Exit from Exporting: Does Engagement in Transnational Networks Matter?

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Abstract:

The aim of this paper is to investigate whether the probability of ceasing exports is lower for firms that are integrated in transnational production chains, once other firm characteristics are controlled for. On the basis of the estimation of a random-effects probit model with panel data, we find that the superior characteristics of firms involved in global networks (in terms of 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, integration in international networks plays an important role in continuing to export. Thus, it seems that small firms which participate in networks 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.

JEL codes: F14, F60.

Key words: Probability of ceasing to export, firms' characteristics, integration in global value networks.

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1. INTRODUCTION

Since the seminal research by 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 studying the factors that contribute to reducing the high rate of exit from export markets. This has occurred within a context of strictly containing internal demand, where the dynamism of a country's exports becomes particularly important in order to avoid the collapse of the national production.

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 aid firms in joining and staying in export markets has been developed on the basis of that consideration.[2] Their results 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 about factors that determine export exit rates is more limited. Ilmakunnas and Nurmi (2010) research which factors influence exit rates in Finnish manufacturing firms. They find 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, that the firm's productivity does not have a significant impact, and that market traits like distance and import tariffs increase the probability of exiting. Albornoz *et al.* (2012) introduce the following as explanatory elements of export market exit: whether the company is a new exporter; whether it resumes exporting after a period with no exports; or whether it is a continuing exporter. They find for Argentine manufacturing companies that exit rates are higher for continuing exporters.

Our paper is in keeping with this line of research. Its goal is to more deeply explore the factors that influence the interruption of export activity, introducing the firm characteristic of participation in international production networks as an explanatory variable, a point which has not been addressed in the empirical literature. Our hypothesis is that firms involved in networks—which for our purposes means those which demonstrate vertical specialization as understood by Hummels *et al.* (2001), that is, those which possess the double condition of importer of intermediate inputs and exporter—face less uncertainty in their activity abroad, which translates to lower export market exit

[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).

rates[3]. There is less uncertainty because within networks, exporters can use the contacts that their trade partners already have to obtain information about foreign markets or new additional contacts (Chaney, 2011). Moreover, the process of international fragmentation of production requires close collaboration among network partners, which leads them to share technological knowledge, skilled labor and business strategies, creating ties that foster the stability of trade relationships between exporters and importers.

In addition, we expect the impact of belonging to networks on export behaviour to be especially important for small firms. For these entities, incorporation into global value chains is viewed as an opportunity to enter and expand in foreign markets, but this opportunity is limited by higher entry costs faced as a consequence of their smaller size (OECD, 2008; Giovannetti *et al.*, 2013). As such, small firms that manage to join these networks can overcome some of the limitations related to their size by benefiting from processes of technology transfer, marketing and distribution networks designed by leading firms, better access to information about foreign markets, suppliers and clients, standards of quality, etc. With the aim of confirming this second hypothesis, the study differentiates firms by size.

This is the first study that is focused on the impact of participating in international production networks on the probability that a firm will cease exporting, which is our main contribution to the literature about the subject.[4] Differentiating companies by size is another contribution.

To verify the hypotheses put forward, we estimate a probit model with firm level data which research the effect of participating in networks on the probability that a firm will stop exporting, at the same time controlling for other firm characteristics.

However, the inclusion of a variable that measures participation in networks poses an initial problem: the possibility that joining international production networks is linked to the existence of distinguishing firm characteristics that, as a last resort, determine the lowest risk of losing one's status as an exporter.[5] The studies by Aristei *et al.* (2013) for eastern European and central Asian firms, and by Veugelers *et al.* (2013) for firms from a group of countries from the EU (France, Italy,

[3] For the connection between uncertainty in trade and the success or failure of exporting, see Impullitti *et al.* (2013).
[4] From the perspective of the duration and survival of bilateral trade relationships at the product-line level, Obashi (2010) and Córcoles *et al.* (2012) find a higher stability for trade involved in global production networks. 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) and others on export volume and export scope (Bas and Strauss-Kahn, 2011; Feng *et al.*, 2013; Navas *et al.*, 2013).
[5] The existence of better performance characteristics for firms that simultaneously export and import (two-way traders) was initially shown 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 and Castellani *et al.* (2010) for Italian firms.

Spain, the UK, Germany, Austria and Hungary) point in this direction. It is understood that, before tackling the econometric analysis, it is necessary to examine the possible existence of distinguishing traits that characterize firms that participate in networks to specify the empirical model correctly.

The results of our research show that, indeed, firms in global production chains show distinctive traits (a *premium* for productivity, size, skilled labor, etc.) compared to other export 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, belonging to international production networks is still a significant determinant of persistence as an exporter. Thus, for small firms, participation in networks 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. In the next section, we present the data and a brief descriptive analysis of companies that participate in networks and the degree of interruption of their export flows. In Section 3, we examine the characteristics of firms that participate in networks, comparing them to the characteristics of export firms that are not supplied from abroad. Then, we present the econometric estimation and its results. The article ends with our conclusions.

2. DATA AND DESCRIPTIVE ANALYSIS.

To study the relationship between belonging to production networks and firm 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.[6] The ESEE provides establishment-level data on many of the firm characteristics.

We consider a firm to be integrated in transnational production networks when it exhibits the double condition of being a firm that both imports intermediate inputs and exports. As such, participation in networks implies the acquisition of imported intermediate inputs, which constitute the phase of the production process that takes place abroad, and which are incorporated into the manufacturing phase performed in the national economy to generate end products destined for export or semi-finished

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

goods that will continue their manufacturing process in another country (Veugelers *et al.*, 2013[7]; Baldwin and Yan, 2014). This way, the network is extended to at least three establishments located in three different countries, as required by Hummels *et al.* (2001) in their concept of vertical specialization. As information related to imported intermediate inputs is available in the survey only as of 2006, the period studied covers the years 2006-2010. Initially, we distinguished 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).

According to our data, at present, two-thirds of Spanish manufacturing firms are exporters and 60% of them are part of production chains, with both percentages having increased sharply in recent years regardless of the size of the firm. [8] As shown in Table 1, nearly all of the large firms (over 90%) are exporters and most of them (75% in 2010) belong to networks, compared to those which are only exporters. Within the group of medium-sized firms, those engaged in foreign markets predominate (83% in 2010), with the prevalence of those involved in networks repeated (65%) compared to those which only export. Only in the group of small firms are firms with activity abroad a minority (a figure less than 50%) as are also those which participate in networks (45%) compared to the other exporters. In all three groups, the percentage of firms that belong to networks has increased during the study period.

Table 1: Exporting firms engaged and not engaged in GVC

	All firms		Large		Medium		Small	
	2006	2010	2006	2010	2006	2010	2006	2010
FIRMS IN GVC								
No. of firms	688	786	348	288	191	312	149	186
Share of exporting firms (%)	55,8	61,3	69,3	75,6	56,2	64,7	38,2	44,4
Average exports value per firm	66,9	53,2	127,3	131,3	8,0	11,9	1,1	1,6
Exports value per firm (GVC firms)/ Exports value per firm (other exporting firms)	3,5	4,4	2,1	2,7	1,3	1,5	1,4	1,7
TOTAL EXPORTERS								
No. of firms	1232	1282	502	381	340	482	390	419
Share of total firms (%)	63,1	68,6	90,1	93,4	75,4	83,0	41,4	47,6
Value of exports per firm	45,8	37,4	106,6	111,0	7,1	10,4	0,9	1,2

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

[7] Veugelers *et al.* (2013) establish different levels of involvement in global value chains depending on the complexity of firms' international strategies. According to their classification, firms which are engaged in importing components and exporting their products (dual-mode firms) are firms with a medium level of GVC involvement. A high level of involvement also requires organizing production abroad (triple-mode firms). The lowest level of involvement occurs in firms that are internationally active only in one mode.

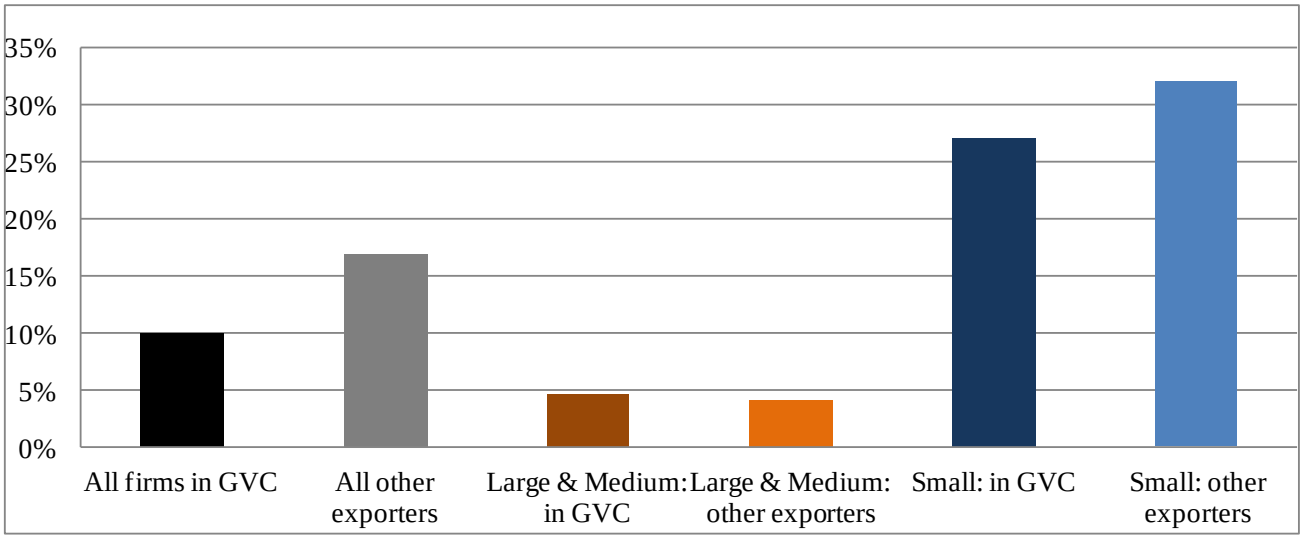
[8] Differences in data sources make it difficult to compare findings across countries.

Differences in export activity according to involvement in networks are present not only in the so-called extensive margin but also in the intensive margin (volume exported per firm). Thus, we observe that the value of exports in firms that belong to networks is significantly higher than the corresponding value of firms which are only exporters. This differential increases over time and is substantially greater for large firms (more than double). This importance within the business world of firms involved in international networks increases 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 networks 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 firms involved in networks is only evident in small firms (27% compared to 32%). That is, within the group of small firms, there is a lower tendency to interrupt export activity on the part of firms integrated in international chains, which reveals that, regardless of the influence of other factors, the condition of being involved in networks is especially beneficial for small firms, in terms of a lower probability of quitting export markets.

Figure 1: Export exit rate

(percentage of export stoppers over total exporters; 2006-2010)



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

Similar conclusions are reached if 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 networks (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, participating in networks implies a greater guarantee of remaining in export markets. Furthermore, we find an elevated 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)	Involved in GVC (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
	Involved in GVC (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
	Involved in GVC (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
	Involved in GVC (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 cross-border production sharing shown in the previous section can be influenced by the existence of characteristics that distinguish these firms from other exporters. In this regard, it seems necessary to do a prior study that would

allow us to determine what traits would have to be taken into account in the empirical analysis afterwards.

The analysis of differential firm characteristics according to whether firms are only exporters or are integrated in a global value chain 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 participation in networks variable:

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

where *X* is the firm characteristic to analyze (included are the usual characteristics in the studies that consider firm heterogeneity an explanatory factor of export and/or import behaviour) and *GVC* is a dummy variable that takes the value 1 if the firm is part of an international production chain, understood as the simultaneous activities of 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 integration in networks (β) would express the average difference in each firm characteristic between firms that combine exports with imports of intermediate inputs in their activity abroad and other exporting firms.

The results of our estimations are presented in Table 3. Substantial differences in the firm characteristics between firms involved in international chains and other export firms are found. For all of the exporting firms in the sample (top part of the table), the firms involved in networks are larger, are more productive, have higher foreign ownership, are more engaged in outward FDI, are more likely to do product and process innovation, and are more skill-intensive than other exporters.[9]

The connection between integration in networks 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, 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 the internationalization of the firm through the acquisition of imported inputs goes two ways. First, as already mentioned, in their activity abroad, firms

[9] Given that the firm characteristic to analyze in relation to innovation is whether the firm innovates or not, the estimations have been repeated using a probit model. The results allow us to reach the same conclusions as the OLS estimation.

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).[10] This way, only firms that are more productive will be able to face these costs and engaged in global networks. 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.[11]

The arguments used by previous studies would justify the productivity premium shown by firms that participate in transnational production systems. The additional size requirements for involvement in networks may be due to the fact that large firms have more resources for collecting necessary information about foreign markets, obtaining the funds necessary for investments or pursuing strategies of marketing, innovation and specialized training of labor. Likewise, firms with foreign ownership and firms involved in FDI would supply knowledge of foreign markets and facilitate the search for new suppliers and foreign clients, which helps integration in networks. Lastly, the availability of skilled labor and a certain capacity for innovation would help reduce uncertainty about whether the firm can meet the demands of cross-border production sharing.

This superiority of firms that join networks in each of the characteristics analyzed is maintained for each of the groups of firms according to size, except those related to differences in process innovation, which are not significant. Moreover, the positive differences in favour of firms integrated in networks is greater in the group of small firms for almost all of the characteristics analyzed (except participation of foreign capital).

Our analysis therefore reveals the existence of some distinctive traits for firms involved in GVC compared to other exporting firms, features that are, moreover, more marked in small firms.

[10] 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.

[11] 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).

Table 3: *Premium* for being a firm engaged in GVC

	Employment	Productivity	Foreign ownership	Outward FDI	Product innovation	Process innovation	Skilled Labor
All firms							
Firm involved in GVC	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							
Firm involved in GVC	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							
Firm involved in GVC	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. 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.

4. BELONGING TO NETWORKS AND EXIT FROM EXPORT MARKETS: THE EMPIRICAL MODEL

The objective of this section is to investigate whether the integration of a firm in international value chains hinders or prevents exit from export markets relative to other export firms. To do this, we propose an empirical model which analyzes whether a firm's interruption rates of sales abroad depends on its double condition as an exporter and an importer of intermediate inputs and controls for other firm characteristics that might influence export behaviour.

We start with a categorical dependent variable which observes whether the firm continues or ceases exports in period *t*, considering that it had exported in the previous period *t-1*. To this end, we estimate a random-effects probit model in which it is possible to control for unobserved heterogeneity 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):

$$y_{it} = (No\ export_{it} | Export_{it-1}) = 1\ \ if\ (No\ export_{it} | Export_{it-1})^{*} > 0;\ \ 0\ \ otherwise \quad (3)$$

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 (belonging to *GVC*, 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 variance $\left(\mu \sim N(0, \sigma^2)\right)$. 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.

With the objective of capturing 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).[12] 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).

[12] 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.

Lastly, we also control for specific industry effects by including industry dummies and for firm age.

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.[13]

The results of these estimations indicate that belonging to GVC does not have a significant impact on the probability of ceasing export activity once other firm characteristics are controlled for. As for 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 integration in international networks 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 networks.

[13] The information about this variable is available for 2006 and 2010. We extrapolate the data for the remaining years.

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

VARIABLES	Specification (1a)	Specification (1b)	Specification (2a)	Specification (2b)
Firm in GVC	0.0052	0.0050	0.0048	0.0044
	(0.0048)	(0.0048)	(0.0049)	(0.0050)
Small firm	0.0356***	0.0360***	0.0356***	0.0362***
	(0.0066)	(0.0067)	(0.0064)	(0.0065)
Labor productivity	-0.0083**	-0.0071*	-0.0082**	-0.0069*
	(0.0036)	(0.0037)	(0.0036)	(0.0037)
Foreign ownership	-0.0002**	-0.0002*	-0.0001	-0.0001
	(0.0000)	(0.0000)	(0.0001)	(0.0001)
Outward FDI	-0.0002	-0.0002	-0.0001	-0.0002
	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Product innovation	0.0013	0.0023	0.0039	0.0049
	(0.0061)	(0.0062)	(0.0067)	(0.0068)
Process innovation	-0.0074	-0.0068	-0.0073	-0.0075
	(0.0051)	(0.0051)	(0.0047)	(0.0048)
Skilled labor		-0.0005**		-0.0005**
		(0.0002)		(0.0002)
Short previous export experience	-0.0947***	-0.0924***	-0.1020***	-0.0972***
	(0.0227)	(0.0225)	(0.0256)	(0.0248)
Long previous export experience	-0.1221***	-0.1202***	-0.1334***	-0.1281***
	(0.0217)	(0.0215)	(0.0247)	(0.0238)
Firm age	0.0002	0.0000	0.0005	0.0003
	(0.0037)	(0.0037)	(0.0037)	(0.0038)
INTERACTION TERMS	No	No	Si	Si
Small firm#Firm in GVC			-0.0274*	-0.0272*
			(0.0164)	(0.0165)
Foreign ownership# Firm in GVC			-0.0004**	-0.0004*
			(0.0002)	(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, firm age and skilled labor. 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 GVC 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 integration in networks. 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 belonging to networks 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 belonging to networks is different according to firm size, level of productivity or other firm characteristic; 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 GVC (Brambor *et al*., 2006). For example, the interaction of the GVC variable with the Small Firm variable allows us to isolate the impact of firm size and the impact of participating in networks, controlling for the relationship between both variables (as it has been observed that small firms participate less in networks). Also, it contributes to determine whether the impact of being a firm involved in networks 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.[14]

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 involved in GVC. These interaction terms allow us to distinguish the impact of each firm characteristic on the probability of

[14] 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.

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 participation in networks, the foreign capital participation does not seem to significantly affect exit rates for export activity.

Although interactions between being engaged in GVC 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 firms integrated in networks and those that are not.

In the case of the interaction between being part of a network and foreign ownership, the negative sign demonstrates that the foreign capital participation diminishes the probability of ceasing export activity more when the firm is integrated in networks; in fact, the impact is significant only in the case of being a firm that is integrated in networks (or what is the same, that participation in networks 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 involved in networks.

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 integrated in global production chains. That is, for small firms, belonging to networks does aid the stability of the status of exporter, supporting our hypothesis on the role of participation in international networks 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.

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 firm. The results of these estimations have been omitted for reasons of space but are available to the reader upon request.

5. CONCLUSIONS

In this article, we have studied the impact of joining transnational production networks on export behaviour, in particular, 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 participating in these global networks 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 integrated in international networks, mainly among small firms. Moreover, the analysis has shown how firms involved in international networks have 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, at least for firms as a whole and once other firm characteristics are controlled for, the role of integration in networks as a deterrent to exiting export markets. However, the positive impact of this participation in networks on the stability of the firm's exporter status is significant for these small firms, showing that for small firms, incorporation in international networks is an opportunity to increase their probability of remaining an exporter.

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