WORKING PAPER

Exports, Foreign Direct Investment and Productivity: Evidence from German Firm Level Data

by

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Evidence from German firm level data

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Abstract:

This paper presents the first empirical test with German establishment level data of a hypothesis derived by Helpman, Melitz and Yeaple in a model that explains the decision of heterogeneous firms to serve foreign markets either trough exports or foreign direct investment: only the more productive firms choose to serve the foreign markets, and the most productive among this group will further choose to serve these markets via foreign direct investments. Using a non-parametric test for first order stochastic dominance it is shown that, in line with this hypothesis, the productivity distribution of foreign direct investors dominates that of exporters, which in turn dominates that of national market suppliers.

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1. Motivation

Kicked-off by the Brookings paper of Bernard and Jensen (1995) a new literature emerged during the past ten years that used longitudinal data for hundreds of thousands of plants from various countries to demonstrate that exporters and non-exporters differ within industries. A survey of 45 microeconometric studies with data from 33 countries that were published between 1995 and 2004 finds that, details aside, exporters are more productive than their counterparts which sell on the domestic market only, and that the more productive firms self-select into export markets, while exporting does not necessarily improve productivity (Wagner 2005).

This empirical literature inspired a number of theoretical papers that drop the assumption of a representative firm and investigate the behaviour of heterogeneous firms in general equilibrium models of open economies. These theoretical models in turn generate testable hypotheses, and serve as a catalyst for a new generation of microeconometric studies of international activities of firms. A case in point is the multi-country, multi-sector general equilibrium model of Helpman, Melitz and Yeaple (2004) (henceforth, HMY) that explains the decision of heterogeneous firms to serve foreign markets either trough exports or foreign direct investment (FDI). They show that, in equilibrium, only the more productive firms choose to serve the foreign markets, and the most productive among this group will further choose to serve these markets via FDI.

Three empirical papers take the HMY-model as a point of departure. Head and Ries (2003) use data for Japanese firms; they find that firms that only serve the domestic market tend to be smaller than firms that export and firms that do FDI. Investors who also export are generally larger than exporters who do not have overseas investment. Production function residuals

yield much weaker relationships with firm type; orderings vary across samples and differences are uniformly small. Girma, Kneller and Pisu (2003) and Girma, Görg and Strobl (2004) use data from the UK and Ireland, respectively. Both papers test for stochastic dominance between the productivity distributions of the various types of firms. While Girma, Kneller and Pisu (2003) find robust support for the HMY hypothesis for UK firms – the productivity distribution of multinational firms dominates that of export firms, which in turn dominates that of non-exporters – Girma, Görg and Strobl (2004) find for Irish firms that the distribution for multinationals dominate that of domestic exporters and non-exporters, while they do not find clear differences in plant performance between domestic exporters and non-exporters.

This paper contributes to the literature by providing the first empirical study on the HMY hypothesis with data from Germany, one of the most important actors on the world market for goods and services. Section 2 discusses the empirical strategy and the plant level data used; section 3 presents the empirical results; section 4 concludes.

2. Empirical strategy and data

The empirical strategy used here to test the HMY hypothesis closely follows the approach applied by Girma, Kneller and Pisu (2003) and Girma, Görg and Strobl (2004). It uses a non-parametric test for first order stochastic dominance of one distribution over another that was introduced into the empirical literature on exports and productivity by Delgado, Farinas and Ruano (2002): Let F and G denote the cumulative distribution functions of productivity for two groups of firms (say, exporters and firms that serve the national market only). First order stochastic dominance of F relative to G is given if $F(z) – G(z)$ is less or equal zero for all z with strict inequality for some z. Given two independent random samples of plants from each

group, the hypothesis that F is to the right of G can be tested by the Kolmogorov-Smirnov test based on the empirical distribution functions for F and G in the samples (for details, see Conover 1999, p. 456ff.). Note that this tests not only for differences in the mean productivity of both groups (like in almost all other papers in the literature on trade and productivity) but for differences in all moments of the distribution.

The data used in this note were collected in personal interviews with firm owners or top managers. The population covered encompasses all manufacturing establishments with at least 5 employees in the German state of Lower Saxony. From this population a random sample (stratified by industry and size classes) was interviewed. Detailed information on the data set and how it can be accessed by researchers is given in Gerlach, Hübler and Meyer (2003). One great advantage of this survey for the investigation performed here is that it has information on whether or not a plant was an exporter, or a foreign direct investor, in 1995. Therefore, we can distinguish three groups of establishments: Those selling on the national market only, exporters without foreign direct investment, and foreign direct investors (which may or may not be exporters, too). A disadvantage (which is common in this kind of survey data; see e.g. Girma, Görg and Strobl 2004) is that we do not have information on the capital stock; therefore, we cannot calculate total factor productivity. Instead, we use value added per employee as an indicator for labour productivity. To mitigate concerns that performance differences simply reflect differences in the sectoral composition of the three firm types, and following Girma, Görg and Strobl (2004), value added per employee is calculated relative to the two-digit industry mean, and is in logged values.

3.   Results

The sample used here is made of 531 manufacturing establishments. 198 of them sell their products on the national market only; 263 are exporters without foreign direct investments; 70 are foreign direct investors (all but one of these are exporters, too). Note that the large share of internationally active firms in the sample is due to oversampling of larger firms. According to table I the ranking of the mean values for value added per employee (calculated relative to the two-digit industry mean, and logged) conforms with the HMY hypothesis: foreign direct investors outperform exporters, which in turn outperform national market suppliers. A t-test for differences in the means reveals that this ranking is statistically significant at any conventional error level.

Results of the two-sample Kolmogorov-Smirnov tests show that not only the means of the productivity distributions are ranked in this way. Using a conventional error level of five percent, we find that in line with the HMY hypothesis the productivity distribution of foreign direct investors dominates that of exporters, which in turn dominates that of national market suppliers.

4. Conclusions

This paper presents the first empirical test with German establishment level data of a hypothesis derived by Helpman, Melitz and Yeaple (2004) in a model that explains the decision of heterogeneous firms to serve foreign markets either trough exports or foreign direct investment, namely that only the more productive firms choose to serve the foreign markets and the most productive among this group will further choose to serve these markets via foreign direct investments. Using a non-parametric test for first order stochastic

dominance it is shown that, in line with this hypothesis, the productivity distribution of foreign direct investors dominates that of exporters, which in turn dominates that of national market suppliers.

These results are in line with the findings by Girma, Kneller and Pisu (2003) for the UK, while Girma, Görg and Strobl (2004) report results for Ireland that differ with respect to the difference between exporters and plants that supply to the national market only. As suggested by Girma, Kneller and Pisu (2003, p. 15) it would therefore be beneficial to investigate this topic with the same methodology, but for different countries and time periods, to learn more about the circumstances under which the HMY hypothesis is or is not supported by the data. This could help to understand an important aspect of the relationship between productivity and international activities of firms, a topic that is not least important because it is linked to the wider theme of the role played by trade and foreign direct investment for growth in general.

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Table I

Results of the empirical investigation

		National market suppliers	Exporters	Foreign direct investors
Number of establishments		198	263	70
Value added/employee	mean	4.384	4.530	4.700
	standard deviation	0.484	0.430	0.407

	National market suppliers vs. exporters	National market supplier vs. foreign direct investors	Exporters vs. foreign direct investors
Prob-values of t-tests for differences in the means[1]			
Value added/employee	0.000	0.000	0.001
Prob-values of two-sample Kolmogorov-Smirnov test[2]			
Value added/employee	0.002	0.000	0.031

[1] Test of H_0: mean of first group equal to mean of second group against H_a: mean of first group smaller than mean of second group
[2] Test of H_0: distributions are equal against H_a: distribution of second group stochastically dominates distribution of first group

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