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by

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Are low-productive exporters marginal exporters? Evidence from Germany[*]

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Abstract:

A stylized fact from the emerging literature on the micro-econometrics of international trade and a central implication of the heterogeneous firm models from the new new trade theory is that exporters are more productive than non-exporters. It is argued that this exporter-productivity premium is due to extra cost of exporting that can be covered profitably by more productive firms only. Germany is a case in point - exporting firms from manufacturing industries are more productive than non-exporting firms from the same 4-digit industry both on average and over the whole productivity distribution. However, many firms from the lower end of this distribution are exporters. This paper report that these low-productivity exporters are not marginal exporters defined according to the share of exports in total sales, or export participation over time, or the number of goods exported, or the number of countries exported to.

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1.   Motivation

Ever since Bernard and Jensen (1995) started the literature on what is now labelled the *Micro-econometrics of International Firm Activities* some twenty years ago empirical studies that compare exporting and non-exporting firms report that exporters are more productive than non-exporters of the same size and from the same narrowly defined industry. This positive exporter productivity premium has been found in hundreds of studies for countries from all over the world, and it is considered as a stylized fact today (see the surveys by Greenaway and Kneller (2007), Bernard et al. (2012) and Wagner (2007a, 2012a)). Germany, one of the leading actors on the world market for goods and services, is a case in point (see Bernard and Wagner (1997) for manufacturing firms from one federal state, Lower Saxony, and Wagner (2007b) for German manufacturing as a whole).

The empirical finding of a positive exporter productivity premium motivated Melitz (2003) to develop a dynamic industry model with heterogeneous firms in which a firm that exports has to have a productivity value that lies beyond some threshold, while firms with a lower productivity serve the home market only (and the least productive firms exit the market). The reason for this productivity threshold that divides exporters from non-exporters is that exporters have to cover extra-costs to serve a foreign market (including cost for finding foreign customers, transportation costs, distribution or marketing costs, costs for personnel with skill to manage foreign networks, or costs to modify products for foreign customers), and only the more productive firms can cover these export-related costs while still being profitable.

The Melitz (2003) model has become the workhorse model of a large and growing theoretical literature labeled the *New New Trade Theory* (reviewed in Helpman (2006, 2011), Redding (2011) and Melitz and Redding (2012)). Recently,

the core ideas made its way into undergraduate classes on International Economics (see Krugman, Obstfeld and Melitz (2012), ch. 8). A graph showing productivity thresholds that divide firms into three groups – exits, non-exporters and exporters – like figure 5.1 in Helpman (2011, p. 103) or figure 2 in Melitz and Redding (2012, p. 20) will soon be as familiar to students of international trade all over the world as a graph showing the consequences of a tariff on production and consumption in a small open economy.

That said, there is empirical evidence that does not fit well into the picture sketched so far: There are exporting firms which are located at the lower end of the productivity distribution and high-productive non-exporting firms. Powell and Wagner (2011) document that in Germany exporters and non-exporters are highly heterogeneous with regard to productivity. Neither low-productivity exporters nor high-productivity non-exporters are a rare species. Hallak and Sivadasan (2010) document similar evidence for India, the U.S., Chile, and Columbia. There is no such thing as a single cut-off point in the productivity distribution that separates non-exporters and exporters.

This paper discusses whether this evidence for low-productive exporters casts doubts on the validity of the stylized fact that exporters tend to be more productive than non-exporters and on the usefulness of theoretical models of the Melitz (2003) type that assume a productivity threshold that exporters have to cross. To do so it uses firm-level data from German manufacturing industries to look at the characteristics of these low-productive exporters for the first time. To anticipate the contribution of this paper to the literature we find that low-productivity exporters are not marginal exporters defined according to the share of exports in total sales, or export participation over time, or the number of goods exported, or the number of

countries exported to. The hypothesis that the lack of an observed productivity threshold between exporters and non-exporters in German manufacturing industries is due to the fact that low-productive exporters are marginal exporters for which the extra costs of exporting compared to selling on the home market might be considered as negligible, therefore, is not supported by the data.

2. Low-productive exporters in German manufacturing industries

2.1 Data and measurement issues

The empirical investigation uses data from two sources. The first source is the regular survey of establishments from manufacturing industries by the Statistical Offices of the German federal states. The 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 (see Malchin and Voshage (2009) for details). For this study establishment data were aggregated to the enterprise level to match the unit of observation in the second data source (described below). The survey has information on the number of employees in the firm, total turnover, total exports and detailed industry affiliation.

These data do not cover any information about the goods exported and the countries of destination of the goods. In other words, we know from these data *who* trades *how much*, but not *what* and *with whom*. Information on the goods traded internationally and on the countries with which these goods are traded is available from the statistic on foreign trade (*Außenhandelsstatistik*). This statistic is based on two sources. One source is the reports by German firms on transactions with firms from countries that are members of the European Union (EU); these reports are used

to compile the so-called *Intrahandelsstatistik* on intra-EU trade. The other source is transaction-level data collected by the customs on trade with countries outside the EU (the so-called *Extrahandelsstatistik*).[1] Data in the statistic of foreign trade are transaction-level data, i.e. they relate to one transaction of a German firm with a firm located outside Germany at a time.

For the reporting year 2009 these transaction-level data have been aggregated at the level of the exporting firm for the first time. For each exporting firm that reported either to the statistic on intra-EU trade, or to the statistic on trade with countries outside the EU, we know from these data, among others, the number of goods exported and the number of countries exported to.[2] Using the firms' registration number for turnover tax statistics these data were matched with the enterprise register system (*Unternehmensregister-System*). For enterprises from manufacturing industries this matching made it possible to add information (that is taken from the regular survey of manufacturing firms discussed above) on industry affiliation, total turnover and the number of employees (see Wagner (2012b)). These newly available data are the second source of data used in this paper. With these data it is possible to investigate the relationship between productivity on the one hand and the number of goods exported and the number of countries traded with on the other hand.

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[1] Note that firms with a value of exports to and imports from EU-countries that does not exceed 400,000 Euro in 2009 do not have to report to the statistic on intra-EU trade. For trade with firms from non-member countries all transactions that exceed 1,000 Euro are registered. For details see Statistisches Bundesamt, Qualitätsbericht Außenhandel, Januar 2011.

[2] Note that information for firms with a value of exports to and imports from EU-countries that does not exceed 400,000 Euro in 2009 is not covered in the data (see footnote 1). Small exporters and importers that trade with EU-countries only are therefore underrepresented in the sample. Presumably, many of these are firms that trade only one good (or a very small number of goods) with one country (or a very small number of countries).

In this section of the paper cross-section data for 2009 are used. The reason is that as of today the newly available firm level data that are based on transaction level data are only available for this year. Given that the East German economy still differs in many respects from the West German economy, especially with regard to exporting (see Wagner (2008)), this study looks at West German and East German manufacturing enterprises separately.

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. However, 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 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. Labor productivity is expressed in percentage of the mean value of labour productivity in the 4digit industry to take care of productivity differences across industries due to differences in capital intensity, demand conditions, regulation and trade barriers, among others.

2.2 Empirical findings

The empirical investigation starts with reproducing one empirical finding that has been reported for Germany (and for many other countries) in numerous studies before: Exporters are more productive than non-exporters

Table 1 documents this finding for enterprises from manufacturing industries in both parts of Germany in 2009. Controlling for 4-digit level industries productivity is much higher in exporting firms compared to non-exporting firms both at the mean and at any other point of the productivity distribution. Statistical tests (t-tests for comparison of mean values and Kolmogorov-Smirnov tests for comparison of distributions) reject the null-hypothesis of equality and point to higher productivity of exporting compared to non-exporting firms (with p-values reported to be p = 0.000).

Furthermore, Table 1 indicates that both exporters and non-exporters are highly heterogeneous – low-productive and high-productive exporters and low-productive and high-productive non-exporters coexist. Table 2 reports the share of exporters and non-exporters in the deciles of the productivity distribution in manufacturing enterprises in Germany in 2009. While the share of exporting firms in all firms increases over the deciles, there are high shares of exporters at the lower end of the productivity distribution (and many non-exporting firms at the upper end). This is the second finding: Low productive exporters abound

This finding is at odds with a core implication of the dynamic industry model with heterogeneous firms by Melitz (2003) in which a firm that exports has to have a productivity value that lies beyond some threshold, while firms with a lower productivity serve the home market only (and the least productive firms exit the market). There is no productivity threshold that divides non-exporters and exporters in German manufacturing industries. This lack of a productivity threshold between exporters and non-exporters has been pointed out before by Hallak and Sivadasan (2010) for India, the U.S., Chile, and Columbia, and by Powell and Wagner (2011) for German manufacturing industries based on firm-level data for earlier years.

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The literature on heterogeneous firms and exports argues that the reason for a productivity threshold that divides exporters from non-exporters is that exporters have to cover extra-costs to serve a foreign market (including cost for finding foreign customers, transportation costs, distribution or marketing costs, costs for personnel with skill to manage foreign networks, or costs to modify products for foreign customers), and only the more productive firms can cover these export-related costs while still being profitable. How can this be reconciled with the finding reported here?

An explanation for the lack of a productivity threshold between exporters and non-exporters observed in the data here might be that the extra-costs to serve a foreign market are (close to) zero for some exporters. This could be the case if low-productive exporters are marginal exporters. When talking to owners or managers of firms about the way they (started to) export one often hears answers like "There was this guy from Denmark I met at the trade fair, and he ordered some units of our good X", or "I received a mail from company Y in Switzerland in which they asked for one of our new machines". In situations like this, or in similar situations where firms export only a tiny share of their total product, export only one single good, or export to one single foreign country only, the extra costs of exporting compared to selling on the home market mentioned above might well be negligible. To see whether this is the case in Germany we will next take a closer look at the low-productive exporters.

One way to test whether low-productive exporters are marginal exporters, and whether high-productive exporters are not, is to look at the share of exports in total sales for exporting manufacturing enterprises in the deciles of the productivity distribution. Table 3 reports empirical evidence for Germany in 2009. On average, the share of exports in total sales is higher at the top than at the bottom of the productivity distribution, but marginal exporters are found in each decile (and firms

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with very large shares of exports to total sales, too), and the average value of the exports to sales ratio is far from small at the bottom end of the productivity distribution. This is the third empirical finding: Low productive exporters are not marginal exporters with a low share of exports in total sales.

A second way to define a marginal exporter is to consider firms that export occasionally only (presumably when they receive an unsolicited export order) as marginally engaged in exporting, and firms that export continuously as non-marginal exporters. In general, participation in exporting tends to be highly persistent among firms from manufacturing industries in Germany. Among firms from manufacturing industries that exported in at least one year over the period from 2008 to 2010 in West Germany 90.2 percent exported in each year; the corresponding figure for East Germany is 86.3 percent. Table 4 reports the share of continuous exporters over the period 2008 – 2010 in all exporting firms in the deciles of the productivity distribution. While this share increases along the productivity distribution, it is only slightly below average at the lower end. This is the fourth empirical finding: Low productive exporters are not marginal exporters that export only occasionally.

Another way to define a marginal exporter is to consider the number of different goods exported or the number of countries traded with (or both). We know that in Germany productivity increases with both the number of goods traded and the number of countries traded with (see Wagner (2012b, 2012c)). Table 5 reports the number of goods exported by manufacturing enterprises in the deciles of the productivity distribution.[3] The share of firms that exported only one good (or a small

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[3] A good is an eight-digit number from the official nomenclature for the statistics of foreign trade. Note that the results reported in Table 5 – Table 8 are based on the figures reported in the statistic on foreign trade (discussed in detail in the introductory section), so exports to EU-countries with a value

number of goods) declines over the productivity distribution, but the fraction of firms which export only few goods is not extremely large at the lower end of this distribution, and many firms with a low productivity export many goods. This is the fifth empirical finding: Low productive exporters are not marginal exporters that export only one good or few different goods.

Table 6 reports a similar finding for the number of countries exported to. The share of firms that exported to one country (or to a small number of countries) only declines over the productivity distribution, but many firms with a low productivity export to many countries. This is the sixth empirical finding: Low productive exporters are not marginal exporters that export only to one country or to a few countries.

Firms that export one good only might be non-marginal exporters because they export this good to a large number of countries (which might cause high extra cost for, inter alia, doing market research, finding trading partners and adapt the good to special requirements in each country). Similarly, firms that export to one country only might be non-marginal exporters because they export many goods to this country (which might cause high extra costs for, inter alia, adapt each good to special requirements in that country). A different way to define a marginal exporter, therefore, is to consider firms that export one good to one country only, maybe dealing only with one customer who placed an order with the German company. Table 7 reports the share of exporting manufacturing enterprises of this "one-good-one-target-country-only" – type in the deciles of the productivity distribution. The share of these marginal exporters declines over the productivity distribution, but by far not all exporters from the lower end of the distribution are marginal exporters of

of up to 400,000 Euro are not included (see footnotes 1 and 2 above). Firms that export only to the EU with an export value of less than 400,00 Euro are, therefore, not included in the sample analyzed here.

this type. This is the seventh empirical finding: Low productive exporters are not marginal exporters that export only one good to one country.

3.   Concluding remarks

The bottom line, then, is that low-productivity exporters are not marginal exporters defined according to the share of exports in total sales, or export participation over time, or the number of goods exported, or the number of countries exported to. The hypothesis that the lack of an observed productivity threshold between exporters and non-exporters in German manufacturing industries is due to the fact that low-productive exporters are marginal exporters for which the extra costs of exporting compared to selling on the home market might be considered as negligible, therefore, is not supported by the data.

To put these findings into perspective, it seems appropriate to quote at some length from a recent paper[4] by two of the most important theoreticians in this area, Melitz and Redding (2012, p.5): "Naturally, the model is an abstraction and does not capture all of the features of the data. … (M)uch of our analysis concentrates on heterogeneity in productivity …, and hence does not capture the rich range of dimensions along which trading and non-trading firms can differ. Additionally, the baseline version of the model yields sharp predictions such as a single productivity threshold above which all firms export …. Although these sharp predictions are unlikely to be literally satisfied in the data, they capture systematic relationships or average tendencies in the data, as the higher average productivity of exporters … ."

We demonstrate that, indeed, the sharp prediction from the baseline version of the Melitz (2003) model, namely that there is a single productivity threshold above

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[4] This paper is forthcoming in Vol. 4 of the highly prestigious Handbook of International Economics.

which all firms export, is at odds with the data from German manufacturing enterprises. While this does not at all devaluate the Melitz (2003) model as a tool for theoretical analyses, it points to the need for a closer look at "the rich range of dimensions along which trading and non-trading firms can differ" mentioned by Melitz and Redding (2012, p. 20). Unfortunately, however, the data used here are not rich enough to proceed in this direction.

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Table 1:   Productivity distribution of exporters and non-exporters in manufacturing industries in Germany, 2009

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		Mean	Std.Dev.	p1	p25	p50	p75	p99
West Germany								
Exporters	(N = 22,286)	105.60	85.13	19.25	61.48	87.23	126.01	384.58
Non-Exporters	(N = 8,380)	86.45	105.70	7.09	44.98	66.13	101.35	353.04
East Germany								
Exporters	(N = 3,974)	109.76	113.55	14.54	59.41	88.06	131.02	454.71
Non-Exporters	(N = 2,893)	87.56	82.67	10.34	49.27	69.60	104.77	341.91

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Note: Productivity is total sales / employees, measured as a percentage of the average value of the 4-digit level industry. Columns labeled p1 – p99 refer to percentiles of the productivity distribution.

Table 2:   Share of exporters and non-exporters in the deciles of the productivity
distribution in manufacturing enterprises in Germany, 2009

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	West Germany		East Germany	
	Exporters (%)	Non-exporters (%)	Exporters (%)	Non-exporters (%)
Deciles				
1	49.85	50.15	48.79	51.21
2	59.94	40.06	46.01	53.99
3	67.71	32.29	48.12	51.88
4	70.86	29.14	49.78	50.22
5	76.90	23.10	56.81	43.19
6	78.49	21.51	61.10	38.90
7	81.35	18.65	63.62	36.38
8	81.25	18.75	62.99	37.01
9	80.86	19.14	69.42	30.58
10	78.68	21.32	71.70	28.30

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Note: Productivity is total sales / employees, measured as a percentage of the average value of the
4-digit level industry.

Table 3: Share of exports in total sales for exporting manufacturing enterprises in the deciles of the productivity distribution in Germany, 2009

Deciles	West Germany			East Germany		
	Mean	p1	p99	Mean	p1	p99
1	23.22	0.04	97.77	24.35	0.02	100.0
2	23.47	0.06	90.83	19.47	0.02	87.27
3	24.66	0.05	92.37	18.76	0.03	92.00
4	25.47	0.06	88.42	20.31	0.06	95.74
5	26.74	0.04	91.83	20.58	0.07	80.96
6	28.53	0.07	91.28	22.11	0.02	93.53
7	30.69	0.07	94.52	22.88	0.03	93.01
8	32.72	0.06	94.04	23.87	0.03	89.11
9	35.73	0.13	94.19	28.56	0.03	99.42
10	38.37	0.06	98.65	34.41	0.01	99.99

Note: Productivity is total sales / employees, measured as a percentage of the average value of the 4-digit level industry. Columns labeled p1 and p99 refer to percentiles of the distribution of the share of exports in total sales

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Table 4:   Share of continuous exporters over the period 2008 – 2010 in all
             exporting firms in the deciles of the productivity distribution in
             manufacturing industries in Germany

Deciles (% of firms)	West Germany	East Germany
1	79.89	79.44
2	84.96	80.14
3	88.55	84.12
4	90.66	86.67
5	91.83	87.03
6	90.56	86.51
7	92.34	86.84
8	92.26	88.12
9	92.24	88.84
10	92.73	90.43

Note: Productivity is total sales / employees in 2009, measured as a percentage of the average
        value of the 4-digit level industry. The entries in the table are the percentage shares of firms
        that exported in each year between 2008 and 2010 in all firms that exported in at least one
        year between 2008 and 2010.

Table 5:   Number of goods exported by manufacturing enterprises in the deciles
            of the productivity distribution in Germany, 2009

	West Germany				East Germany			
No. of goods	1	2-5	6-9	>= 10	1	2-5	6-9	>= 10
Deciles (share of firms; %)								
1	22.4	34.6	14.5	28.5	27.1	35.4	16.7	20.8
2	17.7	35.3	14.0	33.0	27.1	39.1	17.7	16.1
3	16.1	31.9	13.6	38.4	21.7	39.1	15.9	23.3
4	14.4	30.5	13.9	41.2	21.8	39.9	14.5	23.8
5	12.5	29.0	14.2	44.3	16.5	35.6	13.8	34.0
6	12.8	26.1	14.8	46.2	11.3	40.2	16.5	32.0
7	11.1	25.1	13.1	50.7	19.2	36.3	15.5	29.0
8	11.0	24.7	13.0	51.2	13.4	39.7	11.9	35.0
9	9.9	22.7	12.1	55.4	16.1	30.0	16.6	37.3
10	8.1	23.6	10.9	57.5	11.5	26.6	14.6	47.4

Note: Productivity is total sales / employees, measured as a percentage of the average value of the
        4-digit level industry. The entries in the table are the shares of firms from a decile of the
        productivity distribution with the number of products exported listed in the column header.

Table 6: Number of countries exported to by manufacturing enterprises in the deciles of the productivity distribution in Germany, 2009

No. of countries	West Germany				East Germany			
	1	2-5	6-9	>= 10	1	2-5	6-9	>= 10
Deciles (share of firms; %)								
1	16.1	24.4	14.4	45.1	19.3	32.8	12.5	35.4
2	12.6	21.4	12.0	54.0	20.3	30.7	16.7	32.3
3	9.9	16.4	13.6	60.1	16.9	28.0	15.3	39.7
4	9.3	15.2	10.4	65.1	15.0	28.0	12.4	44.6
5	7.8	14.6	11.0	66.6	12.2	29.1	15.3	43.4
6	7.4	14.6	8.9	69.1	8.8	19.1	13.9	58.3
7	5.0	12.5	11.1	71.5	11.4	22.3	13.0	53.4
8	6.2	12.3	9.5	72.1	9.8	19.6	11.9	58.8
9	3.9	11.9	10.4	73.9	7.3	18.1	13.0	61.7
10	3.2	10.5	11.1	75.2	6.3	20.3	9.9	63.5

Note: Productivity is total sales / employees, measured as a percentage of the average value of the 4-digit level industry. The entries in the table are the shares of firms from a decile of the productivity distribution with the number of countries exported to listed in the column header.

Table 7:   Share of exporting manufacturing enterprises with one good exported to one country in the deciles of the productivity distribution in Germany, 2009

Deciles (share of firms; %)	West Germany	East Germany
1	10.85	15.63
2	7.51	14.58
3	5.60	12.70
4	5.99	9.33
5	4.43	7.41
6	4.49	5.15
7	2.95	6.74
8	4.23	5.15
9	2.28	4.15
10	1.76	3.65

Note: Productivity is total sales / employees, measured as a percentage of the average value of the 4-digit level industry. The entries in the table are the shares of firms in all exporting firms from a decile of the   productivity distribution that export one good to one country only.

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