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The granular hypothesis in EU country exports

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HIGHLIGHTS

- I explore whether granular behaviour is present in exports by product.
- I use Comext data for 11 European Union countries from 1988 to 2011.
- The granular hypothesis cannot be rejected for the smaller and less diversified countries.

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ABSTRACT

I investigate whether the 'granular' behaviour of aggregate outcomes suggested by Gabaix (2011) is present in country exports by product. Using data for 11 EU countries over the 1988–2011 period, the results show that the idiosyncratic shocks to the main products may have significant effects on total exports for the smaller countries.

1. Introduction

In a recent paper, Gabaix (2011) argues that a significant portion of economic fluctuations can be attributable to the idiosyncratic shocks of the 'grains' of economic activity such as large firms. He shows that the particular movements of the 100 larger non-financial firms in the US can account for about one-third of the volatility of output growth. The explanation for this 'granular' behaviour is related to the size distribution of the units: firms, in his case. When the firm size distribution is fat tailed, idiosyncratic shocks to large firms affect the aggregate volatility. Empirically, these idiosyncratic shocks are measured by the 'granular residual', a weighted sum of the growth rate of larger firms demeaned by average firm growth.

The 'granular hypothesis' postulated by Gabaix (2011) has begun to be studied in different strands of literature.[1] In this paper, I explore whether granular behaviour is present in exports by product. To do so, I use Comext data for European Union (EU) countries from 1988 to 2011. The database is presented in Section 2, as well as brief descriptive evidence of export concentration and the empirical approach to be used. Section 3 presents baseline as well as some additional results. Section 4 concludes the paper.

2. Data and empirical approach

I use the Comext database, the Eurostat (Statistical Office of the European Communities) reference database for the external trade of EU countries.[2] Comext collects EU customs data on international trade flows as reported by EU Member States, comprising the value and quantity of goods traded between EU countries

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[1] The granular residual has been applied in empirical papers to study volatility in economic activity, like the banking (Blank et al., 2009) or manufacturing (Wagner, 2012) sector. Di Giovanni and Levchenko (2012) show that trade openness has the potential to increase granular performance and hence aggregate volatility. In a related though competing approach, Acemoglu et al. (2012) argue that microeconomic idiosyncratic shocks and intersectoral input–output linkages may lead to aggregate fluctuations.

[2] Methodological details can be found in Eurostat (2006). See also the quality analysis in Eurostat (2010).

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Table 1
Export concentration indicators by EU country (1988–2011 mean).

Country (ISO code)	Herfindahl index	Number of SITC categories	Coverage rate	Top 30 share	Top 60 share	Top 90 share
Belgium and Luxemburg (BL)	0.016	3060.9	0.93	0.36	0.44	0.51
Denmark (DK)	0.008	2882.0	0.87	0.34	0.47	0.54
France (FR)	0.010	3033.4	0.92	0.35	0.44	0.49
Germany (DE)	0.014	3030.9	0.92	0.31	0.39	0.45
Great Britain (GB)	0.011	3068.2	0.93	0.40	0.48	0.54
Greece (GR)	0.015	2553.3	0.77	0.48	0.62	0.69
Ireland (IE)	0.030	2571.8	0.78	0.64	0.75	0.80
Italy (IT)	0.005	3032.3	0.92	0.27	0.37	0.43
Netherlands (NL)	0.008	3030.5	0.92	0.36	0.47	0.54
Portugal (PT)	0.014	2743.8	0.83	0.46	0.58	0.65
Spain (ES)	0.024	3013.5	0.91	0.39	0.47	0.53

Note: All the indicators have been drawn up with export value on a 5-digit SITC-Comext product basis, and are expressed as the 1988–2011 mean. The Herfindahl Index is calculated as $H_t = \sum_{i=1}^{N_t} \left(\frac{X_{it}}{X_t}\right)^2$, X_{it} being the export value of product i, and $X_t = \sum_{i=1}^{N_t} X_{it}$. Number of SITC categories refers to the number of products (5-digit SITC-Comext codes) exported. The coverage rate is computed by dividing the number of SITC categories by the maximum according to the SITC-Comext classification. After ranking the products according to their export value, the top 30, 60, and 90 shares reflect the sum of the export value of the largest 30, 60, and 90 products as a fraction of total export value.

(intra-EU trade) and by EU countries with third countries (extra-EU trade). The data is provided according to the 8-digit Combined Nomenclature (CN), a product classification based on the international Harmonized System, and is available from 1988 onwards.

The CN is a very detailed classification; there are approximately 10,000 8-digit codes. However, this figure is an average, because the CN classification is updated every year,[3] meaning that a product may receive a new 8-digit CN code from one year to the next. These changes are continuous and numerous, especially when there is a revision of the Harmonized System. Eurostat also provides the Comext data on an SITC (Standard International Trade Classification) basis. SITC is a classification system kept by the United Nations, with more than 3000 product categories at its maximum disaggregation level (5 digits), and it has experienced several revisions. However, the SITC used by Eurostat is an idiosyncratic modified version with more product categories (in round numbers, an average of 3300), mainly due to adapting the special CN alphanumeric codes used by Eurostat to identify confidential or adjusted data. Eurostat has provided Comext data on an SITC basis since 1995, as well as providing, via its metadata server 'Ramon' (www.ec.europa.eu/eurostat/ramon), a conversion table between CN and SITC that begins in 1988. I will use Comext data in the SITC provided by Eurostat, considering it appropriate to label it as 'SITC-Comext'. I will test the granular hypothesis in exports by EU countries on a product basis, that is to say, taking the SITC-Comext codes as units of measurement.

As shall soon be seen, it is highly recommended to have a sample period as large as possible, so I only choose the 12 countries that have been Member States since 1988 and for which data is available from that year onwards. Furthermore, seeing that Belgium and Luxemburg appear in the data as a single unit up until 1999, I will maintain that unit for the entire period. Hence, the final number of EU countries taken into account will be 11.[4]

Table 1 shows several measures of export concentration for the sample countries, averaged for the 1988–2011 sample period. For each country, the indicators were drawn up using nominal export values, ranking the products (5-digit SITC-Comext categories) according to their weights in total export values. Besides the Herfindahl Index, Table 1 shows the number of products exported, the coverage rate calculated between that number and the maximum according to the SITC-Comext classification and, finally, the shares of the top 30, 60 and 90 products (these figures correspond roughly to 1, 2, and 3% of the total categories exported by the average country).

As regards the empirical approach employed in this paper, I replicate the methodology used by Gabaix (2011) to investigate the granular behaviour of EU country exports analysed on a product basis. The first step consists in constructing a parsimonious measure of the shocks to the top products, ranked by their export value in the previous year. The granular residual for an EU country's exports will be the sum of the idiosyncratic shocks of the top K products, weighted by size:

$$G_t = \sum_{i=1}^{K} \frac{X_{i,\,t-1}}{X_{t-1}} (g_{i,t} - \overline{g}_t), \tag{1}$$

where $X_{i,t-1}$ is the export value of product i in year $t-1$, X_{t-1} is the total export value in year $t-1$, $g_{i,t}$ is the growth rate of product i exports between years $t-1$ and t, and $\overline{g}_t = Q^{-1} \sum_{i=1}^{Q} g_{i,t}$ is the mean growth rate of the top Q products, with $Q \geq K$. Another specification consists in controlling for an alternative mean, $\overline{g}_{DIV_i,t}$, the mean growth rate between products that are in the SITC division (2-digit level) of product i and which are among the top Q products. There is no specific rule to fix the parameters K and Q; Gabaix (2011) chose the top 100 firms for both parameters; these represent about one-third of US output. I will use the figures in Table 1, i.e. the 30, 60, and 90 top products, and will take $K = Q = 60$ for the baseline estimation.

After computing the granular residual, the question of interest is whether the idiosyncratic shocks in large export product categories can explain total exports, so the second step consists in regressing the growth rate of total exports on the granular residual. As a variant, I also include a lagged granular residual. Given that the primary focus will be the goodness of fit, the coefficient of determination will constitute the main statistic of interest.

3. Results

Tables 2 and 3 show the baseline results regarding the granular behaviour of EU country exports for the period 1988–2011 analysed on an SITC-Comext product basis. Both tables show the regression results of the growth rate of total exports on the granular residual, without and with a lag for the granular residual. The granular residual is computed by summing the idiosyncratic shocks of the $K = 60$ largest products weighted by size. The difference lies

[3] See Eurostat (2012).

[4] The countries are the following (ISO alpha-2 codes in parenthesis): Belgium and Luxemburg (BL), Denmark (DK), France (FR), Germany (DE), Great Britain (GB), Greece (GR), Ireland (IE), Italy (IT), Netherlands (NL), Portugal (PT), and Spain(ES). To be consistent with previous data, from 1999, the combination Belgium and Luxemburg includes the sum of the exports of both countries to the rest of the World, except for exports between them. Germany includes the German Democratic Republic from 1991; trade between West and East Germany for the period 1988–1990 is not included in the Comext data.