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Exporting under Financing Constraints: Firm-level Evidence from EU Countries

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Abstract: Financing constraints have been identified as an additional source of firm heterogeneity that affects export participation and export performance. This paper examines whether and to what extent financing constraints affect firms' exporting across different types of firms and industries. It uses comparable micro data from France, Germany, Italy and Spain and estimates the sensitivity of firms' extensive and intensive margins of exporting to financing constraints. The empirical results indicate that firms which were less constrained financially were more likely to export, while financing constraints did not affect the export intensity of existing exporters. It appears that financing constraints affect export participation via firms' productivity. The sensitivity of exporting to access to external financing appears to be most important for young, domestic-owned and firms in traditional industries. The sensitivity of the export propensity to financing constraints decreased with firm size.

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Exporting under Financing Constraints: Firm-level Evidence from EU Countries

1. Introduction

This paper examines firms' export participation and export intensity under financing constraints. Specifically, the following research questions are addressed: (i) How do financing constraints affect firms' engagement in exporting? (ii) To what extent are financing constraints linked to export intensity? Are there differential effects of financing constraints on export participation and export intensity for different groups of firms?

Export participation and export intensity vary greatly within industries across firms. The theoretical and empirical literature on international trade with heterogeneous firms has established that exporters differ systematically from firms serving only domestic markets and that these differences exist before firms engage in exporting (Bernard and Jensen 1995, 1999; Melitz 2003; Bernard et al., 2007). Thus, it has been established empirically and theoretically that exporters are larger, have higher productivity, higher capital intensity and higher skills intensity than non-exporters.¹

Exporting involves high sunk costs which can be overcome only by firms with a productivity above certain thresholds. Such upfront costs include searching for market-specific information; product tailoring and compliance with product standards and regulations in foreign markets; distribution networks costs; management and monitoring costs, contract enforceability in foreign countries and risks associated with exchange rate changes (Manova 2013; Schiavo 2014; Foley and Manova 2015). Exporting is also associated with variable trade costs such as shipping, duties and freight insurance (Manova 2013).

Financing constraints have been identified as an additional source of firm heterogeneity that contributes to the understanding of the differences in export participation and export intensity within industries across firms (Chaney, 2013; Manova, 2006; Berman and Héricourt, 2010; Bellone et al., 2010). Under imperfect financial markets, exporting firms may be less financially constrained than non-exporting firms (Bellone, et al., 2010; Bricongne et al., 2012). Four channels underlying this hypothesis are documented by the theoretical and empirical literature. Firstly, given the substantial sunk costs related to export participation (extensive margin), only less financially constrained firms engage in exporting (Chaney 2013). Secondly, exporting could improve access to external financing through more stable cash flows derived from the international diversification of sales and thus lower exposure to demand-side shocks (Campa and Shaver 2002; Bridges and Guariglia 2008). Thirdly,

¹ Recent reviews of micro-econometric evidence include Helpman (2006), Bernard et al. (2007), Greenaway and Kneller (2007) and Wagner (2007).

exporting could be perceived by investors as a signal of external competitiveness and would thus reduce informational asymmetries which underline financial market imperfections (Ganesh-Kumar, 2001). Finally, exporting could facilitate access to external funds in international financial markets (Bellone et al., 2010).

The bulk of existing evidence relates to the relationship between financing constraints and export participation while the link with export intensity has been less analysed. Greenaway et al. (2007) find evidence for a positive link between export participation and financial health for firms in the UK over the period 1993-2003. Further, they uncover that this positive link was driven by continuous exporters while export starters had poorer financial health (low liquidity and high leverage ratios). Their evidence also indicates that export participation improved *ex-post* the financial health of firms. In contrast, Bellone et al. (2010) found that over the period 1993-2005, less financially constrained firms (with access to external financing) self-selected into exporting in France. Their evidence highlighted that export starters had a better financial health than non-exporters. Furthermore, they found no evidence of a positive relationship between financial health and the share of exports in total sales. Silva (2011) found that new exporters in Portugal over the period 1993-2006 improved their financial health after entering into exporting. This positive link was found to be especially important for small firms and it was independent of export intensity.

Berman and Héricourt (2010) used data for nine developing countries over the period 1998-2004 and found that financial health of firms increased the probability to start exporting. However, it appears that financial health played no significant role in maintaining export participation or on the size of exports. Further, they find that productivity and access to external finance were positively linked and that productivity matters for export entry only above a certain threshold of access to finance. If access to credit were very limited, productivity and export status were not correlated. Furthermore, they found that financial development at country level affects positively the selection of firms into exporting and the number of exporters. Thus, in more financially developed countries, exporting firms are more productive and export larger quantities.

Minetti and Zhu (2011) found that credit rationing reduced the exporting probability and the export sales of firms in Italy in 2000. While credit rationing had also a negative effect on domestic sales, its impact on export sales was significantly stronger. Furthermore, they find that financial constraints were a hampering factor for exports especially in high-tech industries and in industries highly dependent on external finance.

Bricogne et al. (2012) found that the collapse of trade over the period 2008-2009 in France was mainly due to the large demand shock and product composition of exports. It was found that while

the financial crisis worsened the export performance of financially constrained firms, it had only a limited impact on export performance. While large firms adjusted by reducing their portfolio of products offered for export and consequently their export sales, small firms reduced the range of export destinations or stopped exporting.

Cagesse and Cuñat (2013) show theoretically and empirically (using data for manufacturing firms in Italy over the period 1995-2003) that financing constraints distort the selection of firms into exporting. As a consequence, when a substantial number of firms face financing constraints, the impact of productivity on the export participation decision decreases. The implication of their evidence is that limited access to credit reduces the aggregate productivity gains induced by trade liberalisation.

In summary, existing evidence suggests that less financially constrained firms are more likely to engage in exporting. These effects appear to be stronger in sectors with a high external financing dependence. The evidence is less clear cut for the link between financing constraints and export intensity. In addition, there is less evidence on the mechanisms through which these effects come about. To fill this gap, this paper uses comparable micro data from France, Germany, Italy and Spain and examines export participation and export intensity under financing constraints. Furthermore, we investigate whether the sensitivity of exporting to financing constraints is different across various types of firms.

Our empirical results indicate that firms which were less constrained financially were more likely to export, while financing constraints did not affect the export intensity of existing exporters. It appears that financing constraints affected export participation via their effect on firms' productivity. The sensitivity of exporting to access to external financing appears to be most important for young firms, domestic-owned and firms in the traditional industries. The sensitivity of export propensity to financing constraints decreased with firm size.

The rest of this paper is structured as follows. Section 2 presents the empirical methodology used in this paper to identify the responsiveness of export participation and export intensity to financing constraints. Section 3 discusses data and measurement issues. The next section discusses the empirical results while section 5 summarises the key findings of the analysis and implications for enterprise policy aimed at fostering exporting.

2. Empirical Methodology

2.1 The effect of financing constraints on export participation – the extensive margin

Following on from the existing theoretical and empirical literature on exporting and financing constraints discussed above, we estimate the export probability for firm i in country c industry k during year t (X_{ickt}) as follows:

$$Prob(X_{ickt} > 0) = \{1, \text{if } \alpha + \beta Z_{ickt-1} + \gamma FC_{ickt-1} + \mu_{ckjt} + \varepsilon_{ickt} > 0; 0 \text{ otherwise}\} \quad (1)$$

Z is a vector of firm characteristics (size, age, ownership, productivity, innovation output, human capital, capital/labour ratio, IT capacities, international managerial experience) and other control variables (sales' growth at the firm and industry levels). FC is a firm-level measure of financing constraints. To alleviate concerns concerning potential simultaneity, the explanatory variables are lagged by one year with respect to the dependent variable. μ is a set of dummies to control for unobserved characteristics of country, industry, and industry group.² ε_{ickt} is a composite error term.

Exporting, labour productivity and financing constraints could be determined simultaneously by unobserved firm characteristics. To account for this potential endogeneity, we instrument labour productivity and financing constraints with their lagged values.

All regressions are weighted using relative weights computed on the basis of the original firm distribution provided by the Eurostat.³

2.2 The effect of financial constraints on export participation – the intensive margin

To examine the relationship between financing constraints and export intensity, we estimate the following model:

$$\ln(x_{ickt}) = \theta + \rho Z_{ickt-1} + \sigma FC_{ickt-1} + \mu_{ickjt} + \omega_{ickt} \text{ if } x_{ickt} > 0 \quad (2)$$

The dependent variable is the share of turnover that is exported by firm i in country c industry k during year t . The explanatory variables are the same as in Eq. (1). We only observe the export sales for exporting firms. To account for this selection issue, we estimate the export intensity conditional on the propensity of firms to export by using a Heckman two-step estimator. The Heckman specification consists of two equations:

² Industry groups are classified following Pavitt (1984) based on the technological class of the industry in which the firm has its primary activity. These industry groups are the following: scale-intensive industries; traditional industries; specialised industries; high-tech industries. Details on the composition of these industry groups are provided in Table A1 in the Appendix.

³ Details about the computation of weights are available from Altomonte and Aquilante (2012).

The selection equation explains the export propensity as a function of firm characteristics, financing constraints and controls for unobserved industry and country specific effects. *The quantitative equation* explains the export intensity as a function of determinants of exporting. For identification purposes we exclude from the quantitative equation firm level employment used a proxy for firm size.⁴

All regressions are weighted using relative weights computed on the basis of the original firm distribution provided by the Eurostat.⁵

As there are unobserved firm-level characteristics which we are unable to control for, our estimates should be interpreted as structural rather than causal links between financing constraints and export performance.

3. Data and Summary Statistics

To conduct this analysis we used the EFIGE linked dataset for the period 2001-2008.⁶ We applied a number of criteria to clean the data used in our analysis. Firms with zero values for sales and fixed assets in 2008 and 2007 were excluded. We dropped outliers⁷ in the data for the following variables: financing constraints; labour productivity; capital/labour ratio; employees; and earnings per employee. Following on from Altomonte et al. (2013) we excluded data for Austria, UK and Hungary from our sample due to the limited number of observations available. We also excluded from the analysis the firms which had negative cash flows in 2008.

3.1 Measuring Financing Constraints

Given that financing constraints are not observable, several methods have been used to identify and measure them (Siedschlag et al. 2014). Four methodological approaches can be distinguished in previous studies. A first empirical approach identifies the extent of financing constraints faced by firms by estimating the reliance of investment and other firm outcomes (exporting, employment, productivity) on internal financing such as retained earnings and internal cash flows (Fazzari et al.

⁴ While firm size is a determinant of the exporting propensity, existing empirical evidence (for a recent review of this evidence see Bernard et al. 2012) suggests that export sales do not grow proportionally with firm size.

⁵ Details about the computation of weights are available from Altomonte and Aquilante (2012).

⁶ The EFIGE data set has been collected with a survey of a representative sample of manufacturing firms in Austria, France, Germany, Hungary, Italy, Spain, and the United Kingdom. The survey has been conducted in 2009 and it combines information at firm level for the following categories of variables: structural characteristics; workforce; investment, technological innovation and R&D; internationalisation; finance; market and pricing. These data have been linked to balance sheet data from the *Amadeus* data set provided by Bureau van Dijk. A detailed description of the data set is available in Altomonte and Aquilante (2012).

⁷ Outliers were defined as in the cases where the observation's modified z-score based on the median absolute deviation exceeded a value of 4 in 2007.

1988; Hubbard, 1998; Love, 2003; Bond and Soderbom 2013). A second method measures financing constraints on the basis of financial factors (such as net worth, liquidity, interest rate payments) which condition the financial health of firms (Whited 1992; Bond and Meghir 1994; Bond et al. 2003; Whited and Wu 2006). Thirdly, direct measures of perceived and actual financial constraints have been constructed using information from surveys on access to finance (Beck et al. 2006; Clarke et al. 2006; Byiers et al. 2010; Brown et al. 2012; Popov and Udell 2012). Finally, credit rating scores have been used to construct measures of financing constraints (Muûls 2008, 2012; Secchi et al. 2014; Wagner 2014).

In this paper we construct a firm level measure of financing constraints based on Whited and Wu (2006). The Financing Constraints Index (FCI) is defined using parameter estimates from a structural investment model⁸ as follows:

$$FCI_{it} = -0.091CF_{it} - 0.062DIVPOS_{it} + 0.021TLTD_{it} - 0.044LNTA_{it} + 0.102ISG_{it} - 0.035SG_{it} \quad (3)$$

The variables included above are defined as follows:

- CF: the ratio of cash flow to total assets;
- DIVPOS: a binary variable which is equal to one if the firm pays cash dividends and zero otherwise;
- TLTD: the ratio of the long-term debt to total assets;
- LNTA: the natural logarithm of total assets;
- ISG: the firm's two digit industry sales growth;
- SG: the firm's sales growth.

Following on from previous studies (for example, Manova et al. 2015), using the estimated parameters for the US in computing the firm-level FCI is justified on three reasons: (i) given that the US have one of the most developed financial systems, the behaviour of US firms approximates their optimal asset structure and use of external capital in the absence of binding credit constraints; (ii) using the US as a reference (benchmark) ensures that financing constraints are not measured endogenously to the analysed countries financial development; (iii) identification does not require that financing constraints are the same in the US and the analysed countries, rather that firms' ranking remain stable across countries.

To compute the firm-level FCI we use the EFIGE linked data set for the period 2001-2008. Since data on dividends payments is available for only a limited number of firms, we proxy the DIVPOS variable following Mancusi and Vezzulli (2010). We construct a dummy variable equal to one if the firm's net

⁸ Their estimates were obtained using quarterly data from the COMPUSTAT data set.

assets in 2008 were less than the sum of its net assets in 2007 plus profits (or losses) computed before tax. Following Altomonte et al. (2013), we subtract from each firm's *FCI* the country sample median. This variant of the index (FCI_{it}) provides improved comparability of the measure of financing constraints across countries.

3.2 *Summary Statistics*

Table 1 presents information on the composition of the sample used in the analysis by country ownership, size group, age and industry group. Italian and Spanish firms make up 73 per cent of the sample. The majority of firms in the sample are domestically-owned, while the decomposition of the sample by size groups indicates that 87 percent of firms have less than 50 employees. Over half of the firms in the sample are more than 20 years of age. The industry grouping of firms, based on the Pavitt industry classification, shows that 53 percent of firms are in traditional industries. Firms in high-tech industries represent 4 percent of the sample.

[Table 1 about here]

Variables definitions and data sources are described in Table A2 in the Appendix.

Table 2 provides summary statistics on the main variables used in the empirical analysis for the full sample and also by exporters and non-exporters. The summary statistics suggest that firms which exported in 2008 had, on average, a higher proportion of foreign owners, higher sales, and employed a higher number of workers compared with non exporting firms. Consistent with findings in the related literature on exporting and firm performance, the summary statistics also indicate that exporters had higher labour productivity and capital intensity and introduced on average more product and process innovation. Further, exporters appear more likely to have employed managers with experience working abroad and to have invested in ICT systems which manage e-commerce or supply networks. Finally, the *FCI* indicates that non-exporters were more financially constrained than exporters.

[Table 2 about here]

Table 3 shows the sample averages of the *FCI* for exporters and non-exporters by size class, age group, and ownership. It appears that the *FCI* is higher for younger firms and domestically-owned firms compared with older firms and foreign-owned firms, respectively. The summary statistics suggest that, on average, larger firms were less financially constrained than smaller firms. In terms of the main relationship of interest in our analysis, Table 3 shows that non-exporters were more financially constrained than exporters for each group.

[Table 3 about here]

Figure 1 plots the share of exporters against the mean FCI for each industry in each country. The figure indicates a negative relationship between the two variables. Figure 2 plots the relationship for these two variables by firm size, ownership and age. It shows that average industry export participation is lower in industries with higher average FCI. Turning our attention to the export intensive margin, Figure 3 suggests there is a negative relationship between the average share of firm exports in total sales and the mean FCI across industries. The information in Figure 4 indicates that this relationship generally holds for subsamples of firms grouped by size, ownership and age classes.

[Figures 1-3 about here]

4. Empirical Results

In this section we discuss the estimates of our analysis of export participation and export intensity under financing constraints. Table 4 shows the estimates of the single equation probit model described by Eq. (1). The figures shown are marginal effects and robust standard errors are reported in parentheses. All specifications include country, sector and industry group dummies to control for possible cross - firm heterogeneity arising from country, industry and industry group effects. Our initial estimates indicate that, relative to non-exporters, exporters were likely to be more productive, larger, older, product innovators, foreign-owned, users of ICT systems to manage e-commerce and supply networks, and had at least one manager with experience working abroad. We also find that, on average, less financially constrained firms in 2007 had a higher propensity to export in 2008. This result is in line with findings in Altomonte et al. (2013) and European Commission (2013).

[Table 4 about here]

Exporting, labour productivity and financing constraints may be simultaneously determined by unobserved firm characteristics. To account for this potential heterogeneity, we instrument labour productivity and financing constraints with their lagged values in 2006, 2005, and 2004. The estimates of the instrumental variable probit model are shown in Table 5. The results reinforce the main messages on exporting under financing constraints discussed above. The estimates shown in column 1 indicate that financing constraints were negatively associated with labour productivity. This result suggest that financing constraints affect export participation via productivity. Export propensity was higher amongst firms which were older, product innovators, foreign-owned, used ICT systems to manage e-commerce and supply networks, and employed a manager with at least one year of work experience abroad. Also, we continue to find that less financially constrained firms in

2007 were associated with a higher propensity of exporting in 2008. The labour productivity coefficient becomes marginally insignificant at the 10 percent level. The F-test from the first stage equations and the Amemiya-Lee-Newey test statistic suggests the instruments are valid.

[Table 5 about here]

We investigate next whether the strength of the negative relationship between financing constraints and export propensity differed across groups of firms. We examine the potentially heterogeneous relationship between firms' financing constraints and their propensity to export by interacting the firms' financing constraints measure with dummy variables for: (i) ownership; (ii) age; (iii) size; and (iv) industry grouping.

Table 6 presents the average marginal effects based on the model specifications which include the interaction of the financial variables with dummy variables for: ownership (column 1); age (column 2); size (column 3); and industry group (column 4). The computed average marginal effects take into account the interaction terms. The results shown in Table 6 are consistent with our initial findings. The average marginal effects of financing constraints on exporting propensity for different firm groups are calculated in the bottom section of Table 6. We observe that financing constraints were associated with a lower export propensity for firms younger than 20 years, domestically-owned firms, and firms in traditional industries. It is noteworthy that for small firms, financing constraints were associated with a lower export propensity. However, this relationship weakens as firms increase in size and becomes insignificant for firms above the median percentile.

[Table 6 about here]

Table 7 presents the estimates for the intensity of exporting conditional on deciding to export. We find that firms that were larger, more productive, foreign-owned, product-innovators and employed internationally experienced managers were more likely to export and also exported a higher share of their total sales. We observe that while older firms and firms with ICT systems used for the management of supply networks and e-commerce were more likely to export, these firm characteristics did not affect significantly export intensity.

[Table 7 about here]

Table 8 reports the average marginal effects for different groups of firms. These estimates are consistent with our initial findings. Focusing on the average marginal effects with respect to the responsiveness of exporting to financing constraints, we find that firms which are financially constrained are less likely to engage in exporting. Our estimates suggest that financing constraints

do not affect significantly the size of export sales. Furthermore, it appears that financing constraints for different firm groups, which are calculated in the bottom section of Table 8, are also insignificant.

Table 9 reports the marginal effects of financing constraints on the propensity to export and on the intensity of exporting for different groups of firms. Financing constraints were associated with a lower export propensity for domestically-owned firms, and firms younger than 20 years. Further, financing constraints appear associated with a lower export propensity for small firms. This relationship becomes insignificant for firms with more than the median number of employees. We find no significant relationships between the financing constraints and export intensity.

[Table 9 about here]

5. Summary of Results and Policy Implications

This paper examined whether and to what extent financing constraints affect firms' export performance. Specifically, using micro data from four large economies (France, Germany, Italy, and Spain) we analysed the responsiveness of firms' export participation and export intensity to financing constraints. Since financing constraints vary across different types of firms, we also investigated the heterogeneity of the sensitivity of export performance conditioned by firm characteristics such as ownership, age, size, and industry group.

Our research results indicate that, relative to non-exporters, exporters were more likely to be firms which were foreign-owned, more productive, larger, older, and product innovators. Furthermore, our estimates indicate that the exporting probability was positively and significantly associated with ICT systems used to manage e-commerce and supply networks, and the presence in the firms of at least one manager with experience working abroad.

On average, other things equal, the probability of exporting appears to be negatively associated with financing constraints faced by firms. This result is consistent with the argument that less financially constrained firms are more capable of overcoming the sunk costs associated with entry in foreign markets. Our analysis highlights that the channel through which financing constraints affect firms' export participation appears to be the impact of financing constraints on firms' productivity. Our results also indicate that, on average, financing constraints did not affect significantly export intensity.

The effect of financing constraints on the exporting propensity varies depending on firm characteristics. Financing constraints were associated with a lower export propensity for firms younger than 20 years, domestically-owned firms, and firms in traditional industries. Further, we find that financing constraints were associated with a lower export propensity for small firms, but

the relationship weakened as firm size increased and became insignificant for firms above the median size percentile. With respect to the effect of financing constraints on export intensity, we find no significant differential effects linked to firms characteristics such as ownership, size, age, and industry group.

Our results indicate that while financial market imperfections are likely to affect the propensity of firms to engage in exporting, they appear to play no significant role in extending export sales by existing exporters. Financing constraints appear to reduce the probability to export particularly for young, small, domestic firms and firms in the traditional industries. These findings suggest that policy measures to address financial market imperfections are likely to improve firms' productivity and foster their engagement in exporting.

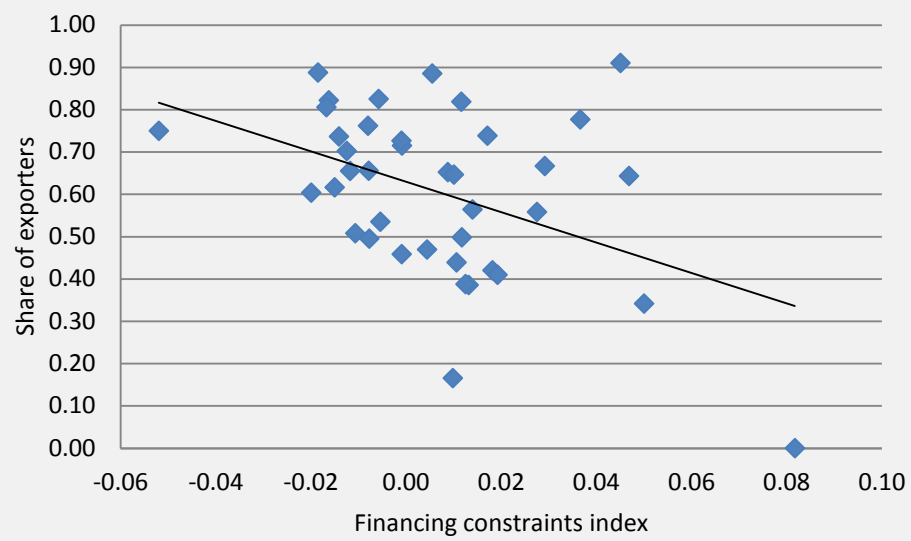
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Figure 1: Export participation and financing constraints at industry level, full sample

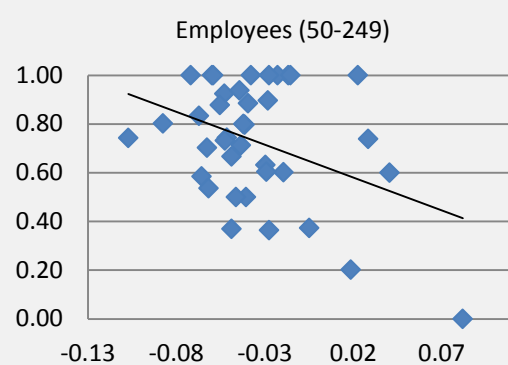
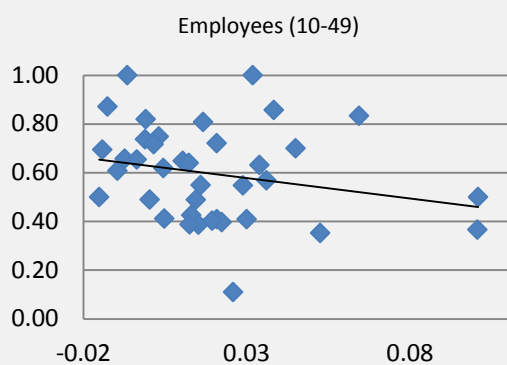


Notes: x-axis: mean country-industry financing constraints index, y-axis: country-industry share of exporters.

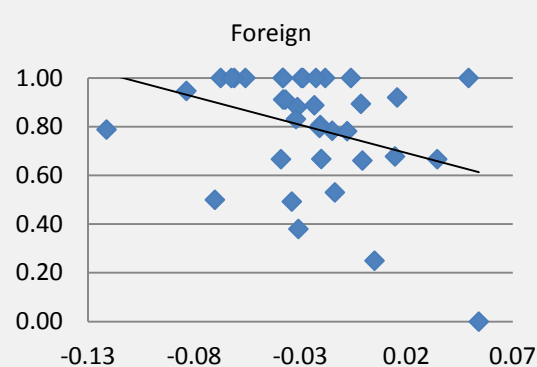
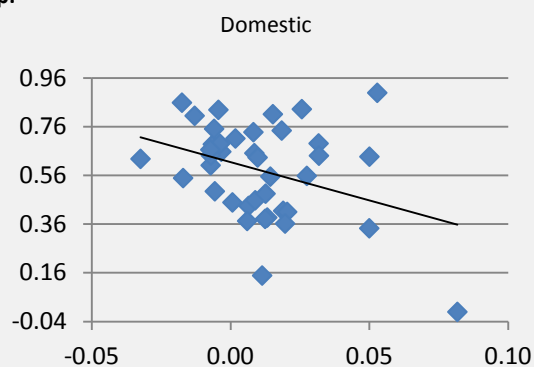
Source: EFIGE linked dataset

Figure 2: Export participation and financing constraints by firm characteristics

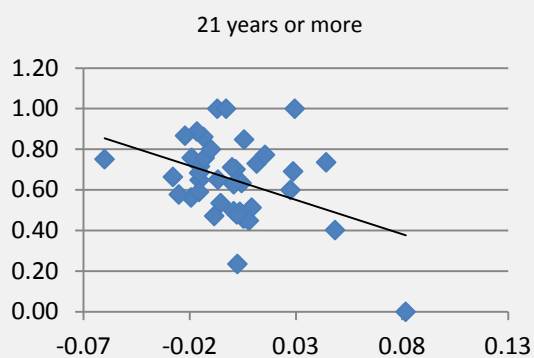
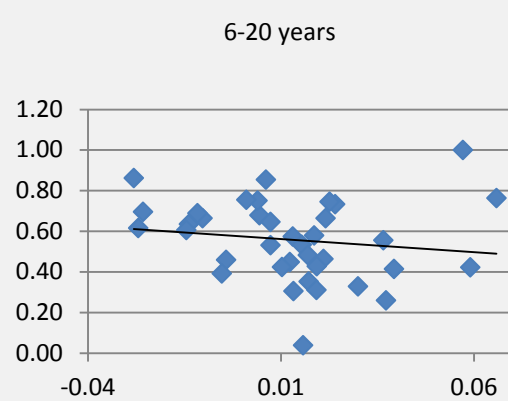
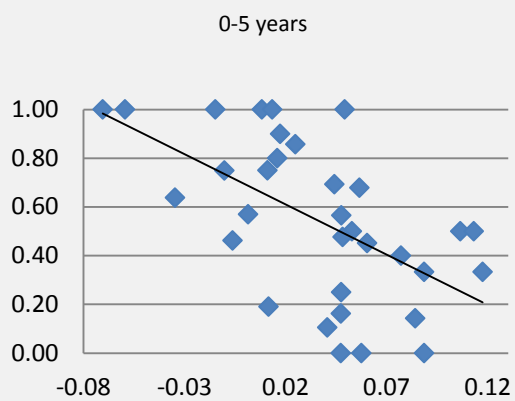
Size:



Ownership:



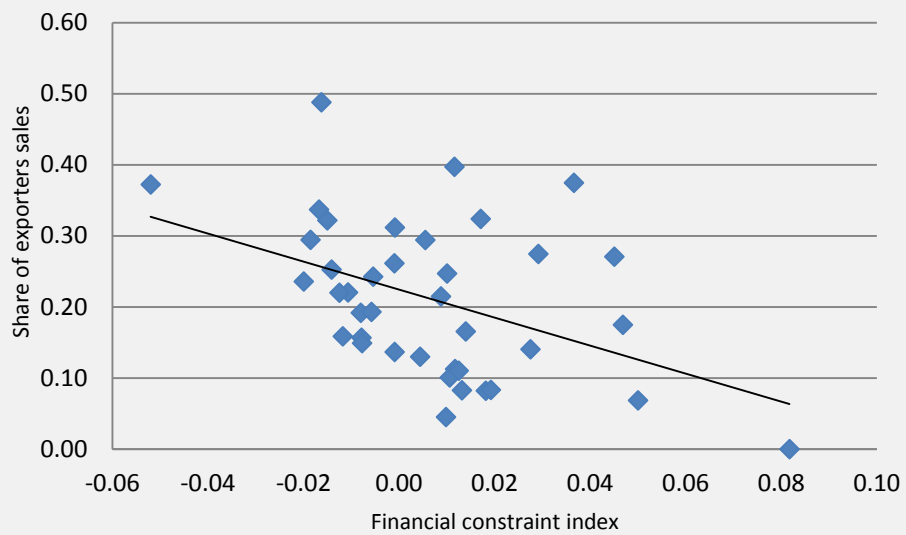
Age:



Notes: x-axis: mean country-industry financing constraints index;
y-axis: country-industry share of exporters.

Source: EFIGE linked data set.

Figure 3: Export intensity and financing constraints by industry, full sample



Notes: x-axis: mean country-industry financing constraints index, y-axis: mean country-industry share of export intensity.

Source: EFIGE linked dataset

Figure 4: Export intensity and financing constraints by firm characteristics

Size:

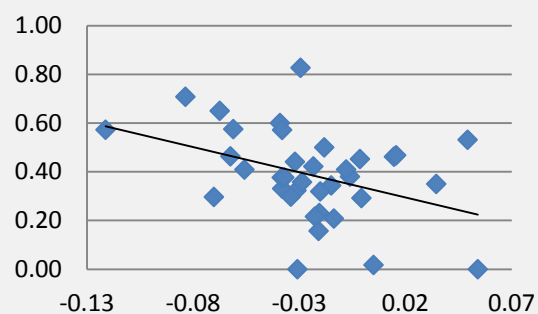
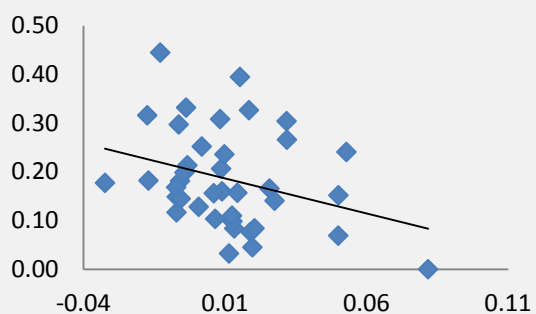
Employees (10-49)

Employees (50-249)

Ownership:

Domestic

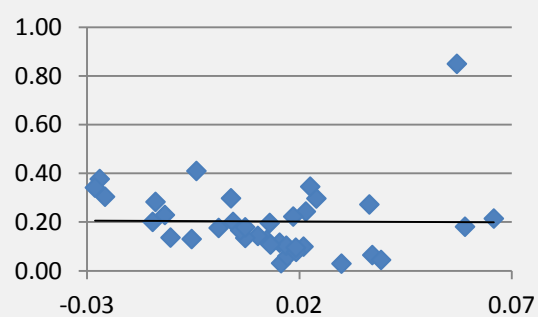
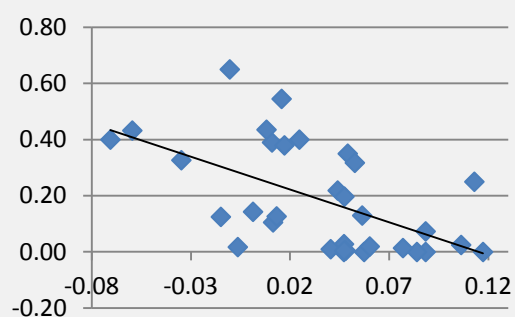
Foreign



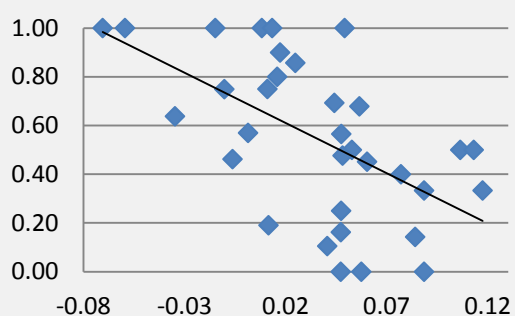
Age:

0-5 years

6-20 years



21 years or more



Notes: x-axis: mean country-industry financing constraints index, y-axis: mean country-industry share of export intensity.

Source: EFIGE linked data set.

Table 1: Sample composition by country, ownership, size, age and industry group

		Number of observations	Share
Country	France	961	0.24
	Germany	131	0.03
	Italy	1543	0.39
	Spain	1358	0.34
Ownership	Foreign	332	0.08
	Domestic	3661	0.92
Size group	less than 50	3483	0.87
	50 to 249	478	0.12
	More than 250	32	0.01
Age	0-5 years	193	0.05
	6-20 years	1514	0.38
	more than 20 years	2286	0.57
Industry group	Economies of scale industries	877	0.23
	Traditional industries	2062	0.54
	Specialized industries	721	0.19
	High-tech industries	168	0.04

Source: EFIGE linked dataset.

Table 2: Summary statistics of main explanatory variables

	All firms		Exporters		Non-exporters	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
	(1)	(2)	(3)	(4)	(5)	(6)
Domestic-owned	0.93	0.25	0.91	0.29	0.97	0.17
Sales	5456	9046	6454	10260	4010	6662
Labour productivity	4.99	0.63	5.12	0.57	4.80	0.65
Wage per employee	3.47	0.33	3.51	0.33	3.41	0.33
Employment	29.17	31.5	32.05	36.37	25.00	22.02
Capital-Labour ratio	36.22	51.74	38.07	52.91	33.52	49.89
Age (0-5)	0.05	0.22	0.04	0.21	0.06	0.24
Age (6-20)	0.38	0.49	0.34	0.47	0.44	0.50
Age (over 20)	0.57	0.5	0.62	0.49	0.50	0.50
Sales growth	0.12	0.31	0.12	0.32	0.13	0.29
Industry sales growth	0.09	0.07	0.09	0.07	0.09	0.07
Share of firms with product innovation	0.47	0.5	0.57	0.49	0.33	0.47
Share of firms with process innovation	0.44	0.5	0.47	0.50	0.41	0.49
Share of firms using ICT	0.49	0.5	0.52	0.50	0.45	0.50
Share of firms with internationally experienced managers	0.14	0.35	0.18	0.39	0.08	0.27
Financing Constraints Index	0.01	0.05	-0.001	0.048	0.020	0.052

Note: Labour productivity, employment, capital-labour ratio and wage per employee are expressed in natural logs.

Source: EFIGE linked dataset

Table 3: Summary statistics for financing constraints by types of firms

		Financing Constraints Index	
		Non Exporter	Exporter
Size	Small (10-49 employees)	0.02	0.01
	Medium (50-249 employees)	-0.03	-0.04
	Large (more than 250 employees)	-0.08	-0.09
Age	Age (0-5 years)	0.06	0.03
	Age (6 -20 years)	0.03	0.00
	Age (more than 20 years)	0.01	-0.01
Ownership	Foreign-owned	-0.001	-0.03
	Domestic-owned	0.02	0.00

Source: EFIGE linked dataset.

Table 4: Financing constraints and export participation - Probit estimates			
	(1)	(2)	(3)
Financing Constraints Index $t-1$			-0.503**
			(0.256)
Domestic- owned $t-1$	-0.177***	-0.141***	-0.139***
	(0.033)	(0.034)	(0.035)
Age (> 20 years)	0.080***	0.080***	0.076***
	(0.016)	(0.015)	(0.016)
Labour productivity $t-1$	0.158***	0.148***	0.134***
	(0.016)	(0.017)	(0.019)
Capital- labour ratio $t-1$	-0.012*	-0.010	-0.013*
	(0.007)	(0.007)	(0.008)
Wage per employee $t-1$	-0.017	-0.004	-0.010
	(0.031)	(0.031)	(0.032)
Employment $t-1$	0.092***	0.073***	0.050***
	(0.014)	(0.014)	(0.018)
Sales growth $t-1$	-0.037	-0.037	-0.016
	(0.027)	(0.028)	(0.029)
Industry sales growth $t-1$	-0.220	-0.180	-0.165
	(0.175)	(0.182)	(0.185)
Product innovator $t-1$		0.153***	0.152***
		(0.016)	(0.017)
Process innovator $t-1$		0.020	0.019
		(0.016)	(0.016)
ICT usage $t-1$		0.040***	0.042***
		(0.015)	(0.016)
International managerial knowledge $t-1$		0.142***	0.142***
		(0.022)	(0.023)
Observations	3993	3810	3720
Country dummies	yes	yes	yes
Sector dummies	yes	yes	yes
Adjusted R ²	yes	yes	yes
<p><i>Notes:</i> Regressions are weighted using relative weights computed on the basis of the original firm distribution by size and industry provided by the Eurostat. The dependent variable is a dummy variable equal to one if firm exported in 2008 and zero otherwise. Age is a dummy variable equal to one if the firm's age is greater than 20 years and zero otherwise. Labour productivity, capital – labour ratio, and employees, are expressed in natural logs. Country and sector dummies account for unobserved country and sector characteristics that affect export propensity at firm level.</p> <p><i>Source:</i> EFIGE linked data set</p>			

Table 5: Financing constraints and export participation - Instrumental variable probit estimates

	First Stage	First Stage	Second Stage
	Labour Productivity, 2007	Financing Constraint Index, 2007	
	(1)	(2)	(3)
Financing Constraints Index $t-1$			-1.172* (0.663)
Domestic-owned $t-1$	-0.016*** (0.013)	-0.003 (0.002)	-0.153*** (0.044)
Age (> 20 years)	0.018** (0.007)	-0.001 (0.001)	0.064*** (0.021)
Labour productivity $t-1$			0.057 (0.037)
Capital- labour ratio $t-1$	0.004 (0.003)	-0.003*** (0.001)	-0.008 (0.011)
Wage per employee $t-1$	0.174*** (0.014)	-0.010*** (0.003)	0.062 (0.043)
Employment $t-1$	-0.028*** (0.008)	-0.022*** (0.001)	0.030 (0.034)
Sales growth $t-1$	0.600*** (0.017)	0.001 (0.003)	-0.058 (0.054)
Industry sales growth $t-1$	0.041 (0.087)	0.078*** (0.016)	-0.206 (0.264)
Product innovator $t-1$	-0.007 (0.007)	0.001 (0.001)	0.128*** (0.020)
Process innovator $t-1$	-0.01 (0.007)	0.001 (0.001)	0.029 (0.020)
ICT usage $t-1$	0.011 (0.007)	0.000 (0.001)	0.055*** (0.020)
International managerial knowledge $t-1$	-0.004 (0.01)	0.000 (0.002)	0.136*** (0.029)
Labour productivity $t-2$	0.758*** (0.014)	-0.030*** (0.003)	
Labour productivity $t-3$	0.015 (0.016)	0.011*** (0.003)	
Labour productivity $t-4$	0.099*** (0.014)	-0.001 (0.003)	
Financing Constraints Index $t-2$	-0.195** (0.096)	0.251*** (0.017)	
Financing Constraints Index $t-3$	-0.324*** (0.1)	0.228*** (0.018)	
Financing Constraints Index $t-4$	0.002 (0.002)	0.000 (0.000)	
Observations	2099	2099	2099
Wald test of exogeneity:			$\chi^2(2) = 1.98$, Prob > $\chi^2_2 = 0.3724$
Amemiya-Lee-Newey minimum χ^2 statistic			$\chi^2(4) = 4.189$, P-value = 0.3810
F tests	F(32, 2066) = 933.55***	F(32, 2066) = 157.07***	
Adjusted R ²	0.9343	0.7042	

Notes: Regressions are weighted using relative weights computed on the basis of the original firm distribution by size and industry provided by the Eurostat. The dependent variable is a dummy variable equal to one if firm exported in 2008 and zero otherwise. Labour productivity, capital-labour ratio, and employees, are expressed in natural logs. Age is a dummy variable equal to one if the firm's age is greater than 20 years and zero otherwise. Labour productivity and the financial constraint index are instrumented with their lagged values in 2006, 2005, and 2004. Country and sector dummies account for unobserved country and sector characteristics that affect export propensity at firm level. Source: EFIGE linked data set.

Table 6: Financing constraints and export participation - Heterogeneous effects

	Ownership (1)	Age (2)	Size (3)	Sectors (4)
Financing Constraints Index $t-1$	-0.506** (0.256)	-0.520** (0.256)	-0.516** (0.256)	-0.527** (0.257)
Domestic owned $t-1$	-0.140*** (0.035)	-0.134*** (0.032)	-0.141*** (0.032)	-0.140*** (0.032)
Age (> 20 years)	0.077*** (0.016)	0.076*** (0.016)	0.076*** (0.016)	0.076*** (0.016)
Labour productivity $t-1$	0.134*** (0.019)	0.132*** (0.019)	0.134*** (0.019)	0.134*** (0.019)
Capital labour ratio $t-1$	-0.013* (0.008)	-0.014* (0.008)	-0.013* (0.008)	-0.013* (0.008)
Wage per employee $t-1$	-0.010 (0.032)	-0.012 (0.032)	-0.010 (0.032)	-0.013 (0.032)
Employment $t-1$	0.050*** (0.018)	0.051*** (0.018)	0.057*** (0.018)	0.052*** (0.018)
Sales growth $t-1$	-0.016 (0.029)	-0.007 (0.030)	-0.014 (0.029)	-0.017 (0.029)
Industry sales growth $t-1$	-0.166 (0.185)	-0.172 (0.184)	-0.182 (0.184)	-0.164 (0.185)
Product innovator $t-1$	0.152*** (0.017)	0.153*** (0.017)	0.152*** (0.017)	0.154*** (0.017)
Process innovator $t-1$	0.019 (0.016)	0.020 (0.016)	0.019 (0.016)	0.020 (0.016)
ICT usage $t-1$	0.043*** (0.016)	0.042*** (0.015)	0.042*** (0.015)	0.041*** (0.015)
International managerial knowledge $t-1$	0.143*** (0.023)	0.144*** (0.023)	0.144*** (0.023)	0.142*** (0.023)
Traditional				0.141*** (0.028)
Specialised				0.055 (0.054)
High-tech				0.028 (0.046)
Observations	3720	3720	3720	3720
Pseudo R ²	0.1564	0.1575	0.1570	0.1582
Country dummies	yes	yes	yes	yes
Sector Dummies	yes	yes	yes	yes
Pavitt Industry group dummies	yes	yes	yes	yes
Heterogeneous effects of financing constraints - Average marginal effect of Financing Constraints for:				
Foreign owned firms	-0.289 0.536			
Domestic owned firms	-0.523** (0.262)			
Firms 20 year old or less		-0.935*** (0.311)		
Firms older than 20 years		-0.201 (0.294)		
Employment (25 th percentile)			-0.698** (0.275)	
Employment (50 th percentile)			-0.531** (0.258)	
Employment (75 th percentile)			-0.364 (0.268)	
Economies of Scale				0.125
				0.353

Traditional Industries				-0.831***
				0.283
Specialised Industries				-0.175
				0.442
High Tech industries				-0.820
				0.719

Note: Regressions are weighted using relative weights computed on the basis of the original firm distribution by size and industry provided by the Eurostat. The dependent variable equals to one if firm exported in 2008 and zero otherwise. Labour productivity, capital- labour ratio and employees are expressed in natural logs. The financial constraint index is interacted with the firm characteristic shown at top of the column. The average marginal effects measure the variation of the sensitivity of export participation to changes in firm characteristics for different firm groups

Source: EFIGE linked dataset

Table 7: Financing constraints and export Intensity - Heckman model

	Intensity (1)	Selection (2)
Financing Constraints Index t_{-1}	-0.691 (0.824)	-0.407* (0.233)
Domestic-owned t_{-1}	-0.505*** (0.097)	-0.122*** (0.034)
Age (> 20 years)	0.042 (0.061)	0.074*** (0.016)
Labour productivity t_{-1}	0.225*** (0.081)	0.136*** (0.020)
Capital labour ratio t_{-1}	-0.012 (0.026)	-0.013* (0.007)
Wage per employee t_{-1}	-0.142 (0.112)	-0.025 (0.031)
Employment t_{-1}	0.150*** (0.036)	0.058*** (0.015)
Sales growth t_{-1}	0.004 (0.081)	-0.021 (0.027)
Industry sales growth t_{-1}	-0.624 (0.701)	-0.245 (0.192)
Product innovator t_{-1}	0.212** (0.089)	0.124*** (0.018)
Process innovator t_{-1}	-0.095* (0.054)	0.028* (0.016)
ICT usage t_{-1}	-0.037 (0.053)	0.038** (0.015)
International managerial knowledge t_{-1}	0.261*** (0.082)	0.119*** (0.024)
Observations	3617	3617
Wald test of independent equation ($\rho = 0$)	$\chi^2(1) = 25.68$; Prob > $\chi^2 = 0.000$	
Log pseudolikelihood	-5350	
Country dummies	yes	yes
Sector dummies	yes	yes
Pavitt industry group	yes	yes

Notes: Regressions are weighted using relative weights computed on the basis of the original firm distribution provided by the Eurostat. The dependent variable in the intensity equation is the natural log of export sales per total sales. The dependent variable in the selection equation is a dummy variable equal to one if firm exported in 2008 and zero otherwise. Labour productivity, capital-labour ratio and employees are expressed in natural logs. For model identification, firm size (number of employees) variable is excluded from the intensity equation; the average marginal effect reported captures the indirect effect of firm size on export intensity.

Source: EFIGE dataset

Table 8: Financing constraints and export intensity – Heterogeneous effects - Heckman model

	Ownership		Age		Size		Sectors	
	Intensity	Selection	Intensity	Selection	Intensity	Selection	Intensity	Selection
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Financing Constraints Index t_{-1}	-0.701 (0.842)	-0.407* (0.235)	-0.708 (0.853)	-0.434* (0.235)	-0.594 (0.890)	-0.451* (0.238)	-0.679 (0.832)	-0.434* (0.234)
Domestic owned t_{-1}	-0.511*** (0.106)	-0.126*** (0.034)	-0.486*** (0.094)	-0.119*** (0.032)	-0.479*** (0.095)	-0.126*** (0.032)	-0.479*** (0.090)	-0.126*** (0.031)
Age (> 20 years)	0.043 (0.061)	0.075*** (0.016)	0.046 (0.063)	0.075*** (0.016)	0.043 (0.061)	0.075*** (0.016)	0.040 (0.059)	0.075*** (0.016)
Labour productivity t_{-1}	0.225*** (0.082)	0.136*** (0.020)	0.227*** (0.081)	0.133*** (0.020)	0.230*** (0.082)	0.134*** (0.020)	0.229*** (0.077)	0.134*** (0.019)
Capital labour ratio t_{-1}	-0.012 (0.026)	-0.013* (0.007)	-0.012 (0.026)	-0.014* (0.007)	-0.012 (0.026)	-0.013* (0.007)	-0.015 (0.026)	-0.014* (0.007)
Wage per employee t_{-1}	-0.145 (0.112)	-0.025 (0.032)	-0.140 (0.113)	-0.027 (0.032)	-0.138 (0.114)	-0.025 (0.031)	-0.153 (0.111)	-0.030 (0.031)
Employment t_{-1}	0.150*** (0.035)	0.058*** (0.015)	0.149*** (0.036)	0.058*** (0.016)	0.160*** (0.037)	0.063*** (0.016)	0.156*** (0.035)	0.060*** (0.015)
Sales growth t_{-1}	0.005 (0.081)	-0.021 (0.028)	0.002 (0.087)	-0.011 (0.028)	-0.000 (0.084)	-0.017 (0.028)	-0.013 (0.076)	-0.022 (0.027)
Industry sales growth t_{-1}	-0.611 (0.703)	-0.245 (0.192)	-0.621 (0.704)	-0.246 (0.192)	-0.598 (0.704)	-0.260 (0.192)	-0.546 (0.687)	-0.234 (0.191)
Product innovator t_{-1}	0.211** (0.089)	0.127*** (0.019)	0.214** (0.091)	0.127*** (0.020)	0.213** (0.090)	0.126*** (0.019)	0.204** (0.079)	0.127*** (0.018)
Process innovator t_{-1}	-0.096* (0.054)	0.027* (0.016)	-0.095* (0.054)	0.028* (0.016)	-0.097* (0.054)	0.028* (0.016)	-0.093* (0.053)	0.029* (0.016)
ICT usage t_{-1}	-0.037 (0.053)	0.039** (0.015)	-0.039 (0.053)	0.038** (0.015)	-0.038 (0.053)	0.038** (0.015)	-0.040 (0.053)	0.036** (0.015)
International managerial knowledge t_{-1}	0.245*** (0.082)	0.118*** (0.023)	0.250*** (0.082)	0.120*** (0.023)	0.245*** (0.082)	0.120*** (0.023)	0.240*** (0.075)	0.118*** (0.022)
Traditional Industries dummy	0.495*** (0.141)	0.126*** (0.031)	0.497*** (0.140)	0.126*** (0.031)	0.498*** (0.139)	0.126*** (0.031)	0.466*** (0.132)	0.123*** (0.030)
Specialised Industries dummy	0.110 (0.147)	0.084* (0.051)	0.107 (0.147)	0.082 (0.051)	0.106 (0.147)	0.082 (0.051)	0.077 (0.146)	0.077 (0.050)
High Tech Industries dummy	-0.034 (0.125)	0.052 (0.043)	-0.029 (0.125)	0.051 (0.043)	-0.032 (0.124)	0.051 (0.042)	-0.032 (0.123)	0.037 (0.042)
Observations	3617	3617	3617	3617	3617	3617	3617	3617
Wald test of independent	$\chi^2(1) = 25.66^{***}$		$\chi^2(1) = 24.19^{***}$		$\chi^2(1) = 24.47^{***}$		$\chi^2(1) = 41.0^{***}$	

equation (rho = 0)								
Log pseudo likelihood	-5349.727		-5347.578		-5348.10		-5340.689	
Country dummies	yes	yes	yes	yes	yes	yes	yes	yes
Sector Dummies	yes	yes	yes	yes	yes	yes	yes	yes

Notes: Regressions are weighted using relative weights computed on the basis of the original firm distribution by size and industry provided by the Eurostat. The dependent variable in the primary equation is the natural log of export sales per total sales. The dependent variable in the selection equation is a dummy variable equal to one if firm exported in 2008 and zero otherwise. Labour productivity, capital-labour ratio and employees are expressed in natural logs. The financial constraints index is interacted with the firm characteristic shown at the top of the column. The computed average marginal effects take into account the interaction terms. For model identification, firm size is excluded from the intensity equation; the corresponding average marginal effect reported captures the indirect effect of firm size on export intensity.

Source: EFIGE linked dataset

Table 9: Financing constraints and export intensity - Average marginal effect of financing constraints By firm characteristic

	Ownership		Age		Size		Sectors	
	Intensity	Selection	Intensity	Selection	Intensity	Selection	Intensity	Selection
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Foreign owned firms	0.292	-0.092						
	(1.396)	(0.504)						
Domestic owned firms	-0.766	-0.429*						
	(0.871)	(0.242)						
Firms 20 year old or less			-0.623	-0.810***				
			(1.281)	(0.301)				
Firms older than 20 years			-0.734	-0.149				
			(0.862)	(0.268)				
Employment (25 th percentile)					-0.560	-0.638**		
					(1.109)	(0.270)		
Employment (50 th percentile)					-0.535	-0.468*		
					(0.909)	(0.240)		
Employment (75 th percentile)					-0.532	-0.297		
					(0.794)	(0.244)		
Economies of Scale							-0.034	0.230
							(1.169)	(0.332)
Traditional Industries							-0.842	-0.894***
							(1.081)	(0.276)
Specialised Industries							-0.171	0.444
							(1.139)	(0.416)
High Tech industries							-0.227	-0.842
							(1.826)	(0.621)

Notes: Regressions are weighted using relative weights computed on the basis of the original firm distribution by size and industry provided by the Eurostat. The marginal effects of the financing constraints on export intensity (propensity to export) for different firm groups are reported in the odd (even) numbered columns. For model identification, firm size is excluded from the export intensity equation; the corresponding average marginal effect reported captures the indirect effect of firm size on export intensity.

Source: EFIGE linked dataset

Appendix Data Description

Table A1 Industry groups classified by technology class of firms' primary activity

NACE code	Economies of scale industries	NACE code	Traditional industries
21	Paper and pulp	15	Food and beverages
22	Publishing and press	16	Tobacco
23	Petroleum and coke products	17	Textiles
240	Chemicals, not specified	18	Wearing apparel
241	Basic chemicals	19	Leather and leather products
242	Agrochemicals	20	Wood and wood products
246	Other chemical products	28	Fabricated metal products
247	Man-made fibres	36	Furniture and other manufacture
250	Rubber and plastic, not specified	37	Recycling
251	Rubber products		
26	Other non-metallic mineral products		
27	Basic metals		
297	Domestic appliances		
31	Electrical machinery and apparatus		
32	Radio, television and communication equipment		
34	Motor vehicles and trailers		
35	Other transport equipment		
NACE code	Specialised industries	NACE code	High-tech industries
252	Plastic products	243	Paints and varnishes
290	Machinery and equipment, not specified	244	Pharmaceuticals
291	Machinery for production and use of mechanical power	245	Soaps and detergents
292	Other general purpose machinery	30	Office machinery and computers
293	Agricultural and forestry machinery	331	Medical and surgical equipment
294	Machine tools	332	Instruments for measuring and other purposes
295	Other special purpose machinery	333	Industrial process control equipment
296	Weapons and ammunition		
334	Optical instruments and photographic equipment		
335	Watches and clocks		

Note: Industry classification follows Pavitt (1984).

Table A2: Variables Definitions and Data Sources

Variable	Definition	Data Source
Firm ownership	Categorical variable equal to one if firm is part of a national group and foreign shareholders own less than ten per cent of firm's capital	EFIGE linked data set
Sales	Firm level total sales	EFIGE linked data set
Labour productivity	Sales over total number of employees at firm level	EFIGE linked data set
Employment	Total number of employees at firm level	EFIGE linked data set
Wage per employee	Labour compensation over number of employees at firm level	EFIGE linked data set
Capital-labour ratio	Total tangible assets over total number of employees at firm level	EFIGE linked data set
Firm age	Years from the date of firm's establishment	EFIGE linked data set
Firm sales growth	Growth rate of sales at firm level	EFIGE linked data set
Industry sales growth	Growth rate of sales at industry level	EFIGE linked data set
Product innovators	Categorical variable equal to one if firm carried out product innovation (the introduction of a new or significantly improved goods with respect to its fundamental characteristics; innovation new to the firm); zero otherwise	EFIGE linked data set
Process innovators	Categorical variable equal to one if firm carried out process innovation (the adoption of a production technology which either new or significantly improved; innovation new to the firm); zero otherwise	EFIGE linked data set
ICT usage	Categorical variable equal to one if firm used IT systems/solutions for E-commerce (online purchasing/online sales) and for management of the sales/purchase network (suppliers' orders, customer service); zero otherwise.	EFIGE linked data set
International managerial knowledge	Categorical variable equal to one if firm employed foreign executives (including middle management); zero otherwise	EFIGE linked data set
Financing constraints index	Estimated measure of financing constraints at firm level (see section 3.1).	EFIGE linked data set

Year	Number	Title/Author(s) ESRI Authors/Co-authors <i>Italicised</i>
2016	529	Fisheries Management for different angler types <i>John Curtis and Benjamin Breen</i>
	528	Poorest made Poorer? Decomposing income losses at the bottom of the income distribution during the Great Recession <i>Michael Savage</i>
	527	Profile of second-level students exempt from studying Irish <i>Emer Smyth and Merike Darmody</i>
	526	Modelling the Vietnamese Economy Pho Chi , <i>John FitzGerald</i> , Do Lam , Hoang Ha , Luong Huong, Tran Dung
	525	Attitudes to Irish as a school subject among 13-year-olds <i>Emer Smyth and Merike Darmody</i>
	524	Attitudes of the non-Catholic Population in Northern Ireland towards the Irish Language in Ireland <i>Merike Darmody</i>
	523	An auction framework to integrate dynamic transmission expansion planning and pay-as-bid wind connection auctions <i>Niall Farrell, Mel T. Devine and Alireza Soroudi</i>
	522	Surplus Identification with Non-Linear Returns <i>Peter D. Lunn</i> and Jason J. Somerville
2015	521	Water Quality and Recreational Angling Demand in Ireland <i>John Curtis</i>
	520	Predicting International Higher Education Students' Satisfaction with their Study in Ireland Mairead Finn and <i>Merike Darmody</i>
	519	What Factors Drive Inequalities in Carbon Tax Incidence? Decomposing Socioeconomic Inequalities in Carbon Tax Incidence in Ireland <i>Niall Farrell</i>