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German multiple-product, multiple-destination exporters: Bernard-Redding-Schott under test

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German multiple-product, multiple-destination exporters:

Bernard-Redding-Schott under test*

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Abstract:

Export is dominated by enterprises that trade more than one good with customers in more than one destination country. Germany, one of the leading actors on the world market for goods, is a case in point. Theoretical models of multiple-product, multiple-destination exporters that can guide empirical research of their production and export decisions are still rare. Recently, Bernard, Redding and Schott (QJE 2011) published a general equilibrium model that serves this purpose and find support for many of its implications in U. S. trade data. This note uses newly available transaction-level data for German manufacturing firms for an empirical test of implications of this model. Results are strikingly similar to findings reported for the United States.

JEL Classification: F14

Keywords: multi-product exporters, multi-country exporters, Germany

* All computations were done at the Research Data Centre of the German Statistical Office. I thank Christopher Gürke for preparing the data, running my Stata do-files and checking the results for any violation of privacy. The enterprise level data used are confidential but not exclusive; see http://www.forschungsdatenzentrum.de/nutzungsbedingungen.asp for any details regarding the access to the data.

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1. Motivation

Export is dominated by enterprises that trade more than one good with customers in more than one destination country. Germany, one of the leading actors on the world market for goods, is a case in point. Table 1 documents that many manufacturing enterprises in West Germany and in East Germany[1] export only a small number of goods[2] to a small number of countries, but that firms that export more than 10 different goods to more than ten different countries are responsible for more than 90 percent of all exports by firms from manufacturing industries in West Germany and for more than two thirds of exports in East Germany.[3]

[Table 1 near here]

Theoretical models of multiple-product, multiple-destination exporters that can guide empirical research of their production and export decisions are still rare. Recently, Bernard, Redding and Schott (2011) published a general equilibrium model that serves this purpose and find support for many of its implications in U. S. trade data.

[1] The economy differs between West Germany and the former communist East Germany even some 20 years after unification in 1990, and this holds especially for exports (see Wagner (2008) for a detailed analysis). Therefore, all computations were performed for West Germany and East Germany separately.

[2] A good is an eight-digit number from the official nomenclature for the statistics of foreign trade.

[3] The number of total firms differs between the first and the second panel of Table 1 because exports of certain goods and exports to certain countries are kept secret by request of the exporters. Therefore, for a small number of exporters with a known number of goods traded the number of countries traded with is not known, and vice versa. Note that exports to EU countries are only recorded in the transaction-level data if they exceed a limit of 400.000 Euro; for details see: Statistisches Bundesamt, Qualitätsbericht Außenhandel, Januar 2011.

This note uses newly available transaction-level data for German manufacturing firms for a further empirical test of these implications, keeping in mind that 'the credibility of a new finding that is based on carefully analyzing two data sets is far more than twice that of a result based only on one' (Hamermesh, 2000, p. 376). To anticipate the most important finding, results for Germany are strikingly similar to those reported for the United States.

2. Implications from the theoretical model

Bernard, Redding and Schott (2011) (henceforth, BRS) present a general equilibrium model of multi-product, multi-destination firms in which firms are heterogeneous with regard to an attribute that they label "ability" and in which products have attributes that are idiosyncratic across products and possibly also across export destinations within the firm. Products are imperfect substitutes in demand and, within each product, firms supply horizontally differentiated varieties of the product. "Ability" is modeled as firm productivity and product attributes as "consumer taste" for the firm's products. There are fixed costs in exporting to each destination and in exporting each product to each market. Firms with a higher ability can generate sufficient profits to cover the product related fixed export cost at a lower value of product attributes; these firms supply a wider range of products to each market. Firms with a sufficiently low value of ability cannot cover the fixed costs of serving the market and will not export to it. This leads to a hierarchy of firms according to their export activities: The lowest-ability firms are unprofitable and choose to exit, firms with an intermediate ability serve the home market only, the highest-ability firms export. Firms that export sell their products with the worst attributes on the domestic market only, while the products with the best attributes are exported to the largest number of markets.

In the BRS-model the interaction of firm ability and product attributes drive the differences in exports across firms. Both firm ability and product attributes are unobservable (at least, to a researcher investigating the firm-level data). BRS show that the number of exported products and the number of export destinations, i.e. the firms' extensive margins of exports, are both monotonically increasing in unobserved firm ability in the model. The same holds for total exports, exports of the firm's largest product across all markets (the firms' intensive margins of exports), and measured productivity (see BRS (2011), p. 1307f.). The BRS-model, therefore, has the following testable implications:

In a firm both the number of products exported and the number of export destinations are positively related with total exports, exports of the largest product across all markets, and productivity.

3. Empirical results for exporters from German manufacturing industries

BRS test the implications of their model using data for some 30,000 firms from the U.S. in 1997. Empirical evidence is in support of the predictions of the model (see Table III in BRS (2011), p. 1309). This section reports results of a replication study based on data for exporting firms from German manufacturing industries.

The empirical investigation uses a newly constructed data set that is based on customs' records about goods exported to countries outside the European Union and on information delivered by firms about goods exported to EU member countries.[4] These transaction-level data were aggregated at the level of the exporting enterprise by the German Statistical Office for the first time for the reporting year 2009.[5] The

[4] For details see Statistisches Bundesamt, Qualitätsbericht Außenhandel, Januar 2011.

[5] Data for more recent years are not yet available.

data have, among others, information at the firm level about the value of all exports, the value of the largest product exported, the number of different goods exported and the number of destination countries. These firm level data on exports were linked to the enterprise register system. By linking the aggregated transaction-level export data to the enterprise register system it was possible to match these data with information on the number of employees in the firm and total turnover of the firm taken from the regular survey of manufacturing firms. Total turnover per employee is used as a measure of labor productivity.[6]

Results of the empirical test of the implications of the BRS-model are reported in Table 2 for West-Germany and in Table 3 for East-Germany. These results are fully in line with the theoretical hypotheses and with the findings from BRS (2011) for the U. S.: The number of products exported and the number of export destinations are positively and statistically highly significantly related with total exports, exports of the largest product across all markets, and productivity.[7]

[6] Productivity is measured as labor productivity because information on the capital stock of a firm is not available, so more elaborate measures of total factor productivity cannot be used in this study. Bartelsman and Doms (2000, p. 575) point to the fact that heterogeneity in labor productivity has been found to be accompanied by similar heterogeneity in total factor productivity in the reviewed research where both concepts are measured. In a recent comprehensive survey Chad Syverson (2011) argues that high-productivity producers will tend to look efficient regardless of the specific way that their productivity is measured. Furthermore, Foster, Haltiwanger and Syverson (2008) show that productivity measures that use sales (i.e. quantities multiplied by prices) and measures that use quantities only are highly positively correlated. Therefore, we argue that labor productivity is a suitable measure for productivity at the firm level.

[7] Note that the estimated regression coefficients are of the same order of magnitude for the U:S. and for Germany. In a robustness check all regressions were estimated using the fully robust MM estimator (see Verardi and Croux (2009) for details) to take care of the possible role of extreme observations, or outliers. Results are similar and lead to identical conclusions; details are available on request.

[Table 2 and Table 3 near here]

The bottom line, then, is that the BRS-model qualifies as a theoretical model of multiple-product, multiple-destination exporters that can guide empirical research of their production and export decisions

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Table 1: Exporter in German Manufacturing Industries by Number of Goods and Number of Countries

	West Germany		East Germany	
Number of Goods exported	Number of firms	Cumulated share (%)	Number of firms	Cumulated share (%)
1	1,672	14.02	378	19.35
2	1,202	24.09	257	32.51
3	941	31.98	197	42.60
4	704	37.88	143	49.92
5	554	42.53	108	55.45
6	486	46.60	96	60.37
7	424	50.16	73	64.11
8	366	53.22	73	67.84
9	312	55.84	53	70.56
10 and more	5,268	100.00	575	100.00
Total	11,929		1,953	
Number of countries exported to				
1	956	8.11	244	12.70
2	621	13.38	171	21.60
3	451	17.20	109	27.28
4	405	20.64	104	32.69
5	334	23.47	92	37.48
6	369	26.60	75	41.38
7	340	29.49	77	45.39
8	301	32.04	55	48.26
9	311	34.68	50	50.86
10 and more	7,700	100.00	944	100.00
Total	11,788		1,921	

	Enterprises that trade 10 or more goods with 10 or more countries		
	Number of Enterprises	Share in total trade (%)	Share in all enterprises (%)
West Germany	4,678	91.1	39.1
East Germany	439	67.8	22.4

Source: Research Data Center of the German Statistical Office, Foreign Trade Statistics 2009, own calculations

Table 2: Correlation of German manufacturing firms' extensive and intensive margins in exports: West Germany, 2009

		ln (number of products)			ln (number of countries)		
		[1]	[2]	[3]	[4]	[5]	[6]
ln (size of largest product)	ß	0.325			0.376		
	p	0.000			0.000		
ln (total exports)	ß		0.377			0.384	
	p		0.000			0.000	
ln (productivity)	ß			0.573			0.458
	p			0.000			0.000
Constant	ß	-2.976	-3.891	-5.219	-3.270	-3.501	-3.121
	p	0.000	0.000	0.000	0.000	0.000	0.000
Observations		11,583	11,929	11,929	11,454	11,788	11,788
R^2		0.328	0.427	0.156	0.553	0.609	0.139

Source: Research Data Center of the German Statistical Office, Foreign Trade Statistics 2009, own calculations.

Note: Table reports results of enterprise-level OLS regressions of the log number of products exported by the firm, or log number of destination countries served by the firm, on noted covariates. All regressions include dummy variables for firms' two-digit industry. p-values are based on heteroscedasticity-robust standard errors.

Table 3: Correlation of German manufacturing firms‘ extensive and intensive margins in exports: East Germany, 2009

		ln (number of products)			ln (number of countries)		
		[1]	[2]	[3]	[4]	[5]	[6]
ln (size of largest product)	ß	0.225			0.361		
	p	0.000			0.000		
ln (total exports)	ß		0.273			0.360	
	p		0.000			0.000	
ln (productivity)	ß			0.416			0.412
	p			0.000			0.000
Constant	ß	0.128	-0.861	-1.709	-2.366	-1.882	-1.253
	p	0.445	0.000	0.003	0.000	0.000	0.019
Observations		1,844	1,953	1,953	1,819	1,921	1,921
R^2		0.227	0.319	0,108	0,507	0.556	0.126

Source: Research Data Center of the German Statistical Office, Foreign Trade Statistics 2009, own calculations.

Note: Table reports results of enterprise-level OLS regressions of the log number of products exported by the firm, or log number of destination countries served by the firm, on noted covariates. All regressions include dummy variables for firms’ two-digit industry. p-values are based on heteroscedasticity-robust standard errors.

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