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The Granular Nature of the Great Export Collapse in German Manufacturing Industries, 2008/2009

Joachim Wagner

Abstract
This paper uses comprehensive high-quality panel data from official statistics for exporting enterprises to investigate the micro-structure of the recent export collapse in manufacturing industries in Germany during the crisis of 2008/2009. Almost all of the decline in exports was due to negative changes of exports in firms that continue to export (i.e. at the so-called intensive margin) while the decrease of exports due to export stoppers (at the so-called extensive margin) was tiny. It is shown that idiosyncratic shocks to very large firms played a decisive role in shaping the export collapse.

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Keywords Exports; great trade collapse; granular economy; Germany

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1 Motivation

In late 2008 world trade experienced a sudden, severe and synchronized collapse that was the sharpest in recorded history and the deepest since World War II – this is now known as The Great Trade Collapse (Baldwin 2009, p. 1). German exports are a case in point. 2009 was the year with the sharpest decline in foreign trade in the history of the Federal Republic of Germany. The value of total exports declined by 18 percent compared to 2008, and Germany lost the title of the World Export Champion to China.

This paper contributes to the literature by presenting the first results for the microstructure of the great export collapse based on comprehensive high quality data for all firms (with a minimum workforce of twenty persons) from manufacturing industries in Germany. The aim of this paper is to contribute to a better understanding of what happened to exports of manufacturing industries of one of the largest actors on the world market for goods during the largest export crash in recorded history. To do so it looks at the role of the extensive and the intensive margin, document the amount of heterogeneity in exporting firms in total and in different size classes, and it demonstrates the role of the largest firms in the export collapse. To anticipate the most important results this study demonstrates that a very large share of the decline in exports from manufacturing firms in Germany in 2009 was due to negative changes of exports in enterprises that continued to export (i.e. at the so-called intensive margin) while the decrease of exports due to export stoppers (at the so-called extensive margin) was tiny. In West Germany where exports declined by 20.5 percent a small fraction made of five percent of all exporting firms from the size class with 500 or more employees was responsible for 72 percent of the gross decrease in exports. Idiosyncratic movements of the top 10 firms in an industry can explain a large fraction (more than one third) of export fluctuations here. In East Germany where exports declined only moderately by 3.8 percent a large fraction of the gross decline of exports was compensated by an increase in exports in a small group of large firms that made up 0.5% of all firms engaged in exports.

The paper is linked to a growing literature. A number of studies (including Anderton and Tewolde (2011), Asmundson et. al. (2011), di Mauro et al. (2010), Eaton et al. (2011), OECD (2010) and Stehrer et. al. (2011: ch. 5) analyze this trade crisis from a macroeconomic point of view. Studies that take a

microeconomic perspective and that try to understand what was going on under the veil of the macroeconomic developments by looking at firm level data , however, are scarce. Behrens et al. (2011) match firm-level data for firm-country-product exports with balance sheet data for Belgium and decompose the trade collapse along the extensive and the intensive margins, where the extensive margin is defined as changes in exports due to firms that stop or start to export and the intensive margin refers to (negative or positive) changes in exports by firms that continue to export. They find that firm exit and the dropping of products and markets played only a small role during the trade collapse – changes in trade volumes were essentially driven by reduced quantities and unit prices. The intensive margin was much more important than the extensive margin. Similarly, based on analyses of firm-level data for France Fontagné and Gaulier (2009) report that the number of exporters has been only slightly reduced by the crisis, while the bulk of the observed decline in exports happened at the intensive margin and, more precisely, was due to the drop in the value exported by the top 1% of exporters (see also Bricongne et al. 2010, 2011).

Only one study based on firm-level data touches upon the case of Germany. The second policy report of the project EFIGE – European Firms in a Global Economy (Barba Navaretti et al. 2011) is based on firm level data collected in surveys in Austria and Hungary (covering about 500 firms in each country), Germany and the UK (for about 2,000 firms), and France, Italy and Spain (for about 3,000 firms). While the questionnaire is mainly focused on 2008, some information is collected on 2009 and changes between the two years. Slightly more than half of the 7,536 exporters in the sample reduced the value of their exports in 2009 compared to 2008, 29.8 percent reported unchanged exports and 18.7 percent increased them. Firms that stopped exports were rare, covering only 3.8 percent of the firms in the sample. These findings fit into the big picture reported in the country studies for Belgium and France summarized above, pointing out that the intensive margin was much more important than the extensive margin during the great export collapse.

The rest of the paper is organized as follows: Section 2 introduces the enterprise level data used in this study. Section 3 presents the empirical approach applied to decompose the overall change of exports into components that enables a look behind the veil of macroeconomic aggregates and discusses the results of the

decomposition of export dynamics. Section 4 investigates the role of idiosyncratic shocks to the largest firms for the overall change in exports. Section 5 concludes.

2 Data

The data used in this study are based on the monthly report for establishments in manufacturing industries, a survey conducted regularly by the German statistical offices that is described in detail in Konold (2007). This survey covers all establishments from manufacturing industries that employ at least twenty persons in the local production unit or in the company that owns the unit. Participation of firms in the survey is mandated in official statistics law. For this study the information collected at the establishment level has been aggregated at the enterprise level (see Malchin and Voshage (2009) for details). The unbalanced panel data set includes all firms that were active in at least one year over the period 2008 and 2009. The nominal export values reported in the survey were deflated using the index of export prices (2005=100) reported by the Deutsche Bundesbank.

Although the data are comprehensive for the manufacturing sector of the German economy, some limitations have to be pointed out. First of all, although the data are based on monthly reports of the firms, the data can only be accessed by researchers in the research data centres of the statistical offices after aggregation to annual values. Therefore, it is not possible to investigate changes from, say, the fourth quarter of 2008 to the third quarter of 2009 (which would be a more precise time span for the great export crisis). Another limitation is the absence of any information on products exported and destination countries. Therefore, it is not possible to investigate the role of other extensive margins besides starting and stopping to export, i.e. adding or dropping products or destinations. Furthermore, in this data set, export refers to the amount of sales to a customer in a foreign country plus sales to a German export trading company; indirect exports (for example, tires produced in a plant in Germany that are delivered to a German manufacturer of cars who exports some of his products) are not covered by this definition.

3 Decomposition of Export Dynamics

3.1 Method of Analysis

With the panel data set described in section 2 firms can be followed over time. The basic idea on how to look behind the veil of aggregate figures of export dynamics familiar from publications of official statistics is to apply a technique widely used in the analysis of job turnover in a slightly modified way. When firms are compared between the two years 2008 and 2009 there are some which did not export in both years. These firms are ignored in the analysis. Each of the other firms belongs to one of five types:

(1) Export starters (firms that did not report exports in 2008 but in 2009).
(2) Enterprises with increased exports between 2008 and 2009.
(3) Enterprises with constant exports in both years.
(4) Enterprises with decreased exports between 2008 and 2008.
(5) Export stoppers (firms that did report exports in 2008 but not in 2009).

The net change in total exports between the two years is the sum of the positive gross changes by the first two types and the negative gross changes by the last two types of firms. The percentage rate of change in total exports can be decomposed accordingly to show the relative contribution of each of these types of firms to total export dynamics.

This decomposition analysis can be performed for all enterprises from manufacturing industries and for various subgroups of firms. In this paper results are reported for enterprises from six size classes (measured by the number of employees: 1–19, 20–49, 50–99, 100–249, 250–499, and 500 and more) . Given that the economy differs between West Germany and the former communist East Germany even some 20 years after the unification in 1990, and that this holds especially for exports (see Wagner (2008) for a detailed analysis), all computations are performed for West Germany and East Germany separately.

3.2 Results

Results for West Germany are reported in Table 1. From the first row it can be seen that exports from manufacturing enterprises fell dramatically by 20.48 percent from 2008 to 2009 during The Great Export Collapse. Most of this decline

is due to negative changes of exports in enterprises that continue to export (i.e. at the so-called intensive margin) while the decrease of exports due to export stoppers (at the so-called extensive margin) is tiny. These findings are in accordance with results reported for Belgium and France (discussed in the introductory section). Surprisingly (at least for readers not familiar with the job creation and destruction literature, or with earlier studies on export dynamics based on firm level panel data) even in this period of an extreme export decline there were thousands of enterprises with increased exports – some 28 percent of all firms fall into this group (see second row of Table 1). The increase of exports due to these firms, however, is small compared to the decrease in exports due to firms with fallen exports.

Results for enterprises from the five size classes that are reported in the lower panel of Table 1 show a rather similar broad picture with regard to the role of the extensive and intensive margins of exports and regarding the share of firms with decreased or increased exports. Note that the share of firms with increased exports declines with an increase in the firm size class, while the opposite holds for the share of firms with decreased exports.

The small group of firms with 500 or more employees is of a dominant importance for the total decline in exports. The share of these firms in all exports was 74 percent in 2008 and 71 percent in 2009. From the figures reported in row one of Table 1 it can be seen that the net reduction of exports by 124 bn. Euro is the result of a gross increase of exports by 20 bn. Euro and a gross decrease by 144 bn. Euro. From this total gross decrease in exports according to the last but one row of Table 1 104 bn. Euro are due to firms with decreased exports from the largest size class. This means that 1,079 firms from the total of 22,025 firms – or five percent of all exporting firms – are responsible for around 72 percent of the gross decrease in exports.

Results for East Germany are reported in Table 2. These results differ considerably from the results reported for West Germany. East German manufacturing exports declined by 3.8 percent only (see the first row of Table 2), and this decline was small compared to the dramatic decline of 20.5 percent in West Germany – in the East German manufacturing sector there was no such thing as a great export collapse in 2009. As in West Germany (and as in Belgium and France) changes at the extensive margin due to export starters and export stoppers

Table 1: Decomposition of Export Dynamics in German Manufacturing Industries: West Germany – 2008 / 2009

	[1] Total exports in 2008 (Million Euro)	[2] Total exports in 2009 (Million Euro)	[3] Rate of change of exports (percent)	[4] Increase of exports due to export starters (% of [1])	[5] Increase of exports due to firms with increased exports (% of [1])	[6] Decrease of exports due to firms with decreased exports (% of [1])	[7] Decrease of exports due to export stoppers (% of [1])
All enterprises (No. of firms / share in %)	604,830	480,978	-20.48	0.06 (609 / 2.77)	3.31 (6,086 / 27.63)	-23.54 (14,642 / 66.48)	-0.31 (688 / 3.12)
Enterprises with							
1 – 49 employees (No. of firms / share in %)	11,074	9,356	-15.52	1.00 (416 / 5.06)	9.24 (2,519 / 30.64)	-23.76 (4,805 / 58.45)	-1.99 (480 / 5.84)
50 – 99 employees (No. of firms / share in %)	24,286	20,341	-16.24	0.45 (135 / 2.27)	7.81 (1,671 / 28.10)	-23.85 (3,994 / 67.17)	-0.66 (146 / 2.46)
100 – 249 employees (No. of firms / share in %)	61,416	50,893	-17.13	0.15 (43 / 0.91)	5.60 (1,196 / 25.41)	-22.69 (3,430 / 72.87)	-0.19 (38 / 0.81)
250 – 499 employees (No. of firms / share in %)	70,769	57,806	-18.32	0.07 (12 / 0.67)	4.25 (421 / 23.60)	-22.15 (1,334 / 74.78)	-0.48 (17 / 0.95)
>= 500 employees (No. of firms / share in %)	437,285	342,572	-21.66	0.001 (3 / 0.22)	2.44 (279 / 20.39)	-23.87 (1,079 / 78.87)	-0.23 (7 / 0.51)

Table 2: Decomposition of Export Dynamics in German Manufacturing Industries: East Germany – 2008 / 2009

	[1] Total exports in 2008 (Million Euro)	[2] Total exports in 2009 (Million Euro)	[3] Rate of change of exports (percent)	[4] Increase of exports due to export starters (% of [1])	[5] Increase of exports due to firms with increased exports (% of [1])	[6] Decrease of exports due to firms with decreased exports (% of [1])	[7] Decrease of exports due to export stoppers (% of [1])
All enterprises (No. of firms / share in %)	78,892	75,896	-3.80	0.13 (217 / 5.59)	8.79 (1,166 / 30.02)	-12.48 (2,285 / 58.83)	-0.23 (216 / 5.56)
Enterprises with							
1 – 49 employees (No. of firms / share in %)	1,576	1,262	-19.92	2.04 (147 / 9.14)	8.62 (472 / 29.33)	-28.27 846 / 52.58)	-2.31 (144 / 8.95)
50 – 99 employees (No. of firms / share in %)	3,826	3,130	-18.20	0.19 (41 / 3.84)	8.95 (341 / 31.90)	-24.06 (633 / 59.21)	-3.28 (54 / 5.05)
100 – 249 employees (No. of firms / share in %)	8,588	7,580	-11.73	0.72 (26 / 2.93)	9.09 (268 / 30.21)	-21.36 (578 / 65.16)	-0.18 (15 / 1.69)
250 – 499 employees (No. of firms / share in %)	6,608	5,742	-13.11	## (3 / 1.38)	6.29 (61 / 27.98)	-19.34 (151 / 69.27)	## (3 / 1.38)
>= 500 employees (No. of firms / share in %)	58,294	58,182	-0.19	0.00 (0 / 0.0)	9.02 (24 / 23.76)	-9.21 (77 / 76.24)	0.00 (0 / 0.00)

indicates a confidential value.

contributed only marginally to the overall development of exports. The rate of change of exports was driven by developments at the intensive margin, where the 12.48 percentage decrease of exports due to firms with decreased exports was compensated to 70 percent by an increase of exports due to firms with increased exports of 8.79 percent.

Results for enterprises from the five size classes that are reported in the lower panel of Table 2 show that the moderate decline in manufacturing exports from East German enterprises is driven by the firms from the largest size class. In 2008, 73.9% of all exports originated in firms from this size class; the corresponding figure for 2009 is 76.7%. The decrease of exports by firms with decreased exports from the size class of firms with 500 or more employees is nearly compensated by the increase of exports due to firms with increased exports from this size class – the net change of exports is tiny (–0.19%). While the 77 firms from the largest size class with decreased exports were responsible for 56% of the overall gross decline of exports, the 24 large firms with increased exports were responsible for 75% of the overall gross increase in exports. It would be very interesting to find out more about these 24 firms (that were only 0.6 % of all firms active in exporting in East German manufacturing) that managed to increase their exports considerably during a period of world-wide export decline. What are their firm specific advantages that make them so successful? In which countries do they sell their exports, which role did exchange rate changes and business cycle conditions in these countries play? Unfortunately, however, due to strict confidentiality of the micro data from official statistics used in this study it is not possible to dig deeper here.

While the big picture on the export dynamics in the manufacturing sector during the great crisis of 2009 differs considerably between West Germany and East Germany – demonstrating again that a separate analysis for both parts of Germany is necessary even some 20 years after the unification of both parts of Germany – the look behind the veil of macroeconomic aggregates by using firm level data to decompose the overall change in exports into its components reveals one striking similarity: A small fraction of firms from the largest size class is responsible for shaping the big picture. To put these findings into perspective, Table 3 documents evidence on the concentration of exports and domestic sales in enterprises from German manufacturing industries in 2008 and 2009. The shares of the 3, 10, 50 and 100 largest exporters (by value of export sales) and largest

firms in domestic sales (by value of domestic sales) are reported separately for West Germany and East Germany.

In both parts of Germany a small number of very large firms are responsible for a large share of both exports and domestic sales. This concentration is higher in exports than in domestic sales, and it is higher in East Germany than in West Germany. This illustrates that a small fraction of large enterprises is responsible to a high degree for the macroeconomic development, a point that is elaborated on in the next section.

Table 3: Concentration of domestic and export sales in enterprises from German manufacturing industries, 2008 – 2009

Year	Share of largest # exporters in total exports (percent)				Share of largest # enterprises in total domestic sales (percent)			
	3	10	50	100	3	10	50	100
West Germany								
2008	13.64	24.98	38.07	45.09	8.84	15.20	25.91	31.10
2009	12.77	25.18	37.66	44.72	7.75	14.01	25.31	30.76
East Germany								
2008	##.##	56.60	70.55	76.62	14.46	21.68	34.78	42.42
2009	##.##	62.86	74.82	80.02	16.23	23.30	36.51	43.68

Note: ##.## indicates a confidential value.

4 The Granular Nature of Manufacturing Exports in Germany

Standard macroeconomic reasoning usually discards the possibility that idiosyncratic microeconomic shocks to firms may lead to large aggregate fluctuations by referring to a diversification argument. A classical case in point is the argument put forward by Robert Lucas (1977) that such microeconomic shocks

would average out and, therefore, would only have negligible aggregate effects. In a recent Econometrica paper Xavier Gabaix (2011) proposes that, contrary to this traditional view, idiosyncratic firm-level shocks can indeed explain an important part of aggregate economic movements and provide a micro-foundation for aggregate shocks. He shows that the "averaging out" argument breaks down if the size distribution of firms is fat-tailed and very large firms play an important role in an economy. This is the case in the United States, where, according to the findings of Gabaix (2011), the idiosyncratic movements of the largest 100 firms appear to explain about one-third of variations in output growth. Wagner (2012b) reports similar evidence for the manufacturing sector in Germany and finds that idiosyncratic shocks in the largest firms are important for an understanding of aggregate volatility in German manufacturing industries.

Gabaix (2011) argues that many economic fluctuations are attributable to the incompressible "grains" of economic activity, the large firms. Therefore, he names this view the "granular" hypothesis. The granular view does not neglect the role of aggregate shocks like changes in monetary, fiscal, and exchange rate policy as important drivers of macroeconomic activity. It only argues that such aggregate shocks are not the only important drivers, and that firm specific idiosyncratic shocks, too, are an important, and possibly the major, part of the origin of business-cycle fluctuations (Gabaix 2011, p. 764).

As said the "averaging out" argument of standard macroeconomic reasoning breaks down if the size distribution of firms is fat-tailed and very large firms play an important role in an economy. From the percentage shares of the largest enterprises in total exports in manufacturing industries West Germany in 2008 and 2009 that are documented in Table 3 it is evident that the exports of manufacturing enterprises are highly concentrated. The very large firms, therefore, represent a large part of the export activity in the manufacturing sector.

In Table 4 the estimated power law exponents for exports are reported for all firms and for firms from 18 manufacturing industries. A power law is a relation of the type $Y = k*X^{ß}$, where Y and X are variables of interest, ß is the power law exponent, and k is a constant. A popular way to estimate the power law exponent ß for the firm size distribution (where firm size is measured by exports here) is to compute the rank of each firm in the size distribution and to run an OLS regression of log(rank) on a constant and log(size). The estimated regression coefficient of

Table 4: Estimated power law exponents for exports in manufacturing industries, West Germany, 2009

Industry	ß	t-value	R2	Number of enterprises
All	-0.356	-103.27	0.744	21,328
15/16	-0.355	-25.18	0.775	1,268
17	-0.330	-45.21	0.793	511
18/19	-0.332	-12.67	0.774	321
20	-0.248	-18.03	0.754	650
21	-0.368	-17.12	0.754	586
22	-0.174	-20.10	0.656	808
23/24	-0.550	-23.62	0.811	1,116
25	-0.347	-30.94	0.778	1,914
26	-0.318	-19.54	0.755	764
27	-0.477	-18.56	0.811	689
28	-0.259	-42.28	0.728	3,575
29	-0.382	-47.02	0.758	4,421
30/31	-0.379	-26.89	0.756	1,446
32	-0.460	-12.19	0.804	297
33	-0.386	-24.00	0.764	1,152
34	-0.490	-18.08	0.774	654
35	-0.529	-9.62	0.799	185
36	-0.317	-22.03	0.769	971

Note: For a definition of the industries see the appendix table. The power law exponent ß and its standard error are estimated by the method suggested in Gabaix and Ibragimov (2011); see text.

log(size) is an estimate for ß. Gabaix and Ibragimov (2011) show that this procedure leads to strongly biased estimates in small samples. They provide a simple practical remedy for this bias by suggesting to use rank – ½ instead of rank and then run log(rank – ½) = k–ß*log(size). They show that the shift of ½ is optimal

and reduces the bias to a leading order. Note that the standard error of ß is not the OLS standard error reported by the computer program, but is asymptotically given by (2/n) ½ *|b| (where n is the number of firms used in the estimation).

The estimated power-law coefficient for exports is statistically significantly different from zero at an error level of less than 1 percent in German manufacturing as a whole and in every industry. According to the R2-value the fit is rather tight. These results indicate that exports are power-law distributed in all industries. Descriptive results, therefore, indicate that the distribution of exports from the German manufacturing sector as a whole and from the various industries that are part of it can be characterised as fat-tailed.

To test for the granular nature of exports from German manufacturing industries the data for enterprises from 18 manufacturing industries that are described above are used and the role of the 10 largest firms in each industry is considered. The empirical approach closely follows Gabaix (2011, p. 750ff.). The idiosyncratic firm-level sales shock is measured by the "granular residual" that is computed as follows. git is the growth rate of exports for firm i and year t, computed as log(exportsit) – log(exportsit–1). g10t is the average of the growth rates of the 10 largest firms (according to exports in year t–1) in an industry. The granular residual is a weighted sum of the 10 largest firm's growth rate minus g10t, where the weights are the shares of the firms in total exports of all firms in an industry in year t–1. Here, t refers to 2009 and t–1 refers to 2008.

Before proceeding with the empirical analysis, a discussion of the firm-specific export shocks that are at the center of the granular hypothesis is in order. What can justify the conjecture that there are firm-specific shocks of this kind? Unfortunately, data protection law prohibits the identification of the 10 largest firms in each industry, and, therefore, it is not possible to check their annual reports, press releases, information for shareholders etc. to identify what happened to the exports of these firms in detail in 2008–2009. Hypothetical examples, however, might help to illustrate the kind of firm-specific export shocks. First of all, keep in mind that firms from two-digit industries are not homogeneous firms that sell identical product to the same markets. Exported products are heterogeneous (and often idiosyncratic), and the target markets differ widely. This means that the foreign customers of the firms in a given two-digit industry are far from identical. Any customer might be hit by a firm-specific shock of some kind – a positive productivity shock, a negative demand shocks, sudden financial pressure

and credit constraints to name but a few – and this might lead to an increase or a decrease of orders from the German exporting firm that is the trade partner of this firm. If foreign customers of firms from a two-digit industry differ, and if these foreign firms are hit by firm-specific shocks, this will lead to firm-specific export shocks in German firms. These idiosyncratic firm-level export shocks are measured by the granular residual using the method introduced by Gabaix (2011).

In the next step the growth rate of total exports in an industry, defined as log(total exports in 2009) minus log(total exports in 2008), is regressed on the granular residual from the industry using Ordinary Least Squares (OLS). Results are reported in the first column of Table 5. They are supportive of the granular hypothesis. The estimated coefficient for the granular residual is highly statistically significant. If only aggregate shocks were important for the growth rate of total exports in an industry, then the R2 of the regressions in Table 5 would be zero. It is not. Idiosyncratic movements of the top 10 firms in an industry can explain a large fraction (more than one third) of export fluctuations.

It is well known that results estimated by OLS can be highly sensitive to a small fraction of observations that lay far away from the majority of observations in the sample. As a robustness check, therefore, we investigate whether the results reported depend on extreme observations, or outliers. Rousseeuw and Leroy (1987) distinguish three types of outliers that influence the OLS estimator: vertical outliers, bad leverage points, and good leverage points. Verardi and Croux (2009, p. 440) illustrate this terminology in a simple linear regression framework that is used here (the generalization to higher dimensions is straightforward) as follows: "Vertical outliers are those observations that have outlying values for the corresponding error term (the y dimension) but are not outlying in the space of explanatory variables (the x dimension). Their presence affects the OLS estimation and, in particular, the estimated intercept. Good leverage points are observations that are outlying in the space of explanatory variables but that are located close to the regression line. Their presence does not affect the OLS estimation, but it affects statistical inference because they do deflate the estimated standard errors. Finally, bad leverage points are observations that are both outlying in the space of explanatory variables and located far from the true regression line. Their presence significantly affects the OLS estimation of both the intercept and the slope."

Using this terminology one can state that the popular median regression estimator (also known as Least Absolute Deviations or LAD) protects against

vertical outliers but not against bad leverage points (Verardi and Croux 2009, p. 441). Full robustness can be achieved by using the so-called S-estimator that can resist contamination of the data set of up to 50% of outliers (i.e., that has a breakdown point of 50 % compared to zero percent for OLS). A discussion of any details of this estimator is beyond the scope of this paper (see Verardi and McCathie (2012) for this estimator and for Stata commands to compute it).

Results computed by the S-estimator are reported in the second column of Table 5. The robust estimator identifies six outliers. These outliers are the observations from the industries 18/19 (clothing/leather goods), 22 (publishing, printing and reproduction of recorded media), 30/31 (office machinery, computers, other electrical machinery), 32 (radio, television, communication equipment), 33 (medical, precision and optical instruments, watches, clocks) and 34 (motor vehicles, trailers and semi-trailers). When these outliers are dropped from the estimation sample the estimated regression coefficient for the granular residual is again highly statistically significant. The R2 value from the robust S-regression is considerably larger than the corresponding value from the OLS regression. The conclusion remains the same: Idiosyncratic movements of the top 10 firms in an industry can explain a large fraction of export fluctuations.

Table 5: Explanatory power of the granular residual for export growth in manufacturing industries, West Germany, 2008/2009

Independent variable: export growth 2008/2009 (percentage)

Estimation method:		OLS	S-estimator
Granular residual 2008/2009	ß	0.00868	0.131
	P	0.000	0.004
Constant	ß	-19.515	-17.975
	P	0.000	0.000
Number of industries		18	12
R2		0.357	0.585

Note: ß is the estimated regression coefficient, p is the prob-value. For a definition of the industries see Table 4 and the appendix table. For a definition of the granular residual see text.

The bottom line, then, is that the good explanatory power of the granular residual points out that the manufacturing part of the German export sector is a granular economy.

5 Concluding Remarks

This study shows that a very large share of the decline in exports from manufacturing firms in Germany in 2009 was due to negative changes of exports in enterprises that continued to export (i.e. at the so-called intensive margin) while the decrease of exports due to export stoppers (at the so-called extensive margin) was tiny. In West Germany where exports declined by 20.5 percent a small fraction made of five percent of all exporting firms from the size class with 500 or more employees was responsible for around 72 percent of the gross decrease in exports. Idiosyncratic movements of the top 10 firms in an industry can explain a large fraction (more than one third) of export fluctuations here. In East Germany where exports declined only moderately by 3.8 percent a large fraction of the gross decline of exports was compensated by an increase in exports in a small group of large firms that made up 0.6 percent of all firms engaged in exports.

This paper demonstrates that idiosyncratic shocks to the largest firms' exports are important for an understanding of aggregate volatility in total exports from West German manufacturing industries. Here, about one third of export fluctuations can be explained by idiosyncratic movements of the top 10 firms in an industry. As stated at the beginning of section 4, following Gabaix (2011) this granular view does not intend to neglect the role of aggregate shocks – it only argues that such aggregate shocks are not the only important drivers of export fluctuations.

This finding of a granular nature of the great export collapse has implications for both theoretical and empirical research.

Theoretical models should drop the assumption of homogeneous representative firms and consider heterogeneous firms instead – like, for example, in the rich literature from the new new trade theory surveyed in Redding (2011). Here, a special focus should be on models for multiple-product, multiple-destination exporters (see, e.g., the recent theoretical model by Bernard et al. (2011)). These firms are known to be large exporters. Empirical evidence for a positive

correlation of total exports of a firm and both the number of products exported, and the number of countries exported to, is provided by Bernard et al. (2011) for the United States and by Wagner (2012c) for Germany.

Empirical studies that investigate the role of the largest firms need to be based on firm level data, and an easy access to these data (that are often confidential like the micro data from official statistics used in this study) for researchers is a must to foster research that will help us to understand what drives aggregate movements of the economy. While it is not possible to identify the names of the largest firms from confidential firm level data like this, fortunately the usual suspects are well known and published annual reports or information available in commercial data bases can be used to investigate the concrete shocks to large players (like Daimler, Siemens, Volkswagen, BASF or Bosch in German manufacturing).

In sum, the by now familiar decomposition analysis and the granular approach recently introduced by Gabaix (2011) suggests a road that should be travelled in the analysis of export dynamics.

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Appendix: Definition of manufacturing industries and number of enterprises in 2008

No.	Industry	No. of enterprises
15	Manufacture of food products and beverages	3,998
16	Manufacture of tobacco products	5
17	Manufacture of textiles	561
18	Manufacture of wearing apparel; dressing and dyeing of fur	251
19	Tanning and dressing of leather; manufacture of leather goods	116
20	Manufacture of wood and products of wood except furniture	951
21	Manufacture of pulp, paper and paper products	651
22	Publishing, printing and reproduction of recorded media	1,254
23	Manufacture of coke, refined petroleum products and nuclear fuel	44
24	Manufacture of chemicals and chemical products	1,157
25	Manufacture of rubber and plastic products	2,206
26	Manufacture of other non-metallic mineral products	1,251
27	Manufacture of basic metals	751
28	Manufacture of fabricated metal products, except machinery and equipm.	5,070
29	Manufacture of machinery and equipment n. e. c.	5,061
30	Manufacture of office machinery and computers	126
31	Manufacture of electrical machinery and apparatus n. e. c.	1,638
32	Manufacture of radio, television and communication equipm. and apparatus	354
33	Manufacture of medical, precision and optical instruments, watches, clocks	1,623
34	Manufacture of motor vehicles, trailers and semi-trailers	762
35	Manufacture of other transport equipment	236
36	Manufacture of furniture, manufacturing n. e. c.	1,171
		29,247

Note: The 2-digit-industries are defined according to the German classification WZ 2003.