ETLA

Keskusteluaiheita – Discussion papers

1227

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QUALITY-ADJUSTED SIMILARITY

OF EU COUNTRIES' EXPORT STRUCTURES

15.11.2010

ABSTRACT: We propose a new way to measure the extent to which countries compete in their exports. We augment the similarity index proposed by Finger and Kreinin (1979) with product quality. Quality is measured using unit export prices in the tradition of the horizontal/vertical intra-industry trade literature. We analyse the EU27 countries' export structures using 1) overall similarity à la Finger and Kreinin, 2) same-quality similarity, and 3) quality-adjusted similarity that combines the first two measures. We find that the similarity of the export structures of the new member countries and the cohesion countries vis-à-vis the non-cohesion EU15 countries has increased, but that there remains a divide between them especially in terms of same-quality exports.

KEY WORDS: Exports, similarity, quality

JEL codes: F14, F15

TIIVISTELMÄ: Tässä tutkimuksessa rakennetaan uusi menetelmä mitata maiden välistä kilpailua vientimarkkinoilla. Lisäämme nk. similariteetti- eli samankaltaisuusindeksiin (Finger ja Kreinin, 1979) vientituotteiden laatukomponentin. Laatu lasketaan viennin yksikköarvojen avulla, kuten horisontaalin ja vertikaalin ristikkäiskaupan kirjallisuudessa tehdään. Tutkimuksessa analysoidaan EU27-maiden viennin rakennetta kolmella mittarilla: 1) similariteetti-indeksillä, 2) samanlaatuisen similariteetin asteella sekä 3) laatukorjatulla similariteetti-indeksillä, joka on johdettu kahdesta ensimmäisestä mittarista. Tulosten mukaan uusien EU-maiden ja nk. koheesiomaiden vientirakenteiden samankaltaisuus verrattuna ei-koheesio EU15-maiden viennin rakenteeseen on lisääntynyt. Näiden maaryhmien välillä on kuitenkin edelleen suuri ero erityisesti samanlaatuisten vientituotteiden osalta.

AVAINSANAT: Vienti, samankaltaisuus, laatu

JEL-koodit: F14, F15

1 Introduction

The similarity of export structures tells us about the intensity of competition between two countries in world markets. The structures also explain some of the similarity in the effects of demand and supply shocks that arise via international trade.

In the European context, similarity gives us information about the extent to which countries form an optimal currency area, as well as about the level of integration and (dis)similar specialisation between them.

However, even if two countries have similar export structures, the quality of the exported products may differ substantially. Despite their apparent similarity, the products may thus be imperfect substitutes to each other. A technically more advanced country is likely to have a higher level of productivity and produce higher-quality products than a less advanced country. Consequently, the former may not be directly 'threatened' by competition from the latter. Competition may intensify in the future, however, if technological catching up between the countries takes place.

In this paper, we propose a new measure that combines the similarity of export structures with a quality dimension. We do this by merging the similarity index proposed by Finger and Kreinin (1979) and product quality as measured in the literature on horizontal and vertical intra-industry trade or IIT (see Greenaway, Hine and Milner (1994, 1995) and others).

Similar export structures in two countries with dissimilar productivity and wage levels may often be – especially in the European context – a result of foreign direct investment flows from more advanced countries (typically the EU15) to less advanced countries (typically the new member countries (NMCs) that joined in 2004 or 2007). In this transaction the firm making the investment is trying to benefit from lower production costs in the latter group of countries.[1]

Our results reflect the catching up of the NMCs with the non-cohesion EU15 countries. According to the results, the so-called co-

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[1] Harding and Javorcik (2009) found that especially for less developed countries attracting FDI inflows offers a chance to upgrade exports. They used unit values to assess the quality of exports.

hesion countries (Greece, Portugal and Spain)[2] resemble the NMCs. Similarity in export structures between the two groups has increased. Also the quality of the catching-up countries' exports compared with the non-cohesion EU15 has risen.[3] Nevertheless, there remains a quality divide between the NMCs and the cohesion countries on the one hand and the non-cohesion EU15 countries on the other hand especially in terms of the similarity of same- and higher-quality exports.

2 A quality similarity index in the tradition of IIT literature

Antimiani and Henke (2008) analysed the similarity in exports of agricultural food products from selected EU15 countries and NMCs. They constructed a product similarity index (*PSI*) and a quality similarity index (*QSI*). In the spirit of Grubel and Lloyd (1971, 1975) and the IIT literature, Antimiani and Henke's product similarity index is given by

$$PSI = 1 - \frac{\sum_k \left| x_k^{ac} - x_k^{bc} \right|}{\sum_k \left(x_k^{ac} + x_k^{bc} \right)},$$

where x_k^{ac} and x_k^{bc} are the total exports of product k from countries a and b, respectively, to some market area c.

The quality similarity index *QSI* is given by *PSI* but so that the data only includes goods that are of similar quality as measured using the unit value of exports (see below equations 2 and 3).

Antimiani and Henke's (2008) QSI index differs from the one we construct because QSI uses absolute exported values meaning that a small country does not weigh a lot relative to a large one. In contrast, we compare the shares of different products in a country's total exports. This way we can shed more light to the actual similarity in the countries' foreign trade and the implications for European integration. Our approach is in line with any analysis of optimal currency areas and international trade shocks.

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[2] Ireland is one of the cohesion countries, but in terms of our results it does not resemble either them or the non-cohesion EU15 countries.

[3] For example Jansky (2010) observed a rise in the unit export values of the new member countries and argued that this reflects a rise in product quality.

3 The quality-adjusted similarity indicator

We calculate the similarity of export structures using the similarity index proposed by Finger and Kreinin (1979). The index is given by

$$S = \sum_k \min\left(\frac{x_k^a}{X^a}, \frac{x_k^b}{X^b} \right), \qquad (1)$$

where x_k^a and x_k^b are the exports of product k from countries a and b, respectively, and X^a and X^b are the total exports of these countries.[4] The index goes from 0 to 1 as similarity increases. Naturally, all exports that are not similar in structure are dissimilar between the countries concerned.

We calculate the index at the four-digit level of the HS trade classification and have 1,255 product groups. The analysis is done by country pairs for the EU15 countries in 1995 and the EU27 countries in 1999 and 2008.[5]

To determine the quality of the traded goods, we will use unit values in the tradition of the IIT literature. Basically we assume that out of two goods that belong to the same product category at the four-digit level of the HS classification and that have the same weight in kilos, the one with the higher price tag is of higher quality. If their prices are the same, but product x_k^a is lighter than product x_k^b then the former is of higher quality.

We use the word quality in a very wide sense. It includes not only the quality of materials, technological characteristics and design, but also brand image and product goodwill. Export prices may also depend on things other than product quality. These may include exchange rate misalignments (not so much an issue in the Economic and Monetary Union), differences in production costs or transportation costs. (See discussion in e.g. Fontagné, Gaulier and Zignago, 2008).

In some sectors low unit values can be an indicator of low costs and high efficiency, especially in highly competitive industries with generic products.[6] According to Aiginger (1997), who used German data, about two-thirds of three-digit sectors are dominated by price

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[4] For the sake of simplicity in notation, we will refrain from using the superscript *(a,b)* every time we refer to similarity in export structures between countries *a* and *b*.

[5] Because of their economic union, data for Belgium and Luxembourg are combined by statistical authorities for 1995 and the results can be found under Belgium.

[6] See discussion in e.g. Aiginger (1997).

competition and one-third by quality competition. Quality dominates the trade flows in the machinery industry and in some subsectors of the chemical industry. Price competition dominates in capital-intensive industries.

Martínez-Zarzoso and Suárez Burguet (2000) applied index-number theory to construct industry-level export price indices and export quality indices using Spanish data. They concluded that quality change is an important phenomenon in explaining the variation of unit values. Roughly half of the unit value differences among destination countries can be explained by quality differentials. They also argued that the use of unit values results in downward (upward) bias in the case of quality upgrading (downgrading).

The unit value of exports of product k from country a is given by

$$ UV_k^a = \frac{x_k^a}{q_k^a}, \tag{2} $$

where q is the quantity of exports in kilos. As is usually done in the horizontal/vertical IIT literature, we assume that unit values in the range of ±15 per cent represent similar quality:

$$ \frac{1}{1.15} \leq \frac{UV_k^a}{UV_k^b} \leq 1.15 . \tag{3} $$

If the ratio is smaller than $1/1.15 \approx 0.8696$ country a has a lower unit value of exports in product k than country b.[7] Then also product quality is lower in country a. If the ratio is higher than 1.15, the opposite is true.

We can now decompose S into three mutually exclusive parts depending on whether the unit export ratio is less than 1/1.15, between 1/1.15 and 1.15, or higher than 1.15:

$$ S = S^{low} + S^{same} + S^{high} . \tag{4} $$

S^{same} refers to the share of same-quality similarity in the total exports of two countries.

We also construct a single quality-adjusted similarity indicator that takes into account both S and S^{same}. This is because they are both important meters in terms of international competition. We specify the quality-adjusted similarity indicator as

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[7] Using 0.85 instead of the reciprocal of 1.15 would produce asymmetrical results.

$$\sigma = \frac{S^{same}}{1 - S} \,. \tag{5}$$

The value of σ is larger if, ceteris paribus, the share of same-quality exports is larger or if overall similarity increases. If both S^{same} and S are very high, σ can exceed unity. In practice, however, σ never exceeds unity in the country-pair analyses. Of course it is not possible to have $S^{same} > S$.

4 Similarity of countries' exports vis-à-vis the rest-of-the-EU

We will first review the results for 2008 with each country's export structure compared with that of the rest-of-the-EU, i.e. by excluding the country in question. This way the country under analysis does not distort the point of comparison. The results – sorted by σ – are reported in Table 1.

Germany and France have the highest quality-adjusted similarity when compared with the rest-of-the-EU. Both countries have higher S and higher S^{same} than any other country. The level of overall similarity is about the same for both countries, but France has less same-quality exports, and thus σ is larger in Germany.

On the other hand, France has a larger share of similar high-quality exports than Germany. Also Belgium, Denmark, the Netherlands, Austria and – surprisingly – the Czech Republic have a higher share of S^{high} than Germany.

In terms of S, Germany and France are followed by the UK, Spain, Belgium, Italy, Austria and Sweden. Higher shares of same-quality similarity in Italy and Sweden lift these two countries when measuring quality-adjusted similarity σ. On the other hand, Spain is suppressed by the large share of low-quality similarity.

Catching-up countries, be they the former transition economies of Central and Eastern Europe or for example Spain, have a large share of low-quality similarity despite a relatively high overall S. We argue that the similarity is largely due to foreign direct investment inflows from countries such as Germany. Similar but low-quality exports dominate especially in Spain, Poland, Slovenia and Latvia.

Overall similarity S is particularly low in the very small countries – Malta, Cyprus and Luxembourg – but also Ireland. In these countries also same-quality similarity is strikingly low, with much more either

high-quality or low-quality products. As a result, the value of σ is very low in these four countries.

Table 1 **Similarity of export structures compared with the EU27 less the country in question in 2008, sorted by σ**

| Country | Population, mill. | Similar (*S*) | of which | | | Quality-adjusted similarity σ |
			low quality (S^{low})	same quality (S^{same})	high quality (S^{high})	
Germany	82.4	0.79	0.13	0.39	0.28	1.91
France	64.1	0.76	0.05	0.30	0.41	1.23
Italy	58.1	0.67	0.16	0.26	0.25	0.81
Sweden	9.0	0.66	0.13	0.26	0.26	0.77
Belgium	10.4	0.68	0.11	0.24	0.34	0.74
United Kingdom	60.8	0.70	0.25	0.21	0.25	0.70
Austria	8.2	0.67	0.16	0.22	0.29	0.64
Netherlands	16.6	0.61	0.06	0.24	0.30	0.61
Spain	40.5	0.69	0.45	0.18	0.05	0.58
Poland	38.5	0.61	0.40	0.16	0.05	0.41
Denmark	5.5	0.56	0.08	0.17	0.31	0.38
Czech Republic	10.3	0.62	0.19	0.14	0.29	0.37
Hungary	10.0	0.55	0.26	0.16	0.14	0.35
Portugal	10.6	0.54	0.29	0.15	0.10	0.32
Finland	5.2	0.47	0.11	0.16	0.20	0.31
Greece	10.7	0.46	0.23	0.17	0.06	0.30
Romania	22.3	0.48	0.29	0.14	0.05	0.28
Slovenia	2.0	0.58	0.39	0.11	0.08	0.26
Lithuania	3.6	0.47	0.27	0.13	0.07	0.25
Estonia	1.3	0.46	0.27	0.13	0.07	0.24
Slovakia	5.5	0.53	0.28	0.11	0.13	0.23
Latvia	2.3	0.49	0.31	0.10	0.08	0.19
Bulgaria	7.3	0.41	0.26	0.10	0.05	0.17
Ireland	4.1	0.30	0.10	0.04	0.16	0.06
Luxembourg	0.5	0.30	0.13	0.04	0.13	0.06
Cyprus	0.8	0.32	0.14	0.03	0.16	0.04
Malta	0.4	0.23	0.08	0.02	0.14	0.02

We can see differences between the *S* and σ columns. Although there is a relatively strong positive non-linear correlation between the two, there is a lot more variation in σ than in *S*. The more there is similarity between export structures, the more it tends to be of similar quality.

Between 1999 and 2008, all countries except Ireland and Luxembourg have experienced an increase in overall similarity vis-à-vis the-rest-of-the-EU. This shows that integration has made Europe more similar during the decade. The largest positive changes have occurred in the new member countries: Latvia, Romania, Lithuania, Estonia and Poland. Same-quality similarity has increased especially in Germany and Sweden but also Italy, Greece, Romania and Lithuania.

The significant rise in same-quality similarity has lead to a very large increase in Germany's σ. There is also a considerable increase in σ in Sweden and Italy. Meanwhile, there is a decline especially in Malta, but also Belgium, the UK and Slovakia.

There has occurred a considerable move from low-quality similarity to high-quality similarity especially in the Czech Republic, but also France, Italy, Belgium and the Netherlands. On the other hand, there has been a move from high-quality similarity to low-quality similarity especially in Germany, but also Sweden, the UK, Spain, Portugal and Estonia.

5 Extensive margin and quality margin of the export structures

The overall export structures of the large member countries – measured by population in Table 1 – are the most similar with respect to the rest-of-the-EU average. Large countries – and of course the EU as a whole – have a more heterogeneous manufacturing and export structure than smaller countries that tend to specialise more. There are some exceptions among the smaller countries. Notably Sweden, Belgium and Austria have relatively high S. Belgium is lifted by its status in arbitrage trade.

This tendency is in line with the models of monopolistic competition in the tradition of Krugman (1981). According to these models, larger economies produce and export a larger range of goods (the extensive margin).

On the other hand, the catching-up countries (the NMCs, Greece, Portugal and Spain) specialise relatively speaking more in low-quality products. This corresponds to the world of vertical differentiation models – e.g. Flam and Helpman (1987). According to these models, wealthier countries produce and export higher quality goods than less advanced countries (the quality margin).

According to Hummels and Klenow (2005) the extensive margin accounts for a little over 60 per cent of the greater exports of larger

economies.[8] The extensive margin plays a more prominent role for wealthier economies (66 per cent) than for economies with more workers (59 per cent). Countries with twice the GDP per worker export 34 per cent higher quantities at 9 per cent higher prices, which is consistent with higher product quality.

Table 2 shows the results of simple OLS regressions (using data from Table 1). First we have the similarity vis-à-vis the rest-of-the-EU as the dependent variable and either population or GDP as the independent variable. The coefficients are positive and statistically highly significant, which is in line with the theory of extensive margins.

Table 2   Analysis of extensive and quality margins in 2008

Extensive margin Dependent variable 'Similarity vis-à-vis the rest-of-the-EU'		
Constant	0.029^{***} (0.029)	-0.336^{**} (0.127)
log of population	0.082^{***} (0.011)	..
log of GPD in market prices	..	0.073^{***} (0.011)
R^2	0.68	0.66
Quality margin Dependent variable 'High-quality similarity vis-à-vis the rest-of-the-EU'		
Constant	-0.781^{***} (0.257)	
log of GPD per capita in market prices	0.096^{***} (0.026)	
R^2	0.36	

Note: Using purchasing-power-adjusted GDP and GDP per capita gives qualitatively similar results as does GDP in market prices that we have used here. Standard errors are presented in parenthesis. *** = significant at the 1 per cent level, ** = significant at the 5 per cent level.

The last regression shows the share of similar high-quality products (S^{high}) as the dependent variable and GDP per capita as the independent variable. The higher GDP per capita and thus average productivity in the country are the larger is the share of similar high-quality prod-

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[8] They use data that covers exports from 126 countries to each of 59 importers in over 5,000 six-digit product categories in 1995.

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ucts in its exports vis-à-vis the average export structure of other EU countries. This result supports the existence of a quality margin.

6 Same-quality similarity between pairs of countries

There are 351 country pairs between the 27 EU countries. As can be expected, average similarity is somewhat lower when analysing country pairs than when comparing against the rest-of-the-EU.

Figure 1 depicts the sorted values of S^{same} in a descending order. In 1999 the average of S^{same} was 0.076 and the median 0.064. In 2008 both the average and the median were 0.092. The highest and the lowest values have not changed that much, but in between there is a clear increase in S^{same}.

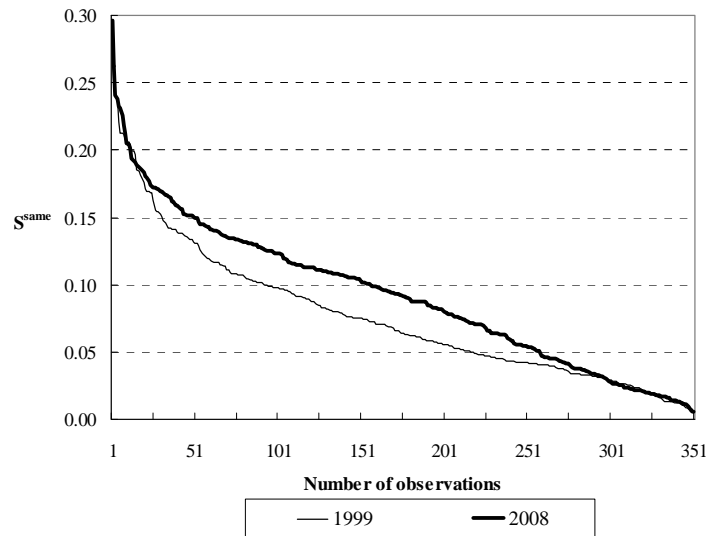**Figure 1** S^{same} **sorted in a descending order**

Table 3 shows the averages and medians for S^{same} calculated for country pairs between and within two groups of countries: 1) the EU11 countries, i.e. the EU15 less the cohesion countries (Greece, Ireland, Portugal and Spain), and 2) the remaining 16 EU countries. This division follows checker-board line drawn in Figure 2 below.[9]

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9   In terms of our results, Ireland differs from the other cohesion countries, but also from the other EU15 countries (see Table 1). We have included Ireland in the group of cohesion countries.

Table 3   **Average and median results for S^{same} between and within two groups: EU11 and NMCs+cohesion countries**

Year and country groups compared	Average	Median	Standard deviation
1999			
Within EU11	0.123	0.118	0.059
Between EU11 and NMCs + cohesion	0.058	0.046	0.038
Within NMCs + cohesion	0.082	0.079	0.048
Within EU27	0.076	0.064	0.051
2008			
Within EU11	0.129	0.136	0.062
Between EU11 and NMCs + cohesion	0.080	0.080	0.040
Within NMCs + cohesion	0.094	0.097	0.061
Within EU27	0.092	0.092	0.054

Note: EU11 = EU15 less cohesion countries (Greece, Ireland, Portugal and Spain).

In terms of S^{same} the EU11 countries were a tighter group than the second group of countries in 1999. The level of same-quality similarity between the two groups was rather low at 0.058. The medians were always a little lower than the averages. In 2008, the within-average for the EU11 had risen slightly to 0.129, the one for the other group moderately to 0.094, and the between group average a bit more to 0.080. Now the medians were the same or higher than the averages.

The between-group average has increased the most. This is evidence of the rise in the relative quality of the products exported by the NMCs and cohesion countries as well as of the growing similarity between the EU countries overall.

Figure 2 depicts the strongest S^{same} links between countries. In 2008, 74 out of the 351 country pairs had overall similarities exceeding 0.5. However, in only 38 cases S^{same} exceeded 0.16, and in only 12 cases it exceeded 0.20. Germany and Austria had the highest bilateral S^{same}, i.e. the share of same-quality exports, 0.296. The limits 0.16 and 0.20 have been chosen so that the graph remains legible.

Looking at the patterns of S^{same}, certain competing country clusters may be tentatively identified: Netherlands–Belgium; Germany–Austria–Sweden; Germany–France–Italy; Spain–Poland; and Romania–Bulgaria–Lithuania. Meanwhile there are four countries, Cyprus, Ireland, Luxembourg and Malta, whose same-quality similarities are too low with respect to all other EU countries to exceed 0.16.

Figure 2   **Same-quality similarity (S^{same}) in 2008**
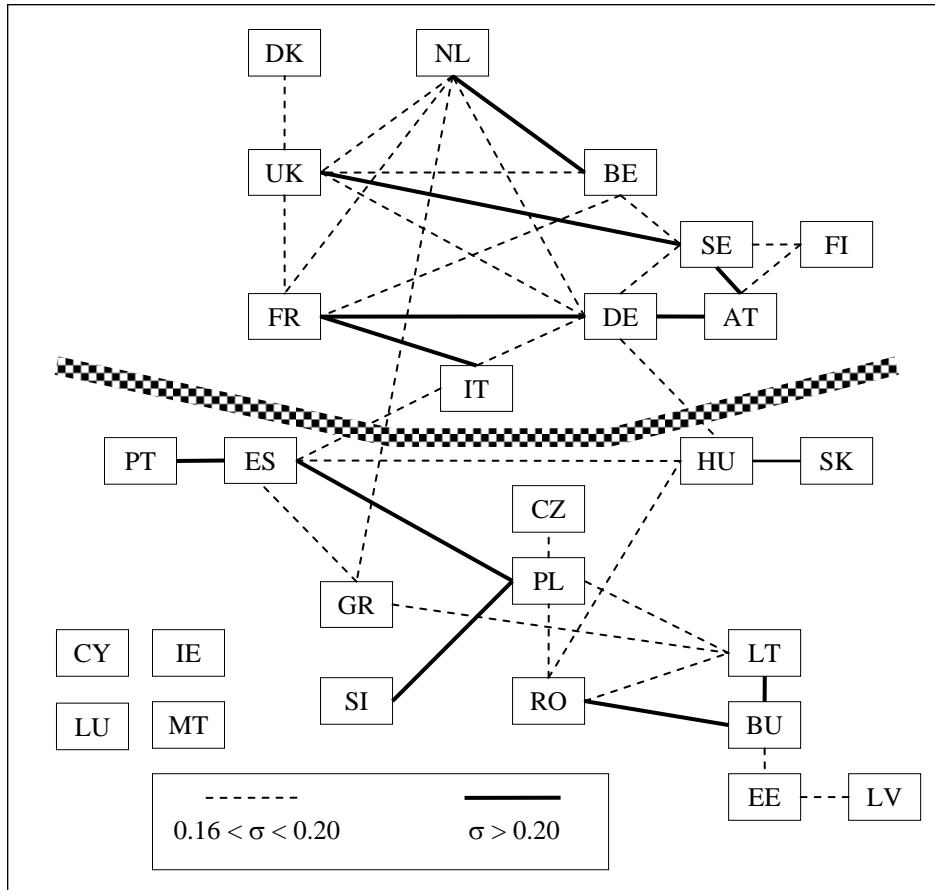
We have drawn a checker-board line between the non-cohesion EU15 countries on the one hand and the NMCs plus the cohesion countries on the other hand. This ravine is only bridged by Spain with Italy, Greece with the Netherlands, and Hungary with Germany. Otherwise high same-quality similarity occurs within either of the two groups of countries. However, as we saw above in Table 3, S^{same} has increased the most between these two groups so the situation is changing.

As we will later see, the quality-adjusted similarity index allows for more connecting lines between the two groups of countries because σ is a function of not just S^{same} but also S.

7 Quality-adjusted similarity between pairs of countries

Drawing a graph of σ's sorted by values produces a picture that is qualitatively similar to Figure 1. We will not show this graph, but will instead look at the within and between-averages for the two country groups: 1) EU11 and 2) NMCs + cohesion countries.

In 1999, the within-average of σ was 0.261 for the EU11 area, and 0.129 for the NMCs + cohesion countries. The between-average was again lower: 0.095. The medians were a little lower than the averages. In 2008, the within-average for the EU11 had risen slightly to 0.284, the one for the other group to 0.168. The between-average had risen a bit more to 0.144. The medians remained a little lower than the averages but their difference had decreased.

Table 4   Average and median results for σ between and within two groups: EU11 and NMCs+cohesion countries

Year and country groups compared	Average	Median	Standard deviation
1999			
Within EU11	0.261	0.216	0.177
Between EU11 and NMCs + cohesion	0.095	0.072	0.077
Within NMCs + cohesion	0.129	0.115	0.097
Within EU27	0.132	0.103	0.120
2008			
Within EU11	0.284	0.276	0.183
Between EU11 and NMCs + cohesion	0.144	0.143	0.087
Within NMCs + cohesion	0.168	0.162	0.129
Within EU27	0.174	0.162	0.130

Note: EU11 = EU15 less cohesion countries (Greece, Ireland, Portugal and Spain).

Next we will map the highest σ pairs for 1995, 1999 and 2008 in Figures 3-5. Data for 1995 only includes the EU15 countries. The countries that do not have any $\sigma > 0.3$ compared with other EU15 countries are gathered on the side of the graph. Quality-adjusted similarity is divided into four intensities.

In 1995, there was strong quality-adjusted similarity between France–Germany, France–UK, and Sweden–Finland, as well as slightly weaker similarity between France on the one hand and the Netherlands and Belgium on the other. There was also relatively strong similarity between the Netherlands on the one hand and the UK and Belgium on the other, as well as between Spain and Italy.

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Figure 3   **Quality-adjusted similarity (σ) of export structures in 1995 (data for EU15 countries only)**
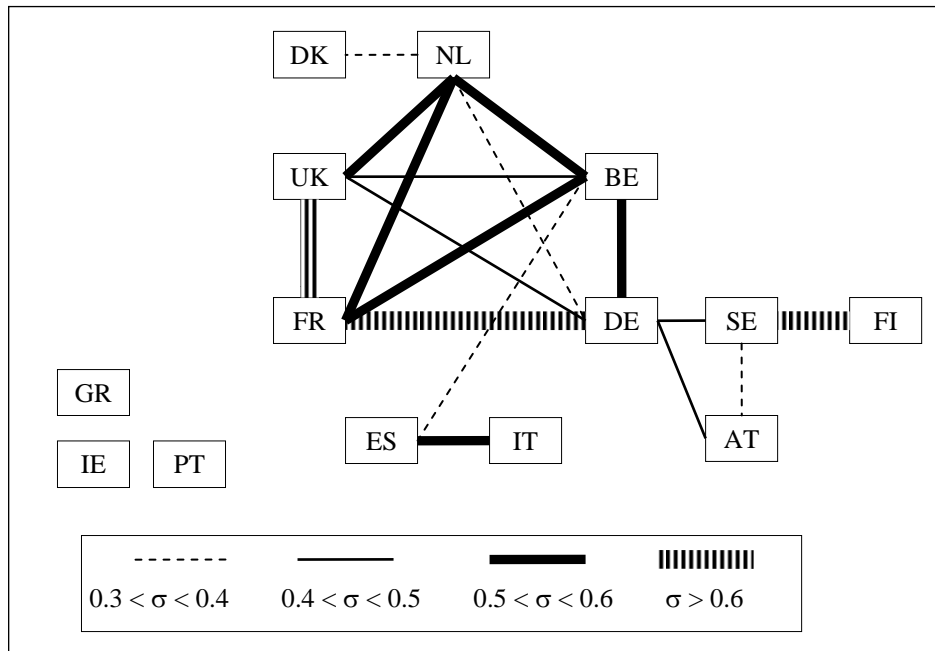
In 1999, we can include the NMCs into the analysis. First let us see what has happened between the EU15 countries. The similarities have in many cases decreased.[10] Strong links remain for Germany–France and Sweden–Finland. A new link has emerged in Germany–Austria. The new member countries have moderate similarity with some EU15 countries as well as with each other, especially the Czech Republic with Spain and Poland as well as Romania with Bulgaria. There are nine countries that do not have any $\sigma > 0.3$.

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[10] The average of σ for intra-EU15 country pairs (excl. Luxembourg) was 0.224 in 1995, 0.221 in 1999, and 0.254 in 2008. The intra-Euro Area average increased from 0.222 in 1999 to 0.251 in 2008. The non-Euro Area countries Denmark, Sweden and the UK experienced a similar rise on average, so the introduction of the euro may not have affected the development.

Figure 4   **Quality-adjusted similarity (σ) of export structures in 1999**
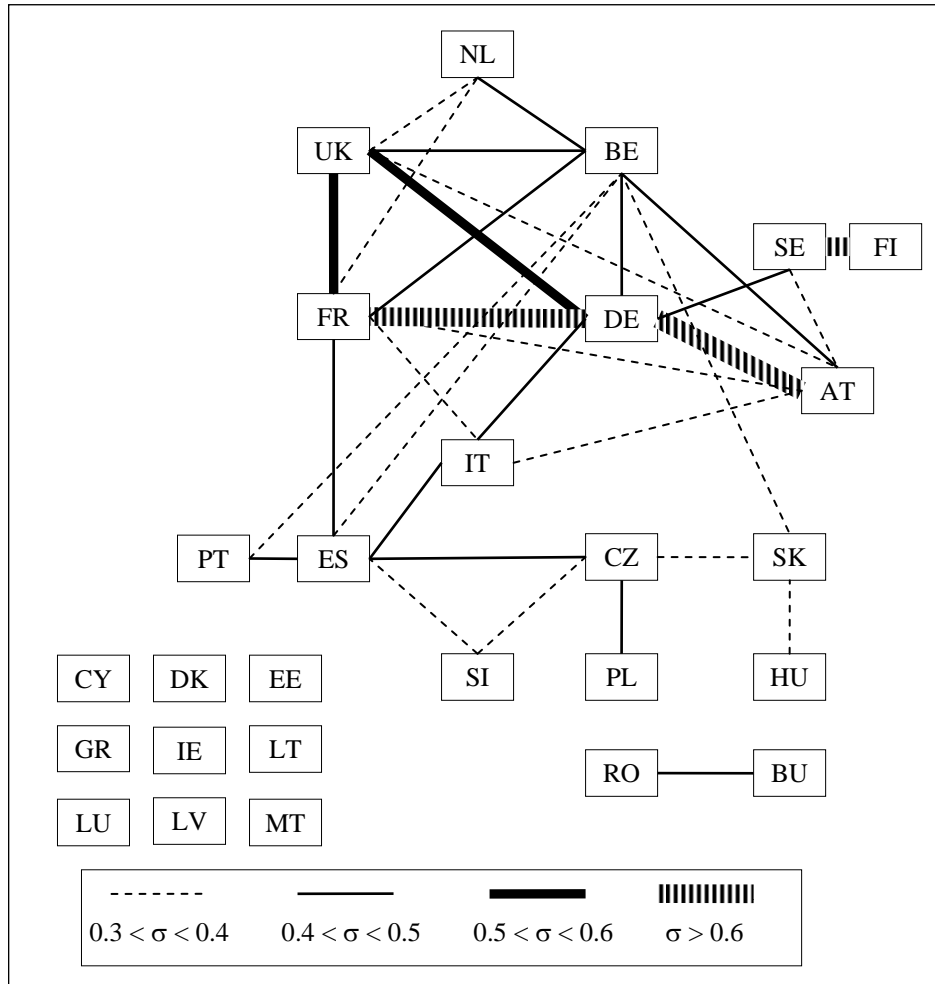
By the time we get to the year 2008, these trends have for the most part strengthened (see Figure 5). The French–German and the German–Austrian links remain strong. Other relatively strong links now exist for Netherlands–Belgium and Sweden–Austria. Spain faces competition from Portugal and Poland, and Poland also from and the Czech Republic. A strong Balkan link has emerged in Romania–Bulgaria, and the latter also competes with the Baltic countries.

Figure 5   **Quality-adjusted similarity (σ) of export structures in 2008**

There are some moderate links between the EU15 countries and the NMCs, but not that many. The Baltic countries, Romania and Bulgaria do not have any. Nevertheless, the number of country pairs with $\sigma > 0.3$ has increased considerably. This is evidence of increasing integration and catching up. According to De Benedictis and Tajoli (2007) similarity in export composition (at the sectoral level) has had a positive effect on catching-up in the EU.

Also Crespo and Fontoura (2007) argued in their analysis with data ending in 2003 that the new member countries' trade specialization was evolving quickly closer to the EU15, mainly in the more ad-

vanced NMCs. Still, most NMC exports were more similar to each other than to the EU15. The exceptions, in this context, were the Czech Republic, Hungary and Slovenia. These results are relatively consistent with ours.

8 Conclusions

We have analysed the similarity of EU countries' export structures and constructed a quality-adjusted similarity indicator by combining the similarity index proposed by Finger and Kreinin (1979) with product quality as measured in the literature of horizontal and vertical intra-industry trade.

The similarity of export structures tells us about the intensity of competition between two countries in world markets as well about the similarity in the effects of demand and supply shocks that arise via international trade. With the introduction of the quality dimension, similar products turn out to be less perfect substitutes to each other than in an analysis that does not consider quality.

We find support of both the extensive margin in the tradition of monopolistic competition models (Krugman 1981, etc.) as well as the quality margin in the tradition of vertical differentiation models (Flam and Helpman 1987, etc.). Evidence in support of the extensive margin can be seen in that the largest countries have the most similar export structures relative to the rest-of-the-EU, i.e. the EU without the country in question. Evidence in support of the quality margin can be seen when we analyse quality-adjusted similarity.

Between 1999 and 2008 almost all EU countries have seen an increase in overall similarity vis-à-vis the rest-of-the-EU. Integration has made Europe more similar over the course of time. The largest positive changes have occurred in some new member countries: Latvia, Romania, Lithuania, Estonia and Poland.

Also the average of same-quality similarity, measured for pairs of countries, has increased considerably. The rise has occurred especially within the group that includes the NMCs and cohesion countries (Greece, Ireland, Portugal and Spain), as well as between these countries and the EU11, i.e. the EU15 less the cohesion countries. This is evidence of the rise in the relative quality of the products exported by the NMCs and the cohesion countries as well as of the growing similarity between the EU countries overall.

Our quality-adjusted similarity indicator, σ, is a positive function of overall similarity and S^{same}. We can see a clear rise in σ by pairs of countries between 1999 and 2008. The strongest quality-adjusted similarity now exists between France–Germany and Germany–Austria. Other relatively strong links exist between Netherlands–Belgium, Sweden–Austria, Spain–Portugal–Poland, Poland–Czech Republic, and Romania–Bulgaria.

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