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Working Paper

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Economics Discussion Papers, No. 2015-15

Provided in Cooperation with:
Kiel Institute for the World Economy – Leibniz Center for Research on Global Economic Challenges

Suggested Citation: Díaz-Mora, Carmen; Córcoles, David; Gandoy, Rosario (2015) : Exit from exporting: Does being a two-way trader matter?, Economics Discussion Papers, No. 2015-15, Kiel Institute for the World Economy (IfW), Kiel

This Version is available at:
https://hdl.handle.net/10419/107774

Economics
The Open-Access, Open-Assessment E-Journal

Discussion Paper
No. 2015-15 | March 09, 2015 | http://www.economics-ejournal.org/economics/discussionpapers/2015-15

Exit from Exporting: Does Being a Two-way Trader Matter?

Carmen Díaz-Mora, David Córcoles, and Rosario Gandoy

Abstract
The aim of this paper is to investigate whether the probability of ceasing to export is lower for firms that simultaneously import intermediate inputs and export (vertically specialized firms à la Hummels et al., *The Nature and Growth of Vertical Specialization in World Trade*, 2001), once other firm characteristics are controlled for. On the basis of the estimation of a random-effects probit model with panel data, the authors find that the superior characteristics of this type of two-way trading firms (in terms of size, productivity, foreign ownership and skilled labor) explain their greater resistance to losing their status as exporters. However, for small firms, even when these distinctive features are controlled for, sourcing inputs from abroad plays an important role in continuing to export. Thus, it seems that small firms which are both importer of intermediates and exporter have an added advantage which enables them to confront the uncertainty of foreign markets in better conditions and translates to a lower likelihood that they will stop exporting.

(Published in Special Issue Micro-econometric Analyses of International Firm Activities)

JEL F14 F60
Keywords Probability of ceasing to export; firms' characteristics; imports of intermediate inputs; manufacturing firms

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Citation Carmen Díaz-Mora, David Córcoles, and Rosario Gandoy (2015). Exit from Exporting: Does Being a Two-way Trader Matter?. Economics Discussion Papers, No 2015-15, Kiel Institute for the World Economy. http://www.economics-ejournal.org/economics/discussionpapers/2015-15

Received February 28, 2015 **Accepted as Economics Discussion Paper** March 4, 2015 **Published** March 9, 2015

1. INTRODUCTION

Since the seminal work of Besedes and Prusa (2006) provided evidence of the short duration of international trade in the United States, a considerable number of studies have confirmed this result for other economies. Moreover, there has been increasing interest in investigating the factors that contribute to reducing the high rate of exit from export markets, mainly in a context of low domestic demand, where export dynamism becomes particularly important to enhance economic growth.

The consideration of firm heterogeneity in international trade models has provided a new perspective for explaining trade flows.[1] A series of empirical studies that try to determine what characteristics helps firms to join and stay in export markets has also been developed.[2] Their findings coincide in noting that, when faced with fixed-entry costs and a high degree of uncertainty in foreign trade relations, the more productive, larger, more capital and skill intensive are more likely to become exporters (self-selection bias).

Empirical evidence from firm level data which introduces firm heterogeneity as a determining factor for export exit is more limited and also very recent. Alvárez and López (2008) use Chilean data to examine the determinants of exit in exports markets, introducing industry and firm heterogeneity. They find that the second type of heterogeneity (differences in total factor productivity, skills, size and capital per worker) is more relevant. Ilmakunnas and Nurmi (2010) investigate which factors influence exit rates in Finnish manufacturing firms, showing that firms that are larger, younger, more productive, more capital-intensive and have more foreign ownership are less vulnerable. Creusen and Lejour (2011) study the probability of quitting an export market for Dutch firms, finding that it is lower for large firms, the firm's productivity does not have a significant impact, and market traits like distance and import tariffs increase the probability of exiting. Harris and Li (2011) examine exit from exporting in UK manufacturing firms, adding firm-level heterogeneity to other more general factors such as industrial concentration and trade costs, for which they obtain also a significant effect. Albornoz *et al.* (2012) introduce the following as explanatory elements of export market exit: whether the company is a new exporter; whether it re-start to export after a period with no exports; whether it is a continuing exporter; and, moreover, whether a market is the firm's first foreign market or not. They find for Argentine manufacturing companies two main results: first, exit rates are higher for firms that start with a single market than for experienced exports and, second, continuing exporters are more likely to exit that new simultaneous exporters and re-entrants.

[1] A review of this theoretical literature can be found in Redding (2011) and Melitz and Redding (2012).
[2] For a review of the literature, see Wagner (2012) and Bernard *et al.* (2012).

In keeping with this line of research, the purpose of this study is to more deeply explore the factors that influence the interruption of export activity, introducing the firm characteristic of being an importer of intermediate inputs as an explanatory variable, a point which has not been addressed in the empirical literature about exit from exporting. Our hypothesis is that a specific type of two-way firms, i.e. vertically specialized firms *à la* Hummels *et al.* (2001), defined as those which possess the double condition of importer of intermediate inputs and exporter[3]—face less uncertainty in their activity abroad, which translates to lower export market exit rates[4]. There is less uncertainty because vertical specialization requires close collaboration among trade partners, creating ties that foster the stability of trade relationships. Moreover, the uncertainty is lower because two-way traders can use the contacts that their trade partners already have to obtain information about foreign markets or new additional contacts (Chaney, 2014). Furthermore, the increase in overall firm's efficiency derived from purchasing intermediate inputs abroad is also expected to improve export performance (Bertrand, 2011).

At firm-level data, only a few papers study the connection between imported intermediate inputs and export performance. Some of them focus on the impact of foreign intermediate inputs on the probability of exporting (Sjöholm and Takii, 2008; Aristei *et al.*, 2013; Lo Turco and Maggioni, 2013; Giovannetti *et al.*, 2013; Meinen, 2015) and others on export volume and export scope (Bas and Strauss-Kahn, 2014; Bertrand, 2011; Feng *et al.*, 2012; Navas *et al.*, 2013)[5]. To the best of our knowledge, this is the first study that is focused on the impact of being an importer of intermediate inputs on the probability that a firm will cease exporting, which is our main contribution to this strand of literature.

To research whether there is a differentiated impact of being two-way trader on export exit according to firm size is another contribution. We expect that impact to be even greater for small firms. A common finding in prior empirical research is that entry and survival in foreign markets for these firms is limited by higher entry costs faced as a consequence of their smaller size (OECD, 2013; Giovannetti *et al.*, 2013). As such, small firms engaged in vertical especialization can overcome some of the limitations related to their size by benefiting from processes of technology transfer, better access to information about foreign markets, suppliers, standards of quality, etc. With the aim of confirming this second hypothesis, the study differentiates firms by size.

[3] In this paper, we use the terms "two-way trader", "vertically specialized firms" and "double condition of importer of intermediates and exporter" as synonymous.
[4] For the connection between uncertainty in trade and the success or failure of exporting, see Impullitti *et al.* (2013).
[5] Another approach is adopted by Wagner (2003) and Wagner and Weche (2014) who investigate the relationship between firm survival and two-way trading.

To verify the hypotheses put forward, we estimate a probit model using data from Spanish manufacturing firms where the probability that a firm will stop exporting depends on being an importer of intermediate inputs as well as other firm characteristics.

However, the inclusion of a variable that captures imported intermediates poses an initial problem: the possibility that being a two-way trader is linked to the existence of distinguishing firm characteristics that, as a last resort, determine the lowest risk of losing the firm's exporter status. The existence of better performance characteristics for firms that simultaneously export and import was initially provided by Bernard et al. (2007) for U.S. firms, and it was also reported by Muûls and Pisu (2009) for Belgium firms, Vogel and Wagner (2010) for German firms, Castellani et al. (2010) for Italian firms and Hayakawa and Matsuura (2014) for Japanese firms. Focussing specifically on imports of intermediate inputs, Aristei *et al.* (2013) for eastern European and central Asian firms, and Veugelers *et al.* (2013) for firms from a group of countries from the EU (France, Italy, Spain, the UK, Germany, Austria and Hungary) point in the same direction[6]. It should be noted that, in order to properly specify the empirical model, these distinguishing traits that characterize vertically specialized firms have to be examined.

The results of our research show that, indeed, two-way traders show distinctive traits (a *premium* for productivity, size, skilled labor, etc.) compared to other exporting firms. For the group consisting of large and medium-size firms, such characteristics explain as a whole why they are less likely to lose their status as exporters. However, in the case of small firms, even when these distinctive traits are controlled for, being an importer of intermediate inputs is still a significant determinant of persistence as an exporter. Thus, for small firms, being a two-way trader seems to confer an added advantage that allows them to face the uncertainty of foreign markets in better conditions, which translates to more successful export activity in terms of the probability of quitting foreign markets compared to those companies which only export.

The paper is structured as follows. The next section introduces the data and presents a descriptive analysis of the rates of interruption of export flow in firms engaged in both import of intermediate inputs and export, compare them to remaining exporters. In Section 3, we examine the characteristics of these two-way trading firms. Section 4 presents the econometric estimations and the results. Section 5 concludes.

[6] Although these works study the relevance and characteristics of two-way traders, none of them investigate the impact of being a two-way trader on the probability of stopping to export.

2. DATA AND DESCRIPTIVE ANALYSIS.

To study the relationship between being an importer of intermediate inputs and export behaviour, we use data from the Survey on Business Strategies (*Encuesta sobre Estrategias Empresariales*, initialled ESEE in Spanish). It is a representative sample of Spanish manufacturing firms with 10 or more employees, using the exhaustive sample of large firms (more than 200 employees) and random-sampling criteria for small and medium-sized firms. The survey includes around 2,000 firms every year.[7] The ESEE provides establishment-level data on many of the firm characteristics. Initially, we distinguish three types of firms according to number of employees: large firms (more than 200 employees), medium-sized firms (between 50 and 200 employees) and small firms (between 10 and 49 employees)[8].

We consider a firm to be a two-way trader or vertically specialized when it exhibits the double condition of being a firm that both imports intermediate inputs and exports. As such, vertical specialization, as required by Hummels *et al.* (2001), implies the acquisition of imported intermediate inputs, which constitute the phase of the production process that takes place abroad, to be incorporated into the manufacturing phase performed in the national economy to generate final products destined for export or semi-finished goods for further processing abroad. As information related to imported intermediate inputs is available in the survey as of 2006, the period studied covers the years 2006-2010. This is a very significant time period because it is just before and after the global crisis.

According to our data, at present, two-thirds of Spanish manufacturing firms are exporters and 60% of them are two-way traders, with both percentages having increased sharply in recent years regardless of the size of the firm.[9] As shown in Table 1, nearly all of the large firms (over 90%) are exporters and most of them are also importers of intermediate inputs (75% in 2010). Within the group of medium-sized firms, exporters predominate (83% in 2010), with the prevalence of two-way traders repeated (65%). Only in the group of small firms are exporting firms a minority (less than 50%) as are also those two-way traders (45%). In all three groups, the percentage of vertically specialized firms has increased during the study period.

[7] Detailed information about the ESEE is available at www.funep.es.

[8] The number of firms that cross the firm size group thresholds during the sample period (for instance, from low to medium or from large to medium) is less than 5%. This percentage is even lower if we only consider to exporting firms. We consider the firm size changeable over time. Therefore a firm could be regarded as a small firm in *t-1* but a large firm in *t*, when increasing its number of employees. In order to contrast the robustness of estimated models, we have alternatively introduced an unchanged time variable considering the initial size status in the first year and the results are very similar to those presented in this paper.

[9] Differences in data sources make it difficult to compare findings across countries.

Table 1: Number of exporting firms and two-way trading firms

		IMPORTERS OF INTERMEDIATE INPUTS & EXPORTERS		TOTAL EXPORTERS	
		No. of Firms	Share of exporting firms (%)	No. of Firms	Share of total firms (%)
All firms	2006	688	55.8	1232	63.1
	2007	755	61.2	1233	63.8
	2008	770	61.4	1254	66.1
	2009	777	61.5	1263	67.7
	2010	786	61.3	1282	68.6
Large	2006	348	69.3	502	90.1
	2007	365	72.8	501	89.8
	2008	321	71.0	452	91.3
	2009	306	72.3	423	92.9
	2010	288	75.6	381	93.4
Medium	2006	191	56.2	340	75.4
	2007	210	61.9	339	75.5
	2008	277	68.6	404	77.8
	2009	284	64.7	439	81.1
	2010	312	64.7	482	82.9
Small	2006	149	38.2	390	41.4
	2007	180	45.8	393	42.5
	2008	172	43.2	398	45.1
	2009	187	46.6	401	46.1
	2010	186	44.4	419	47.6

Source: Own elaboration from data of the Survey on Business Strategies.

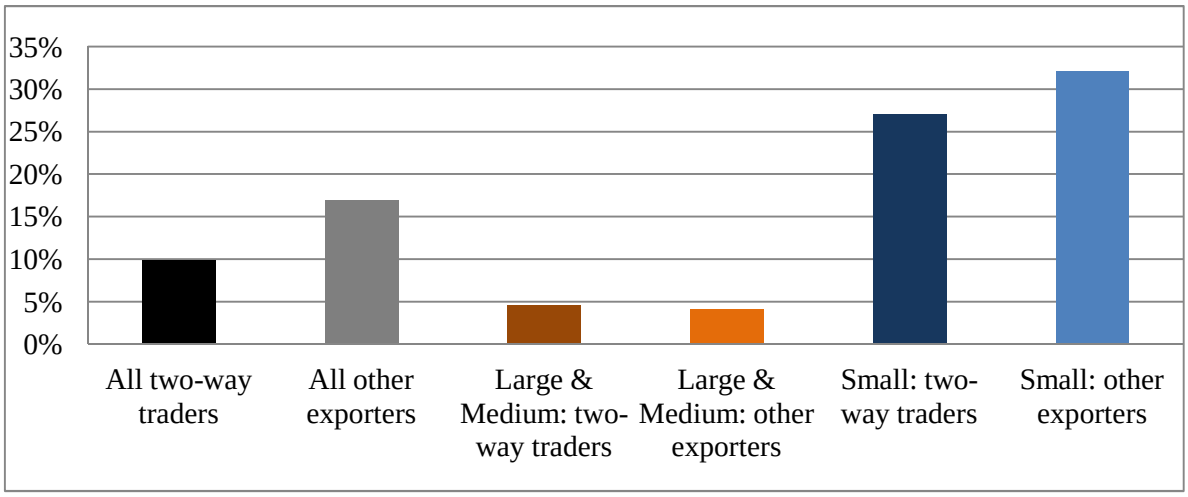
Thus, our data show the relevance of firms that are engaged simultaneously in sourcing inputs from abroad and exporting. This fact enhances the interest in learning about their behaviour in terms of export exit rates, given their considerable impact on the aggregate of the country's exports.

Figure 1 shows export exit rates by firm size for the period studied. In the whole period, around 13% of exporting firms lose their status as exporters. The exit rate was 10% for firms involved in vertical specialization and 17% for firms that only export. When they are broken down by firm size, the majority of those that lose their status as exporters are small firms (120 of the 158 firms). The small number of large and medium-sized firms that cease exports (15 and 23, respectively) seriously limits the analysis for these two groups of firms and prompts us to consider them as a single group. When done this way, the lower exit rate for two-way traders is only evident in small firms (27% compared to 32%). That is, within the group of small firms, there is a lower probability to interrupt export activity in two-way traders, which reveals that, regardless of the influence of other factors, the

condition of being an importer of intermediate inputs is especially beneficial for small firms, in terms of a lower probability of quitting export markets.

Figure 1: Export exit rate by employment size and by foreign trade activity

(Percentage of export stoppers over total exporters; whole period, 2006-2010)



Source: Own elaboration from data of the Survey on Business Strategies.

Similar conclusions are reached when the probabilities of transition for different firm thresholds are analyzed (Table 2). For small firms, the probability of ceasing to export when the firm had exported the year before is higher for firms which only export (9.1%) than for firms involved in both export and import activities (6.3%), which does not occur in the case of large and medium-sized firms, where the probabilities are more similar. That is, for small firms, importing intermediates implies a greater guarantee of remaining in export markets. Furthermore, we find a high persistence in the status of double importer and exporter, which is explained by two factors (Kasahara and Lapham, 2013): the presence of sunk costs associated with undertaking foreign trade relations (true state dependence) and the existence of unobservable heterogeneity such that, even without sunk costs, the most productive firms show a higher probability of maintaining the double status of exporter-importer (spurious state dependence). Keeping in mind that, according to previous empirical literature, some of the sunk costs are shared for import and export activity and that firms which combine both types of foreign activity have an advantage in productivity over firms that only export, persistence in the double status of importer-exporter is even greater than the persistence in the status of exporter. The complementarity of sunk costs also explains why the probability of transition to the double condition of importer-exporter is much higher for firms that are already exporters than for firms that are not.

Table 2: Transition probabilities for firms by employment size and by foreign trade activity

t-1 / t		Do not export (t)	Do only export (t)	Export & Import of intermediates (t)
All firms	Do not export (t-1)	94.79	2.93	2.28
	Do only export (t-1)	5.02	75.39	19.59
	Export & Import of intermediates (t-1)	2.30	8.50	89.19
Large & Medium	Do not export (t-1)	91.77	3.77	4.46
	Do only export (t-1)	1.14	73.42	25.44
	Export & Import of intermediates (t-1)	1.06	7.09	91.85
Small	Do not export (t-1)	95.14	2.94	1.92
	Do only export (t-1)	9.14	77.42	13.45
	Export & Import of intermediates (t-1)	6.35	12.71	80.94

Source: Own elaboration from data of the Survey on Business Strategies.

3. INTERNATIONALIZATION AND FIRM CHARACTERISTICS

The greater persistence in the exporter status of firms involved in vertical specialization shown in the previous section could be influenced by the existence of characteristics that distinguish them from other exporters. Therefore, it seems necessary to do a prior study that would allow us to determine what traits would have to be included in the empirical model to be estimated in the next section.

The analysis of the specificities of firms that both import intermediates and export can be carried out following the study by Bernard and Jensen (1999), through a regression where each of the firm characteristics are made to depend on the firm's double condition of importer of intermediates and exporter:

$$Ln\, X_{it} = \alpha + \beta X\&Mint_{it} + \gamma Ln\, Employment_{it} + \theta Industry + \lambda Time_t + \varepsilon_{it} \quad (1)$$

where X is the firm characteristic to analyze (which are the usual characteristics included in the studies that consider firm heterogeneity an explanatory factor of export and/or import behaviour) and *X&Mint* is a dummy variable that takes the value 1 if the firm is engaged simultaneously in importing intermediate inputs and exporting, or the value 0 if it is only an exporter. In the estimation, we control for firm size (measured by the number of employees, *Employment*), except when the characteristic to explain is firm size, and industry-fixed effects (*Industry*) and year-fixed effects (*Time*) are also introduced. We perform the estimation for all exporting companies in the sample and for each of the groups according to firm size.

The premium for being a two-way trader (β) would express the average difference in each firm characteristic between firms that combine exports with imports of intermediate inputs and other

exporting firms. Note that these results show simple correlations that allow to quantify the firm specificities of two-way traders, once differences in firm size and industry affiliation are considered.

The findings of our estimations are presented in Table 3. Substantial differences in the firm characteristics between firms involved in vertical specialization and other exporting firms are found. For all firms (top part of the table), two-way traders are "better" firms, i.e. larger, more productive, with higher foreign ownership, more engaged in outward FDI, more likely to do product and process innovation, and more skill-intensive.[10]

Table 3: *Premium* for being both importer of intermediate inputs and exporter

(OLS regressions)

	Employment	**Labor Productivity**	**Foreign ownership**	**Outward FDI**	**Product innovation**	**Process innovation**	**Skilled Labor**
All firms							
Export&Import int.	0.702***	0.105***	7.010***	1.684*	0.066***	0.021	1.659***
Log (employment)		0.116***	10.19***	11.01***	0.063***	0.078***	1.236***
No. observations	6,142	5,620	6,142	6,142	6,142	6,142	2,393
R^2	0.180	0.216	0.221	0.193	0.097	0.081	0.206
Large and medium firms							
Export&Import int.	0.258***	0.0809***	10.12***	2.179*	0.0546***	0.0185	1.588*
Log (employment)		0.121***	11.30***	13.99***	0.0745***	0.0863***	1.679***
No. observations	4,188	3,842	4,188	4,188	4,188	4,188	1,631
R^2	0.079	0.168	0.161	0.142	0.078	0.052	0.223
Small firms							
Export&Import int.	0.113***	0.140***	3.424***	2.495***	0.0876***	0.0169	5.826***
Log (employment)		0.134***	4.169***	2.573***	0.0535***	0.128***	-1.913
No. observations	1,954	1,778	1,954	1,954	1,954	1,954	762
R^2	0.067	0.189	0.070	0.041	0.089	0.063	0.208

Notes: Estimations for the 2006-2010 period. Labor productivity is measured by value added per employee. For foreign ownership and domestic ownership of firms located abroad, any percentage of ownership is considered. Skilled labor is measured by the ratio of workers with university education over total firm employment. Data from skilled labor are available only every four years. ***, ** and * denote statistical significance at 1%, 5% and 10% level, respectively. All the estimations include year and industry dummies.

The connection between two-way traders and labor productivity finds support in theoretical studies like Kasahara and Lapman's (2013). These authors develop a model as an extension of the one by Melitz (2003) about monopolistic competition with exporters which differ in their productivity,

[10] As the firm characteristic to analyze in relation to innovation is whether the firm innovates or not, the estimations have been also run using a probit model. The results and conclusions are similar as those obtained using OLS estimations.

where they also introduce differences between firms in the use of imported intermediate inputs and sunk costs for participation in international markets. In accordance with their model, the relationship between firm productivity and firm internationalization through the acquisition of imported inputs goes two ways. First, as already mentioned, in their activity abroad, firms confront fixed costs and sunk costs (associated with having to establish a network of clients/suppliers abroad, learning other countries' regulations, etc.), which will be higher when the strategy of exporting is combined with the strategy of importing intermediate inputs (although some of these costs are complementary).[11] This way, only firms that are more productive will be able to face these costs and engaged in vertical specialization. Second, the use of imported intermediate inputs increases the firm's productivity because of the presence of increasing returns and the increase in the variety of inputs.[12]

These arguments would justify the productivity premium shown by two-way traders. The additional size requirements may be due to the fact that large firms have more resources for collecting necessary information about foreign markets, and are more likely to obtain credit for international operations than small firms (Beck *et al.*, 2008). Same argument can be used to explain why vertically specialized firms show higher foreign ownership and outward FDI. Lastly, the literature highlights a two-way nexus between sourcing inputs from abroad and innovation, where more robust evidence have been found of a causal effect of importing inputs on product innovation and on skill-intensive activities (Aristei *et al.*, 2013).

This superiority of two-way traders in each of the characteristics analyzed is maintained for the two size groups, except those related to differences in process innovation, which are not significant. Moreover, the positive difference in favour of firms engaged simultaneously in importing intermediates and exporting is greater in the group of small firms for almost all of the characteristics analyzed (except participation of foreign capital).

Therefore, our analysis reveals the existence of some distinctive traits for firms involved in vertical specialization compared to other exporters, features that are, moreover, more marked in small firms.

[11] As Onkelinx and Sleuwaegen (2010) note, from the point of view of learning economies, firms that import intermediate inputs have contacts with foreign partners that would generate privileged knowledge, thus helping these firms to reduce the risk and the costs of exporting to these same foreign markets. And vice versa: the export of a certain country could provide valuable information about possible suppliers located in that country.

[12] In this regard, Navas *et al.* (2013), following the examples of Melitz (2003) and Chaney (2008), develop a model in which they introduce trade in intermediate goods in a context of firm heterogeneity and also of asymmetry of trading-partner countries. According to these authors, the bigger the country of origin of intermediate inputs is, the more positive the effect of importing these inputs on firm productivity will be (because a greater variety of inputs will be available), and the greater the costs of trading with that country are, the less positive of an effect it will have (because the capacity of the firm to expand the variety of inputs originating from this country will be limited).

4. EMPIRICAL MODEL

The objective of this section is to investigate whether sourcing inputs from abroad hinders or prevents exit from export markets relative to other exporting firms. To do this, we propose an empirical model where a firm's interruption of export activity depends on its double condition as an importer of intermediate inputs and exporter while other firm characteristics that might influence export behaviour are controlled for.

The dependent variable is a categorical variable which identifies whether the firm continues or ceases exports in period *t*, considering that it had exported in the previous period *t-1*. In practice, this variable is equivalent to the hazard rate of exporting and therefore, the estimated model is similar to a survival discrete-choice model. The exit rate is only related with a unique point in the period *t-1* (firm exported in *t-1*). This is an important advantage over survival rate that is correlated to whole period of exporting (*T*).

Previous econometric literature provides evidence about estimation problems in discrete-choice models with fixed effects (incidental parameters problem). Additionally the coefficients could be severely biased (Nickell, 1981; Greene, 2004; Fernández-Val, 2009). These problems are specially relevant in samples like ESEE, with small T-periods and a high number of individuals. For this reason, we estimate a random-effects probit model in which it is possible to control for unobserved heterogeneity (frailty) of firms over time. The general equation of the probit for firm i at moment t is:

$$y_{it}^{*} = \beta X_{it-1} + \varepsilon_i + \varepsilon_t + \mu_{it} \quad (2)$$

where y_{it}^{*} is the estimated dependent variable that will take the value 1 if the firm stops exporting in period *t*, having exported in *t-1*, and zero in any other case (when the firm continues to export, having also exported in the previous period)[13]:

$$y_{it} = (No\ export_{it} | Export_{it-1}) = 1\ if\ (No\ export_{it} | Export_{it-1})^{*} > 0;\quad y_{it} = \begin{Bmatrix} 0 & if & (Export_{it} | Export_{it-1}) \\ missing & if & (No\ export_{it} |\ No\ export_{it}) \\ missing & if & (No\ export_{it} |\ Export_{it}) \end{Bmatrix} \quad (3)$$

where $\left(X_{it-1} = x_{1_{it-1}}, x_{2_{it-1}}, \ldots x_{n_{it-1}}\right)$ is a vector that contains the explanatory variables considered in Section 3 (two-way trader, size, productivity, foreign ownership, outward FDI, product and process innovation and skilled labor), $\beta = (\beta_1, \beta_2 \ldots \beta_n)$ is the vector of associated coefficients; ε_i is the error term that controls for the firm's time-invariant fixed effects; ε_t is the error term that controls for year fixed effects; and μ_{it} is the independent error term, of mean zero and constant

[13] The first year (2006) can take zero or one value because information about exports from previous year (2005) is available.

variance $(\mu \sim N(0, \sigma^2))$. The explanatory variables are introduced lagged in one period, understanding that their effect must precede the firm's decision to exit or stay in the export market.

To capture the effect of the previous export experience, we also keep in mind the number of consecutive years of export prior to the decision to exit or stay in international markets. It is a categorical variable that takes three possible values (1, 2 or 3 depending on whether it is 1 year, 2 years or 3 or more years).[14] Sporadic exporters or those that enter foreign markets for the first time will be at greater risk of failing at export activity than those that have already consolidated their status as an exporter (Albornoz *et al.*, 2012; Creusen and Lejour, 2011). We also control for firm age, for specific industry effects by including industry dummies and for specific time effects.

The results of the estimations are presented in Table 4. The first two columns show two different specifications for the random-effects probit: the first (specification 1a), which uses only the variables of firm characteristics there is information on for all years of the period analyzed, and the second (specification 1b), which uses all the variables of firm characteristics, although the information about skilled labor is only available every four.[15]

The results of these estimations indicate that being a two-way trader does not have a significant impact on the probability of ceasing export activity once other firm characteristics are controlled for. As for other firm characteristics, size is important in continuing export activity: small firms show a higher exit rate. Firms with greater productivity are at a lower risk of losing their status as exporters. This is also true for firms with foreign ownership, more skilled labor and those with previous experience in export markets. Innovation, whether process or product, as well as firm age and outward FDI do not seem to have a significant impact on the probability of ceasing to export. As such, our initial hypothesis about the role of vertical specialization as a deterrent to exiting export markets does not seem to be confirmed, beyond the indirect effect through the differential characteristics shown by firms involved in both importing intermediates and exporting activities.

[14] Taking into account that data on firm export status is available as of 1990, the left-censoring problem is minor and previous export experience can be measured properly.
[15] The information about this variable is available for 2006 and 2010. We extrapolate the data for the remaining years.

Table 4: Estimations results (random effects Probit model, average marginal effects)

VARIABLES	Specification (1a)	Specification (1b)	Specification (2a)	Specification (2b)
Export & Import int.	0.0052 (0.0048)	0.0050 (0.0048)	0.0048 (0.0049)	0.0044 (0.0050)
Small firm	0.0356*** (0.0066)	0.0360*** (0.0067)	0.0356*** (0.0064)	0.0362*** (0.0065)
Labor productivity	-0.0083** (0.0036)	-0.0071* (0.0037)	-0.0082** (0.0036)	-0.0069* (0.0037)
Foreign ownership	-0.0002** (0.0000)	-0.0002* (0.0000)	-0.0001 (0.0001)	-0.0001 (0.0001)
Outward FDI	-0.0002 (0.0001)	-0.0002 (0.0001)	-0.0001 (0.0001)	-0.0002 (0.0001)
Product innovation	0.0013 (0.0061)	0.0023 (0.0062)	0.0039 (0.0067)	0.0049 (0.0068)
Process innovation	-0.0074 (0.0051)	-0.0068 (0.0051)	-0.0073 (0.0047)	-0.0075 (0.0048)
Skilled labor		-0.0005** (0.0002)		-0.0005** (0.0002)
Short previous export experience	-0.0947*** (0.0227)	-0.0924*** (0.0225)	-0.1020*** (0.0256)	-0.0972*** (0.0248)
Long previous export experience	-0.1221*** (0.0217)	-0.1202*** (0.0215)	-0.1334*** (0.0247)	-0.1281*** (0.0238)
Firm age	0.0002 (0.0037)	0.0000 (0.0037)	0.0005 (0.0037)	0.0003 (0.0038)
INTERACTION TERMS	No	No	Yes	Yes
Small firm # X&Mint			-0.0274* (0.0164)	-0.0272* (0.0165)
Foreign ownership # X&Mint			-0.0004** (0.0002)	-0.0004* (0.0002)
Industry dummies	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Observations	4781	4755	4781	4755
Number of firms	1235	1232	1235	1232

Notes: Standard errors in brackets. *p <0.05; **p <0.01; ***p < 0.001. All explanatory variables are dummies except labor productivity (in logs), firm age (in logs) and skilled labor. Labor productivity is measured by value added per employee. For foreign ownership and domestic ownership of firms located abroad, any percentage of ownership is considered. Skilled labor is measured by the ratio of workers with university education over total firm employment. Data from skilled labor are available only every four years. Short previous export experience refers to those firms that have export activity only one or two years consecutively before exit, whereas long previous experience refers to continuing exporters for three or more years before exit; these two variables are referred to be an exporter only the previous year. Interaction terms between each explanatory variable and *X&Mint* variable are included in the model, but only those that are statistically significant are reported.

However, the previous estimations do not take into account that firm characteristics can influence export exit rates as well as being a two-way trader. Taking into account the existence of heterogeneity across firms, this aspect is particularly relevant. To keep it in mind, it is necessary to estimate interaction coefficients (Buis, 2010). Starting from equation (2), if we suppose that we have two explanatory variables and that the interacted variable is x_1, now the general model would be:

$$y_{it}^{*} = \beta_1 x_{1_{it-1}} + \beta_2 x_{2_{it-1}} + \beta_3 \left(\left(x_{1_{it-1}} \right)^{*} \left(x_{2_{it-1}} \right) \right) + \varepsilon_i + \varepsilon_t + \mu_{it} \quad (4)$$

where β_1 and β_2 determine the individual impact of each explanatory variable and β_3 the joint effect of both variables.

The incorporation of interaction terms allows us to isolate the effect of being a two-way trader from the impact of the rest of the characteristics, controlling for possible distortions that could cause correlation between them. Moreover, interactions help to identify whether the effect of being a vertically specialized firm is different according to firm size, level of productivity or other firm characteristics; or viewed from another perspective, whether the impact of each of the firm characteristics differs according to whether or not the firm is engaged in both importing intermediates and exporting (Brambor *et al*., 2006). For example, the interaction of the two-way trader variable with the Small Firm variable allows to isolate the impact of firm size and the impact of being a two-way trader, controlling for the relationship between both variables (because it has been observed that small firms are involved less in vertical specialization). Also, it contributes to determine whether the impact of being a two-way trader is different between the group of large and medium-sized firms and the group of small firms.

In these selection models with interaction terms**,** one must be especially cautious when analyzing the results. More specifically, the interpretation of the regression coefficients equally as in linear models would lead to erroneous conclusions (Ai and Norton, 2003; Hoetker, 2007). This is why it is necessary to estimate the marginal effects that show the change in the probability of export exit in response to a change in the explanatory variable. One limitation in using marginal effects is that they are sensitive to changes in the values of the explanatory variables, which is why we could find different results throughout the estimated distribution function (Buis, 2010; Ai and Norton, 2003; Hoetker, 2007). For that reason, it is necessary to make suppositions about the variability of the explanatory variables. In this paper, we have calculated the marginal effects for each explanatory variable in averages, supposing that the rest remain constant in their average value.[16]

[16] We have also calculated the marginal effects for different values of the explanatory variables and for the median value. These results are omitted because of space constraints but are available upon request.

The last two columns of Table 4 (specifications 2a and 2b) show the results of the estimations, introducing interactions of each of the variables with the condition of being both importer of intermediate inputs and exporter. These interaction terms let us to distinguish the impact of each firm characteristic on the probability of stopping export activity, differentiating between whether or not the firm has the double condition of exporter and importer of intermediate inputs.

Most of the results described about the impact of different firm characteristics hold true when interaction terms are introduced. Thus, small firms face a higher risk of being expelled from export markets, while this risk is lower for the most productive firms, for firms with more experience as exporters and for firms with a higher level of education among their employees. The condition of foreign ownership ceases to have a significant effect; that is, once one takes into account the relationship between this variable and being a two-way trader, the foreign capital participation does not seem to significantly affect exit rates for export activity.

Although interactions between being engaged in vertical specialization and each firm characteristics have been included, only those which turned out to be statistically significant are reported. There are two of these: the interactions with foreign ownership and with being a small firm. In both cases, the sign of the interaction is negative. For the rest of the firm characteristics, the interactions are not significant, which implies that their impact on the probability of ceasing to export is similar for two-way traders and the remaining exporters.

In the case of the interaction between being a two-way trader and foreign ownership, the negative sign demonstrates that the foreign capital participation diminishes the probability of ceasing export activity more when the firm show the double condition of importer of intermediates and exporter; in fact, the impact is significant only in that case (or what is the same, that being a two-way trader reduces the risk of ceasing to export significantly only in firms with foreign ownership). This result implies that the negative effect on the probability of interrupting exports found in the estimations without interactions is not due to the foreign capital participation in itself but instead to the fact that this trait is usually linked to be a vertically specialized firm.

In the case of interaction with firm size, the negative sign of the interaction means that the positive effect of being small on the probability of ceasing to export is significantly lower when these small firms are also importers of intermediate inputs. That is, for small firms, sourcing inputs from abroad does favours the stability of the status of exporter in the 2006-2010 period, supporting our hypothesis on the role of being a two-way trader as a deterrent to stopping export activity for small firms. Bearing in mind the greater difficulties small firms have in meeting the fixed and sunk costs of

export activity, this result can show that there are fewer difficulties for firms that import intermediate inputs, helping to preserve their status as exporters. The vertical specialization of small firms could be related to their involvement in international production networks which help them to survive in international markets (OECD, 2008).

As an analysis of robustness, alternative estimations have been made. In the first place, a different threshold for foreign ownership and domestic ownership of firms located in other countries has been used (threshold of 50%). The latter variable becomes significant only in the specifications without interactions (1a and 1b) and maintains its negative sign; that is, those firms engaged in outward FDI are less likely to lose their status as an exporter. The rest of the results remain practically unchanged. Secondly, considering the high persistence shown by the double condition of exporter and importer of intermediate inputs, we have introduced the assumption that the firm that had imported intermediate inputs every year from 2006 to 2010 had also done so in previous years, and the period of study has been expanded to 2004-2010 and 2000-2010**,** which allows us to increase the number of observations. As in the previous case, the conclusions hold. The results of these estimations are available to the reader upon request.

5. CONCLUSIONS

Using a sample of Spanish manufacturing firms in the recent period 2006-2010, in this paper we have studied the impact of being a vertically specialized firm *à la* Hummels *et al.* (2001), i.e. being jointly an importer of intermediate inputs and exporter, on the probability of ceasing to export. Also, we differentiate by firm size to determine whether the reduction in the probability of quitting foreign markets as a result of being a two-way trading firm is especially important for small firms.

The study of export exit rates and transition matrix probabilities indeed indicates a lower probability of interrupting export activity for firms that simultaneously import intermediates and export, mainly among small firms. Moreover, the analysis has shown how these two-way trading firms show superior distinctive characteristics in terms of size, productivity, foreign ownership, outward FDI and skilled labor.

The estimation of a random-effects probit model in which we investigate the factors that influence the probability that a firm will lose its status as an exporter does not confirm for firms as a whole, once other firm characteristics are controlled for, the role of being a two-way trader as a deterrent to exiting export markets. However, the positive impact of this deeper form of internationalization on the stability of the firm's exporter status is significant for small firms, showing that for these firms,

sourcing inputs from abroad has enhanced the probability of remaining as exporters during the period just before and after the global crisis.

Acknowledges: The authors gratefully acknowledge the financial support of the Cátedra de Innovación y Desarrollo Cooperativo y Empresarial from the University of Castilla-La Mancha (UCLM) and Fundación Caja Rural Castilla-La Mancha as well as UCLM internal funding for research groups.

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Statistical Appendix:

Table A.1. Descriptive statistics

	Mean	Std. Desv.			Min	Max	Firms	Observations
		Overall	Between	Within				
Export exit (dependent variable)	0.034	0.181	0.213	0.119	0.000	1.000	1754	6610
Export & Import int. (dummy)	0.410	0.492	0.433	0.227	0.000	1.000	2713	10662
Small Firm (dummy)	0.468	0.499	0.487	0.124	0.000	1.000	2930	12636
Labor productivity (log)	3.685	0.690	0.616	0.358	-2.303	7.064	2707	11647
Foreign ownership	14.968	34.778	32.556	9.810	0.000	100.000	3003	13334
Outward FDI	11.215	30.132	27.107	11.077	0.000	100.000	3003	13351
Product innovation (dummy)	0.200	0.400	0.329	0.246	0.000	1.000	3003	13351
Process innovation (dummy)	0.317	0.465	0.367	0.316	0.000	1.000	3003	13351
Previous export experience (in years)	2.600	0.728	0.725	0.494	1.000	3.000	5040	35280
Firm age (log)	3.251	0.673	0.664	0.122	0.000	0.563	4284	29966
Skilled labor	13.089	15.348	14.668	3.846	0.000	100.000	2644	16000