



# Patterns and Determinants of Variety and Quality of Intra-European Trade

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Preliminary Version (ETSG 2007 - Athens)

## Abstract

Trade patterns hide variety and quality components. Using detailed data on export flows, this paper studies the determinants of variety and quality of trade among European Union member states. It confirms the earlier findings that country size and income play an important role. Additionally we find that at the sectoral level variety and quality of trade is driven by innovativeness and international technological spillovers. Finally geographical distance between EU-countries lowers the variety and volume of trade, but has a positive effect on the quality of exported varieties.

Keywords: International Trade, Technological Spillovers, Quality  
JEL: F10, F15

## 1 Introduction

In this paper we will study the evidence of variety and quality of trade among European Union member states. New trade theory predicts that countries produce and export different varieties of goods. These varieties can be either horizontally (by characteristics) or vertically (by quality) differentiated. Several authors have recently used very detailed (sectoral or product-level) export data to study the empirical evidence regarding the variety and quality of international trade, including a search for determinants of both variety and quality. This paper adds more empirical evidence to the existing literature. It is innovative first by exclusively focusing on the European Union, secondly by extending the existing methodology and finally by taking into account the role of technological innovation and spillovers as determinants of variety and quality of trade.

In order to study the importance of variety and quality in trade flows, total trade val-

ues are decomposed into variety and quality components. This can be done in several ways. One popular approach is to calculate intensive and extensive margins. A higher value of a nation's export can be the result from either a higher quantity and/or a higher price of exported products (the intensive margin), or from a higher number of varieties exported (the extensive margin). On the one hand, an increase in the extensive margin indicates an increase in the role of variety. An increase in the intensive margin, on the other hand, reflects further and successful specialization in the production of existing varieties. The intensive margin can further be decomposed into a quantity and a price component. Higher export prices, mostly proxied by export unit values (export value divided by export volume), are regarded as evidence for higher quality.

Recent empirical evidence points to considerable heterogeneity in variety and quality patterns in international trade (e.g., Schott (2004), Hummels and Klenow (2005), Kaplinsky and Santos-Paulino (2005), Broda and Weinstein (2004)). Once variety and quality are measured, one can look for explanations for observed variety- and quality-patterns. The majority of studies look into price differences (hence quality differences), but the interest for determinants of variety has recently increased as well. Schott (2004) shows that unit values of US manufacturing imports from different trading partners vary widely even within very detailed product categories. US import unit values are systematically higher for varieties originating in capital- and skill-abundant countries compared to those from labour-abundant countries. More capital-intensive techniques also cause higher export prices. Finally, over time capital- and skill-deepening countries experience an increase in unit values relative to the countries that they leave behind. Hummels and Klenow (2005) extend Schott's findings to more exporting countries and more import markets. Using 1995 trade data for 126 exporters for 59 import markets, Hummels and Klenow study the relationship between country size and variety and quality patterns using a decomposition into extensive and intensive components. There appears to be large heterogeneity among exporters in their extensive and intensive margins. It appears that larger countries export more especially as they export more varieties. This finding implies that the extensive margin is more important in larger economies' export patterns. Moreover country size has a bigger impact on the quantity component than on the price/ quality component of the intensive margin, although also prices are positively influenced by exporter size and income. Hence larger and richer countries export more units of the same varieties at modestly higher prices, equivalent to modestly higher quality exports. Kaplinsky and Santos-Paulino (2005) find evidence, based on a study of the evolution in unit values of imports into the European Union countries in a selected number of disaggregated manufacturing sectors, that unit-price trends vary with the type of economy exporting into the European Union and the type of product being exported. Low-income countries show in the period 1988-2002 a decline in their export prices for the European Union market, pointing to intense competition in the markets that they operate on. At the sectoral level, higher technological content appears to be a protection against falling export prices in the European Union.

Most of these arguments are supply-side determinants. However, also demand-side explanations have been formulated, inspired by the Linder-hypothesis (1961). Sev-

eral theoretical (general equilibrium) models have formalized the Linder hypothesis or related arguments (e.g., Falvey and Kierzkowski (1987) and Stokey (1991)). Flam and Helpman (1987) develop a formal model with North-South trade. Quality is part of the individual's utility function. Assuming that richer countries have a comparative advantage in producing high-quality goods, the overlap of income distributions between north and south is shown to be a source of trade. Several authors extend the Flam-Helpman model using income differences as source of trade between poor and rich countries (e.g., Copeland and Kotwal (1996) and Murphy and Shleifer (1997)). More recently, Fan (2004, 2005) develops a model with a combination of economies of scale and different quality preferences. He formally shows that this combination explains the observed trade patterns of intra-industry trade. Focusing on recent empirical work, Hallak (2005) develops a framework to estimate the impact of quality on bilateral trade. His results confirm the role of demand-side elements as richer countries tend to import relatively more from countries that produce high-quality goods. Also Funke and Ruhwedel (2001) conclude that per capita income positively affects both exports and imports across 19 OECD countries.

To summarize, many recent studies point to heterogeneity in the varieties and quality traded by countries. For the explanation of differences in export prices, hence for differences in quality of traded products, both demand-side and supply-side arguments have been formulated and tested. The literature hence clearly shows that importer's and exporter's income and size are important determinants of both variety and quality patterns. In addition, factor proportions contribute to the explanation of observed international export price differences.

### *Motivation and Topic*

In this paper, we focus on 11 member states of the European Union<sup>1</sup>. Apart from mapping the respective importance of variety and quality in European trade, we attempt to explain these patterns. The European Union is an interesting group of countries to study variety and quality of trade for several reasons. First, the European market is a custom's union. Hence the pattern of variety and quality will not be affected by barriers to trade, such as tariffs, quotas, etc. Secondly, the European Union is much more than a custom union, namely an integrated market. Within this integrated market several policies have been harmonized or transferred to the European level leading to a situation of fair competition among the member states (e.g., common European competition policy). Given this market situation, firms within the European Union market compete, much more than in other parts of the world, based on their real comparative advantages without being protected by discriminating barriers to trade. This implies that price differences for similar products, more than elsewhere, reflect differences in quality<sup>2</sup>. Hence we are more confident in interpreting our findings about price differences as evidence about quality differences. Nevertheless the European Union is

<sup>1</sup> These countries are Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Portugal, Spain, Sweden and the United Kingdom. Of the EU15 countries Luxembourg, Portugal, Greece and Austria have been excluded because of data limitations (see data section).

<sup>2</sup> Gil-Pareja and Sosvilla-Rivero (2004) show that export-price dispersion across European Union coun-

a heterogeneous group of countries. They differ in their characteristics (size, income, geographical location,...), but also in their economic structure, reflected in different sectoral specialization patterns. This motivates the current paper focusing on the impact of country and sectoral characteristics.

In order to study the determinants of variety and quality in intra-European trade flows, we opt for a specific approach. Following Hummels and Klenow (2005), we adapt Feenstra's (1994) definition of extensive and intensive margins. We further decompose the intensive margin into a quantity and price/ quality component. Similar to most earlier studies we use very disaggregated export data to calculate each of these trade components. Similar to Hummels and Klenow (2005) we also focus on bilateral trade among a selected group of countries instead of focusing on a single market (like e.g., Schott (2004) for the US). However, by focusing on European Union countries we select a group of countries with less trade distortions among each other. Unlike these related studies we want to take into account other determinants of variety and quality. In particular we are interested in the role of technology-indicators, both country-level and sector-specific indicators. Determining the role of sectoral characteristics for variety and quality of trade is not straightforward. Given the detailed level of export data it is impossible to relate at such detailed level variety and quality evidence to sectoral characteristics. Unfortunately such detailed product characteristics are not available. Therefore we have to construct sectoral indicators of quality and variety based on the product-level information for all products belonging to the sectors defined.

We investigate the role of technological performance as determinant of variety and quality of intra-European trade, controlling for the determinants found in earlier studies. There is extensive evidence in the literature that technological performance improves export performance (e.g., Grossman and Helpman (1991, 1995), Murphy and Shleifer (1997)). We investigate whether this is reflected also at the product level, and whether technological performance increases either the number of varieties exported, or the quality of traded varieties. Good export performance, either reflected by the

export of new varieties or by a successful specialization in existing varieties, can be the result from a comparative advantage in the production of these goods. By focusing on technological performance, we study whether technological innovation can be the source of such comparative advantage. However, we do not limit our analysis to domestic innovation efforts only. We will also investigate whether international technology spillovers have an impact on variety and quality of trade. In order to do so we will measure the extent of technology spillovers among European Union countries, either through the trade or the foreign direct investment channel.

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tries is smaller than across OECD countries. In addition, export price convergence is larger in the European Union. This evidence can be considered as an indication that the European market is relatively highly integrated.

Apart from case studies for particular sectors or products, there is not much evidence about the relationship between trade and technology based on data at the product level. A notable exception is Anderton (1999) who shows, based on rather disaggregated trade data, that German and British imports are affected by innovation, quality and variety. Nevertheless Anderton does not directly relate quality and variety to innovation.

The remainder of this paper is organized as follows. In section 2 the methodology is explained and an empirical model is formulated. Section 3 describes the data sources. The empirical results are discussed in section 4. Section 5 concludes.

## 2 Methodology

### 2.1 Decomposing Trade into Variety and Quality

Total trade figures hide variety and quality characteristics of bilateral trade flows. Therefore we decompose bilateral export flows among European Union member states into extensive and intensive margins, and the latter further into quantity and quality components.

For the calculation of these margins we use the adaptations of Feenstra's (1994) methodology as applied by Hummels and Klenow (2005). We allow however for variation in these indicators in three dimensions, namely by exporting country, by importing country and by sector. One could add a time dimension, but we drop it here since we will perform a cross-sectional study in the empirical part of this paper. Hence for each import market  $m$  the extensive margin for sector  $i$ , composed of varieties (or products)  $k$  (with quantity  $x$  and price  $p$ ), from exporter country  $j$  to importing country  $m$  (both  $j$  and  $m$  belong to the European Union) is equal to

$$EM_{jmi} = \frac{\sum_{k \in K_{ijm}} p_{lmik} x_{lmik}}{\sum_{k \in K_{ilm}} p_{lmik} x_{lmik}} \quad (1)$$

$K_{ijm}$  is the set of observable products within sector  $i$  in which country  $j$  has non-zero exports to country  $m$ , hence  $x_{jmik} > 0$ . The entire European Union (EU-15), denoted by  $l$ , is used as reference "country". Hence  $K_{ilm}$  is the set of observable products within sector  $i$  in which the European Union has non-zero exports to country  $m$  during the period observed. According to this definition the extensive margin can be interpreted as the weighted number of varieties exported by country  $j$  to country  $m$

relative to the total weighted number of varieties exported by European Union countries to country  $m$ . The varieties are weighted by their importance in European Union exports to country  $m$ <sup>3</sup>.

The corresponding intensive margin is equal to

$$IM_{jmi} = \frac{\sum_{k \in K_{ijm}} p_{jmik} x_{jmik}}{\sum_{k \in K_{ijm}} pl_{mik} x_{lmik}} \quad (2)$$

The intensive margin hence measures the export market share of country  $j$  in total European Union exports to country  $m$  in those varieties which  $j$  exports to  $m$ . Note that the total market share in sector  $i$  of country  $j$  in total intra-European exports is equal to the product of the extensive and intensive margins, i.e.

$$EM_{jmi} IM_{jmi} = \frac{\sum_{k \in K_{ijm}} p_{jmik} x_{jmik}}{\sum_{k \in K_{ilm}} pl_{mik} x_{lmik}} \quad (3)$$

The intensive margin can further be decomposed into a quantity and a price (quality) component. For each sector  $i$  and each import market  $m$ , we construct a price index based on a weighted average of the export price of country  $j$ 's varieties in market  $m$  relative to the average export price of European Union exporters' varieties in market  $m$ . This price index is equal to

$$P_{jmi} = \prod_{k \in K_{ijm}} \left( \frac{p_{jmik}}{pl_{mik}} \right)^{w_{jmik}} \quad (4)$$

These relative prices are weighted by  $w_{jmik}$ , equal to the logarithmic mean of  $s_{jmik}$  (the share of variety  $k$  in country  $j$ 's exports to  $m$  in sector  $i$ ) and  $s_{lmik}$  (the share of variety  $k$  in European Union exports to  $m$  in sector  $i$ , where  $k \in K_{ijm}$ ), or

$$s_{jmik} = \frac{p_{jmik} x_{jmik}}{\sum_{i \in K_{ijm}} p_{jmik} x_{jmik}} \quad (5)$$

$$s_{lmik} = \frac{pl_{mik} x_{lmik}}{\sum_{i \in K_{ijm}} pl_{mik} x_{lmik}} \quad (6)$$

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<sup>3</sup> As Hummels and Klenow argue, this approach has the advantage that no bias can be caused by products mainly (or only) exported by a single European Union country to country  $m$ . The disadvantage is that the extensive margin can be large because a single country exports a small amount of many varieties in which the entire European Union exports a lot. Since Hummels and Klenow do not find evidence for the latter, the disadvantage is not likely to affect the results.

$$w_{jmik} = \frac{\frac{s_{jmik} - s_{lmik}}{\ln s_{jmik} - \ln s_{lmik}}}{\sum_{i \in K_{jmi}} \frac{s_{jmik} - s_{lmik}}{\ln s_{jmik} - \ln s_{lmik}}} \quad (7)$$

At the individual product level, it holds that the intensive margin is equal to

$$IM_{jmi} = P_{jmi} X_{jmi} \quad (8)$$

$X_{jmi}$  is the quantity index corresponding to the price index.

In the empirical part of this paper we will compute the extensive margin, the intensive margin and the quality and quantity components for each European Union exporter in each European Union member state market for several sectors. We focus on the sectors within the manufacturing sector. We then regress these indicators on a number of country and sector characteristics (see below). This entire analysis is similar to Hummels and Klenow's work. However, there are two important differences in our approach. First, we use only intra-European Union trade flows in order to reduce the impact of trade policies and other hampering barriers to trade on the results. Trade policies and barriers to trade affect in particular the price of exported goods, hence our study reduces such possible bias. Secondly, we calculate the indicators at the sectoral level instead of at the country level. This allows us to take into account sectoral characteristics. In particular we will focus on the role of technological indicators on the variety and quality pattern of intra-European trade.

## 2.2 Empirical Model and Estimation Methodology

For each sector and for each exporter in each import market we construct the extensive margin, the intensive margin, and the quantity and quality components of the intensive margin. Each of these margins or components (generally denoted by  $Q_{jmi}$ ) are regressed on a number of country and sectoral characteristics. We estimate the following model (all variables in natural logs):

$$\begin{aligned} Q_{jmi} = & \alpha + \alpha_i + \beta_1 GDP_j + \beta_2 GDP_m + \beta_3 \left( \frac{GDP_j}{POP_j} \right) \\ & + \beta_4 \left( \frac{GDP_m}{POP_m} \right) + \beta_5 TECH_{ji} + \beta_6 SPIL_{ji} \\ & + \beta_7 DIST_{jm} + \varepsilon_{jmi} \end{aligned} \quad (9)$$

As to country-level characteristics, we take into account, following the earlier evidence, the role of country size (GDP) and income (GDP per capita) of both the importer and exporter country. At the sectoral level, we try to answer two questions. First, we wonder whether the technological performance of the exporter country has a statistically significant impact on the variety and/or quality of its sectoral bilateral trade. Secondly, we investigate whether additionally international technological spillovers matter for variety and quality of trade. We control for unobserved fixed effects at the sectoral level. We estimate this model by OLS. Since we take into account fixed effects in the panel data (without time dimension, but with sectoral/exporter/importer-dimensions), this corresponds to a fixed-effects (within) estimator. Given the evidence of heteroskedasticity, we correct for it by clustering at sector-country level.

We use two different measures for technological innovativeness (both denoted in the empirical specification by  $TECH_{ji}$ ). Each of these indicators measure the technological performance of a particular sector  $i$  in a particular exporting country  $j$ , relative to the overall technological performance of country  $j$ . Further each indicator is expressed relative to its counterpart at the total European Union level (defined as the 11 countries included). By using a measure of relative technological performance we control for the impact of country size on absolute technological performance<sup>4</sup>. The three different indicators we use, are:

- The share of R&D expenditures by country  $j$  in sector  $i$  in total manufacturing R&D expenditures by country  $j$ ;
- The share of the number of patents<sup>5</sup> granted in the USA to European country  $j$  in sector  $i$  in the total number of patents granted in the USA to country  $j$  (stock calculated by perpetual inventory method for period 1980-2004).

These technological indicators reflect different measurement techniques of technological performance as applied throughout the literature. The patent indicator is an output innovation indicator, reflecting successful innovation efforts at the sectoral level. On the other hand, innovation efforts are not always successful, and hence do not always lead to patent grants. Therefore we alternatively measure technological innovation by R&D expenditures (so called input innovation indicator).

Apart from indicators of technological performance, we also take into account indicators of international technological spillovers ( $SPIL_{ji}$ ). There is considerable evidence that such spillovers take place, in particular between open economies (see e.g., Keller (2004) for an overview). Although many approaches are possible, we focus on intra-European intra-sectoral technology spillovers in this paper. Such spillovers may have an impact on diverse economic phenomena (e.g., Coe and Helpman (1995) show that TFP is positively influenced by technological spillovers from trading partners). We distinguish between two indicators, inspired by the two main channels through which spillovers take place, i.e. imports and foreign direct investment. Hence

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<sup>4</sup> Moreover by defining the technological indicators relative to the European Union level, we are able to measure both sectoral-specific and country-specific performance relative to competing sectors and countries.

<sup>5</sup> We use fractional counts.

we take the sum of the total number of patents granted to each EU-country in the US in sector  $i$  weighted by respectively:

- import share of each country in total EU imports by country  $j$ ;
- stock of foreign direct investment share of each country in total stock of EU foreign direct investments in country  $j$ .

Finally, we add distance ( $DIST_{jm}$ ) between the capital cities of the exporting and importing country to the empirical specification. By doing so, we test the so-called "Alchian-Allen" conjecture that the quality composition of exports increases with the distance between trading partners (Hummels and Skiba (2004)).

### 3 Data Description

Trade data are taken from the United Nations (2007) Commodity Trade Statistics Database. We use the most detailed data available, i.e. export flows at the 6-digit level of the Harmonised System (version 2002). According to this classification total trade flows are divided into 5017 product categories. In order to compute the extensive and intensive margins, and the quantity and quality components of the latter, we aggregate these data at the sectoral level (23 manufacturing sectors - see Figure 1). We aggregate at the 2-digit ISIC rev. 3 classification. Hence each product is assigned to a particular ISIC rev. 3 sector, according to a conversion table between the two classifications<sup>6</sup>. At the 2-digit ISIC rev. 3 level we can study the impact of sectoral characteristics on the sectoral indicators of variety and quality, which is impossible at more detailed levels since no such data for possible determinants are available.

The patent data come from the United States Patent and Trademark Office (USPTO). Patent data from the (large) US market can be considered as a proxy for the technological performance in the entire world. Data are converted from ussic to ISIC rev.3<sup>7</sup>. R&D expenditures and value added are taken from the OECD (2006) STAN database and the OECD (2006) Science, Technology and Industry Outlook. Distance (in km) is from [www.mappy.com](http://www.mappy.com). GDP and population data come from IMF (2007) Outlook Database. Foreign direct investment data are taken from the UNCTAD (2006).

Since R&D expenditures are not available at a comparable level for all countries for several years, we focus on the most recent year available, i.e. 2002.

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<sup>6</sup> More details on conversions between different classifications are available upon request.

<sup>7</sup> This is a rather original conversion. More details are available upon request.

## 4 Empirical Results

The large amount of data and dimensions in the data make it impossible to summarize the measurement of the extensive and intensive margin, and the quality and quantity components within the scope of this paper<sup>8</sup>. Generally speaking, we find considerable heterogeneity, in the sectoral as well as in the cross-country dimension. However, in comparison with the findings by Hummels and Klenow (2005), there appears to be less differences in the relative importance of variety and quality in intra-European trade than in trade in general. In this paper we hence concentrate on the determinants of the observed variety and quality patterns. The estimation results for the extensive margin and the intensive margin can be found respectively in Figures 2 and 3. Figures 4 and 5 show the results for respectively the price component (hence quality) and quantity component of the intensive margin. We estimate the same model for each of these dependent variables.

Our findings for intra-European export flows are in line with previous studies. We confirm the important role of income and country size in general. We start by discussing the size and income effects. As to income the extensive margin is positively affected by both exporter's and importer's income, overall across all sectors. Hence larger countries trade more at the extensive margin than smaller countries, i.e. larger countries export and import more varieties which causes higher total trade flows. Moreover, from Figure 3 we learn that also the intensive margin is positively affected by the size of exporting countries. It appears that larger economies export both at the extensive and intensive margin, but they import only at the extensive margin. So although they sell both a higher number of varieties and a higher value of their varieties (either resulting from higher quantities or higher prices) than other EU-countries, they spend more on foreign varieties whilst not buying more different varieties. Finally, from the decomposition into price and quantity components it becomes clear that larger countries export more of the same varieties but at a lower price. Hence they benefit from a volume effect, possibly created by production scale effects, which offers them a price advantage.

We now turn to the evidence about countries' income. Controlling for country size, there is some evidence that richer economies' exports and imports are less diversified, although the findings are not statistically significant in all model specifications. Hence the importance of variety is much more driven by countries' size than by countries' income. A possible explanation is that richer countries are more selective in the products that they buy and sell. In particular richer countries sell products at higher prices, which is equivalent to higher quality exports. Surprisingly richer countries do not seem to import higher quality products. These findings may of course be affected by the overall income elasticity we show here, regardless of the sectors. The income elasticities are likely to differ across sectors (and even within these sectors). We leave this issue for future research.

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<sup>8</sup> These figures are available upon request.

As to the effect of distance we can be very clear. It has a clearly negative effect, both on the extensive and intensive margin, hence both on the number and on the value of varieties traded. Separating the effect on prices and quantities, the results show that a larger distance between trading partners lowers the trade volume (equivalent to the trade reducing effect of larger trading and transportation costs). However, the effect on prices is to some extent positive. Hence there is some limited evidence (but no longer significant once controlling for technology effects) that more distant trading partners trade higher quality goods. This latter finding is a confirmation, although the evidence weak, of the Alchian-Allan conjecture in intra-EU trade.

Finally we discuss the effect of technological innovation and technological spillovers<sup>9</sup> on the variety and quality of intra-EU trade. The overall effect for patents on the number of varieties exported is positive, but we do not find a significant effect neither from R&D expenditures, nor from technological spillovers. The intensive margin is positively affected by innovation and technological spillovers - however in case of patents not always significantly - which implies that the value of trade rises if countries are technologically superior compared to other EU countries. Further decomposition shows that technological innovation affects both the volume and the price of traded goods. Taking patents and R&D separately, the volume of trade is increased by both whilst the quality of trade is positively affected by R&D expenditures, but not affected by successful patents. Taking patents and R&D together, the volume of trade is increased by successful patenting performance, but not by the size of R&D expenditures whilst the quality of trade is positively influenced by more R&D expenditures, but is negatively affected by more patents. Although this final result might seem surprising, it is not illogical. Since patents are a stock variable, they reflect a long-term successful technological position, which may be reflected in a cost advantage. R&D expenditures however lead to a short term success which enables firms to increase their prices. Finally international technological spillovers positively affect both quality and quantity of traded varieties.

## 5 Conclusion

We calculated the importance of variety and quality in intra-European trade. There appears to be considerable heterogeneity in sectoral and cross-country importance of variety and quality. We tried to explain this variation by looking into the role of technological innovation and international technological spillovers apart from the well-documented role played by income and country size.

Larger EU-countries sell both a higher number and a higher value of varieties than smaller EU-countries, but they sell them at a lower price. Although they do not buy more different varieties, larger countries spend more on foreign varieties. Richer coun-

tries select more high quality products and are less focused on variety in trade.

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<sup>9</sup> We only report the results for the international technological spillovers through the trade channel since the alternative results based on the FDI channel are always insignificant.

These findings call for more theoretical underpinnings. None of the existing trade models is able to account for these observed trade patterns all at once. Technological innovation and international technological spillovers are important sources for the competitive advantage of nations. The exact way in which they affect a country's export performance should be modeled in future research.

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<b>ISIC rev. 3 Sector</b>	<b>Description of the Sector</b>
15	Food
17	Textiles
18	Wearing Apparel
19	Leather
20	Wood
22	Printing
24	Chemicals (without Pharmaceuticals)
2423	Pharmaceuticals
25	Rubber and Plastic
26	Minerals
271+2731	Iron and Steel
272+2732	Non-Ferrous Metals
28	Fabricated Metal Products
29	Machinery and Equipment
30	Office Machinery
31	Electrical Machinery
32	Communication Equipment
33	Medical, Precision Instruments
34	Motor Vehicles
351	Building and Repairing of Ships and Boats
353	Aircraft and Spacecraft
352+359	Railroad and Other Transport Equipment
36	Other Manufacturing

Figure 1: Manufacturing sectors included in the study.

Dependent Variable: Extensive Margin	coefficient (SD)	coefficient (SD)	coefficient (SD)	coefficient (SD)	coefficient (SD)
exporter's income	0.17 *	0.16 *	0.08 *	0.16 *	0.13 *
	0.01	0.02	0.02	0.02	0.01
importer's income	0.08 *	0.07 *	0.06 *	0.06 *	0.06 *
	0.01	0.02	0.02	0.02	0.02
exporter's income per capita	-0.49 *	0.02	-0.39 *	-0.14	-0.13
	0.08	0.14	0.11	0.18	0.19
importer's income per capita	-0.08	-0.13	-0.13	-0.25 *	0.19
	0.07	0.08	0.11	0.12	0.01
distance	-0.19 *	-0.15 *	-0.20 *	-0.21 *	-0.21 *
	0.02	0.02	0.02	0.03	0.03
technological innovation - patents		0.06 *		0.09 *	0.07 *
		0.01		0.03	0.19
technological innovation - R&D			0.00	-0.03	-0.03
			0.01	0.03	0.03
technological spillovers - trade					0.00
					0.03
constant	5.31 *	0.60	5.60 *	4.02	3.41
	1.29	1.96	1.93	2.57	1.88
F.E.	yes	yes	yes	yes	yes
R <sup>2</sup> within	0.19	0.17	0.14	0.20	0.23
F	75.75	28.94	25.27	15.52	15.52

Fixed Effects Estimator - robust with clustering on sector-country dimension - (\*) = significant at 10 % level

Figure 2: Regression Results for the Determinants of the Extensive Margin in Intra-EU Trade.

Dependent Variable: Intensive Margin	coefficient (SD)	coefficient (SD)	coefficient (SD)	coefficient (SD)	coefficient (SD)
exporter's income	0.80 *	0.81 *	0.72 *	0.83 *	0.79 *
importer's income	0.03	0.04	0.03	0.05	0.05
exporter's income per capita	-0.03	-0.05	0.03	0.00	0.00
importer's income per capita	0.03	0.04	0.04	0.06	0.06
distance	0.01	0.33	0.57 *	0.31	0.30
technological innovation - patents	0.16	0.31	0.20	0.37	0.38
technological innovation - R&D	-0.39 *	-0.38	-0.49 *	-0.69 *	-0.71 *
technological spillovers - trade	0.17	0.23	0.26	0.32	0.32
constant	-0.67 *	-0.64 *	-0.64 *	-0.69 *	-0.74 *
F.E.	0.03	0.05	0.05	0.06	0.06
R <sup>2</sup> within		0.06 *		0.06	0.05
F		0.02	0.14 *	0.04	0.08
			0.03	0.06	0.07
	0.71 *	-2.38	-3.45	1.37	2.34
	2.83	4.63	4.00	6.17	4.39
	yes	yes	yes	yes	yes
	0.40	0.40	0.36	0.43	0.47
	296.30	119.09	100.84	60.15	89.33

Fixed Effects Estimator - robust with clustering on sector-country dimension - (\*) = significant at 10 % level

Figure 3: Regression Results for the Determinants of the Intensive Margin in Intra-EU Trade.

Dependent Variable: Price Component	coefficient (SD)	coefficient (SD)	coefficient (SD)	coefficient (SD)	coefficient (SD)
exporter's income	-0.10 *	-0.09 *	-0.04 *	-0.14 *	-0.09 *
	0.01	0.02	0.02	0.04	0.04
importer's income	0.00	-0.02	-0.02	-0.05	-0.01
	0.02	0.03	0.03	0.05	0.05
exporter's income per capita	0.50 *	0.22 *	0.49 *	-0.02	0.67
	0.07	0.13	0.11	0.17	0.13
importer's income per capita	-0.03	-0.12	-0.18	-0.39	-0.31
	0.11	0.17	0.17	0.31	0.22
distance	0.08 *	0.03	0.02	-0.08	0.03
	0.02	0.04	0.04	0.07	0.06
technological innovation - patents		-0.01		-0.20 *	-0.20 *
		0.02		0.07	0.04
technological innovation - R&D			0.03 *	0.09 *	0.10 *
			0.01	0.03	0.01
technological spillovers - trade					0.04 *
					0.00
constant	-4.54 *	-0.42	-2.62	5.90	3.45
	1.66	2.54	2.48	4.41	4.66
F.E.	yes	yes	yes	yes	yes
R <sup>2</sup> within	0.05	0.02	0.03	0.05	0.12
F	41.17	9.94	13.65	3.37	15.78

Fixed Effects Estimator - robust with clustering on sector-country dimension - (\*) = significant at 10 % level

Figure 4: Regression Results for the Price Components in Intra-EU Trade.

Dependent Variable: Quantity Component	coefficient (SD)	coefficient (SD)	coefficient (SD)	coefficient (SD)	coefficient (SD)
exporter's income	0.89 *	0.90 *	0.76 *	0.98 *	0.75 *
	0.03	0.04	0.04	0.07	0.07
importer's income	-0.03	-0.04	0.06	0.05	0.03
	0.03	0.05	0.05	0.08	0.09
exporter's income per capita	-0.49 *	0.11	0.07	0.33	0.45
	0.18	0.35	0.23	0.42	0.44
importer's income per capita	-0.33 *	-0.26	-0.34	-0.30	-0.40
	0.20	0.28	0.31	0.44	0.43
distance	-0.75 *	-0.67 *	-0.66 *	-0.61 *	-0.67 *
	0.04	0.06	0.07	0.10	0.14
technological innovation - patents		0.08 *		0.26 *	0.14 *
		0.03		0.09	0.07
technological innovation - R&D			0.10 *	0.05	0.07
			0.03	0.06	0.31
technological spillovers - trade					0.03 *
					0.01
constant	5.06	-1.96	-0.52	-4.53	-2.18
	3.27	5.50	4.84	7.98	8.55
F.E.					
R <sup>2</sup> within	0.39	0.36	0.29	0.31	0.34
F	321.00	120.34	91.04	53.42	67.74

Fixed Effects Estimator - robust with clustering on sector-country dimension - (\*) = significant at 10 % level

Figure 5: Regression Results for the Determinants of the Quantity Component in Intra-EU Trade.