UCD CENTRE FOR ECONOMIC RESEARCH

WORKING PAPER SERIES

2012

Export mode, Trade Costs, and Productivity Sorting

Ronald B Davies and Tine Jeppesen, University College Dublin,

WP12/25

October 2012

UCD SCHOOL OF ECONOMICS
UNIVERSITY COLLEGE DUBLIN
BELFIELD DUBLIN 4

Export mode, Trade Costs, and Productivity Sorting*

Ronald B. Davies and Tine Jeppesen

This Draft: September 2012

Abstract: In this paper we directly test the proposed productivity hierarchy of direct, indirect and non-exporters using firm-level data from 105 developing and transition countries. Using both regression analysis and propensity score matching, we find strong evidence to suggest that direct exporters are on average more productive than both indirect and non-exporters. However, only the results obtained using regression analysis support a similar ranking between indirect and non-exporters. Furthermore, we test the underlying relationship between *source-specific* fixed trade costs and the average productivity differences between the three firm-types. We find a significant and positive relation between such costs and the average productivity premium of direct exporters only. While other studies have shown that exports by trade intermediaries increase with destination-specific fixed costs, our results suggest that this is also true for source-specific costs, as an increase in the average productivity of direct exporters indicate that a larger share of less productive direct exporters choose to make use of a trade intermediary as export costs rise.

JEL codes: F1

Keywords: Heterogeneous firms; Export mode; Exporting Costs.

* The authors thank Fergal McCann and the UCD trade group for helpful comments and suggestions. The authors acknowledge that this paper is produced as part of the project "Globalization, Investment and Services Trade (GIST) Marie Curie Initial Training Network (ITN)" funded by the European Commission under its Seventh Framework Programme - Contract No. FP7-PEOPLE-ITN-2008-211429.
Davies: School of Economics, University College Dublin. Belfield, Dublin 4. Email: ronbdavies@gmail.com.
Jeppesen: School of Economics, University College Dublin, Belfield, Dublin 4. Email: tinejep@gmail.com.

1. Introduction

In the last decade a large literature has emerged focusing on differences between exporters and non-exporters. One of the most robust findings to emerge from these studies is that exporters are substantially more productive than non-exporters.[1] As shown by Melitz (2003), such productivity differences are due in part to a selection effect arising from the additional fixed costs associated with exporting. Building on these insights, researchers have recently started to look closer at the heterogeneity among exporting firms in order to explain why some firms choose to export directly to consumers in the foreign market while others export indirectly by making use of a trade intermediary such as a wholesaler.[2] Among such studies are Akerman (2010) and Ahn, Khandelwal and Wei (2011), who offer models where trade intermediaries hold a different technology than producers, which allows them to spread the fixed cost of exporting across a range of goods and thereby offer producers low cost access to export markets.[3] However, in order to cover their own fixed costs, trade intermediaries charge a mark-up over the domestic price of a given good, causing the variable costs of exporting indirectly to exceed those of exporting directly. Thus, akin to the sorting in Melitz (2003), this trade-off results in a sorting in which the most productive firms choose to export directly, incurring relatively high fixed costs, while less productive firms choose to export via intermediaries and the least productive firms focus exclusively on the domestic market.

Despite the intuitive nature of this prediction, there is little empirical evidence testing this sorting. We contribute to this literature in three ways. First, we directly test for productivity sorting using a set of firm-level controls. Ahn, Khandelwal and Wei (2011) and

[1] See Wagner (2007) for a comprehensive review of this literature.
[2] Findings indicate that wholesalers account for 20 percent of total exports in France (Crozet, Lalanne and Poncet, 2012), 22% of total exports in China (Ahn, Khandelwal and Wei, 2011), 11% in Italy (Bernard, Grazzi and Tomasi, 2011) and 8% in the US (Bernard, Jensen, Redding and Schott, 2010).
[3] Other factors that have been offered as explanations for the use of trade intermediaries include: incomplete contracts (Felbermayr and Jung, 2011), quality differentiation (Biglaiser, 1993; Tang and Zhang, 2011) and trade networks (Rauch and Watson, 2004; Petropoulou, 2007).

Crozet, Lalanne, and Poncet (2010) utilize an indirect approach for Chinese and French data respectively that compares unit prices for intermediary exporters with those that export directly, finding sorting along quality dimensions but no evidence of productivity sorting. One possible reason for this is the lack of productivity data. McCann (2010) meanwhile does directly test for productivity differences using a set of 28 Eastern European firms. Although he finds evidence of productivity sorting, he is not able to control for other firm level controls. One potentially important control is firm size, something commonly found correlated with productivity. Abel-Koch (2010) examines Eastern European and Central Asian firms, finding that larger firms tend to export a greater share of their products directly. However, she does not control for productivity. By way of contrast, our data has information on firms in 105 developing and transition countries, including both productivity and size.

Our second contribution is that, because of the availability of our firm level controls and productivity measures, we are able to use propensity score matching to compare exporters of one type with another type of firms. This adds to the regression analysis. The results obtained using both methodologies provide strong evidence to suggest that direct exporters, on average, are more productive than both indirect and non-exporters, while only the results obtained using regression analysis support a similar distinction between indirect and non-exporters.

Our third contribution is on the relationship between trade costs and exporting modes. A handful of studies have found a positive correlation between destination-specific fixed cost and the share of exports by intermediaries for Sweden (Akerman, 2010), China (Ahn, Khandelwal and Wei, 2011), Italy (Bernard, Grazzi and Tomasi, 2011), and France (Crozet, Lalanne, Poncet, 2012). However, none of the papers are able to test the underlying relationship between trade costs and the average productivity differences between direct, indirect and non-exporters. Our data does not have that limitation. Further, in contrast to

those papers examination of destination-specific trade costs, we use measures of source-specific trade costs.[4] Because these costs are under the control of the exporting country, recognizing their importance in firm choices is useful for developing policy as, in opposition to the costs imposed by the importing country, these can be unilaterally addressed by the exporting country. The estimates indicate that the average productivity premium of direct exporters, relative to both indirect and non-exporters, increase with the fixed cost of exporting, while no evidence is found to suggest that this is also so for indirect exporters. As the additional mark-up charged by intermediaries drives up the price of indirect exports, relative to that of goods exported directly, these results imply that source-specific trade costs may negatively affect the international competitiveness of firms, which in the absence of such costs would be able to export directly.

Before moving on to the empirical analysis, we provide a theoretical basis for our analysis in Section 2 in which we motivate the use of source-specific trade costs. This is followed by a presentation of the data in Section 3. Section 4 outlines the empirical strategy used and Section 5 presents the results. Finally, Section 6 concludes.

2. Theoretical framework

In this section, we present a basic variant on the Melitz (2003) model in order to frame our empirics. Consider a small home country that trades with the rest of the world. The rest of the world's variables will be denoted by *s. Home has a population of N individuals whereas the rest of the world's population is N^*. All consumers' preferences given by:

$$U = \mu \ln(X) + Y \tag{1}$$

[4] Although we must admit that this choice is also practical due to our data's lack of information on the destination of exports.

where $X = \left(\int_{j \in \Omega} x(j)^{\rho} dj \right)^{\frac{1}{\rho}}$ is a differentiated product sector where the set of available products is Ω and *Y* is a numeraire. The elasticity of substitution is $\varepsilon = 1/(1-\rho)$. This results in individual demand for a variety *j* of:

$$x(j) = \frac{p(j)^{-\varepsilon} \mu}{\mathcal{P}^{1-\varepsilon}} \tag{2}$$

where $\mathcal{P} = \left(\int_{j \in \Omega} p(j)^{1-\varepsilon} dj \right)^{\frac{1}{1-\varepsilon}}$ is the price index. With *N* individuals, this results in total domestic demand for variety *j* of $\frac{p(j)^{-\varepsilon} N \mu}{\mathcal{P}^{1-\varepsilon}}$. Using the consumer's budget constraint, where income *I* will be the sum of labour income and firm profits, total demand for the numeraire is:

$$Y = N(I - \mu). \tag{3}$$

Likewise in the rest of the world, demand for variety *j* in the rest of the world will be $\frac{p(j)^{-\varepsilon} N^* \mu}{\mathcal{P}^{*1-\varepsilon}}$. Since home is small, as per Flam and Helpman (1987), the number of firms in the rest of the world is constant.[5] As will be shown momentarily, this will imply that the rest of the world's price index is also exogenous.

As is common in the trade in heterogeneous products literature, the numeraire is traded under the conditions of free trade and perfect competition. Normalizing the price and unit labour demand of *Y* so that one unit of *Y* requires one worker results in an equilibrium wage equal to 1.

On the other hand, *X* is monopolistically competitive and is distinguished by heterogeneous firms. A firm with index *j* requires $a(j)$ units of labour to produce a unit of

[5] This notion of small has been used in the heterogenous firms literature by Davies and Paz (2011), Demidova and Rodriguez-Clare (2009), and others.

output which is increasing in j.[6] Thus, lower index firms are more productive firms. If the firm chooses to sell in the rest of the world, it can either export directly, incurring a per unit iceberg trade cost τ_d or indirectly, incurring per unit iceberg trade cost τ_i. These variable trade costs are lower for direct exporting, i.e. $\tau_d < \tau_i$. In addition to variable costs, the firm faces a fixed cost of production *F* and a fixed cost of exporting, F_d if it exports directly and F_i if it exports indirectly. Both the direct and indirect exporting fixed cost depend on a common, source-specific parameter *R*, which we refer to as red tape. Unlike the trade costs, the direct method has the greater fixed cost, that is $F_d(R) > F_i(R)$ for all *R*. In addition, we assume that $F_d'(R) \geq F_i'(R)$ for all *R*. Intuitively, Suppose that *R* is the number of forms a firm must fill out in order to export (one measure of trade costs used in our empirical analysis). This increases the cost of exporting for both types of exporters, but since an indirect exporter has an intermediary firm to assist in this, the cost rises less for that firm. Similarly, the rest of the world's producers face a set of trade costs τ_i^*, τ_d^*, $F_i^*(R^*)$, and $F_d^*(R^*)$ to reach the home market. Note that these are *source*-specific trade costs and are in contrast to the destination-specific costs of Ahn, Khandelwal, and Wei (2011) or Akerman (2010). This distinction is important given the differing nature of our data and theirs.

Given the results from the consumer's problem, a home firm that sells a positive quantity in the home market will do so with a price and quantity given by:

$$p(j) = \frac{a(j)}{\rho} \text{ and } q(j) = \left(\frac{\rho}{a(j)}\right)^{\varepsilon} \mathcal{P}^{\varepsilon-1} N\mu .$$

Similarly, if it sells in the rest of the world indirectly, price and quantity are:

[6] It is common in these models to include a cost for an entrepreneur to learn her productivity parameter. As the purpose of this model is to set the stage for our empirics, we omit it for brevity.

$$p(j)=\frac{(1+\tau_i)a(j)}{\rho} \text{ and } q(j)=\left(\frac{\rho}{(1+\tau)a(j)}\right)^{\varepsilon}\mathcal{P}^{*\varepsilon-1}N^{*}\mu.$$

A direct exporter, however sells a greater quantity at a lower price than an indirect exporter:

$$p(j)=\frac{(1+\tau_d)a(j)}{\rho} \text{ and } q(j)=\left(\frac{\rho}{(1+\tau_d)a(j)}\right)^{\varepsilon}\mathcal{P}^{*\varepsilon-1}N^{*}\mu$$

due to its lower exporting cost.

Thus, the firm will choose one of four firm structures: non-entry, non-exporting, indirect exporting, and direct exporting, depending on which yields the highest profit level. These profits are respectively, where $\kappa\equiv\left(\frac{1-\rho}{\rho^{1-\varepsilon}}\right)\mathcal{P}^{\varepsilon-1}N\mu$ and $\kappa^{*}\equiv\left(\frac{1-\rho}{\rho^{1-\varepsilon}}\right)\mathcal{P}^{*\varepsilon-1}N^{*}\mu$:

$$\pi_0=0 \tag{4}$$

$$\pi_n(j)=a(j)^{1-\varepsilon}\kappa-F \tag{5}$$

$$\pi_i(j)=a(j)^{1-\varepsilon}\kappa+\left((1+\tau_i)a(j)\right)^{1-\varepsilon}\kappa^{*}-F-F_i(R) \tag{6}$$

and

$$\pi_d(j)=a(j)^{1-\varepsilon}\kappa+\left((1+\tau_d)a(j)\right)^{1-\varepsilon}\kappa^{*}-F-F_d(R). \tag{7}$$

There will be a similar set of profit levels for the rest of the world's firms. As is well understood, which structure yields the highest profits depends on the firm's productivity and results in three cutoff indices that govern the set of firms choosing each structure. The lowest productivity firm to produce is the one with index j_n where $\pi_n(j_n)=0$. This is implicitly given by:

$$a(j_n)=\kappa^{-\frac{1}{1-\varepsilon}}F^{\frac{1}{1-\varepsilon}} \tag{8}$$

Although it is not necessary for our analysis, it is often assumed that this index is such that, in equilibrium, some home firms do not produce. Note that if the mass of active firms is fixed,

so too is the price index. This implies that, since home is small and changes there do not affect the number of overseas firms, the overseas price index is invariant to home variables.

The lowest productivity firm to export indirectly is j_i where $\pi_i(j_i) = \pi_n(j_i)$, i.e. where the profits generated by exporting indirectly are exactly offset by the additional costs. This is implicitly given by:

$$a(j_i) = (1+\tau_i)^{-1} \kappa^{*-\frac{1}{1-\varepsilon}} F_i(R)^{\frac{1}{1-\varepsilon}}. \tag{9}$$

Note that the rest of the world's indirect exporter cutoff, j_i^* would depend on the home price index and the rest of the world's trade costs.

Finally, the lowest productivity direct exporter is j_d where $\pi_i(j_d) = \pi_d(j_d)$, that is, where the lower transport costs of direct exporting are exactly offset by the higher fixed costs of doing so. This is implicitly determined by:

$$a(j_d) = \left((1+\tau_d)^{1-\varepsilon} - (1+\tau_i)^{1-\varepsilon}\right)^{-\frac{1}{1-\varepsilon}} \kappa^{*-\frac{1}{1-\varepsilon}} \left(F_d(R) - F_i(R)\right)^{\frac{1}{1-\varepsilon}} \tag{10}$$

From here, note that by the rest of the world's counterparts of (9) and (10), combined with (8), the set of varieties available in home, Ω, is independent of the home-specific trade costs $\{\tau_i, \tau_d, F_i(R), F_d(R)\}$. This results in the exporter cut-offs being determined by (9) and (10). By taking the derivatives of the profit conditions and applying the envelope theorem, it is simple to show that $j_d < j_i < j_n$. As illustrated in Figure 1, this means that the most productive firms export directly, intermediate productivity firms export indirectly, low productive firms serving only the domestic market, and the least productive firms do not to produce at all. This is our first testable hypothesis.

By totally differentiating (9), we see that:

$$\frac{dj_i}{d\tau_i} = -a'(j_i)^{-1}(1+\tau_i)^{-2} \kappa^{*-\frac{1}{1-\varepsilon}} F_i(R)^{\frac{1}{1-\varepsilon}} < 0 \tag{11}$$

and

$$\frac{dj_i}{dF_i} = \frac{1}{1-\varepsilon} a'\left(j_i\right)^{-1}\left(1+\tau_i\right)^{-1}\kappa^{*-\frac{1}{1-\varepsilon}} F_i\left(R\right)^{\frac{\varepsilon}{1-\varepsilon}} < 0\,. \tag{12}$$

In words, as the cost of reaching the rest of the world rises, regardless of whether those are variable or fixed costs, the lowest productivity indirect exporters stop exporting entirely. Note that this also means that an increase in red tape, *R*, which increases F_i, also reduces the indirect exporter cutoff:

$$\frac{dj_i}{dR} = \frac{1}{1-\varepsilon} a'\left(j_i\right)^{-1}\left(1+\tau_i\right)^{-1}\kappa^{*-\frac{1}{1-\varepsilon}} F_i\left(R\right)^{\frac{\varepsilon}{1-\varepsilon}} F_i'(R) < 0 \tag{13}$$

By totally differentiating (10), we find that, in contrast to the indirect exporter cutoff:

$$\frac{dj_d}{d\tau_i} = a'\left(j_d\right)^{-1}\left(\left(1+\tau_d\right)^{1-\varepsilon} - \left(1+\tau_i\right)^{1-\varepsilon}\right)^{-\frac{1}{1-\varepsilon}-1}\left(1+\tau_i\right)^{-\varepsilon}\kappa^{*-\frac{1}{1-\varepsilon}}\left(F_d\left(R\right)-F_i\left(R\right)\right)^{\frac{1}{1-\varepsilon}} > 0 \tag{14}$$

and

$$\frac{dj_d}{dF_i} = \frac{1}{\varepsilon-1} a'\left(j_d\right)^{-1}\left(\left(1+\tau_d\right)^{1-\varepsilon} - \left(1+\tau_i\right)^{1-\varepsilon}\right)^{-\frac{1}{1-\varepsilon}}\kappa^{*-\frac{1}{1-\varepsilon}}\left(F_d\left(R\right)-F_i\left(R\right)\right)^{\frac{\varepsilon}{1-\varepsilon}} > 0 \tag{15}$$

i.e. as indirect trade costs rise, the most productive indirect exporters switch to direct exporting. Nevertheless, as the costs of direct exporting rise, the number of direct exporters falls:

$$\frac{dj_d}{d\tau_d} = -a'\left(j_d\right)^{-1}\left(\left(1+\tau_d\right)^{1-\varepsilon} - \left(1+\tau_i\right)^{1-\varepsilon}\right)^{-\frac{2-\varepsilon}{1-\varepsilon}}\left(1+\tau_d\right)^{-\varepsilon}\kappa^{*-\frac{1}{1-\varepsilon}}\left(F_d\left(R\right)-F_i\left(R\right)\right)^{\frac{1}{1-\varepsilon}} < 0 \tag{16}$$

and

$$\frac{dj_d}{dF_d} = \frac{1}{1-\varepsilon} a'\left(j_d\right)^{-1}\left(\left(1+\tau_d\right)^{1-\varepsilon} - \left(1+\tau_i\right)^{1-\varepsilon}\right)^{-\frac{1}{1-\varepsilon}}\kappa^{*-\frac{1}{1-\varepsilon}}\left(F_d\left(R\right)-F_i\left(R\right)\right)^{\frac{\varepsilon}{1-\varepsilon}} < 0\,. \tag{17}$$

An increase in red tape costs, however, increases both the direct and indirect fixed costs. Nevertheless, since red tape increases direct exporting fixed costs faster:

$$\frac{dj_d}{dR} = \left(F_i'(R) - F_d'(R)\right)\frac{1}{\varepsilon - 1}a'(j_d)^{-1}\left(\left(1+\tau_d\right)^{1-\varepsilon} - \left(1+\tau_i\right)^{1-\varepsilon}\right)^{-\frac{1}{1-\varepsilon}}\kappa^{*-\frac{1}{1-\varepsilon}}\left(F_d(R) - F_i(R)\right)^{\frac{\varepsilon}{1-\varepsilon}} < 0 \tag{18}$$

the net effect is negative and the mass of direct exporters falls. In Figure 2 we show the effect of an increase in the red tape costs of exporting on the cutoff points. As discussed above, an increase in such costs causes the least productive indirect exporters to become non-exporters, which is depicted by the leftward shift in the cutoff point for indirect exporters from j_i to j_i' and the most productive direct exporter to become an indirect exporter, as seen by the leftward shift in the threshold for direct exporters from j_d to j_d'.

These changes in cutoffs then have implications for the average productivity of indirect and direct exporters where the productivity of a firm with index *j* is defined as $a(j)^{-1}$. Defining the cumulative distribution function for productivities as $G(j)$, the average productivity of a non-exporter, indirect exporter, and direct exporter is:

$$A_n(j_i, j_n) = \frac{\int_{j_i}^{j_n} a(j)^{-1} g(j)\, dj}{\int_{j_i}^{j_n} g(j)\, dj} \tag{19}$$

$$A_i(j_i, j_d) = \frac{\int_{j_d}^{j_i} a(j)^{-1} g(j)\, dj}{\int_{j_d}^{j_i} g(j)\, dj} \tag{20}$$

and

$$A_d(j_d) = \frac{\int_0^{j_d} a(j)^{-1} g(j)\,dj}{\int_0^{j_d} g(j)\,dj}. \tag{21}$$

Noting that j_n is independent of red tape, we find that:

$$\frac{dA_n(j_i, j_n)}{dR} = -\left(a(j_i)^{-1} - A_n(j_i, j_n)\right)\frac{g(j_i)}{\int_{j_i}^{j_n} g(j)\,dj}\frac{dj_i}{dR} > 0. \tag{22}$$

As red tape costs rise, low productivity indirect exporters switch to non-exporting. Since these firms are more productive than non-exporters, average non-exporter productivity rises.

Also, from (20), an increase in red tape increases the average productivity of indirect exporters:

$$\frac{dA_i(j_i, j_d)}{dR} = \left(a(j_i)^{-1} - A_i(j_i, j_d)\right)\frac{g(j_i)}{\int_{j_d}^{j_i} g(j)\,dj}\frac{dj_i}{dR} - \left(a(j_d)^{-1} - A_i(j_i, j_d)\right)\frac{g(j_d)}{\int_{j_d}^{j_i} g(j)\,dj}\frac{dj_d}{dR} > 0. \tag{23}$$

This occurs because the increase in red tape drives relatively low productivity indirect exporters from this category, increasing the average, while pushing direct exporters into it, further increasing it. Finally, from (21) we see that:

$$\frac{dA_d(j_d)}{dR} = \left(a(j_d)^{-1} - A_d(j_d)\right)\frac{g(j_d)}{\int_0^{j_d} g(j)\,dj}\frac{dj_d}{dR} > 0. \tag{24}$$

As red tape rises, low productivity direct exporters switch to indirect exporting, resulting in an increase in average productivity for direct exporters.

What an increase in red tape does to the average productivity of one group relative to another, however, is ambiguous. This is because it depends on both the distribution (the $g(.)$ terms) and the changes in the cutoffs (which depend on factors such as the difference in trade costs across exporting methods and the relative movements in the fixed exporting costs as red

tape changes). Therefore we do not have an *a priori* expectation on how the productivity differences between direct, indirect, and non-exporters varies with red tape and now turn to the data for guidance.

3. Data and descriptive statistics

Data at the firm-level come from the World Bank's Enterprise Surveys (World Bank, 2012b). The final dataset used covers a total of 105 developing and transition countries over the period 2006-2011.[7] The data is cross-sectional with surveys taking place once in each country during the time period.[8] The surveys, used in all countries, are of a similar layout and have been conducted using a common methodology of random stratified sampling. In all cases, the survey universe is defined as "commercial, service or industrial business establishments with at least five fulltime-employees". From the group of firms that fulfil this criteria, within each country, those interviewed have been chosen using stratified random sampling, with the levels of stratification being industry, region and firm size.

While, the surveys contain a few country specific questions, the majority are asked of firms in all countries and include information regarding export behaviour, firm-size and sales figures. All monetary values are reported in local currencies, which we deflate using the annual consumer price index from the World Bank Development Indicators (World Bank, 2012c) and thereafter convert to US dollars using the annual average exchange rate from the same source.[9]

[7] The specific dataset is entitled "Standardized data" and was downloaded, Dec. 2011. http://www.enterprisesurveys.org/
[8] There are a few exceptions to this, mainly in Latin America, where surveys have taken place twice. As it is not clear what proportion of firms have been interviewed twice within these countries, we use only the largest survey round for each country. However, this does not cause any major changes to the key results.
[9] Sales values are reported in dollars only for Ecuador.The Consumer price index for Chile (2006), DRC (2010), Eritrea (2009), Uzbekistan (2009) all come from IMF, Economic Outlook Database Sep. 2011. (Downloaded Dec. 2011). Exchange rates for Uzbekistan is from http://unstats.un.org/unsd/snaama/resCountry.asp UN operational rate used (downloaded Dec. 2011).

After cleaning the data, the total sample size is 38,452 and covers firms in the manufacturing, services as well as the retail and whole sale sectors.[10] While we make use of data from all sectors, we also provide results for the manufacturing sector exclusively, as this is the most commonly examined in these types of studies. Furthermore, our measure of trade costs applies specifically to the export of goods, making it a suitable measure of such costs particularly for the manufacturing sector.

Table 1 gives an overview of all the countries contained in the dataset.

3.1 Export mode

In the survey all respondents are asked to specify the share of annual sales exported directly and indirectly, where the latter means that the goods are sold to a third party domestically prior to being exported. Using this information, we follow McCann (2010) and define firms as direct exporters if any share of sales is exported directly.[11] This in turn means that indirect exporters are firms which exclusively export via intermediaries. [12] Using this definition 78% of all exporters are classified as direct exporters, while 22% are classified as indirect exporters. Among the group of direct exporters, 16% of firms export using both modes.[13] Nevertheless, as discussed below, our results are robust to classifying those that export both directly and indirectly as indirect exporters.[14]

Table 2 provides an overview of direct, indirect and non-exporters in terms of their relative frequency as well as their importance in terms of total sales. Using our primary definition of export mode, we see in Panel A that non-exporters are the most frequent type of

[10] See the appendix for a detailed description of the process of data cleaning.
[11] While this is our primary classification of firm types, we also make use of an alternative definition where direct exporters are firms that exclusively export directly, while any firms which use both modes are coded as indirect exporters. Under this alternative, our regression results are largely unchanged. We discuss this more below.
[12] McCann (2010) argues that this definition is in accordance with the underlying theory by Melitz (2003), as firms that export any share of sales directly may have incurred the sunk costs associated with doing so.
[13] Among the group of exporters that make use of both modes, 28% of total sales are, on average, exported via direct channels, compared to an average of 21% via indirect channels. This is again part of our rationale for classifying these firms as direct exporters.
[14] It is also important to note that, since only a relatively small number of firms use both exporting methods, we do not attempt analysing the share of exports that are direct as, for the large majority of exporters, this would be zero or one.

firm across all regions, but account for a smaller share of total sales than direct exporters across all regions but Sub-Saharan Africa. Indirect exporters are the least frequent firm type and also accounts for the smallest share of sales across all regions.

In order to get a first impression of the productivity hierarchy between firm types, we again follow McCann (2010) and compare the distribution of labour productivity across non-exporters, indirect-exporters and direct-exporters in Figure 3. The left-hand side plot shows the kernel density estimate of the log of labour productivity for all firms in the sample, while the right-hand side plot shows the equivalent for firms in the manufacturing sector exclusively, defined as industries 15 to 37 using the ISIC 3.1 Rev. Classification. As is clear from both plots, the productivity distributions accurately reflect the general sorting pattern predicted by the model of Section 2 and by Akerman (2010), Ahn, Khandelwal and Wei (2011) and Bernard, Grazzi and Tomasi (2011). The entire distribution for indirect exporters lies to the right of non-exporters, while that of direct exporters lies to the right of both non-exporters and indirect exporters along all points.

To test whether the observed distributions differ significantly from each other, we display the results of a Kolmogorov-Smirnov test in Table 3. In the first row we compare the distributions of indirect exporters and non-exporters and in the second row we test the difference between indirect exporters and direct exporters. In both cases the difference is significant, supporting the theory of a productivity hierarchy among the three types of firms.

3.2 Data: Trade cost

To measure the source-specific fixed costs of exporting, we use data from the World Bank *Doing Business* dataset (World Bank, 2012a), which records the number of documents as well as the cost and time required to export a standardized cargo of goods by ocean transport. The measures take into account all procedures required to get the goods from their warehouse into containers and transported to their port of exit, but exclude ocean transport.

Across all countries, the World Bank assumed that the exporter is a domestic privately owned firm with at least 60 employees and is located in the largest city. The good that is exported is assumed to be non-hazardous, to travel in a dry-cargo container and to be one of the country's leading export products. Based on these assumptions, the World Bank has collected data from local freight forwarders, shipping lines, customs brokers, port officials and banks. Furthermore, payment is assumed to be made by a letter of credit and the number of documents required, therefore include bank documents as well as documents required for customs, port handling and transport. Time is measured in days and takes into account the time it takes to obtain all the necessary documents as well as the inland transportation, customs clearance and port handling. Finally, the cost of exporting is measured as the US dollars per container and includes the cost of obtaining all required documents, the cost of inland transportation as well as the cost of customs clearance and port handling fees.[15]

In order to gain an impression of the magnitude and variance of these measures, we display the summary statistics in Panel A of Table 4. The number of observations is slightly smaller than our total sample size, as no information on these measures is available for Kosovo. Across all three measures, there is a relatively high cross-country variation. The cost of exporting ranges from $500 in Latvia to $5367 in Chad, while the number of documents required range from 3 in both Estonia and Panama to 14 in Rwanda. Estonia is also the country where it takes the least time to clear a cargo of goods for exporting, with an average of 5 days. At the other end of the distribution is Kazakhstan, with an average of 89 days.

As the three measures are relatively highly correlated (see Panel B in Table 4) we follow Bernard et al. (2011) and make use of a principal component analysis to construct an index of trade costs.[16] As Vyas and Kumaranayake (2006) discuss, the general idea behind

[15] This is measured only as the official costs and do not take into account any potential bribes.

[16] Bernard, Grazzi and Tomasi. (2011) use the principal component of the equivalent measures for importing, as they have data on the destination of exports across a sample of Italian exporters, enabling them to look at destination-specific fixed costs of exporting.

this method is to reduce a number of variables into a smaller set of orthogonal components, where each represents a linear combination of the original variables, weighted by the eigenvectors of the correlation matrix.[17] The maximum number of components or factors computed is therefore determined by the number of variables used, with each component accounting for a smaller share of the total variation of the original variables.

In panel B of Table 5, we list the full set of factors computed. Column (1) shows the variance extracted by each of these, expressed as the proportion of total variance in the data in column (2).[18] As we can see, the factor 1 accounts for 69% of the total variance. As this factor is the only one that accounts for at least as much of the variation as one of the original variables, we follow the Kaiser criterion and discard factors 2 and 3. To see how the remaining factor relates to each of the underlying variables, the factor loadings are displayed in column (1) in panel C. These indicate the weights and correlations between factor 1 and each of the individual variables. As expected, these are all relatively large. Finally, column (2) in panel C displays the part of the variance that is unique to each of the individual variables. With the exception of *Documents to export,* these are all relatively low, meaning that each variable contributes considerably to the computation of the principal component.

In order to get an impression of the association between the frequency of firm type and our index of source-specific trade costs, we divide the sample into quartiles. Firms based in countries facing the lowest fixed costs of exporting are in the first quartile, while firms facing the highest costs are placed in the fourth quartile (see Table A1 in the appendix for a breakdown of countries in each quartile). The relative frequency of firm type across the quartiles is displayed in Table 6. We see that as trade costs increase, the share of exporters, regardless of type, decreases. While 33% of all firms export in the first quartile only 13% of

[17] If the variables are standardized the co-variance matrix is used instead (Vyas and Kumaranayake, 2006).
[18] This is computed using the *factor* command with the *pcf* option in Stata, which makes use of the correlation matrix, rendering prior standardization of the variables unnecessary. The interpretation of the table draws heavily on the chapter on Factor Analysis in StatSoft, Inc. (2012).

firms in the fourth quartile do so. This is not surprising, as the countries in the fourth quartile tend also to be the poorest.[19] However, the relative decrease in the frequency of exporters is disproportionately made up by direct exporters. Across the first three quartiles, indirect exporters constitute approximately a fifth of all exporters compared to a third in the fourth quartile.

In order to see if this pattern is a reflection of the hypothesized impact of the source-specific fixed costs of exporting, we now turn to the empirical part of the paper. The following section provides an overview of the empirical strategy used.

4. Empirical strategy

As mentioned, we make use of both regression analysis and propensity score matching. To explain how we do this, we start with the baseline model, which focuses exclusively on the proposed productivity sorting by firm type, and apply both regression and propensity score matching methodologies to it. Following that, we present an extended model, which takes trade costs into account, and repeat our analysis.

4.1 Baseline: Regression analysis

To examine the proposed productivity hierarchy of firm types, we first run a simple OLS regression:

$$\ln LP_{ijk} = \beta_0 + \beta_1 IE_{ijk} + \beta_2 DE_{ijk} + \beta_3 X_{ijk} + \theta_j + \theta_k + \theta_t + \varepsilon_{ijk} \qquad (25)$$

where subscript *ijk* refers to firm *i* in industry *j* in country *k*. *IE* and *DE* are dummy variables equal to one for indirect and direct exporters, respectively.

[19] The correlation coefficient between our index of trade costs and GDP per capita is -0.41

Given the results of Section 2, we expect both $\beta_1 > 0$ and $\beta_2 > 0$, which would indicate that exporters of both types are more productive than non-exporters. Further, we expect $\beta_2 > \beta_1$, i.e. direct exporters are more productive than indirect exporters. In order to account for any factors that may be correlated with both productivity and the selection into either mode of exporting, we further include a vector of firm-level controls (X_{ijk}) as well as a full set of industry, country, and year fixed effects (θ_j, θ_k, and θ_t respectively).[20]

At the firm level, controls are included for firm size and age measured respectively as the log of the number of full-time employees and the log of the number of years that the firm has been established in country k. In addition, we also include a series of binary variables indicating whether the firm is foreign owned, holds an internationally recognised quality certificate, is a multi-product firm, uses imported intermediaries and whether the firm licenses a foreign technology.[21] Unfortunately, information on the latter two variables is limited to firms in the manufacturing sector and we therefore only include these covariates when we look at that sector exclusively.

The choice of our control variables is informed by previous findings by, among others, McCann (2010) who finds that the likelihood of being foreign owned, producing several products, importing intermediates, or using foreign licensed technology is higher for direct and indirect exporters than non-exporters. In addition, Abel-Koch (2010) finds a negative relation between the share of indirect exports and the number of employees (her measure of size). The author also proposes a negative relation between firm age and the share of exports sold via intermediaries but fails to find any statistical significance. However, as this is a variable commonly controlled for in studies looking only at the distinction between

[20] Recall that our data are pooled cross-sectional, thus year information refers to the year in which a particular firm was surveyed.
[21] Although it would be ideal to also control for R&D expenditures this is not possible due to data constraints.

exporters and non-exporters, we include it in our analysis. Finally, Biglaiser (1993) argues that one of the roles performed by trade intermediaries is quality assurance and evidence in support of this is found by Ahn, Khandelwal and Wei (2011) and Crozet, Lalanne, and Poncet (2010). Concerns regarding product quality, may as Tang and Zhang (2011) write, be particularly acute in the case of foreign produced goods and perhaps even more so in the case of exports from developing countries, which make up the majority of our sample. If quality signalling is indeed part of the reason why firms export via trade intermediaries, we may expect those which hold an internationally recognised quality certificate to be less likely to export via this mode. As a number of quality certificates e.g. those belonging to the ISO family are costly to obtain, it is also highly likely that only the most productive firms hold such certificates, making this factor a potential source of bias if not controlled for. Table A2 in the appendix gives a detailed description of all firm-level covariates.

To get an initial impression of how the firm-level control variables differ across firm types, Table 7 contains the mean of each variable for each type of firm. As expected, the largest mean values are found for direct exporters, followed by indirect and non-exporters. Finally, we display the results from a t-test of mean differences between non-exporters and indirect exporters in column (4) and between indirect-exporters and direct-exporters in column (5). The results indicate that the differences observed are statistically significant.

Finally, it should be mentioned that, due to data limitations, our analysis has caveats which we acknowledge. As we do not have panel data, we are not able to make any claims regarding causality, i.e. whether firms select into a given mode of exporting on the basis of their productivity or whether such differences are due to differences in the strength of possible 'learning-effects' arising from both indirect and direct exports.[22] Further, due to

[22] Mengista and Patillo (2004) suggest that potential learning effects may be greater for direct than indirect exporters, as the former group are directly in contact with the purchaser and therefore likely to receive more and better information, which in turn may translate into lower costs or product improvements.

lack of data on other inputs, we use labour productivity as our dependent variable instead of the preferred measure of total factor productivity. While labour productivity is commonly used as an alternative to total factor productivity in these types of studies, Pavcnik (2002) notes that differences in labour productivity between exporters and non-exporters, could simply reflect differences in capital intensity between the two types of firms. This would lead to an upwards bias on the estimated coefficients of both direct and indirect exporters relative to non-exporters, if exporters, regardless of type, are more capital-intensive than non-exporters. However, as we are looking mainly at developing countries, which tend to export labour intensive products, this is perhaps less of a concern than for similar studies focusing on developed countries. Secondly, it is not clear that this should bias the estimates of direct exporters relative to indirect exporters. A last concern is that no information on hours worked is given in the dataset. Therefore, it is not clear whether a higher level of productivity is due to the innovation of the production process or whether this merely reflects longer working hours. This could potentially be a source of bias, if the average working week differs systematically by firm type. Nevertheless, with these caveats in mind, we proceed with our analysis.

4.2 Baseline: Propensity score matching

As an alternative estimation strategy, we also use propensity score matching to estimate the average productivity premium accruing to each type of exporter.[23] The basic idea behind this approach is to match firms in a given treatment group (defined by export mode) with those firms in the control group (i.e. non-exporters) which are most alike in terms of their estimated probability of receiving the treatment. By doing so, we ensure that the firms in our comparison group are as similar as possible to those in our treatment group and thereby minimize any bias arising from selection into the treatment.

[23] This section draws heavily on the insights from Caliendo and Kopeinig (2008).

As this strategy requires the definition of only one treatment group, we cannot look at direct and indirect exporters simultaneously as in equation (25). Therefore, we match across each pair of firm type instead. This allows us to estimate the average treatment effect of i) exporting directly compared to indirectly, ii) exporting directly compared to not exporting at all and iii) exporting indirectly compared to not exporting. In each case, the estimation strategy looks as follows[24]:

$$\tau_{ATT} = E_{D=1,p(x)|}\left\{E\left[\ln LP(1)\big|_{D=1,p(x)}\right] - E\left[\ln LP(0)\big|_{D=0,p(x)}\right]\right\} \quad (26)$$

where, the average treatment effect on the treated category (*ATT*) is estimated as the mean difference of the outcomes in the log of productivity, *lnLP*, for the treated (*D = 1*) and the non-treated (*D = 0*) groups weighted by the propensity score of receiving the treatment *p(x)*. The latter is, in this case, estimated using a probit model (Caliendo and Kopeinig, 2008).

As any remaining differences in the productivities of the matched sample of treated and non-treated firms is attributed to the treatment, it is paramount to ensure that all observable factors influencing the firm's selection into a given treatment as well as the firm's productivity level, are controlled for. Again, we let previous findings guide our choice and include the same set of covariates as in the regression analysis, including country, industry and year fixed effects. In addition, we also include a squared term for the log of employment and the log of firm age, as it is highly likely that the propensity to export either directly or indirectly is not a linear function of either of these variables.[25,26,27]

Aside from the choice of covariates, the quality of the matching may also vary with the algorithm used. To minimize any bias arising from this source, we use three different

[24] The following equation is amended from Caliendo and Kopeinig (2008).
[25] The quality of the matching also increases significantly when we include these terms.
[26] Preferably, we would like to have used lags of the control variables to ensure that the selection into treatment is probably controlled for. However, due to data limitations this is not possible.
[27] Note that the country, industry fixed effects "penalize" foreign firms and those in other industries due to the difference in fixed effects. Thus, all else equal, better matches are those in the same country and industry.

matching algorithms and choose our preferred method on the basis of a number of sensitivity tests. The methods used are nearest-neighbour, caliper and kernel matching. The first of these methods matches firms based on the criteria that the distance between their estimated propensity scores should be the smallest possible.[28] Caliper matching is built on the same principle but imposes a tolerance level on the maximum distance between the propensity scores of a treated and untreated firm. As Caliendo and Kopeinig (2008) write, the advantage of using this method is that the risk of 'bad matches' is minimized, but at the cost of a higher variance as fewer matches are performed. Finally, kernel matching uses a weighted average of all firms in the control group as the counterfactual for a treated firm.

4.3 Extended model

In order to test how the average productivity differences between direct, indirect and non-exporters varies with the source-specific fixed costs of exporting, we follow the same methodology as in the baseline and use both regression analysis and propensity score matching. The OLS model is as follows:

$$\ln LP_{ijk} = \beta_0 + \beta_1 IE_{ijk} + \beta_2 TC_k * IE_{ijk} + \beta_3 DE_{ijk} + \beta_4 TC_k * DE_{ijk} + \beta_5 X_{ijk} + \theta_j + \theta_k + \theta_t + \varepsilon_{ijk} \quad (27)$$

where, TC_k denotes our measure of trade costs. As the equation includes country fixed effects, this variable is not included on its own.[29] Given that trade costs increase the productivity threshold for exporting through direct channels relatively more than the equivalent threshold for exporting indirectly, we would expect $\beta_3 + \beta_4 > \beta_1 + \beta_2 > 0$. As discussed in Section 2, this would arise if parts of the fixed costs of exporting indirectly are born by the trade intermediary.

[28] We allow for replacement, meaning that an untreated firm (e.g. an indirect exporter) may be used more than once as a match for a treated firm (e.g. a direct exporter).

[29] In Figure A2 in the appendix, we plot the estimated country fixed effects against the trade cost index. As expected, higher trade costs are associated with lower productivity for all firm types.

As trade costs vary only at the country level, we furthermore cluster the standard errors at this level, to avoid underestimating the standard errors on both interaction terms (Moulton, 1990). Aside from these changes, equation (27) is comparable to equation (25).

4.4 Extended model: Propensity score matching

In order to check whether the obtained estimates from equation (27) are robust to the use of an alternative estimation strategy, we again use propensity score matching. The way we do this is by dividing the data into quartiles on the basis of trade costs as done in Section 3. We then perform the matching procedure separately for each quartile and compare the treatment effects across the quartiles of trade costs. If the productivity premium of direct exporters increases with trade costs, relative to either or both of the other firm types, we expect to see the relatively largest treatment effect of exporting directly among the group of firms in the fourth quartile.

5. Results

5.1. Baseline: Regression analysis

The results for the baseline regression model are displayed in Table 8. In the first two columns, we use the whole sample, while we focus exclusively on firms from the manufacturing sector in columns (3) and (4). In both cases we show the results from a 'naive' regression without any additional firm-level controls in column (1) and (3) as well as the results from the full model, including all controls, in column (2) and (4). While the magnitude of the coefficients on the dummy variables indicating indirect and direct exporters decrease significantly in column (2) and (4), they remain positive and significant.

According to these results, the average productivity premium accruing to direct exporters relative to non-exporters range between 20% in the case of the manufacturing sector to 27% if all sectors are included, while the equivalent figure for indirect exporters is

around 8%.[30] On the basis of a series of F-tests we can furthermore reject equality between the coefficients on indirect and direct exporters. These results, therefore, confirm the sorting pattern proposed in the literature as they provide strong evidence to suggest that direct exporters on average are more productive than indirect exporters, which in turn are more productive than non-exporters.

The results are robust to a number of additional checks, including the use of our alternative definitions of indirect and direct exporters (see Table A3 in the appendix) and the use of slightly different sample (see Table A4 in the appendix) as well as the inclusion of potential outliers (see Table A5 in the appendix).

The most relevant empirical paper to draw comparisons with is McCann (2010). Our results differ slightly from that study as we find strong evidence for a productivity premium accruing to both types of exporters, relative to non-exporters, while McCann (2010) finds robust evidence only in the case of direct exporters. However, once we run the model separately for each region (Table 9), our results from the region of Eastern Europe and Central Asia are fully compatible with those of McCann (2010), despite the fact that we use a slightly different sample.[31]

5.2 Baseline: Propensity score matching

In Table 10 we display the results obtained using propensity score matching. In panel A we display the average treatment effect of exporting directly compared to indirectly. In Panel B indirect exporters are excluded and the treatment effect displayed is that of being a direct exporter compared to a non-exporter. Finally in panel C, we display the treatment effect of exporting indirectly compared to not exporting at all. In each case the results are displayed using nearest–neighbour matching in the first row, followed by caliper matching with a

[30] The percentage differences are calculated as: 100*(exp(β) -1).
[31] McCann (2010) uses data collected over three waves of surveys, while we just have a single survey round per country.

tolerance level of 0.001 and 0.0001 in the second and third row. Finally, results using kernel matching is displayed in the fourth row.

As the average treatment effect on the treated is only defined for firms which have a potential match in the control group, we impose the so-called common support condition by discarding any treated observations with a predicted propensity score that lies outside the range of the predicted scores for the control group (Caliendo and Kopeinig, 2008).[32] In the case of direct versus indirect exporters, the predicted probability of being a direct exporter ranges from 0.1447 to 1 for the group of direct exporters, while the equivalent range is 0.0884 to 0.9923 for indirect exporters.[33] This means that the zone in which there is no common support by indirect exporters is above 0.9923. Imposing this condition, therefore results in the loss of nine out of 6,122 direct exporters included in the analysis. In the case where we compare direct exporters to non-exporters, 46 out of 6,144 direct exporters lie outside of the range of common support. Finally, in the case where we compare indirect and non-exporters, we lose six observations due to this condition.[34] However, when caliper matching is employed, the number of treated observations is reduced in all cases, as the imposed tolerance level reduces the area of common support further.

In terms of the results, we see that the estimated average treatment effects (ATT) obtained using the different methodologies lie within a relatively small range in panel A, whereas they differ somewhat more in panel B and C.

[32] As Caliendo and Kopeinig (2008) point out, the imposing the condition of common support is especially important in the case of kernel matching as the counter-factual is based on a weighted average of all untreated observations.
[33] The results for the probit model used to estimate the propensity scores is presented in Table A11 in the appendix.
[34] In panel B, where we compare direct and non-exporters, the predicted probability of being a direct exporter ranges from 0.00006 to 1 for direct exporters, while the equivalent range for non-exporters is 0.000006 to 0.979. In panel C, where we compare indirect and non-exporters, the estimated probability of being an indirect exporter ranges from 0.002 to 0.73 for indirect exporters, and from 0 to 0.65 for non-exporters.

In order to check the quality of the matching obtained by each algorithm and thereby gain an insight into which method produces the most reliable treatment effects, we do a number of post-estimation checks, discussed in Caliendo and Koeinig, (2008). The first of these is a two-sample t-test, which works by comparing the means of the covariates between the treatment and control group, before and after matching. If the matching is of a high quality, no significant differences should be found after the matching has been undertaken. The second test involves re-estimating the propensity score using the matched sample and comparing the Pseudo R-squared obtained from the probit estimation before and after matching. If the matching is of a high quality, the distribution of the covariates should be similar across treated and untreated firms and we should therefore expect a relatively low pseudo-R^2 after matching has taken place. Finally, we perform a likelihood test on the joint significance of all the variables included in the probit model before and after matching. Following the same logic, we should expect to reject this test on the matched sample only (Caliendo and Kopeinig, 2008).

From the result of these tests we find that our preferred matching algorithm is caliper matching with an imposed threshold of 0.0001. As is clear from the results of each test displayed in Table 11, this algorithm produces matches of a high enough quality to pass all 3 tests. The average treatment effects obtained using this algoritm also compares well with the estimates obtained using OLS. The average treatment effect of exporting directly compared to indirectly is 0.22, which translates into an average difference in productivities of 25%. The equivalent percentage difference between direct exporters and non-exporters is 29%, while no significant difference is found between indirect and non-exporters.

In conclusion, our results pertaining to the baseline model finds considerable evidence to support the suggested productivity hierarchy. Direct exporters are found to be significantly more productive than both indirect and non-exporters using both regression analysis and

propensity score matching. Using regression analysis we also find strong evidence to suggest that indirect exporters are more productive than non-exporters, although this result is subject to a larger degree of regional variation and is furthermore not robust to the use of propensity score matching.

5.3. Extended model

In Table 12, we present the regression results of the extended model for all sectors as well as for the manufacturing sector exclusively. As the results differ slightly, depending on how we define firm types, we also present the results obtained using our alternative definition of direct and indirect exporters. As discussed in Section 3, only firms that export exclusively via direct channels are coded as direct exporters, according to this definition.

Across all sectors, the results displayed in columns (1) and (4) suggest that an increase in the source specific fixed costs of exporting is associated with an increase in the average productivity of direct exporters, relative to non-exporters. The results, for the manufacturing sector, displayed in columns (2) and (5), are less clear as no statistical significance is found for the interaction term between direct exporters and trade costs, when we use our primary definition of firm type. However, in both cases, we see a significant effect of trade costs on the average productivity of direct exporters relative to indirect exporters in columns (3) and (6), in which the sample is limited to exporters only.[35]

While we find slight differences in the effects of trade costs for direct exporters across the various specifications, the equivalent results for indirect exporters are unambiguous and indicate that source specific trade costs do not affect the productivity levels of indirect exporters. Referring back to the model presented in Section 2, this may be due to intermediaries assisting indirect exporters in dealing with such costs.

[35] In order to examine this further we tried excluding each industry as the trade costs may impact firms' ability to export differently across industries. Once we exclude the food industry (ISIC 15), we find that the interaction term in column (2) is significant at the 5% level. See Table A8 in the appendix.

Finally, we display the results of the propensity score matching for each quartile of trade costs in Table 13. The average treatment effects are estimated using calibre matching with a threshold of 0.001 and refer to our primary definition of firm types. In panel A, we focus on the treatment effect of exporting directly compared to indirectly. With the exception of the second quartile, for which no significant difference in productivities between the two groups is found, the results indicate an increasing treatment effect across the quartiles. In panel B, where the control group used is non-exporters, we also find the strongest effect in the fourth quartile. Finally, in panel C, where indirect exporters are compared to non-exporters, no significance is found.

While these results support the general findings from our regression analysis, it should be mentioned that the quality of the matching is not as good as for our baseline model (see Table A9 – A12 in the appendix). One reason for this may be that we use a slightly higher threshold than in the baseline as we have fewer observations per quartile. The lesser quality of the matching may be part of the reason why we find a significantly larger treatment effect of exporting directly in panel A than in panel B, which contrasts with the general sorting pattern found.

6. Conclusion

The purpose of this paper has been to directly examine the proposed productivity sorting of direct, indirect and non-exporters, using firm-level data from 105 developing and transition countries. The results obtained using both regression analysis and propensity score matching indicate a significant productivity difference between direct exporters and both indirect and non-exporters, while only the results obtained using regression analysis support a similar hierarchy between indirect and non-exporters. This then adds to the indirect tests used

by Ahn, Khandelwal and Wei (2011) and Crozet, Lalanne, and Poncet (2010) and the descriptive analysis of McCann (2010).

Furthermore, we have shown that source-specific trade costs are associated with an increase in the average productivity premium of direct exporters relative to both indirect and non-exporters. This result suggests that such costs may increase the productivity threshold for exporting via direct channels only, causing a larger share of exporters to make use of a trade intermediary. As indirect exports may be relatively less competitive in the international market, due to the mark-up charged by trade intermediaries, the implication of these results are straight forward. By ensuring that domestically created trade costs are kept at a minimum, governments may facilitate exports through direct channels and thereby increase the competitiveness of domestically produced goods on the international market. Furthermore, whereas lowering overseas trade barriers requires a country to negotiate with its trade partners, lowering outbound trade costs do not. Therefore source-specific barriers are possibly easier to address than the destination-specific ones.

References

Abel-Koch, Jennifer. 2010. "Firm Size and the Choice of Export Mode". Mimeo, University of Mannheim Centre for Doctoral Studies in Economics.

Ahn, JaeBin, Amit K. Khandelwal, and Shang-Jin Wei. 2011. "The role of intermediaries in facilitating trade". *Journal of International Economics,* 84, 73-85.

Akerman, Anders. 2010. "Wholesalers and economies of Scope in International Trade". Research papers in Economics, Department of Economics, Stockholm University 2010:1.

Bernard, Andrew B., J. Bradford Jensen, Stephen J. Redding and Peter K. Schott. 2010. "Intermediation in International Trade". *American Economic Review: Papers & Proceedings.*

Bernard, Andrew B., Marco Grazzi, Chiara Tomasi. 2011 "Intermediaries in International Trade: Direct versus Indirect Modes of Export". Working Paper, University of Trento, Department of Economics 16/2010.

Biglaiser, Gary. 1993. "Middlemen as experts". *RAND Journal of Economics.* Vol. 24, No. 2.

Caliendo, Marco and Sabine Kopeinig. 2008. "Some Practical Guidance for the Implementation of propensity Score Matching". *Journal of Economic Surveys.* Vol. 22, No. 1, pp. 31 -72.

Crozet, Matthieu, Guy Lalanne and Sandra Poncet. 2012. "Wholesalers in International Trade." Working paper.

Davies, Ronald B. and Lourenço S. Paz. 2011. "Tariffs vs. VAT in the Presence of Heterogeneous Firms," *International Tax and Public Finance*, 18(5), 533-554.

Demidova, S. and A. Rodriguez-Clare. 2009. "Trade policy under firm-level heterogeneity in a small economy." Journal of International Economics 78, 100-112

Felbermayr, Gabriel J. and Benjamin Jung. 2011. "Trade intermediation and the organization of exporters". Tübinger Diskussionsbeitrag Nr. 331.

Flam, H., and E. Helpman. 1987. "Industrial policy under monopolistic competition." *Journal of International Economics, 22*, 79–102.

McCann, Fergal. 2010. "Indirect Exporters". CEPII, Working paper No. 2010-22.

Melitz, Marc J. 2003. "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Preoductivity". *Econometrica.* Vol 71(6) pp 1695-1725.

Mengistae, Taye and Catherine Pattillo. 2004. "Export Orientation and Productivity in Sub-Saharan Africa." IMF Staff Papers, Palgrave MacMillan, vol. 51(2).

Moulton, Brent R. 1990. "An Illustration of a Pitfall in Estimating the Effects of Aggregate variables on Micro Units". *Review of Economics and Statistics.* Vol 72(2).

Pavcnik, Nina. 2002. “Trade Liberalization, Exit and Productivity Improvements: Evidence from Chilean Plants”. *The Review of Economic Studies,* 69(1), pp. 245 – 276.

Petropoulou, Dimitra. 2007. “Information Costs, Networks and Intermediation in International Trade.” CEP Discussion paper No. 848, Centre for Economic Performance, London School of Economics and Political Science.

Rauch, James E. and Joel Watson. 2004. “Network Intermediaries in International Trade”. *Journal of Economics & Management Strategy.* Vol. 13, pp. 69-93.

Tang, Heiwai and Yifan Zhang. 2011. Working paper.

Vyas, Seema and Lilani Kumaranayake. 2006. “How to do (or not to do)…Constructing socio-economic status indices: how to use principal components analysis.” Oxford University Press.

Wagner, Joachim (2007): Exports and Productivity: A survey of the Evidence from Firm-level Data. *The World Economy.*

World Bank. 2012a. “Doing Business.” http://www.doingbusiness.org/

World Bank. 2012b. “Enterprise Surveys.” http://www.enterprisesurveys.org/

World Bank. 2012c. “World Development Indicators.” http://data.worldbank.org/indicator

Figure 1: Relative indices of firm structures.

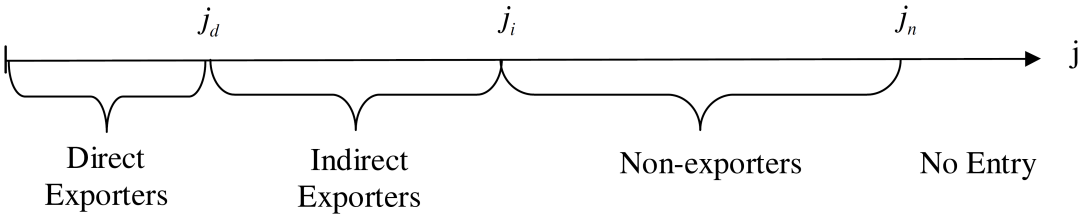

Figure 2: Impact of an increase in red tape

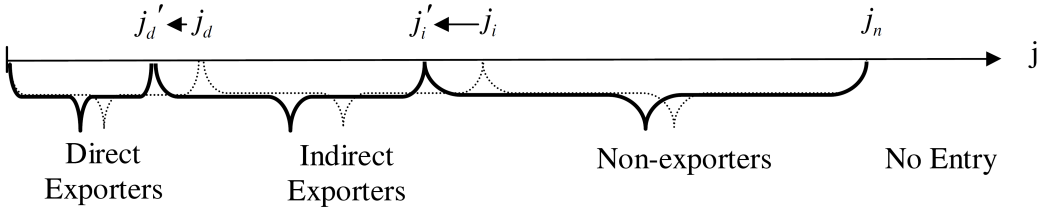

Figure 3: Kernel Density Estimate

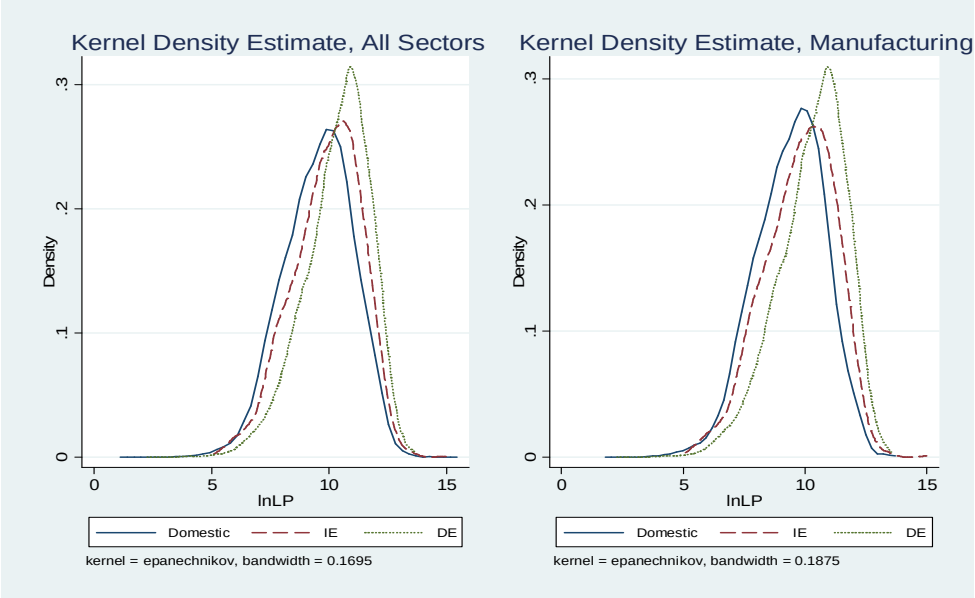

Table 1: Year of Survey and Number of Observations by Country

Country	Year	N	Country	Year	N	Country	Year	N
Afghanistan	2008	378	Gabon	2009	88	Niger	2009	119
Albania	2007	194	Gambia	2006	132	Nigeria	2007	1656
Angola	2006	365	Georgia	2008	233	Panama	2006	386
Argentina	2010	885	Grenada	2010	129	Paraguay	2006	382
Armenia	2009	253	Guatemala	2006	428	Peru	2010	839
Azerbaijan	2009	319	Guinea	2006	204	Philippines	2009	1017
Bahamas	2010	120	Guinea Bissau	2006	118	Poland	2009	245
Bangladesh	2007	1345	Guyana	2010	132	Romania	2009	326
Belarus	2008	214	Honduras	2006	349	Russia	2009	684
Benin	2009	102	Hungary	2009	264	Rwanda	2006	184
Bhutan	2009	226	Indonesia	2009	299	Samoa	2009	66
Bolivia	2006	432	Ivory Coast	2009	386	Senegal	2007	473
Bosnia & Herzegov.	2009	225	Jamaica	2010	312	Serbia	2009	337
Botswana	2006	292	Kazakhstan	2009	383	Sierra Leone	2009	108
Brazil	2009	1486	Kenya	2007	585	Slovak Republic	2009	179
Bulgaria	2007	933	Kosovo	2009	208	Slovenia	2009	254
Burkina Faso	2009	305	Kyrgyz Rep.	2009	157	South Africa	2007	896
Burundi	2006	220	Lao PDR	2009	327	St. Kitts and Nevis	2010	119
Cameroon	2009	285	Latvia	2009	238	St.Vinc. & Gren.	2010	133
Cape Verde	2009	132	Lesotho	2009	112	Swaziland	2006	256
Chad	2009	136	Liberia	2009	83	Tajikistan	2008	246
Chile	2010	868	Lithuania	2009	235	Tanzania	2006	379
Colombia	2006	890	Madagascar	2009	315	Timor Leste	2009	30
Congo	2009	91	Malawi	2009	111	Togo	2009	111
Costa Rica	2010	341	Mali	2007	469	Tonga	2009	137
Croatia	2007	535	Mauritania	2006	174	Trinidad & Tobago	2010	294
Czech Republic	2009	174	Mauritius	2009	330	Turkey	2008	819
DRC	2006	292	Mexico	2010	1200	Uganda	2006	489
Dominican Republic	2010	317	Moldova	2009	328	Ukraine	2008	547
Ecuador	2006	507	Mongolia	2009	240	Uruguay	2006	458
El Salvador	2006	578	Montenegro	2009	75	Uzbekistan	2008	333
Eritrea	2009	107	Mozambique	2007	418	Vanuatu	2009	95
Estonia	2009	245	Namibia	2006	261	Vietnam	2009	924
Fiji	2009	77	Nepal	2009	330	Yemen	2010	262
FYR Macedonia	2009	288	Nicaragua	2006	368	Zambia	2007	461
			Total	38452				

Table 2: Relative frequency of firm type and share of total sales by region

Firm type	Geographical Region					
Panel A: Observations (Relative frequency) by firm type						
	All	Sub-Saharan Africa	East Asia and Pacific	Eastern Europe and Central Asia	Latin America and Caribbean	South Asia
Non-exporter	29589 (0.77)	9921 (0.88)	2167 (0.73)	6851 (0.70)	8638 (0.72)	1768 (0.78)
Indirect exporter	1963 (0.05)	375 (0.03)	218 (0.07)	492 (0.05)	762 (0.06)	109 (0.05)
Direct exporter	6900 (0.18)	949 (0.08)	587 (0.20)	2398 (0.25)	2553 (0.21)	402 (0.18)
Panel B: Share of total regional sales by firm type						
Non-exporter	0.44	0.54	0.32	0.45	0.44	0.31
Indirect exporter	0.07	0.08	0.06	0.05	0.08	0.08
Direct exporter	0.49	0.38	0.62	0.50	0.48	0.62

Notes: (1) Direct exporters are defined as firms which export any share of total sales directly, while indirect exporters are those that exclusively export via intermediaries. (2) The total share of sales, displayed in panel B, include all sales by firm type, which means that the share of sales by either type of exporter include both domestic sales as well as exports. (3) The region of the Middle East and Northern Africa is not included as there is only one country (Yemen) included in the dataset for this region. (4) Due to the rounding of decimals, the regional sum of shares does not always add up to 1.

Table 3: Kolmogorov-Smirnov test

	All Sectors		Manufacturing Sector	
	Difference	P-value	Difference	P-value
IE vs. NE	0.11	0.000	0.12	0.000
IE vs. DE	0.13	0.000	0.16	0.000

Notes: The distributions of labour productivity for indirect exporters and non-exporters are compared in the first row, while those of indirect and direct exporters are compared in the second row.

Table 4: Trade costs

Panel A: Summary statistics					
Variable	Observations	Mean	Std. Dev.	Min	Max
Cost to export	38244	1315.33	656.19	500	5367
Documents to export	38244	7.44	1.99	3	14
Time to export	38244	28.16	15.38	5	89

Panel B: Correlation Matrix			
	Cost to export	Doc. to export	Time to export
Cost to export	1		
Documents to export	0.38	1	
Time to export	0.70	0.49	1

Table 5: Principal component analysis

Panel A:	(1)	(2)
Number of observations		38244
Retained factors		1
No. parameters		3
Panel B:	Variance (eigenvalue)	Proportion
Factor 1	2.06	0.69
Factor 2	0.66	0.22
Factor 3	0.29	0.10
Panel C:		
Variables	Factor 1 Loadings	Uniqueness
Cost to export	0.85	0.27
Documents to export	0.72	0.48
Time to export	0.90	0.19

Notes: The factor analysis is performed on the correlation matrix, and the variables are therefore not standardized first.

Table 6: Relative frequency of firm type by quartiles of trade costs

Firm Type	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Non-exporter	0.68	0.73	0.80	0.88
Indirect exporter	0.07	0.06	0.04	0.04
Direct exporter	0.26	0.21	0.16	0.09

Notes: Direct exporters are defined as firms which export any share of total sales directly, while indirect exporters are those that exclusively export via intermediaries. See table A1 in the appendix for a list of countries in each quartile.

Table 7: Control variables (mean across firm types)

Variables	(1) Non-exporters (NE)	(2) Indirect exporters (IE)	(3) Direct exporters (DE)	(4) Difference NE vs. IE	(5) Difference IE vs. DE
Employment	62.04	141.53	273.61	-79.49***	-132.2***
Foreign	0.08	0.16	0.24	-0.08***	-0.08***
Quality Cert.	0.13	0.28	0.45	-0.15***	-0.16***
Age	16.05	19.92	23	-3.86***	-3.1***
Multi-product	0.61	0.64	0.66	-0.03**	-0.02*
License	0.11	0.2	0.24	-0.09***	-0.04***
Import	0.22	0.38	0.67	-0.17***	-0.29***

Results are based on a t-test assuming equal variance for the two groups of firms compared.*** p<0.01, ** p<0.05, * p<0.1. Direct exporters are defined as firms which export any share of total sales directly, while indirect exporters are those that exclusively export via intermediaries.

Table 8: Baseline model (OLS)

Dependent variable: Labour productivity (log)				
	All Sectors		Manufacturing Sector	
	(1)	(2)	(3)	(4)
Indirect exporter	0.190***	0.0708***	0.221***	0.0814***
	(0.0259)	(0.0269)	(0.0293)	(0.0302)
Direct exporter	0.437***	0.241***	0.512***	0.183***
	(0.0159)	(0.0180)	(0.0177)	(0.0211)
Employment (log)		0.0649***		0.0392***
		(0.00540)		(0.00707)
Foreign owned		0.259***		0.166***
		(0.0207)		(0.0249)
Quality certificate		0.223***		0.218***
		(0.0170)		(0.0205)
Age (log)		0.0499***		0.0394***
		(0.00807)		(0.00954)
Multi-product		0.0851***		0.0600***
		(0.0133)		(0.0159)
Foreign License				0.0950***
				(0.0219)
Importer				0.369***
				(0.0190)
Constant	9.718***	9.332***	8.619***	8.119***
	(0.636)	(0.621)	(0.312)	(0.381)
Observations	38,452	30,163	22,210	19,212
No. Countries	105	100	105	99
R-squared	0.474	0.503	0.496	0.539
F-test for equality of coefficients between indirect and direct exporters				
F	77.7	34.78	87.68	10
P-value	0.000	0.000	0.000	0.0016

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All regressions include country, industry (2-digit) and year fixed effects. Direct exporters are defined as firms which export any share of total sales directly, while indirect exporters are those that exclusively export via intermediaries. The number of countries differs across the columns as some countries do not have any observations, for which at least one of the firm-level control variables are not missing. Countries excluded in column (2) are Congo, Gabon, Lesotho, Liberia and Sierra Leone. In column (4) countries excluded include those as well as Lao PDR.

Table 9: Baseline Results by region (all Sectors)

Dependent variable: Labour productivity (log)					
	AFR	EAP	ECA	LAC	SAR
	(1)	(2)	(3)	(4)	(5)
Indirect exporter	0.129**	-0.169*	0.0700	0.0737*	0.336***
	(0.0623)	(0.0887)	(0.0496)	(0.0444)	(0.113)
Direct exporter	0.152***	-0.0398	0.252***	0.283***	0.623***
	(0.0451)	(0.0709)	(0.0297)	(0.0305)	(0.0835)
Employment (log)	0.106***	0.0361*	0.0307***	0.0952***	0.0418*
	(0.0134)	(0.0209)	(0.00885)	(0.00948)	(0.0232)
Foreign owned	0.334***	0.346***	0.208***	0.219***	0.0530
	(0.0394)	(0.0684)	(0.0375)	(0.0384)	(0.137)
Quality certificate	0.347***	0.353***	0.164***	0.190***	0.270***
	(0.0400)	(0.0626)	(0.0271)	(0.0303)	(0.0785)
Age (log)	0.0619***	0.0697**	-0.0261*	0.0785***	0.109***
	(0.0158)	(0.0302)	(0.0154)	(0.0144)	(0.0303)
Multi-product	0.0888***	0.145***	0.121***	0.0270	0.0216
	(0.0281)	(0.0490)	(0.0220)	(0.0256)	(0.0489)
Constant	9.258***	7.041***	9.124***	9.028***	10.28***
	(1.046)	(1.184)	(0.998)	(0.739)	(1.022)
Observations	6,780	2,812	9,191	9,177	1,946
R-squared	0.422	0.321	0.472	0.459	0.303
F-test for equality of coefficients between indirect and direct exporters					
F	0.10	1.73	12.77	18.80	6.07
P-value	0.7477	0.1880	0.000	0.000	0.0138

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. All regressions include country, industry (2-digit) and year fixed effects. Direct exporters are defined as firms which export any share of total sales directly, while indirect exporters are those that exclusively export via intermediaries. "AFR" = Sub-Saharan Africa, "EAP" = East Asia and Pacific, "ECA" = Eastern Europe and Central Asia, "LAC" = Latin America and Caribbean, "SA" = South Asia. The region of the Middle East and Northern Africa is not included as there is only one country (Yemen) included in the dataset for this region.

Table 10: Matching results for all firms (outcome variable labour productivity (log))

Method	Outcome Treatment	Outcome Control	ATT	Std. Error	p-value
Panel A: Direct vs. indirect exporters					
Nearest-Neighbour	10.37 (N = 6113)	10.17 (N = 1719)	0.196	0.066	0.003
Caliper (0.001)	10.35 (N = 5884)	10.15 (N = 1719)	0.205	0.051	0.000
Caliper (0.0001)	10.31 (N = 2696)	10.08 (N = 1719)	0.223	0.073	0.002
Kernel (epanechnikov)	10.37 (N = 6113)	10.15 (N = 1719)	0.223	0.047	0.000
Panel B: Direct exporters vs. Non-exporters					
Nearest-Neighbour	10.36 (N = 6098)	10.20 (N = 22250)	0.164	0.046	0.000
Caliper (0.001)	10.35 (N = 5849)	10.18 (N = 22250)	0.171	0.042	0.000
Caliper (0.0001)	10.29 (N = 3988)	10.04 (N = 22250)	0.253	0.046	0.000
Kernel (epanechnikov)	10.36 (N = 6098)	10.25 (N = 22250)	0.116	0.023	0.000
Panel C : Indirect exporters vs. Non-exporters					
Nearest-Neighbour	9.87 (N = 1715)	9.87 (N = 21868)	-0.006	0.056	0.910
Caliper (0.001)	9.87 (N = 1665)	9.86 (N = 21868)	0.015	0.058	0.800
Caliper (0.0001)	9.86 (N = 1463)	9.81 (N = 21868)	0.045	0.060	0.454
Kernel (epanechnikov)	9.87 (N = 1715)	9.84 (N = 21868)	0.029	0.031	0.364

Notes: (1) "ATT" refers to the Average Treatment effect on the Treated. (2) The order in which the data are sorted is random. (3) N equals the number of observations within the region of common support. (4) Standard errors are obtained using bootstrapping with 50 repetitions.

Table 11: Sensitivity checks (Caliper = 0.0001)

Variable	Unmatched			Matched		
	Treated	Control	T (p-value)	Treated	Control	T (p-value)
Panel A: Direct vs. Indirect Exporters						
Employment (log)	4.496	3.714	19.74 (0.000)	4.378	4.357	0.53 (0.596)
Employment^2 (log)	22.356	15.779	18.03 (0.000)	21.155	20.952	0.57 (0.568)
Foreign	0.239	0.148	8.15 (0.000)	0.202	0.193	0.79 (0.432)
Quality Cert	0.448	0.277	12.83 (0.000)	0.404	0.424	-1.47 (0.143)
Age (log)	2.815	2.649	7.42 (0.000)	2.791	2.792	-0.09 (0.932)
Age^2 (log)	8.582	7.736	6.78 (0.000)	8.453	8.457	-0.03 (0.974)
Multiproduct	0.662	0.639	1.73 (0.084)	0.647	0.633	1.11 (0.269)
Pseudo R^2 (Raw)	0.115					
Pseudo R^2 (Matched)	0.018					
LR chi2 (p>chi2) (Raw)	952.03 (0.000)					
LR chi^2 (p>chi^2) (Matched)	137.70 (0.372)					
Panel B: Direct Exporters vs. Non-exporters						
Employment (log)	4.493	3.045	78.16 (0.000)	4.034	4.039	-0.18 (0.856)
Employment^2 (log)	22.328	10.792	77.40 (0.000)	18.069	18.255	-0.69 (0.492)
Foreign	0.240	0.073	38.00 (0.000)	0.161	0.162	-0.06 (0.952)
Quality Cert	0.449	0.135	57.23 (0.000)	0.325	0.353	-2.56 (0.011)
Age (log)	2.814	2.489	27.13 (0.000)	2.746	2.740	0.33 (0.738)
Age^2 (log)	8.578	6.895	27.67 (0.000)	8.182	8.158	0.24 (0.809)
Multiproduct	0.661	0.606	7.79 (0.000)	0.654	0.655	-0.12 (0.906)
Pseudo R^2 (Raw)	0.343					
Pseudo R^2 (Matched)	0.009					
LR chi^2 (p>chi^2) (Raw)	10174.94 (0.000)					
LR chi^2 (p>chi^2) (Matched)	103.43 (0.988)					

Panel C: Indirect Exporters vs. Non-exporters						
Employment (log)	3.712	3.054	21.03 (0.000)	3.522	3.509	0.26 (0.796)
Employment^2 (log)	15.764	10.855	20.78 (0.000)	14.154	14.142	0.03 (0.976)
Foreign	0.148	0.073	11.24 (0.000)	0.122	0.131	-0.72 (0.470)
Quality Cert	0.277	0.135	16.16 (0.000)	0.234	0.232	0.13 (0.896)
Age (log)	2.648	2.489	7.58 (0.000)	2.641	2.636	0.15 (0.881)
Age^2 (log)	7.733	6.897	8.06 (0.000)	7.707	7.708	-0.01 (0.995)
Multiproduct	0.639	0.606	2.78 (0.005)	0.647	0.639	0.42 (0.671)
Pseudo R^2 (Raw)	0.157					
Pseudo R^2 (Matched)	0.018					
LR chi^2 (p>chi^2) (Raw)	1937.48 (0.000)					
LR chi^2 (p>chi^2) (Matched)	72.83 (1.00)					

Notes: The upper part of each panel shows the differences in covariates before and after matching, while the lower part of each panel contain the Pseudo R^2 values obtained from a probit regression on the unmatched and matched sample. Below that, the results from the likelihood ratio test are displayed.

Table 12: Extended model including trade costs

Dependent variable: Labour productivity (log)						
	Primary def. of export mode			Alternative def. of export mode		
	All sectors	Manufacturing		All sectors	Manufacturing	
	All firms	All firms	Exporters	All firms	All firms	Exporters
	(1)	(2)	(3)	(4)	(5)	(6)
IE	0.0589	0.0610		0.0938**	0.0773*	
	(0.0443)	(0.0490)		(0.0361)	(0.0421)	
DE	0.259***	0.196***	0.241***	0.278***	0.215***	0.208***
	(0.0320)	(0.0369)	(0.0333)	(0.0343)	(0.0382)	(0.0304)
IE * Trade costs	-0.0407	-0.0686		-0.0170	-0.0348	
	(0.0419)	(0.0438)		(0.0329)	(0.0333)	
DE * Trade costs	0.0576**	0.0450	0.131***	0.0664**	0.0550*	0.0972**
	(0.0267)	(0.0290)	(0.0401)	(0.0291)	(0.0322)	(0.0407)
Employment (log)	0.0645***	0.0390**	-0.0385*	0.0643***	0.0383**	-0.0385*
	(0.0117)	(0.0167)	(0.0199)	(0.0117)	(0.0166)	(0.0197)
Foreign owned	0.260***	0.167***	0.191***	0.258***	0.165***	0.188***
	(0.0292)	(0.0263)	(0.0364)	(0.0291)	(0.0263)	(0.0365)
Quality cert.	0.224***	0.219***	0.223***	0.227***	0.221***	0.229***
	(0.0209)	(0.0261)	(0.0307)	(0.0208)	(0.0260)	(0.0305)
Age (log)	0.0488***	0.0381**	0.0673***	0.0491***	0.0386**	0.0690***
	(0.0146)	(0.0158)	(0.0181)	(0.0146)	(0.0157)	(0.0183)
Multi-product	0.0844***	0.0604***	0.0218	0.0860***	0.0616***	0.0282
	(0.0154)	(0.0168)	(0.0262)	(0.0153)	(0.0168)	(0.0259)
Foreign license		0.0930***	0.0868***		0.0937***	0.0877***
		(0.0243)	(0.0321)		(0.0242)	(0.0323)
Importer		0.370***	0.254***		0.369***	0.258***
		(0.0305)	(0.0390)		(0.0303)	(0.0383)
Constant	8.884***	7.737***	9.098***	8.872***	7.737***	9.083***
	(0.658)	(0.527)	(0.348)	(0.658)	(0.528)	(0.348)
Observations	29,986	19,159	6,159	29,986	19,159	6,159
R-squared	0.504	0.540	0.575	0.504	0.540	0.575
Number of clusters	99	98	96	99	98	96

Notes: Standard errors are clustered by country and shown in parentheses. All regressions include country, industry (2-digit) and year fixed effects. In columns (1) ,(2) and (3) direct exporters are defined as firms which export any share of total sales directly, while indirect exporters are those that exclusively export via intermediaries. In columns (4), (5) and (6) direct exporters are defined as firms which exclusively export via direct channels. *** p<0.01, ** p<0.05, * p<0.1.

Table 13: Matching by quartiles, Caliper (0.001), all sectors

Quartiles	Treatment	Control	ATT	Std. error	P-value
Panel A: Direct vs. indirect exporters					
1st Quartile	10.68 (N = 1987)	10.49 (N = 615)	0.193	0.096	0.045
2nd Quartile	9.94 (N = 1313)	9.77 (N = 477)	0.174	0.119	0.144
3rd Quartile	10.47 (N = 760)	10.21 (N = 343)	0.261	0.155	0.092
4th Quartile	9.87 (N = 314)	9.49 (N = 272)	0.383	0.200	0.056
Panel B: Direct exporters vs. Non-exporters					
1st Quartile	10.70 (N = 2026)	10.51 (N = 5979)	0.186	0.059	0.002
2nd Quartile	10.00 (N = 1434)	9.88 (N = 5607)	0.125	0.085	0.142
3rd Quartile	10.42 (N = 943)	10.23 (N = 4708)	0.191	0.063	0.003
4th Quartile	9.85 (N = 567)	9.60 (N = 5795)	0.245	0.094	0.009
Panel C: Indirect exporters vs. Non-exporters					
1st Quartile	10.32 (N = 571)	10.36 (N = 5965)	-0.031	0.109	0.774
2nd Quartile	9.63 (N = 419)	9.53 (N = 5294)	0.092	0.129	0.474
3rd Quartile	9.90 (N = 325)	9.89 (N = 4693)	0.001	0.104	0.989
4th Quartile	9.20 (N = 253)	9.16 (N = 5662)	0.041	0.115	0.722

Notes: (1) "ATT" refers to the Average Treatment effect on the Treated. (2) The order with which the data is sorted is random. (3) N equals the number of observations within the region of common support. (4) Standard errors are obtained using bootstrapping with 50 repetitions.

Appendix

Data Cleaning:

The raw dataset was comprised of 61332 observations covering 108 countries. Out of these we drop all observations for Ghana and Venezuela due to unreliable sales values. In addition all observations for Micronesia are dropped, as no consumer price index is available for this country. Following each survey, the interviewer is asked to comment on his/hers perception of the truthfulness of the answers provided. Using this information, we furthermore drop all observations deemed to have answered the questions untruthfully or provided arbitrary and unreliable figures pertaining to e.g. sales values etc. In total this affects 7.8% of the raw data. After deflating all sales values, reported in local currencies, by the annual country specific consumer price index and converting all monetary values to US dollars, we impose a lower bound on the sales values included and drop all observations with annual sales less than 100 dollars. Likewise, we drop any observations which report sales values in excess of the country's GDP. In total these criteria leads to a loss of only 33 observations. For any country in which surveys have taken place twice during the time period, we keep only the largest survey round, as no information is available on the share of firms interviewed more than once. By doing this, we lose an additional 9260 observations.

In order to avoid the analysis being driven by outliers, we furthermore drop any observations with a labour productivity lower than the 25^{th} percentile minus three times the interquartile range (75^{th} percentile – 25^{th} percentile) or higher than the 75^{th} percentile plus three times the interquartile range, for a given country (Figure A1 gives an overview of the distribution of labour productivity in each countries after outliers have been dropped.). Defining outliers according to this methodology leads to a loss of a further 2451 observations. Finally, of the remaining observations we lose an additional 12% due to missing information regarding either export mode if the firm is an exporter, industry code, sales or employment figures. In total, this leaves us with 38452 observations covering 105 countries.[36]

Fixed Effects and Trade Costs

In the analysis, due to the lack of time variation by country, by using country dummies we are not able to include trade costs as a control. Here, investigate the impact of trade costs on country-wide productivity by plotting the country fixed effects obtained from the following regression

$$\ln LP_{ijk} = \beta_0 + \beta_1 IE_{ijk} + \beta_2 TC_k * IE_{ijk} + \beta_3 DE_{ijk} + \beta_4 TC_k * DE_{ijk} + \delta_k + \varepsilon_{ijk}$$

against our measure of trade costs. As one might well expect, Figure A2 shows that countries with higher trade barriers tend to have lower fixed effects. This is confirmed by regressing the fixed effects on trade costs. This suggests that countries with high exporting costs have lower productivities for all firm types.

[36] Industry code is determined by the 2-digit sector code as oppose to the 4-digit code of the firm's main product. The authors of the survey recommend using the latter, as this is more precise measure. However, a relatively large share of this variable is missing, we use the sector codes.

Figure A2: Fixed Effects and Trade Costs

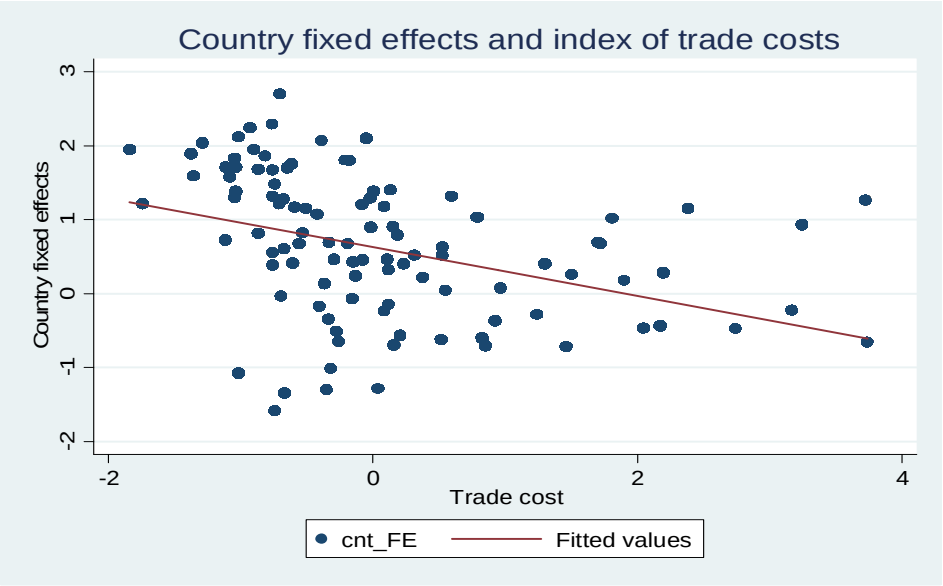

Table A1: Countries by quartiles of trade cost

1st Quartile (N = 9889): Bahamas, Bosnia and Herzegovina, Cape Verde, Chile, Czech Republic, Dominican Republic, El Salvador, Estonia, Hungary, Indonesia, Latvia, Lithuania, Mauritius, Mexico, Montenegro, Panama, Peru, Poland, Romania, Serbia, St. Kitts and Nevis, St. Vincent and Grenadines, Tonga, Trinidad and Tobago, Turkey, Vietnam.
2nd Quartile (N = 9790): Albania, Armenia, Bangladesh, Brazil, Bulgaria, Costa Rica, Croatia, FYR Macedonia, Gabon, Gambia, Georgia, Grenada, Guinea, Guinea Bissau, Guyana, Honduras, Madagascar, Mozambique, Philippines, Samoa, Slovak Republic, Slovenia, Tanzania, Timor Leste, Togo, Yemen.
3rd Quartile (N = 9170): Argentina, Belarus, Benin, Bolivia, Cameroon, Colombia, Ecuador, Fiji, Guatemala, Jamaica, Lesotho, Liberia, Moldova, Nicaragua, Nigeria, Senegal, Sierra Leone, South Africa, Ukraine, Uruguay, Vanuatu.
4th Quartile (N = 9311): Afghanistan, Angola, Azerbaijan, Bhutan, Botswana, Burkina Faso, Burundi, Chad, Congo, DRC, Eritrea, Ivory Coast, Kazakhstan, Kenya, Kyrgyz Republic, Lao PDR, Malawi, Mali, Mauritania, Mongolia, Namibia, Nepal, Niger, Paraguay, Russia, Rwanda, Swaziland, Tajikistan, Uganda, Uzbekistan, Zambia.

Table A2: Description of covariates

Variable:	Description
Labour productivity (log)	ln (Sales/ employment)
DE	See definition page
IE	See definition page
Employment (log)	ln (Number full-time employees)
Foreign owned	1 if foreign enterprises, individuals or organisations own at least 10% of the firm, 0 otherwise.
Quality certificate	1 if the firm has an internationally recognised quality certificate, 0 otherwise.
Age (log)	Survey year - year the firm was established.
Multi-product	1 if less than 100% of total annual sales come from the firm's primary product, 0 otherwise.
Foreign License	1 if the firm uses technology licensed from a foreign-owned company, 0 otherwise.
Importer	1 if the firm directly imports any material inputs or supplies. 0 otherwise.

Notes: All variables are taken from the 'standardized' dataset 2006 – 2011, obtained from the World Bank's Enterprise Surveys. 'Foreign License' and 'Importer' are only available for the manufacturing sector (15 – 37 ISIC REV. 3.1).

Table A3: Alternative definition of direct and indirect Exporters

Dependent variable: Labour productivity (log)				
	All Sectors		Manufacturing Sector	
	(1)	(2)	(3)	(4)
Indirect exporter	0.248***	0.101***	0.293***	0.0903***
	-0.0214	-0.0225	-0.024	-0.0254
Direct exporter	0.452***	0.256***	0.530***	0.198***
	-0.0169	-0.019	-0.0188	-0.022
Employment (log)		0.0649***		0.0387***
		-0.00539		-0.00707
Foreign owned		0.257***		0.165***
		-0.0207		-0.0249
Quality certificate		0.225***		0.220***
		-0.017		-0.0205
Age (log)		0.0502***		0.0397***
		-0.00807		-0.00954
Multi-product		0.0867***		0.0614***
		-0.0133		-0.0159
Foreign License				0.0952***
				-0.0219
Importer				0.369***
				-0.0189
Constant	9.705***	9.318***	8.693***	8.112***
	-0.636	-0.621	-0.28	-0.381
Observations	38,452	30,163	22,210	19,212
No. countries	105	100	105	99
R-squared	0.474	0.503	0.495	0.539
F-test for equality of coefficients between indirect and direct exporters				
F	69.81	38.27	78.77	15.21
P-value	0.0000	0.0000	0.0000	0.0001

Notes: In this table, we present the results of the baseline regression using our alternative definition of direct and indirect exporters. A firm is defined as being a direct exporter only if all exports are sold directly. Any firm that exclusively export indirectly or make use of both modes are classified as an indirect exporter. Standard errors in parentheses. All regressions include industry (2-digit), country and year fixed effects. *** p<0.01, ** p<0.05, * p<0.1.

Table A4: Baseline results using the whole sample

Dependent variable: Labour productivity (log)				
	All Sectors		Manufacturing Sector	
	(1)	(2)	(3)	(4)
Indirect exporter	0.180***	0.0599**	0.201***	0.0566**
	(0.0234)	(0.0244)	(0.0265)	(0.0273)
direct exporter	0.440***	0.246***	0.514***	0.180***
	(0.0143)	(0.0163)	(0.0159)	(0.0189)
Employment (log)		0.0670***		0.0416***
		(0.00489)		(0.00637)
Foreign owned		0.246***		0.168***
		(0.0189)		(0.0228)
Quality certificate		0.218***		0.216***
		(0.0154)		(0.0185)
Age (log)		0.0521***		0.0424***
		(0.00737)		(0.00865)
Multi-product		0.0952***		0.0625***
		(0.0121)		(0.0143)
Foreign License				0.0872***
				(0.0199)
Importer				0.375***
				(0.0171)
Constant	9.712***	9.424***	9.686***	9.119***
	(0.631)	(0.660)	(0.420)	(0.473)
Observations	45,632	35,932	26,639	23,092
No. countries	105	100	105	99
R-squared	0.465	0.488	0.482	0.525
F-test for equality of coefficients between indirect and direct exporters				
F	105.46	50.01	124.54	17.92
P-value	0.000	0.000	0.000	0.000

Notes: In this table, we present the results of the baseline regression using the whole sample. This means that we do not drop any waves for countries that have been surveyed more than once during the time period. As is clear from the results, this does not cause any major changes to the key results. Standard errors in parentheses. All regressions include industry (2-digit), country and year fixed effects. *** p<0.01, ** p<0.05, * p<0.1.

Table A5: Baseline results including potential outliers

Dependent variable: Labour productivity (log)				
	All Sectors		Manufacturing Sector	
	(1)	(2)	(3)	(4)
Indirect exporter	0.254***	0.104***	0.276***	0.118***
	(0.0293)	(0.0303)	(0.0326)	(0.0334)
direct exporter	0.547***	0.302***	0.621***	0.252***
	(0.0178)	(0.0200)	(0.0195)	(0.0231)
Employment (log)		0.0584***		0.0268***
		(0.00604)		(0.00780)
Foreign owned		0.401***		0.279***
		(0.0226)		(0.0269)
Quality certificate		0.303***		0.289***
		(0.0189)		(0.0225)
Age (log)		0.0570***		0.0530***
		(0.00906)		(0.0106)
Multi-product		0.0742***		0.0466***
		(0.0149)		(0.0177)
Foreign License				0.141***
				(0.0240)
Importer				0.398***
				(0.0209)
Constant	9.096***	8.827***	9.196***	7.464***
	(0.741)	(0.728)	(0.301)	(0.446)
Observations	40,836	31,956	23,267	20,097
No. countries	105	100	105	99
R-squared	0.402	0.441	0.437	0.487
F-test for equality of coefficients between indirect and direct exporters				
F	85.98	37.57	100.55	14.22
P-value	0.000	0.000	0.000	0.000

Notes: In this table, we present the results of the baseline regression, based on the sample including potential outliers. As is clear from the results, this increases the productivity premium of both direct and indirect exporters slightly, but does not change the productivity hierarchy. Standard errors in parentheses. All regressions include industry (2-digit), country and year fixed effects. *** p<0.01, ** p<0.05, * p<0.1.

Table A6: Baseline results by region (manufacturing sector only)

Dependent variable: Labour productivity (log)	AFR	EAP	ECA	LAC	SAR
	(1)	(2)	(3)	(4)	(5)
Indirect exporter	0.0417	-0.0256	0.105*	0.0722	0.507***
	(0.0642)	(0.109)	(0.0627)	(0.0477)	(0.117)
direct exporter	0.127***	-0.0737	0.247***	0.201***	0.554***
	(0.0455)	(0.0856)	(0.0414)	(0.0338)	(0.0863)
Employment (log)	0.0734***	-0.0186	0.00726	0.0555***	-0.00688
	(0.0145)	(0.0279)	(0.0143)	(0.0119)	(0.0271)
Foreign owned	0.234***	0.169*	0.139***	0.157***	0.0172
	(0.0412)	(0.0878)	(0.0526)	(0.0448)	(0.185)
Quality certificate	0.260***	0.378***	0.174***	0.181***	0.243***
	(0.0427)	(0.0798)	(0.0378)	(0.0349)	(0.0819)
Age (log)	0.0135	0.0684*	-0.00531	0.0617***	0.0918**
	(0.0163)	(0.0409)	(0.0222)	(0.0161)	(0.0360)
Foreign license	0.112***	0.00981	0.0554	0.128***	-0.0796
	(0.0432)	(0.0892)	(0.0394)	(0.0371)	(0.122)
Importer	0.331***	0.483***	0.237***	0.419***	0.404***
	(0.0371)	(0.0757)	(0.0383)	(0.0311)	(0.0744)
Multi-product	0.0545*	0.117*	0.114***	0.00658	0.0660
	(0.0289)	(0.0622)	(0.0325)	(0.0283)	(0.0550)
Constant	8.117***	11.36***	10.06***	8.890***	8.623***
	(0.947)	(1.334)	(0.566)	(0.514)	(0.912)
Observations	5,322	1,694	3,886	6,919	1,240
R-squared	0.478	0.349	0.504	0.501	0.287
F-test for equality of coefficients between indirect and direct exporters					
F	1.39	0.17	5.06	6.23	0.17
P-value	0.2377	0.6782	0.0245	0.0126	0.6829

Notes: In this table, we present the results of the baseline regression for the manufacturing sector only, by region. Standard errors in parentheses. All regressions include industry (2-digit), country and year fixed effects. "AFR" = Sub-Saharan Africa, "EAP" = East Asia and Pacific, "ECA" = Eastern Europe and Central Asia, "LAC" = Latin America and Caribbean, "SA" = South Asia. The region of the Middle East and Northern Africa is not included as there is only one country (Yemen) included in the dataset for this region. *** p<0.01, ** p<0.05, * p<0.1.

Table A7: Propensity score: (baseline, probit model)

Dependent variable:	Direct Exporter (1)	Indirect Exporter (2)	Direct Exporter (3)
Employment (log)	0.331***	0.224***	0.556***
	(0.0575)	(0.0449)	(0.0352)
Employment^2 (log)	-0.0133**	-0.00702	-0.0223***
	(0.00643)	(0.00550)	(0.00407)
Foreign owned	0.232***	0.297***	0.510***
	(0.0483)	(0.0455)	(0.0309)
Quality certificate	0.173***	0.302***	0.499***
	(0.0395)	(0.0362)	(0.0250)
Age (log)	0.328***	-0.0831	0.180***
	(0.0910)	(0.0667)	(0.0569)
Age^2 (log)	-0.0592***	0.0203	-0.0298***
	(0.0168)	(0.0130)	(0.0107)
Multi-product	-0.00208	0.127***	0.110***
	(0.0382)	(0.0303)	(0.0229)
Constant	1.413	-5.317	-3.433***
	(126.7)	(81.04)	(0.788)
Observations	7,841	23,589	28,394
Pseudo R	0.1154	0.1572	0.3431

Notes: In this table, we present the results of the probit model, used to estimate the propensity score. In column (1) we present the results of the model estimating the likelihood of being a direct exporter using only the sample of exporters. The model presented in column (2) excludes direct exporters and estimate the likelihood of being an indirect exporter compared to a non-exporter. Finally, the likelihood of being a direct exporter compared to a non-exporter is estimated in column (3). Standard errors in parentheses. All regressions include industry (2-digit), country and year fixed effects. *** p<0.01, ** p<0.05, * p<0.1.

Table A8: Dropping one industry at a time (manufacturing sector only, primary definition of direct and indirect exporters)

Dependent variable: Labour productivity (log)

Excl. Industry (ISIC Rev 3.1)	15	16	17	18	19	20	21	22	23	24	25	26
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
IE	0.0732	0.0615	0.0322	0.114**	0.0554	0.0673	0.0571	0.0593	0.0594	0.0469	0.0646	0.0790
	(0.0540)	(0.0491)	(0.0420)	(0.0546)	(0.0470)	(0.0498)	(0.0499)	(0.0501)	(0.0491)	(0.0505)	(0.0527)	(0.0504)
DE	0.175***	0.196***	0.203***	0.212***	0.182***	0.194***	0.197***	0.194***	0.195***	0.196***	0.200***	0.220***
	(0.0433)	(0.0372)	(0.0412)	(0.0340)	(0.0335)	(0.0372)	(0.0376)	(0.0377)	(0.0366)	(0.0370)	(0.0367)	(0.0370)
IE * TC	-0.00263	-0.0698	-0.0750*	-0.0964**	-0.0661	-0.0665	-0.0681	-0.0643	-0.0650	-0.0850*	-0.0781*	-0.0708
	(0.0469)	(0.0439)	(0.0438)	(0.0457)	(0.0437)	(0.0433)	(0.0461)	(0.0464)	(0.0442)	(0.0446)	(0.0469)	(0.0454)
DE * TC	0.0757**	0.0435	0.0500*	0.0367	0.0430	0.0491*	0.0429	0.0465	0.0476	0.0424	0.0334	0.0350
	(0.0342)	(0.0288)	(0.0298)	(0.0269)	(0.0277)	(0.0284)	(0.0292)	(0.0305)	(0.0289)	(0.0305)	(0.0293)	(0.0302)
Emp. (log)	0.0297	0.0388**	0.0460***	0.0534***	0.0422**	0.0373**	0.0383**	0.0359**	0.0398**	0.0397**	0.0369**	0.0312*
	(0.0194)	(0.0167)	(0.0166)	(0.0171)	(0.0170)	(0.0166)	(0.0166)	(0.0168)	(0.0165)	(0.0179)	(0.0171)	(0.0164)
Foreign owned	0.185***	0.164***	0.168***	0.174***	0.166***	0.167***	0.163***	0.169***	0.166***	0.175***	0.159***	0.154***
	(0.0294)	(0.0263)	(0.0271)	(0.0284)	(0.0266)	(0.0267)	(0.0262)	(0.0270)	(0.0263)	(0.0268)	(0.0280)	(0.0269)
Quality cert.	0.229***	0.220***	0.208***	0.203***	0.220***	0.220***	0.220***	0.229***	0.221***	0.222***	0.226***	0.211***
	(0.0285)	(0.0261)	(0.0265)	(0.0261)	(0.0261)	(0.0262)	(0.0264)	(0.0260)	(0.0261)	(0.0294)	(0.0259)	(0.0269)
Age (log)	0.0422**	0.0379**	0.0366**	0.0271*	0.0316*	0.0417***	0.0368**	0.0397**	0.0380**	0.0340**	0.0369**	0.0415**
	(0.0182)	(0.0158)	(0.0164)	(0.0161)	(0.0160)	(0.0156)	(0.0159)	(0.0160)	(0.0158)	(0.0151)	(0.0161)	(0.0163)
Foreign license	0.104***	0.0938***	0.0973***	0.0858***	0.0987***	0.0914***	0.0948***	0.0955***	0.0915***	0.0829***	0.0966***	0.0790***
	(0.0274)	(0.0243)	(0.0244)	(0.0259)	(0.0241)	(0.0250)	(0.0244)	(0.0250)	(0.0244)	(0.0260)	(0.0253)	(0.0258)
Importer	0.360***	0.370***	0.366***	0.387***	0.370***	0.373***	0.369***	0.372***	0.369***	0.369***	0.367***	0.374***
	(0.0308)	(0.0307)	(0.0317)	(0.0297)	(0.0308)	(0.0309)	(0.0305)	(0.0312)	(0.0304)	(0.0314)	(0.0296)	(0.0326)
Multi-product	0.0682***	0.0604***	0.0645***	0.0409**	0.0561***	0.0601***	0.0627***	0.0626***	0.0603***	0.0611***	0.0684***	0.0537***
	(0.0176)	(0.0168)	(0.0183)	(0.0177)	(0.0172)	(0.0171)	(0.0172)	(0.0170)	(0.0167)	(0.0181)	(0.0165)	(0.0176)
Constant	8.813***	8.251***	8.112***	8.071***	7.618***	7.429***	8.256***	8.692***	8.127***	8.671***	7.746***	8.147***
	(0.526)	(0.528)	(0.333)	(0.332)	(0.330)	(0.337)	(0.528)	(0.520)	(0.328)	(0.333)	(0.526)	(0.326)
Observations	14,707	19,134	17,802	16,260	18,603	18,535	18,969	18,549	19,146	17,492	18,269	18,152
R-squared	0.553	0.540	0.540	0.534	0.538	0.540	0.539	0.541	0.540	0.533	0.538	0.541
Number of clusters	98	98	98	98	98	98	98	98	98	98	98	98

Notes: In this table, we present the results of the extended model for the manufacturing sector, in which we exclude each industry at a time. By doing so, we see that the results presented in column (2) in Table 12, are subject to variation across industries. Trade costs are found to have a positive and significant effect, when for example the food sector (ISIC Rev. 15) is excluded. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A8 continued: Dropping one industry at a time (Manufacturing sector only, primary definition of direct and indirect exporters)

Excluding ISIC:	(13) 27	(14) 28	(15) 29	(16) 30	(17) 31	(18) 32	(19) 33	(20) 34	(21) 35	(22) 36	(23) 37
IE	0.0578	0.0581	0.0511	0.0611	0.0631	0.0627	0.0613	0.0511	0.0587	0.0617	0.0617
	(0.0498)	(0.0513)	(0.0486)	(0.0490)	(0.0494)	(0.0492)	(0.0489)	(0.0476)	(0.0489)	(0.0504)	(0.0490)
DE	0.194***	0.197***	0.195***	0.197***	0.195***	0.197***	0.195***	0.194***	0.193***	0.202***	0.196***
	(0.0376)	(0.0400)	(0.0381)	(0.0367)	(0.0362)	(0.0371)	(0.0367)	(0.0360)	(0.0364)	(0.0366)	(0.0369)
IE * TC	-0.0690	-0.0924**	-0.0532	-0.0688	-0.0599	-0.0701	-0.0698	-0.0712	-0.0733*	-0.0628	-0.0695
	(0.0442)	(0.0445)	(0.0444)	(0.0439)	(0.0460)	(0.0440)	(0.0440)	(0.0436)	(0.0427)	(0.0435)	(0.0439)
DE * TC	0.0391	0.0443	0.0528*	0.0448	0.0464	0.0442	0.0448	0.0449	0.0453	0.0439	0.0450
	(0.0305)	(0.0304)	(0.0312)	(0.0290)	(0.0300)	(0.0288)	(0.0289)	(0.0288)	(0.0290)	(0.0307)	(0.0290)
Emp. (log)	0.0359**	0.0376**	0.0422**	0.0390**	0.0397**	0.0391**	0.0390**	0.0391**	0.0398**	0.0364**	0.0388**
	(0.0160)	(0.0169)	(0.0163)	(0.0167)	(0.0169)	(0.0166)	(0.0168)	(0.0168)	(0.0166)	(0.0160)	(0.0167)
Foreign owned	0.171***	0.159***	0.162***	0.168***	0.176***	0.171***	0.168***	0.169***	0.166***	0.160***	0.168***
	(0.0262)	(0.0268)	(0.0274)	(0.0263)	(0.0261)	(0.0262)	(0.0262)	(0.0269)	(0.0265)	(0.0267)	(0.0263)
Quality cert.	0.217***	0.214***	0.226***	0.220***	0.212***	0.221***	0.218***	0.221***	0.219***	0.221***	0.219***
	(0.0257)	(0.0282)	(0.0268)	(0.0262)	(0.0265)	(0.0262)	(0.0262)	(0.0262)	(0.0262)	(0.0258)	(0.0263)
Age (log)	0.0411**	0.0424**	0.0382**	0.0381**	0.0414**	0.0374**	0.0391**	0.0366**	0.0378**	0.0414** *	0.0383**
	(0.0161)	(0.0166)	(0.0169)	(0.0158)	(0.0158)	(0.0158)	(0.0160)	(0.0150)	(0.0158)	(0.0151)	(0.0158)
Foreign license	0.0929** *	0.0944** *	0.0917** *	0.0926** *	0.0959** *	0.0998** *	0.0914** *	0.0921** *	0.0937** *	0.0924** *	0.0911** *
	(0.0242)	(0.0247)	(0.0246)	(0.0244)	(0.0241)	(0.0241)	(0.0243)	(0.0244)	(0.0242)	(0.0242)	(0.0242)
Importer	0.368***	0.372***	0.374***	0.369***	0.369***	0.368***	0.371***	0.366***	0.369***	0.359***	0.370***
	(0.0306)	(0.0319)	(0.0308)	(0.0305)	(0.0312)	(0.0295)	(0.0310)	(0.0303)	(0.0303)	(0.0311)	(0.0305)
Multi-product	0.0608** *	0.0695** *	0.0572** *	0.0604** *	0.0619** *	0.0623** *	0.0609** *	0.0596** *	0.0602** *	0.0598** *	0.0595** *
	(0.0171)	(0.0170)	(0.0171)	(0.0168)	(0.0180)	(0.0170)	(0.0168)	(0.0171)	(0.0169)	(0.0184)	(0.0169)
Constant	8.252***	8.104***	7.607***	7.841***	7.727***	8.123***	7.611***	8.256***	8.126***	8.144***	8.252***
	(0.528)	(0.326)	(0.331)	(0.305)	(0.528)	(0.330)	(0.333)	(0.527)	(0.328)	(0.330)	(0.528)
Observations	18,884	17,377	18,320	19,151	18,795	19,085	19,121	18,999	19,099	17,907	19,142
R-squared	0.540	0.533	0.540	0.540	0.539	0.540	0.539	0.542	0.540	0.542	0.540
# of clusters	98	98	98	98	98	98	98	98	98	98	98

Table A9: Sensitivity checks (quartile 1)

	Unmatched			Matched		
Variable	Treated	Control	T (p-value)	Treated	Control	T (p-value)
Panel A: Direct vs. Indirect Exporters						
Employment (log)	4.55	3.88	10.29 (0.00)	4.49	4.48	0.41 (0.681)
Employment^2 (log)	22.68	17.14	9.26 (0.00)	22.21	22.00	0.49 (0.621)
Foreign	0.22	0.11	6.07 (0.00)	0.19	0.17	1.74 (0.082)
Quality Cert	0.50	0.31	8.66 (0.00)	0.48	0.48	-0.51 (0.612)
Age (log)	2.83	2.72	3.10 (0.002)	2.83	2.76	2.83 (0.005)
Age^2 (log)	8.61	8.06	2.78 (0.005)	8.61	8.25	2.54 (0.011)
Multiproduct	0.69	0.66	1.25 (0.213)	0.69	0.68	0.48 (0.633)
Pseudo R^2 (Unmatched)	0.100					
Pseudo R^2 (Matched)	0.018					
LR chi^2 (p>chi^2)	301.85 (0.000)					
LR chi^2 (p>chi^2)	96.34 (0.002)					
Panel B: Direct Exporters vs. Non-exporters						
Employment (log)	4.55	3.21	40.06 (0.000)	4.36	4.38	-0.39 (0.693)
Employment^2 (log)	22.7	12.12	38.17 (0.000)	20.85	21.11	-0.65 (0.519)
Foreign	0.23	0.07	21.63 (0.00)	0.18	0.19	-0.93 (0.355)
Quality Cert	0.50	0.18	31.58 (0.00)	0.44	0.50	-3.59 (0.000)
Age (log)	2.83	2.65	9.10 (0.000)	2.81	2.82	-0.57 (0.569)
Age^2 (log)	8.61	7.68	9.00 (0.000)	8.50	8.56	-0.42 (0.676)
Multiproduct	0.69	0.67	1.66 (0.097)	0.69	0.67	1.04 (0.297)
Pseudo R^2 (raw)	0.309					
Pseudo R^2 (Matched)	0.018					
LR chi^2 (p>chi^2) (raw)	3051.87 (0.000)					
LR chi^2 (p>chi^2) (Matched)	100.94 (0.001)					

Panel C: Indirect Exporters vs. Non-exporters						
Employment (log)	3.88	3.21	11.70 (0.000)	3.78	3.72	0.72 (0.473)
Employment^2 (log)	17.14	12.11	11.16 (0.000)	16.26	15.8	0.65 (0.515)
Foreign	0.11	0.07	4.55 (0.000)	0.10	0.12	-1.13 (0.261)
Quality Cert	0.3	0.18	7.71 (0.000)	0.29	0.28	0.46 (0.646)
Age (log)	2.72	2.65	1.95 (0.051)	2.72	2.65	1.35 (0.176)
Age^2 (log)	8.06	7.68	2.14 (0.032)	8.09	7.76	1.25 (0.210)
Multiproduct	0.66	0.67	-0.36 (0.721)	0.67	0.68	-0.25 (0.801)
Pseudo R^2 (raw)	0.140					
Pseudo R^2 (Matched)	0.023					
LR chi^2 (p>chi^2) (raw)	573.08 (0.000)					
LR chi^2 (p>chi^2) (matched)	36.50 (0.988)					

Table A10: Sensitivity checks: (quartile 2)

	Unmatched			Matched		
Variable	Treated	Control	T (p-value)	Treated	Control	T (p-value)
Panel A: Direct vs. Indirect Exporters						
Employment (log)	4.56	3.86	8.93 (0.000)	4.44	4.49	-0.89 (0.373)
Employment^2 (log)	23.12	16.95	8.49 (0.000)	21.91	22.37	-0.85 (0.396)
Foreign	0.26	0.20	2.81 (0.005)	0.24	0.26	-0.99 (0.322)
Quality Cert	0.42	0.30	4.76 (0.000)	0.40	0.43	-1.78 (0.075)
Age (log)	2.70	2.65	1.08 (0.281)	2.67	2.67	-0.02 (0.981)
Age^2 (log)	7.85	7.66	0.85 (0.395)	7.68	7.81	-0.72 (0.469)
Multiproduct	0.58	0.59	-0.18 (0.854)	0.59	0.54	2.64 (0.008)
Pseudo R^2 (Raw)	0.114					
Pseudo R^2 (Matched)	0.027					
LR chi^2 (p>chi^2) (Raw)	267.71 (0.000)					
LR chi^2 (p>chi^2) (Matched)	99.25 (0.001)					
Panel B: Direct Exporters vs. Non-exporters						
Employment (log)	4.55	3.09	42.03 (0.000)	4.22	4.21	0.22 (0.826)
Employment^2 (log)	23.04	10.99	42.36 (0.000)	19.93	19.95	-0.05 (0.960)
Foreign	0.27	0.07	23.08 (0.000)	0.21	0.23	-1.58 (0.113)
Quality Cert	0.43	0.15	26.42 (0.000)	0.35	0.40	-2.51 (0.012)
Age (log)	2.7	2.54	7.60 (0.000)	2.66	2.71	-1.89 (0.060)
Age^2 (log)	7.84	7.05	7.35 (0.000)	7.61	7.89	-1.81 (0.70)
Multiproduct	0.58	0.54	2.96 (0.003)	0.58	0.58	0.04 (0.970)
Pseudo R^2 (Raw)	0.371					
Pseudo R^2 (Matched)	0.020					
LR chi^2 (p>chi^2) (Raw)	3091.14 (0.000)					
LR chi^2 (p>chi^2)(Matched)	79.60 (0.065)					

Panel C: Indirect Exporters vs. Non-exporters						
Employment (log)	3.85	3.12	12.48 (0.000)	3.70	3.73	-0.22 (0.826)
Employment^2 (log)	16.89	11.18	12.86 (0.000)	15.54	15.95	-0.50 (0.614)
Foreign	0.20	0.07	10.57 (0.000)	0.15	0.14	0.49 (0.626)
Quality Cert	0.30	0.15	8.94 (0.000)	0.25	0.23	0.89 (0.374)
Age (log)	2.65	2.54	2.96 (0.003)	2.65	2.63	0.38 (0.707)
Age^2 (log)	7.65	7.07	3.04 (0.002)	7.63	7.51	0.41 (0.685)
Multiproduct	0.59	0.54	2.30 (0.021)	0.59	0.58	0.35 (0.726)
Pseudo R^2 (Raw)	0.194					
Pseudo R^2 (Matched)	0.033					
LR chi^2 ($p>chi^2$) (Raw)	639.97 (0.000)					
LR chi^2 ($p>chi^2$) (Matched)	37.99 (0.961)					

Table A11: Sensitivity checks (quartile 3)

	Unmatched			Matched		
Variable	Treated	Control	T (p-value)	Treated	Control	T (p-value)
Panel A: Direct vs. Indirect Exporters						
Employment (log)	4.34	3.42	10.93 (0.000)	4.14	4.14	0.02 (0.982)
Employment^2 (log)	20.8	13.32	9.77 (0.000)	18.86	19.24	-0.55 (0.580)
Foreign	0.21	0.10	4.82 (0.000)	0.16	0.16	-0.35 (0.727)
Quality Cert	0.44	0.22	7.50 (0.000)	0.38	0.33	1.98 (0.048)
Age (log)	3.06	2.72	6.33 (0.000)	2.99	3.07	-1.72 (0.085)
Age^2 (log)	10.05	8.28	5.82 (0.000)	9.71	10.09	-1.49 (0.137)
Multiproduct	0.73	0.70	1.06 (0.287)	0.72	0.69	1.18 (0.238)
Pseudo R^2 (Raw)	0.152					
Pseudo R^2 (Matched)	0.028					
LR chi^2 (p>chi^2) (Raw)	249.18 (0.000)					
LR chi^2 (p>chi^2) (Matched)	58.81 (0.116)					
Panel B: Direct Exporters vs. Non-exporters						
Employment (log)	4.34	2.92	37.11 (0.000)	4.02	3.98	0.78 (0.433)
Employment^2 (log)	20.8	9.79	36.32 (0.000)	17.91	17.57	0.63 (0.528)
Foreign	0.21	0.06	17.34 (0.000)	0.15	0.17	-0.75 (0.453)
Quality Cert	0.44	0.11	28.04 (0.000)	0.34	0.37	-1.45 (0.149)
Age (log)	3.06	2.51	19.96 (0.000)	2.95	2.95	-0.15 (0.881)
Age^2 (log)	10.06	7.04	21.16 (0.000)	9.36	9.43	-0.30 (0.762)
Multiproduct	0.73	0.65	5.46 (0.000)	0.71	0.71	-0.20 (0.839)
Pseudo R^2 (Raw)	0.344					
Pseudo R^2 (Matched)	0.014					
LR chi^2 (p>chi^2) (Raw)	2073.83 (0.000)					
LR chi^2 (p>chi^2) (Matched)	35.83 (0.947)					

Panel C: Indirect Exporters vs. Non-exporters						
Employment (log)	3.41	2.92	7.79 (0.000)	3.37	3.34	0.25 (0.805)
Employment^2 (log)	13.24	9.77	7.36 (0.000)	12.93	12.64	0.37 (0.710)
Foreign	0.09	0.06	2.81 (0.005)	0.10	0.10	-0.13 (0.895)
Quality Cert	0.22	0.11	5.70 (0.000)	0.21	0.22	-0.38 (0.703)
Age (log)	2.72	2.51	4.35 (0.000)	2.74	2.72	0.31 (0.754)
Age^2 (log)	8.27	7.04	5.07 (0.000)	8.30	8.19	0.30 (0.761)
Multiproduct	0.70	0.65	1.94 (0.053)	0.71	0.68	0.85 (0.395)
Pseudo R^2 (Raw)	0.148					
Pseudo R^2 (Matched)	0.026					
LR chi^2 (p>chi^2) (Raw)	368.93 (0.000)					
LR chi^2 (p>chi^2) (Matched)	23.42 (0.999)					

Table A12: Sensitivity checks (quartile 4)

	Unmatched			Matched		
Variable	Treated	Control	T (p-value)	Treated	Control	T (p-value)
Panel A: Direct vs. Indirect Exporters						
Employment (log)	4.48	3.49	9.62 (0.000)	4.19	4.26	-0.68 (0.494)
Employment^2 (log)	22.24	14.07	8.85 (0.000)	19.35	20.24	-0.88 (0.382)
Foreign	0.27	0.20	2.25 (0.025)	0.23	0.22	0.19 (0.849)
Quality Cert	0.37	0.24	3.69 (0.000)	0.33	0.29	1.03 (0.302)
Age (log)	2.68	2.40	4.43 (0.000)	2.6	2.68	-1.15 (0.252)
Age^2 (log)	7.96	6.49	4.46 (0.000)	7.55	7.82	-0.78 (0.436)
Multiproduct	-0.66	0.59	1.96 (0.050)	0.64	0.64	-0.08 (0.934)
Pseudo R^2 (Unmatched)	0.186					
Pseudo R^2 (Matched)	0.056					
LR chi^2 (p>chi^2) (Raw)	216.38 (0.000)					
LR chi^2 (p>chi^2) (Matched)	47.39 (0.655)					
Panel B: Direct Exporters vs. Non-exporters						
Employment (log)	4.47	2.95	31.53 (0.000)	4.09	4.07	0.20 (0.841)
Employment^2 (log)	22.14	10.13	32.89 (0.000)	18.47	18.47	0.00 (1.0000
Foreign	0.27	0.10	13.87 (0.000)	0.23	0.28	-2.19 (0.029)
Quality Cert	0.36	0.10	21.11 (0.000)	0.27	0.31	-1.31 (0.190)
Age (log)	2.66	2.26	12.14 (0.000)	2.62	2.65	-0.65 (0.518)
Age^2 (log)	7.9	5.82	13.30 (0.000)	7.57	7.76	-0.73 (0.468)
Multiproduct	0.65	0.56	4.54 (0.000)	0.62	0.68	-1.99 (0.047)
Pseudo R^2 (Raw)	0.341					
Pseudo R^2 (Matched)	0.030					
LR chi^2 (p>chi^2) (Raw)	1568.58 (0.000)					
LR chi^2 (p>chi^2) (Matched)	46.68 (0.958)					

Panel C: Indirect Exporters vs. Non-exporters						
Employment (log)	3.50	2.94	7.35 (0.000)	3.38	3.24	1.13 (0.257)
Employment^2 (log)	14.07	10.1	7.44 (0.000)	13.18	12.47	0.75 (0.456)
Foreign	0.20	0.10	5.50 (0.000)	0.18	0.17	0.12 (0.907)
Quality Cert	0.24	0.10	7.75 (0.000)	0.21	0.22	-0.11 (0.914)
Age (log)	2.40	2.25	2.73 (0.006)	2.39	2.38	0.14 (0.887)
Age^2 (log)	6.49	5.79	2.90 (0.004)	6.48	6.57	-0.22 (0.824)
Multiproduct	0.59	0.56	0.90 (0.366)	0.62	0.60	0.27 (0.785)
Pseudo R^2 (Raw)	0.174					
Pseudo R^2 (Matched)	0.052					
LR chi^2 (p>chi^2) (Raw)	385.05 (0.000)					
LR chi^2 (p>chi^2) (Matched)	35.91 (0.990)					

UCD CENTRE FOR ECONOMIC RESEARCH – RECENT WORKING PAPERS

WP12/01 Mark E McGovern: 'A Practical Introduction to Stata' January 2012
WP12/02 Colm McCarthy: 'Ireland's European Crisis: Staying Solvent in the Eurozone' January 2012
WP12/03 Colm McCarthy: 'Improving the Eurosystem for Old and New Members' January 2012
WP12/04 Ivan Pastine and Tuvana Pastine: 'All-Pay Contests with Constraints' February 2012
WP12/05 David Madden: 'Methods for Studying Dominance and Inequality in Population Health' February 2012
WP12/06 Karl Whelan: 'ELA, Promissory Notes and All That: The Fiscal Costs of Anglo Irish Bank' February 2012
WP12/07 Olivier Bargain, Eliane El Badaoui, Prudence Kwenda, Eric Strobl and Frank Walsh: 'The Formal Sector Wage Premium and Firm Size for Self-employed Workers' March 2012
WP12/08 Brendan Walsh: 'The Influence of Macroeconomic Conditions and Institutional Quality on National Levels of Life Satisfaction' March 2012
WP12/09 Ronald B Davies and Rodolphe Desbordesz: 'Greenfield FDI and Skill Upgrading' March 2012
WP12/10 Morgan Kelly and Cormac Ó Gráda: 'Change Points and Temporal Dependence in Reconstructions of Annual Temperature: Did Europe Experience a Little Ice Age?' March 2012
WP12/11 Morgan Kelly and Cormac Ó Gráda: 'The Waning of the Little Ice Age' April 2012
WP12/12 Morgan Kelly and Cormac Ó Gráda: 'Agricultural Output, Calories and Living Standards in England before and during The Industrial Revolution' April 2012
WP12/13 Arnaud Chevalier and Orla Doyle: 'Schooling and Voter Turnout - Is there an American Exception?' April 2012
WP12/14 David Madden: 'The Relationship Between Low Birthweight and Socioeconomic Status in Ireland' April 2012
WP12/15 Robert W Fairlie, Kanika Kapur and Susan Gates: 'Job Lock: Evidence from a Regression Discontinuity Design' April 2012
WP12/16 John Regan: 'Ballot Order effects: An analysis of Irish General Elections' April 2012
WP12/17 Orla Doyle: 'Breaking the Cycle of Deprivation: An Experimental Evaluation of an Early Childhood Intervention' April 2012
WP12/18 Ivan Pastine, Tuvana Pastine and Paul Redmond: 'Incumbent-Quality Advantage and Counterfactual Electoral Stagnation in the U.S. Senate' May 2012
WP12/19 Adrian Corcoran and Robert Gillanders: 'Foreign Direct Investment and The Ease of Doing Business' July 2012
WP12/20 Wen Fan and Yuanyuan Ma: 'Estimating the External Returns to Education: Evidence from China' August 2012
WP12/21 David Madden: 'The Socioeconomic Determinants of Mental Stress in Ireland' August 2012
WP12/22 Sinéad Kelleher: 'Playing by the Rules? The Development of an Amended Index to Measure the Impact of Rules of Origin on Intra-PTA Trade Flows' September 2012
WP12/23 Christopher Jepsen, Kenneth Troske and Paul Coomes: 'The Labor-Market Returns to Community College Degrees, Diplomas, and Certificates' September 2012
WP12/24 Ronald B Davies: 'CCCTB 4 EU? SA vs. FA w/ FTA' October 2012