-time increase in growth rates in the second year after entry.

TABLE 6

Propensity score matching: effects of export entry on labour productivity growth

Treatment variable	*Matching algorithm*	*Period 2*		*Period 3*		*Period 4*	
Multi-market entry	NN5	5.343	(1.96)**	-0.255	(0.1)	-0.651	(0.28)
	NN2	5.135	(1.68)*	-0.560	(0.2)	-1.363	(0.52)
	Unmatched	9.076	(5.02)***	1.806	(0.78)	0.436	(0.22)
Single market entry	NN5	4.450	(2.54)**	-1.646	(0.89)	-1.308	(0.9)
	NN2	4.057	(2.09)**	-3.636	(1.77)*	-2.551	(1.58)
	Unmatched	5.877	(4.66)***	-1.015	(0.68)	-0.686	(0.55)
Multi-product entry	NN5	8.734	(3.89)***	3.909	(1.91)*	2.902	(1.58)
	NN2	9.400	(3.69)***	5.713	(2.46)**	3.458	(1.68)*
	Unmatched	10.604	(7.54)***	3.535	(2.08)**	2.603	(1.75)*
Single-product entry	NN5	-0.175	(0.09)	1.970	(0.67)	-0.016	(0.01)
	NN2	8.161	(1.77)*	1.585	(0.41)	0.559	(0.28)
	Unmatched	2.583	(1.71)*	6.767	(3.72)***	3.496	(2.95)***

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. t-statistics in parentheses. NN5: nearest neighbour matching with 5 matches; NN2: nearest neighbour matching with 2 matches; ATT: Average

Treatment Effect on the Treated (ATT), t-statistics are in parentheses. Period 0: last year before exporting. Panel data of firms from the manufacturing industry. Period: 1995–2003. Matching based on values of variables at the time of export market entry.

The somewhat varying findings in Table 5 and Table 6 show that it is important to check the treatment effect of the different modes of export entry, based on different measures of productivity. The effects of multi-market entry are stronger in the case of the more general measure of growth in productivity: TFP growth. Our findings suggest that the difference in TFP between the different types of entrants are not only because of selection effects but also because of the stronger effects of wider expansion at the product level or the market level on subsequent productivity growth.

We have also completed a number of robustness tests on these results. The estimated effects on the level of TFP and on the level of labour productivity as outcome variables are given in Appendix C (Table C1 and Table C2). These results suggest as well that wider entry into export markets has stronger effects on TFP. However, the findings based on the level of labour productivity as a dependent variable do not show a stronger effect among multi-market entrants, compared with multi-product entrants. This stresses the need for caution in interpreting the results. To some extent, the findings depend on which indicator is chosen as the outcome variable in the PSM.

De Loecker (2007) showed stronger learning effects from exporting to developed countries. Similarly, our results stress the heterogeneity of the effects of export entry. Although earlier studies often lack significant evidence of the average (causal) effect of exporting from other countries, it appears that one might expect effects of wider experimentation with export markets and products. The scope of learning is certainly different in the case of different export strategies. Here we have outlined the potential effects of four simple export entry modes. These effects could also differ according to the duration of exports and their intensity, and the type of products being exported.

One explanation of our results could have been that the differences between multi-market and single-market exporters could be the result of the differences in their export markets. Multi-market exporters might be exporting a great amount to more advanced countries, with the resulting stronger learning effects. However, the effects found here do not seem to be fully driven by the propensity to export to advanced countries, as many single-market entrants start by exporting to nearby advanced countries Finland or Sweden.

An issue affecting the interpretation of our results could be that at firm level the number of products and markets could be correlated. We argue that this is probably not a big concern, given that the correlation between the number of products and the number of markets is significant but not very strong (0.38). Also, firms may define the same product differently (with a different CN code) in different markets, owing to issues related to taxation and trade barriers. We do not see this as a major problem, though, as it is likely to relate to only a small share of firms.

VI. Conclusions

This paper has studied how the different approaches to entering export markets can affect a firm's performance. Previous empirical literature, theoretical arguments (such as Albornoz *et al.* 2010) and our own data show that most firms start exporting sequentially (starting with only a smaller number of products and markets or, in the main case, a single product and a single market); only later do they expand into other markets. However, a significant proportion of firms export multiple products to several markets in their first year of exporting.

We show that this more extensive entry into the export markets may confer benefits that result in stronger positive effects on productivity, despite the larger sunk costs. Our analysis, which is based on propensity score matching, shows that firms that start exporting early to several markets or which enter exporting with a number of products experience faster growth in productivity after entry, compared with those new exporters that entered only one foreign market or exported only one product. We argue that these stronger effects may be the result of more learning-by-exporting in the case of multi-market and multi-product entry, compared with the more gradual approach of entry and expansion into export markets.

One potential extension of our analysis would be to investigate how the effects of exporting on productivity may differ for differentiated goods and homogeneous standardised goods, or for goods with different levels of technical complexity. The scope for learning may vary according to the type of goods.

Also, the effects of entering export markets could be expected to depend on the absorptive capacity of firms (Cohen and Levinthal 1989), as shown by Albornoz and Ercolani (2007) for export entry in the case of Argentina. There may be potential important complementarities between learning from various sources of knowledge in different markets. This is similar to the idea of complementarities of a firm's own knowledge creation and external knowledge acquisition (Cassiman and Veugelers 2006). For example, knowledge sourced from partners in one market might help to improve the speed and ease of learning from external partners in other markets.

References

Aghion, P. and Griffith, R. (2005). *Competition and Growth: Reconciling Theory and Evidence*, MIT Press, Cambridge, MA,

Albornoz, F. and Ercolani, M. (2007). 'Learning by Exporting: Do Firm Characteristics Matter? Evidence from Argentinean Panel Data.' Discussion Papers 07-17, Department of Economics, University of Birmingham.

Albornoz, F., Calvo Pardo, H., Corcos, G. and Ornelas, E. (2010). 'Sequential exporting.' CEPR Discussion Paper No. DP8103.

Alvarez, R. and López R. A. (2005). 'Exporting and Performance: Evidence from Chilean Plants', *Canadian Journal of Economics*, Vol. 38, pp. 1384–1400.

Bernard, A. B. and Jensen, J. B. (1999). 'Exceptional Exporter Performance: Cause, Effect, or Both?', *Journal of International Economics*, Vol. 47, pp. 1–25

Bernard, A. B. and Jensen, J. B. (2004). 'Exporting and Productivity in the USA', *Oxford Review of Economic Policy*, Vol. 20, pp. 343–357.

Bernard, A. B., Jensen J. B., Redding S. J. and Schott, P. K. (2007). 'Firms in International Trade', *Journal of Economic Perspectives*, Vol. 21, pp. 105–130.

Bernard, A. B., Redding, S. J. and Schott, P. K. (2010). 'Multiple-Product Firms and Product Switching', *American Economic Review*, Vol. 100, pp. 70–97.

Bernard, A. B., Redding, S. J. and Schott, P. K. (2011a). 'Multi-product Firms and Trade Liberalization', *Quarterly Journal of Economic*s, Vol. 126, pp. 1271–1318.

Bernard, A. B., Jensen, J. B., Redding, S. J. and Schott P. K. (2011b). 'The Empirics of Firm Heterogeneity and International Trade', CEP Discussion Paper No. 1084.

Bernard, A. B., Eaton, J., Jensen, J. B. and Kortum, S. (2003). 'Plants and Productivity in International Trade', *American Economic Review*, Vol. 93, pp. 1268–1290.

Blalock, G. and Gertler, P. J. (2004). 'Learning from exporting revisited in a less developed setting', *Journal of Development Economics*, Vol. 75, pp. 397–416.

Bloom, N. and Van Reenen, J. (2007). 'Measuring and Explaining Management Practices Across Firms and Countries', *The Quarterly Journal of Economics*, Vol. 122, pp. 1351–1408,

Caliendo, M. and Kopeinig, S. (2008). 'Some Practical Guidance for the Implementation of Propensity Score Matching', *Journal of Economic Surveys*, Vol. 22, pp. 31–72.

Cassiman, B. and Veugelers, R. (2006). 'In Search of Complementarity in Innovation Strategy: Internal R& D and External Knowledge Acquisition', *Management Science*, Vol. 52, pp. 68–82.

Chesbrough, H. (2006). *Open Business Models: How to Thrive in the New Innovation Landscape*, Harvard Business School Press, Boston, MA.

Clerides, S. K., Lach, S. and Tybout, J. R. (1998). ‘Is Learning by Exporting Important? Micro-Dynamic Evidence from Colombia, Mexico, and Morocco’, *The Quarterly Journal of Economics*, Vol. 113, pp. 903–947.

Damijan, J. P., Kostevc, Č. and Polanec, S. (2011). ‘Export Strategies of New Exporters: Why is Export Expansion along the Extensive Margins so Sluggish’, Licos Discussion Papers 277/2011.

Defever, F., Heid, B. and Larch, M. (2010). ‘Spatial Exporter Dynamics’, University of Nottingham, mimeo.

Eaton, J., Eslava, M., Kugler, M. and Tybout J. (2008). ‘The Margins of Entry into Export Markets: Evidence from Colombia’, in E. Helpman, D. Marin and T. Verdier (eds), *The Organization of Firms in a Global Economy*, Harvard University Press, Cambridge, MA.

Eckel, C. and Neary J. P. (2010). ‘Multi-Product Firms and Flexible Manufacturing in the Global Economy’, *Review of Economic Studies*, Vol. 77, pp. 188–217.

Elliott, R. and Virakul, S. (2010). ‘Multi-product firms and exporting: a developing country perspective’, *Review of World Economics (Weltwirtschaftliches Archiv)*, Vol. 146, pp. 635–656.

Falvey, R. and Yu, Z. (2005). ‘Exporting and Productivity Growth: Theory’, in H. Görg, D. Greenaway, R. Kneller (eds) *Globalisation and Productivity Growth*, Palgrave Macmillan, London.

Freund, C. and Pierola, M. (2010). ‘Export Entrepreneurs: Evidence from Peru’, *World Bank Policy Research Working Paper* No. 5407.

Görg, H., Kneller, R. and Muraközy, B. (2011). ‘What makes a successful export?’, *Canadian Journal of Economics*, forthcoming.

Granovetter, M. (1973). 'The Strength of Weak Ties', *American Journal of Sociology*, Vol. 78, pp. 1360–1380.

Greenaway, D. and Kneller, R. (2007). 'Firm Heterogeneity, Exporting and Foreign Direct Investment', *The Economic Journal*, Vol. 117, pp. 134–161.

Iacovone, L. and Javorcik, B. (2010). 'Multi-product Exporters: Product Churning, Uncertainty and Export Discoveries', *Economic Journal*, Vol. 120, pp. 481–499.

Johanson, J. and Vahlne, J.-E. (1977). 'The Internationalization Process of the Firm: A Model of Knowledge Development and Increasing Foreign Market Commitments', *Journal of Intenational Business Studies*, Vol. 8, pp. 23–32

Laursen, K. and Salter, A. (2006). 'Open for Innovation: The role of openness in explaining innovation performance among UK manufacturing firms', *Strategic Management Journal,* Vol. 27, pp. 131–150.

Leibenstein, H. (1966). 'Allocative efficiency versus X-efficiency', *American Economic Review*, Vol. 56, pp. 392–415.

Levinsohn, J. and Petrin, A. (2003). 'Estimating Production Functions Using Inputs to Control for Unobservables', *Review of Economic Studies*, Vol. 70, pp. 317–341.

Leuven, E. and Sianesi, B. (2003).' PSMATCH2: Stata Module to Perform Full Mahalanobis and Propensity Score Matching, Common Support Graphing, and Covariate Imbalance Testing', http://ideas.repec.org/c/boc/bocode/s432001.html.

Madsen, T. K. and Servais, P. (1997). 'The Internationalization of Born Globals: an Evolutionary Process?', *International Business Review*, Vol. 6, pp. 561–583.

Mayer, T., Melitz, M. J. And Ottaviano G.I.P (2011). 'Market Size, Competition, and the Product Mix of Exporters', National Bureau of Economic Research, NBER Working Paper 16959.

McKinsey & Co. (1993). ‘Emerging Exporters. Australia's High Value-Added Manufacturing Exporters’, Melbourne: McKinsey & Company and the Australian Manufacturing Council.

Melitz, M. J. (2003). ‘The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity’, *Econometrica*, Vol. 71, pp. 1695–1725.

Moen, Ø. And Servais, P. (2002). ‘Born global or gradual global? Examining the export behavior of small and medium-sized enterprises’, *Journal of International Marketing*, Vol. 10, pp. 49–72.

Panzar J. and Willig, R. D. (1975). Economies of Scale and Economies of Scope in Multi-Output Production. Econ. discussion paper no. 33, Bell Laboratories.

Panzar, J. and Willig, R. D. (1981). ‘Economies of Scope’, *The American Economic Review*, Vol. 71, pp. 268–272.

Pisu, M. (2008). ‘Export destinations and learning-by-exporting: Evidence from Belgium’, *Working Paper* No 140, National Bank of Belgium.

Rauch, J. and Watson J. (2003). ‘Starting Small in an Unfamiliar Environment’, *International Journal of Industrial Organization*, Vol. 21, pp. 1021–1042.

Rosenbaum, P. and Rubin, D. (1983). ‘The Central Role of the Propensity Score in Observational Studies for Causal Effects’, *Biometrika*, Vol. 70, pp. 41–50.

Teece, D. J. (1982). ‘Towards an economic theory of the multiproduct firm’, *Journal of Economic Behavior and Organization*, Vol. 3, pp. 39–63.

van Biesebroeck J. (2005). ‘Exporting raises productivity in sub-Saharan African manufacturing firms’, *Journal of International Economics*, Vol. 67, pp. 373–391.

Vickers, J. (1995). ‘Concepts of competition’, *Oxford Economic Papers*, Vol. 47, pp. 1–23.

Wagner, J. (2007). ‘Exports and Productivity: A Survey of the Evidence from Firm-level Data’, *The World Economy*, Vol. 30, pp. 60–82.

Appendix A: Productivity of new exporters compared with non-exporters

TABLE A1

Labour productivity after entry into exporting, according to mode of entry

		Percentage of firms whose productivity has increased		*Mean value of productivity relative to the pre-exporting level*		*Mean value of productivity*	
Entry mode	*Year of exporting*	*Non-exporters*	*Export entrants*	*Non-exporters*	*Export entrants*	*Non-exporters*	*Export entrants*
Multiple markets	0			1.00	1.00	135.7	145.3
	1	54	70.4	1.03	1.19	149.1	208.2
	2	58.4	70.1	1.06	1.24	160.0	268.5
	3	64.8	86.2	1.07	1.39	155.4	275.4
	4	64.1	83.4	1.10	1.32	179.8	281.4
Multiple products	0			1.00	1.00	132.9	139.0
	1	56	71.9	1.05	1.17	147.2	187.7
	2	65.7	71.7	1.08	1.24	156.6	237.8
	3	66.4	81.8	1.09	1.33	158.0	244.4
	4	68.1	81.7	1.15	1.26	172.8	254.6
All exporters	0			1.00	1.00	140.7	149.0
	1	56	67.6	1.03	1.13	148.1	185.1
	2	59.4	74.2	1.06	1.22	155.2	228.9
	3	62.2	79.2	1.07	1.30	158.0	244.9
	4	64.5	82.3	1.11	1.30	165.8	242.3

Notes: Firms from manufacturing industry. Period: 1995–2003. Under Year, '0' denotes the year before exports began and '1' denotes the first year of exporting, etc. Labour productivity is calculated as sales per number of employees.

Appendix B: Quality of matching

TABLE B1

Quality of matching: mean variable differences before and after matching, nearest neighbour matching with 5 neighbours

		Entry into more than 1 export market vs. no entry			*Entry into 1 export market vs. no entry*			*Entry with more than 1 product vs. no entry*			*Entry with 1 product vs. no entry*		
Variables	*Comparison*	*Treated*	*Control*	*T-test*	*Treated*	*Control*	*T-test*	*Treated*	*Control*	*T-test*	*Treated*	*Control*	*T-test*
Ln(Labour productivity)	Before matching	12.261	11.667	(19.35)***	12.003	11.667	(20.04)***	12.079	11.667	(19.13)***	12.047	11.667	(18.9)***
	After matching	11.720	11.666	(0.59)	11.594	11.593	(0.02)	11.634	11.644	(0.14)	11.633	11.657	(0.35)
Ln (TFP)	Before matching	10.603	10.053	(12.55)***	10.075	10.053	(0.9)	10.347	10.053	(9.47)***	10.067	10.053	(0.49)
	After matching	10.121	10.098	(0.19)	9.882	9.864	(0.22)	10.096	10.098	(0.03)	9.787	9.822	(0.38)
Size	Before matching	2.126	1.497	(22.26)***	1.737	1.497	(15.25)***	1.941	1.497	(21.93)***	1.733	1.497	(12.6)***
	After matching	2.587	2.478	(0.95)	2.036	1.979	(0.83)	2.416	2.334	(0.96)	1.958	1.990	(0.39)
Size squared	Before matching	6.326	3.807	(16.67)***	4.440	3.807	(7.53)***	5.388	3.807	(14.62)***	4.452	3.807	(6.46)***
	After matching	8.108	7.657	(0.68)	5.305	5.074	(0.74)	7.265	6.897	(0.8)	4.877	5.074	(0.54)
Age	Before matching	0.982	1.640	(44.52)***	1.245	1.640	(50.23)***	1.065	1.640	(55.8)***	1.289	1.640	(37.52)***
	After matching	0.912	0.905	(0.11)	1.205	1.197	(0.16)	0.950	0.945	(0.09)	1.302	1.307	(0.08)
Age squared	Before matching	1.421	3.257	(40.8)***	2.075	3.257	(49.48)***	1.634	3.257	(51.8)***	2.177	3.257	(37.89)***
	After matching	1.354	1.419	(0.41)	2.030	2.005	(0.22)	1.442	1.492	(0.42)	2.258	2.274	(0.1)
Cash/assets	Before matching	1.016	14.934	(0.34)	1.673	14.934	(0.6)	0.956	14.934	(0.49)	2.002	14.934	(0.49)
	After matching	0.709	0.861	(1.29)	0.693	0.630	(1.61)	0.742	0.700	(0.89)	0.646	0.613	(0.86)
Ln(K/L)	Before matching	10.847	10.746	(2.36)**	10.822	10.746	(3.16)***	10.708	10.746	(1.25)	10.931	10.746	(6.48)***
	After matching	10.529	10.483	(0.29)	10.340	10.367	(0.28)	10.451	10.451	(0)	10.345	10.404	(0.51)
FDI dummy	Before matching	0.177	0.069	(22.42)***	0.130	0.069	(23.68)***	0.175	0.069	(31.35)***	0.112	0.069	(14.01)***
	After matching	0.135	0.092	(1.42)	0.110	0.084	(1.39)	0.163	0.149	(0.54)	0.063	0.050	(0.76)
Capital region	Before matching	0.584	0.495	(9.53)***	0.542	0.495	(9.42)***	0.574	0.495	(12.1)***	0.532	0.495	(6.29)***
	After matching	0.404	0.442	(0.81)	0.373	0.378	(0.16)	0.403	0.417	(0.4)	0.358	0.354	(0.12)

Notes: t-statistics of difference between treatment and control group means are in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Firms from manufacturing industry. Period: 1995–2003. Matching based on the values of variables at the time of export market entry, observations with later treatment excluded.

Appendix C: Effects of different export entry modes on productivity levels

TABLE C1

Propensity score matching results: effects of export entry modes on level of TFP (log TFP)

Treatment variable	*Matching algorithm*	*Period 1*		*Period 2*		*Period 3*		*Period 4*
Multi-market entry	NN5	0.435	(3.03)***	0.528	(3.33)***	0.522	(3.15)***	0.369
	NN2	0.467	(2.84)***	0.572	(3.21)***	0.519	(2.75)***	0.470
	Unmatched	0.130	(0.91)	0.180	(1.22)	0.235	(1.5)	0.217
Single market entry	NN5	0.185	(2.12)**	0.248	(2.72)***	0.200	(2.06)**	0.160
	NN2	0.169	(1.74)*	0.256	(2.48)**	0.179	(1.64)	0.191
	Unmatched	-0.016	(0.2)	0.054	(0.62)	-0.051	(0.57)	0.049
Multi-product entry	NN5	0.432	(4.11)***	0.440	(3.89)***	0.400	(3.33)***	0.292
	NN2	0.390	(3.33)***	0.438	(3.49)***	0.377	(2.75)***	0.322
	Unmatched	0.145	(1.41)	0.214	(1.94)*	0.172	(1.48)	0.177
Single-product entry	NN5	0.203	(1.92)*	0.197	(1.76)*	0.106	(0.92)	0.216
	NN2	0.210	(1.76)*	0.202	(1.62)	0.117	(0.9)	0.179
	Unmatched	-0.087	(0.91)	-0.021	(0.21)	-0.106	(1.01)	0.022

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. t-statistics in parentheses. NN5: nearest neighbour matching with 5 matches; NN2: nearest neighbour matching with 2 matches; ATT: Average Treatment Effect on the Treated (ATT), t-statistics are in parentheses. Firms from manufacturing industry. Period: 1995–2003. Matching based on values of variables before the time of export market entry.

TABLE C2

Propensity score matching results: effects of export entry modes on level of labour productivity (log of value added per employee)

Treatment variable	*Matching algorithm*	*Period 1*		*Period 2*		*Period 3*		*Period 4*
Multi-market entry	NN5	0.066	(0.73)	0.138	(1.6)	0.092	(0.93)	0.159
	NN2	0.120	(1.22)	0.133	(1.4)	0.167	(1.55)	0.196
	Unmatched	0.109	(1.37)	0.170	(2.09)**	0.172	(2.07)**	0.229
Single market entry	NN5	0.133	(2.6)***	0.146	(2.72)***	0.119	(2.23)**	0.124
	NN2	0.122	(2.13)**	0.127	(2.16)**	0.103	(1.75)*	0.056
	Unmatched	0.112	(2.46)**	0.110	(2.35)**	0.071	(1.45)	0.070
Multi-product entry	NN5	0.171	(2.57)**	0.157	(2.23)**	0.161	(2.17)**	0.186
	NN2	0.154	(2.12)**	0.108	(1.4)	0.146	(1.79)*	0.123
	Unmatched	0.159	(2.77)***	0.160	(2.69)***	0.164	(2.66)***	0.197
Single-product entry	NN5	0.049	(0.82)	0.075	(1.27)	0.042	(0.71)	0.029
	NN2	0.078	(1.15)	0.112	(1.66)*	0.048	(0.71)	0.039
	Unmatched	0.072	(1.33)	0.094	(1.72)*	0.038	(0.66)	0.050

Notes: * significant at 10%; ** significant at 5%; *** significant at 1%. t-statistics in parentheses. NN5: nearest neighbour matching with 5 matches; NN2: nearest neighbour matching with 2 matches; ATT: Average Treatment Effect on the Treated (ATT), t-statistics are in parentheses. Firms from manufacturing industry. Period: 1995–2003. Matching based on values of variables before the time of export market entry.