ISSN 1825-0211

FIRMS' EXPORTING AND IMPORTING ACTIVITIES: IS THERE A TWO-WAY RELATIONSHIP?

David ARISTEI — Davide CASTELLANI
Chiara FRANCO

Quaderno n. 99 — Dicembre 2011

QUADERNI DEL DIPARTIMENTO
DI ECONOMIA, FINANZA
E STATISTICA

Firms' exporting and importing activities: is there a two-way relationship?

David Aristei*
Davide Castellani†
Chiara Franco‡

December 15, 2011

Abstract

The literature on firm heterogeneity and trade has highlighted that most trading firms tend to engage in both importing and exporting activities. This may be due to some common sunk costs or to a true state dependence. This paper provides some evidence that helps sort this issue out. Using firm level data for a group of 27 Eastern European and Central Asian countries from the World Bank Business Environment and Enterprise Performance Survey (BEEPS) over the period 2002-2008, we estimate a bivariate probit model of exporting and importing. The main finding is that there is a positive correlation between import and export at the level of the firm, but after controlling for size (and other firm level characteristics) importing have a positive effect on exporting, but exporting to not increase the probability of importing. The evidence is thus consistent with the presence of common sunk costs and with a one-way link between importing and exporting. The positive effect of import on export is mainly due to an increase in firm productivity and product innovation

Keywords: Exports, Imports, Firm heterogeneity, Eastern European and Central Asian countries

JEL Classification: F14; F21; F23.

*Department of Economics, Finance and Statistics, University of Perugia, david.aristei@stat.unipg.it

†Department of Economics, Finance and Statistics, University of Perugia, davide.castellani@unipg.it

‡Department of Economics, University of Bologna; e-mail: chiara.franco2@unibo.it

1 Introduction

The recent literature on firm heterogeneity and trade has highlighted that a high proportion of trading firms, which have been labelled as two-way traders, is engaged in both importing and exporting activities[1]. This pattern can be explained by the existence of sunk costs which are common to both exporting and importing activities or by some specific state dependence effects. Common sunk cost arise when firms implement an organizational structure in charge of international operations [2], or when firms acquire information on foreign markets, which may include both potential buyers (export) and suppliers of intermediate inputs (import). As Kasahara and Lapham (2008) show, in the presence of sunk cost complementarity, the cost of exporting (importing) decreases whenever firms already carry out importing (exporting) activities, and this would decrease the productivity threshold required to become two-way trader, once a firm is a one-way trader.

However, cost complementarity is not the only explanation for the co-existence of importing and exporting, since one may think at direct channels which would reinforce trading activities at the firm-level. On the one hand, import may increase firm efficiency (Kasahara and Lapham, 2008; Halpern, Koren, and Szeidl, 2009) or product scope and quality (Kugler and Verhoogen, 2009; Goldberg, Khandelwal, Pavcnik, and Topalova, 2010), which in turn allow firms to be more competitive on the international markets, and thus start exporting. On the other hand, exporting may also increase firm productivity (De Loecker, 2007; Lileeva and Trefler, 2010), which in turn enables firms to bear the sunk cost of importing, or induce them to introduce new products, improve product quality (Verhoogen, 2008; Lileeva and Trefler, 2010; Salomon and Shaver, 2005) and adopt newer technologies (Bustos, 2011; Lileeva and Trefler, 2010), which may require sourcing foreign intermediate or capital inputs. Furthermore, to the extent that firms' exporting and importing activities are part of some fragmentation of production, we may observe firms starting to export (to related or unrelated parties) and then importing processed goods. Instead, if firms are processing goods for some foreign counterparts, the opposite sequence would occur (firms' import intermediate good and then export processed ones).

This paper addresses this two-way link for a sample of 1,085 firms from 27 Eastern European and Central Asian (ECA) countries from the World Bank Business Environment and Enterprise Performance Survey (BEEPS) over the period 2002-2008. We estimate a bivariate probit model of the probability of firms' exporting

[1]Evidence of this pattern has been provided for countries as different as Belgium (Muûls and Pisu, 2009), Chile (Kasahara and Lapham, 2008), Denmark (Smeets and Warzynski, 2010), Germany (Vogel and Wagner, 2010), Hungary (Altomonte and Bekes, 2010), Italy (Castellani, Serti, and Tomasi, 2010) and the United Stated (Bernard, Jensen, and Schott, 2009)

[2]This most likely happens in smaller firms, which would not create two separate departments for importing and exporting activities.

and importing, and the main finding is that there is indeed a positive two-way correlation between import and export but, after controlling for size, importing have a positive effect on exporting, while exporting does not increase the probability of foreign sourcing. The evidence is thus only partially consistent with the presence of common sunk costs, and it mainly stresses that sourcing foreign inputs can pave the way to domestic firms' international competitiveness. Conversely, our evidence supports that the positive correlation between firms' exporting activities and sourcing of foreign inputs is mainly due to the existence of common sunk costs correlated with firm size thresholds: larger firms are more able to sustain the organizational costs associated with both importing and exporting activities. Once accounted for that, previous exporting does not make foreign sourcing more likely. This is consistent with the lack of evidence on learning-by-exporting (Clerides, Lach, and Tybout, 1998; ISGEP, 2008) but may also depend on the characteristics of the countries considered in this analysis. As we will show in the paper, in most of these countries exporting is a rarer (and probably newer) phenomenon than sourcing foreign inputs, so it may well be that the effect of exporting kicks in after a certainly degree of involvement in foreign markets (Lileeva and Trefler, 2010; Castellani, 2002).
The rest of the paper is organized as follows. Section 2 discusses the related literature. Section 3 presents the sample and data used for the empirical analysis, while Section 4 lays out our econometric methodology, specification and results. Section 6 concludes the paper.

2 Related literature

The recent availability of microeconomic evidence has spurred new interest on the mechanisms that determine interdependence between export and import at the firm-level. In particular, a consistent finding across different countries, is that most traders are engaged in both importing and exporting activities[3]. This suggests that once firms initiate sourcing inputs from abroad, it is more likely that they also (subsequently) start selling abroad, and viceversa. From a theoretical point of view, this may be due to cost complementarity, that is some of the costs are common to both sides of trading activities, so firms engaging in one-way trade bear lower costs when they become two-way traders. This mechanism is formalized by Kasahara and Lapham (2008) who extend the Melitz (2003) model incorporating the possibility that firms engage in intermediate goods import. The model includes both sunk costs of initiating export ($c_x(1-d^x_{it-1})$) and import ($c_m(1-d^m_{it-1})$)[4], but the cost of carrying out both activities is assumed

[3]See footnote 1

[4]The model includes also per period fixed costs of importing and exporting and a start-up cost, which we omit for the sake of simplicity. d^x_{it-1} and d^m_{it-1} are indicators which take value 1 if a firm was exporting or importing at t-1.

to be $\zeta[c_x(1 - d^x_{it-1}) + c_m(1 - d^m_{it-1})]$, with the cost complementarity parameter $\zeta < 1$. This formulation suggests that once a firm exports (imports) the additional productivity required to reach the threshold which makes importing (exporting) profitable may be relatively low. Kasahara and Lapham (2008) estimate the parameter ζ for Chilean firms finding that it is significantly lower than one (ranging from .746 in the Wood industry, to .930 in Food). Muûls and Pisu (2009) find evidence of sunk cost complementarity in a large sample of 19,178 Belgian firms over the period 1996-2004. They estimate a dynamic panel probit for both the probability of export (import), controlling for the import (export) status in the previous year. They find that previous trade status is significant in both equations, and the effect is of similar magnitude. This is consistent with sunk costs complementarity since there is no reason to believe that sunk costs of import are more effective than sunk cost of export in reducing the cost of further internationalization.

Sunk cost complementarity is not the only explanation of why firms shift from one-way to two-way traders. On the one hand, importing may increase firm productivity which in turn allows them to be more competitive on the international markets. Such effect of importing intermediates on productivity has attracted a number of recent theoretical and empirical contributions. Imports may affect productivity through several mechanisms such as improvement of input quality or the expansion of inputs variety. Amiti and Konings (2007) showed that the reduction in intermediate inputs tariff had a significant effect on Indonesian firms' productivity, while more direct evidence on the positive link between firm productivity and foreign sourcing has been provided in the case of Belgium (Muûls and Pisu, 2009), Chile (Kasahara and Rodrigue, 2008), Germany (Vogel and Wagner, 2010), Ireland (Forlani, 2011) Italy (Castellani, Serti, and Tomasi, 2010; Conti, Lo Turco, and Daniela, 2011), Spain (Augier, Cadot, and Dovis, 2010; Farinas and Martin-Marcos, 2010), Sweden (Andersson, Loof, and Johansson, 2008; Loof and Andersson, 2010) and the US (Bernard, Jensen, and Schott, 2009). Most of these studies find, consistently with the idea that sourcing foreign inputs requires bearing sunk costs (as in the case of export), that only the relatively more productive firms self-select into importing. However, unlike the case of export, in many countries importing intermediates have also a causal effect on firm productivity. In one of the more comprehensive study on the links between imported intermediates and firms' productivity, Halpern, Koren, and Szeidl (2009) find that with respect to Hungary, two-third of productivity gains from importing is due to availability of a variety and complementarity effect, and one-third to higher quality of foreign sourced inputs. A complementary stream of research has found sound evidence of a positive effect of imported intermediates on product quality (Kugler and Verhoogen, 2009) and scope (Goldberg, Khandelwal, Pavcnik, and Topalova, 2010; Colantone and Crinò, 2011).

On the other hand, exporting may raise also firms' productivity, enabling firms to bear the sunk cost of importing, inducing them to introduce new products

or improving product quality and adopting newer technologies. To carry out these activities firms may require sourcing foreign intermediate or capital inputs from abroad. Most studies on export and productivity find sound evidence of a self-selection effect, that is future exporters are ex-ante more productive while evidence on the productivity-enhancing effects of exporting activity ('learning-by-exporting') is mixed (Wagner, 2007). Earlier studies found no such effects in countries as different as Colombia (Clerides, Lach, and Tybout, 1998) and the United States (Bernard and Jensen, 1999), and these results were later confirmed for a larger number of both developed and developing countries (ISGEP, 2008). However, other studies have found evidence of positive effects of exporting on firm productivity in Canada (Lileeva and Trefler, 2010), Chile (Alvarez and López, 2005), China Park, Yang, Shi, and Jiang (2010), Indonesia (Blalock and Gertler, 2004), Italy (Serti and Tomasi, 2008) Slovenia (De Loecker, 2007), sub-Saharan Africa (Van Biesebroeck, 2005), UK (Girma, Greenaway, and Kneller, 2004). Lileeva and Trefler (2010) showed that these gains were more significant for firms whose initial productivity was relatively lower and for old exporters. The latter result is consistent with some evidence on China, Italy and Sweden where higher productivity growth is associated with a higher share export on total sales (Kraay, 1999; Castellani, 2002; Andersson and Loof, 2009).

Only a few papers analyze the trade-productivity nexus in the context of transition countries, which will be the focus of our empirical analysis. Analysing export of Russian firms towards developed countries, Wilhelmsson and Kozlov (2007) find inconclusive evidence for learning-by-exporting effects, while De Loecker (2007), using data from Slovenia, find evidence of a causal effect of firms' exporting activities on their productivity. Damijan and Kostevc (2006) qualify this result, noticing that gains in productivity are larger immediately after the entry into the export market but they tend to vanish quite easily. More general results are provided by Damijan, de Sousa, and Lamotte (2009) for six transition countries in South-Eastern-Europe (Bosnia-Herzegovina, Bulgaria, Croatia, Macedonia, Romania and Slovenia). They find that the importing and exporting have positive effects on firm productivity in four out to 6 countries, but these results depend on the destination/origin markets trading with advanced countries has a larger impact on productivity.

A related strand of research has tried to make a step forward investigating whether the self-selection or learning-by-exporting holds when the performance measure is innovation, rather than productivity. As in the case of the export-productivity nexus, most studies support the hypothesis that firms that start to sell into foreign markets are ex-ante more innovative, while only a few paper convincingly show evidence that exporting activity spurs product innovation (also in the form of improved product quality) or process innovation (also through the adoption of newer technologies). Self-selection is consistent with theoretical models, such as the one proposed by Atkeson and Burstein (2007), where productivity and the choice of investing in R&D are interdependent. This aspect is also shown

by Aw, Roberts, and Xu (2008) who find out find that, while firm export performance is positively correlated with investment in R&D and innovation, only few firms can undertake this extra cost. This investment is considered important as it should positively impact firm future productivity, reinforcing in this way the self selection hypothesis. The innovation-export nexus seems differentiated according to the type of innovation. Using a panel of Spanish manufacturing firms Cassiman, Golovko, and Martínez-Ros (2010) find that product innovation - and not process innovation - affects productivity and induces small non-exporting firms to enter the export market. Instead, Caldera (2010) findings are consistent with the fact product upgrading has a larger effect on the Spanish firm export participation than the introduction of cost-saving innovations.

Evidence from a panel of Slovenian firms for the period 1996-2002, instead supports that neither product nor process innovation increase the likelihood to become an exporter. However, exporting increases the probability of becoming a process rather than product innovator, and that exporting leads to productivity improvements (Damijan, Kostevc, and Polanec, 2010). The causal effect of exporting on product innovation has been supported by Lileeva and Trefler (2010) in the case of Canadian firms,Salomon and Shaver (2005) in Spain and Bratti and Felice (2011) in Italy. In particular, Lileeva and Trefler (2010) find that Canadian exporters that improved productivity were more likely to introduce new product innovation and advanced manufacturing as well as inspection and communication technologies. They argue that it is exactly the combination of improved market access, allowed by the possibility to enter into the export market, and investment in technology and product innovation that spurs productivity growth in some firms. One may argue that at least some of those investments may lead to importing capital and intermediate goods. Consistent with these results, Bustos (2011) finds that Argentinian firms in industries facing higher reductions in Brazil's tariffs increase investment in technology faster.

Finally, a few studies have addressed the effect of imported intermediates on firms' exporting. Using firm-level data on imports at the product (HS6) level Bas and Strauss-Kahn (2010) find that a higher diversification of and increased number of imported varieties affect export scope, mainly through complementarity and technology transfer mechanism, while the effect through a reduction in prices is limited. Instead, Lo Turco and Maggioni (2011) show some evidence of a price effect in Italy. In particular, a higher share of imports from low-income countries, which they assume are motivated by the desire to lower costs, have positive effect on the propensity to export of Italian firms, while import from high-income countries have no effect.

3 Data

We exploit firm-level data from the World Bank's Business Environment and Enterprise Performance Survey (BEEPS), covering a sample of firms from Eastern European and Central Asian countries (ECA surveys), both from the manufacturing and service sectors, for the years 2002, 2005 and 2008. The Surveys use standardized instruments and a uniform sampling methodology to obtain comparable data across countries[5]. For the purpose of this analysis, we focus on manufacturing firms from 27 ECA countries[6]. As we will show in Section 4, our econometric specification requires that for each firm we have information on current and past indicators of exporting and importing activity, as well as on predetermined firm-characteristics. This reduces significantly the number of usable observations, since we drop all firms which are surveyed only once. As documented by Table 1 we end-up using 1,085 observations, out of which 714 refer to import and export status in 2008 (for which explanatory variables refer to 2005) and 371 refer to the 2005 survey for the dependent variables (and the 2002 survey for the regressors)[7]. We will treat the data as two independent cross-sections, even if it is should be said that for 110 firms we have two observations[8].
Table 1 reveals that one-fourth of the firms do not trade, and only 6.1% are engaged only in exporting activities. Two-way traders and firms sourcing foreign inputs (but serving only the domestic market) are both around one-third of the sample. Table 2 shows that the propensity to engage in either or both exporting and importing activities differs across countries. In particular, in some of the relatively more advanced (and integrated within the European Union) countries, such as Czech Republic, Estonia, Hungary, Latvia, Lithuania, Serbia, Slovakia and Slovenia, the share of two-way traders is sensibly higher. In the econometric analysis we will take this issue into account by way of country fixed effects.

In Table 3 we address the issue of the firm transition between trade status. The highest probability of transition is observed for firms which started out as exporter-only. Only 32.9% of such firms remain in the same status, as opposed to more 50% in the case of firms which at time $t-3$ where non-traders, importer-

[5]This data source have been used in various studies such as for example Kenny (2009). Particularly close to the present work is Seker (2009) who focus on differences in productivity and innovation of importers, exporters and two-way traders

[6]We chose to exclude Turkey, which had a far larger number of observations then the other countries, so that results would have been too much dependent on this country

[7]The original sample of manufacturing firms also includes 5,747 firms observed only for one year (3,080 firms in 2008 and 2,667 in 2005) that cannot be used in the empirical application. Comparing the estimation sample to the original one, we did not find significant differences in firm characteristics and sectoral composition, apart from a slight over-representation of large and medium sized firms, as well as of state- and foreign-owned firms, in the former.

[8]These firms are observed in all the three surveys, while the remaining 261 are observed in 2005 and 2002, while 604 are observed in 2008 and 2005

Table 1: Sample composition, by year and trade status

Year	Total	Non Traders	Export -only	Import -only	Two-way traders	
	abs. #	percentage values				
2005	371	27.4	7.2	28.5	36.6	100
2008	714	25.2	5.6	37.8	31.3	100
Total	1,085	25.9	6.1	34.6	33.1	100

only or two-way traders. Among exporter-only firms there is a relatively high probability to stop exporting (20.3% become non-traders and 15.2% stop exporting but start importing), but the more likely event is to keep exporting and add importing (31.7%). However, firms starting out as exporters-only are only 79 out of 1,085. The number of firms which at time $t-3$ were importers-only is much larger (331) and they display a higher rate of persistence and, while it is rather unlikely that these firm stop importing and start exporting (only 3.3% of the cases), it is equally likely that they either stop importing or add exporting activities. Two-way traders are the most persistent type (67% of firms remain in this trade status) and if they change trade status they are more likely to stop exporting rather than importing. Finally, non-traders tend to remain non-internationalized but if they do start trading, they begin by sourcing foreign inputs, rather by selling into foreign markets.

In Table A.1 we provide a description of the variables used in the sample while in Table 4 we show some basic statistics of our sample firms by trade status. The upper panel of the table reports the distribution by size classes, which highlights the well know relationship between trade and size. While approximately 50% of non-traders have less than 20 employees, the share of exporters and two-way traders is 20.9% and 11.4% respectively. Interestingly enough, a rather large share of importers-only has less than 20 employees. This suggests that for firms in the ECA countries, importing intermediate or capital goods is a viable strategy also for relatively smaller firms. Exporters are relatively more concentrated among medium-sized firms, while two-way traders are more likely among the larger firms. These patterns are reflected in the average size of firms (lower panel), which is below 100 employees for non-traders and importers, reaches 153 for exporters and 250 for two-way traders. When we compare firms in terms of productivity (which, do missing information on value added and the stock of capital, can be measured only as sales per worker) we notice that two-way traders (non-traders) are confirmed as the best (worst) performers, while importers-only, despite the relatively smaller size, rich higher productivity level than exporters-only. This ranking of firm types is consistent with the existence of different sunk costs for different trading activities: engaging in both import and export has a higher sunk

Table 2: Sample composition, by country and trade status

Country	Total	Non traders	Export -only	Import -only	Two-way traders	
	abs. #		percentage values			
Albania	33	18	3	42	36	100
Armenia	67	15	1	54	30	100
Azerbaijan	70	47	4	40	9	100
Belarus	29	10	0	59	31	100
Bosnia	26	19	4	35	42	100
Bulgaria	46	22	9	30	39	100
Croatia	31	10	3	48	39	100
Czech Rep.	16	6	6	25	63	100
Estonia	21	10	5	38	48	100
FYROM	44	11	5	39	45	100
Georgia	31	19	13	26	42	100
Hungary	32	22	6	22	50	100
Kazakhstan	51	55	0	33	12	100
Kyrgyz	37	38	5	32	24	100
Latvia	24	25	13	17	46	100
Lithuania	24	21	4	21	54	100
Moldova	75	24	11	45	20	100
Montenegro	2	0	0	100	0	100
Poland	44	32	11	27	30	100
Romania	74	36	5	42	16	100
Russia	22	23	9	45	23	100
Serbia	60	17	8	10	65	100
Slovakia	17	0	18	6	76	100
Slovenia	41	5	2	7	85	100
Tajikistan	33	33	9	39	18	100
Ukraine	90	34	7	37	22	100
Uzbekistan	45	44	7	36	13	100
Total	1,085	26	6	35	33	100

Table 3: Transition matrix across trade status

Trade Status $_{t-3}$	Trade status $_t$: Non traders	Export -only	Import -only	Two-way traders	Total
	absolute numbers				
Non trader	173	6	103	14	296
Exporter-only	16	26	12	25	79
Importer-only	65	11	188	67	331
Two-way trader	28	24	73	254	379
Total	282	67	376	360	1085
	percentage values				
Non trader	58.5	2.0	34.8	4.7	100.0
Exporter-only	20.3	32.9	15.2	31.7	100.0
Importer-only	19.6	3.3	56.8	20.2	100.0
Two-way trader	7.4	6.3	19.3	67.0	100.0
Total	26.0	6.2	34.7	33.2	100.0

cost than engaging in one-way trade.

Similar rankings emerge when we investigate other firms' characteristics. In terms of innovation, the unconditional probability to introduce a new product or process is only 39% for non-traders, while it is about 60% for one-way traders, and up to 71% for two-way traders. The share of white-collar workers also increases moving from one-way to two-way traders, although we oddingly find that non-traders have in fact the highest share of white collar workers. Finally, exporters are more likely to be foreign-owned (i.e. affiliates of foreign multinational firms), while on the contrary, exporting is rare among state-owned companies. In the next section we will use these variables as controls in a bivariate probit regression of the probability to engage in exporting and importing activity.

4 Econometric specification and results

We model the probability of being a trading firm, by specifying a bivariate probit of exporting and importing as a function of previous import and export status, respectively, controlling for country and sector fixed effects, as well as a number of (lagged) firm-level characteristics illustrated in the previous section. This modelling strategy allows to account for the contemporaneous correlation between the two choices and is analogous to the one that Aw, Roberts, and Winston (2007) and Girma, Görg, and Hanley (2008) used to explain the two-

Table 4: Descriptive statistics

	Obs.	Non traders	Export -only	Import -only	Two-way traders	Total
		column percentages				
Small (<20)		49.65	20.9	39.1	11.39	31.52
Medium (20-99)		36.88	52.24	36.44	33.61	36.59
Large (100 and over)		13.48	26.87	24.47	55	31.89
		100	100	100	100	100
		average values				
N. employees	1083	69.16	153.01	87.27	250.71	140.82
Sales per worker (in logs)	930	12.10	12.22	12.51	13.10	12.59
=1 if foreign owned, 0 otherwise	1077	0.05	0.26	0.16	0.32	0.19
=1 if State owned, 0 otherwise	1077	0.10	0.05	0.10	0.12	0.10
=1 if introduced new pdt	1085	0.39	0.61	0.57	0.71	0.57
% of white collar workers	1052	29.7%	27.4%	28.0%	29.0%	28.8%

way relationship between export and R&D.

Formally, our empirical model takes the following form:

$$exp_{it} = \begin{cases} 1 & \text{if } exp^*_{it} > 0 \\ 0 & \text{if } exp^*_{it} \leq 0 \end{cases} \quad \text{and} \quad imp_{it} = \begin{cases} 1 & \text{if } imp^*_{it} > 0 \\ 0 & \text{if } imp^*_{it} \leq 0 \end{cases} \tag{1}$$

with

$$\begin{cases} exp^*_{it} = \delta_1 imp_{i,t-3} + \mathbf{x'}_{i,t-3}\beta_1 + \varepsilon_{1it} \\ imp^*_{it} = \delta_2 exp_{i,t-3} + \mathbf{x'}_{i,t-3}\beta_2 + \varepsilon_{2it} \end{cases} \tag{2}$$

where the vector of control variables is

$$\mathbf{x}_{i,t-3} = (\text{productivity}_{i,t-3}, \text{size}_{i,t-3}, \text{other}_{i,t-3}, \text{country}_j, \text{sector}_s) \tag{3}$$

and the the error terms are normally distributed with a zero mean, variance equal to 1 and ρ denoting their covariance term

$$\begin{pmatrix} \varepsilon_{1it} \\ \varepsilon_{2it} \end{pmatrix} \sim N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix}\right] \tag{4}$$

The parameters of the model δ_1, δ_2, β_1, β_2 and ρ are estimated via maximum likelihood, using the software Stata 10.1, and presented in Table 5. In specification (1) we present results for the determinants of export (import) controlling for import (export) and country and sector dummies only. Results suggest a two-way relationship between export and import: firms which were involved in importing, after three years are more likely to be exporters and (viceversa) previous exporters are more likely be importers today. Results are largely confirmed if we

control for productivity (column 2). Only a slight drop in the coefficients of past import (export) is registered, even if, due to missing values, the number of observations drops and the standard error slightly increases, making the effect of past exporting on the probability of importing non significantly different from zero at the usual confidence levels. More relevant changes are obtained when we control for size, using dummies for small- and medium-sized firms (larger firms being the baseline category): the coefficients on both past exports and imports drop but while past importing status still is a significant determinant of current exporting activity, past exporting does not increase the probability of importing. This result is confirmed after controlling for other firm characteristics (column 4), which further decrease the coefficient on past imports and exports. The coefficient of past export on import remains non significant as in the previous specifications[9] In sum, the positive two-way correlation between exporting and importing activity in ECA countries is the result of firm-heterogeneity (mainly in term of firm-size) which is correlated with trading activities. To some extent we may think that some of the sunk costs required to export and import are also correlated with firm size and other characteristics (such as being an affiliate of a multinational firm). This is the case for example of an organizational structure which enables the firm to manage international operations. The fact that once controlled for these characteristics the two-way correlation vanishes, suggests that the role of common sunk costs may not be so important. In fact, if common sunk costs were to play a key role, it would not matter whether firms internationalize first by exporting or importing and the coefficients on previous trade status would be both significant and similar in magnitude (as in Muûls and Pisu (2009)). Rather, results suggest that it is the specific effect of importing activity which foster subsequent export, via increases in efficiency (Bas and Strauss-Kahn, 2010; Halpern, Koren, and Szeidl, 2009), or product scope and quality (Kugler and Verhoogen, 2009; Goldberg, Khandelwal, Pavcnik, and Topalova, 2010).

[9]To check whether endogeneity may bias the relationship between past importing status and current exporting behaviour, we consider a recursive probit model (Maddala, 1983). In particular, we estimate the following bivariate probit model for export at time t with the endogenous dummy $imp_{i,t-3}$:

$$\begin{cases} exp^*_{it} = \delta_1 imp_{i,t-3} + \mathbf{x'}_{i,t-3}\beta_1 + \varepsilon_{1it} \\ imp^*_{i,t-3} = \mathbf{x'}_{i,t-3}\beta_2 + \varepsilon_{2it} \end{cases}$$

Results (not presented here, but available from the authors) confirm the existence of a significant positive effect of past importing, while the hypothesis of exogeneity of the lagged import dummy is supported by the absence of statistically significant correlation between the error terms of the two equations (see Monfardini and Radice (2008) for a discussion on testing exogeneity in bivariate probit models).

Table 5: A two way link between firms' exporting and importing activities, bivariate regressions

	(1)		(2)		(3)		(4)	
	Export(d)$_{it}$	Import(d)$_{it}$	Export(d)$_{it}$	Import(d)$_{it}$	Export(d)$_{it}$	Import(d)$_{it}$	Export(d)$_{it}$	Import(d)$_{it}$
Import (d)$_{i,t-3}$	0.5884***		0.5256***		0.3434***		0.2337*	
	(0.111)		(0.126)		(0.131)		(0.134)	
Export (d)$_{i,t-3}$		0.2377**		0.2056		-0.0437		-0.1527
		(0.113)		(0.131)		(0.139)		(0.145)
Sales per worker (d)$_{i,t-1}$			0.1908***	0.0932**	0.2136***	0.0952**	0.2176***	0.0997**
			(0.048)	(0.038)	(0.053)	(0.040)	(0.050)	(0.041)
Small (d)$_{i,t-3}$					-1.2491***	-0.9723***	-1.1295***	-0.9340***
					(0.141)	(0.147)	(0.151)	(0.155)
Medium (d)$_{i,t-3}$					-0.5324***	-0.6249***	-0.4882***	-0.6332***
					(0.126)	(0.133)	(0.133)	(0.137)
Foreign-owned(d)$_{i,t-3}$							0.5888***	0.3619**
							(0.146)	(0.158)
State-owned(d)$_{i,t-3}$							0.0602	-0.0999
							(0.189)	(0.175)
Share of white collars (d)$_{i,t-3}$							-0.1838	0.1169
							(0.247)	(0.232)
Product innovation (d)$_{i,t-3}$							0.1888*	0.1111
							(0.108)	(0.106)
Year 2008 (d)	-0.1445	0.1480	-0.2283**	0.1167	-0.1910	0.1726	-0.1338	0.2341*
	(0.097)	(0.094)	(0.113)	(0.106)	(0.120)	(0.109)	(0.130)	(0.120)
Constant	-5.6266***	5.5631***	-2.7368***	-0.0011	-2.2789***	0.7021	-2.5624***	0.4229
	(0.255)	(0.432)	(0.698)	(0.639)	(0.775)	(0.677)	(0.775)	(0.705)
ρ	0.2221***		0.2234***		0.2291**		0.2659***	
	(0.076)		(0.086)		(0.089)		(0.090)	
Sector fixed effects	Yes		Yes		Yes		Yes	
Country fixed effects	Yes		Yes		Yes		Yes	
N. observations	1085		841		841		797	

5 Robustness checks

5.1 Lagged dependent variables

Admittedly, the previous specification may not be able to capture the true transition from one-way to two-way trading, and may be biased by the fact that previous export (import) status may be correlated with previous import (export) status. Thus to control for this effect, we introduce the lagged dependent variables. While a proper estimation of such a dynamic model would require to deal with the endogeneity of the lagged dependent variables, our aim here is to show whether and how the baseline results are robust to control for the persistence in trade status. This will allow us to ascertain whether past import (export) has an effect on the probability of exporting (importing) activity conditional on the firms being an exporter (importer) three years earlier. In other words, this will allow to focus on firms switching into export (import) activities.
To fix ideas equation 2 becomes:

$$\begin{cases} exp^*_{it} = \alpha_1 exp_{i,t-3} + \delta_1 imp_{i,t-3} + \mathbf{x'}_{i,t-3}\beta_1 + \varepsilon_{1it} \\ imp^*_{it} = \alpha_1 imp_{i,t-3} + \delta_2 exp_{i,t-3} + \mathbf{x'}_{i,t-3}\beta_2 + \varepsilon_{2it} \end{cases} \tag{5}$$

Results, presented in Table 6, suggest that the effect of past import (export) on future export (import) is reduced when we control for the lagged dependent variable. Comparing column 1 in Tables 5 and 6 we gather that the coefficient δ_1 drops from .588 to .473, while δ_2 slides from .237 to .185 but they both retain statistical significance. Interestingly enough, once controlled for productivity, size and other firm characteristics, the results on δ_1 and δ_2 from the basic and the dynamic model are remarkably similar, and confirm that being an importer has a positive effect on the probability of becoming a two-way trader, while being an exporter has no such an effect. The main difference between the static and dynamic estimates lies in the effect of some of the control variables (such as the foreign-owned or innovation dummies) become non-significantly different from zero or significantly reduced in magnitude (as in the case of the size dummies). This is consistent with the fact that these variable are moving slowly over time, and in the dynamic model their effect is thus picked-up by α_1 and α_2.

5.2 Contemporaneous productivity and product innovation

As a further control, we introduce the current level of productivity and propensity to innovate products. Introducing these variables do not alleviate endogeneity problems, but in this way, we are able to shed some light on the channels through which import may affect export. We first add either productivity or innovation both at time t and t-3 (column 2 and 3 of Table 7). Both variables are

positively and significantly associated with current export, while current import is only correlated with product innovation. More interestingly, when controlling for current productivity and product innovation, the effect of past import on current export slides and becomes non-significantly different from zero. This suggests that past import is correlated with current productivity and innovation and, once controlled for these variables, the direct effect of past import on current export vanishes. In other other words, these results are consistent with the idea the the effect of import on export is mediated by an increase in productivity and innovation. Noticeably, the effect through innovation appears more important than the one via productivity increase. In fact, δ_1 drops from 0.234 (in column 1) to 0.188 (in column 3) upon controlling for product innovation, and slides by a small 0.007 when we further control for productivity (column 4). Conversely, δ_1 drops from 0.206 (in column 2) to 0.181 (in column 4) when we add product innovation to the equation controlling for current productivity. These findings are consistent with the theoretical and empirical results showing that past import improves both firm productivity (Amiti and Konings, 2007; Halpern, Koren, and Szeidl, 2009; Kasahara and Rodrigue, 2008) and firm innovation (Goldberg, Khandelwal, Pavcnik, and Topalova, 2010; Kugler and Verhoogen, 2009), which in turn foster exporting activity. Results from the dynamic model, presented in Table 8, are in line with those of the static model. The only difference appears to be that upon controlling for the lagged dependent variable, it becomes clearer that product innovation rather than productivity is the more effective channel through which past importing affects current exporting. In fact, while δ_1 drops only slightly (from 0.257 to 0.244) but remain statistically significant when we introduce current productivity (column 2), controlling for current innovation is associated with larger slide in magnitude (from 0.257 to 0.191) and, in column (3), δ_1 turns non-significantly different from zero.

5.3 Trade intensity

In order to further check for the robustness of our results, we turn to the analysis export and import intensities. To this aim, we specify a bivariate Tobit which allows to jointly model the determinants of export and import levels (measured as the percentage of sales from direct exports and as the percentage of material inputs and supplies of foreign origin, respectively), while controlling for the high proportion of zeros in the two dependent variables[10]. In particular,

[10]In this respect, our approach is close to that of (Girma, Görg, and Hanley, 2008), who use the 3-stage least squares to estimate the relationships between export and R&D intensities, but has the advantage of explicitly accounting for the censored nature of the dependent variables.

we consider the following bivariate dynamic Tobit model:

$$\begin{cases} export\_perc_{it} = \alpha_1 export\_perc_{i,t-3} + \delta_1 import\_perc_{i,t-3} + \mathbf{x'}_{i,t-3}\beta_1 + u_{1it} \\ import\_perc_{it} = \alpha_2 import\_perc_{i,t-3} + \delta_2 export\_perc_{i,t-3} + \mathbf{x'}_{i,t-3}\beta_2 + u_{2it} \end{cases} \tag{6}$$

in which each equation controls firm characteristics and for lagged export and import intensities and the error terms u_1 and u_2 are assumed to be normally distribute with zero mean, variances σ_1^2 and σ_2^2 and covariance equal to ρ_{12}:

$$\begin{pmatrix} u_{1it} \\ u_{2it} \end{pmatrix} \sim N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_2^2 & \rho_{12} \\ \rho_{12} & \sigma_2^2 \end{pmatrix} \right] \tag{7}$$

Estimations have been carried out in Stata 10.1, using the package *mvtobit*. As previously done for the probit analysis, two alternative specifications of the bivariate dynamic Tobit model have been considered to allow controlling also for the effects of contemporaneous productivity levels and innovation activity. Results, presented in Table 9 are in line with the previous ones and suggest that export intensity does not affect firms' importing behaviour, while a higher import intensity foster a higher involvement in international markets. However, as showed in column (2), the effect turns non significantly different from zero once controlling for current productivity and product innovation.

6 Concluding remarks

One of the most robust piece of evidence in the recent empirical literature on firm heterogeneity and trade is that a large share of internationalized firms are engaged in both import of intermediate inputs and export of final goods. The co-occurrence of foreign sourcing and exporting at the level of the individual firm raises the question of whether these two activities are actually related. As a matter of fact, this correlation may be the result of some complementarity between the sunk cost incurred when exporting and importing, or may depend from the fact that import paves the way to export and/or viceversa. Despite the ample evidence on the empirical relevance of two-way traders, few empirical works have addressed the two-way links between exporting and importing activities
This paper provides empirical evidence which contributes to fill this gap. By estimating a bivariate probit model of the probability of exporting and importing for a sample of 1,085 firms from 27 ECA countries over the period 2002-2008, we find a two-way link between serving foreign markets and sourcing inputs from abroad. However, this two-way correlation disappears once controlled for size, and while importing remains a positive determinant of the probability of future exporting activities, the latter does not seem to affect the probability to source

Table 6: A two way link between firms' exporting and importing activities, bivariate regressions, dynamic model

	(1)		(2)		(3)		(4)	
	Export(d)$_{it}$	Import(d)$_{it}$	Export(d)$_{it}$	Import(d)$_{it}$	Export(d)$_{it}$	Import(d)$_{it}$	Export(d)$_{it}$	Import(d)$_{it}$
Import (d)$_{i,t-3}$	0.473***	0.971***	0.435***	0.940***	0.336***	0.858***	0.257**	0.765***
	(0.101)	(0.095)	(0.118)	(0.110)	(0.120)	(0.112)	(0.126)	(0.119)
Export (d)$_{i,t-3}$	1.411***	0.185*	1.560***	0.207*	1.402***	0.014	1.345***	-0.040
	(0.099)	(0.098)	(0.117)	(0.109)	(0.122)	(0.117)	(0.130)	(0.125)
Sales per worker (d)$_{i,t-3}$			0.185***	0.079**	0.194***	0.080**	0.211***	0.084**
			(0.041)	(0.040)	(0.043)	(0.040)	(0.045)	(0.041)
Small (d)$_{i,t-3}$					-0.688***	-0.711***	-0.623***	-0.718***
					(0.160)	(0.145)	(0.171)	(0.155)
Medium (d)$_{i,t-3}$					-0.336**	-0.480***	-0.337**	-0.514***
					(0.137)	(0.132)	(0.142)	(0.137)
Foreign-owned(d)$_{i,t-3}$							0.221	0.171
							(0.154)	(0.157)
State-owned(d)$_{i,t-3}$							0.065	-0.100
							(0.197)	(0.174)
Share of white collars (d)$_{i,t-3}$							-0.356	0.118
							(0.272)	(0.244)
Product innovation (d)$_{i,t-3}$							0.095	0.058
							(0.116)	(0.109)
Year 2008 (d)	-0.198*	0.183*	-0.259**	0.161	-0.237*	0.197*	-0.202	0.234*
	(0.106)	(0.097)	(0.124)	(0.111)	(0.126)	(0.113)	(0.137)	(0.124)
Constant	-5.632***	4.065***	-3.762***	-0.502	-3.280***	0.050	-3.394***	-0.044
	(0.353)	(0.391)	(0.705)	(0.661)	(0.716)	(0.670)	(0.757)	(0.691)
ρ	0.328***		0.318***		0.280***		0.298***	
	(0.071)		(0.079)		(0.082)		(0.084)	
Sector fixed effects	Yes		Yes		Yes		Yes	
Country fixed effects	Yes		Yes		Yes		Yes	
N. observations	1085		841		841		797	

Table 7: A two way link between firms' exporting and importing activities, bivariate regressions, static model

	(1)		(2)		(3)		(4)	
	Export (d)	Import (d)	Export (d)	Import (d)	Export (d)	Import (d)	Export (d)	Import (d)
Import (d) t-3	0.234*		0.206		0.188		0.181	
	(0.134)		(0.147)		(0.136)		(0.150)	
Export (d) t-3		-0.153		-0.203		-0.148		-0.194
		(0.145)		(0.155)		(0.148)		(0.160)
Sales per worker (log) t-3	0.218***	0.100**	0.279***	0.142***	0.204***	0.089**	0.272***	0.132***
	(0.050)	(0.041)	(0.065)	(0.047)	(0.052)	(0.040)	(0.069)	(0.047)
Sales per worker (log) t			0.127***	0.071			0.131***	0.069
			(0.049)	(0.047)			(0.050)	(0.048)
Product innovation (d) t-3	0.189*	0.111	0.192	0.129	0.097	0.045	0.108	0.064
	(0.108)	(0.106)	(0.119)	(0.115)	(0.110)	(0.107)	(0.121)	(0.116)
Product innovation (d) t					0.599***	0.457***	0.552***	0.468***
					(0.114)	(0.106)	(0.126)	(0.115)
Foreign-owned(d) t-3	0.589***	0.362**	0.593***	0.464***	0.592***	0.343**	0.592***	0.445***
	(0.146)	(0.158)	(0.163)	(0.168)	(0.151)	(0.157)	(0.169)	(0.168)
State-owned(d) t-3	0.060	-0.100	0.128	-0.016	0.114	-0.067	0.161	-0.002
	(0.189)	(0.175)	(0.205)	(0.190)	(0.195)	(0.176)	(0.209)	(0.190)
Share of white collars (d) t-3	-0.184	0.117	-0.448	0.072	-0.220	0.107	-0.492*	0.070
	(0.247)	(0.232)	(0.275)	(0.257)	(0.252)	(0.234)	(0.282)	(0.260)
Small (d) t-3	-1.129***	-0.934***	-1.250***	-0.849***	-1.162***	-0.929***	-1.267***	-0.835***
	(0.151)	(0.155)	(0.172)	(0.170)	(0.153)	(0.157)	(0.173)	(0.173)
Medium (d) t-3	-0.488***	-0.633***	-0.468***	-0.653***	-0.522***	-0.646***	-0.502***	-0.673***
	(0.133)	(0.137)	(0.147)	(0.146)	(0.135)	(0.137)	(0.149)	(0.148)
yr2008	-0.134	0.234*	-0.232	0.218*	-0.217	0.167	-0.320**	0.152
	(0.130)	(0.120)	(0.146)	(0.132)	(0.132)	(0.119)	(0.147)	(0.131)
Constant	-2.562***	0.423	-4.650***	-1.112	-2.604***	0.381	-4.811***	-1.159
	(0.775)	(0.705)	(1.144)	(0.966)	(0.782)	(0.704)	(1.147)	(0.974)
Contry fixed effects	Yes		Yes		Yes		Yes	
Sector fixed effects	Yes		Yes		Yes		Yes	
ρ	0.266***		0.269***		0.223**		0.225**	
	(0.090)		(0.100)		(0.092)		(0.102)	
Log-likelihood	410.5		369.4		430.2		391.8	
N. observations	797		684		797		684	

Table 8: A two way link between firms' exporting and importing activities, bivariate regressions, dynamic model

	(1)		(2)		(3)		(4)	
	Export (d)	Import (d)	Export (d)	Import (d)	Export (d)	Import (d)	Export (d)	Import (d)
Import (d) t-3	0.257**	0.765***	0.244*	0.785***	0.191	0.731***	0.200	0.761***
	(0.126)	(0.119)	(0.141)	(0.130)	(0.129)	(0.119)	(0.145)	(0.131)
Export (d) t-3	1.345***	-0.040	1.354***	-0.081	1.388***	-0.059	1.411***	-0.096
	(0.130)	(0.125)	(0.145)	(0.136)	(0.135)	(0.126)	(0.151)	(0.139)
Sales per worker (log) t-3	0.211***	0.084**	0.265***	0.120***	0.199***	0.074*	0.258***	0.111**
	(0.045)	(0.041)	(0.059)	(0.046)	(0.046)	(0.040)	(0.061)	(0.047)
Sales per worker (log) t			0.087*	0.059			0.089*	0.059
			(0.047)	(0.046)			(0.048)	(0.048)
Product innovation (d) t-3	0.095	0.058	0.125	0.084	-0.004	0.004	0.029	0.028
	(0.116)	(0.109)	(0.128)	(0.118)	(0.122)	(0.109)	(0.135)	(0.119)
Product innovation (d) t					0.670***	0.395***	0.654***	0.425***
					(0.125)	(0.111)	(0.137)	(0.120)
Foreign-owned(d) t-3	0.221	0.171	0.209	0.265	0.220	0.168	0.200	0.260
	(0.154)	(0.157)	(0.171)	(0.170)	(0.160)	(0.156)	(0.179)	(0.170)
State-owned(d) t-3	0.065	-0.100	0.052	-0.020	0.107	-0.072	0.064	-0.004
	(0.197)	(0.174)	(0.218)	(0.195)	(0.204)	(0.175)	(0.221)	(0.194)
Share of white collars (d) t-3	-0.356	0.118	-0.572*	0.043	-0.412	0.114	-0.642**	0.041
	(0.272)	(0.244)	(0.303)	(0.267)	(0.282)	(0.244)	(0.315)	(0.269)
Small (d) t-3	-0.623***	-0.718***	-0.752***	-0.608***	-0.651***	-0.736***	-0.766***	-0.611***
	(0.171)	(0.155)	(0.195)	(0.171)	(0.177)	(0.157)	(0.202)	(0.173)
Medium (d) t-3	-0.337**	-0.514***	-0.370**	-0.519***	-0.376***	-0.536***	-0.417***	-0.545***
	(0.142)	(0.137)	(0.158)	(0.147)	(0.144)	(0.137)	(0.159)	(0.148)
yr2008	-0.202	0.234*	-0.331**	0.218	-0.311**	0.181	-0.455***	0.163
	(0.137)	(0.124)	(0.157)	(0.134)	(0.140)	(0.123)	(0.160)	(0.134)
Constant	-3.394***	-0.044	-4.782***	-1.368	-3.518***	-0.023	-5.007***	-1.374
	(0.757)	(0.691)	(1.125)	(0.951)	(0.782)	(0.696)	(1.142)	(0.970)
ρ	0.298***		0.295***		0.254***		0.251***	
	(0.084)		(0.092)		(0.086)		(0.095)	
Contry fixed effects	Yes		Yes		Yes		Yes	
Sector fixed effects	Yes		Yes		Yes		Yes	
Log-likelihood	582.6		521.7		608.5		542.4	
N. observations	797		684		797		684	

Table 9: A two way link between firms' exporting and importing activities, dynamic bivariate tobit model

	(1)		(2)	
	Export $(\%)_{it}$	Import$(\%)_{it}$	Export $(\%)_{it}$	Import$(\%)_{it}$
Import (%)i,t-3	0.089*	0.548***	0.071	0.488***
	(0.047)	(0.052)	(0.052)	(0.056)
Export (%)i,t-3	0.824***	-0.035	0.836***	-0.023
	(0.052)	(0.055)	(0.057)	(0.060)
Sales per worker (d)i,t-3	7.843***	0.892	8.158***	1.564
	(1.597)	(1.166)	(1.866)	(1.432)
Sales per worker (d)i,t			3.477***	1.605
			(1.254)	(1.314)
Product innovation (d)i,t-3	(2.791)	3.189	(1.092)	-0.655
	(3.439)	(3.451)	(3.731)	(3.650)
Product innovation (d)i,t			15.585***	15.193***
			(3.907)	(3.945)
Small (d)i,t-3	-24.031***	-15.406***	-22.358***	-12.655**
	(4.887)	(4.797)	(5.349)	(5.126)
Medium (d)i,t-3	-10.215**	-10.809***	-8.339**	-10.319**
	(4.053)	(4.090)	(4.164)	(4.366)
Foreign-owned(d)i,t-3	8.788**	3.568	(7.723)	5.556
	(4.476)	(4.588)	(4.776)	(4.867)
State-owned(d)i,t-3	(2.479)	-3.82	(4.520)	-2.421
	(5.212)	(5.892)	(5.248)	(6.372)
Share of white collars (d)i,t-3	-(0.435)	7.538	-(4.377)	5.34
	(8.259)	(8.350)	(8.615)	(8.823)
Year 2008 (d)	-10.845***	3.51	-13.314***	1.803
	(3.860)	(4.157)	(4.217)	(4.474)
Constant	-198.186***	8.995	-278.481***	-40.123
	(41.019)	(30.446)	(52.942)	(42.773)
σ_1	35.57***		34.375***	
	(1.893)		(1.970)	
σ_2	42.435***		41.719***	
	(1.419)		(1.445)	
ρ_{12}	0.135***		0.096*	
	(0.051)		(0.057)	
LR test of $\rho_{12} = 0$	7.41		3.2	
p-value ($\chi^2(1)$)	0.0383		0.0738	
Country fixed effects	Yes		Yes	
Sector fixed effects	Yes		Yes	
N. observations	762		658	

foreign inputs. This result partially supports the hypothesis that some sunk costs may be common to importing and exporting. However, according to our evidence, the common sunk costs are mainly related to the size of the firm, suggesting that larger firms can bear the organizational costs of trade, which in turn foster firms' engagement in two-way trading activities. In line with other recent evidences, the positive effect of foreign sourcing on exporting seems to derive from a boost in firm productivity and innovation, and suggests that falling trade barriers, especially on intermediate inputs, can be an important policy to promote international competitiveness of domestic firms.

References

Altomonte, C., and G. Bekes (2010): "Trade Complexity and Productivity," CeFiG Working Papers 12, Center for Firms in the Global Economy.

Alvarez, R., and R. López (2005): "Exporting and performance: evidence from Chilean plants," *Canadian Journal of Economics*, 38(4), 1384–1400.

Amiti, M., and J. Konings (2007): "Trade Liberalization, Intermediate Inputs, and Productivity: Evidence from Indonesia," *American Economic Review*, 97(5), 1611–1638.

Andersson, M., and H. Loof (2009): "Learning-by-Exporting Revisited: The Role of Intensity and Persistence," *Scandinavian Journal of Economics*, 111(4), 893–916.

Andersson, M., H. Loof, and S. Johansson (2008): "Productivity and International Trade: Firm Level Evidence from a Small Open Economy," *Review of World Economics*, 144 (4), 774–801.

Atkeson, A., and A. Burstein (2007): "Innovation, Firm Dynamics, and International Trade," *NBER Working Papers No. 13326, Cambridge, MA: National Bureau of Economic Research.*

Augier, P., O. Cadot, and M. Dovis (2010): "Imports and TFP at the Firm Level: The Role of Absorptive Capacity," CEPREMAP Working Papers (Docweb) 1016, CEPREMAP.

Aw, B. Y., M. Roberts, and D. Xu (2008): "R&D Investments, Exporting, and the Evolution of Firm Productivity," *American Economic Review*, 98(2), 451–56.

Aw, B. Y., M. J. Roberts, and T. Winston (2007): "Export Market Participation, Investments in R&D and Worker Training, and the Evolution of Firm Productivity," *The World Economy*, 30(1), 83–104.

Bas, M., and V. Strauss-Kahn (2010): "Does importing more inputs raise exports? Firm level evidence from France," MPRA Paper 27315, University Library of Munich, Germany.

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

Bernard, A. B., J. B. Jensen, and P. K. Schott (2009): "Importers, Exporters and Multinationals: A Portrait of Firms in the U.S. that Trade Goods," in *Producer Dynamics: New Evidence from Micro Data*, NBER Chapters, pp. 513–552. National Bureau of Economic Research, Inc.

Blalock, G., and P. J. Gertler (2004): "Learning from exporting revisited in a less developed setting," *Journal of Development Economics*, 75(2), 397 – 416, 15th Inter American Seminar on Economics.

Bratti, M., and G. Felice (2011): "Are Exporters More Likely to Introduce Product Innovations?," Development Working Papers 306, Centro Studi Luca dÁgliano, University of Milano.

Bustos, P. (2011): "Trade Liberalization, Exports, and Technology Upgrading: Evidence on the Impact of MERCOSUR on Argentinian Firms," *American Economic Review*, 101(1), 304–40.

Caldera, A. (2010): "Innovation and exporting: evidence from Spanish manufacturing firms," *Review of World Economics*, 146, 657–689.

Cassiman, B., E. Golovko, and E. Martínez-Ros (2010): "Innovation, exports and productivity," *International Journal of Industrial Organization*, 28, 372–376.

Castellani, D. (2002): "Export behavior and productivity growth: Evidence from Italian manufacturing firms," *Review of World Economics (Weltwirtschaftliches Archiv)*, 138(4), 605–628.

Castellani, D., F. Serti, and C. Tomasi (2010): "Firms in International Trade: Importers' and Exporters' Heterogeneity in Italian Manufacturing Industry," *The World Economy*, 33(3), 424–457.

Clerides, S. K., S. Lach, and J. R. Tybout (1998): "Is Learning By Exporting Important? Micro-Dynamic Evidence ¿From Colombia, Mexico, And Morocco," *The Quarterly Journal of Economics*, 113(3), 903–947.

Colantone, I., and R. Crinò (2011): "Imported Inputs and Domestic Product Scope," Discussion Paper 312, Centro Studi Luca D'Agliano Working Paper.

Conti, G., A. Lo Turco, and M. Daniela (2011): "Rethinking the import-producitvity nexus for Italian manufacturing: Do exports matter?," Working paper, Polytechnic University of Marche.

Damijan, J. P., J. de Sousa, and O. Lamotte (2009): "Does international openness affect the productivity of local firms? Evidence from south-eastern Europe," *Economics of Transition*, 17(3), 559–586.

Damijan, J. P., v. Kostevc, and S. Polanec (2010): "From Innovation to Exporting or Vice Versa?," *World Economy*, 33(3), 374–398.

Damijan, P. J., and C. Kostevc (2006): "Learning-by-exporting: Continuous productivity improvements or capacity utilization effects? Evidence from Slovenian firms," *Review of World Economics*, 142, 599–614.

De Loecker, J. (2007): "Do exports generate higher productivity? Evidence from Slovenia," *Journal of International Economics*, 73(1), 69–98.

Farinas, J. C., and A. Martin-Marcos (2010): "Foreign Sourcing and Productivity: Evidence at the Firm Level," *World Economy*, 33(3), 482–506.

Forlani, E. (2011): "Irish firms' productivity and imported inputs," mimeo.

Girma, S., H. Görg, and A. Hanley (2008): "R&D and Exporting: A Comparison of British and Irish Firms," *Review of World Economics*, 144, 750–773, 10.1007/s10290-008-0168-6.

Girma, S., D. Greenaway, and R. Kneller (2004): "Does Exporting Increase Productivity? A Microeconometric Analysis of Matched Firms," *Review of International Economics*, 12(5), 855–866.

Goldberg, P. K., A. K. Khandelwal, N. Pavcnik, and P. Topalova (2010): "Imported Intermediate Inputs and Domestic Product Growth: Evidence from India," *The Quarterly Journal of Economics*, 125(4), 1727–1767.

Halpern, L., M. Koren, and A. Szeidl (2009): "Imported Inputs and Productivity," CeFiG Working Papers 8, Center for Firms in the Global Economy.

ISGEP (2008): "Understanding Cross-Country Differences in Exporter Premia: Comparable Evidence for 14 Countries," *Review of World Economics*, 144, 596–635, The International Study Group on Export and Productivity.

Kasahara, H., and B. Lapham (2008): "Productivity and the Decision to Import and Export: Theory and Evidence," Discussion Paper 2240, Cesifo Working Paper.

Kasahara, H., and J. Rodrigue (2008): "Does the use of imported intermediates increase productivity? Plant-level evidence," *Journal of Development Economics*, 87(1), 106–118.

Kenny, C. (2009): "Measuring Corruption in Infrastructure: Evidence from Transition and Developing Countries," *Journal of Development Studies*, 45(3), 314–332.

Kraay, A. (1999): "Exports and economic performance: evidence from a panel of Chinese enterprises," *Revue d'Economie du Developpement*, (1-2), 183–207.

Kugler, M., and E. Verhoogen (2009): "Plants and Imported Inputs: New Facts and an Interpretation," *American Economic Review*, 99(2), 501–07.

Lileeva, A., and D. Trefler (2010): "Improved Access to Foreign Markets Raises Plant-Level Productivity... for Some Plants," *The Quarterly Journal of Economics*, 125(3), 1051–1099.

Lo Turco, A., and D. Maggioni (2011): "The role of imports in enhancing manufacturing exports," Discussion paper, Department of Economics, Polytechnic University of Marche, mimeo.

Loof, H., and M. Andersson (2010): "Imports, Productivity and Origin Markets: The Role of Knowledge-intensive Economies," *World Economy*, 33(3), 458–481.

Maddala, G. S. (1983): *Limited Dependent and Qualitative Variables in Econometrics*. Cambridge University Press, Cambridge.

Melitz, M. J. (2003): "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity," *Econometrica*, 71(6), 1695–1725.

Monfardini, C., and R. Radice (2008): "Testing exogeneity in the bivariate Probit model: A Monte Carlo study," *Oxford Bulletin of Economics and Statistics*, 70 (2), 271–282.

Muûls, M., and M. Pisu (2009): "Imports and Exports at the Level of the Firm: Evidence from Belgium," *The World Economy*, 32(5), 692–734.

Park, A., D. Yang, X. Shi, and Y. Jiang (2010): "Exporting and Firm Performance: Chinese Exporters and the Asian Financial Crisis," *Review of Economics and Statistics*, 92(4), 822–842.

Salomon, R. M., and J. M. Shaver (2005): "Learning by Exporting: New Insights from Examining Firm Innovation," *Journal of Economics & Management Strategy*, 14(2), 431–460.

Seker, M. (2009): "Importing, exporting and innovation in developing countries," Policy Research Working Paper Series 5156, The World Bank.

Serti, F., and C. Tomasi (2008): "Self-Selection and Post-Entry Effects of Exports: Evidence from Italian Manufacturing Firms," *Review of World Economics*, 144, 660–694, 10.1007/s10290-008-0165-9.

Smeets, V., and F. Warzynski (2010): "Learning by Exporting, Importing or Both? Estimating productivity with multi-product firms, pricing heterogeneity and the role of international trade," Working Papers 10-13, University of Aarhus, Aarhus School of Business, Department of Economics.

Van Biesebroeck, J. (2005): "Exporting raises productivity in sub-Saharan African manufacturing firms," *Journal of International Economics*, 67(2), 373–391.

Verhoogen, E. A. (2008): "Trade, Quality Upgrading, and Wage Inequality in the Mexican Manufacturing Sector," *The Quarterly Journal of Economics*, 123(2), 489–530.

Vogel, A., and J. Wagner (2010): "Higher productivity in importing German manufacturing firms: self-selection, learning from importing, or both?," *Review of World Economics*, 145, 641–665, 10.1007/s10290-009-0031-4.

Wagner, J. (2007): "Exports and Productivity: A Survey of the Evidence from Firm-level Data," *The World Economy*, 30(1), 60–82.

Wilhelmsson, F., and K. Kozlov (2007): "Exports and productivity of Russian firms: in search of causality," *Economic Change and Restructuring*, 40, 361–385.

Appendix

Table A.1: Variable definitions

Variable	Description
Dependent variables	
Export	Equals 1 if firm directly exports its products and services; 0 otherwise
Import	Equals 1 if firm uses material inputs and supplies of foreign origin; 0 otherwise
Exportperc	Percentage of firms sales from direct exports
Importperc	Percentage of material inputs and supplies of foreign origin
Explanatory variables (Continuous)	
Productivity	Sales per worker (in logs)
WhiteCollar	Percentage of non-production workers
Explanatory variables (Binary)	
Innovation	Dummy variable equal to 1 if firm has introduced new products or services in the last three fiscal years; 0 otherwise
Small	Equals 1 if firm has less than 20 employees; 0 otherwise
Medium	Equals 1 if firm has 20 to 99 employees; 0 otherwise
Foreign-owned	Equals 1 if firm is foreign-owned; 0 otherwise
State-owned	Equals 1 if firm is state-owned; 0 otherwise

ISSN 1825-0211

QUADERNI DEL DIPARTIMENTO DI ECONOMIA, FINANZA E STATISTICA

Università degli Studi di Perugia

Quaderni pubblicati nel 2011

83	Gennaio 2011	Davide CASTELLANI Fabio PIERI	Foreign Investments and Productivity Evidence from European Regions
84	Febbraio 2011	Stefano HERZEL Marco NICOLOSI Cătălin STĂRICĂ	The cost of sustainability on optimal portfolio choices
85	Marzo 2011	Pierluigi GRASSELLI Cristina MONTESI	Politiche orientate al bene comune e politiche attive del lavoro
86	Marzo 2011	Massimo DE FELICE Franco MORICONI	Un'estensione stocastica del modello "Fisher-Lange"
87	Marzo 2011	Mirella DAMIANI Fabrizio POMPEI Andrea RICCI	Temporary job protection and productivity growth in EU economies
88	Aprile 2011	Gaetano MARTINO Paolo POLINORI	Productive process innovation as sequential adjustment of the hybrid governance structure: the case of the poultry sector
89	Aprile 2011	Stefano CASTRIOTA Marco DELMASTRO	Inside the black box of collective reputation
90	Maggio 2011	Roberto BASILE Luigi BENFRATELLO Davide CASTELLANI	Spatial clustering and nonlinearities in the location of multinational firms
91	Giugno 2011	Andrea RICCI Robert WALDMANN	Job Security and Training: the Case of Pareto Improving Firing Taxes
92	Giugno 2011	Francesca PIERRI Alberto BURCHI Elena STANGHELLINI	La capacità predittiva degli indicatori di bilancio: una verifica sulle aziende umbre
93	Luglio 2011	Francesco VENTURINI	Product variety, product quality, and evidence of Schumpeterian endogenous growth: a note
94	Settembre 2011	Francesco VENTURINI	Looking into the black box of Schumpeterian Growth Theories: an empirical assessment of R&D races
95	Ottobre 2011	Massimo MANCINI	Labor effort and temporary jobs: evidence for Italy
96	Ottobre 2011	Marco NICOLOSI Stefano GRASSI Elena STANGHELLINI	How to measure Corporate Social Responsibility
97	Novembre 2011	Mirella DAMIANI Andrea RICCI	Decentralised bargaining, contingent pay and unions: New evidence from Italy
98	Dicembre 2011	Ioannis BOURNAKIS Michela VECCHI Francesco VENTURINI	Offshoring and Specialisation: are Industries Moving abroad?
99	Dicembre 2011	David ARISTEI Davide CASTELLANI Chiara FRANCO	Firms' exporting and importing activities: is there a two-way relationship?