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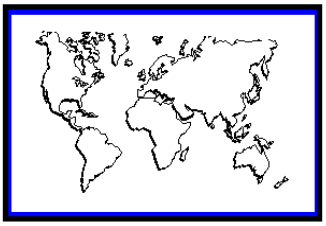

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Abstract:

The aim of this paper is to investigate the dynamics of the exporting activity of manufacturing firms that are involved in complex internationalization strategies. We consider complex internationalization to be when firms are simultaneously active in exporting, importing intermediates and international production, which are typically associated with participation in GVCs. Our descriptive data show that these triple mode internationalized firms belong to an elite group of firms that exhibit a higher level of labour productivity, are larger and show a higher likelihood of engaging in product innovation. On the basis of the estimation of a random-effects probit model with panel data, we find that once such firm characteristics are controlled for, internationalization complexity plays an important role in continuing to export. Additionally, the results from a dynamic panel data model show that being involved in more sophisticated internationalization modes positively influences the level of exports. Thus, it seems that firms active in a complex mix of internationalization strategies have an added advantage which enables them to confront the uncertainty of foreign markets in better conditions and translates to a lower likelihood of ceasing exporting and to higher export values. We go one step further and investigate whether the impact is different during the trade collapse in 2009 and the following recovery.

JEL codes: F14, F60.

Key words: Export dynamics, firms' characteristics, complex internationalization, trade collapse and recovery.

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1. INTRODUCTION

The fall of world trade in 2009 has generated a considerable amount of literature that tries to explain the causes of the high sensitivity of trade to the international financial crisis. One of the aspects studied has been the role of global value chains (hereafter GVCs) in the great trade collapse (Baldwin, 2009). The expansion of GVCs was an important determinant of the increase of trade elasticity in 1990s and it also seems to be important for the collapse and subsequent slowdown of trade (Escaith et al., 2010; Milberg and Wincler, 2010; Constantinescu, 2015). However, firm-level empirical literature is not conclusive on this issue (Stehrer et al., 2012).

Altomonte et al. (2012) find evidence of an overreaction of trade in intermediate inputs (as an indicator of engagement in GVCs) during the 2009 trade collapse. Due to an adjustment of production and stocks to the new expected levels of output (*bullwhip effect* or inventory adjustment), French firms experienced a larger fall in trade in intermediate than in consumption goods. The higher weight of intermediates in overall trade explained the trade collapse in France. Moreover, they also show that trade organised within hierarchies of firms has been more sensitive to the negative demand shock but rebounded faster because of the closer relationship of partners provides a better handling of inventories.

Nevertheless, there are empirical firm-level studies which find that GVC involvement did not play a significant role in the decrease in foreign trade volumes during the crisis or even it helped firms to fare better in the crisis period, playing a stabilising role. Behrens et al. (2013) find, in the case of Belgium, that participation in GVCs did not differentially affect export growth in the trade collapse period (2008-2009) as compared to a normal period (2007-2008). These findings are in line with Giri et al. (2014). They document that Mexican exporters engaged in vertical supply chains (measured by a high fraction of *maquiladora* exports) didn't suffered more during the crisis period (2008-2009) and post- crisis period (2009-2010), with no differential effect on exit and export growth. Alfaro and Chen (2012) investigate how multinationals around the world responded to the crisis (2007-2009) relative to local counterparts. They find that multinationals that engaged in activities with vertical production links or stronger financial constraints performed better than local firms.

Our paper tries to contribute to this line of research by empirically investigating the export behaviour of firms engaged in GVCs. Recent empirical literature on international trade has shown that only those more capable firms engage in complex combinations of internationalization strategies and go beyond exporting activity (Barba Navaretti et al., 2010; Altomonte et al., 2013; Veugelers et al., 2013). Complex internationalization refers to being involved simultaneously in

various categories of internationalization strategies such as exporting, importing, FDI or outsourcing, which is typically associated with participation in GVCs. As each internationalization mode implies some high and separate fixed costs (although some may be common), combining several of these modes requires greater ability on the part of firms to deal with them as well as with the uncertainty that characterizes operating in foreign markets. This higher ability is widely explained by firm-specific characteristics so that firms engaged in multidimensional internationalization strategies are older, larger, more productive and more innovative.

The aim is to test to what extent their export behaviour has been determined by GVC involvement. Specifically, we examine two different aspects of export performance: exit from exporting and the export value of surviving exporters. Our hypothesis is that firms more deeply involved in internationalization strategies belong to an elite group of firms, the so called 'happy few' (Mayer and Ottaviano, 2008), which have a better performance in terms of exports dynamics, mainly during the great trade collapse and the following recovery. Investigating whether the effect of being complex internationalizers on export dynamics is different during and after the trade collapse in 2009 is the main contribution of our paper.

Trade collapse was triggered for the slump in demand and was amplified by financial constraints. Regarding the first factor, Novy and Taylor (2014) suggest a tight link between uncertainty and the cyclical behaviour of international trade. Uncertainty leads firms to postpone orders of foreign suppliers reducing international trade. We argue that complex internationalized firms face less uncertainty becausethey can use the contacts that their trade partners already have to obtain information about foreign markets or new additional contacts (Chaney, 2014). Regarding to the second factor, there is no doubt that the increase of financial cost and the lack of financing help to explain the behaviour of trade in recent years. Nevertheless, it is reasonable to assume that not all firms are affected in the same way. It is likely that firms involved in GVCs are less affected by trade finance shortages since lead firms can provide financial support to suppliers and buyers to avoid the disruption of the production process (Altomonte and Ottaviano, 2009; Milberg and Wincler, 2010).Thus, based on these two arguments, we could expect a better trade performance in GVC firms.

Focussing specially on export survival, it is expected that firm's participation in multidimensional internationalization prevents exit from exporting activity. Altomonte and Ottaviano (2009) suggest that trade within international supply chains has exhibited some degree of resilience to large adverse shocks like the great trade collapse. Because of the existence of sunk costs in setting up and organizing cross-border production sharing, long-lasting relations are expected within GVC sin

order to avoid disrupting part of the supply chain. Moreover, the process of international fragmentation of production requires close collaboration among network partners, which leads them to share technological knowledge, skilled labour and business strategies, enhancing productivity, improving firms´ competitive position in international markets and strengthening ties that foster the stability of trade relationships between exporters and importers.

We address the question of the effect of engagement in GVCs on export performance using a two-step empirical analysis. First, a random-effects probit model with panel data is estimated to explore, once firm characteristics are controlled for, the role of internationalization complexity in continuing to export. Second, using a dynamic panel data model, we examine the influence of GVC involvement on export value of surviving exporters.

To preview our findings, our estimations suggest that, on the one hand, internationalization complexity plays an important role in continuing to export although this behaviour is not different since 2009; and on the other hand, GVC involvement positively influences the level of exports, an effect that it is even higher since 2009, suggesting that the negative impact of trade collapse in 2009 on export level has been lower for GVC-involved firms and the subsequent recovery has been more intense.

The paper is structured as follows. In Section 2 we introduce the data and provide some descriptives of firms that participate in networks. Moreover, we examine the characteristics of firms engaged in GVCs, comparing them to the characteristics of other exporting firms. In Section 3 we present the econometric estimations for the role of integration in GVCs on export exit and on the values of surviving exporters. In Section 4 we present some concluding remarks.

2. DATA AND DESCRIPTIVE ANALYSIS.

It is difficult to precisely identify firms integrated in transnational production networks. Veugelers et al. (2013) identify the extent of a firm's involvement in global value chains depending on the complexity of its international strategies. According to this, firms most involved in GVCs are those that combine three types of international activities (triple-mode firms), that is, importing of components, exporting and organizing production abroad, either through foreign manufacturing affiliates or contracting with other manufacturing firms abroad. As such, participation in cross-border networks implies carrying out certain tasks abroad and the acquisition of imported intermediate inputs which are incorporated into the manufacturing phase performed in the national economy to generate end products destined for export or semi-finished goods for further processing

in another country. Firms active in two modes of international activity or even one mode are firms with lower levels of GVC involvement. Within dual-mode firms, those that exhibit the double condition of being a firm that both imports intermediate inputs and exports are the most common. This is how participation in GVCs is measured in other papers (Baldwin and Yan, 2014).

In order to capture the close and complex linkages between actors within cross-border networks, GVC-involved firms are those that are simultaneously active in exporting, importing intermediates and international production (either through inward FDI –foreign ownership– or outward FDI –FDI maker–)[1]. Note that the last condition restricts cross-border networks to intra-firm relationships, excluding market-based (arm's length) linkages.

Data is 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 has been carried out since 1990 and it includes around 2,000 firms every year.[2] The ESEE provides establishment-level data on many of the firm characteristics. As information related to imported intermediate inputs is available in the survey only as of 2006, the period studied covers the years 2006-2013.

According to our data, three-quarters of all Spanish manufacturing firms are exporters and more than one-quarter of them (28%) are involved in complex internationalization (Table 1). Nearly all of the large firms (over 90%) are exporters and half of them are GVC-involved firms. Within the group of medium-sized firms, exporters also predominate (88% in 2013) and over 30 percent are involved in complex internationalization. Exporting firms are rarer within small firms (around 55% in 2013) and even more scarce are firms engaged in cross-border networks (5%). Moreover, in medium-sized firms, the share of them that active in a complex mix of internationalization strategies has increased by 10 percentage points during the study period.

Differences in export activity according to internationalization complexity are present not only in the so-called extensive margin but also in the intensive margin (export value per firm). The average value of exports per firm is significantly higher for firms that belong to networks than for only exporting firms. Specifically, it was eight times higher in 2006 and now it is four times. Although firms involved in complex internationalization make up only 28 percent of exporting firms, they concentrate 63 percent of total exports in 2013 (75 percent in 2006). This gap is substantially greater for small firms (3.1 percent of firms concentrate 9.7 percent of total exports), although

[1]For measuring foreign ownership and ownership of firms located abroad, any share is considered.
[2] Detailed information about the ESEE is available at www.funep.es.

declining over the period examined. The importance of GVC-involved firms and the subsequent impact on a country's aggregate exports raises interest in learning about their exporting behaviour.

Table 1: Exporting firms engaged and not engaged in complex internationalization

	All firms			Large firms			Medium firms			Small firms		
	2006	**2009**	**2013**	**2006**	**2009**	**2013**	**2006**	**2009**	**2013**	**2006**	**2009**	**2013**
FIRMS IN GVCs												
No. of firms	341	351	319	250	208	149	79	117	150	12	26	20
Share of exporters (%)	27,7	27,8	27,6	49,8	49,2	50,3	23,2	26,7	32,5	3,1	6,5	5,0
Share of total value of exports (%)	75,2	70,6	63,0	77,5	74,9	66,6	34,1	33,3	39,7	9,7	14,7	11,0
Value of exports per firm	124,2	88,6	104,4	165,9	142,9	207,9	10,5	11,1	15,1	3,0	2,7	3,7
OTHER EXPORTERS												
No. of firms	891	912	836	252	215	147	261	322	312	378	375	377
Share of exporters (%)	72,3	72,2	72,4	50,2	50,8	49,7	76,8	73,3	67,5	96,9	93,5	95,0
Value of exports per firm	15,7	14,2	23,4	47,8	46,3	105,4	6,1	8,1	11,1	0,9	1,1	1,6
TOTAL EXPORTERS												
No. of firms	1232	1263	1155	502	423	296	340	439	462	390	401	397
Share of total firms (%)	63,1	67,7	74,9	90,1	93,0	94,6	75,4	81,1	88,5	41,4	46,1	56,2

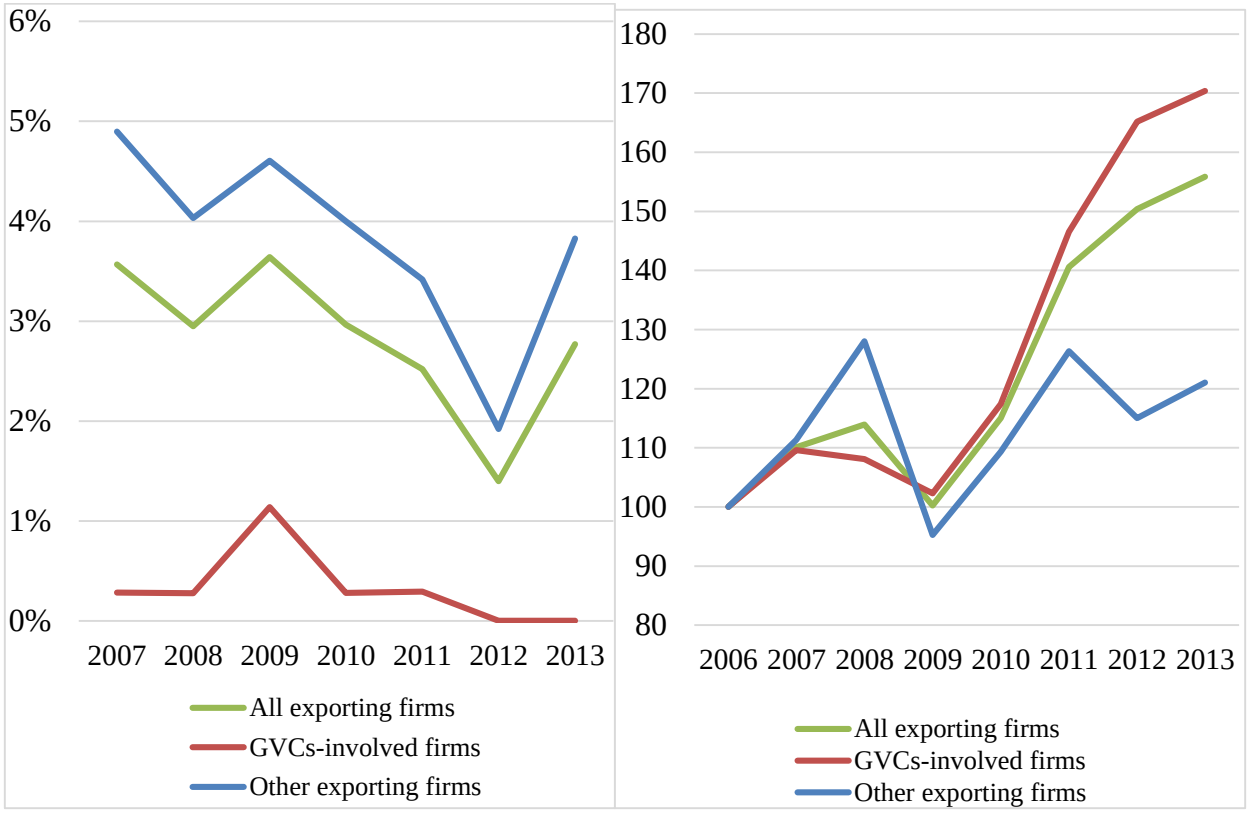
Note: Firm size is measured by the number of employees: large firms (more than 200 employees), medium-sized firms (between 50 and 200 employees) and small firms (between 10 and 49 employees).

Source: Authors' elaboration from data from the Survey on Business Strategies.

Figure 1 shows the evolution of export exit rates and export values for continuing exporters by internationalization mode for the period studied. Two facts can be highlighted. The first is that firms engaged in complex internationalization strategies exhibit a lower probability of export interruption than firms that only export. The average exit rate was 0.3% for triple-mode internationalized firms and 3.8% for only exporters, the latter being higher throughout the entire observation period (figure on the left).When firm size is considered, the relative lower exit rate for complex internationalizers is even clearer for small firms.

Figure 1: Export behaviour by internationalization mode

(a) Exit from exporting **(b) Aggregate value of exports (2006=100)**



Note: In the figure on the left, export exit rate is measured as the share of the number of export stoppers each year over the number of exporters in the previous year. In the figure on the right, the aggregate value of exports refers to the sum of the value of exports of all firms; the panel is balanced on firms that are continuously GVC-involved (or continuously other exporters) in each of the years 2006 to 2013.

Source: Authors' elaboration from data from the Survey on Business Strategies.

The second is that internationalization mode also matters in export growth which is higher for continuing GVC-involved firms, mainly since the great trade collapse[3]. For these firms, the aggregate value of exports is 70 percent higher in 2013 than in 2006, whereas it is only 20 percent higher for the other exporting firms (figure on the right). Moreover, the drop in total export value in 2009 was more intense for the second type of firm, whereas the recovery was for the first type of firm.

Thus, our data suggest a lower tendency to interrupt export activity and a more dynamic export growth for firms integrated in international production networks. This reveals that, regardless of the

[3] To abstract the effects of market entry and exit in export activity or from changes in internationalization modes, we only consider those firms that were triple-mode internationalizers or only exporting firms throughout the entire period 2006-2013.

influence of other factors, the condition of being involved in multidimensional internationalization is especially beneficial for strengthening export activity.

It could be argued that the lower exit rates from exporting and the higher export intensity growth exhibited by GVC-involved firms are explained by the peculiarities that distinguish them these firms from other exporters. To take this into account, for both types of firms, we investigate firms' characteristics such as labour productivity, size, innovation activity and skilled labour, which are the usual characteristics in studies including firm heterogeneity as an explanatory factor of export behaviour.

Table 2 presents these firm characteristics of the GVC-involved firms and compares them with those of other exporting firms. The first ones are larger, more productive, more innovative and more skilled-labour intensive. The clearer difference is in size, since the average number of employees in multidimensional internationalized firms is triple the number in only exporting firms. In the other characteristics, the gap is narrower (50 percent lower in other exporting firms). Moreover, these firm characteristics are similar before and after the great trade collapse, except size which has been lower for both groups of firms since 2009.

Table 2: Firm characteristics by internationalization mode (average 2006-2013)

Firm characteristic	GVC-involved firms	Other exporting firms
Size (Employment)	589,9	174,6
Labour productivity	73,7	52,7
Product innovation	35,5	21,7
Process innovation	50,0	36,5
Skilled Labour	21,6	14,0

Notes: Labour productivity is measured by value added per employee. Product and Process innovation represent the percentage of firms that are engaged in product and process innovation. Skilled labour is measured by the ratio of workers with tertiary education over total firm employment. Data for skilled labour are available only every four years.

Furthermore, to deeply explore these differences, we follow the study by Bernard and Jensen (1999) and we regress each firm's characteristic on firm GVC participation. In this way, we try to identify the distinctive characteristics of firms engaged in GVCs compared to only exporting firms.

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

Where *X* is the firm characteristic to analyze and *GVC* is a dummy variable that takes the value 1 if the firm is involved in GVCs, 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 for industry-fixed effects at the 2-digit NACE level (*Industry*) and year-fixed effects (*Time*). The premium for integration in networks (β) expresses the average difference in each firm characteristic between firms involved in complex internationalization and only exporting firms.

These estimations show that there are substantial differences in characteristics between them (Table 3). Triple-mode internationalized firms are larger, more productive and more likely to engage in product innovation compared to only exporters.[4]

Table3: *Premium* for being a firm engaged in complex internationalization (OLS estimation)

	Employment	Labour Productivity	Product innovation	Process innovation	Skilled Labour
Firm involved in GVCs	0.078***	0.077***	0.023*	0.009	0.152
Log (employment)		0.119***	0.066***	0.085***	0.830***
No. observations	10,018	9,269	10,018	10,018	9,527
No. firms	2,109	2,025	2,109	2,109	1,866
R^2	0.094	0.216	0.086	0.079	0.203

Notes: Estimations for the 2006-2013period. Labour productivity is measured by value added per employee. Skilled labour is measured by the ratio of workers with tertiary education over total firm employment. Data for skilled labour are available only every four years. ***, ** and * denote statistical significance at 1%, 5% and 10% level, respectively. All the estimations include year dummies and NACE-2 digit industry dummies.

3. BELONGING TO NETWORKS AND EXPORT DYNAMICS:THE EMPIRICAL MODEL

3.1. Exit from exporting

The first step of our empirical analysis is to investigate whether the firm's participation in multidimensional internationalization prevents exit from exporting activity. We propose an empirical model which analyzes the effect of GVC engagement on the probability of export failure, while other firm characteristics that might influence export behaviour are controlled for. This is a crucial issue since firms engaging in a complex mix of internationalization strategies show distinctive firm characteristics which could contribute to explaining the impact of GVC

[4] When the characteristic is whether the firm innovates or not, estimations have also been run using a probit model and conclusions are similar to those obtained with OLS estimation.

involvement on export exit. To control for this unobserved firm heterogeneity over time, a random-effects probit model is estimated[5]:

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

Where y_{it}^{*} is the estimated dependent variable that will take the value 1 if the firm *i* ceases exporting in period *t*, having exported in the previous year *t-1*, and zero in any other case (when the firm continues to export, also having 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 includes the explanatory variables related to firm characteristics such as belonging to GVCs, size, productivity, product and process innovation and skilled labour; they are introduced lagged in one period to mitigate endogeneity concerns. $\beta = (\beta_1, \beta_2 \ldots \beta_n)$ is the vector of associated coefficients; $\varepsilon_i$denotes the error term that controls for the firm's time-invariant fixed effects; $\varepsilon_t$denotes the error term that controls for year fixed effects; and μ_{it} is the independent error term, of mean zero and constant variance $\left(\mu \sim N(0, \sigma^2)\right)$.

Related literature highlights the role of previous export experience in current export behaviour. Sporadic exporters or new exporters usually exhibit a low rate of survival than those that have consolidated their status as an exporter (Albornoz *et al.*, 2012; Creusen and Lejour, 2011; Eaton *et al.*, 2007). To capture its effect, a dummy variable for being a continuous exporter is also included in the estimations. We define continuous exporters to be those firms that have exported for three consecutive years or more before the reference year. The variable takes the value 1 for those firms and 0 otherwise.

As usual in non-linear models, marginal effects are calculated to simulate the change in the probability of export exit in response to a change in the explanatory variable. Specifically, we compute average marginal effects.

The results of the estimations are presented in column (1) of Table 4. It is found that firms involved in deeper internationalization strategies show a lower probability of ceasing export activity. So, our

[5]Fixed-effect probit models are methodologically not possible. Previous econometric literature points out some inherent problems for fixed-effects in models with dichotomous dependent variable. Computing fixed-effect MCO models provides implausible predictions outside of zero-one interval (Eppinger and Smolka, 2015). In our case the fixed MCO model for the probability of exit exporting reports around 20% of negative estimated probabilities. Additionally we attempt specify logit models controlling for fixed-effects but it might not be possible because the excessive number of firm dummies. In this regard, Nickell (1981) and Green (2004) point out the problems for getting efficient results, as in our case, in samples with small T and high individuals.

initial hypothesis is confirmed and GVC involvement seems to prevent firms from leaving their export status[6].

Regarding the other firm characteristics, most of them are statistically significant and have a negative impact on export exit. The larger the firm is, the lower the likelihood of export interruption. Moreover, more productive and more skilled-labour intensive firms also exhibit a higher probability of survival. Furthermore, non-sporadic exporters are at a lower risk of losing their status as exporters. Nevertheless, product and process innovation does not have a significant impact on exit from exporting. While no year dummies are statistically significant, the exit rate was not significantly different in each year compared to 2006. That is, the likelihood of export interruption was not higher during the 2009 trade collapse. This result is in line with Behrens et al. (2013), who reported that the dynamics of export exit during the crisis did not substantially differ from those observed in a normal year.

To assess whether exporting activity of GVC-involved firms has been hit less strongly than in other exporting firms, particularly during the crisis and recovery, interaction terms between year dummies and GVC participation are incorporated in the regressions. The results, which are offered in column (2) of Table 4, are very similar to those in the first column. Moreover, none of the interactions are statistically significant. That is, GVC-involved firms show a lower exit rate than other exporting firms, and this positive behaviour is not particularly different during the 2009 trade collapse nor in the following years. In a similar way, the risk of export failure for GVC-involved firms in 2009 and subsequent years is not different compared to what it was in 2006, either.

It could be expected that complex internationalization would influence export exit rates in a different way depending on firm size. Evidence from the descriptive analysis above suggests that differences in export exit regardless GVC engagement are shorter for large firms than for small firms. That is, GVC participation would be more relevant for smaller firms. This hypothesis finds support in the idea that small firms that manage to join these networks can overcome some of the limitations, related to their size, to enter and stay in foreign markets, helping them to increase their survival as exporters.

[6] For less complex internationalization modes such as two-way traders, their impact on export exit is not statistically significant for all firms, while it is positive and significant for the specific group of smaller firms (Díaz-Mora et al, 2015). However, being involved in more complex internationalization strategies enhances the probability of continuing to export for all firms.

Table 4: Estimations results. Dependent variable: Exit from exporting

(Probit model, average marginal effects)

	Column (1) (0.00231)	Column (2) (0.00232)	Column (3) (0.00229)	Column (4) (0.00230)
GVC involvement (triple-mode internationalizers)	-0.0155*** (0.0051)	-0.0164*** (0.0049)	-0.0239*** (0.0039)	-0.0237*** (0.0040)
Employment	-0.0140*** (0.0023)	-0.0141*** (0.0023)	-0.0144*** (0.0023)	-0.0144*** (0.0023)
Labour productivity	-0.0097*** (0.0034)	-0.0097*** (0.0035)	-0.0097*** (0.0034)	-0.0097*** (0.0035)
Product innovation	0.0008 (0.0057)	0.0008 (0.0057)	0.0007 (0.0057)	0.0007 (0.0057)
Process innovation	-0.0065 (0.0047)	-0.0068 (0.0048)	-0.0067 (0.0044)	-0.0070 (0.0044)
Continuous exporter	-0.0432*** (0.0078)	-0.0435*** (0.0077)	-0.0425*** (0.0078)	-0.0427*** (0.0076)
Skilled labour force	-0.0004** (0.00018)	-0.0004** (0.00018)	-0.0004** (0.00018)	-0.0004** (0.00018)
Year 2007	-0.0027 (0.0061)	-0.0026 (0.0063)	-0.0028 (0.0061)	-0.0026 (0.0062)
Year 2008	0.0069 (0.0068)	0.0058 (0.0068)	0.0067 (0.0068)	0.0055 (0.0068)
Year 2009	-0.0048 (0.0067)	-0.0053 (0.0067)	-0.0050 (0.0067)	-0.0054 (0.0067)
Year 2010	0.0047 (0.0079)	0.0045 (0.0080)	0.0042 (0.0079)	0.0040 (0.0079)
Year 2011	0.0018 (0.0081)	0.0019 (0.0082)	0.0015 (0.0081)	0.0017 (0.0082)
Year 2012	0.0027 (0.0084)	0.0030 (0.0086)	0.0025 (0.0084)	0.0027 (0.0085)
Interaction terms with year dummies	**No**	**Yes**	**No**	**Yes**
Year 2007 # GVC involvement		0.0062 (0.0102)		-0.0001 (0.0075)
Year 2008 # GVC involvement		0.022 (0.0173)		0.008 (0.0115)
Year 2009 # GVC involvement		0.017 (0.0170)		0.011 (0.0105)
Year 2010 # GVC involvement		0 .008 (0.0192)		0.001 (0.0117)
Year 2011 # GVC involvement		-0.011 (0.0119)		-0.005 (0.0097)
Year 2012 # GVC involvement		-0.0123 (0.0122)		-0.007 (0.0100)
Interaction terms with Firm Size	**No**	**No**	**Yes**	**Yes**

Employment # GVC involvement			0.017*** (0.0028)	0.017*** (0.0028)
Industry dummies	Yes	Yes	Yes	Yes
Observations	6096	6096	6096	6096
Number of firms	1268	1268	1268	1268

Notes: Standard errors in brackets. *p <0.05; **p <0.01; ***p < 0.001. All explanatory variables are dummies except labour productivity, firm age and skilled labour. All the estimations include year dummies and NACE-2 digit industry dummies. Interaction terms between firm size and GVC involvement are added in columns (3) and (4). Interaction terms between year dummies and GVC variable are added in columns (2) and (4).

We examine this by including an interaction term between firm employment and complex internationalization. This interaction allows us to explore how the impact of GVC involvement varies with firm size (or how the effect of firm size on exit from exporting is different according to GVC involvement). It also helps to isolate the effect of firm size from the effect of GVC involvement, after controlling for correlation between them (larger firms are more likely to be engaged in a multidimensional internationalization strategy)[7].

The last two columns of Table 4 report the results of the estimations when an interaction term between firm size and GVC involvement is added. It is important to note that, when interaction effects are added, the coefficient of the variable now represents the effect of that characteristic for the reference group (in our study, the other exporting firms) whereas the coefficient for the interaction term captures the differential impact between GVC-involved firms and the reference group. Anyway, the aforementioned findings about how firm characteristics affect export exit hold when that interaction term is included. Larger, more productive and more highly-skilled firms and continuous exporters face a lower risk of being expelled from exporting activity. The interaction term with firm size is statistically significant, indicating that its influence on export exit differs when the firm is engaged in GVCs. Moreover, it yields a positive coefficient, implying that firm size reduces the exit probability less for GVC-involved firms. That is, the influence of size on the risk of export interruption is less relevant for them, whereas it is significantly higher for other exporting firm (Figures 2a and 2b).From a different perspective, the negative impact of GVC participation on exit from exporting is higher (lower) for smaller (larger) firms.

[7] For an explanation of how to interpret coefficients of interaction terms in logit or probit models, see Aid and Norton (2003), Brambor et al. (2006), Buis (2010) and Hoetker (2007).

Figure 2a: Predicted export exit probabilities by internationalization mode

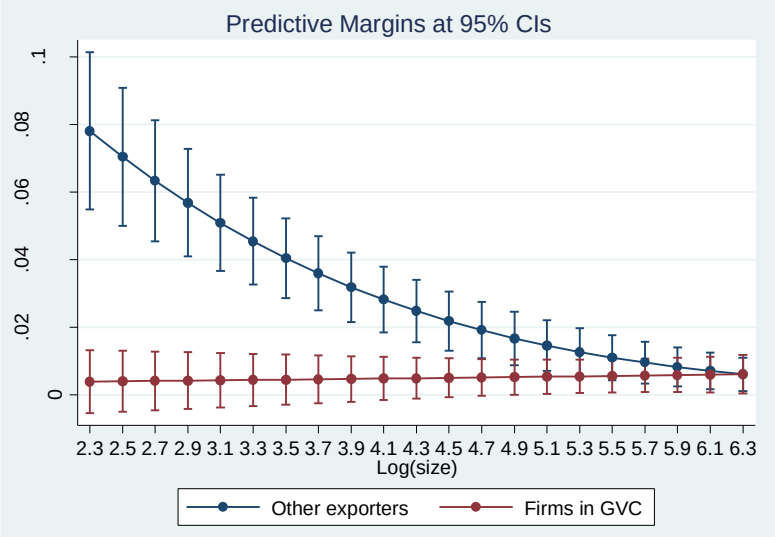
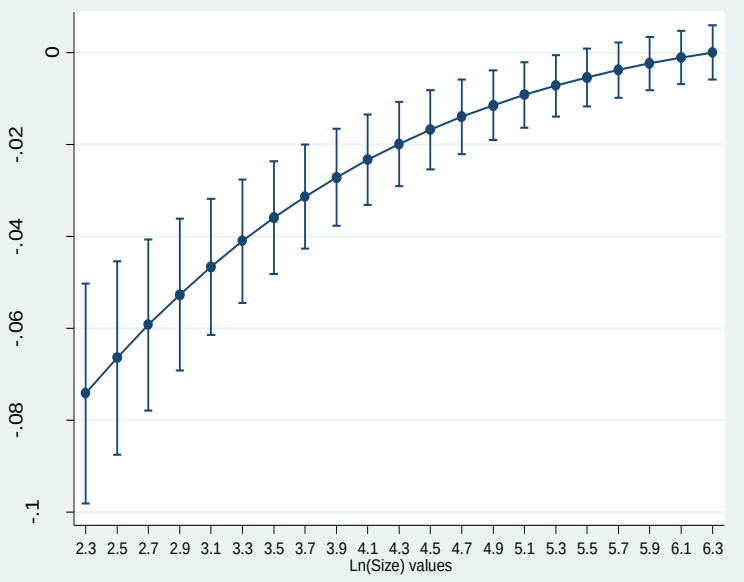


Figure 2b: Differences between Firms in GVC and other exporters in average marginal probability of export exit by size



All these results are similar whether or not interactions with year dummies are added (column 4) and no significantly different impact of GVC involvement in 2009 is found.

3.2. Export values

The second step of our analysis is to address how complex internationalization influences the level of exports. Here we propose an empirical model to test the impact of GVC engagement on the value

of exports, while other firm characteristics that might affect export behaviour are controlled for[8]. We estimate a dynamic panel data model to account for persistence of exports resulting for a combination of sunk costs and uncertainty (Das et al., 2007).The econometric model takes the following form:

$$Y_{it} = \alpha Y_{it-1} + \beta X_{it-1} + \varepsilon_i + \varepsilon_t + \eta_{it} \qquad (4)$$

Where Y_{it} is the logarithm of the value of exports and Y_{it-1} is the logarithm of the one-year lagged export value[9]. The remaining terms are the same as in Equation (2).

Since the lagged dependent variable appears on the right-hand side of the regression equation, the model is estimated with the two-step system GMM method in order to obtain more efficient estimators (Arellano and Bover, 1995; Blundell and Bond, 1998). It is well suited to deal with potential endogeneity issues due to including the lagged dependent variable and other explanatory variables that were not fully exogenous, and also with unobservable firm heterogeneity (i.e., fixed firm effects). This method combines the estimation in differences, where the instruments are the own lags of the endogenous or predetermined variables, and the estimation in levels, where the instruments are the variables in first differences.

Table 5 reports the results of the dynamic panel data estimation. Column (1) provides estimates for the basis specification, where interaction terms are not included. The estimation results reveal persistence in the firm's export activity since the level of exports depends positively on the value of previous exports. The positive and statistically significant coefficient for the GVC variable indicates that firms engaged in a complex mix of internationalization strategies enjoy higher export values once previous export level and other firm characteristics are controlled for. That is, exports from GVC-involved firms do grow relatively faster. Among these other firm characteristics, size, labour productivity, process innovation, skilled labour and continuous exporter affect positively export level. Only product innovation influences negatively. Therefore, larger firms exhibit better export performance, a result also found by Berthou and Vicard (2015), and continuous exporters status tend to grow less rapidly than sporadic or new exporters (conditional on survival), a finding that it is also consistent with previous studies (Cheng and Yu, 2010; Creusen and Lejour, 2011; Berthou and

[8]Alternatively we have specified a two-stage Heckman probit in order to consider the possibility of sample selection bias in the export value equation. We have obtained non-significant values for the inverse Mills ratio, indicating absence of sample selection bias. This result confirms the suitability of using separately models to analyse the exit of exporting and the value of exports. Results are omitted due to space constraints but are available upon request.

[9] As Equation (4) includes the lagged dependent variable as a regressor, this equation can be expressed as follows:

$$Y_{it} - Y_{it-1} = (\alpha-1)Y_{it-1} + \beta X_{it-1} + \varepsilon_i + \varepsilon_t + \eta_{it} \qquad (5)$$

Where the dependent variable is the growth rate in exports defined as the annual difference in log export value (Silve and Plekhanov, 2015).

Vicard, 2015). It is worth noting that the coefficients for the year dummies show that there are significant time-specific effects for each year, negative for the years 2007 to 2010 and positive for the years 2011 and 2012 with 2006 being the reference year. This means that, once firm characteristics are controlled for, the level of exports was significantly lower from 2007 to 2010 and higher since then, compared to the 2006 level.

Column (2) reports estimates in which interactions between GVC involvement and year dummies are added. Most of them (interaction terms with years 2009to 2012) are statistically significant and have a positive sign. These results indicate that GVC-involved firms show a better export performance that is even higher since 2009, suggesting that the negative impact on export levels of the trade collapse in 2009 has been lower for GVC-involved firms and that the subsequent recovery was more intense. This better export behaviour during the crisis years is also found for foreign-owned firms in Eppinger and Smolka (2015) who explore the role of foreign ownership status on the export intensity of Spanish manufacturing firms before and after the 2009 trade collapse. They find a positive impact which is significantly higher in the years 2009-2012 than before the crisis when pooled OLS estimates are used (the results are not clear with fixed effects estimates). They argue that these results support the view that foreign-owned firms can alleviate credit constraints by exploiting their preferential access to foreign capital markets in the credit crunch.

Table 5: Estimation results. Dependent variable: Export value

(Dynamic GMM model)

	Column (1)	Column (2)	Column (3)	Column (4)
Lagged export value	0.357***	0.362***	0.356***	0.361***
	(0.00204)	(0.00216)	(0.00165)	(0.00183)
GVC involvement	0.259***	0.0216***	0.249***	0.0145*
	(0.00742)	(0.00840)	(0.00677)	(0.00770)
Employment	0.878***	0.902***	0.859***	0.877***
	(0.00975)	(0.0104)	(0.00789)	(0.00824)
Labour productivity	0.0956***	0.103***	0.0984***	0.103***
	(0.00440)	(0.00443)	(0.00385)	(0.00382)
Product innovation	-0.0165**	-0.0130*	-0.0096	-0.0063
	(0.00694)	(0.00700)	(0.00615)	(0.00646)
Process innovation	0.0279***	0.0271***	0.0329***	0.0331***
	(0.00441)	(0.00452)	(0.00407)	(0.00422)
Continuous exporter	0.0386***	0.0369***	0.0398***	0.0355***
	(0.00712)	(0.00712)	(0.00629)	(0.00661)

Skilled labour force	0.0021***	0.0017***	0.0019***	0.0017***
	(0.000211)	(0.000207)	(0.000194)	(0.000196)
Year 2007	-0.0951***	-0.112***	-0.0933***	-0.111***
	(0.00528)	(0.00647)	(0.00460)	(0.00569)
Year 2008	-0.185***	-0.203***	-0.182***	-0.200***
	(0.00472)	(0.00582)	(0.00408)	(0.00530)
Year 2009	-0.272***	-0.301***	-0.270***	-0.296***
	(0.00468)	(0.00576)	(0.00379)	(0.00517)
Year 2010	-0.0553***	-0.0780***	-0.0561***	-0.0722***
	(0.00398)	(0.00528)	(0.00351)	(0.00483)
Year 2011	0.0086***	-0.0355***	0.0085***	-0.0327***
	(0.00248)	(0.00397)	(0.00207)	(0.00376)
Year 2012	0.0397***	0.0203***	0.0402***	0.0217***
	(0.00250)	(0.00369)	(0.00210)	(0.00329)
Interaction terms with year dummies	No	Yes	No	Yes
2007 # GVC involvement		0.0087		0.0210*
		(0.0135)		(0.0112)
2008 # GVC involvement		0.0079		0.0179*
		(0.0114)		(0.0098)
2009 # GVC involvement		0.0516***		0.0528***
		(0.0106)		(0.0084)
2010 # GVC involvement		0.0318***		0.0229***
		(0.0087)		(0.0071)
2011 # GVC involvement		0.108***		0.105***
		(0.0077)		(0.0068)
2012 # GVC involvement		0.0338***		0.0350***
		(0.0072)		(0.0062)
Interaction terms with Firm Size	No	No	Yes	Yes
Employment # GVC involvement			0.0001	0.0001***
			(0.0001)	(0.0000)
Industry dummies	Yes	Yes	Yes	Yes
Sargan Test	793.8286	786.7092	809.6519	803.9806
Sargan p-value	(0.3670)	(0.4460)	(0.3986)	(0.4637)
AR(2) test	1.2655	1.274	1.2729	1.2795
AR(2) p-value	(0.2057)	(0.2027)	(0.2031)	(0.2007)
Observations	5899	5899	5899	5899
Number of firms	1212	1212	1212	1212

Notes: Two-step system GMM estimations. Standard errors in brackets. *p <0.05; **p <0.01; ***p < 0.001. All explanatory variables are dummies except labour productivity, firm age and skilled labour. All the estimations include year dummies and NACE-2 digit industry dummies. Interaction terms between firm size and GVC involvement are added in columns (3) and (4) and between year dummies and GVC involvement in columns (2) and (4).System GMM estimations. AR(2) test is the second-order tests of serial correlation, and Sargan Test is a test of over-identification of restrictions; p-values below 0.05 means rejecting the validity of the instruments used in the estimation.

Next, we control for the relationship between GVC involvement and firm size by including an interaction term between them (column (3)). This implies that the effect of employment may be different between GVC-involved firms and other exporting firms, or put another way, the impact of GVC involvement may vary at different levels of employment. As has already been explained, with interaction effects, the coefficient for the size captures the effect of that characteristic for the reference group (other exporting firms). Our findings reveal that for other exporting firms, export growth increases with size, and the positive effect is not significantly different for GVC-involved firms (since the coefficient for the interaction term is not statistically significant).

Finally, in column (4) we also add interactions with year dummies, all of them showing positive and statistically significant coefficients. These results imply that export performance in each year is particularly better for GVC-involved firms. The higher coefficient of the interaction term with the year 2009 reveals that GVC-involved firms are performing differently mainly in that year, supporting the hypothesis of less contractive behaviour of those firms during the trade collapse. The coefficients for the other explanatory variables remain very similar. Only the interaction term between complex internationalization and firm size changes, becoming statistically significant, although the coefficient is really very small. This means that the positive impact of engagement in GVCs on export value decreases slightly with firm size and it is a little more relevant a factor for smaller firms (or, from a different perspective, firm size is a factor of less importance for GVC-involved firms).

To verify GMM consistency, the validity of the instruments used and the absence of second order autocorrelation need to be ensured; we do that using the Sargan test and a test for second order correlation. According to their p-values which are reported at the bottom of Table 5, there is no evidence of second order correlation and the joint validity of the instruments used is confirmed.

5. CONCLUSIONS

In this article, we have studied the impact of complex internationalization on export behaviour, in particular, on the probability of ceasing to export and on the export value of continuing exporters. Moreover, we have also investigated whether the impact is different during the trade collapse in 2009 and the following recovery.

According to our descriptive analysis, multidimensional internationalized firms belong to an elite group of firms that exhibit a higher level of labour productivity, are larger and show a higher likelihood of engaging in product innovation. On the basis of the estimation of a random-effects

probit model with panel data, we have found that once such firm characteristics are controlled for, internationalization complexity plays an important role in continuing to export. GVC-involved firms show a lower exit rate compared to other exporting firms and this behaviour is not different during the 2009 trade collapse nor in the subsequent years. Additionally, the negative impact of GVC participation on exit from exporting is higher for smaller firms.

The results from a dynamic panel data model also show that being involved in more sophisticated internationalization modes positively influences the level of exports. Furthermore, GVC-involved firms show a better export performance that is even higher since2009, suggesting that the negative impact of trade collapse in 2009 on export level has been lower for these firms and the subsequent recovery has been more intense. Thus during the financial crisis complex internationalization has played an amplified positive effect on the intensive margin of trade. As Stehrer et al. (2012) suggest, it may have been caused by the fact that firms inside the GVCs help each other, e.g. by providing trade finance.

To conclude, it seems that firms active in a complex mix of internationalization strategies have an added advantage which enables them to confront the uncertainty of foreign markets in better conditions and translates to a lower likelihood of ceasing exporting and to higher export values.

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