A Note on the Link between Firm Size and Exports

Hernandez, Pedro J.

Universidad de Murcia

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Pedro J. Hernández
Departamento de Fundamentos del Análisis Económico
Facultad de Economía y Empresa. Universidad de Murcia
Campus de Espinardo, 30100 Espinardo (Murcia)
Telephone: (+34) 868 88 37 33. Fax: (+34) 868 88 37 58
Email: nani@um.es

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Abstract

This paper re-examines the link between firm size and exports in order to study the proposal that consists of increasing the firm size to raise exports as a way out of the current economic crisis. The elasticity of export propensity (percentage of exported sales) with respect to firm size depends on several firm characteristics. The new theories of international trade emphasize the firm heterogeneity as the theoretical basis of this behaviour. In the context of such heterogeneity, this paper uses the quantile regression methodology to analyze the effect of firm size on export propensity of the firms, confirming the existence of a positive relationship that becomes less important as export propensity increases. The traditional estimate of this elasticity on the average of the export propensities distribution underestimates the effect in the bottom of the distribution and overestimates the effect on most of it.

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1. Introduction

This paper analyzes the proposal that increasing the average firm size can raise exports of a country by studying this relationship at firm level. This relationship between firm size and export has been used in recent years in Spain to explain a paradoxical behaviour observed in the Spanish export share. Antrás (2011) indicates that, while competitiveness of the Spanish firms has declined and the export share of emerging countries (like China and India) has increased in recent years, it is surprising that the Spanish export share has remained constant in this context. His explanation is that only large firms would be causing the maintenance of the national total export share, because their unit labour costs have progressed better than other companies. Therefore, the firm size of exporters is a crucial variable to explain and to increase the firm export intensity or propensity (percentage of sales exported)[1]. The small average size of Spanish companies with respect to the average size of the firms of European Union is a disadvantage in this aspect. Therefore, there are proposals that seek to increase this size. This paper is in that line.

Although a positive relationship between size and export propensity has long been generally accepted (Wagner, 1995, Majocchi *et al*., 2005), there are studies that point in other directions. Verwaal and Donkers (2002) cite papers from the 1980s and 90s where this relationship does not exist or even it is negative. More recently, Pla-Barber and Alegre (2007) does not find this relationship in a sample of French biotechnology industry, and Iyer (2010) finds that firm size has a negative effect on export intensity in New Zealand's agriculture and forestry. Due to this kind of findings, Verwaal and Donkers (2002) refer to this relationship as an empirical puzzle. These authors try to solve this puzzle including a transaction cost analysis of export relationships. They show that the relationship between firm size and export intensity is moderated by the size of export relationships (measured by the firm's average annual value of transactions per foreign buyer), so it is possible to find positive and negative effects depending on the magnitude of these transaction costs, the firm size and the type of industry.

The new international trade theories emphasize firm heterogeneity to explain many of the behaviours that we observe in the international markets (Bernard *et al*., 2007 and 2011 and Redding, 2010). According to this theory, not only are exporting firms very different from non-exporters (Bernard and Jensen, 1995), but there is also high heterogeneity within

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[1] The fourth quarter 2012 report of BBVA Research about economic outlook Spain presents this same idea and recommends analyzing the date at firm level to solve this "Spanish puzzle".

the firms of these two groups (Powell and Wagner, 2011). In the context of this heterogeneity, differences at the mean of a distribution of some variable or econometric estimates that only obtain valid results in this average are incomplete. Because of this, empirical analyses along the distribution of a given variable are replacing those that only look at the mean. Wagner (2011) recommends this kind of analysis along the whole distribution of a given variable when the theoretical framework is firm heterogeneity and proposes the use of quantile regression as a way to do it.

2. The data

The data used in this paper are the *Encuesta Sobre Estrategias Empresariales* (Survey on Companies' Strategies, hereinafter, ESEE) and the EFIGE dataset. The ESEE originates from an agreement signed in 1990 between the Ministry of Industry of Spain and the SEPI Foundation, formerly the *Fundación Empresa Pública* (Public Firm Foundation). It is an unbalanced panel of Spanish manufacturing firms in operation since 1990. The database contains information about an average sample of 1,800 firms every year, and includes information about activity, products and manufacturing processes, customers and suppliers, costs and prices, markets covered, technological activities, income statements, accounting balance sheets, employment and foreign trade. Firms with fewer than 10 employees were excluded from the survey. All firms with over 200 employees are included along with a random sample of the rest (firms with 10 to 200 employees).

The EFIGE is a cross section dataset that has recently been collected within the EFIGE project (European Firms in a Global Economy: internal policies for external competitiveness) supported by the European Commission[2]. This database, present for the first time in Europe, combines measures of firms' international activities (e.g. exports, outsourcing, FDI, imports) with quantitative and qualitative information on some 150 items ranging from R&D and innovation, labour organisation, financing and organisational activities, and pricing behaviour. The data consists of a representative sample (at the country level for the manufacturing industry) of almost 15000 surveyed firms (above 10 employees) in seven European economies (Germany, France, Italy, Spain, United Kingdom, Austria, and Hungary). It was collected in 2010, covering the years from 2007 to 2009. Special questions

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[2] Altomonte and Aquilante (2012) describe this dataset with detail.

related to the behaviour of firms during the crisis were also included in the survey, but the sample is built to be representative for 2008.

Table A1 of the Appendix shows the export growth for Spanish manufacturing firms with the ESEE dataset measured by its extensive margin (percentage of firms that report having exported) and the intensive (average percentage of export propensity of each company). However, this increase has not occurred evenly across all firms, but if we analyze the behavior according to their size, we note that there is a high heterogeneity. With the EFIGE dataset Table A1 shows only the intensive margin by countries, because virtually all firms in this dataset are exporter. Spain has the lowest intensive margin.

In Table A2 we see that, while the average export propensity is higher in firms with more than 50 employees, the export propensity values obtained in the considered percentiles show that in the three groups of firms there coexist companies with high export propensity with others whose percentage of export sales is relatively small. In the ESEE in 2010 there are firms with fewer than 50 employees whose propensity to export in the 95th percentile reaches 231.4% of the mean[3]. Similar percentages are obtained in larger companies (280.8% in those with more than 50 and fewer than 250 employees and 258.6% in those with more than 249 employees). At the same time, the export propensity of the largest companies is very similar to the smaller ones in the 5th percentile: 2.6% for those with more than 249 employees and 1.6% for those with fewer than 50 employees. In the EFIGE dataset there are more differences in the 5th percentile, but the percentages obtained in the 95th percentile are also quite similar in the three firm sizes considered.

The percentage of firms by size along the distribution of export propensities shown in Table A3 shows the same idea. The percentage of companies with over 249 employees located in the first quintile of the distribution of export propensities stands at around 25% for the period considered in the ESEE, although there is a clear downward trend (39.4% in 1990 and 13.7% in 2010). At the top of the distribution, the percentage of firms with fewer than 50 employees located in the fifth quintile of the distribution stands at around 21% throughout the period considered, and in this case there is no clear downward trend. In short, the high firm heterogeneity is clear. Although there is a positive correlation between firm size and export propensity for any size considered, we can always find a significant fraction of firms with

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[3] The export intensity is the percentage of exported sales measured as percentage of the average value of export intensity in the 20 considered industries and 21 years included in ESEE dataset, and in the 11 industries and 166 regions included in EFIGE dataset.

high export propensity with others firms whose export propensity is low, and vice versa, between firms that export a lot, we can find both small and large companies, and between firms that do not export much, too. Consequently, the analysis of the differences in the mean of the distribution is a quite incomplete exercise in this context of high heterogeneity. As a result, this paper proposes an analysis along the distribution of export propensities using the quantile regression.

3. Regression results

To analyze the effect of firm size on export propensity in the average of distribution I estimate the equation (1)[4] with the ESEE dataset

$$ln\,P_{jt} = \alpha_j + \beta\,ln\,S_{jt} + \delta_t + u_{jt} \tag{1}$$

where P_{jt} is the export propensity of the firm j in the year t measured as a percentage of the average value of export propensity in the 20 industries considered and for each of the 21 years included in ESEE dataset, and in the 11 NACE-CLIO industries and 166 regions (at the NUTS-1 level of aggregation) included in EFIGE dataset. The firm size is measured by the number of employees in the firm j in the year t, S_{jt}. With the ESEE dataset both firm fixed effects (α_j) and temporary fixed effects (δ_t) are included. With EFIGE it is not possible to include these fixed effects, so I include other controls (Z_j) available in the data and estimate equation (2)

$$ln\,P_j = \alpha + \beta\,ln\,S_j + Z_j'\gamma + \varepsilon_j \tag{2}$$

These controls are the countries, the industries, the firm age and others firm characteristics like importer of materials, importer of services, active outsourcer, passive outsourcer, foreign direct investor, global exporter, active abroad, employees to R&D activities, product innovation, process innovation, market innovation, organizational innovation, human capital, labour flexibility, credit request, credit obtained, family managed, family chief executive officer, foreign group, decentralized management, bonus for managers, quality certification, and competition from abroad.

The estimate of the elasticity β of export propensity with respect to firm size in the average of distribution is in the first file of Table 1 and reaches 0.146 in the ESEE dataset and

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[4] It has previously been tested that there is no selection bias estimating the Heckman selection model (Heckman, 1979) with the sample of exporting and non-exporting firms. Vermeulen (2004) obtains this same result.

0.078 in EFIGE dataset. That is to say, the size firm has a positive effect on the export propensity, although in an inelastic way. A 10% increase in the number of employees of the firm increases its export propensity by 1.46% in the ESEE dataset and by 0.78% in the EFIGE dataset.

However, this effect on the mean of the distribution is incomplete when we assume firm heterogeneity (Wagner, 2011). Such heterogeneity involves differences beyond that observed in the mean of the distribution, extending the majority of the same. To analyze this elasticity taking into account such heterogeneity I will use the quantile regression methodology developed by Koenker and Basset (1978) to estimate this elasticity at different percentiles of the distribution of export propensities. For the ESEE dataset I estimate the following equation

$$ln\, P_{jt} = \alpha_{\tau j} + \beta_\tau\, ln\, S_{jt} + u_{\tau jt} \tag{3}$$

$$\ln P_{jt}^\tau = \alpha_{\tau j} + \beta_\tau \ln S_{jt} \tag{4}$$

where $ln\, P_{jt}^\tau$ is the τth quantile of the logarithm of export propensity conditioned to the logarithm of the firm size of the firm j in the year t; $\alpha_{\tau j}$ is the firm fixed effect at τth quantile and β_τ is the elasticity of export propensity with respect to firm size at τth quantile. According to equation (2), for EFIGE dataset I estimate the following equation

$$ln\, P_j = \alpha_\tau + \beta_\tau\, ln\, S_j + Z_j'\gamma_\tau + \varepsilon_{\tau j} \tag{5}$$

$$\ln P_j^\tau = \alpha_\tau + \beta_\tau \ln S_j + Z_j'\gamma_\tau \tag{6}$$

Table 1 shows the results of this elasticity with the two dataset. It is positive, statistically significant and less than unity, but it decreases as we move along the distribution of export propensities. Note that this elasticity is 0.234 at the 10th quantile and decreases up to 0.045 at the 90th quantile in the ESEE dataset. These numbers are 0.128 and 0.03 in the EFIGE dataset. Consequently, the traditional estimate of this elasticity on the average of the export propensities distribution underestimates the effect in the bottom of the distribution (up to the first quartile approximately) and overestimates the effect on most of it. These same effects are obtained when the second order term (log of firm size square) is also included in the regressions. The estimates are available upon request.

The explanation for this result could be the influence of transaction costs on the relationship between firm size and export intensity, as noted in Verwaal and Donkers (2002). According to these authors, the firm size doest not capture all the economies in the context of export relationships, but it is necessary to include the size of the export relationship. They use the average annual value of transactions per foreign buyer as an explicative variable of export intensity and an interaction term between this variable and the firm size. The export relationship size variable has a positive influence on export propensity and a moderating effect on the firm size and export propensity relationship, because the coefficient of export relationship size is positive and significant and the coefficient of that interaction term is negative and statistically significant. "Small firms can realize economies of scale if they specialize in exports and develop export relationships of significant size" (Verwaal and Donkers, 2002, page 611). In my dataset there is no information about the number of foreign buyers and I can not include this size of the export relationship but, according to Verwaal and Donkers (2002), there is a positive correlation between size of the export relationship and export propensity. Consequently, the moderating effect of export relationship size on the elasticity of export propensity with respect to firm size is greater in firms with higher export propensities.

However, the export propensity has an upper bound (although I use a relative measure of the export propensity by industry and year) and the firms that have a higher export propensity can not increase it as much as firms with less export propensity. To check that this does not affect the previous result and to find greater robustness, I estimate the elasticity of value of exports with respect to firm size with de ESEE dataset.[5] Column 3 of Table 1 shows this elasticity and confirms the previous results. The estimate elasticity in the average of distribution of export values is unitary, but up to 30th quantile it is greater than unity and from there it is less than unity. Therefore, it is shown that the effect of firm size on exports – export intensity or value of exports– is smaller as exports rise.

4. CONCLUSIONS

The elasticity of export propensity with respect to firm size is positive, statistically significant and less than unity along the distribution of export propensities. However, this elasticity decreases as the export propensity increases. So, the traditional estimate of this elasticity on

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[5] With the EFIGE dataset is not possible to estimate this elasticity because the annual turnover is defined by ranges and there is no upper bound.

the average of the export propensities distribution underestimates the effect in the bottom of the distribution and overestimates the effect on most of it. Consequently, the positive effect of firm size on export propensity is relatively more important in companies with less export propensity.

I also estimate the elasticity of value of exports with respect to firm size in order to check the robustness of this result. The estimates obtained are similar: the estimated elasticity in the average of distribution of export values is lees than the obtained up to 30th quantile and higher than that obtained in the rest of the distribution.

This finding may have important policy implications in the discussion of the increase in exports that has been promoted lately in Spain and others countries as a way out of the current economic crisis, where the aim is that the increase of the foreign demand counters reduced domestic demand. According to the results obtained in this paper, it would be more efficient to direct public funds to increasing firm size for companies with less export intensity, because this would generate a greater increase in overall export intensity (or value of exports) due to the increase of export intensity being higher in these firms than others.

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APPENDIX

Table A1. Average export intensity

	The Survey on Companies' Strategies (ESEE)		The EFIGE dataset (2008)	
	Percentage of exporting firms	Average export intensity	Average export intensity	
1990	47.51	22.01 (24.15)	Austria	42.88 (34.36)
1995	59.09	27.91 (26.40)	France	29.58 (24.41)
2000	64.99	30.14 (26.83)	Germany	31.22 (24.41)
2005	62.13	30.47 (27.40)	Hungary	47.10 (35.61)
2008	63.27	30.62 (28.25)	Italy	35.85 (28.52)
2009	63.92	31.97 (28.70)	Spain	26.85 (26.39)
2010	65.42	32.48 (29.05)	United Kingdom	30.20 (28.90)

Standard deviations are in brackets.

Table A2. Export intensity distribution by firm size

			Mean	Standard Deviation	Quantile				
					5%	25%	50%	75%	95%
E S E E	**1990**	Fewer than 50 employees	94.06	120.85	2.68	14.75	40.14	116.51	355.79
		Between 50-249 employees	113.72	127.53	2.69	21.45	71.01	172.05	331.69
		More than 249 employees	96.50	95.34	3.39	22.58	65.42	141.75	299.75
	2000	Fewer than 50 employees	75.26	90.02	1.37	10.94	37.27	105.71	265.40
		Between 50-249 employees	103.11	90.09	2.08	28.14	81.89	160.61	268.82
		More than 249 employees	115.88	82.88	6.99	47.48	103.37	173.94	263.37
	2010	Fewer than 50 employees	72.53	83.07	1.57	11.02	41.76	111.91	231.36
		Between 50-249 employees	116.43	98.07	4.14	34.55	98.18	174.75	280.77
		More than 249 employees	111.27	83.46	2.62	44.39	103.53	169.00	258.59
EFIGE		Less than 50 employees	91.12	79.24	4.76	26.54	73.68	133.33	242.42
		Between 50-249 employees	113.68	84.15	8.33	45.58	100.00	165.18	269.69
		More than 249 employees	125.60	76.14	16.9	71.49	114.50	170.67	253.91

The export intensity is the percentage of exported sales measured as percentage of the average value of export intensity in the 20 considered industries and 21 years included in ESEE dataset, and in the 11 industries and 166 regions included in EFIGE dataset.

Table A3. Share of firms by size in the quintiles of the export intensity distribution

			Quintile				
			1	2	3	4	5
E S E E	1990	Fewer than 50 employees	37.23	32.49	23.59	23.56	26.70
		Between 50-249 employees	23.40	22.34	23.08	25.65	29.32
		More than 249 employees	39.36	44.16	52.82	50.79	43.98
	1995	Fewer than 50 employees	48.99	34.34	23.98	18.27	19.90
		Between 50-249 employees	23.74	27.78	31.12	31.47	33.16
		More than 249 employees	27.27	37.88	44.39	49.75	46.43
	2000	Fewer than 50 employees	49.59	37.86	24.07	17.70	20.33
		Between 50-249 employees	26.45	28.81	30.71	27.98	30.71
		More than 249 employees	23.55	32.92	45.23	53.91	48.96
	2005	Fewer than 50 employees	48.26	36.07	33.76	16.81	19.41
		Between 50-249 employees	28.70	31.15	33.76	33.19	38.82
		More than 249 employees	23.04	32.79	32.49	49.58	41.35
	2010	Fewer than 50 employees	54.58	44.27	28.52	23.28	22.52
		Between 50-249 employees	31.68	37.79	43.73	47.33	52.29
		More than 249 employees	13.74	17.56	27.76	29.39	25.19
EFIGE		Fewer than 50 employees	77.64	72.28	62.93	58.65	56.57
		Between 50-249 employees	19.22	20.68	25.93	28.41	30.68
		More than 249 employees	3.14	7.04	11.14	12.94	12.75

Table 1. Mean estimates and quantile regression estimates of the elasticity of export propensity and the elasticity of value of exports with respect to firm size.

Dependent variable and dataset	Export propensity ESEE	Export propensity EFIGE	Value of exports ESEE
Mean estimate	0.146 (2.89)	0.078 (5.33)	0.991 (18.30)
Quantile			
0.05	0.250 (2.99)	0.159 (5.14)	1.181 (11.91)
0.10	0.234 (3.97)	0.128 (4.36)	1.087 (22.52)
0.15	0.195 (6.24)	0.112 (4.35)	1.080 (27.82)
0.20	0.158 (4.16)	0.091 (3.32)	1.073 (29.05)
0.25	0.132 (6.18)	0.090 (3.50)	1.029 (35.13)
0.30	0.115 (4.99)	0.064 (2.61)	1.003 (32.46)
0.35	0.097 (7.93)	0.072 (5.64)	0.979 (38.98)
0.40	0.077 (4.93)	0.074 (6.39)	0.964 (48.06)
0.45	0.068 (4.37)	0.077 (3.89)	0.940 (45.91)
0.50	0.058 (4.80)	0.081 (4.52)	0.934 (35.43)
0.55	0.050 (3.47)	0.077 (639)	0.930 (42.44)
0.60	0.057 (3.32)	0.067 (5.37)	0.922 (46.62)
0.65	0.065 (3.17)	0.053 (4.11)	0.919 (39.03)
0.70	0.065 (3.92)	0.050 (3.12)	0.909 (35.66)
0.75	0.056 (3.14)	0.039 (2.37)	0.909 (36.79)
0.80	0.047 (1.85)	0.040 (3.60)	0.895 (31.84)
0.85	0.052 (2.50)	0.033 (2.38)	0.887 (27.80)
0.90	0.045 (1.49)	0.030 (3.41)	0.907 (24.48)
0.95	0.084 (2.70)	0.016 (1.23)	0.888 (14.42)
Year fixed effects	Yes	Not	Yes
Firm fixed effects	Yes	Not	Yes
Others controls	Not	Yes	Not
Firms	3249	7807	3259
Observations	23083	7807	23245

t-statistics are in brackets. The export intensity is the percentage of exported sales measured as percentage of the average value of the export intensity in the 20 considered industries and 21 years included in ESEE dataset, and in the 11 industries and 166 regions included in EFIGE dataset. Others controls in the EFIGE estimates are Countries, Industries, Age, Importer of materials, Importer of services, Active outsourcer, Passive outsourcer, FDI, Global exporter, Active abroad, Employees to R&D activities, Product innovation, Process innovation, Market innovation, Organizational innovation, Human capital, Labour flexibility, Credit request, Credit obtained, Family managed, Family chief executive officer, Family group, Decentralized management, Bonus, Quality certification, Competition from abroad.