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Re-estimating International Elasticity of Substitution

A Preliminary Study of Price and Quality Competition

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Trade in quality has become a dominant economic phenomenon since the 1990s (Fontagné et al, 1998). Studying the role of product quality through an import market share equation addresses the problem of biasness in estimating import price elasticities. Indeed, including a proxy for product quality via a culmination of R&D expenditures as well as other knowledge externalities from other sectors and countries helps to increase the estimation of import price elasticites, often increasing them above one, such that they coincide with the traditional estimations of elasticities of substitution as supported by the 'new' trade theory. In addition, a comparison of these import price elasticities shows that these elasticities tend to be higher for homogeneous goods sectors due to increased substitutability as compared to the differentiated goods sectors. Finally, both the estimated price and the quality elasticities help to define the countries that have a comparative advantage in competing with lower prices namely Netherlands, Sweden, Denmark, France and Norway while Germany, France, Netherlands and the UK are quality competitors.

1. INTRODUCTION

Europe, one of the most competitive regions in the world, is currently facing a decline in its export competitiveness as well as its growth. Other regions such as the United States and the BRIC countries (Brazil, Russia, India and China) are catching up and even superseding Europe in terms of economic growth and competitiveness. The major reason for Europe's lag behind these regions is that Europe is currently experiencing a loss of competitiveness in terms of prices. Given that Europe is a high wage and high cost region, this higher factor reward translates into increased goods' prices, thereby compromising Europe's competitiveness in the world market as well as the intra-European market where tough price competition comes in the form of goods produced by low-cost, developing economies.

In the midst of rising quality in trade within Europe since the 1990s (Fontagné et al, 1998), Europe could regain its competitiveness through trading in quality. Competing in quality grants Europe a competitive edge since high wage countries tend to have higher demand for higher quality goods as they have higher disposable income. This demand is stronger in rich countries thereby providing them with a first mover advantage in raising additional resources essential for research and skilled labor support innovation (Linder hypothesis, 1961).

Given this dominant trade phenomenon, a study of the implications of a R&D policy becomes all the more important and interesting. Merely understanding the qualitative implications of this policy is not sufficient to reap the full benefits of improved product quality on national and regional trade competitiveness. It is essential to quantify the effects of an innovation policy on Europe's trade competitiveness. The first step in so doing requires us to develop econometric models that make use of elasticity of substitution. Several authors such as Cox and Harris (1985), Brown (1987) and Shiells and Reinert (1993) confirm that the values of elasticities of substitution have a significant role on the quantitative and qualitative results of analyses performed on the basis of multinational models. Thus, the need to correctly estimate these elasticities that allow us to further study the quantitative implications of an innovation policy becomes all the more important.

This article attempts to re-estimate these generally under-estimated international elasticities of substitution using an import market share equation and a quality proxy, so as to reconcile these estimations with those of the 'new' trade theory. The 'new' trade theory demonstrates that import price elasticities tend to coincide with the theoretical elasticities of substitution, which are often above one, in industries producing large varieties of products (Krugman and Helpman, 1985). By extracting the quality effect from the price effect through the addition of the quality proxy, we show that the elasticities of substitution increase and become superior to one. Comparing these elasticities and weighing them with the trade market shares of the countries in the study, we derive the countries which have a comparative advantage in competing with its competitors for a reduction in relative prices in a particular market. In addition, considering the impact of the product quality, we determine the countries that have a comparative advantage in quality competition arising from the rise in product quality.

2. THEORETICAL MODEL

The model used in this study follows the model from Crozet and Erkel-Rousse's paper (2004) entitled "Quality Matters" which was based on a trade model developed by Erkel-Rousse (1997, 2002). The model takes into account the preferences of the consumer through a Spence-Dixit-Stiglitz sub-utility function which weighs the consumer's preferences between domestic and imported goods from different origins.

Given there are I≥2 countries involved in trading with each other and i refers to the exporting country while j refers to the importing country and k refers to the differentiated product that is traded. A representative consumer in the importing country j aims to maximize his Spence-Dixit-Stiglitz sub-utility function subject to his budget constraint:

$$U_{kj} = [\sum_{t=1}^{I} \sum_{v=1}^{n_{kj}} \alpha_{kij} y_{vij}^{\frac{\sigma-1}{\sigma}}]^{\frac{\sigma}{\sigma-1}}$$

Where y_{vij} stands for the total demand for variety v addressed to the producer of country i, n_{kj} reflects the number of varieties originating from country i. σ is the elasticity of substitution between domestic and imported goods from different origins. Here, the preference parameter is noted as α which corresponds to the quality of the product that is imported. In other words, these preference parameters stem from the national differences in terms of technological knowledge incurred through externalities as well as own R&D investment of a particular country.

In terms of the supply side, the model solves for the profit maximization problem to obtain a price expression as seen below:

$$p_{kij} = c_{ki}(1 + t_{kij}) \frac{\epsilon_{kij}}{(\epsilon_{kij} - 1)}$$

Where c_{ki} represents the production cost per unit related to producing the good k in the exporting country i and ϵ_{kij} corresponds to the price elasticity of demand for the variety (v, i) in the importer country j.

Following closely to the model developed, we rewrite the trade equation by manipulating the sub-utility equation and the price expression to derive the following[1] where E_{kj} referes to the share of country j's national revenue allocated to the consumption of product k:

$$M_{kij} = n_{ki} p_{kij} y_{kij} = \left(\frac{p_{kij}}{p_{kj}}\right)^{1-\sigma} \left(\frac{n_{kj}\alpha_{kij}^{\sigma}}{\sum_{i'=1}^{I} n_{ki'}\alpha_{ki'j}^{\sigma}}\right) E_{kj}$$

Expressing the total imports M of country j with respect to j's imports emanating from a competitor i results in an import market share expression shown below:

$$\frac{M_{kij}}{M_{ki'j}} = \left(\frac{p_{kij}}{p_{ki'j}}\right)^{1-\sigma} \left(\frac{n_{ki}}{n_{ki'}}\right) \left(\frac{\alpha_{kij}}{\alpha_{ki'j}}\right)^{\sigma}$$

The log-transformation of this equation (through transforming it into growth rate and then integrating) leads to the derivation of the testable import market share equation which we see below. We have transformed the above equation including some other variables so as to parallel the import market share equation from our reference paper.

$$\log\left(mshare_{kijI't}\right) = -\left(e_p - 1\right)\log\left(price_{kijI't}\right) + e_g\left(emp_{ijI't}\right) + e_q \log\left(know_{kijI't}\right) - e_d \log\left(dist_{ijI't}\right) + fixed\ effects + intercept + u_{kijI't}$$

where $mshare_{kijI't} = \frac{M_{kijt}}{\sum_{i' \in I'} M_{ki'j}}$

$$price_{kijI't} = \frac{p_{kijt}}{\overline{p_{kI'jt}}}$$

$$emp_{ijI't} = \frac{emp_{kit}}{\overline{emp_{kI't}}}$$

$$know_{ijI't} = \frac{know_{kijt}}{\overline{know_{kI'jt}}}$$

[1] For an in-depth treatment of this model, consult "Trade Performances, Product Quality Perceptions, and the Estimation of Trade Price Elasticities" (2004), Mathieu Crozet and Erkel-Rousse (Review of International Economics), 12(1), pg 108-129

The variables $\overline{p_{kijl't}}$, $\overline{emp_{kl't}}$ and $\overline{know_{kl'jt}}$ stands for the average import prices, average employment and average knowledge originating for the set of i's competitors I'.

$mshare_{kijl't}$ reflects the import share of goods from a particular sector k originating from an exporter country i to an importer country j over time, t. $price_{kijl't}$ reflects the relative import price of a good k coming from country i to country j. $emp_{ijl't}$ reflects the relative employment of a sector in the importer country. It is indicative of the level of varieties available in the importer country. $know_{ijl't}$ reflects the relative quality of the importer good. Finally, $dist_{ijl't}$ reflects the relative distance between the trading partners i and j relative to the distance between the importer country and its trading competitors (to j). This variable is added together with the intercept as an invariant factor that affects the relative import market share. Distance, according to Anderson and Marcouiller (1999) and Rauch (1999) may be added to control for barriers to trade that are not accounted for through the realtive prices.

In addition, e_p is the elasticity of substitution that we are interested in estimating and $e_q$is the relative quality elasticity between the various varieties of good k. e_p is an estimate of the theoretical elasticity of substitution, noted by σ. Due to several mismeasurements that could arise in the data especially for the price variable, it might be that e_p does not exactly equal to σ.

According to the model to be estimated, there are four varaibles affecting the relative market share namely relative prices, relative quality, number of varieties and the distance variable. This suggests that exporters can attempt to procure a greater market share via two channels: they can lower their prices relative to those of their competitors or they can enforce their relative strength through the differentiation channel, that is, by either increasing the number of varieties offered or improving the quality of their product relative to that of their competitors. Note that the coefficient of the price factor in the model is strictly negative since we assume that the elasticity of substitution, $e_p > 1$.

To study these relationships between imports and price and quality, we consider the data for a group of 11 European countries over the periods of 1990 to 2003 for a total of 20 manufacture goods

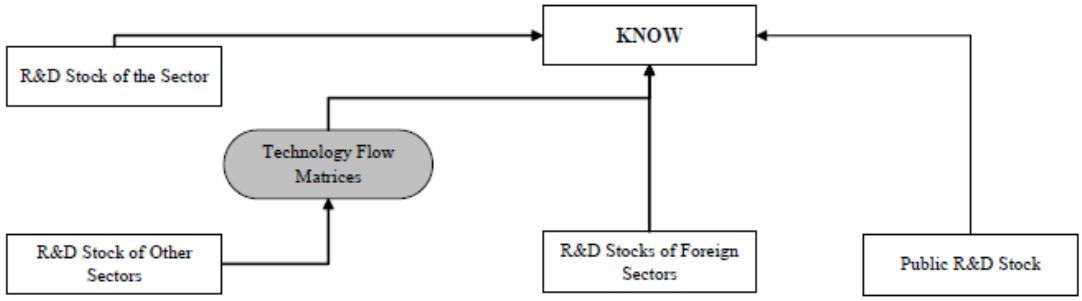
sectors. The data is largely compiled from various sources namely WIOD, CEPII, Chelem, Eurostats, EUKLEMS and OECD. In particular, the data on trade disaggregated over sectors is taken from WIOD (revised). The data on employment was taken partly from WIOD and revised with information from CHELEM and Eurostat. Price data represents the import price indices that are taken from the CEPII database which have been transformed to correspond to the nomenclature of our sectors. Likewise, the distance data is also obtained from CEPII. The distance is measured in kilometers between the major cities of the partners and the information on the country-city pair can be found in the Appendix. Finally, the quality data is constructed using data on R&D expenditures, taken from OECD and Eurostat, as well as the Johnson (2002) matrix that helps to account for the externalities resulting from research and development conducted in other sectors and countries that could potentially spillover to a particular sector.

We understand that the quality of the product can influence the demand of the product from the point of view of the consumer. If the consumer prefers a higher quality product, he is still willing to pay for it despite its higher price. Thus, ignoring the quality aspect of a product leads to an underestimation of the trade price elasticity since it generates a positive correlation between import price indices and the value of manufactures imports.

Our study differs from others in the use of the quality variable. We proxy the consumer's preference for a high quality good using a variable known as the knowledge variable. The knowledge variable attempts to capture both the R&D expenditure on a particular good as well as other knowledge spillovers arising from innovation performed on other sectors. With such improvements in innovation on a particular product, we are able to correlate the quality of the product with the amount spent on improving the product via innovation. Our paper is unique is presenting quality of the product being represented by the accumulation of R&D expenditures and other knowledge spillovers. In addition, this proxy aims to show the link between how the knowledge of producing one product has increasing returns on the knowledge required to produce another product. In this way, the quality variable which is a demand side variable for the consumers is derived from the supply side variable for the producers, that is, the technological know-how.

The construction of the knowledge variable is slightly complex. We use the value of R&D expenditures in a particular sector as well as the R&D expenditures in other sectors. We convert the R&D expenditures from other sectors via technology flow matrices. These matrices were constructed under the methodology developed by Johnson for the OECD with sectoral differentiation (Johnson, 2002). Figure 2.1 charts the construction of the knowledge variable as a quality proxy.

Figure 2.1: Constructing the Knowledge Variable



Source: The NEMESIS Reference Manual (ERASME lab work)

The knowledge variable considers the quality of the imported good. Thus, if the quality of the imported good is high, then this will increase imports coming into the country. So, we expect a positive coefficient when regressing quality proxy in the gravity equation.

The list of countries considered, as well as, the list of the sectors included are provided in the Appendix.

3. Main Estimation Results

The main estimation results are provided in the tables in this section namely Tables 3.1, 3.2, 3.3, 3.5 and 3.6. Tables 3.1 pool all the data in the database allowing for sectoral and country-specific heterogeneity. Table 3.2 reports the results for all the specific sectors considered in the model. Table 3.3 provides the results for country-specific estimations. Tables 3.5 and 3.6 sum up the role of price competitiveness and quality competitiveness for each exporting country, with respect to its 9 competitors in a particular market.

Table 3.1: Pooled Results

	Without quality					With quality				
Estimation Method	OLS	OLS	2SLS	2SLS	Poisson	OLS	OLS	2SLS	2SLS	Poisson
1-e_p	0.0416***	0.101***	0.0617***	0.144***	0.0778***	-0.0429***	-0.0896***	-0.0632***	-0.127***	-0.0878***
e_q	-	-	-	-	-	0.333***	0.329***	0.354***	0.323***	0.945***
e_g	0.182*	0.211*	0.246*	0.176*	0.179***	0.173*	0.135*	0.236**	0.096*	0.0083***
e_d	-	-0.658***	-	-0.651***	-0.799***	-	-0.657***	-	-0.651***	-0.833***
Constant	7.524***	11.840***	7.361***	11.12***	9.294***	6.300***	8.910***	6.070***	8.595***	9.154***
Fixed effects	Yes	No	Yes	No	-	Yes	No	Yes	No	-
R2	17.22	10.50	17.54	13.73	-	15.03	16.32	16.16	17.54	-
e_p	0.958	0.899	0.938	0.856	0.922	1.043	1.090	1.063	1.127	1.088
Observations	26320	26320	24440	24440	26320	26320	26320	24440	24440	26320

Note: *, **, *** refers to significance testing under 10%, 5% and 1% significance level

Based on the results from Table 3.1, we observe that the relative price indicator has a negative relation which is often significant to the import share. This is because the relative price we consider is the price of import good relative to the price of the competitor's good. So if the price of the importer good from j is higher than the average price of the importer good from I's, j's competitors, then consumers would prefer to buy from j's competitors given that both goods are identical (no quality effects intervening) thereby reducing the import share coming from j. Thus, the relationship between relative price and imports is negative.

We note that without the adjustment for quality, the coefficients of the price variable are positive. However, with the adjustment for quality, the coefficients reduce drastically even going below zero implying that the elasticities of substitution become higher than one.

For the quality index, the effect should be positive. The knowledge variable is given by the quality of import good from j relative to the quality of the import good coming from I'. So if the quality of j's good is higher than that of the competitors, the import share for that particular good k should increase. All the coefficients for the quality coefficient are positive and highly significant. Notably, the regressions with fixed effects display higher coefficients for quality than those for the regressions without fixed effects. As the model for fixed effects is recommended to account for within effects coming from the countries as well as from the sectors, we choose to consider these higher coefficients which are significant but below unity.

The relationship between imports and employment is positive and significant. This is because the employment variable helps to control for the effect of varieties on consumer preferences. According to Acemoglu and Ventura (2002), the firm size proxy captures the effect of varieties on export potential because the number of employees employed in a particular sector is proportional to number of varieties that sector produces. Thus, an exporting country i with a higher export potential (proxied by higher employment) is expected to export increasing varieties of goods in relation to its competitors. This means that an importing country prefers to import more goods from j rather than its competitors so as to provide higher varieties of the same good k in its country for its consumers.

The results from Table 3.1 show the regression performed on the entire sample size. With respect to the relative price variable, the estimation methods yield somewhat robust results. The results are important in explaining the role of quality in trade.

As predicted, adjusting for quality decreases the price coefficients given by (1-e_p) under all the estimations thereby correcting the under-estimation bias. Inserting the quality variable ends up increasing the elasticity of substitution e_p to above 1 through the reduction of the coefficient of the price variable.

When accounting for quality, many authors readdress this bias and obtain relatively higher trade price elasticities, generally superior to 1, which is in line with the theoretical elasticities of substitution. Notably, work by Hummels (1999), Erkel-Rousse and Daniel Mirza (1999), Erkel-Rousse and Le Gallo (2002) and Crozet and Erkel-Rousse (2004) have proven that trade price elasticities do increase significantly, often above 1, when corrected for quality effects. Thus, our pooled results conforms to past work thereby confirming the notion that import price elasticities are under-estimated and should be above unity.. Thus, price does play a significant role in determining import trade between countries.

The quality proxy is highly significant according to the results above. Indeed, an improvement in the quality of products from the exporting countries (proxied by the R&D expenditure and other externalities that determine the quality of the product) does lead to higher exports from these countries. Thus, quality also plays a significant role in determining trade flows between countries.

Distance, as expected, varies negatively and significantly with trade flows. As longer distances increase transportation costs, countries tend to trade more with neighboring countries. Thus, distance between trading partners is another significant variable in determining trade flows. Under this regression, we did not constrain the coefficients of both price and distance to be the same. This is because the results were much more robust without the constraint. Nevertheless, the role of distance remains the same in reducing trade across countries when distance between trading partners rises.

The employment variable is positively significant in all regressions. An exporting country with high export potential and higher variety tends to export more products. So, exports from the exporting country j to the importing country increase with its export potential relative to that of its trading partners. We also note that the coefficient of employment falls with the addition of the quality proxy. This decline is due to the fact that without the quality proxy, the variety variable captures part of the effect of vertical differentiation. With quality effect, the effects are then differentiated. This is in line with empirical finding that support this negative relationship between quality and variety. Indeed, firms make a trade-off between quality and variety of their products. An exporter that improves his product quality can choose to reduce his product variety and vice versa. According to Krugman (1980), the parameter relative to the variety proxy should equal unity. Unfortunately in our case, the coefficient of the variety variable does not approach unity. This could be due to the weak proxy. Many economists recommend total production as a proxy for exporter potential. We were unable to procure data on total production because the total production data was not disaggregated over the sectors. Thus, we chose employment data as the proxy. Nevertheless, even with total production as a proxy, some studies were still unable to support Krugman's theory. Thus, we should analyze the role of variety in import trade and in determining international elasticities of substitution with care.

Table 3.2: Bilateral Results

Sector	Name	Initial e_p	Adjusted e_p	e_q	Product differentiation by Rauch	Product differentiation by OMSP
1	Agriculture	1.097***	1.108***	0.027***	HOM	HOM
4	Gas Distribution	1.165**	1.217***	0.021***	HOM	HOM
5	Refined Oil	1.050	1.074*	0.055***	HOM	HOM
6	Electricity	1.239***	1.252***	0.021***	HOM	HOM
8	Ferrous and Non-Ferrous Metals	1.154***	1.165***	0.063***	HOM	HOM
9	Non-metallic mineral products	1.026	1.027*	0.061*	HOM	HOM
10	Chemicals	1.006	1.010	0.041***	DIF	HOM
11	Metal Products	1.007	1.008	0.501	DIF	HOM
12	Agricultural and Industrial Machines	1.014	1.070***	0.454***	DIF	DIF
13	Office Machines	1.032**	1.032**	0.138*	DIF	DIF
14	Electrical Goods	1.037**	1.041**	0.420**	DIF	DIF
15	Transport Equipment	1.038**	1.038**	0.360**	DIF	DIF
16	Food, Drink and Tobacco	1.053***	1.065***	0.152***	HOM	HOM
17	Textiles, Cloth and Footwear	1.003	1.005	0.300	DIF	HOM
18	Paper and	1.037	1.049*	0.610**	DIF	HOM

	Printing Products					
19	Rubber and Plastic	1.025**	1.064***	0.125***	DIF	HOM
20	Other Manufactures	1.027	1.031	0.280	DIF	DIF

Note: *, **, *** refers to significance testing under 10%, 5% and 1% significance level

According to Table 3.2, all the sectors show an elasticity of substitution higher than 1 with quality adjustments. These values were obtained by running the regressions using 0LS estimator with fixed effects even though the results were robust for both the 2SLS as well as the Poisson estimations. In fact, most of these sectors had an initial elasticity of substitution exceeding 1 which further increased with the quality adjustments. This simply shows that adjusting for quality helps to correct for the downward bias in estimating the elasticities of substitution.

The last two columns of Table 3.2 record the type of product classification, be it homogenous (HOM) or differentiated (DIF). This product classification is based on Rauch's calculations (1996) as well as the work of Oliveira-Martins, Scarpetta and Pilat (OMSP, 1996) on STAN sectors. However, the sectoral classification in our case differs slightly from that of STAN sectors since there are more sectors under STAN. As such, we had to regroup certain sectors such that they conform to the calculations performed by Rauch and OMSP. Given this limitation, it is possible that some sectors though they seem to produce homogeneous products have relatively lower elasticities of substitution that correspond to those of the differentiated sectors. For instance, the Non-metallic mineral product sector and the Food, Drink and Tobacco sector, despite being categorized as a sector that produces highly homogeneous products, portray an elasticity of substitution that is relatively low, in line with the elasticities of substitution corresponding with highly differentiated products. As such, keeping in mind these shortfalls, we can proceed to analyze these results with care.

The industries with low product differentiation have relatively higher elasticities of substitution when compared to the industries with high product differentiation. Under the OMSP

classification, the industries with relatively higher elasticities of substitution are mostly homogenous goods producing sectors or non-industrialized sectors like Agriculture, Gas Distribution, Refined Oil, Electricity, Ferrous and Non-Ferrous Metals, where the estimated elasticities range between 1.074 and 1.252. The sectors with high product differentiation or largely industrialized sectors had relatively lower elasticities of substitution ranging between 1.005 and 1.074. Out of the 12 sectors with common classification under both Rauch and OMSP calculations (of which 7 are homogenous-goods sectors), only 2 of the homogenous (non-industrialised) industries had relatively lower elasticities of substitution.

These results do not display the same results in terms of magnitude where earlier studies recorded the range for homogenous sectors to be between 3.5 and 6 while for the differentiated sectors to be between 3.5 and 4.0. Nevertheless, these results are in line with the sectoral results derived by a similar study performed by Erkel-Rousse and Mirza (2002). Notably, sectors that produce differentiated and industrialized products tend to display lower elasticities of substitution as shown above. This is in line with the theory based on monopolistic competition. With the exception of Non-metallic mineral products and Food, Drink and Tobacco sectors, the results coincide with past empirical work that proved that industries producing homogenous and non-industrialized products tend to have higher elasticities of substitution than industries producing differentiated and industrialized products due to the higher substitutability among homogeneous goods.

Now, we consider the role of quality innovation on import of these products. Most of the coefficients found produce a highly positive and significant effect of quality on imports with the exception for Metal Products, Textiles, Cloth and Footwear and Other Manufactures sectors. Classification of the sectors may have led to slightly biased estimations for these sectors, leading to the loss of significance of the quality variable.

Nevertheless, for most of the sectors, the impact of quality innovation is positive and highly significant. Thus, an improvement in the quality of exporting goods relative to those of the competitors leads to an increase in its export share. A 1% increase in relative product quality leads to

higher export share varying between 0.021% and 0.600%. The sectors that display relatively high coefficients for quality are largely the sectors producing highly differentiated products such as Metal products, Agricultural and Industrial Machines, Electrical Goods, Transport Equipment, Textiles, Cloth and Footwear, Paper and Printing Products and Other Manufactures except for Office Machines. These industrialized sectors have large scope for product differentiation. Thus, quality improvements are more useful in these sectors than in the homogeneous product sectors such as Agriculture and Gas Distribution.

Table 3.3: Price Elasticity by Importing Country

Importing Country	Initial e_p	Adjusted e_p	e_q
DE (Germany)	0.986	1.027*	0.678***
DK (Denmark)	1.044*	1.046*	0.375*
ES (Spain)	1.029	1.032**	0.387***
FI (Finland)	0.986	1.006*	0.383***
FR (France)	1.028	1.030**	0.396***
IE (Ireland)	1.086**	1.099***	0.363*
IT (Italy)	1.050*	1.051***	0.497***
NL (Netherlands)	1.009*	1.015*	0.211***
NO (Norway)	1.026*	1.030*	0.331***
Sweden (SE)	1.012*	1.018*	0.210***
UK (United Kingdom)	1.087**	1.099***	0.363*

Note: *, **, *** refers to significance testing under 10%, 5% and 1% significance level

We, now, proceed to look at the elasticities of substitution from the point of view of the importing country given quality adjustments. The results are consolidated based on the various estimation

methods, be it OLS, 2SLS or Poisson estimations. The results are robust across the estimation methods which add more credibility to our results. The elasticities of substitution reported are the average elasticities from the various estimation methods.

Out of the sample of 11 countries, all of them display an elasticity of substitution superior to 1 after being adjusted for quality effects of their products. In fact, the elasticities of substitution were often insignificant prior to the adjustment for most countries like Germany, France and Spain. Adjusting for quality not only raises the elasticities but it also restores the significance to the elasticities. Thus, these countries portray significantly high sensitivity to relative prices in comparison to those of their competitors (the substitution elasticity ranges between 1.006 and 1.099). Overall, all the countries in the sample improve their elasticities of substitution when they have been adjusted for quality effects.

The countries with relatively high elasticity of subsitution tend to be the richer countries. We expect larger and richer economies like Denmark, the Netherlands and the UK to display higher elasticity of substitution. But an exception to this rule is seen in France, Finland and Germany. According to Imbs and Méjean (2010), rich countries tend to import goods that are not substitutable, while the reverse is true for large developing countries. Thus, this is one explanation as to why some richer countries like Germany and Finland display lower elasticities as opposed to countries like Denmark, the Netherlands and the UK. In addition, the importance of specialization of industries also determines the elasticities. Since the service industry is exempted from this study, it might bias the 'true' elasticities of substitution for some importing countries that focus more on service trade rather than goods trade like Ireland. Also, domestic consumers may prefer imports from other trading partners that are not included in this study so it might bias the estimation of elasticity of substitution for some countries like Spain which trades intensively with Switzerland and Russia. We also do not consider the role of re-exports in these regressions. Thus, these results neglect the role of some countries like Ireland that serve as gateway to Europe markets for non-European products. Thus, these results need to be consulted with these shortfalls in mind that might bias the estimation of the 'true' elasticities of substitution.

From the point of view of the importing country, if this country has a high elasticity of substitution, it means that the consumers in this country have a strong preference for its domestic goods. The idea is that for a small increase in average price of its competitors, an importer is able to raise its market share via a large proportion because its consumers will substitute away from the higher priced competitor goods towards the lower priced domestic good. From the results in Table 3.3, we notice that importer countries that can procure higher market share via a price increase of its competitors (or a price decrease of its own goods) are Denmark, Ireland, Italy, Netherlands and the United Kingdom.

In terms of quality effects, an importer country can increase its domestic market share by increasing its product quality by 1% relative to its competitors. So if the quality elasticity is high, the gains from product innovation are higher for the importing country. Following this idea, we conclude that countries which gain the highest market share via product innovation are Germany, Denmark, France, Finland, Ireland, Italy and Spain. Overall, the relative quality elasticities are highly significant and positive ranging between 0.210 and 0.678 percentage points, thus supporting the notion that improving quality of its products relative to that of its competitors' allows for an increase in the importer's domestic market share.

Now, we proceed to study the type of competitiveness displayed by exporter countries. A study by Hélène Erkel-Rousse and Françoise Le Gallo (2002), following the study done by Fontagné et al (1998), uses the concept of price and quality competitiveness in classifying the countries in Europe in terms of their performance. According to their analysis, some countries in Europe perform better in terms of price competitiveness while others fare better in quality competitiveness.

"If unit values reflect costs and the product is homogenous, then countries with lower costs should be net exporters in quantities and countries with higher costs should be net import countries. If a country is a net exporter in quantities, despite the fact that it has higher unit values, then it must be due to quality differences" (Aiginger, 1995). This was the way in which quality competitiveness was distinguished from price competitiveness. With this classification, Erkel-Rousse and Le Gallo were

able to dissect the trade performance of 12 OECD countries on the external markets. The table below reproduces the results for the 7 countries on which our analysis is based.

Table 3.4: Trade Performance of 7 Countries on the External Markets (Overall Performance of Exporting Countries (rows) on Importing Countries (columns))

	Germany	France	Netherlands	UK	Italy	Spain	Ireland
Germany		Q	Q	Q	Q	Q	M
France	Q		Q	Q	P	Q	M
Netherlands	P	Q		Q	Q	M	M
UK	Q	P	P		P	P	P
Italy	P	P	M	S		P	M
Spain	S	P	S	S	P		M
Ireland	S	M	M	P	Q	M	

Note: M-poor price competitiveness, P-good price competitiveness, Q-good quality competitiveness, S-structural problem

Source: FLUBIL database (figures from OECD Series C), extracted from Erkel-Rousse and Le Gallo (2002)

From Table 3.4, Germany and, to a small extent, France are characterized by good quality competitiveness. On the other hand, Italy and Spain owe their trade performance to price competitiveness when they do not run into structural difficulties. The Netherlands and the UK take on intermediary positions, alternating between price competitiveness and quality competitiveness. Given this classification, it is reasonable to say that trade in qualities is a dominant phenomenon in Europe. Thus, ignoring quality effects will ultimately downward bias the import price elasticities leading to biased policy prescriptions. We juxtapose our results with those obtained by the above study.

Table 3.5: Impact of 1% Decrease in Relative Product Price on Market Share where Rows refer to Domestic Markets and Columns to Exporting Countries

	DE	DK	ES	FI	FR	IE	IT	NL	NO	SE	UK
DE		14.98	13.10	9.84	22.24	8.11	13.76	25.43	12.95	10.56	12.08
DK	1.53		0.58	1.93	0.83	0.56	0.65	1.15	3.36	6.97	1.14
ES	3.72	3.64		2.41	10.17	3.78	6.05	3.92	1.97	2.21	4.00
FI	0.99	2.36	0.33		0.49	0.37	0.44	0.98	1.29	7.04	0.56
FR	10.51	3.88	19.95	3.62		5.38	11.73	8.77	6.72	4.94	8.04
IE	0.56	1.21	0.42	0.38	0.68		0.29	0.71	1.14	0.43	8.05
IT	7.18	2.90	9.93	0.28	11.52	3.40		4.99	2.85	3.17	3.55
NL	7.91	4.32	3.18	6.90	5.27	4.46	0.28		12.16	5.33	9.56
NO	0.77	6.85	0.44	2.76	0.40	0.48	0.47	0.85		10.34	1.25
SE	2.20	15.29	0.85	14.13	1.33	0.76	1.01	1.73	7.52		2.21
UK	6.30	8.01	0.32	5.19	0.82	8.87	5.55	0.91	27.16	7.47	
Av impact across markets	4.17	6.34	4.91	4.74	6.82	3.62	4.02	4.94	7.72	5.85	5.04

According to the Table 3.5, we are able to disaggregate the competitiveness of each exporter country with respect to its competitors in a particular domestic/ importer market. This format of studying competitiveness is similar to that of the work done by Erkel-Rousse and Le Gallo (2002) discussed above. The results on this table are obtained from multiplying the average market share of an exporter in a particular market with respect to the total exports from that country with the estimated bilateral elasticities of substitution. These market shares have been calculated using the OECD database. Both the markets shares and the estimated bilateral elasticities of substitution are provided in the Appendix. The average impact measures the percentage gain in market share obtained across the 11 markets due to a rise of 1% price of its competitors. The larger the impact across the markets, the larger is the market share gained via a comparative advantage in price competitiveness. The exporters that experience the largest gain in relative market share through an increase of 1% in the average price

of its competitors are Netherlands, Sweden, Denmark, France and Norway. The average impact of an increase in market share for these exporters is between 3.62 and 7.72 percentage points.

In considering the role of all competitors in a particular market, we look at the relative impact of each exporter country on the market share with respect to its competitors. In the German market, Denmark, France and Netherlands excel in terms of price competitiveness as they are able to increase their relative market share in that market proportionately higher than those of its competitors due to a 1% increase in the price of its competitors. In the Danish market, Norway and Sweden perform better in terms of price competitiveness. For the Spanish market, France and Italy override in terms of price competitiveness. In the Finnish market, we have good price competition from Denmark and Sweden. In the French market, Germany, Spain, Italy and Netherlands perform relatively better in price competition. In Ireland, only the UK can compete strongly in prices. In the Italian market, Germany, Spain and France excel in price competitiveness. In the Netherlands market, Germany, Finland, Norway and the UK are better in price competition. For the Norwegian market, Denmark, Finland and Sweden have a comparative advantage in price competition. In the Swedish market, Denmark, Finland and Norway perform better in terms of price competition. In the UK market, Denmark, Ireland, Norway and Sweden are better price competitors.

Table 3.6: Impact of 1% Increase in Relative Product Quality on Market Share where Rows refer to Domestic Markets and Columns to Exporting Countries

	DE	DK	ES	FI	FR	IE	IT	NL	NO	SE	UK
DE		15.36	12.64	1.57	11.87	3.25	30.26	19.73	4.21	13.63	1.17
DK	1.53		1.16	1.24	0.32	0.15	0.34	0.29	0.20	3.39	0.23
ES	2.90	1.06		0.43	2.34	1.29	8.07	3.79	0.29	1.22	0.33
FI	2.09	0.76	0.09		0.09	0.02	0.16	0.33	0.66	8.73	0.19
FR	1.42	0.79	4.54	0.76		0.15	1.96	6.79	11.33	0.18	11.00
IE	0.18	1.64	0.01	0.04	0.91		0.60	0.58	1.65	0.38	28.29
IT	6.43	1.51	2.35	0.14	25.62	2.98		12.88	0.27	0.01	2.30
NL	7.39	0.45	2.72	1.04	4.52	0.61	0.07		0.91	6.26	24.69
NO	0.26	2.20	0.21	1.82	0.03	0.04	1.31	0.03		2.76	0.45
SE	8.80	16.38	0.09	3.48	1.82	0.01	0.19	2.16	1.50		0.18
UK	47.30	2.24	2.39	2.70	2.46	23.06	0.29	12.40	5.16	3.00	
Av impact across markets	7.83	4.24	2.62	1.32	4.91	3.12	4.33	5.90	2.62	3.96	6.88

According to Table 3.6, we apply the same classification of competitiveness of a particular exporting country in a specific domestic market in terms of product quality as above. Four exporters are able to increase their relative market share, on average, over 10 domestic markets with respect to their competitors by increasing their own product quality by 1% (spending 1% more on R&D). They are Germany, France, Netherlands and the UK. On average, these countries benefit from a 1% increase in product quality by increasing their market share from 2.62 to as high as 7.83 percentage points.

In comparing the impact of all exporters on a domestic market for an increase in relative product quality of 1%, we define the quality competitiveness of the export competitors. In the German market, quality competition is strongest among Denmark, Spain, France, Italy, Netherlands and Sweden. In the Danish market, Germany, Spain, Finland and Sweden have a comparative advantage in quality competition. In the Spanish market, Germany, France, Italy and Netherlands excel well in quality competition. In the Finnish market, countries like Germany and Sweden perform well in terms

of quality competition. For the French market, Spain, Netherlands, Norway and the UK perform comparatively better in terms of quality competition. In Ireland, only the UK excels in terms of quality competition. In the Italian market, Germany, France and the Netherlands have a comparative advantage in quality competition. In the Netherlands market, Germany, Sweden and the UK excel in quality competition. In the Norwegian market, Denmark, Finland, Italy and Sweden perform better in terms of quality competition. In the Swedish market, Germany, Denmark and Finland appear in the forefront of quality competition. And finally in the UK market, Germany, Ireland and Netherlands are better in quality competition.

4. CONCLUSION

Overall, the paper proves that elasticities of substitution are often under-estimated and that correcting for this biasness through quality effects can help to 'correctly' estimate the 'true' values of import price elasticities. These elasticities tend to conform to the 'new' trade theory elasticities of substitution in that they are always superior to one and tend to be equal in industries producing large varieties.

As for the role of quality, improving the quality of a product leads to an average increase in the export share of an exporter ranging between 0.499 and 1.950 percentage points for a 1 percent increase in product quality innovation. This said, it suggests that a policy aimed at improving the quality of a product allows the exporter to have an edge over its competitors in a particular domestic market.

When looking at the sectoral results, accounting for sectoral heterogeneity becomes all the more important as different sectors have different elasticities of substitution. In particular, sectors which produce highly homogeneous goods tend to have high elasticities of substitution due to the higher substitution effect among these goods, with the exception of Non-metallic mineral products and Food, Drink and Tobacco. Highly differentiated goods sectors have lower elasticities of substitution. These sectors also have wider scope for innovation, thus they display higher relative quality elasticites as opposed to the homogeneous goods sectors.

We also induced the type of competitiveness, both from the point of view of the importing country and the exporting country, from our results. We concluded that importing countries like Denmark, Ireland, Italy, Netherlands and the UK benefit the most in terms of increasing their own domestic market share via reducing the relative prices of their own goods with respect to those of its foreign counterparts (a 1% reduction in relative price induces an increase in domestic market share of between 1.018 and 1.099%). Importing countries that benefit most through a 1% increase in its quality with respect to that of its foreign counterparts are Germany, France, Denmark, Finland, Ireland and

Italy. An increase of 1% of domestic product quality leads to an increase in domestic market share of between 0.21 and 0.68%.

On closer look at the various exporters on the specific domestic markets, we also deduced the type of competitiveness displayed by each exporter country in their respective domestic markets. Countries that excel in price competition with respect to its competitors are Netherlands, Sweden, Denmark, France and Norway. The market share rises between 3.62 and 7.72% due to a 1% decrease in their export prices with respect to those of its competitors. Countries that excel in quality competition with respect to its competitors are Germany, France, Netherlands and the UK. The market share rises between 2.62 and 7.83% due to a 1% rise in their export quality with respect to its competitors. On the whole, price and quality competitiveness works much better in exporting market than for the domestic market since the increase in market share is a lot higher when the same product is being exported than when it is being sold domestically. These results could serve as a policy foundation wherein policy makers can simulate the various competitiveness policies in various exporting markets on which they have an advantage so as to increase their market share in that market and henceforth increase their economic growth which is more of a result of greater exports than as a result of higher consumption. Thus, a further study on this phenomenon as well as an extension of all forms of trade (service and goods trade) can prove to yield interesting policy implications.

Appendix

List of European Countries

Germany. DE	*Italy, IT*
Denmark, DK	*Netherlands, NL*
Spain, ES	*Norway, NO*
Finland, FI	*Sweden, SE*
France, FR	*United Kingdom, UK*
Ireland, IE	

List of Sectors

NEMESIS Sectoral Index	*Sectoral Description*
1	*Agriculture*
2	*Coal and Coke*
3	*Oil and Gas Extraction*
4	*Gas Distribution*
5	*Refined Oil*
6	*Electricity*
7	*Water supply*
8	*Ferrous and Non-Ferrous Metals*
9	*Non Metallic Mineral Products*
10	*Chemicals*
11	*Metal Products*
12	*Agricultural and Industrial Machines*
13	*Office Machines*
14	*Electrical Goods*
15	*Transport Equipment*
16	*Food, Drink and Tobacco*
17	*Textiles, Cloth and Footwear*
18	*Paper and Printing Products*
19	*Rubber and Plastic*
20	*Other Manufactures*

Distance measured across major cities of partner countries (in kilometers)

Country, 2-letter Country Code	City from which distance is measured
Germany, DE	Essen
Denmark, DK	Copenhagen
Spain, ES	Madrid
Finland, FI	Helsinki
France, FR	Paris
Ireland, IE	Dublin
Italy, IT	Rome
Netherlands, NL	Amsterdam
Norway, NL	Oslo
Sweden, SE	Stockholm
United Kingdom, UK	London

Average Trade Market Share of 11 Countries with respect to the world over 1990 to 2003

	DE	DK	ES	FI	FR	IE	IT	NL	NO	SE	UK
DE		14.96	10.48	9.43	16.22	7.12	12.92	22.19	11.32	9.96	10.87
DK	1.47		0.51	1.91	0.60	0.46	0.62	1.11	3.22	6.54	1.02
ES	3.58	2.19		1.92	7.42	3.76	5.75	3.18	1.84	2.03	3.70
FI	0.81	2.28	0.31		0.48	0.33	0.42	0.96	1.25	6.19	0.55
FR	9.42	3.77	18.17	3.29		5.02	11.51	8.07	6.56	4.90	7.72
IE	0.44	1.06	0.39	0.32	0.54		0.26	0.65	1.06	0.41	6.24
IT	6.09	2.63	8.83	0.25	8.08	3.03		4.69	2.50	2.88	3.35
NL	6.49	4.16	3.15	6.64	4.17	3.47	0.25		11.95	4.94	7.82
NO	0.77	6.09	0.43	2.64	0.38	0.47	0.38	0.81		9.97	1.15
SE	2.05	12.76	0.80	11.33	1.31	0.75	1.00	1.63	6.95		2.06
UK	6.16	7.47	6.18	4.48	6.71	7.04	5.30	7.37	27.00	7.40	
World	8.33	0.64	1.61	0.46	3.42	0.77	2.94	3.76	0.86	1.04	2.66

Source: OECD Database

Estimated Bilateral Trade Price Elasticity where Rows refer to Domestic Markets and Columns to Exporting Countries (as estimated by market share equation)

	DE	DK	ES	FI	FR	IE	IT	NL	NO	SE	UK
DE		1.001	1.250	1.043	1.371	1.139	1.065	1.146	1.144	1.060	1.111
DK	1.038		1.137	1.009	1.384	1.222	1.045	1.032	1.043	1.066	1.116
ES	1.040	1.661		1.255	1.370	1.005	1.053	1.232	1.069	1.087	1.081
FI	1.217	1.034	1.079		1.013	1.136	1.049	1.026	1.030	1.138	1.021
FR	1.116	1.028	1.098	1.100		1.072	1.019	1.087	1.024	1.009	1.041
IE	1.291	1.143	1.077	1.203	1.250		1.133	1.097	1.080	1.037	1.290
IT	1.179	1.104	1.125	1.107	1.426	1.121		1.065	1.139	1.102	1.059
NL	1.219	1.039	1.008	1.039	1.263	1.284	1.124		1.101	1.078	1.222
NO	1.001	1.124	1.027	1.046	1.065	1.015	1.224	1.052		1.037	1.085
SE	1.074	1.198	1.061	1.247	1.014	1.010	1.011	1.062	1.077		1.074
UK	1.023	1.072	1.184	1.159	1.166	1.260	1.048	1.073	1.006	1.010	

Estimated Bilateral Quality Elasticities where Rows refer to Domestic Markets and Columns to Exporting Countries (as estimated by market share equation)

	DE	DK	ES	FI	FR	IE	IT	NL	NO	SE	UK
DE		1.027	1.206	0.167	0.732	0.457	2.342	0.889	0.372	1.368	0.108
DK	1.041		2.272	0.650	0.533	0.323	0.552	0.258	0.061	0.518	0.226
ES	0.810	0.485		0.224	0.315	0.342	1.404	1.192	0.157	0.603	0.882
FI	2.573	0.334	0.286		0.179	0.054	0.382	0.343	0.526	1.410	0.349
FR	0.151	0.209	0.250	0.230		0.029	0.170	0.841	1.727	0.036	1.425
IE	0.405	1.549	0.034	0.112	1.673		2.300	0.898	1.555	0.917	4.534
IT	1.056	0.575	0.266	0.564	3.171	0.984		2.746	0.106	0.004	0.687
NL	1.139	0.109	0.864	0.157	1.084	0.176	0.290		0.076	1.268	3.157
NO	0.335	0.362	0.480	0.689	0.077	0.088	3.447	0.041		0.277	0.393
SE	4.294	1.284	0.115	0.307	1.390	0.010	0.193	1.326	0.215		0.085
UK	7.678	0.300	0.386	0.603	0.367	3.276	0.055	1.683	0.191	0.405	

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