

Quality Upgrading, Technological Catching Up and Trade: The Case of Central and Eastern European Countries

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– ABSTRACT –

The aim of the paper is to analyse the role of vertical innovation on the pattern of trade for economies trading with technologically more advanced countries. We first present a model where the international diffusion of knowledge promoted by economic integration is the source of a technological catching up. We show that such a process leads to a “convergence in quality” of traded goods, with a positive effect on exports.

We then focus on the evolution of trade between the Central and Eastern European countries (CEE-5) and their European Union partner countries, in order to assess whether their economic integration into the EU has favoured the quality upgrading of the goods produced. Using a data-set covering the period 1995-2005, we find evidence of an increasing role of intra-industry trade and, more specifically, of vertical differentiation, as well as of a process of specialisation in up-market and higher quality products, in particular in medium and high-skill sectors.

Finally, we test the assumption of the theoretical model that the quality upgrading of the goods produced is the explanation of the improved performance of exports. We find evidence of an increasing role of trade in quality-dominated markets, where the CEE-5 have gained market shares also thanks to a successful quality competition.

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1. Introduction

The recent development of theories of technological change has given rise to a new perspective in the analysis of the relation among trade, growth, and technological change in open economies.¹ In the context of the new-Schumpeterian approach to growth, it has been stressed that goods manufactured in a given economy embody a “quality content” which reflects the stock of knowledge capital available in that country at a given time.² It follows that countries which are characterised by a technological disadvantage with respect to leader economies produce goods with a lower quality content; moreover, such a technological gap is bound to widen over time, due to the lower rate of innovation taking place in lagging countries. Yet, as emphasised in the literature, lagging countries may benefit by the higher level of knowledge capital of technologically advanced countries, given the public good characteristic of knowledge capital. In fact, there is wide empirical evidence that the international diffusion of knowledge is promoted, among others, by trade in goods and services, foreign direct investment, migration and business contacts,³ and that with the integration of markets both the spread of general scientific knowledge and the diffusion of more product-specific information take place.

Within this context Cavallaro-Mulino (2007) address the issue of the external constraint on growth for a follower country, in the presence of a lack of competitiveness stemming from the lower quality of the goods produced. The authors derive export and import demand functions which depend on both tradables’ relative prices and their relative quality content. A catching up process driven by international knowledge spillovers is then considered, which leads to a reduction of the quality gap between tradables, with positive effects on trade. In fact, the model shows that the export performance of the follower country depends to a large extent on its ability to absorb foreign technology, that is, to master and eventually improve upon technologies conceived abroad, and only to a lesser extent on pure terms of trade changes. It turns out that the more lagging countries are open to the rest of the world, the greater is their ability to benefit by the higher stock of knowledge capital which is generated in leader countries.

In the present paper we focus on a group of countries that have undergone a process of intense economic integration, and investigate whether the evolution of trade is consistent with the model predictions that economic integration favours the quality upgrading of the goods produced. We look at the case of new EU members, with particular reference to five⁴ Central and Eastern European countries (CEECs-5). A

¹ Grossman and Helpman (1991), Aghion and Howitt (1992), Edwards (1998).

² As known, such is the case of vertical innovation in the so-called “quality ladder” models, where a quality upgrading process takes place over time.

³ Keller, 1999, 2002; Crispolti and Marconi, 2005; Léon-Ledesma, 2005.

⁴ That is, the Czech Republic, Hungary, Poland, Slovakia and Slovenia.

considerable body of empirical literature has focused on the economic transition of these countries and their catching up with the EU-15, following their economic integration with the other European countries. One of the main questions at issue is whether the acceding process has fostered the growth dynamics in these countries, by affecting their pattern of trade specialisation. Most contributions point to the fact that, as early as the first half of the nineties, such countries have shifted exports from low to high-tech industries, with a decreasing weight of one-way trade, so that in more recent years intra-industry trade (IIT) has a predominant role. Such a process signals the increased similarities of the CEECs with the other EU members. In addition, there is evidence of a greater importance of two-way trade in vertically differentiated products with respect to horizontally differentiated goods.⁵ With reference to the latter point, among the others,⁶ Dulleck *et al.* (2005) address the issue of the quality upgrading evolution of exports in these countries, and find mixed evidence of a reduction in the quality differential of the goods produced. The authors analyse quality at different levels of aggregation,⁷ and find that, whereas the CEECs-5 have managed to move from low to high-quality segments within each industry, and to increase the average quality of the goods produced within segments, the Baltics and South-Eastern Europe appear to have entered a “low-quality trap”.

Our analysis aims to further develop the empirical investigation for the CEECs-5. We use a data-set covering the period 1995-2005, which allows us to consider the whole time period relevant for the economic integration process. We first perform a descriptive analysis in which we study the evolution of the structure of trade, by means of the methodology proposed by Fontagné and Freudenberg (1997), and find evidence of an increasing role for intra-industry trade in the economic relationship between CEECs-5 and EU-13. We then disentangle vertical from horizontal IIT, by resorting to the unit value ratio proposed by Greenaway, Hine and Milner (1994). Within the share of vertical IIT, we further distinguish between the positive and the negative vertical trade, in order to capture the relative quality content of each traded good with respect to the partner country. Our analysis confirms that quality upgrading is on the rise, and that the process of trade reorientation has occurred with a specialisation in up-market and higher quality products, in particular in medium and high-skill sectors.

In order to understand whether the changes occurred in the structure of trade are at the basis of a growth of CEECs-5 exports, we then perform a regressive analysis where we test the role of the changing pattern of trade on the dynamics of the CEECs-5 market shares with respect to EU-13 partner countries. By so doing we provide empirical support to the assumption of a successful quality competition, as we find evidence of an increasing role of trade in quality-dominated markets.

2. The theoretical model

⁵ See, among others, Aturupane, Djankov and Hoekman, 1997 and Freudenberg and Lemoine, 1999. Similar results have been obtained also for EU-15 trade. (Fontagné, Freudenberg and Péridy, 1998).

⁶ Freudenberg and Lemoine (1999), Ferragina and Pastore (2004),

⁷ The different levels quality upgrading are: upgrading across industries, within industries (across different quality segments), within quality segments (across products).

In this section we recall briefly the theoretical model developed in Cavallaro-Mulino (2007), from which we derive some of the results that are at the basis of the empirical investigation of next sections.

As in more recent trade theory contributions, the analytical framework considered is one of a *semi-small* open economy, trading with the “rest of the world”, where imported goods are purchased at given world prices, whereas exported goods are perceived to be imperfect substitutes for the tradable goods of other countries, so that the country faces a downward sloping demand schedule for its exports. The number of goods produced in the country is fixed; over time R&D activity takes place and leads to the quality upgrading of the goods produced, as in the so-called “quality ladders” of the new-Schumpeterian approach to growth. Due to the lower rate of innovation, the goods manufactured in the country have a lower quality content with respect to the goods manufactured in the rest of the world, which will be labelled as the “advanced country”. There are no tariffs, transportation costs or other trade barriers, and only final goods are internationally traded.

Households have a preference for diversity and therefore derive utility from the consumption of n goods manufactured in the follower country and m goods manufactured in the advanced one. Preferences of the representative consumer among home and foreign goods is described by the following utility function:

$$(1) \quad U = \left(q^H \sum_{i=1}^n C_i^{\frac{\theta-1}{\theta}} + q^F \sum_{j=1}^m C_j^{\frac{\theta-1}{\theta}} \right)^{\frac{\theta}{\theta-1}}$$

where the subscripts H and F refer to the home and the foreign countries, respectively. Domestic and foreign goods (imports) enter in consumer’s preferences in relation to their quality content, q^H and q^F , respectively.⁸ It is assumed that all consumption goods manufactured in a given country have an identical quality content, since they embody the same country-specific know-how, and therefore they enter symmetrically in equation (1). The parameter $\theta > 1$ is the constant elasticity of substitution among all goods.⁹

Utility maximisation by the representative consumer in the home country leads to the following demand function for the domestic good i and for the imported good j :

$$(2) \quad C_i = \left(\frac{P_i}{P} \right)^{-\theta} \delta^\theta \frac{E}{P}$$

$$(3) \quad C_j = \left(\frac{rP_j}{P} \right)^{-\theta} (1 - \delta)^\theta \frac{E}{P}$$

⁸ The relative quality content thus represents the relative weight of domestic and foreign goods in consumers’ preferences. In fact, by appropriate transformation of equation (1), the utility function can be

expressed as $U = B \left(\delta \sum_{i=1}^n C_i^{\frac{\theta-1}{\theta}} + (1 - \delta) \sum_{j=1}^m C_j^{\frac{\theta-1}{\theta}} \right)^{\frac{\theta}{\theta-1}}$, where $B = (q^H + q^F)^{\frac{\theta}{1-\theta}}$ and $\delta = \frac{q^H}{q^F + q^H}$.

⁹ To save on notation, the same value of the elasticity of substitution is assumed to hold among all goods, irrespective of their place of production.

where E is consumer i 's expenditure, P_i and P_j represent the prices of the domestic and the imported good, r is the exchange rate, and $\delta = \frac{q^H}{q^F + q^H}$ represents the relative quality content of the domestic goods, which should be intended as the relative amount of services provided by domestic goods. As to P , it denotes the price index consistent with the preference specification given in equation (1).¹⁰

Equations (2) - (3) show that the consumer's demand for good i and for good j , produced in the lagging and in the advanced economy, respectively, is a function of relative prices, with elasticity θ , real income, with unitary elasticity, and that the relative quality content of the good impacts on the magnitude of the expenditure proportionality. The importance of the quality content in the structure of demand appears clearly by looking at the ratio between the demand for consumption goods C_i and C_j :

$$(4) \quad \frac{C_i}{C_j} = \left(\frac{P_i/q^H}{rP_j/q^F} \right)^{-\theta}$$

which shows that consumer i 's relative demand is decreasing in quality-adjusted prices, or equivalently, that relative demand depends on the goods' price ratio and their relative know-how content. Market demand for good i is obtained by summing over residents and non-residents' demands, which are denoted by C_i^H and X_i , respectively. Domestic demand for good i takes exactly the same form as equation (2), but with expenditure referred to national-wide expenditure,¹¹ E^H . As to foreign demand, under the usual assumption that consumers' preferences in the two countries are symmetric, exports of good i are given by:

$$(5) \quad X_i = \left(\frac{P_i}{P} \right)^{-\theta} \delta^\theta \frac{E^F}{P}$$

where $P = rP^F$ is the foreign price index in terms of the domestic currency,¹² and $E^F = rR^F$ is the foreign expenditure in terms of the domestic currency. Correspondently, imports of good j are obtained from equation (3), but with expenditure referred to national-wide expenditure, E^H :

$$(6) \quad M_j = \left(\frac{rP_j}{P} \right)^{-\theta} (1 - \delta)^\theta \frac{E^H}{P}$$

As to the supply-side of the model, there is a large number of firms, each producing a differentiated final good i . Technology is described by the following constant-return-to-scale function

$$(7) \quad Y_i = F_i L_i^\alpha A_i^{1-\alpha}$$

¹⁰ The demand equations are extensively derived in Cavallaro-Mulino (2007), to which we refer for the details.

¹¹ The economy's total expenditure is given by total wages and profits earned in the different sectors of the economy.

¹² This follows from the assumption that consumers' preferences in the two countries are symmetric.

where F_i is an arbitrary constant reflecting the choice of units, L_i and A_i are labour and intermediate input, respectively. Quality improvements take place in the R&D sector and are embodied in the intermediate input. Following Grossman and Helpman (1991), the hypothesis is that the producer in the intermediate sector engages labour resources in R&D at intensity ι for a time interval of length dt .¹³ The probability of gaining success in lab activity is thus proportional to the resources devoted: to achieve a research intensity of ι , it is necessary to invest $L_R = \ell_R \iota$ units of labour services per unit of time, where ℓ_R is a parameter reflecting the productivity of labour in research. The entrepreneur will invest labour in research activity up to the amount for which the cost of R&D activity equals the expected revenues; successful research leads to the manufacture of a new generation intermediate. If successful, he will then be able to manufacture a new generation intermediate¹⁴ which will provide γ additional services with respect to the previous generation intermediate. Assuming that all domestic firms use the same technology in the production of the final good, it follows that $A_i = q^H Z_i$, with Z_i denoting the quantity of the intermediate input and q^H its productivity in terms of the services provided. Thus, q^H reflects the country's state of knowledge at a given time t , and represents the quality embodied in the final good manufactured with the state-of-the-art intermediate.

Given the assumption that each firm is a monopolistic competitor in the world market,¹⁵ the behaviour of firm i is described by a standard profit optimization problem. The optimal price rule followed by producers implies a fixed margin over the unit costs of production both in the final sector and in the intermediate sector; in the latter sector, in particular, the mark-up is equal to γ , that is, it reflects the increase in quality embodied in the superior intermediate so that the price of a better quality input is equal to the minimum quality-adjusted unit production cost.

Since all domestic firms use the same technology in the production of the final good and face the same demand curve, in a symmetric equilibrium all final goods have the same price, that is, $P_i = P^H$.

The focus of the analysis is on the external constraint on long-run growth, and hence the country's export and import demand functions are derived: the former is obtained by summing non residents' demand functions over the n domestic goods; the latter is obtained by summing residents' demands over the m foreign goods. The following current account equilibrium condition is obtained:

$$(8) \quad \sum_{i=1}^n P_i X_i = \sum_{j=1}^m r P_j M_j$$

where the left hand side is the value of exports, and the right hand side is the value of imports in terms of the domestic currency. The corresponding demand functions -

¹³ We are thus assuming that success in innovation and in imitation arises randomly, following a Poisson processes, with ι denoting the parameter of the density function.

¹⁴ Although the arrival of research successes among firms is guided by independent Poisson processes, by the law of large numbers, the process of technological advance at the aggregate level is smooth and non-random. For a similar reasoning, see Grossman and Helpman, 1991.

¹⁵ Such assumption is in line with the imperfectly competitive framework of the new trade theory. See, for instance, Krugman, 1979, 1980.

equations (5) and (6) - are then substituted in equation (8), which is then expressed in dynamical terms, in order to get the growth rate of real income consistent with the current account equilibrium, \tilde{Y}_B^H , that is:

$$(9) \quad \tilde{Y}_B^H = \tilde{Y}^F + (1 - \theta)(\tilde{P}^H - \tilde{r} - \tilde{P}^F) + \theta(\tilde{q}^H - \tilde{q}^F)$$

Along with the impact of the exogenous change in foreign income and of the relative price change,¹⁶ equation (9) shows that a relatively faster technological upgrading in a given country results in a beneficial effect on its growth rate of income. This follows from the fact that the model allows for a quality difference among traded goods, so that the pure price effect does not fully capture the “outcome” of competition on trade. Such a result is in line with the new-Schumpeterian view that firms compete not so much by varying price as by innovating. It follows that the amount and productivity of labour resources devoted to research activity are of the outmost importance in determining a country’s advantage in trade.

The model then addresses the issue of relative quality dynamics in light of the overriding role it plays in determining the follower country’s patten of trade. In fact, as long as the follower country produces goods which lag behind as to their know-how content with respect to the technologically leader country, it is unfavoured in trade and may meet an external constraint on its long-run growth. In fact, in this case the growth rate of quality for the follower country is given by $\tilde{q}^H = \iota \log \gamma$, whereas for the leader country is given by $\tilde{q}^F = \varepsilon \log \gamma$, where ε is its rate of innovation, with $\varepsilon > \iota$.

Yet, as emphasised in recent contributions of the literature on innovation and endogenous growth,¹⁷ knowledge has the characteristic of an international public good, so that knowledge spillovers are international in scope; in such a case, a follower country benefits by the higher level of scientific and technological knowledge of the advanced country, and the knowledge disadvantage turns to be at the basis of a process of technological catching up, which positively impacts on the import and export demand functions. In the model, the productivity of labour resources allocated to research depends both on domestic structural factors, that is the capability of firms to use knowledge and labour effort to produce innovation,¹⁸ and on international spillovers, that are assumed to be positively related to the technological distance between countries. As to international spillovers, openness is a crucial factor in promoting the diffusion of knowledge, fostering both the spread of general scientific knowledge and the diffusion of more product-specific information.¹⁹

¹⁶ Equation (11) is similar to the traditional balance-of-payments constraint formula derived in McCombie (1998), McCombie and Thirlwall (1994) and Thirlwall (1979), except that now it is augmented for a quality differential effect.

¹⁷ See, for instance, Smulders, 2004, Léon-Ledesma, 2005.

¹⁸ Actually, the possibility of benefiting by the above international sources of quality improvement is related to the country’s ability to absorb foreign technology, that is, to master and eventually improve upon technologies conceived in other countries. The factors which make a country receptive of the technology embodied in foreign goods are closely linked to the country’s skill level, innovation policies, infrastructure and institutions conducive to innovation and to the country’s degree of openness.

¹⁹ In the R&D sector both innovation and imitation activities are carried on. The two activities may be treated analytically in a similar way, as imitation requires labour resources much like the other type of research. In fact, it has been stressed that in lagging-behind economies imitation requires “investment in technological capability” which implies “effort to apply existing knowledge in new circumstances.” (Pack and Westphal, 1976, p. 105).

Thus, the productivity of labour resources in research increases with domestic knowledge, as well as with foreign knowledge that flows into the economy:

$$(10) \quad \frac{dq_t^H}{dt} = \varphi \left[(q_t^H)^\omega (q_t^F)^{1-\omega} \right] \iota \log \gamma$$

where $(1 - \omega)$ is the degree to which foreign knowledge flows into the economy and is incorporated into the overall stock of knowledge capital, whereas $\varphi > 1$ reflects the efficiency with which the overall stock of knowledge capital is converted into R&D activity. Its value is assumed to be above unity, since increased market integration leads most follower economies to enhance the speed of quality upgrading thanks to both innovation and imitation activities.

Equation (10) may be restated as

$$(11) \quad \tilde{q}_t^H = \varphi \left(\frac{q_t^H}{q_t^F} \right)^{\omega-1} \iota \log \gamma$$

which shows that the productivity of labour resources in research depends positively on the technological gap, as $\left(\frac{q_t^H}{q_t^F} \right)$ is the measure of the country's technological disadvantage. Thus, a follower country's relative technological disadvantage can be a positive determinant of a catching-up process, provided that such country is able to fully capture the benefits of the international dissemination of knowledge. In fact, given the relative intensity in R&D activity between the two countries, $\frac{\iota}{\varepsilon}$, the more the follower country is able to master the knowledge embodied in foreign goods and technologies, and is efficient in making the overall stock of knowledge capital useful for its R&D activity, the higher will be its "conditional" convergence to the quality level of the advanced economy. Such a process leads to an improvement of its relative position in trade.

3. Methodological issues and descriptive analysis

On the basis of the theoretical setting outlined above, we focus on the evolution of the pattern of trade of the CEECs-5 with their 13 European Union partner countries.²⁰ Our choice is based on the ground that CEECs-5 countries have undergone a process of intense economic integration within the European Union; therefore, our aim is to investigate whether the evolution of their trade is consistent with the model predictions that economic integration favours the quality upgrading of the goods produced.

The measurement of quality upgrading in trade is linked to the notion of intra-industry trade (IIT), that is, to the simultaneous occurrence of imports and exports of goods within the same industry, and, in particular, to vertical intra-industry trade (VIIT), that is, the exchange of different qualities within narrowly defined product groups. The problem of how to measure intra-industry trade has been widely debated.²¹ Among the various indexes of IIT, we opt for the index independently developed by

²⁰ Among the EU-15 countries, we do not consider Belgium and Luxembourg, owing to lack of data.

²¹ For a discussion of such indicators, see Fontagné and Freudenberg (1997), Iapadre (2003), Fontagné, Freudenberg and Gaulier (2005).

Abd-El-Rahman (1986) and Vona (1991), which consider all bilateral trade flows as intra industry trade, without restricting this category to matched flows only, as in the Grubel-Lloyd style indexes. To exclude accidental or not significant bilateral trade, we follow Fontagné and Freudenberg (1997), and impose a threshold of 10% for trade overlapping in order to classify product bilateral trade as IIT.

Trade flows are thus classified as two-way flows only when one of the two components is no less than one tenth the other component, that is, when the following condition holds:

$$(12) \quad \frac{\min(X_{ijkt}, M_{ijkt})}{\max(X_{ijkt}, M_{ijkt})} > 0.10$$

where indices i and j represent the declaring and the partner country,²² respectively, and k stands for the single product in year t . Such trade classification and the corresponding indexes are computed on imports and exports flows at 6-digit level of industrial products from the UNCTAD Trade Analysis System, and aggregated using standard correspondence tables to NACE classification. The data set covers the years between 1996 and 2005.²³

We then distinguish between vertical IIT (VIIT), i.e. trade in goods of different quality, and horizontal IIT (HIIT), indicating trade in varieties of similar quality. Following Greenaway, Hine and Milner (1995), this classification is made on the basis of the unit value ratio (UVR), defined as the ratio between the unit values (value per unit of good per tonne) of exports and imports of the same products. It is assumed that differences in prices are proxied by differences in unit values, and that the latter reflect quality differences for the same product, since goods of a higher quality either are produced employing higher cost inputs or can command a higher price on the market. We distinguish between product varieties (with a similar quality level) and quality differentiated goods by positing a 15% threshold,²⁴ so that traded products are considered horizontally differentiated if the following condition is fulfilled:

$$(13) \quad \frac{1}{1.15} < \frac{UVX_{ijkt}}{UVM_{ijkt}} < 1.15$$

When condition (12) is not fulfilled, products are considered to be vertically differentiated. Following Fontagné and Freudenberg (1997), the lower limit is set at 1/1.15, instead of a “symmetric” 0.85 because, as pointed out by Crespo and Fontoura (2004), in this way goods are always classified in the same category, irrespective of the choice of the reporter and the partner country.²⁵ We further divide VIIT into positive VIIT (VIIT+), which refers to goods with $UVR > 1.15$, and negative VIIT (VIIT-), relative to goods with $UVR < 1/1.15$. The former includes goods with a higher unit value for exports than imports, whereas the latter comprises goods with a lower unit value for exports than imports.

²² The CEECs-5 are the declaring countries, whereas the EU-13 are their partner countries.

²³ However, we lack data for the Czech Republic in 2005 and for Slovakia in 2000.

²⁴ The threshold of 15% is based on the hypothesis that transport costs never account for more than 15% of the FOB price.

²⁵ On the contrary, if the “symmetric” threshold were used, a product with UVR of 0.85 would be classified as VIIT in the reporting country and as HIIT in the partner country.

To calculate the indexes of the share of the various trade types (VIIT+, HIIT, VIIT- and InterIT) in total trade of each declaring country, the following formula is applied:

$$(14) \quad V_{it}^z = \frac{\sum_{k=1}^g \sum_{j=1}^{13} (X_{ijkt} + M_{ijkt})}{\sum_{k=1}^f \sum_{j=1}^{13} (X_{ijkt} + M_{ijkt})}$$

where z stands for each of the trade types, g represents the number of goods belonging to any of the categories of trade considered and f represents all traded goods. The above index is calculated for each of the trade types, so that for any i and t , $\sum_{z=1}^4 V_{it}^z = 1$.

In *Table 1* we summarise the results obtained applying the above indexes to the CEECs-5 trade with their EU-13 partners. Our findings are that the share of two-way trade is increasing with respect to inter-industry trade. Some differences among CEECs-5 countries can however be recorded. The Czech Republic is the country with the lowest share of one-way trade in the whole period, and such a share has kept decreasing, accounting for only one third of the total in 2004. Slovenia and Hungary started from a 50% share of inter-industry trade in 1996, but such a share did not substantially change over the period for Slovenia, whereas it decreased to 40% for Hungary. On the contrary, Poland and Slovakia have shown the greatest decrease in the importance of inter-industry trade, 16.2 and 14.4 percentage points, respectively, with the InterIT share attesting to 50.0 and 52.6 in 2005. Overall, the dynamic outlined above suggests that the process of decreasing complementarity between the two regions is going on. In fact, the process of a decreasing weight of one-way trade outlined for the period 1996-2005 confirms the reduction that already occurred in the first half of the 1990s. For instance, for the period 1993-96 Freudenberg and Lemoine (1999) point to a significant reduction in the share of inter-industry trade for all CEECs-5 but Slovenia, the decrease being particularly relevant for the Czech Republic and Slovakia.

Table 1 – Trade between CEECs-5 and EU-13 by trade types and reporting country

	% share of total trade in 2005				Variation [^] over 1996			
	VIIT+	HIIT	VIIT-	Inter-IT	VIIT+	HIIT	VIIT-	Inter-IT
Czech Rep.*	26.0	13.0	27.8	33.2	11.7	4.1	-11.1	-4.7
Hungary	20.3	8.0	30.7	41.0	5.7	0.2	1.0	-6.9
Poland	14.3	13.5	22.2	50.0	9.0	8.5	-1.3	-16.2
Slovakia	15.0	8.4	24.0	52.6	10.8	5.2	-1.6	-14.4
Slovenia	12.6	10.1	29.3	48.0	-11.4	5.0	7.2	-0.8

Own calculations based on UNCTAD Trade Analysis System.

[^] Absolute changes in the share of each trade type, in percentage points

* data refer to 2004

As to two-way trade, the breakdown by product differentiation – reported in the first three columns of *Table 1* – shows that trade in vertically differentiated products is much more important than trade in horizontally differentiated goods. In fact, total VIIT accounts for more than 50% of total trade for the Czech Republic and Hungary, more than 40% for Slovenia and more than 35% of total trade for Slovakia and Poland. The variation between 1996 and 2005 shows that the greatest increases have been attained by the two countries which recorded in 1996 the lowest share of such a trade, that is Slovakia and Poland, whose starting shares were less than 30%. In contrast, HIIT is marginal for all countries, ranging from 13% for the Czech Republic to 8% for Slovakia; however, in the period considered, the weight of this type of trade has increased in all countries, but Hungary. We interpret this result as a movement of traded goods from low quality to high quality products.

In fact, the splitting of vertical intra-industry trade into trade in “up-market” products (VIIT+) and in “down-market” products (VIIT-) provides some first useful information about the relative quality of traded goods, that is, the quality range on which each country is specialised. At the end of the period taken into consideration, only the Czech Republic records nearly the same weight for the two components of VIIT, whereas trade in goods with a higher quality content (VIIT+) accounts for some 40% of total quality differentiated trade in Hungary, Poland and Slovakia. The corresponding figure for Slovenia is the lowest of the region, amounting to slightly less than one third. Therefore, “down-market” goods are still the most important price-quality range for almost all CEECs-5. Yet, as is evident from Table 1, between 1996 and 2005, the share of VIIT+ has increased in all countries, but Slovenia, with the most impressive growth occurring in Slovakia, Poland and the Czech Republic. This evolution seems to indicate that the CEECs-5 countries’ market integration into the European Union is not based on a “residual” specialisation on low-quality products.²⁶

Overall, the trade share of “up-market” goods differs noticeably among the CEECs-5: it ranges from 26% for the Czech Republic, to 20% for Hungary, some 15% for Poland and Slovakia, down to 12,5% for Slovenia. These results suggest a dispersion of production structures among CEECs-5 countries, with a relative specialisation of Czech firms in high-price, high-quality goods and a relative specialisation of Hungarian and Slovenian firms in low-price, low-quality goods. In the period considered, vertical intra-industry trade in “down-market” products has remained rather stable in Hungary, Poland and Slovakia, whereas it substantially decreased in the Czech Republic and increased in Slovenia.

Summing up, the analysis of the evolution of CEECs-5 countries’ trade with EU-13 by trade type seems to indicate that, in general, their market integration has started a process of technological upgrading leading to an improvement of the quality of the goods produced and exported.

In order to shed additional light over this process, we have performed a further exercise. On the basis of the EU Klems Growth and Productivity Accounts, we have grouped industries of the CEECs-5 countries in low-, medium- and high-skill sectors,²⁷ with reference to the employment of highly skilled workers (i.e., with university degree), medium skilled workers (technicians) and low skilled workers (compulsory

²⁶ Dulleck et al. (2005) find a similar result over the period 1995-2000 for the CEECs-5 countries analysing quality differentials inside industries, underlying that there is no evidence of these countries entering a “low-quality trap”, that is, a specialisation in low-quality goods within an industry.

²⁷ See Appendix for details.

school degree). The implicit assumption is that the presence of more qualified human capital allows to detect high-tech and innovative sectors, that is, sectors producing higher quality goods. The theoretical model outlined in the previous section implies that a country's relative technological disadvantage can be a positive determinant of a catching-up process [see equation (11)]; thus, we want to verify whether CEECs-5 countries have experienced higher quality improvements in those sectors which showed a larger initial gap relative to their partner countries,²⁸ that is, in medium- and high-skill sectors.

To this purpose, we analyse the weight of each type of trade in the three skill sectors. Table 2 describes our results obtained by grouping together all reporters' trade versus their EU-13 partners. We calculate the indexes of the share of the various trade types in total trade by employing the Fontagné and Freudenberg indexes [see equation (14)] for each industry category (high-, medium- and low-skill intensity sectors). In this way the trade categories for any kind of industry sum up to one. More specifically:

$$(15) \quad V_t^{zs} = \frac{\sum_{k=1}^g \sum_{i=1}^5 \sum_{j=1}^{13} (X_{ijkt}^s + M_{ijkt}^s)}{\sum_{k=1}^f \sum_{i=1}^5 \sum_{j=1}^{13} (X_{ijkt}^s + M_{ijkt}^s)}$$

where s refers to the kind of sector taken into consideration, defined by its skill intensity (high-, medium- and low-skill intensity). Therefore, for any s and t , $\sum_{z=1}^4 V_t^{zs} = 1$.

Table 2 summarises the results obtained. Data show that medium- and high-skill intensive sectors are characterised by a minority weight of inter-industry trade, but, at the same time, by a relative importance of trade in “down-market” goods, which still accounts for more than one quarter of total trade and for more than a half of IIT. In turn, low-skill intensive sectors present the greatest weight of inter-industry trade in total trade.

Table 2 – Trade between CEECs-5 and EU-13 by trade types and skill sectors

	% share of total trade in 2005				Variation over 1996 [^]			
	VIIT+	HIIT	VIIT-	Inter-IT	VIIT+	HIIT	VIIT-	Inter-IT
Low-skill	16.0	7.0	19.0	58.0	-3.0	-1.9	2.8	2.1
Medium-skill	14.7	13.3	26.5	45.5	7.9	7.8	-6.1	-9.6
High-skill	16.4	10.6	26.6	46.4	4.9	4.7	-5.2	-4.4

Own calculations based on UNCTAD Trade Analysis System.

[^] Absolute changes in the share of each trade type, in percentage points

With respect to the issue of the catching-up sectors, Table 2 confirms that the trade types which have undergone the greatest positive variation between 1996 and 2005 are VIIT+ and HIIT in the medium- and high-skill sectors, that is, the sectors

²⁸ This amounts to an application of Gerschenkron's hypothesis of the “advantage of backwardness” to the industrial level (Gerschenkron, 1962).

which were more technologically lagging behind with respect to EU-13 at the beginning of the period. On the contrary, VIIT- and Inter-IT shares have increased in low-skill sectors. These results point to a process of successful catching-up, with a reduction of the quality gap between tradables, which is higher in the modern sectors than in the traditional ones.

4. Quality upgrading and competitiveness: An empirical investigation

The evidence presented so far shows that the pattern of the CEECs-5 trade with their EU 13 partners over the last years has evolved towards an increasing role of intra-industry trade and, more specifically, of vertical differentiation. The evidence shows also that the process of trade reorientation has occurred with a striking specialisation in up-market and higher quality products, in particular in medium and high-skill sectors. In this section we develop further our analysis in order to understand whether the changes occurred in the structure of trade are at the basis of a growth of these country's exports. In particular, we test the assumption of the theoretical model outlined earlier that the quality upgrading of the goods produced impacts positively on the performance of exports. By so doing we provide empirical support to the assumption of successful quality competition, a concept which has become familiar in modern trade theory.

As first emphasized in Aiginger (1997), the notion of competitiveness in trade should not be confined to one of pure price competition, that is, identified in the ability to produce at low costs. Instead, competitiveness should be extended to include non-price effects stemming, for instance, from quality differences. In fact, when a superior quality, due to product innovation, commands an increasing willing to pay on the part of the consumer, higher prices may well result competitive since they are associated to a higher quality of the products, or equivalently, to additional stages of production necessary to supply those products. In such circumstances, a lower price *per se* is not an assessment of an advantage in trade.

It is thus important to discriminate whether unit values, which are largely employed in empirical analyses on trade, reflect costs or quality differences. Aiginger suggests that unit values reflect costs in mature, homogeneous markets, where price competition matters; on the other side, unit values reflect quality differences in "quality-dominated markets", where goods are differentiated with respect to their technological content. It follows that when goods are price-elastic, successful price competition is the result of lower production costs; on the contrary, successful quality competition is attained in "quality-dominated markets" when higher unit values of exports are matched by higher exported quantities.

On the basis of the above assumption, we investigate the features of CEECs-5 competitiveness over the period 1996-2005 by estimating the role of the evolution occurred in the structure of trade on the dynamics of market shares. In particular, for each of the CEECs-5 we identify the export market with respect to each of the EU-13 partners, and then define the corresponding market share *MKTsh*, as the share of the country's exports towards a partner on total imports of that partner. We thus have 65 observations,²⁹ for the changes occurred in the market shares considered. The strategy

²⁹ Indeed Belgium and Luxembourg are not included, given the lack of data. Moreover, some data relating to trade between Slovenia and Greece are missing, and in some estimations these countries are not considered.

we follow is the following: we first carry on our estimations for the whole sample period 1996-2005, and then for the two sub-periods 1996-2000 and 2000-2005.

In order to provide a more clear picture of the effects of the overall dynamical adjustments in the structure of trade, we consider five different specifications, which differ each other for the trade shares included: $\Delta HIIT$, $\Delta VIIT^+$, $\Delta VIIT^-$, $\Delta InterIT$, $\Delta VIIT$, that is, respectively the changes in horizontal, positive vertical, negative vertical, interindustry and total vertical.³⁰ We then have two additional regressors, a relative price term $\Delta Pr el$ and the initial market share $MKTsh^0$. As to the former, the variable we choose is the logarithm of the ratio between the unit value of the partner's total imports and the unit value of its imports from the single CEE country. With this variable we seek to capture the specific features of competitiveness: a negative sign denotes successful quality competition for the CEECs-5, since increasing market shares are matched by unit values of their exports higher than the (average) unit value of the partner's imports. As to the market share in the initial period, it captures a path dependence effect: the idea is that in a period of increasing integration of markets, the increase in market shares is also characterised by a consolidation of existing trade relationships. In the regressions for the two sub-periods we include dummies for the reporter countries, denoted as $Drep$, in order to check for country-specificities. Given the relative shortness of the series, all the estimations are repeated over the average change of market shares instead of the total change, since the latter is more sensitive to the initial and final values. This helps limiting the effects of fluctuations and, at the same time, provides a test of robustness to our estimations.

The specifications we consider are the following:

- [1] $\Delta MKTsh = a + b_1 \Delta HIIT + b_2 \Delta VIIT^+ + b_3 \Delta VIIT^- + c \Delta Pr el + d MKTsh^0$
- [2] $\Delta MKTsh = a + b_1 \Delta HIIT + b_4 \Delta InterIT + c \Delta Pr el + d MKTsh^0$
- [3] $\Delta MKTsh = a + b_1 \Delta HIIT + b_5 \Delta VIIT + c \Delta Pr el + d MKTsh^0$
- [4] $\Delta MKTsh = a + b_5 \Delta VIIT + c \Delta Pr el + d MKTsh^0$
- [5] $\Delta MKTsh = a + b_2 \Delta VIIT^+ + b_3 \Delta VIIT^- + c \Delta Pr el + d MKTsh^0$
- [6] $\Delta MKTsh = a + b_4 \Delta InterIT + c \Delta Pr el + d MKTsh^0$

Table 3 summarises the results of our estimations for the whole period 1996-2005, whereas the results for the two sub-periods are summarised in Tables 4 and 5. Overall, the explanatory power of the estimated equations is quite good, better in the first sub-period, where the R^2 is between 0.6 and 0.7, than in the whole sample period where the R^2 is slightly above 0, 35; as to the last period, the estimations with the dummies lead to a value of the R^2 around 0.3. The dummies appear significant, especially in the last sub-period, thus indicating that the differentiations among countries become particularly meaningful from the year 2000 onwards.

Altogether, the analysis provides interesting results on the effects of the dynamical adjustments in trade. In particular, it confirms the scenario outlined in the

³⁰ Since the four components of trade are not linearly independent they cannot enter the regression simultaneously.

descriptive evidence, regarding the role of quality differentiation and trade reorientation towards up-market segments. In fact, in the whole period 1996-2005 we find significant evidence for the change in $\Delta VIIT$ (column 3 and 4), and for both its positive and negative components $\Delta VIIT^+$ and $\Delta VIIT^-$ (column 5); moreover, the three coefficients b_2, b_3 and b_5 are positive. The regressions show also a negative sign for the coefficients b_1 of $\Delta HIIT$ and b_4 of $\Delta InterIT$. Considering that the shares of positive vertical and horizontal trade have increased over the period, whereas the shares of negative vertical and interindustry have decreased, the results of the estimates indicate that the CEECs-5 have expanded the markets of their exports thanks to a specialisation in up-market segments. For the whole period the price term has the expected sign, although it is not significant. The negative sign of the coefficient c indicates that the growth of the CEECs-5's market shares has been matched by an increase in unit values of their exports above the increase in the average unit values of the partner's imports.

Table 3 - Determinants of total changes in the market shares of EU-13 imports from CEECs-5 - Total period 1996-2005

	1	2	3	4	5	6
$\Delta HIIT$	-0.306 [0.665]	-1.197 [0.645]*	-0.265 [0.671]			
$\Delta VIIT^+$	0.777 [0.408]*				0.855 [0.397]**	
$\Delta VIIT^-$	1.1391 [0.638]**				1.143 [0.627]**	
$\Delta InterIT$		-0.932 [0.325]***				-0.679 [0.307]**
$\Delta VIIT$			0.932 [0.325]***	0.992 [0.315]***		
$\Delta Prel$	-0.012 [0.048]	-0.006 [0.046]	-0.006 [0.046]	-0.01 [0.046]	-0.016 [0.049]	-0.038 [0.047]
Msh^0	0.286 [0.129]**	0.289 [0.129]**	0.289 [0.129]**	0.298 [0.127]**	0.296 [0.126]**	0.332 [0.133]**
const	0.081 [0.056]	0.093 [0.058]	0.093 [0.058]	0.072 [0.041]*	0.059 [0.038]	0.044 [0.054]
Drep	no	no	no	no	no	no
R ²	0.35	0.35	0.35	0.34	0.35	0.3
F	7.59	5.11	5.11	6.85	9.79	4.94
Obs	64	64	64	64	64	64

Standard errors in brackets; * significant at 10%, ** significant at 5%; *** significant at 1%.

The regressions conducted in the two sub-periods provide further interesting information: it emerges that the years 1996-2000 are characterised by a consolidation of the trade dynamics of the nineties,³¹ as is evident from the high significance of the initial market share $MKTsh^0$ in Table 4, whereas the years 2000-2005 are distinguished

³¹ The regressions over the average shares confirm all the results obtained with the estimations over the total changes, so that they are not presented.

by the emerging of differences among the countries, as pointed earlier in the descriptive evidence. The estimations for these sub-periods confirm the scenario outlined for the whole period. In particular, in 1996-2000 the increase in market shares have occurred thanks to the reduction of the negative component of vertical trade, given the negative sign obtained in the estimation (*Table 4(a) and 4(b)*, columns 1 and 5). In the period 2000-2005 we obtain a negative sign for the coefficient of horizontal trade, as well as for the price term. The latter is negative in all the estimations (*Tables 3, 4 and 5*) and highly significant in the regressions of the last period, where it captures most of the adjustments occurred.

With reference to the sub-period 2000-2005, it appears that the relative increase in unit values of CEECs-5 exports above the average unit values of their partners' imports had a noticeable impact on the growth of their market shares. Considering that, on average, $\Delta Pr el = -0.24$, that $\Delta MKTsh = 0.13$, and that the lowest value for the coefficient c in the regressions is -0.074 , the impact of the relative price amounts to 13.6%, at least. Therefore, about 14% of the market shares' increase is explained by the relative prices increase occurred in the period 2000-2005.

We thus conclude that the structural changes occurred in the CEECs-5, following their integration in the EU, have led to an increasing role of trade in quality dominated markets, where the CEECs-5 have gained market shares thanks to a successful quality competition, particularly in the last period.

Table 4 - Determinants of total changes in the market shares of EU-13 imports from CEECs-5 – Period 1996-2000

	(a)						(b)					
	1	2	3	4	5	6	1	2	3	4	5	6
ΔHIIT	-0.103 [0.449]	-0.189 [0.458]	-0.12 [0.477]				-0.263 [0.491]	-0.192 [0.408]	-0.372 [0.499]			
ΔVIIT+	0.324 [0.346]				0.356 [0.294]		0.118 [0.396]				0.21 [0.309]	
ΔVIIT-	-1.447 [0.743]*				-1.417 [0.776]*		-1.355 [0.685]*				-1.294 [0.685]*	
ΔInterIT		-0.07 [0.350]				-0.027 [0.335]		0.181 [0.397]				0.226 [0.386]
ΔVIIT			0.07 [0.350]	0.106 [0.313]					-0.181 [0.397]	-0.058 [0.325]		
ΔPrel	-0.007 [0.022]	-0.034 [0.019]*	-0.034 [0.019]*	-0.035 [0.019]*	-0.008 [0.023]	-0.036 [0.018]**	0.018 [0.026]	0.004 [0.022]	0.004 [0.022]	-0.001 [0.023]	0.015 [0.026]	0.002 [0.022]
Msh ⁰	0.393 [0.102]***	0.398 [0.119]***	0.398 [0.119]***	0.399 [0.116]***	0.394 [0.100]***	0.397 [0.117]***	0.394 [0.101]***	0.391 [0.112]***	0.391 [0.112]***	0.394 [0.108]***	0.397 [0.097]***	0.389 [0.111]***
const	0 [0.041]	-0.028 [0.051]	-0.028 [0.051]	-0.032 [0.037]	-0.004 [0.031]	-0.029 [0.048]	0.043 [0.058]	0.03 [0.063]	0.03 [0.063]	0.02 [0.056]	0.037 [0.052]	0.034 [0.065]
Drep	no	no	no	no	no	no	yes	yes	yes	yes	yes	yes
R ²	0.64	0.58	0.58	0.58	0.64	0.58	0.68	0.65	0.65	0.65	0.68	0.65
F	5.23	5.44	5.44	5.81	5.43	4.83	4.2	3.79	3.79	3.73	4.22	3.5
Obs	63	63	63	63	63	63	63	63	63	63	63	63

Standard errors in brackets; * significant at 10%, ** significant at 5%; *** significant at 1%.

Table 5 - Determinants of total changes in the market shares of EU-13 imports from CEECs-5 – Period 2000-2005

	(a)						(b)					
	1	2	3	4	5	6	1	2	3	4	5	6
ΔHIIT	-1.28 [0.768]	-1.443 [0.760]*	-1.271 [0.761]				-1.78 [0.691]**	-1.636 [0.772]**	-1.752 [0.699]**			
ΔVIIT+	0.314 [0.465]				0.593 [0.532]		0.193 [0.528]				0.614 [0.643]	
ΔVIIT-	-0.011 [0.469]				0.32 [0.478]		-0.544 [0.474]				-0.022 [0.512]	
ΔInterIT		-0.172 [0.373]				0.247 [0.420]		0.116 [0.418]				0.593 [0.418]
ΔVIIT			0.172 [0.373]	0.472 [0.406]					-0.116 [0.418]	0.341 [0.484]		
ΔPrel	-0.112 [0.049]**	-0.117 [0.048]**	-0.117 [0.048]**	-0.117 [0.050]**	-0.112 [0.051]**	-0.133 [0.053]**	-0.074 [0.040]*	-0.085 [0.041]**	-0.085 [0.041]**	-0.09 [0.048]*	-0.081 [0.047]*	-0.106 [0.051]**
Msh ⁰	-0.13 [0.161]	-0.129 [0.160]	-0.129 [0.160]	-0.108 [0.158]	-0.108 [0.159]	-0.092 [0.159]	-0.192 [0.162]	-0.189 [0.160]	-0.189 [0.160]	-0.153 [0.158]	-0.155 [0.160]	-0.144 [0.157]
const	0.197 [0.068]***	0.193 [0.068]***	0.193 [0.068]***	0.153 [0.068]**	0.156 [0.067]**	0.174 [0.068]**	0.296 [0.125]**	0.295 [0.125]**	0.295 [0.125]**	0.213 [0.124]*	0.213 [0.125]*	0.266 [0.125]**
Drep	no	no	no	no	no	no	yes	yes	yes	yes	yes	yes
R ²	0.19	0.19	0.19	0.16	0.16	0.15	0.33	0.32	0.32	0.26	0.27	0.27
F	1.88	2.31	2.31	2.17	1.63	2.1	2.89	2.95	2.95	2.93	2.75	2.93
Obs	64	64	64	64	64	64	64	64	64	64	64	64

Standard errors in brackets; * significant at 10%. ** significant at 5%; *** significant at 1%.

5. Conclusions

In the paper we consider the role of vertical innovation on the pattern of trade for economies trading with technologically more advanced countries. We first address the issue from a theoretical point of view, by recalling the main results obtained in a previous contribution (Cavallaro-Mulino, 2007), and then provide some empirical evidence by considering the case of the CEECs-5.

In the model we show that the notion of competitiveness in trade which is relevant when goods are differentiated with respect to their technological content is one that includes non-price effects stemming from quality differences. As a result, the relative change in quality is a strategic variable in a country's competitiveness, in line with the neo-Schumpeterian view that firms compete not so much by varying price and quantity, as by innovating. It follows that the possibility for technologically backward countries to become competitive in international markets depends on their ability to absorb foreign knowledge and to improve upon technologies conceived abroad. In fact, as emphasised in the theoretical and empirical literature, such a process is fostered by the economic integration of markets, since trade in goods and services, foreign direct investments, migrations and business contacts, among others, are at the basis of the international diffusion of knowledge.

Our empirical investigation supports the conclusion obtained in the theoretical analysis. As far as the CEECs-5 are concerned, we find evidence of an increasing role of vertical intra-industry trade, as well as of a process of specialization in up-market products. The above results are also confirmed by the regressive analysis where we test the role of the changing pattern of trade on the dynamics of the CEECs-5 market shares. We thus conclude that structural adjustments occurred in the CEECs-5, following their integration in the EU, have led to an increasing role of trade in quality-dominated markets, where the CEECs-5 have gained market shares also thanks to a successful quality competition.

References

- Abd-El-Rahman K.S. (1986). "Réexamen de la définition et de la mesure des échanges croisés de produits similaires entre les nations". *Revue économique*. 37. 1. 89-115.
- Aghion P. Howitt P. (1998). *Endogenous Growth Theory*. The MIT Press: Cambridge. Mass..
- Aiginger. K. (1997). "The use of unit values to discriminate between price and quality competition". *Cambridge Journal of Economics*. 21. 571-92.
- Cavallaro E.. Mulino M. (2007). "Vertical Innovation and Catching Up: Implications for Trade and Growth". *CIDEI Working Paper*. 75. March.
- Crespo N.. Fontoura M. P. (2004). "Intra-Industry Trade by types: what can we learn from Portuguese data?" *Weltwirtschaftliches Archiv*. 140. 1.
- Crispolti V. Marconi D. (2005). "Technology Transfer and Economic Growth in Developing Countries: An Econometric Analysis". *Banca d'Italia. Temi di discussione* 564;.
- Dulleck U.. Foster N.. Stehrer R.. Woerz J. (2005). "Dimensions of Quality Upgrading. Evidence from CEECs". *Economics of Transition*. 13. 1. 51-76.
- Edwards S. (1998). "Openness. Productivity and Growth: What Do We Really Know?". *The Economic Journal*. 108. 383-398.
- Ferragina A.M.. Pastore F. (2004). "Quality Matters. Italy's Intra-industry Trade with Eastern Europe over the Years 1988-1995". *Studi economici*. No. 84. 3.
- Fontagné L.. Freudenberg M. (1997). "Intra-Industry Trade: Methodological Issues Reconsidered". *CEPII Working Paper 97/02*. Centre d'Etudes Prospectives et d'Informations Internationales. Paris.
- Fontagné L.. Freudenberg M.. Péridy N. (1998). "Intra-Industry Trade and the Single Market: Quality Matters". *CEPR Discussion Paper*. No. 1953.
- Fontagné L.. Freudenberg M.. Guillaume G. (2005). "Disentangling Horizontal and Vertical Intra-Industry Trade". *CEPII Working Paper 05/10*. Centre d'Etudes Prospectives et d'Informations Internationales. Paris.
- Freudenberg M.. Lemoine F. (1999). "Central and Eastern European Countries in the International Division of Labour in Europe". *CEPII Working Paper 99/05*. Centre d'Etudes Prospectives et d'Informations Internationales. Paris.
- Gerschenkron A. (1962). *Economic Backwardness in Historical Perspective*. Harvard Univ. Press. Cambridge (Mass.).
- Greenaway D.. Hine R.C.. Milner C.R. (1995). "Vertical and Horizontal Intra-Industry Trade: A Cross Country Analysis for the United Kingdom". *Economic Journal*. 105. November. 1505-1518.
- Grossman G. M.. Helpman E. *Innovation and Growth in the Global Economy*. The MIT Press: Cambridge. Mass.; 1991
- Grubel H.. Lloyd P. (1975). *Intra-Industry Trade*. London. McMillan.
- Keller W. (1999). "How Trade Patterns and Technology Flows Affect Productivity Growth". *NBER Working Paper* 6990.
- Keller W. (2002). "International Technology Diffusion". *CEPR Discussion Paper* 3133.
- Krugman P. R. (1979). "Increasing Returns. Monopolistic Competition. and International Trade". *Journal of International Economics*. 9 (4). 469-479.

- Krugman P. R. (1980). "Scale Economies, Product Differentiation, and the Pattern of Trade". *American Economic Review*. 70. 950-959.
- Iapadre L.P. (2003). "Defining and measuring Intra industry Trade: the relevance of Stefano Vona's contribution". *Foreign Trade and the International Position of the Italian Economy*. Banca d'Italia. Rome.
- Léon-Ledesma M. A. (2005). "Exports, Product Differentiation and Knowledge Spillovers". *Open Economies Review*. 16. 363-379.
- McCombie J. S. L. (1998). "Harrod, Economic Growth and International Trade". in: G. Rampa, L. Stella and A. P. Thirlwall (Eds). *Economic Dynamics, Trade and Growth*. 212-244 (Basingstoke/London: McMillan).
- McCombie J. S. L., Thirlwall A. P. (1994). *Economic Growth and the Balance-of-Payments Constraint*. McMillan: Basingstoke/London.
- Pack H., Westphal L. E. (1986). "Industrial Strategy and Technological Change: Theory versus Reality". *Journal of Development Economics*. 22. 87-128.
- Smulders S. (2004). "International Capital Market Integration: Implications for Convergence, Growth, and Welfare". *International Economics and Economic Policy*. 1. 173-194.
- Thirlwall A. P. (1979). "The Balance of Payments Constraint as an Explanation of International Growth Rate Differences". *Banca Nazionale del Lavoro Quarterly Review*. 128. 45-53.
- Vona S. (1991). "On the Measurement of Intra-Industry Trade: Some Further Thoughts". *Weltwirtschaftliches Archiv*. 127. 4. 678-700.

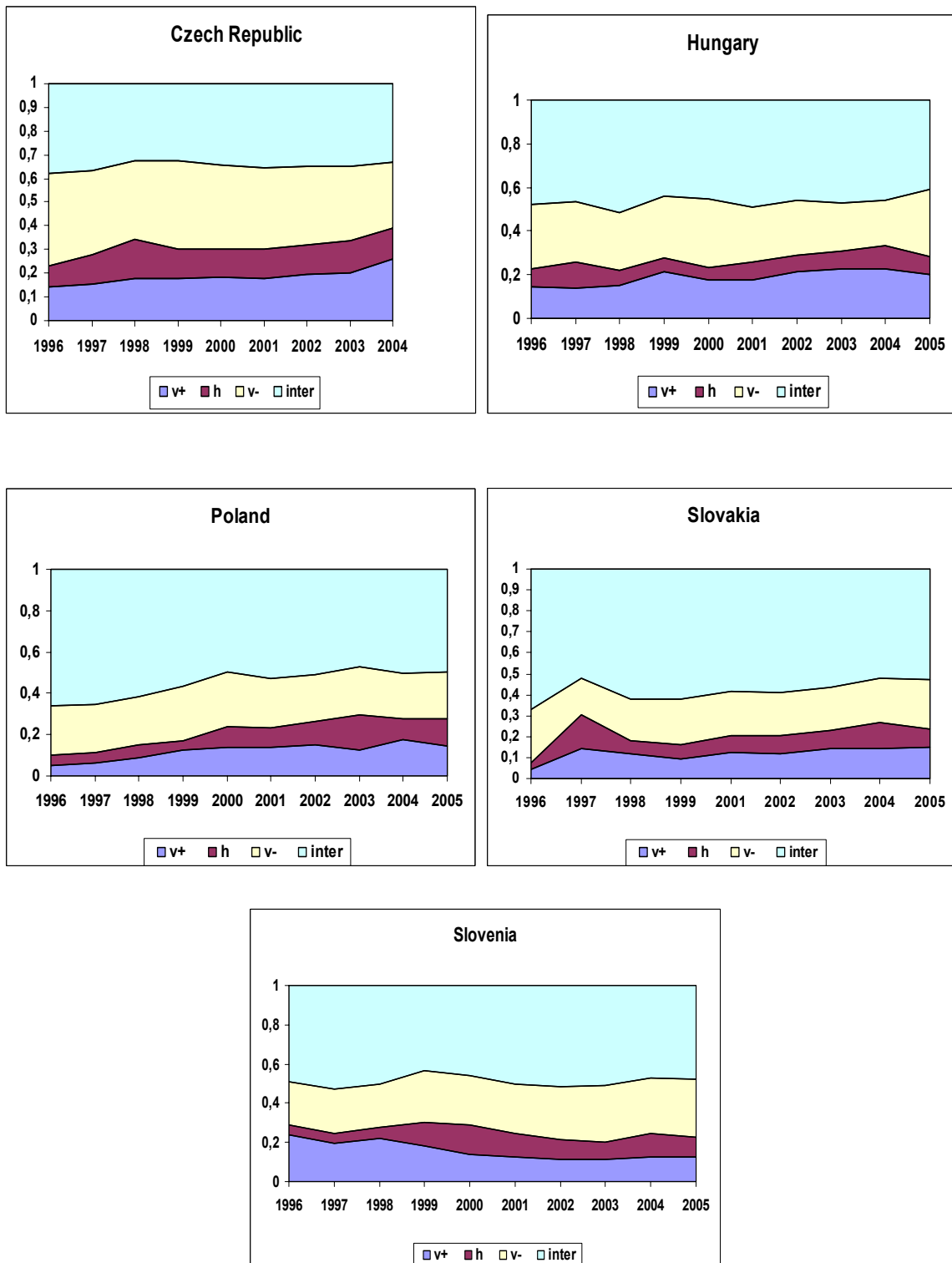


Figure 1 – Trade between CEECs-5 and EU-13 by trade types

Appendix - Grouping of industries into low-, medium- and high-skill industries

Low-skill industries:

- 19 Tanning and dressing of leather
- 18 Wearing apparel
- 17 Textiles
- 19 Wood and products of wood and cork
- 37 Recycling
- 36 Furniture; manufacturing n.e.c.

Medium-skill industries:

- 28 Metal products
- 26 Other non-metallic mineral products
- 15 Food products and beverages
- 25 Rubber and plastic products
- 21 Pulp, paper and paper products
- 27 Basic metals
- 16 Tobacco products

High-skill industries:

- 34 Motor vehicles, trailers and semi-trailers
- 29 Machinery and equipment n.e.c.
- 30 Electrical machinery and apparatus n.e.c.
- 22 Publishing, printing and reproduction of recorded media
- 35 Other transport equipment
- 33 Medical, precision and optical instruments, watches and clocks
- 24 Chemicals and chemical products
- 31 Radio, television and communication equipment and apparatus
- 23 Coke, refined petroleum products and nuclear fuel
- 30 Office machinery and computers