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Research article

Top exporters and regional export specialization

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Abstract: We examined the role of top exporters in sub-national export specialization using Spanish firm-level export data at the province (NUTS 3) level. Our results show that, on average, 28% of aggregate exports in each province are in sectors where the top exporter determines the revealed comparative advantage (RCA). Moreover, provinces with sectors where the top exporter determines the RCA exhibit a more unstable pattern of export specialization over time. This result suggests that the characteristics and strategies of large firms may affect regional specialization patterns.

Keywords: top exporter; comparative advantage; granularity; persistence; province; Spain

JEL Codes: D22, L11, L25, F12, F14

1. Introduction

Only a small percentage of firms export, and a few large firms concentrate most of a country's exports (Bernard et al., 2009). Freund and Pierola (2015) examined whether the presence of very large exporters affects the comparative advantage of a country in some sectors. Using a sample of 32 developing countries, they showed that 20% of industries with revealed comparative advantage (RCA)

would have no RCA if the top exporter disappeared. For Spain, de Lucio et al. (2017) showed that if the top exporter disappeared, Spain would lose RCA in 15% of industries with RCA, accounting for 22% of total Spanish exports.

The studies cited above have used countries as the analysis unit. The contribution of this paper is to examine the role of the top exporter as a determinant of RCA at a sub-national level. The role of the largest exporter is expected to increase as the geographic analysis unit becomes smaller. This was confirmed when we used export data for 50 Spanish provinces (NUTS3) in 2018. We found that 28% of aggregate exports in a typical province were in sectors in which the top exporter determines the RCA. However, there were large differences between provinces. For example, in 13 provinces, more than 50% of exports were affected by the presence of one large firm in several sectors; if that top firm was not included, these sectors would no longer have RCA.

Next, we investigate whether the existence of a top exporter, which determines the RCA of a province in a sector, reduces the persistence of the pattern of export specialization of the province over time. This question is motivated by the "granularity" hypothesis of Gabaix (2011), which shows that idiosyncratic shocks to large firms can generate macroeconomic volatility. di Giovanni and Levchenko (2012) showed that small economies are more open to international trade, are more specialized, and, when a few large firms dominate the firm size distribution, exhibit greater volatility in aggregate exports. For the case of the Spanish provinces, de Lucio et al. (2023) confirm this result.

For the period 1998–2018, we found that the composition of products with revealed comparative advantage in a Spanish province was quite stable. However, we also showed that top exporters affecting RCA have significantly contributed to reducing the high persistence of sub-national export specialization in the last two decades. Therefore, we concluded that, in Spain, a province's high dependence on a top exporter generates instability in the pattern of sub-national trade specialization.

The rest of the paper is organized as follows: Section 2 shows the importance of the top exporter in provincial RCA. Section 3 investigates whether granular sectors affect the persistence of provincial export specialization. Section 4 concludes the work.

2. The importance of the top exporter in sectors with RCA in a province

Following Freund and Pierola (2015), we analyze how the sectoral RCA of provinces changes when we remove the top exporter in each sector. To do so, we calculate the Balassa's RCA index for industry j in province *i* ($RCA_{i,j}$), defined as follows:

$$RCA_{i,j} = \frac{x_{i,j}/x_{world,j}}{X_i/X_{world}} \quad (1)$$

where $x_{i,j}$ and $x_{world,j}$ are the province's and the world's exports in sector j, respectively; and X_i and X_{world} are the province's and the world's total exports, respectively. The distribution of $RCA_{i,j}$ is characterized by a fixed lower bound of 0, an upper bound of X_{world}/X_i, and an invariant demarcation value of 1. When $RCA_{i,j} > 1$, the share of province i in sector j in world exports is greater than the share of province in the world exports, revealing that the province is specialized in that sector. To have a symmetric distribution of our variable of interest, we transform the RCA into the symmetric RCA index (SRCA), defined as follows:

$$SRCA_{ij} = (RCA_{ij} - 1)/(RCA_{ij} + 1) \quad (2)$$

The SRCA has a lower and upper bound distribution ranging from −1 to +1 with a reference value of 0. Positive values indicate comparative advantages, and negative values indicate comparative disadvantages.[1]

We calculate the SRCA index for each of the 95 2-digit HS chapters in 2018 (and also in 1998) with all exporting firms in the province using the United Nations Comtrade database for world exports and the Spanish customs database for Spanish province exports. First, we calculate the SRCA index with and without the top exporter in each province sector. Second, we consider that a province has an RCA in a sector when the Balassa index, including the top exporter, takes a value greater than +0.05. Third, we remove the top exporter of the sector in which the province has a revealed comparative advantage and, if the index falls below −0.05, we say that there is a "granular effect": the top exporter is key for the province to have a revealed comparative advantage in the sector.[2]

Panel A in Table 1 presents the results for 2018. To help the reader understand the content of the table, we describe each cell of the first row in detail. In 2018, the exporting firms in the province of Palencia exported products from 63 out of 95 sectors. Palencia had an SRCA > 0.05 in 5 sectors, representing 95.1% of total exports. When we calculate the SRCA without the top exporter in these 5 sectors, we find that only 2 sectors remain with SRCA > 0.05, representing 8.7% of total exports in the province. Therefore, if the other 3 top exporters in Palencia disappeared, Palencia would lose its revealed comparative advantage in 3 sectors, which account for 86.4% of the total exports of the province. Together with Palencia, there are 4 other provinces (Álava, Baleares, Jaén, and Burgos) that would have lost the RCA if the top exporter in a few sectors disappeared, accounting for most of the total exports of the province.

On average, a typical province exports 80 out of 96 2-digit HS products, having a comparative advantage in 19 of them, which represents 80.2% of the exports of a province. After removing the top exporter in each sector, only 9 sectors remain with SRCA > 0.05 (52.3% of total exports). Thus, there are 10 "granular" sectors per province, which together account for 27.9% of the total exports of a typical province.

Panel B in Table 2 presents the calculations for 1998. Among the provinces most affected by the presence of a top exporter in the pattern of export specialization, only one province remains in the group of 2018: Palencia. Tables A.1 and A.2 in the appendix present the calculations for all provinces based on the 2018 and 1998 data.

For 2018, Figure 1 displays the Spanish provinces with the number of "granular" sectors in brackets and the share of total exports affected (in color). The distribution of provinces according to the share of exports affected by granular sectors is as follows: 9 provinces with more than 50%, 19 between 20% and 50%, and 22 provinces with less than 20%. In the appendix, Figure A.1 repeats the analysis based on the 1998 data.

Table 2 combines information on the importance of the granular sectors for each province in the first and last years. While most provinces remain on the main diagonal (28 provinces), there are a few provinces that show a substantial change in the weight that the granular sectors represent in their total

[1] Laursen (2015) compared SRCA with other measures of comparative advantage, including the Balassa index (RCA), and concluded that among those evaluated, the SRCA was the best measure of comparative advantage when testing the stability of the patterns of specialization of countries over time, which is our research question in the next section.

[2] Freund and Pierola (2015) used the thresholds 0.9 and 1.1 to identify sectors with RCA (RCA > 1.1) and without RCA (RCA < 0.9). In the SRCA, these thresholds are −0.053 and +0.048. For simplicity, we use −0.05 and +0.05.

exports. For example, there are three provinces (Ávila, Baleares, and Tenerife) where the granular sectors represented less than 20% of total exports in 1998 and more than 50% in 2018. Also, there are two other provinces (Álava and Cuenca) with granular sectors that represented more than 50% in 1998 and less than 20% in 2018. In the next section, we examine the importance of the granular sectors in the stability of the pattern of specialization of the Spanish provinces.

Table 1. Contribution of the top exporter to the SRCA index in 1998 and 2018 on selected provinces.

	Number	SRCA all firms		SRCA without top1		Granular impact on SRCA	
	(1)	(2)		(3)		(4)	
Panel A: YEAR 2018							
	HS2 sectors	Sectors	% exports	Sectors	% exports	N. firms	% exports
MOST AFFECTED PROVINCES							
Palencia	63	5	95.1	2	8.7	3	86.4
Ávila	51	16	92.0	3	15.9	13	76.1
Baleares	85	15	76.6	4	8.7	11	67.9
Jaén	73	15	87.3	4	21.3	11	66.0
Burgos	82	23	75.8	6	11.7	17	64.1
50 PROVINCES							
Average	80	19	80.2	9	52.4	10	27.9
Maximum	95	39	96.4	29	77.5	18	86.4
Minimum	51	5	56.4	2	8.7	3	3.9
Panel B: YEAR 1998							
	HS2 sectors	Sectors	% exports	Sectors	% exports	N. firms	% exports
MOST AFFECTED PROVINCES							
Palencia	43	4	97.7	0	0.0	4	97.7
Teruel	33	12	86.1	3	15.5	9	70.6
Soria	34	13	89.2	4	19.6	9	69.6
Cuenca	39	8	97.5	5	28.7	3	68.8
Cantabria	69	21	87.7	6	26.7	15	61.0
50 PROVINCES							
Average	70	17	82.3	8	53.7	8.72	28.6
Maximum	95	36	97.7	23	94.4	15	97.7
Minimum	33	4	54.8	0	0	1	0.3

Note: Information extracted from Table A.1 & Table A.2 in the appendix.

Table 2. Classification of provinces according to the weight of the "granular" sectors in total exports of a province in 1998 and 2018.

2018 1998	[0, 20]	(20, 50]	(50, 100]
[0, 20]	Albacete, Alicante Almería, Badajoz Barcelona, Castellón Córdoba, Girona Lleida, Málaga Murcia, Navarra Las Palmas, Pontevedra	Cáceres La Rioja Orense Tarragona Zaragoza	Ávila Baleares Tenerife
(20, 50]	A Coruña Guipúzcoa Huesca Segovia Sevilla Valencia	Ciudad Real, Granada Huelva, León Madrid, Asturias Salamanca, Toledo Valladolid, Vizcaya Zamora	Burgos Guadalajara Jaen
(50, 100]	Álava Cuenca	Cádiz Cantabria Teruel	Lugo Palencia Soria

Source: Own elaboration using information from Tables A.1 & A.2.

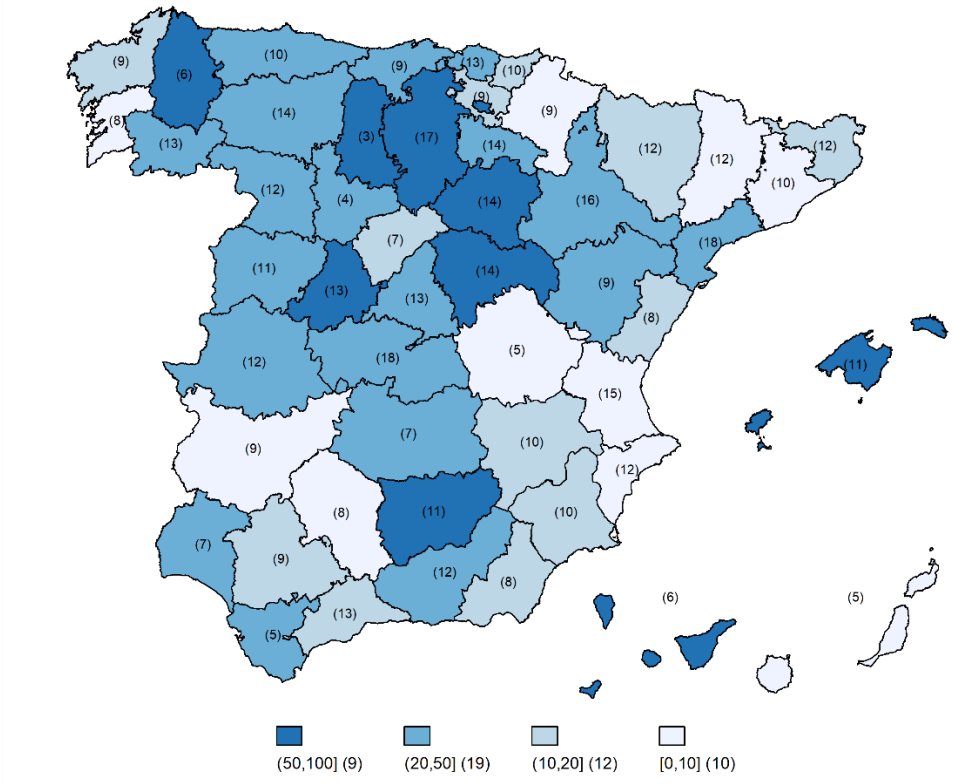

Figure 1. Percentage of total exports (blue color scale) and number of affected sectors in each province (in parentheses) that lose RCA if the top exporter is eliminated in a particular

sector. 2018. Note: Figure A.1 in the appendix provides additional information about the Spanish provinces: name, main exporting sector (HS2), and percentage of total exports in 2018. Source: Own elaboration using Custom data.

3. Do granular sectors affect the persistence of province export specialization?

In this section, we analyze the relationship between granularity and the dynamics of export specialization. First, we check the stability of international specialization patterns. Next, we assess whether and to what extent granularity has contributed to explaining the degree of (in)stability of sectoral export specialization patterns.

First, to test whether the international specialization pattern of Spanish provinces was stable over time, we estimate the following Equation using OLS:[3]

$$SRCA_{ij,t} = \beta_0 + \beta_1 SRCA_{ij,t-k} + \gamma_i + \gamma_j + \varepsilon_{ij} \quad (3)$$

where i = 1, ..., 50 are the Spanish provinces, j = 1, ..., 95 are the 2-digits Harmonized System sectors, t is the final year (2018), $t - k$ is the initial year (1998), γ_i is a vector of province fixed effects, γ_j is a vector of sector fixed effects, and ε_{ij} is an iid error term.

The estimated coefficient β_1 from Equation (3) provides information on the dynamics of the specialization of the Spanish provinces between 1998 and 2018. There are three scenarios: $\beta_1 = 1$ denotes evidence of persistence in the structure of sectoral export specialization; $\beta_1 > 1$ denotes that the initial structure of international specialization has strengthened; and $0 < \beta_1 < 1$ denotes that the initial structure of international specialization has weakened.

Table 3 presents the regression estimates of Equation (3). In column 1, the coefficient of β_1 is 0.626 and statistically different from 1; thus, we reject the null hypothesis of persistence because there is variability in the pattern of international specialization, with a mix of sectors gaining and losing comparative advantage. In column 2, when we eliminate the granular sectors in all provinces and in all years, the coefficient of β_1 increases to 0.695. Next, we repeat the same exercise after selecting province-sector pairs with at least two firms (columns 3 and 4) and with at least five firms (columns 5 and 6) to avoid the loss of comparative advantage due to the elimination of the top exporter. The results remain unchanged. The β_1 coefficient is always higher in the sample without granular sectors (even columns). These results reveal that granular sectors introduce instability in the pattern of export specialization of provinces.

Next, we check whether granular sectors are a source of instability in export specialization. First, we select only those sectors in which a province reveals a comparative advantage in the initial year ($SRCA_{ij,t} > 0.05$). Second, we define $G_{ij,t-k}$ as a dummy variable that takes the value of 1 if the SRCA index changes from above 0.05 to below −0.05 when the top exporter is removed in the initial year. Third, we examine whether the granular sectors in the initial year ($G_{ij,t-k}$) increase or reduce the degree of persistence in the pattern of export specialization in the last year using the interaction variable between $SRCA_{ij,t-k}$and the "granular" dummy variable $G_{ij,t-k}$. Thus, we estimate the following Equation:

$$SRCA_{ij,t} = \beta_0 + \beta_1 SRCA_{ij,t-k} + \beta_2 G_{ij,t-k} + \beta_3 SRCA_{ij,t-k} * G_{ij,t-k} + \gamma_i + \gamma_j + \varepsilon_{ij} \quad (4)$$

[3] We have also estimated a censored model (Tobit model) to account for the fact that our dependent variable is lower- and upper-bounded. The sign and significance of the coefficients did not change.

Table 3. Persistence in export specialization for 1998–2018. Dependent variable: $SRCA_{ij,t}$.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	With G	w/o G	With G	w/o G	With G	w/o G
$SRCA_{ij,t-k}$	0.626***	0.695***	0.653***	0.703***	0.694***	0.738***
	[0.0136]	[0.0141]	[0.0142]	[0.0150]	[0.0157]	[0.0161]
Constant	−0.0816***	−0.0888***	−0.0493***	−0.0636***	−0.0111	−0.0252***
	[0.00917]	[0.0100]	[0.00894]	[0.00995]	[0.00896]	[0.00961]
Observations	3,342	2,716	2,739	2,217	1,910	1,552
R-squared	0.526	0.624	0.578	0.653	0.652	0.728
Min number firms in prov/sector	1	1	2	2	5	5

Note: Regressions include province and sector fixed effects. Standard errors are robust to heteroskedasticity.

As before, we introduce province and sector dummies into the model. Note that the regression only includes province-sectors with $SRCA_{ij,t-k} > 0.05$ in 1998. The interaction term allows us to check whether granular province sectors in 1998 exhibit larger ($\beta_3 \geq 0$) or smaller ($\beta_3 \leq 0$) persistence in export specialization in 2018 than the rest of province sectors.

Table 4. Impact of granular sectors in 1998 on the persistence of comparative advantage in 2018. Dependent variable: $SRCA_{ij,t}$.

VARIABLES	(1)	(2)	(3)	(4)	(5)
$SRCA_{ij,t-k}$	0.961***	0.825***	1.068***	1.053***	0.961***
	[0.0732]	[0.0835]	[0.0936]	[0.0927]	[0.0868]
$G_{ij,t-k}$		−0.149***	0.0933	0.1201	0.0520
		[0.0438]	[0.0780]	[0.0778]	[0.0748]
$SRCA_{ij,t-k} * G_{ij,t-k}$			−0.499***	−0.558***	−0.321**
			[0.147]	[0.154]	[0.162]
Constant	−0.223***	−0.0878	−0.235***	−0.219***	−0.131**
	[0.0423]	[0.0563]	[0.0623]	[0.0616]	[0.0541]
Observations	800	800	800	757	611
R-squared	0.413	0.423	0.432	0.442	0.540
Number loss RCA in year t	232	232	232	209	141
Number granularity in year 0	360	360	360	318	209
Min number firms by prov/sector	1	1	1	2	5

Note: Sample of sectors with $SRCA_{ij,t-k} > 0.05$. $SRCA$ is the symmetric RCA index. $G_{ij,t-k}$ is a dummy that takes value of 1 if SRCA > 0.05 in the initial year and SRCA < -0.05 when the top exporter is removed in the initial year.

Table 4 reports the results of estimating Equation (4). In column (1), we observe that the sectors with revealed comparative advantage exhibit persistence, as we cannot reject that $\beta_1 \neq 1$. In column (2), the negative coefficient on $G_{ij,t-k}$ indicates that 300 granular sectors out a total of 800 sectors with $SRCA_{ij,t-k} > 0.05$ in 1998 have on average a lower SRCA index in 2018 than the rest. Notice that we can reject the null of full persistence ($\beta_1 = 1$) at the 5% significance level but not at the 1% level. In column (3), the coefficient of the interaction term is negative and statistically different from zero

($\beta_3 = -0.499$), the coefficient on the dummy $G_{ij,t-k}$ is not statistically different from zero, and the coefficient β_1 is not statistically different from one ($\beta_1 = 1.068$). Therefore, there is strong evidence that the granular sectors exhibit less persistence in comparative advantage than the rest of the sectors. This finding is robust to changes in the sample when we exclude province-sectors with only one firm or with less than five firms (columns 4 and 5).

4. Conclusions

In this paper, we have examined how top exporters affect the RCA of the province from which they export and whether they turn out to be a source of instability in the pattern of export specialization over time. We used firm-level data for 50 Spanish provinces (NUTS 3) over the period 1998–2018.

We have shown that if we remove the top exporter in each sector in a province, the RCA disappears in 10 sectors, which account for 28% of the aggregate provincial exports in 2018. We also found that the pattern of trade specialization has changed more in those provinces where the comparative advantage in 1998 relied more on the top exporter. In other words, the activity of a top exporter contributed to reducing the degree of persistence in the export specialization of the Spanish provinces over the last two decades.

In terms of policy implications, regional economies should identify potential vulnerabilities due to the presence of large firms in their territories whose activity can be severely affected by international shocks.

Use of AI tools declaration

The authors declare they have not used Artificial Intelligence (AI) tools in the creation of this article.

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Author contributions

The authors confirm contribution to the paper as follows: supervision of the project: Asier Minondo; study conception and design: Juan de Lucio, Asier Minondo, Francisco Requena; resources and data curation: Raúl Mínguez; descriptives and econometric analysis: Juan de Lucio, Francisco Requena. All authors discussed the results and contributed to the final manuscript.

Conflict of interest

All authors declare no conflicts of interest in this paper.

References

Bernard AB, Jensen JB, Redding SJ, et al. (2009) The margins of US trade. *Am Econ Rev* 99: 487–493. https://doi.org/10.1257/aer.99.2.487

de Lucio J, Mínguez R, Minondo A, et al. (2017) The granularity of Spanish exports. *SERIEs* 8:225–259. https://doi.org/10.1007/s13209-017-0157-x

de Lucio J, Mínguez R, Minondo A, et al. (2023) The importance of the top exporter in regional exports. *Investig Reg* 57: 137–143. https://doi.org/10.38191/iirr-jorr.23.021

di Giovanni JD, Levchenko AA (2012) Country Size, International Trade, and Aggregate Fluctuations in Granular Economies. *J Polit Econ* 120: 1083–1132. https://doi.org/10.1086/669161

Freund C, Pierola MD (2015) Export Superstars. *Rev Econ Stat* 97: 1023–32. https://doi.org/10.1162/REST_a_00511

Gabaix X (2011) The Granular Origins of Aggregate Fluctuations. *Econometrica* 79: 733–772. https://doi.org/10.3982/ECTA8769

Laursen K (2015) Revealed comparative advantage and the alternatives as measures of international specialization. *Euroasian Bus Rev* 5: 99–115. https://doi.org/10.1007/s40821-015-0017-1

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