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Abstract: This note uses a tailor-made new data set to investigate for the first time the link between the quality of a firm's exports and the distance to destination countries for Germany. To anticipate the most important result, it is shown that the quality of exported goods and the distance to destination countries are *not* statistically positively correlated.

Keywords: Exports, export quality, distance, Germany

JEL Classification: F14

* All computations were done at the Research Data Centre of the Statistical Office of Berlin-Brandenburg in Berlin. The firm-level data used are strictly confidential but not exclusive; see <http://www.forschungsdatenzentrum.de/datenzugang.asp> for information on how to access the data. To facilitate replications the Stata do-file used is available from the author on request.

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1. Motivation

In a recently published paper Feenstra and Romalis (2014) present a theoretical model where firms, in addition to choosing the price, simultaneously choose quality subject to non-homothetic demand in an extended monopolistic competition framework. They show that in this model of endogenous quality choice by firms goods of higher quality are shipped longer distances. This positive relationship between quality of exports and distance to destination countries follows from the first-order condition of firms for optimal quality choice (see Feenstra and Romalis (2014) for details). Bastos and Silva (2010, p. 100) discuss other recent theoretical models that relate the quality of exported products to the distance of destination countries and argue that the systematic increase of unit values (used as proxy variables for the quality of goods) with distance is linked to self-selection of heterogeneous firms across destinations, with only higher quality producers entering more distant markets.

Empirical evidence on the relationship between quality of exports and distance to destination countries is scarce. Bastos and Silva (2010, p. 99) termed the quality of exports and its drivers “a relatively unexplored dimension of firms’ cross-border activities”. Using Portuguese firm-level data on exports by product and destination market from 2005, they find that export unit values (used as the proxy-variable for export quality) increase systematically with distance.

As yet, comparable evidence for Germany has not been reported in the literature. This can be considered as an important gap in knowledge for at least two reasons. First of all, Germany is one of the most important actors on the world market

for goods.¹ Empirical evidence on the relation between export quality and distance to destination countries for this large “global player”, therefore, is interesting in itself. Second, Germany is a high-wage economy, and the international competitiveness of goods produced in Germany is widely considered to depend on non-price factors, especially on product quality.² Further evidence on the role of quality of exported goods in shaping the spatial distribution of German exports, therefore, adds to our knowledge with regard to an important aspect of international competitiveness of German manufacturing firms.³

This note uses a tailor-made new data set to investigate for the first time the link between the quality of a firm’s exports and the distance to destination countries for Germany. To anticipate the most important result, contrary to both the implications of the theoretical model by Feenstra and Romalis (2014) and other recent models, and to the empirical results reported for Portuguese firms by Bastos and Silva (2010), it is shown that the quality of exported goods and the distance to destination countries are *not* statistically positively correlated.

The rest of the paper is organized as follows. Section 2 discusses the data and measurement issues. Section 3 presents the results of the empirical investigation. Section 4 concludes.

¹ According to the World Trade Organization’s World Trade Report 2012 Germany hold rank 3 among the exporters of goods in 2011 with a share of 8.1 percent; see World Trade Organization (2012, p. 30).

² See the recent report by the Federal Ministry of Economics and Energy (Bundesministerium für Wirtschaft und Energie (2014)).

³ Other aspects of the quality of exports by German firms discussed in recent papers are the role of high-quality goods for the international competitiveness of low-productive exporters (Wagner 2014a), the relation between high-quality inputs and high-quality exports (Wagner 2014b) and the links between firm profitability and quality of exports (Wagner 2014c).

2. Data and measurement issues

The lack of empirical studies for Germany on the link between the distance to destination countries and the quality of exported goods is due to the fact that until most recently suitable data at the level of the firm that could be used in an econometric investigation were not available. The empirical investigation here uses a tailor-made data set that combines for the first time high quality firm-level data from two official sources with data on the distance between Germany and destination countries of exports.

Information on the goods traded internationally 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*).⁴ 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 2010 these transaction-level data have been aggregated at the level of the exporting firm. Using the firms' registration number for turnover tax statistics these data were matched with the enterprise register system (*Unternehmensregister-System*) and with the enterprise level data from the two other sources discussed above. For each exporting firm that reported either to the statistic

⁴ Note that firms with a value of exports to EU-countries that does not exceed 400,000 Euro 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.

on intra-EU trade, or to the statistic on trade with countries outside the EU, we know from the data the value and the volume of exports for the ten most important exported goods. This information is used to compute an index for the quality of exports. Furthermore, this data has information about the ten most important destination countries of exports and the value of exports to these countries. Combined with information on the distance between Germany and each of the destination countries this information is used to compute an index of the distance of exports of a firm. Details on the construction of these two indices are given below.

The second source of firm level information 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 other data sources (described below). From this survey information is used on a number of control variables included in the empirical models.

Data on distance between Germany and the destination countries of exports are taken from the CEPII's *GeoDist* database (Mayer and Zignago 2011). The "distw" – measure is used that calculates the distance between two countries based on bilateral distances between the biggest cities of those two countries, those inter-city distances being weighted by the share of the city in the overall country's population (see Mayer and Zignango (2011, p. 11) for details).

With these data it is possible to investigate the relationship between the quality of goods exported and the distance to the destination countries.

The *quality of exported goods* is defined as the unit value of exports and computed as value of exports (measured in Euro) over quantity of exports (measured in tons). This measure of quality is widely used in the empirical literature. While it is far from perfect, it can be considered as a suitable proxy-variable, because the “unit values of internationally traded goods are heavily influenced by quality” (Feenstra and Romalis (2014, p. 477)). In the data set used here we have information on the value of exports and the quantity of exports for the ten most important products (measured by the value of exports) exported by a firm. For firms that exported more than one good the unit value of exports is the weighted sum of the unit values of the (up to ten) different goods exported, and the weights are the shares of the value of exports of a good in the total exports of the firm of these (up to ten) goods.

Distance to export destination is measured by the distw-index between Germany and the destination country provided in the CEPII database (that is discussed above). For firms that exported to more than one country distance is computed as the weighted sum of the distance to (up to ten) destination countries, and the weights are the shares of the value of exports to a country in the total exports of the firm to these (up to ten) countries.

The empirical model includes a number of control variables. The *number of employees* (also included in squares to take care of non-linearity) is included to control for any relationship between firm size and distance to destination countries. Furthermore, a complete set of *4-digit level industry dummy variables* is included to control for the role of industry-specific factors related to take care of differences across industries due to the nature of the products (e.g., mobile phones and cement).

Given that the East German economy still differs in many respects from the West German economy, especially with regard to exporting (see Wagner (2008)),

and that the number of exporting firms is small in East Germany this study looks at West German manufacturing enterprises only.

3. Results

The sample used in the empirical investigation is made of 10,746 enterprises with complete information on the index of distance to export destination countries and the index of quality of exports in 2010. Descriptive statistics for both indices are reported in Table 1. The distance index varies between 378 kilometers (which refers to a firm with exports to Luxembourg only) and more than 8,500 kilometers at least.⁵ The index of export quality varies widely between next to zero and next to 1,700. Note, however, that these are unconditional descriptive statistics that do not control for the industries the firms are in. Therefore, the large range between the top and the bottom of the (weighted sum of the) value-to-weight ratio comes at no surprise – think, for example, of mobile phones and cement. This fact points to the need to control for detailed industry affiliation of the firms in an empirical investigation of the relation between distance to export destination countries and quality of exports.

[Table 1 near here]

Descriptive statistics on the share of exports and the distance to destination countries by the ten most important destination countries of exports are reported in Table 2. While 10.8 percent of all firms exported to a single destination country only, 68 percent exported to ten or more countries. However, the shares of exports among

⁵ Note that the minimum and maximum values of both indices cannot be reported because they refer to a single firm and, therefore, this information is confidential.

all exports to the ten most important destination countries declines rather rapidly from the most important to less important countries. On average, nearly half of all exports are shipped to the most important destination, and the top five destinations cover on average 87 percent of all exports. Interestingly, the average distance to the destination countries served by a firm does not vary much between firms that export to different numbers of countries. Multi-country exporters do not systematically serve markets that are farther away from Germany.

[Table 2 near here]

To investigate the link between the distance to destination and the quality of exports regression models are estimated with the value of the index of distance to export destination countries as the dependent variable and the value of the index of the quality of the goods exported by a firm plus controls as the independent variables. Note that these regressions are not meant to explain the distance to destination countries of exports by the firms – they are just empirical models to look for the presence and size of any correlation between export quality and distance to destinations of the firms, controlling for other firm characteristics. That said, results for two models are reported in Table 3. Model 1 includes only the detailed 4-digit industry dummy variables as control variables, while model 2 controls for firm size (measured by the number of employees, also included in squares to control for a non-linear relationship), too.

[Table 3 near here]

The most important result is that the link between the distance to destination countries and the quality of exported goods is positive but statistically insignificant at any conventional level. The point estimates for the regression coefficient of the export quality index and the prob-values do not differ between the two empirical models, so controlling for firm size does not change the big picture.⁶ A glance at the point estimates for export quality reveals that even if the regression coefficients were statistically significantly different from zero, the link with the distance index would have to be considered to be non-existent from an economic point of view. A *ceteris paribus* increase of the quality index by 154 (the unconditional mean of this index according to Table 1) is linked to an increase in the index of the distance to destinations by 3.6 kilometers according to the results of model 1, and this is next to zero.. An increase of quality by one standard deviation (i.e. by 1728.43) means an increase of the estimated distance to destination by 39.8 kilometers, again a tiny amount.

4. Discussion

Results of the empirical investigation presented in section 3 are neither in line with the implication of the theoretical model by Feenstra and Romalis (2014) or other recent models that discuss the link between the quality of exported goods and the

⁶ Firm size serves as control variable only. Therefore, we will not discuss the results for the coefficient estimates at some length. Suffice it to say here that the estimates point to a hump-shaped relation between firm size and distance to destination markets. However, the estimated maximum of this link is reached for 133,896 employees and the firm at the 99th percentile of the distribution of the number of employees has 1,923 employees only. Therefore, the estimation results indicate that larger firms tend to export to more distant markets. Note that the index of export quality and firm size are uncorrelated in the sample ($r = 0.0033$).

distance to destination countries, nor are they in line with the empirical results reported for Portuguese firms by Bastos and Silva (2010).

One reason for this empirical finding is the spatial distribution of German exports. In 2010 (the year the data analyzed here are from) 71 percent of all exports went to countries in Europe⁷ where differences in distance to destination countries do not matter (much).

Another reason is that even if the distance to destination countries is large (like in the case of China with a share in total exports of 5.65% or the US with a share of 6.89% in total German exports in 2010) distance related transport costs do not matter much (if at all) in the age of containers that are used to ship goods around the world at next to no costs.⁸ Practitioners in world trade are well aware of this. Michael Behrendt, CEO of Hapag-Lloyd (one of the biggest players on the world market for container transportation), pointed out in 2008 that it costs 10 Dollar to ship a TV-set from China to Europe, one Dollar to ship a vacuum cleaner, and one cent to ship a bottle of beer.⁹ Economists realized this, too. As Glaeser and Kohlhase (2004, p. 199) put it, today “it is better to assume that moving goods is essentially costless than to assume that moving goods is an important component of the production process. (...) Certainly it is an exaggeration to claim that moving goods is free, but it is becoming an increasingly apt assumption.” If shipping costs are tiny even over large distances, relative shipping costs for high-quality high-price goods and low-quality

⁷ See the Statistical Yearbook published by the German Statistical Office (Statistisches Bundesamt, Statistisches Jahrbuch 2012, p. 415).

⁸ See Levinson (2006) for a comprehensive discussion of the role of container transport in world trade.

⁹ See the interview in Der Spiegel 1/2008, p. 62-63.

low-price goods do not differ much, and not only high-quality goods are shipped over longer distances.

To put it differently, the lack of any systematic relation between quality of exports and distance to destination countries for German exports reported in this study for the first time points out that high quality of exports matters irrespective of the destination country.

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Table 1: Distance to destination countries and export quality, West German firms, 2010

| | Distance to destination countries (index) | Quality of exports (index) |
|--------------------|---|----------------------------|
| Mean | 2258.23 | 154.03 |
| Standard deviation | 2103.09 | 1728.43 |
| p1 | 378.00 | 0.24 |
| p10 | 546.86 | 1.78 |
| p50 | 1284.98 | 16.15 |
| p90 | 5592.43 | 174.23 |
| p99 | 8576.41 | 1681.67 |
| Number of firms | 10,746 | 10,746 |

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Note: For a detailed definition of the indices of distance to destination countries and export quality see text. p1, ..., p99 refer to the 1st, ..., 99th percentile of the distribution of the index (minima and maxima cannot be reported due to violation of privacy).

Table 2: Share of exports and distance to destination by 10 most important countries

| Country | Number of exporters with at least 1, 2, ..., 10 different destination countries | Average share of exports to destination country 1, 2, ..., 10 (percent) | Average distance to destination country 1, 2, ..., 10 (index) |
|---------|---|---|---|
| 1 | 10,746 | 45.49 | 2282.64 |
| 2 | 9,583 | 18.35 | 2319.82 |
| 3 | 9,358 | 10.67 | 2338.68 |
| 4 | 9,024 | 7.15 | 2334.57 |
| 5 | 8,786 | 5.18 | 2383.51 |
| 6 | 8,489 | 3.93 | 2411.69 |
| 7 | 8,219 | 3.08 | 2442.99 |
| 8 | 7,974 | 2.45 | 2639.32 |
| 9 | 7,704 | 2.01 | 2595.58 |
| 10 | 7,318 | 1.66 | 2,631.27 |

Note: For a detailed definition of the indices of distance to destination countries and export quality see text. p1, ..., p99 refer to the 1st, ..., 99th percentile of the distribution of the index (minima and maxima cannot be reported due to violation of privacy).

Table 3: Distance to destination countries and quality of exports: Regression results

| | | Dependent variable: Distance to export destination countries (index) | |
|-----------------------------------|---------|--|----------|
| Enterprise characteristic | Model | 1 | 2 |
| Quality of exported goods (index) | β | 0.023 | 0.022 |
| | p | 0.160 | 0.170 |
| Number of employees | β | | 0.111 |
| | p | | 0.001 |
| Number of employees (squared) | β | | -8.29e-7 |
| | p | | 0.009 |
| Constant | β | 2254.74 | 2232.88 |
| | p | 0.000 | 0.000 |
| 4-digit industry controls | | yes | yes |
| R-squared | | 0.175 | 0.176 |
| No. of enterprises | | 10,746 | 10,746 |

Note: OLS regressions. β is the estimated regression coefficient, p is the prob-value (based on heteroscedasticity-consistent standard errors). For a detailed definition of the variables see text.