



Export granularity at regional level¹

Juan de Lucio² (UAH), Raúl Mínguez³ (U. Nebrija), Asier Minondo⁴ (U. Deusto),
Francisco Requena⁵ (U. Valencia)

June 2021

Abstract

We show that the role of the top exporter in exports is even more important at regional level than at national one using Spanish firm-level exports at regional level. Top exporter in each province represents one fifth of total exports and contributes one fifth to export growth during a decade. We show that shocks to the top exporter of a province positively correlates with fluctuations in aggregate exports growth in the majority of provinces.

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

Keywords: top exporter, export concentration, export growth, granularity.

¹ We thank the Department of Customs and Excise of the Spanish Tax Agency (AEAT) for providing Customs data. We also gratefully acknowledge financial support from the Spanish Ministry of Science, Innovation and Universities (RTI2018-100899-B-I00, cofinanced with FEDER), the Basque Government Department of Education, Language Policy and Culture (IT885-16), Comunidad de Madrid & UAH (ref: EPU-INV/2020/006), Comunidad de Madrid (H2019/HUM-5761), UAH (2020/00003/016/001/003), and the Valencian Government-Generalitat Valenciana (GVPrometeo 2018/102).

² de Lucio: Universidad de Alcalá. Pza. San Diego, s/n, 28801, Alcalá de Henares (Spain). Email: juan.delucio@uah.es.

³ Mínguez: Cámara de Comercio de España and Universidad Antonio de Nebrija. Calle de Santa Cruz de Marcenado, 27, 28015, Madrid (Spain). Email: rminguez@nebrija.es.

⁴ Minondo: Deusto Business School, University of Deusto, Camino de Mundaiz 50, 20012 Donostia - San Sebastián (Spain). Email: aminondo@deusto.es

⁵ Requena: Department of Economic Structure, University of Valencia, Avda. dels Tarongers s/n, 46022 Valencia (Spain). Email: francisco.requena@uv.es

I. Introduction

Literature has established that top firms' specific shocks affect growth volatility Gabaix (2011). In this paper we show that shock to top firm induces aggregate export volatility at regional level. Top firm performance condition aggregate exports

Volatility has effect in a variety of economic indicator such as long run growth, income distribution and welfare. Our point of departure is that the impact of idiosyncratic shocks to the top exporter on aggregate exports should be more noticeable as the territory become smaller and open. In other words, we explore, at regional level, the theoretical link between economy size, trade openness, and volatility proposed by Di Giovanni & Levchenko (2012). Specifically, we depart from the previous literature because both; first we focus on regions (small size economic units) instead of countries, and second, we analyze a single main company in each region instead a group of top firms.

Our argument resembles the idea that smaller economic units have a less diversified sectoral structure and exhibit higher volatility (Blattman et al. (2007)), they also show that volatility is a powerful negative determinant of growth. This idea translates at firm level scale to; smaller territories have fewer firms, less diversified firm structure and consequently higher volatility. Shocks to top firm do not cancel out increasing the correlation between top firm shocks and aggregate fluctuations.

We provide empirical evidence at regional level of the relationship between volatility and trade openness and export size. We also present some stylized facts about a single top exporter in each region. We observe that usually top exporter is quite stable in the leadership positions, accounts for an important share of exports and contribute significantly to explain export growth. Our main result shows that shocks to the top exporter of a province correlate with variations in aggregate exports growth in the majority of provinces, these effects are greater at province level than at national level and higher for smaller regions, more open regions and with more firm concentration.

The remaining of the paper is structured as follow. In Section III provides the research framework for the paper. In Section III we present the dataset and the empirical facts that motivates the document. In Section IV we show that fluctuations in aggregate exports are sensitive to shocks to the top exporter in each province (the Gabaix's "granular" hypothesis). Section V concludes.

II. Related literature

There is an increasing body of empirical research examining the role of big size firms on aggregate fluctuations, the so-called granular effect. Gabaix (2011) shows that idiosyncratic movements of the top 100 US firms explain about one-third of variations in

output growth⁶. Di Giovanni et al. (2014) show that firm-specific component contributes to aggregate volatility as much as the common shocks across firms. Carvalho & Grassi (2019) develop a model of aggregate fluctuations caused by firm-level disturbances alone and show that firm size distribution is a “sufficient statistic” for understanding fluctuations in aggregates. Di Giovanni & Levchenko (2012) show that idiosyncratic shocks to large firms have an impact on aggregate volatility, countries with fewer firms and more trade opening make the large firms more important raising macroeconomic volatility. This is the case for subnational territories, they are more open to trade and have a lower number of firms.

Bernard et al. (2009) show that the top 1% of exporters in the United States is responsible for 80% of the total export value. From an international trade perspective, export granularity has been well documented at national level; de Lucio et al. (2017) show that top firm at the HS 2-digit disaggregation explains around 29% of the fluctuation of Spanish exports for Spain; Gouveia et al. (2020) and Wagner (2013) analyze Germany; Freund & Pierola (2015) show, for 32 developing countries, that top five firms export variation explains about one-third of the variation in sectoral exports; finally, del Rosal (2013) for 11 EU countries shows that the idiosyncratic shocks to the main products have significant effects on total exports for the smaller countries. Again, size of territories plays a role. Nevertheless, the regional dimension of granularity has not been yet studied.

Our paper also deep into the regional perspective of exports granularity. Di Giovanni & Levchenko (2012) show that country size and international trade affect macroeconomic volatility⁷. Rodríguez-Pose & Griffiths (2021) show that 19% Fortune Global 500 companies are based in places of less than 500,000 inhabitants what show the potential impact of top companies in all territories. Both papers open the door to the analysis of the role of big exporters in smaller geographical units.

The regional perspective provides additional insights to the literature that analyzes firm's role on international trade. For Italy, a similar country to Spain, Matteis et al. (2019) shows that local context where firms operate (eg. distance from foreign markets, social capital, public sector efficiency, financial markets development and agglomeration economies) impacts on firms' export⁸, even after controlling the effect of firms' characteristics. For Spain de Lucio et al. (2020) conclude that decisions and performance of local exporters affects new exporters destination choices even controlling by firm and regional characteristics. Although the existing evidence about the relation between export and space, the only paper that analyses granularity at regional level do not focus on trade; the paper written by Blanco Arroyo et al. (2019) provides evidence of granular

⁶ Similar findings for Sweden Friberg & Sanctuary (2016) , Belgium Magerman et al. (2016) and Hungary Czinkán (2017).

⁷ Without using trade data del Rosal (2013) and Magerman et al. (2016) show that the impact of idiosyncratic shocks of top firms is larger if the economy is smaller.

⁸ Extant evidence suggests that location characteristics can affect export's propensity, Cole et al. (2010) , Giovannetti et al. (2013) Farole & Winklery (2014) and intensity Brache & Felzensztein (2019) and De Matteis (2019).

behavior that affects aggregate GDP fluctuations at the regional level for 4 Spanish Nuts II regions. To the best of our knowledge, this is the first paper that analyze granular effect on export fluctuations for a set of small geographical units (50 provinces, Nuts III regions).

Nuts III Spanish provinces approach provides a granular and comparable analysis of granularity. The regional analysis, instead the comparative country analysis, provides a homogeneous firm environment (labor markets, technological, normative, etc.) within similar territories. While countries are of different size and have different external and domestic policies (e.g. policies that might affect firm size), Spanish provinces share common policies, have similar geographic extension, and in most cases one city, usually the administrative center, configure main economic pole within the province. This characteristic allows us to perform an analysis independent of structural conditioning factors. Provinces provide an adequate framework for comparison given that they all share economic and trade agreements framework, and firms are free to move within the nation. These harmonization elements imply that the regions are more comparable than countries.

Granular effect raises new possibilities for understand macroeconomic dynamics, business cycles and for stabilization policies design. The granular approach contributes to the literature exploring the role of large local firms, in this case export intensive companies, on a regional economic system; “anchor tenant hypothesis” analyzed by Agrawal & Cockburn (2003). The paper also contributes to the discussion of the links between international trade theory, economic geography and international business, Sjoerd Beugelsdijk et al. (2010). The paper is also related with the multinationals location decision as in Goerzen et al. (2013). Finally, the work has policy recommendations implications similar to Freund & Pierola (2020), highlighting the importance of focusing on top firms’ performance for the understanding of aggregate performance.

III. The importance of top exporter in regional export concentration and export growth

We use annual exports by firm and province of origin obtained from Spanish Custom database over the period 1998-2018. For each firm we have information on the value of its exports for any possible combination of province, product, and country. One of the advantages of the data is that we have information at the establishment level so, for multi-establishment firms, we know the provinces from which the export activity is carried out, therefore we account in the analysis for the fact that some firms export from several locations⁹.

⁹ On average, the top exporter of each province exports from 7 distinct provinces. Occasionally, the same firm is the top exporter of several provinces, this happens with three different companies.

Table 1 presents some descriptive statistics of the dataset. Exports value almost triple during the 2 decades analyzed, moving from 99 billion to 279 billion. This important increase in exports relies on both, an increase in the number of exporters (53%) and on an increase on average exports by firm (84%) This increase is generalized across provinces as we can observe in the positive evolution of: the number of firms (53% growth during the period), exports for the median province (131% increase) and for the number of firms on the top and bottom province (28% and 87% respectively).

Table 1 Basic database descriptive statistics

	1998	2008	2018	Growth 1998-2018
Total exports (€ billion)	99	187	279	181%
Average export by firm (€ thousand)	1323	1948	2436	84%
# firms	75067	96069	114520	53%
Average by Province				
Median # firms	515	893	1188	131%
Median exports	759033	1393988	2177407	187%
Max # firms	17439	21547	22384	28%
Min # firms	76	122	142	87%

Source: own elaboration using custom database

Figure I, left panel, presents the correlation between export volatility and share of country export for the 50 Spanish regions. Right panel use the same measure for the share of exporters. Volatility is defined as the standard deviation of the yearly export mid-point growth rate. We use logarithmic scale in figure 1

Figure 1

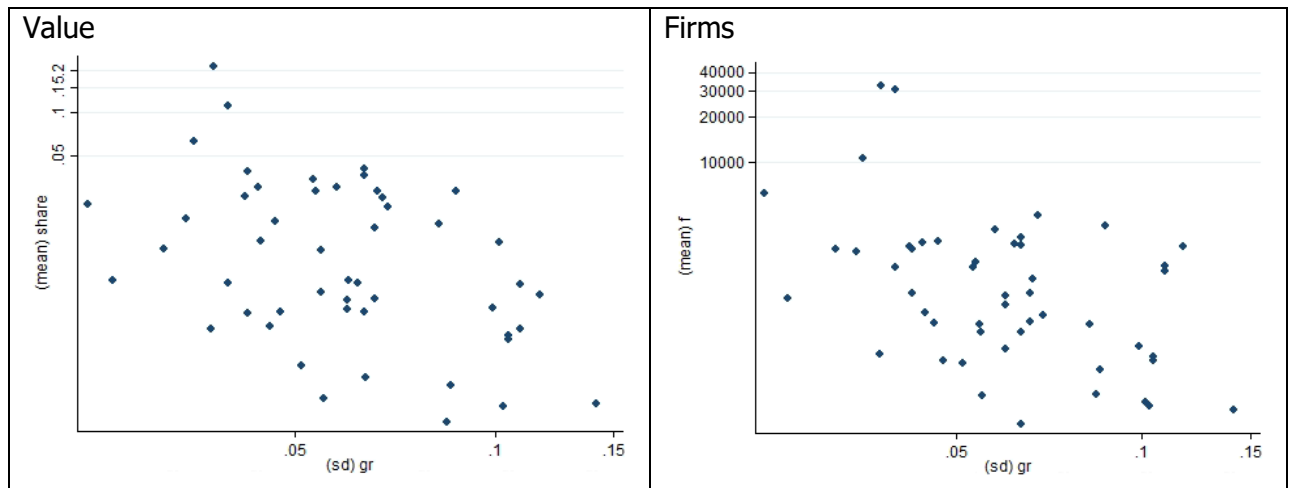
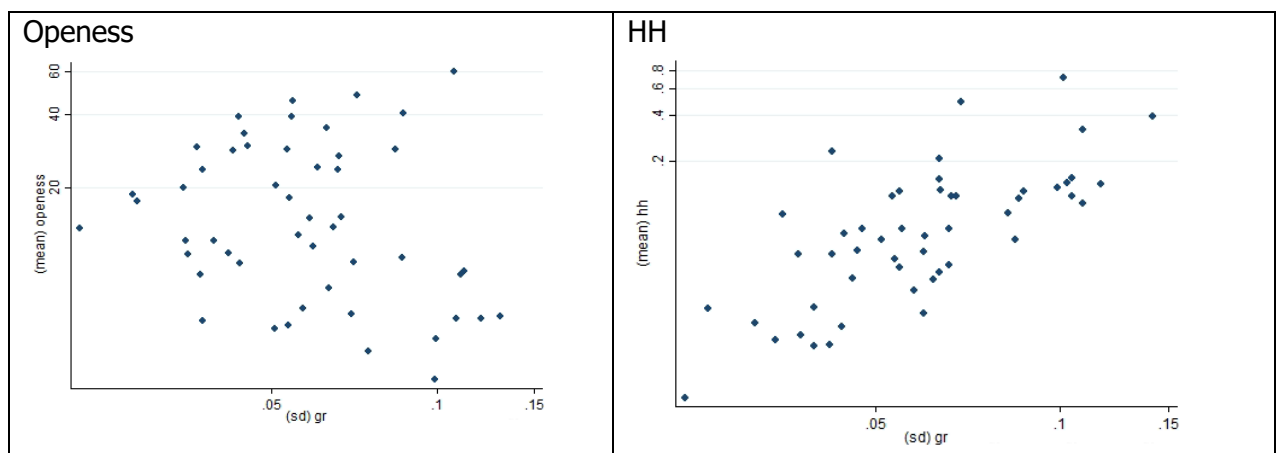


Figure 1 shows that high-exporter regions tend to experience lower export volatility. The elasticity of export growth volatility with respect to region share of exports is about 13% for Spanish regions, and is statistically significant (t-statistic of 3,3). The elasticity of export growth volatility with respect to region share of exporters is about 16% for Spanish regions, and is statistically significant (t-statistic of 3,7).

Additionally, we check the effect of both openness and concentration of exports in specific firms

Openness can be affected by economy size, distance to international markets and productive structure among other factors

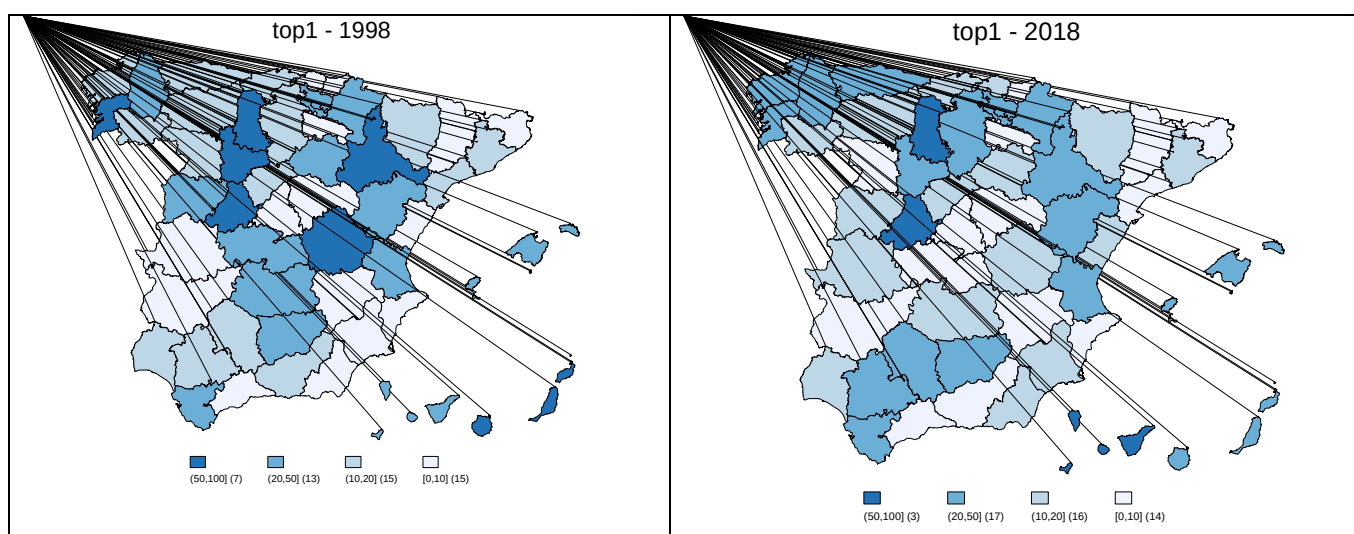
Figure II present the correlation between export volatility and openness, total export over GDP) by region and the correlation between export volatility and firm concentration of exports. We do not observe a positive effect of openness on volatility but we do observe a positive relation between firm concentration of exports in a region and volatility.



To examine the importance of the top exporter in a province over the period 1998-2018, we additionally perform three descriptive analyses. First, we calculate the concentration of the top exporter at the first and last year available. Second, we calculate the contribution of the top exporter to export growth of the province over the period. Third, we illustrate the persistence of top exporter in this position.

Map 1 presents the export share of the top exporter in each province in 1998 and 2018, separately. The darker the color is, the higher is the concentration of exports in the top exporter. In 1998 and 2018, twenty provinces had a top exporter representing more than 20% of aggregate exports. In 1998, there were seven provinces whose top exporter accumulated more than 50% of aggregate exports. Twenty years later the number reduces to only three provinces.¹⁰ Nevertheless, the number of provinces in which top exporter export share is greater than 20% remains stable (20 provinces) in both years.

Map 1 Share of top exporter by province and year



Source: own elaboration using micro-data from Spanish Customs database.

In the case of Spain, the top 1% of exporters in 2018 (775 firms), are responsible for 64% of the total export value. The top exporter represented 2.3%. If we reduce the size of the geographic unit, the importance of the top exporters rises drastically in Spain. At province level, the top exporter represents on average 21.9% of total exports. The top exporter represents above 50% of total exports in three provinces. The province with the lowest weight of the main exporter has a greater export weight of this company in the province than the same calculation for Spain (3.3% compared to 2.3% in 2018).

¹⁰ Map 1 is obtained from the information in Table A.1 in the appendix. Map A.1 in the appendix includes the name of the provinces.

Table 2 reports the number of top exporters over the entire period and the number of years of the top exporter with the longest duration¹¹. On average, a province has 4 different top exporters during the period 1998-2018 and the average span as top exporter is of 13 years¹². There are 7 provinces with the same top exporter during the whole period (21 years) this implies very low top exporter rotation. The province with higher rotation in the top exporter has 10 different firms at the top position during the period¹³. We observe a negative correlation between top exporter share and the rotation in the top exporter position.

Table 2 Top firm rotation by province for the period 1998-2018

	Number top firms 1998-2018	Maximum spell length as top
Average	4	13
Median	3	13
Maximum	10	21
Minimum	1	5

Source: own elaboration using custom database

When we analyze the track of top exporters, we observe high persistence in the top position. For top regional exporters in 2018, 32 firms were also top exporter in their region in 2013, 14 top companies were exporting without being the top exporter (green color), 4 were not exporting (no color). Two decades before, in 1998, 14 were top exporters, 20 were exporting, and 16 were not exporting. 68% of top firms in 2018 were exporting in 1998 and 28% were also top exporters at the initial year¹⁴, annual detail in the appendix, Figure A. 4. These data show a high persistence in the top position, but we also observe sudden introduction of top firms, for instance greenfield investment.

Next, we illustrate the role of top exporters analyzing the importance of top exporters in the growth of total exports at province level. For that purpose, we compute the contribution of the intensive and extensive margins to aggregate exports following the methodology proposed by Bernard et al. (2009). The intensive margin collects the change in the value of exports of existing trade relationships both in the initial and the final year of the period of analysis. The extensive margin refers to the value of the new trade relationships during the same period. We divide the extensive margin into two

¹¹ Table A.1 in the appendix reports detailed information by province.

¹² During the period, Spain had 4 different top exporters. One of them is present in 12 years, during 3 non-consecutive periods. The exporter in the final year, 2018, is the same as in the initial year, 1998.

¹³ The correlation between the two measures of rotation (average number of years in the top position, and number of firms in the top position) for the 50 provinces is -83%

¹⁴ All exporters in 2018 were exporting in 2017. This means that for interannual growth rate the extensive margin only captures new market (countries or products) and no new firms.

parts: first the net entry (new exporters minus exiting exporters) of firms and second the change in the composition of the product-destination portfolio. de Lucio et al. (2011) show that share of the two margin contributions (extensive and intensive) varies between short and long run; the extensive margin grows with time span. We calculate each margin separately for the top exporter and for the rest of firms for three different periods: 1998-2018, 2008-2018 and 2013-2018.

We expect top exporters to be a primary source of intensive margin growth if they are regular exporters. However, stable top exporters (those exporting at the initial and final year) can also adjust their product-country portfolio over time. Therefore, it is interesting to calculate the importance of top exporters in terms of extensive margin growth, i.e. their contribution to the growth of new trade relationships. On aggregate, it is expected that the importance of the extensive margin rises with the length of the period analyzed. As we will see this result is also true for top exporter is analyzed independently.

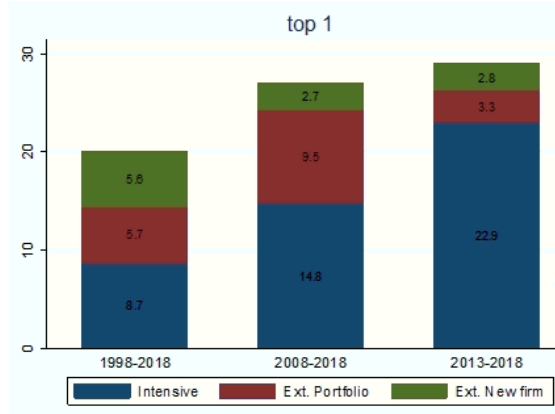
Figure 2, left panel, shows the average contribution of the top exporter to the aggregate exports of a Spanish province for three periods that have in common the last year (2018) and differ in the length: 20 years in left bar, 10 years in middle bar and 5 years in right bar. For the longer period of analysis 1998-2018, the average contribution of the top exporter to a province's growth is 20.1%, with the share of contribution to the extensive margin (11.4%) being greater than the one to the intensive margin (8.7%). For the period 2008-2018 the overall contribution of the top exporter was 27.6% and for the period 2013-2018 it was 29.8%, with the contribution to the extensive margin (6.9%) being smaller than the one to the intensive margin (22.9%). As expected, the contribution of the top exporter extensive margin to export growth becomes smaller relative to the one of the intensive margin as the analyzed period becomes shorter, in line with de Lucio et al. (2011). In the short period (2013-2018) the contribution of the intensive margin of the top exporter in each province is 22.9%, while the one of the extensive margin of the top exporter is reduced to 6.9%¹⁵.

We perform the same analysis when we consider the regular top exporter, that is the top exporter that exported both in the initial and the final year of the analyzed period. Right panel, Figure 2, presents results, in this case the contribution of the extensive margin increases from 3% in the five-year period to 6.3% in the 20 years analysis. The total contribution, extensive plus intensive margin, varies from 26.5 in the five year period to 17% in the 20 year analysis. The decrease in the contribution of top exporters to export growth is consequence of a reduction in the contribution of the intensive margin much smaller in the long run (20 years) than in the 5 years period, about one third. Figure A. 1 in the appendix show similar results when top 5 companies are considered.

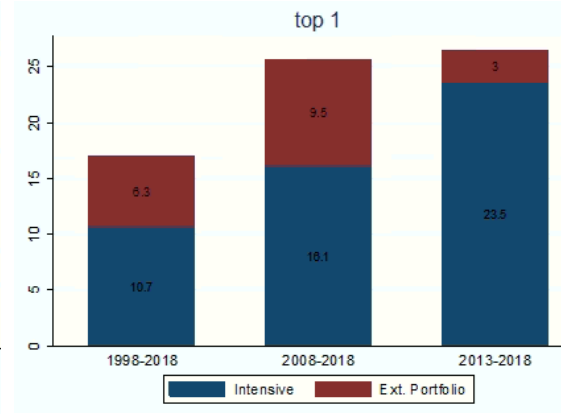
Figure 2. Contribution of top exporter to regional export growth margins.

¹⁵ At national level, for Spain, top exporter does not contribute to export growth, neither in extensive nor intensive margin though 5, 10 or 20 years.

Top firm in the last year



Top firm that exports also in the initial year



Source: own elaboration using micro-data from Spanish Customs.

In this Section we have shown the static and de dynamic relevance of top firm at province level and how volatility relates with economy size and openness. In next section we explore the contribution of top firm to export volatility at province level and relates the explanatory capacity of top firms with size and openness.

IV. How “granular” is export growth at province level?

The granular hypothesis states that idiosyncratic firm-level shocks to the largest firms in the economy have a significant impact on aggregate fluctuations, Gabaix (2011). Transferring this concept to the field of international trade, if top exporters are “big grains”, idiosyncratic firm-level shocks to top exporters will have a significant impact on aggregate exports fluctuations. In this section, we apply the methodology proposed by Gabaix (2011) that consists on calculating the contribution of the granular residual of top exporter to the variation in regional export growth.

Firstly, for each province, we define $X_{i,t}$ as the value of exports of firm i in year t . For each firm in the province, we calculate the mid-point annual growth of exports:

$$g_{i,t} = \frac{X_{i,t} - X_{i,t-1}}{(X_{i,t} + X_{i,t-1})/2} \quad (1)$$

We also calculate the average firm growth rate in the province as:

$$\bar{g}_t^Q = \sum_{i \in Q} g_{i,t} / N_{t-1}^Q \quad (2)$$

with N_{t-1}^Q is equal to a given number of exporters (Q) in the province j at the beginning of the period. In the regression analysis we will consider two definitions of Q : the total number of exporters in the province ($Q=\text{all}$) and the top 100 exporters in the province ($Q=100$).

Secondly, we calculate the idiosyncratic component of the top firm “top” in the province for each year, $ic_{top,t}$, as the difference between the top firm growth rate, and the average firm growth rate in the province:

$$ic_{top,t} = g_{top,t} - \bar{g}_t^Q \quad (3)$$

Thirdly, we calculate the granular residual, $r_{top,t}$, as the idiosyncratic component of the top firm weighted by the share of the top firm in total exports in the province at the beginning of the period ($s_{top,t-1}$):

$$r_{top,t} = ic_{top,t} s_{top,t-1} \quad (4)$$

Finally, we regress the change in aggregate exports on the granular residual of the top exporter.

$$g_t = \alpha + \beta_1 r_{top,t} + \beta_2 r_{top,t-1} + \varepsilon_{j,t} \quad (5)$$

where α is a constant, $\varepsilon_{j,t}$ is the error term and $r_{top,t-1}$ is the lagged granular residual.

Table 3 provides the estimation results of equation (5) after pooling all the observations. We run the regressions using two sample of exporters ($Q=all$ and $Q=100$) to calculate the average firm export growth by province. Column (1) and (4) do not include province fixed effects while the rest of columns does. In all regressions, the granular residual coefficient is positive and highly statistically significant, suggesting a positive correlation between shocks to the top exporter and fluctuations in aggregate province exports. When we introduce one-year lag granular residual in columns (3) and (6), the estimated coefficient is not statistically different from zero. The adjusted R^2 statistic ranges from 39% to 42%, which confirms the importance of top exporters at regional level. Notice that our exercise is very different to the one of de Lucio et al. (2017). They investigated the importance of top national exporters at the product-destination level and found that the top exporter in each trade relationship (product-destination) explained around 29% of the variation in exports.¹⁶ We found that the top exporter explains about 40% of the variation in total province exports¹⁷.

Table 3. Pooled regression analysis of the granular hypothesis.

¹⁶ For output growth, Gabaix (2011) finds that shocks to the top 100 firms in the US explains between 27% and 38% of the GDP fluctuations over the period 1952-2008. Wagner (2012) finds that the top 10 firms explain between 36% and 45% of the fluctuation of manufacturing sales in Germany between 1997 and 2008.

¹⁷ In appendix, Table A. 2, we repeat the analysis for the top 5 exporters by province and the explanatory capacity of the idiosyncratic residual reaches 50%.

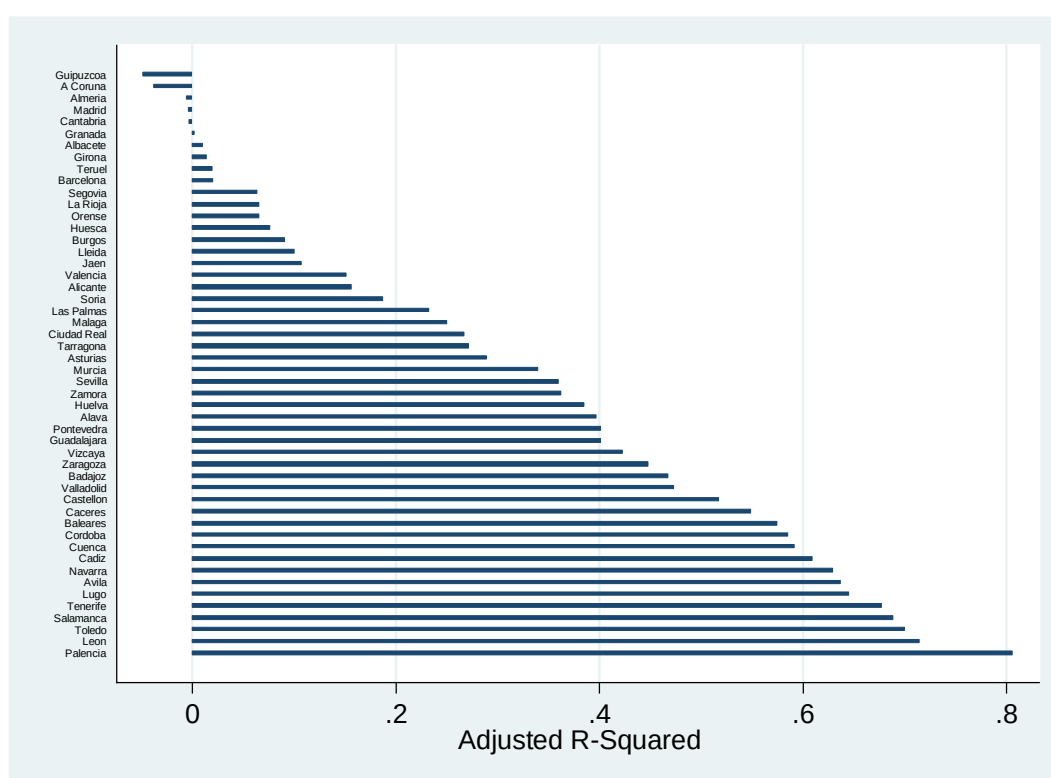
	1	2	3	4	5	6
granular residual	0.993*** [0.0373]	1.017*** [0.0382]	1.019*** [0.0389]	0.943*** [0.0373]	0.975*** [0.0383]	0.979*** [0.0390]
lagged granular residual			0.0254 [0.0386]			0.0438 [0.0386]
Constant	0.0290*** [0.00348]	0.0286*** [0.00350]	0.0292*** [0.00365]	0.0485*** [0.00349]	0.0486*** [0.00350]	0.0501*** [0.00358]
Q firms	All	All	All	100	100	100
FE Province	No	Yes	Yes	No	Yes	Yes
Observations	1000	1000	950	1000	1000	950
Adjusted R-squared	0.415	0.417	0.412	0.390	0.384	0.391

Standard errors in brackets. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Additionally, we run 50 separate regressions with 20 observations over the period 1998-2018, we report the adjusted R^2 statistic obtained from estimating equation (5) for each province. We are interested the value of the R^2 statistic as a measure of the goodness-of-fit, that is, the part of the variance of the dependent variable explained by the variation of the independent variable(s). Figure 3 shows that all but 5 provinces have positive adjusted R^2 statistic, with values ranging from 0.01 to 0.82, revealing that the validity of the granular hypothesis varies by provinces. In 21 provinces the adjusted R^2 statistics is above 0.40, indicating that shocks to the top exporter are stronger correlated with the fluctuations in exports growth in several Spanish provinces¹⁸.

Figure 3. Province-specific adjusted R-squared

¹⁸ This analysis for Spain as a whole does not provide significant results. This mean that at national level the top exporter is not able to explain aggregate export variations.

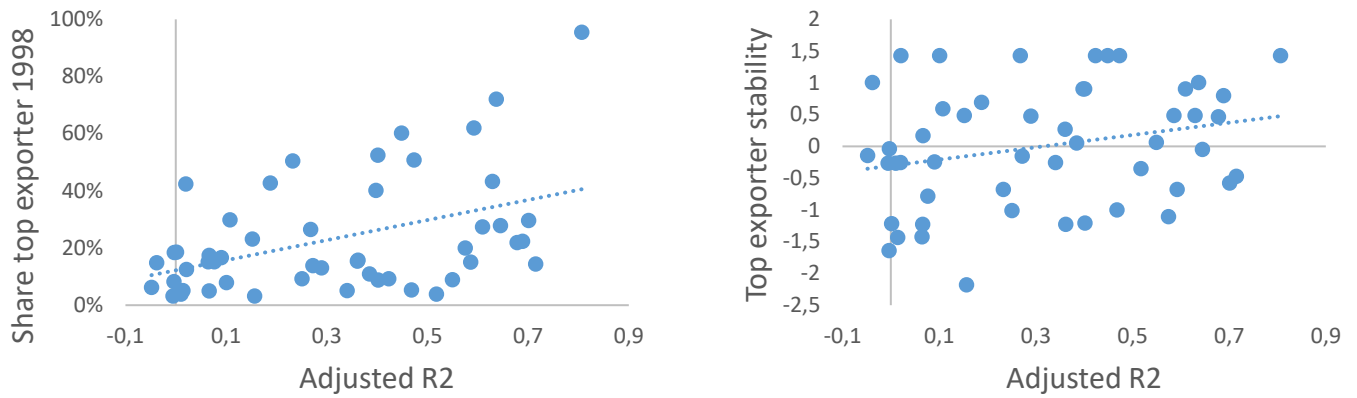


Source: own elaboration using micro-data from Spanish Customs.

Note: Based on estimates of equation (5) with K =all firms and in each province.

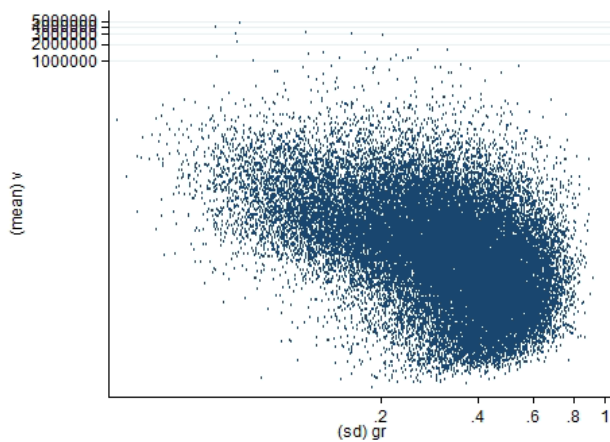
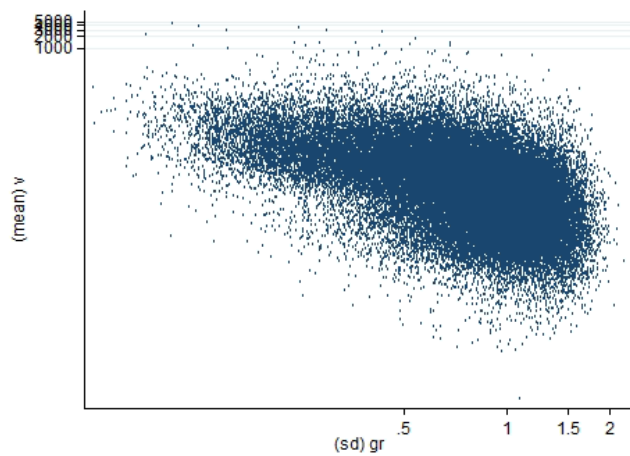
We also want to check whether there is a correlation between the export share of the top exporter in a province and the Gabaix measurement of a granular effect on province export growth. Figure 4, left panel, shows that the market share of the top exporter in 1998 is positive correlated with the magnitude of the Gabaix granular effect on province export growth over the period 1998-2018. Finally, we check if there is a correlation between the stability in the top exporter position (persistence) in a province and the granular effect. In order to do that we built a new indicator. We normalize the number of years and the maximum exporter length in top position (Table A. 1, in the appendix presents these data by province for these variables). The greater the number of top exporters the greater the rotation so we take the inverse of this variable. Finally we calculate the average of both variables. Stability of top exporters relates with granular effects. Right panel in Figure 4 shows that those provinces in which the stability of the top exporter is greater in this position for a longer time span have also greater granular effect.

Figure 4. Gabaix granular effect on province export growth over 1998-2018 and share of top exporter in province total exports in 1998 and top exporter stability.



Source: own elaboration using micro-data from Spanish Customs.

Figure displays average size and volatility for firms with more than ten years in the sample. The growth volatility reduces with firm export size.



Volatility explained by idiosyncratic shocks to top firms is an increasing function of the Herfindahl index of the firms' output shares (Gabaix 2012).

V. Conclusions

Granularity does not only affect countries but regions; does not only affect GDP but exports. We have examined the importance of the top exporters in province export dynamics using firm-level data for 50 Spanish provinces (NUTS III level) over the period 1998-2018. The paper provides evidence of the important role of top exporters at subnational level, even greater than the role at national level.

We show that: first, regional exports are highly concentrated in a few companies with high persistence in top positions; second, the top exporter in each province contributes significantly to the growth as well as to the variation in the growth of the province's exports; third, granularity are positive correlated with the initial share of top exporter and with stability (lower rotation) in the top exporter position; and fourth, the percentage of export concentrated in top exporters is a sufficient measure of granularity.

These results suggest that differences in granularity across regions are key elements on province export performance. The results suggest that regional policies might have large effects in regional performance if they modify the top firm export growth. Future works should analyze how the dominance of a few firms might also affect provincial specialization patterns, resilience, and competitiveness.

VI. References

References

- Agrawal, A., & Cockburn, I. (2003). The anchor tenant hypothesis: Exploring the role of large, local, R&D-intensive firms in regional innovation systems. *International Journal of Industrial Organization*, 21(9), 1227-1253.
doi:[https://doi.org/10.1016/S0167-7187\(03\)00081-X](https://doi.org/10.1016/S0167-7187(03)00081-X)
- Bernard, A. B., Jensen, J. B., Redding, S. J., & Schott, P. K. (2009). The margins of US trade. *American Economic Review*, 99(2), 487-493.
doi:<https://doi.org/10.1257/aer.99.2.487>

- Brache, J., & Felzensztein, C. (2019). Geographical co-location on Chilean SME's export performance. *Journal of Business Research*, 105, 310-321.
doi:<http://dx.doi.org/10.1016/j.jbusres.2017.11.044>
- Carvalho, V. M., & Grassi, B. (2019). Large firm dynamics and the business cycle. *American Economic Review*, 109(4), 1375-1425. doi:10.1257/aer.20151317
- Cole, M. A., Elliott, R. J. R., & Virakul, S. (2010). Firm heterogeneity, origin of ownership and export participation. *World Economy*, 33(2), 264-291.
doi:10.1111/j.1467-9701.2009.01231.x
- Czinkán, N. (2017). The role of individual firms in aggregate fluctuations: Evidence from Hungary. *Financial and Economic Review*, 16(2) Retrieved from
<https://EconPapers.repec.org/RePEc:mnb:finrev:v:16:y:2017:i:2:p:40-63>
- de Lucio, J., Mínguez, R., Minondo, A., & Requena, F. (2017). The granularity of Spanish exports. *SERIEs : Journal of the Spanish Economic Association*, 8(3), 225-259. doi:<https://doi.org/10.1007/s13209-017-0157-x>
- de Lucio, J., Mínguez, R., Minondo, A., & Requena, F. (2020). New exporters benefit more from information spillovers. *Applied Economics Letters*, 27(19), 1587-1591.
doi:10.1080/13504851.2019.1698709
- de Lucio, J., Mínguez-Fuentes, R., Minondo, A., & Requena-Silvente, F. (2011). The extensive and intensive margins of Spanish trade. *International Review of Applied Economics*, 25(5), 615-631. doi:<https://doi.org/10.1080/02692171.2011.557051>
- De Matteis, P. (2019). *Local context and exports* doi:10.1080/00343404.2018.1462482

- del Rosal, I. (2013). The granular hypothesis in EU country exports. *Economics Letters*, 120(3), 433-436. Retrieved from <http://www.econis.eu/PPNSET?PPN=769023371>
- Di Giovanni, J., & Levchenko, A. A. (2012). Country size, international trade, and aggregate fluctuations in granular economies. *Journal of Political Economy*, 120(6), 1083-1132.
- Di Giovanni, J., Levchenko, A. A., & Mejean, I. (2014). Firms, destinations, and aggregate fluctuations. *Econometrica*, 82(4), 1303-1340.
doi:<https://doi.org/10.3982/ECTA11041>
- Farole, T., & Winkler, D. (2014). Firm location and the determinants of exporting in low- and middle-income countries. *Journal of Economic Geography*, 14(2), 395-420. doi:10.1093/jeg/lbs060
- Freund, C., & Pierola, M. D. (2015). Export superstars. *Review of Economics and Statistics*, 97(5), 1023-1032. doi:https://doi.org/10.1162/REST_a_00511
- Freund, C., & Pierola, M. D. (2020). The origins and dynamics of export superstars. *The World Bank Economic Review*, 34(1), 28-47.
doi:<https://doi.org/10.1093/wber/lhy011>
- Friberg, R., & Sanctuary, M. (2016). The contribution of firm-level shocks to aggregate fluctuations: The case of Sweden. *Economics Letters*, 147, 8-11.
doi:<https://doi.org/10.1016/j.econlet.2016.08.009>
- Gabaix, X. (2011). The granular origins of aggregate fluctuations. *Econometrica*, 79(3), 733-772. doi:<https://doi.org/10.3982/ECTA8769>

- Giovannetti, G., Ricchiuti, G., & Velucchi, M. (2013). Location, internationalization and performance of firms in Italy: A multilevel approach. *Applied Economics*, 45(18), 2665-2673. doi:10.1080/00036846.2012.665597
- Goerzen, A., Asmussen, C. G., & Nielsen, B. B. (2013). Global cities and multinational enterprise location strategy. *Journal of International Business Studies*, 44(5), 427-450. doi:<https://doi.org/10.1057/jibs.2013.11>
- Gouveia, C. M., Manteu, C., & Cabral, S. (2020). The granularity of Portuguese firm-level exports. *Economic Bulletin and Financial Stability Report Articles and Banco De Portugal Economic Studies*,
- Magerman, G., De Bruyne, K., Dhyne, E., & Van Hove, J. (2016). Heterogeneous firms and the micro origins of aggregate fluctuations. national bank of Belgium working paper no. 312.
- Matteis, P., Pietrovito, F., & Pozzolo, A. F. (2019). *Local context and exports: An analysis with a matched sample of firm–province data* Figshare. doi:<https://doi.org/10.1080/00343404.2018.1462482>
- Sjoerd Beugelsdijk, Philip McCann, & Ram Mudambi. (2010). Introduction: Place, space and organization—economic geography and the multinational enterprise. *Journal of Economic Geography*, 10(4), 485-493. doi:10.1093/jeg/lbq018
- Wagner, J. (2012). The German manufacturing sector is a granular economy. *Applied Economics Letters*, 19(17), 1663-1665.
- Wagner, J. (2013). The granular nature of the great export collapse in German manufacturing industries, 2008/2009. *Economics. the Open-Access, Open-*

Assessment E-Journal, 7(5), 0_1. Retrieved from

<https://search.proquest.com/docview/1324437832>

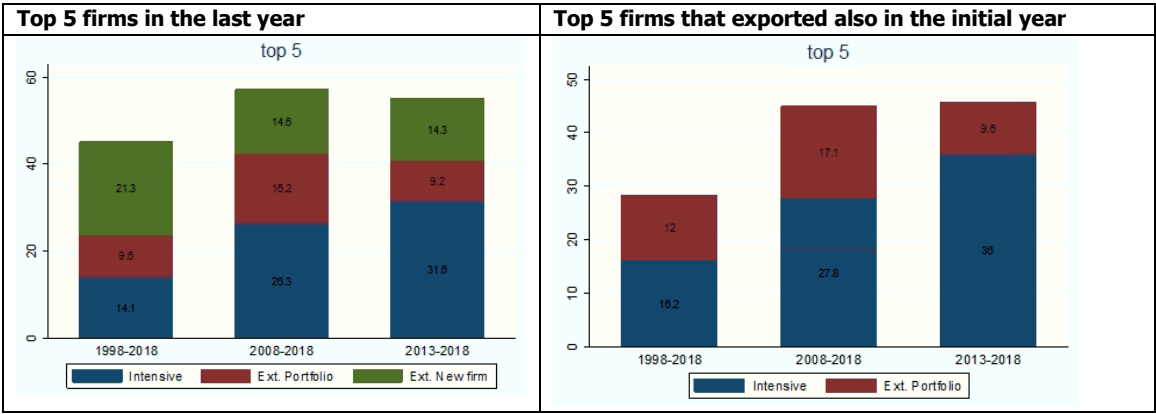
Appendix

Table A. 1 Descriptive statistics of the top exporter by province, 1998-2018

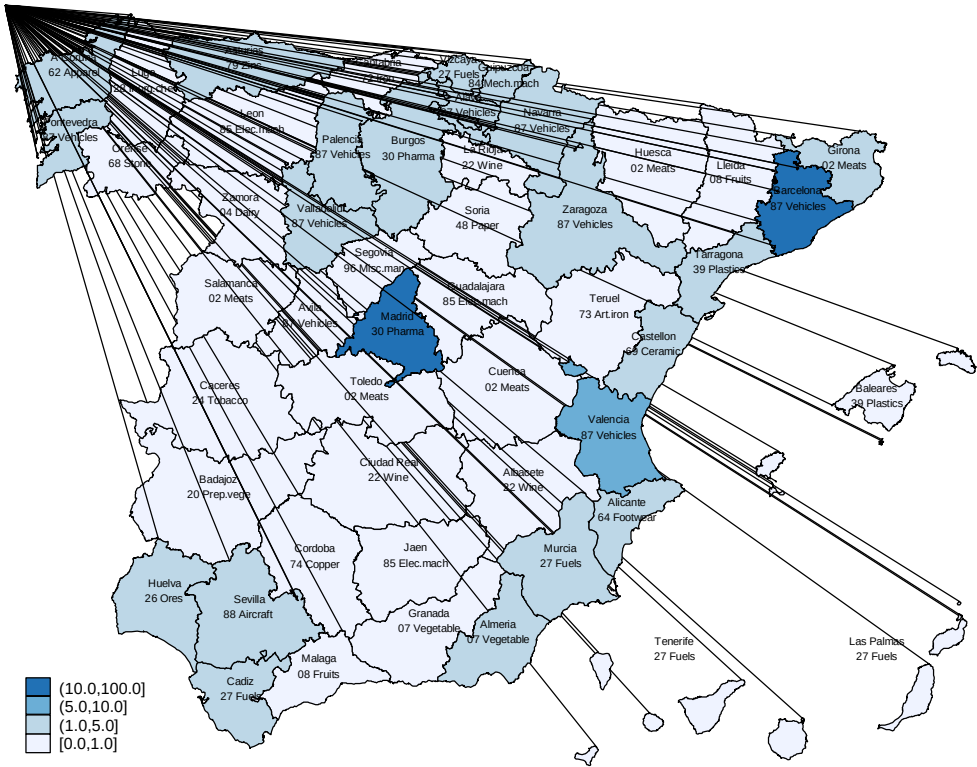
Province	Share of top exporter		# top exporter	Maximum length
	year 1998	year 2018		
Álava	40%	28%	2	18
Albacete	4%	8%	5	13
Alicante	3%	3%	10	5
Almería	3%	11%	5	13
Ávila	72%	51%	2	19
Badajoz	5%	8%	6	8
Baleares	20%	32%	6	7
Barcelona	13%	12%	1	21
Burgos	17%	21%	3	9
Cáceres	9%	15%	3	12
Cádiz	27%	26%	2	18
Castellón	4%	13%	3	8
Ciudad Real	27%	17%	1	21
Córdoba	15%	24%	2	14
A Coruña	15%	22%	2	19
Cuenca	62%	15%	5	9
Girona	5%	3%	8	8
Granada	19%	10%	7	8
Guadalajara	9%	9%	6	6
Guipúzcoa	6%	6%	3	10
Huelva	11%	14%	4	14
Huesca	15%	16%	5	8
Jaén	30%	50%	2	15
León	15%	13%	5	11
Lleida	8%	10%	1	21
La Rioja	5%	7%	8	10
Lugo	28%	26%	4	13
Madrid	8%	5%	8	6
Málaga	9%	9%	7	10
Murcia	5%	13%	4	11
Navarra	43%	30%	2	14
Orense	18%	12%	3	13
Asturias	13%	23%	3	16
Palencia	96%	83%	1	21
Las Palmas	51%	39%	5	9
Pontevedra	53%	25%	2	18
Salamanca	22%	17%	2	17
Tenerife	22%	52%	4	18
Cantabria	19%	11%	3	11
Segovia	15%	12%	7	6
Sevilla	16%	27%	3	14
Soria	43%	16%	2	16
Tarragona	14%	9%	4	12
Teruel	42%	21%	4	11
Toledo	30%	5%	5	10
Valencia	23%	29%	2	14
Valladolid	51%	41%	1	21
Vizcaya	9%	14%	1	21
Zamora	16%	10%	8	10
Zaragoza	60%	27%	1	21

Note: Own elaboration using Custom data.

Figure A. 1. Contribution of top 5 exporters to regional export growth margins.



Map A.1. Distribution of total exports and main export (2-digit HS) sector by province in 2018.



Source: Own elaboration using Custom data.

Table A. 2 Pooled regression analysis of the granular hypothesis. Top 5

	1	2	3	4	5	6
Granular Residual	0.854*** [0.0254]	0.868*** [0.0261]	0.870*** [0.0269]	0.806*** [0.0262]	0.832*** [0.0268]	0.837*** [0.0274]
Lagged granular residual			0.0734*** [0.0265]			0.0907*** [0.0271]
Constant	0.0184*** [0.00317]	0.0179*** [0.00320]	0.0169*** [0.00343]	0.0521*** [0.00320]	0.0523*** [0.00320]	0.0549*** [0.00328]
K firms	All	All	All	100	100	100
FE Province	No	Yes	Yes	No	Yes	Yes
Observations	1000	1000	950	1000	1000	950
Adjusted R-squared	0.530	0.521	0.522	0.486	0.487	0.492

Standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1

Table A. 3 Pooled regression

VARIABLES	(1) r2_a	(2) r2_a	(3) r2_a	(4) r2_a	(5) r2_a	(6) r2_a	(7) r2_a
sh1998	0.553*** [0.162]				0.513*** [0.181]	0.520*** [0.182]	
sh2018		0.755*** [0.214]					
numtop			-0.0273* [0.0153]		-0.00837 [0.0158]		-0.0174 [0.0277]
length				0.0126* [0.00732]		0.00321 [0.00757]	0.00568 [0.0132]
Constant	0.186*** [0.0498]	0.164*** [0.0535]	0.420*** [0.0687]	0.149 [0.103]	0.228** [0.0934]	0.152 [0.0956]	0.307 [0.272]
Observations	50	50	50	50	50	50	50
R-squared	0.195	0.206	0.062	0.058	0.199	0.198	0.066
FE Province	No	No	No	No	No	No	No
Adjusted R2	0.178	0.190	0.0425	0.0383	0.165	0.163	0.0260

Standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

Figure A. 2 Correlation between R^2 for top 1 and R^2 for top 5

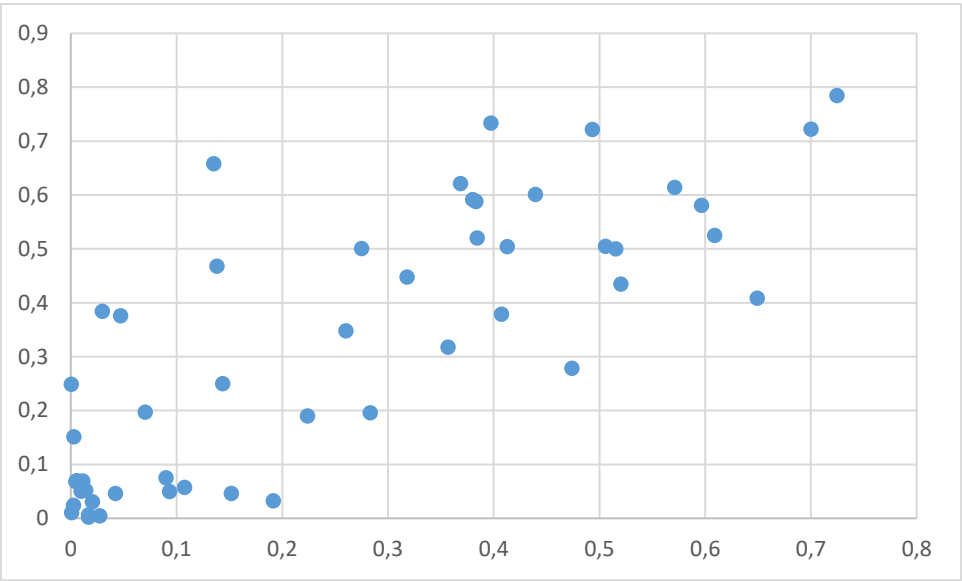


Figure A. 3 Correlation between beta parameters for top 1 and for top 5

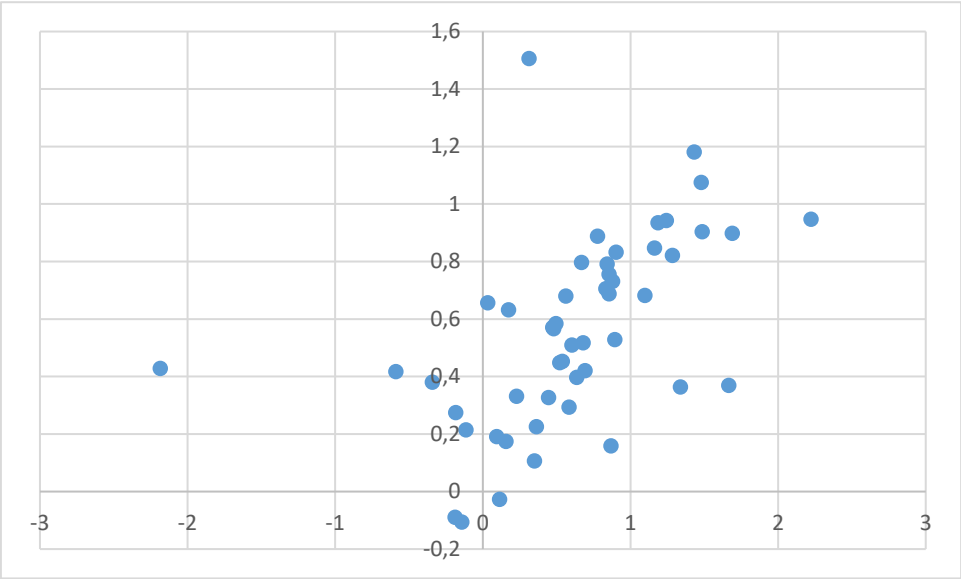


Figure A. 4. Exporting status of top exporters in 2018 during the period 1998-2018. Top exporter in the province in yellow color, exporters in green color and no exporters in white color.



Source: own ellaboration