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## **Keskusteluaiheita – Discussion papers**

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**THE FACTOR INTENSITY OF ACCESSION AND  
EU15 COUNTRIES' COMPARATIVE ADVANTAGE  
IN THE INTERNAL MARKET**

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**ABSTRACT:** Economic relations between the European Union and the accession countries of Central and Eastern Europe (CEE) were liberalised by Europe Agreements after the early 1990s. Free trade and investment have the potential of changing the structure of countries' trade although with some restrictions set by, *inter alia*, the quantity and quality of the available factors of production. The accession countries have lower labour costs coupled with a relatively well-educated labour force. We analyse the factor intensity (skilled/unskilled labour and capital) of the accession countries' comparative advantage in the internal market in 1993-2002. Most accession countries' comparative advantage remains less skill-intensive than that of the EU15 countries. A movement towards a more skill-intensive comparative advantage is shown to have been positively correlated with higher growth rates in the EU15 and the CEE countries.

**KEY WORDS:** EU, eastern enlargement, comparative advantage, factor intensity

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**TIIVISTELMÄ:** Taloussuhteet Euroopan unionin sekä Keski- ja Itä-Euroopan (KIE) EU-hakijamaiden välillä liberalisoitiin Eurooppa-sopimuksilla 1990-luvun alun jälkeen. Vapaa kauppa ja investoinnit saattavat muuttaa maiden välisen ulkomaankaupan rakennetta, joskin rajoitteita tuovat muun muassa tarjolla olevien tuotannon tekijöiden määrä ja laatu. KIE-maissa on EU15-maita alemmat työvoimakustannukset sekä suhteellisen koulutettu työvoima. Tässä tutkimuksessa analysoidaan KIE-maiden suhteellisen edun panosintensiivisyyttä (koulutettu/kouluttamaton työvoima sekä pääoma) niiden viennissä EU15-alueelle vuosina 1993-2002. Useimpien KIE-maiden suhteellinen etu on painottunut alemman osaamisintensiivisyyden tuotteisiin kuin EU15-maiden vastaava suhteellinen etu. Siirtymä kohti osaamisintensiivisempiä tuotteita on korreloinut positiivisesti nopeamman talouskasvun kanssa EU15- ja KIE-maissa.

**AVAINSANAT:** EU, itälaajeneminen, suhteellinen etu, panosintensiivisyys







## 1 Introduction

According to the Heckscher-Ohlin theorem, differences in relative factor endowments determine comparative advantage and trade specialisation. A country will export goods whose production requires the intensive use of that country's relatively abundant and cheap factor(s), and it will import goods whose production requires the intensive use of its relatively scarce and expensive factor(s).

We will analyse the factor intensity of 25 European countries' revealed comparative advantage in their exports to the EU15 area in 1993-2002.<sup>1</sup> The factors are capital and unskilled/skilled labour. The EU15 countries and the ten Central and Eastern European accession countries have different amounts of physical capital and (un)skilled labour available for producing goods. Of course, these qualities and quantities also vary within these two groups of countries. The relative amounts of capital and (un)skilled labour then affect, along with other factors, the structure of the countries' exports.

As trade and the functioning of economies have been liberalised during the period under analysis, foreign direct investment have flowed into the accession countries. Actual membership will bring some new aspects. After a period of transition the new member countries will fully join the Common Agricultural Policy, and movement of labour with the incumbent EU countries will also be liberalised. The new member countries will be eligible for more support from the structural funds of the EU, which seem to have been beneficial at least for Ireland. A few years on we may expect some of the new member countries to join the Economic and Monetary Union, which will further lower trade barriers.

We use OECD data provided in the International Trade by Commodities Statistics (ITCS). The data are at the Harmonised System 4-digit level and there are 1,367 commodity groups in all. We use the EU15 countries' import and export data regardless of the fact that data for the accession countries belonging to the OECD are also available in the data base. We do this for the sake of symmetry.

HS-data for the EU15 countries are available for all countries in 1993-2002, except for Austria in 1993 in which case we have used SITC-data at the 4-digit level and transformed it to the Harmonised System. There is some small difference in these. Furthermore, the OECD does not report Austria's trade with Poland in 1993 even at the SITC-system. To cover this deficiency, we have used Polish data for these two countries' bilateral trade in that year.

This paper is an update of Kaitila (2001), which discussed these issues in a wider context for the years 1993-98. We have now extended the analysis to include the years 1999, 2001 and 2002. We will also discuss changes in factor intensity from the point of view of the countries' growth performance. On the other hand, we will not discuss intra-industry trade nor similarity of export structures.

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<sup>1</sup> The Central and Eastern European countries analysed are Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia of which all but Bulgaria and Romania joined the European Union in May 2004. From the EU side we calculate all results for EU15, which, however, was formed only after Austria, Finland and Sweden joined the EU in 1995.

## 2 Methods of Calculation and Analysis

We calculate the factor intensity of the revealed comparative advantage (RCA) of both the EU15 countries' and the CEE countries' exports to the EU15 area. We then analyse the change that has taken place in the intensity during the period 1993-2002. The analysis takes place in two dimensions: the capital intensity and the skill-intensity of labour used in the production of the export goods.

We have used the Balassa (1965) index to measure revealed comparative advantage. The idea is that trade flows reveal the comparative advantage of nations although we cannot thus explain what is behind the comparative advantage. We calculate the Balassa index as the ratio of the share of a given product in a country's exports to the EU15 area to the share of that product in total intra-EU15 exports. In formal terms, the Balassa index for country  $i$  in its exports to the EU15 of good  $k$  is given by

$$BI_{i,EU}^k = \frac{x_{i,EU}^k / X_{i,EU}}{x^k / X},$$

where  $x_{i,EU}^k$  is exports of product  $k$  from country  $i$  to the EU,  $X_{i,EU}$  is aggregate exports from country  $i$  to the EU,  $x^k$  is intra-EU15 exports of product  $k$ , and  $X$  is total intra-EU15 exports. If the index is greater than one for product  $k$ , the country has a comparative advantage in the exports of that good.

After having calculated  $BI_{i,EU}^k$  for all countries and all products in given years, we disregard the exports of those goods in which the countries did not have a comparative advantage. We are thus left with only the goods in which the value of the Balassa index is larger than unity. We will then divide these into categories following Neven (1995).<sup>2</sup>

Neven classified manufacturing industries into five categories at the NACE CLIO 3-digit level (some at 4-digit) according to their relative capital and skill intensity (see Figure 1). To determine these he used the following variables:

- share of white collar workers in total industry labour force,
- medium wage,
- the ratio of all labour costs to value added, and
- the ratio of fixed investment to value added.

Neven used data from western Europe from the latter part of the 1980s to determine the classification for each sector. Although the data used to determine the categories for manufacturing industries is relatively old, this is unlikely to constitute a problem here.

Another issue is how well these variables represent sectors in transition economies. Certainly, as transition progresses, the potential problem decreases.

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<sup>2</sup> Neven used the formulation  $(x_{ij}/X_j) - (m_{ij}/M_j)$  to determine comparative advantage. His approach differs from the one here in other respects as well.

The share of white-collar workers in total employment is likely to have increased in the CEE countries during the course of transition. Wages are lower in the CEE countries than in the EU, but the ratio of wages to value added hardly differs as much. There has been a more pronounced need for investment in the CEE countries than in the EU, so it is possible that the ratio of investment to value added is higher in the accession countries than in the EU. At least at the national level, investment accounts for a larger share of GDP than in the EU15 countries. On the other hand, the EU15 area hardly constitutes a homogenous group in these respects either.

The sectors with high capital intensity are characterised by a high level of investment as a percentage of value added, while low average wage and a high share of wages in value added are the characteristics of a labour-intensive industry. With a high average wage and a high share of labour in value added, the sector is intensive in human capital. The share of blue-collar workers is used as proxy for the intensity of human capital. See Appendix 1 for a full list of the industries in the five categories. Figure 1 shows the five categories in a two-dimensional space as reproduced here from Neven's article.<sup>3</sup> We have added the scales on the axes.

*Category 1* is characterised by a high proportion of wages in value added, very high wages, and a very high proportion of white-collar workers. These are high-tech industries intensive in human capital.

*Category 2* is intensive in human capital, but uses only little physical capital. It has a relatively low level of investment relative to value added, high wages, and a high level of wages in value added.

*Category 3* is intensive in labour and uses relatively little capital. Average wages are low, and there is a low level of investment and a high level of wages in value added.

*Category 4* includes industries that are intensive in labour and capital. There is a high level of investment, relatively low wages, a low proportion of white-collar workers, and an intermediate proportion of wages in value added.

*Category 5* is dominated by food-processing industries that are intensive in both physical and human capital. The exports of foodstuffs from the accession countries to EU15 have not been totally free and this may decrease the CEE countries' revealed comparative advantage in Category 5.

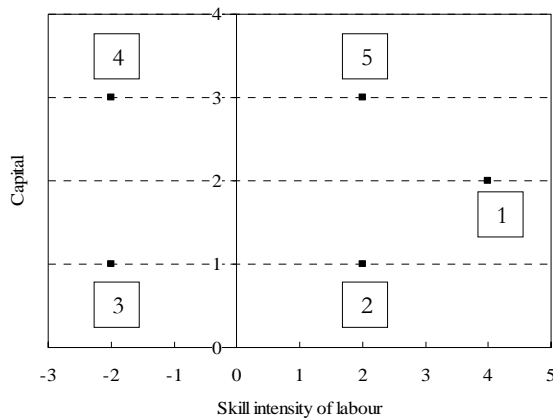
Neven's categories do not cover the whole HS classification. Division into the five categories was only available for between 64 per cent of Latvia's exports and 90 per cent of Romania's exports with RCA to the EU15 in 2002. Consequently, between 10 and 36 per cent of CEE countries' exports to EU15 could not be categorised into the five groups. For Latvia and Lithuania in particular, the problem was large for 1993, when only 33 and 47 per cent of their exports with RCA, respectively, could be categorised. For the other CEE countries, the data covers over 76 per cent of exports even in 1993. Some 12-40 per cent of intra-EU15 exports had to be disregarded due to this same deficiency.

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<sup>3</sup> More accurately from Neven's discussion paper published in CEPR discussion paper series No. 1000 in 1994.



Figure 1 Neven's 5-category classification with values (see below) used in this study



The biggest commodity groups that Neven's classification leaves outside are petroleum oils, and coal and briquettes. Especially petroleum oils explain the somewhat lower coverage of RCA in the exports of the Baltic countries. However, the countries do not produce oil themselves. The oil in question is Russian oil travelling through the Baltic countries and as such it does not really represent these countries' own comparative advantage apart from their geographical location and the presence of ports. Also the lower RCA coverage of Britain and the Netherlands is largely explained by their exports of petroleum oils.<sup>4</sup>

### 3 CEE Countries' RCA and Structural Changes

Table 1 shows the division of the CEE countries' revealed comparative advantage divided into the five categories in 2002 and the percentage point change in these values from 1993. The data for which the category is not known are not included.

<sup>4</sup> The table shows the percentage share of exports with RCA included in the analysis in different years.

EU country	1993	2002	CEE country	1993	1995	1997	1999	2001	2002
Austria	86.8	83.6	Bulgaria	76.5	85.0	87.1	87.3	86.7	80.7
Belgium-Luxembourg	73.9	81.3	Czech Republic	84.8	86.1	86.9	88.0	85.5	85.3
Denmark	73.6	69.9	Estonia	82.7	71.9	67.7	84.0	75.7	74.6
Finland	86.5	79.8	Hungary	76.4	81.9	84.4	82.5	84.6	85.7
France	74.2	78.9	Latvia	32.7	51.4	53.5	70.9	59.9	63.7
Germany	77.8	87.7	Lithuania	47.0	80.8	87.0	87.1	73.5	72.5
Greece	76.4	78.5	Poland	78.9	82.8	81.1	82.9	83.4	81.7
Ireland	74.3	77.8	Romania	92.3	94.5	95.8	95.3	92.4	90.4
Italy	85.1	85.3	Slovakia	83.8	89.2	91.5	93.4	89.7	89.3
Netherlands	59.1	71.1	Slovenia	92.4	91.9	90.7	91.4	88.2	86.8
Portugal	85.7	79.0							
Spain	80.2	81.6							
Sweden	80.3	79.3							
United Kingdom	73.8	62.8							

In 2002, Category 4 with relative capital intensity but low skill-intensity of labour is the most important group for all CEE countries except Bulgaria, Lithuania and Romania for which Category 3 is the most important. The share of Category 4 varies between 19 per cent for Romania and 70 per cent for Latvia. Combining Categories 3 and 4, the low-skill intensive industries emerge as the dominant sectors covering between 56 per cent of Hungary's and 94 per cent of Latvia's revealed comparative advantage.

This leaves a potential for large difference in the importance of Categories 1, 2 and 5, which are relatively more skill intensive. Category 1 is quite pronounced for Estonia and Hungary. These countries have received large inflows of foreign direct investment. The large share of Category 1 for Hungary and Estonia is largely explained by automatic data processing machines and video-recording apparatus in the case of the former and transmission apparatus and parts for radio-telephony in the case of the latter. In Estonia, the production consists mainly of assembly, however.

Category 2, also a relatively high-skill category is important in the comparative advantage of Slovenia, the Czech Republic and Hungary. Category 5, which consists largely of food industries, is understandably of little importance, although it is a major employer in many CEE countries.

We can also see that there has occurred a significant change since 1993 in many of the categories. Estonia and Hungary have increased the share of Category 1 by about 20 percentage points. Category 2 has remained largely unchanged for most countries; some increase has been experienced in especially the Czech Republic.

Category 3, with low intensity in both skills and capital has experienced significant declines in Hungary, Slovenia, Poland, the Czech Republic and Slovakia. On the other hand, Category 3 has increased its importance in Lithuania and Bulgaria. Category 4, another low-skill group, but with higher capital intensity, has been on the rise in Slovakia, Poland, Slovenia and Hungary. This is due to, among other things, the expansion in West European and East Asian car industries based in these countries. Meanwhile, there is a fall in Estonia and Lithuania. The importance of Category 5 has declined moderately in all CEE countries, the most in Bulgaria and Lithuania. Overall, we see that there has been a significant decline in the low-skill Categories 3 and 4 for Estonia, Hungary and the Czech Republic, while there is a rise in Bulgaria.

In 1993-2002, there has been the most net movement between different categories in Hungary and Lithuania and to a slightly lesser extent in Estonia, Poland, Slovakia, Slovenia and the Czech Republic. There has been the least net movement between the categories in Romania and Latvia. Change slowed down towards the end of the period 1993-2001. There was an acceleration in structural change in 2001-2002. This may be a coincidence, however.

Looking at how the shares of Categories 1 through 5 have evolved, we can check what has happened in each country. There was a shift in Poland's revealed comparative advantage from Category 3 to Category 4 between 1993 and 1995, and also between 1999 and 2001. In the Czech Republic, a continuous relative

shift away from Categories 3 and 5 benefited Category 4 up until 1999. In 1999-2002, Categories 1 and 2 benefited.

**Table 1** Share of CEE countries RCA-exports to the EU15 in each of the five categories in 2002, %, and percentage-point change between 1993 and 2002 (with changes of over ten percentage points highlighted)

CEE country	Category					
	1	2	3	4	5	3+4
<b>Bulgaria</b>	4.4	6.7	48.8	35.8	4.2	84.6
<b>Czech Republic</b>	12.9	23.8	10.7	51.3	1.3	62.0
<b>Estonia</b>	26.0	10.6	21.3	39.4	2.7	60.7
<b>Hungary</b>	25.8	17.8	11.3	44.3	0.8	55.6
<b>Latvia</b>	2.1	2.6	24.5	69.8	1.0	94.3
<b>Lithuania</b>	12.9	8.5	42.4	31.2	4.9	73.6
<b>Poland</b>	4.6	14.0	23.5	53.7	4.3	77.1
<b>Romania</b>	1.5	10.6	68.5	18.5	1.0	87.0
<b>Slovakia</b>	7.4	13.5	17.6	59.6	1.9	77.2
<b>Slovenia</b>	3.8	25.5	15.1	55.4	0.2	70.5

CEE country	Category					
	1	2	3	4	5	3+4
<b>Bulgaria</b>	-4.0	-1.0	<b>13.2</b>	1.4	-9.5	<b>14.5</b>
<b>Czech Republic</b>	5.5	<b>11.9</b>	<b>-16.2</b>	3.4	-4.6	<b>-12.9</b>
<b>Estonia</b>	<b>20.6</b>	3.4	-4.4	<b>-18.6</b>	-1.0	<b>-23.0</b>
<b>Hungary</b>	<b>16.3</b>	5.3	<b>-27.6</b>	<b>10.5</b>	-4.5	<b>-17.1</b>
<b>Latvia</b>	-3.2	1.1	8.4	-3.8	-2.5	4.6
<b>Lithuania</b>	-4.2	6.7	<b>22.3</b>	<b>-15.9</b>	-8.9	6.4
<b>Poland</b>	-1.0	7.8	<b>-18.3</b>	<b>15.8</b>	-4.3	-2.5
<b>Romania</b>	-1.4	7.3	-1.1	-3.3	-1.7	-4.3
<b>Slovakia</b>	-0.1	6.4	<b>-16.0</b>	<b>16.4</b>	-6.7	0.4
<b>Slovenia</b>	1.9	6.2	<b>-19.9</b>	<b>12.9</b>	-1.1	-7.0

In Latvia between 1993 and 1995 there was a shift from Category 1 into Category 4, and further between 1995 and 1997 from Category 4 to Category 3. After 1997 there was no significant movement. In Romania, a significant movement from Category 3 to Category 4 took place between 1993 and 1995. This development was, however, turned around between 1995 and 1999. In 1999-2002 there was very little change. This does not of course rule out intra-category changes.

We can also look at the most important product groups in which the CEE countries have enjoyed a comparative advantage in 2002. These are recorded in Appendix 2 along with the share of these products in CEE countries' exports to EU15 in 1993 and 2002. An asterisk (\*) shows which products have evolved a comparative advantage since 1993.

Some noticeable changes can be found. Bulgaria and Romania have not managed to create new important product groups in which they would have a comparative advantage. Latvia has succeeded in introducing only furniture in this re-

spect. Clothing is important for the comparative advantage of Bulgaria, Lithuania and especially Romania. These are also the four poorest accession countries. The other countries have more new important product groups in which they now enjoy a comparative advantage they did not have in 1993.

For the Czech Republic, Hungary, Poland, Slovakia and Slovenia, these new important comparative advantage products lie in the production of motor vehicles or parts thereof (Category 4). For Hungary and Estonia, we see an increase in the importance of smaller consumer goods in Category 1. These are automatic data processing machines etc. in Hungary's case, and telephone equipment and parts in Estonia's case.

Latvia and Lithuania significantly reduced the share of Russian transit oil included in their actual exports to the EU. This has been partly substituted for by the exports of wood (Category 4) in the case of Latvia and of clothing (Category 3) in the case of Lithuania. This helps to explain the decline in the degree of capital intensity of Lithuania's comparative advantage.

#### **4 EU15 Countries' Revealed Comparative Advantage**

Table 2 presents the respective figures for the EU15 countries in 2002 and the percentage-point change since 1993. The skill-intensive categories 1, 2 and 5 are more important in the EU15 countries than in the CEE countries. Even so, Category 4 is the single most important one also for most EU15 countries. In addition to this, Category 3 is very important in Greece and Portugal, but also Italy. Overall, Categories 3 and 4 combined are the most important for the southern European countries of Portugal, Spain, Italy and Greece. This is evidence that CEE countries are still competing more, on average, with southern EU15 countries than northern ones as regards the factor intensity of their comparative advantage.

Within the EU, we also find countries for which Categories 1, 2 and 5 are most important, namely Ireland, Britain, the Netherlands, Finland and Sweden, and, only just, Denmark and France, where these high-skill categories account for over 50 per cent of the comparative advantage.

As we saw, there have been considerable changes in the transition countries' RCA structure since 1993. However, even in the more mature economies of the EU15 there have been noticeable shifts in this respect. Finland, Ireland and Belgium have increased the share of Category 1 significantly, while Portugal has increased the share of Category 4. Category 2 has grown in Austria, France, Sweden and Britain. For Greece and Portugal, the share of Category 3 has fallen significantly. The same has taken place for Britain, Finland, Spain, Ireland and Belgium in Category 4. The low-skilled Categories 3 and 4 have declined the most for Britain, Finland, Ireland, Belgium, Spain and Italy. There has been quite little net change between the categories in 1993-2002 in especially Germany and Denmark, but also Italy and France, and the most in the four geographical corners of EU15, i.e. Finland, Ireland, Portugal and Greece.

Table 2 Share of intra-EU15 RCA-exports in each of the five categories in 2002, %, and percentage-point change between 1993 and 2002 (with changes of over ten percentage points highlighted)

EU15 country	Category					
	1	2	3	4	5	3+4
Austria	9.2	33.2	10.6	42.0	5.0	52.5
Belgium-Luxembourg	33.0	8.0	7.3	46.6	5.0	53.9
Germany	16.8	28.0	5.0	48.1	2.2	53.1
Denmark	16.9	28.6	15.6	33.6	5.3	49.2
Spain	8.1	18.8	9.0	58.0	6.1	67.0
Finland	34.3	13.9	6.5	32.7	12.6	39.2
France	19.0	21.9	3.9	45.9	9.4	49.8
Greece	10.1	16.8	31.0	27.2	14.8	58.2
Ireland	72.4	14.7	0.1	4.7	8.2	4.8
Italy	4.5	29.8	22.6	38.8	4.3	61.4
Netherlands	42.4	25.3	2.5	21.1	8.7	23.6
Portugal	2.6	16.9	30.5	42.3	7.8	72.8
Sweden	16.5	29.3	7.9	33.3	13.0	41.1
Britain	52.2	25.0	2.0	19.6	1.2	21.6

EU15 country	Category					
	1	2	3	4	5	3+4
Austria	-5.7	<b>13.0</b>	-1.7	-7.6	2.0	-9.3
Belgium	<b>15.1</b>	-1.0	2.5	<b>-14.8</b>	-1.7	<b>-12.3</b>
Germany	-2.7	3.3	-2.4	2.7	-0.9	0.3
Denmark	9.3	-3.0	-3.5	-1.6	-1.2	-5.1
Spain	3.3	9.5	3.3	<b>-15.0</b>	-1.2	<b>-11.7</b>
Finland	<b>22.9</b>	6.6	-1.1	<b>-16.7</b>	<b>-11.7</b>	<b>-17.8</b>
France	-3.1	<b>12.3</b>	-0.8	-6.0	-2.3	-6.8
Greece	8.9	3.8	<b>-16.6</b>	7.8	-3.9	-8.7
Ireland	<b>20.8</b>	4.4	-1.6	<b>-14.3</b>	-9.3	<b>-15.9</b>
Italy	1.4	9.3	-7.7	-3.5	0.4	<b>-11.2</b>
Netherlands	8.8	4.8	-2.7	-6.0	-4.9	-8.7
Portugal	-1.8	6.0	<b>-18.8</b>	<b>17.6</b>	-3.1	-1.1
Sweden	1.2	<b>12.1</b>	0.1	-9.0	-4.3	-9.0
Britain	8.9	<b>10.8</b>	-1.5	<b>-17.2</b>	-1.0	<b>-18.7</b>

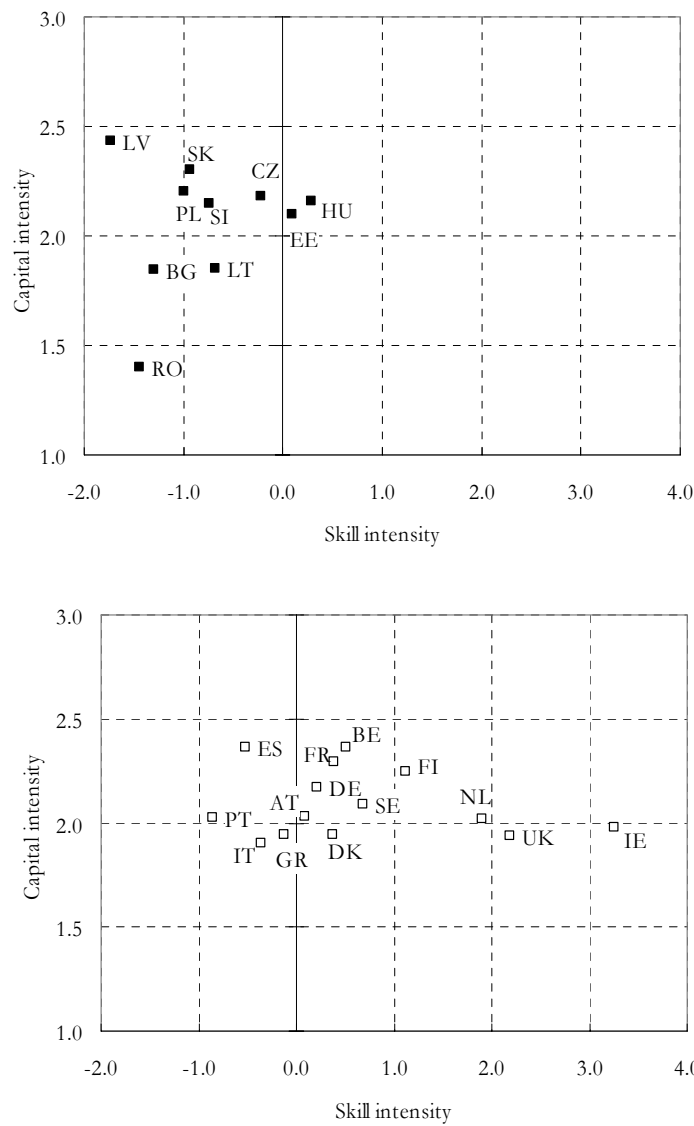
## 5 Pinpointing the Countries in the Two-Dimensional Space

We have also made an effort to try to pinpoint the countries' revealed comparative advantage in the two-dimensional space. Figure 1 shows what values we have used to depict the relative skill and capital intensities. We have applied the values ( $x = 4, y = 2$ ) for Category 1, (2, 1) for Category 2, (-2, 1) for Category 3, (-2, 3) for Category 4, and (2, 3) for Category 5 in order to place a country in a single point on a chart such as Figure 1. The values are relatively arbitrary and have

been chosen on the basis of the figure depicting the relative skills-capital intensity of the different categories. Moreover, we cannot conclude that, for example,  $y = 2$  would mean that production is twice as capital-intensive as  $y = 1$ . Also remember that each Category 1 through 5 comprises a large variety of different manufacturing industries, a cluster if you will of industries with more or less similar capital and labour-skill factor intensities (see Appendix 1).

Using the above values for the five categories, we can show where a country lies in the skills-capital division relative to other countries. Figure 2 shows this point for the CEE countries (above) and the EU15 countries (below) in 2002.

**Figure 2**      **Weighted revealed comparative advantage of exports to the EU15 area in 2002**



As might be expected, the EU15 countries are generally positioned to the right of CEE countries. This means that the comparative advantage of EU15 countries' intra-EU15 exports is, on average, more skill-intensive than that of the exports of CEE countries. There also seems to be a small difference in the average capital-intensity in favour of EU15 countries.

Romania's comparative advantage is based on a much lower level of capital intensity than that of the other countries. Among the CEE countries, Latvia, on the other hand, has a relatively capital-intensive comparative advantage. Both countries are, along with Bulgaria, very far on the left signifying that their comparative advantage is based on low-skill manufacturing sectors.

The other CEE countries are more or less at the same, perhaps slightly below, the level of capital intensity in their comparative advantage as most EU15 countries. On the horizontal axis, the latter are, on average, to the right of the CEE countries. Slovakia, Poland, Slovenia and Lithuania are more or less at the same level of skills as Portugal. Estonia and Hungary are much farther to the right, approximately at the same level as Germany and Austria. Ireland, the UK and the Netherlands form a group of their own with a high skill intensity of their comparative advantage in the EU15 market.

## 6 Movements in the Countries' Weighted Position

As Table 1 indicates, changes have occurred in the relative position of CEE countries' comparative advantage in the EU15 market since 1993. Figure 3 traces these movements. It shows the position of each CEE country in 1993, 1995, 1997, 1999, 2001 and 2002. The smallest marker denotes its position in 1993 and the largest marker its position in 2002. A noticeable fact is that the CEE countries have moved in different directions in the skills-capital space even though the speed has in many cases slowed down or come to a virtual halt. The scale on the axes is the same for all countries.

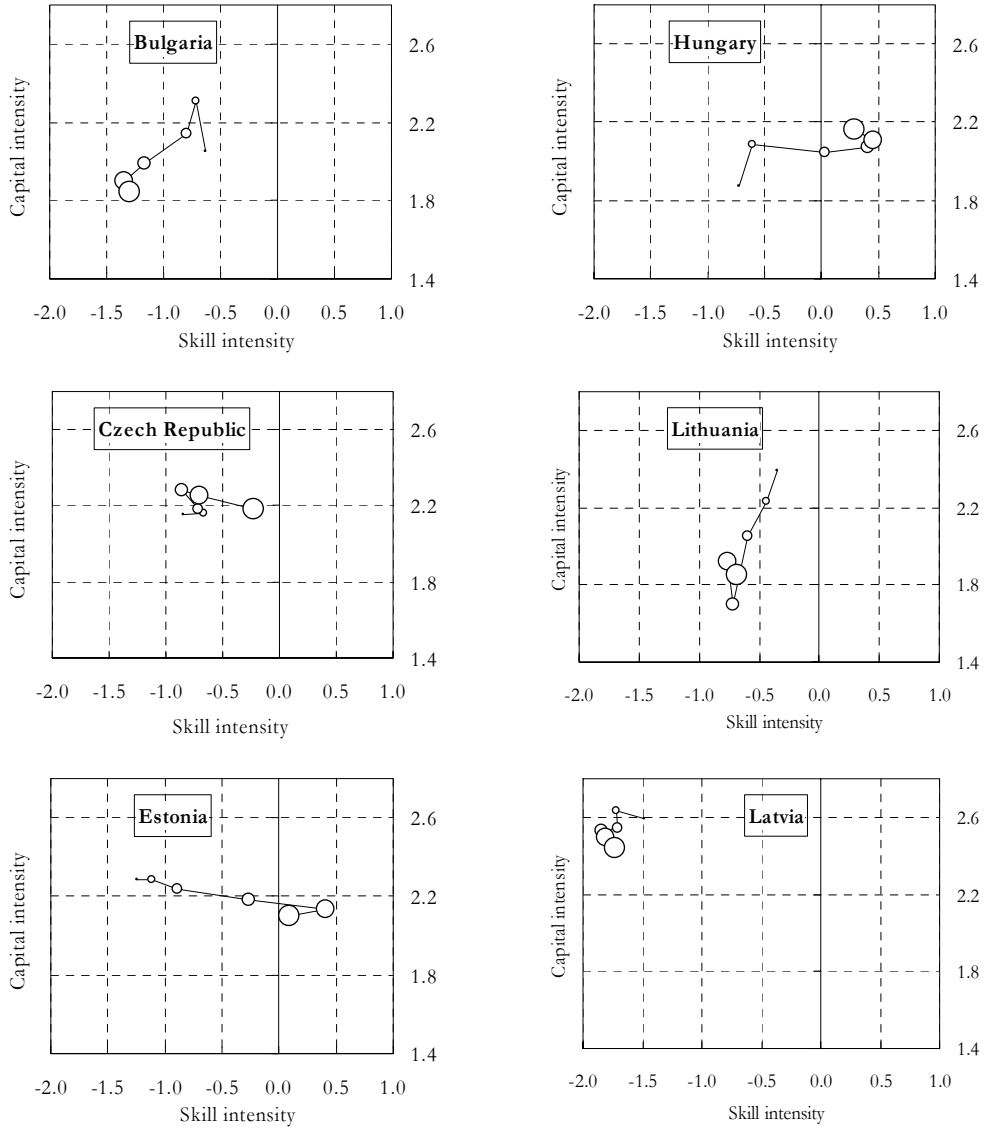
Hungary and Estonia have moved significantly towards the right thus increasing the skill-intensity of their comparative advantage. Hungary also seems to have increased its capital-intensity before 1995. However, the right-bound movement has come to a halt or has been slightly reversed for these two countries.

Slovakia's comparative advantage has moved to the left and right more or less cancelling out, but there has been a slow movement towards a more capital intensive comparative advantage. This trend is likely to continue because several car manufacturers have plans to increase production in Slovakia. Poland and Slovenia, too, have slowly edged upward. In all cases, auto industry plays a role in the developments. The Czech Republic has remained more or less constant despite the growth in car manufacturing. However, there was a move toward a more skill-intensive comparative advantage in 2002.

Latvia has remained more or less constant since 1993, while Lithuania has experienced a radical decline in the capital intensity of its comparative advantage, though there was a slight reversal in 2001. Of the Balkan countries, Bulgaria has continued to shift down and to the left while Romania has remained constant if we disregard the movement in the 1995 marker in Figure 3.

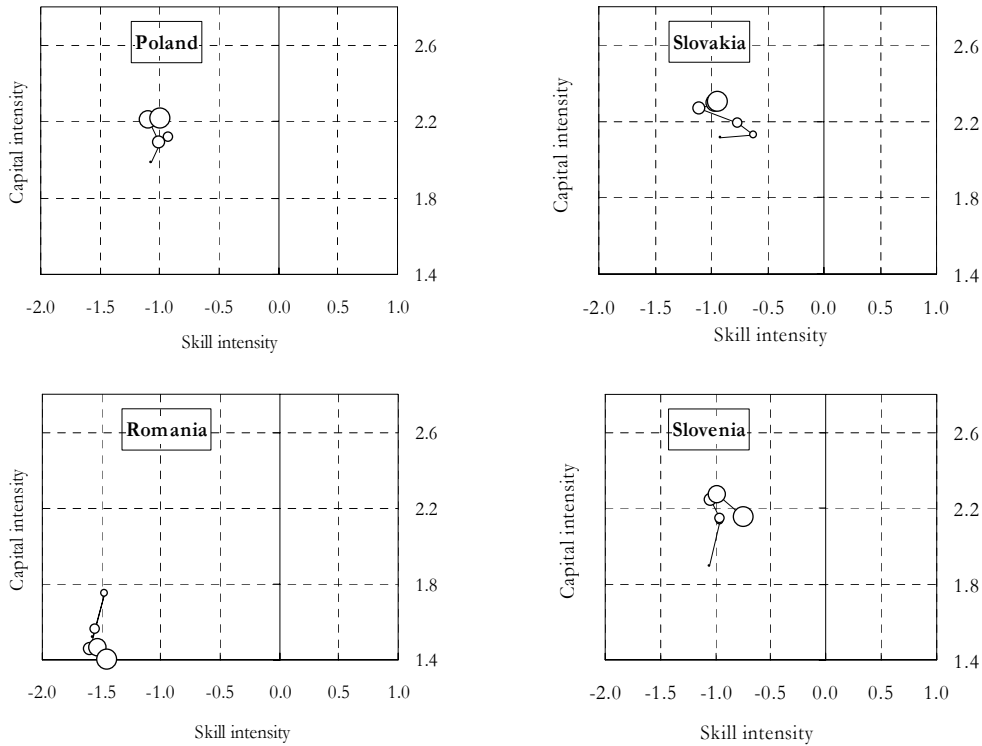
The fact that some countries have remained relatively constant in Figure 3 could mean either that their factor intensity has remained unchanged or that shifts have counterbalanced each other.

**Figure 3** Factor intensity of CEE countries' revealed comparative advantage in exports to the EU15 in 1993 (smallest marker), 1995, 1997, 1999, 2001 and 2002 (largest marker)



Continued on next page...





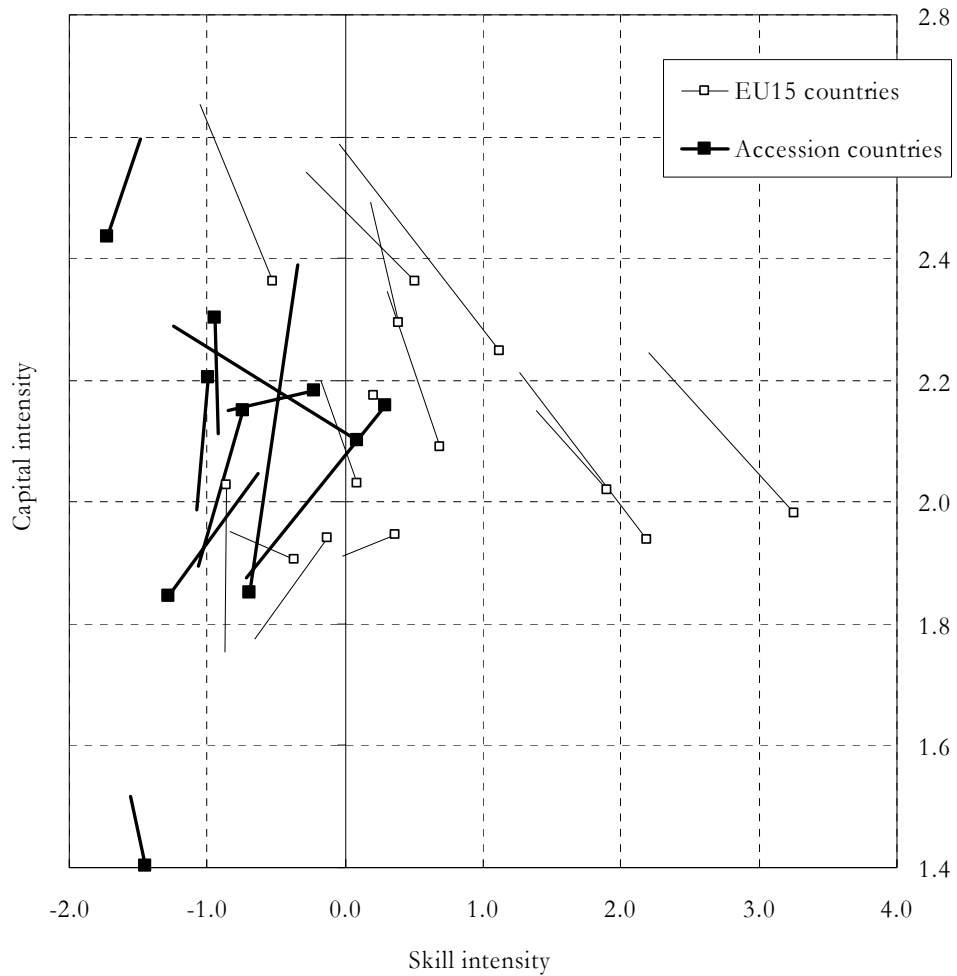
The CEE countries started out their transition from more or less similar positions, but they have moved in different directions. The countries formed a tighter cluster in 1993 than in 2002. In 1993, the non-weighted standard deviation of  $x$  was 0.383 and that of  $y$  0.301. By 2002, the standard deviation of  $x$  had risen to 0.659 and that of  $y$  had fallen to 0.294.<sup>5</sup> In terms of capital intensity, CEE countries' comparative advantage converged, but in terms of labour skills there has occurred a significant increase in diversity. One large reason for this is surely the particular type of FDI that has poured into Hungary and Estonia, which have moved to the right much more radically than any other CEE country.

Figure 4 shows the shift in the EU15 countries' and the accession countries' comparative advantage from 1993 to 2002 in the same graph. Looking at the EU15 countries we see roughly two kinds of movement: mostly to southeast and to a lesser extent to north or northeast. Generally, the EU15 countries that were either particularly capital-intensive or had high skill intensity have moved towards a less capital-intensive and more skill-intensive comparative advantage. On the other hand, those EU15 countries with a comparative advantage marked by low capital and skill intensity, have moved towards a more capital intensive compara-

<sup>5</sup> The standard deviation for  $x$  in the EU15 countries in 2002 was 1.140 and for  $y$  0.163. Consequently, when it comes to the skill intensity of comparative advantage the EU15 countries still form a much more heterogeneous group than the CEE countries do. In 1993 the figures for the EU15 countries were 0.939 and 0.292, respectively, so the EU15 countries comparative advantage has diverged in its skill intensity but converged in its capital intensity just as has happened in the CEE countries.

tive advantage. This is reflected in the more even capital intensity in intra-EU15 comparative advantage

**Figure 4** Shift in the skill and capital intensity of comparative advantage in the EU15 area between 1993 and 2002. The marker shows the country's position in 2002.



The CEE countries have experienced more varied development in very different directions as we have already seen. The average movement in Figure 4 is 0.574 for the EU15 countries and 0.563 for the CEE countries. There was considerable movement in this respect in the 2001-2002 period in the EU15 countries. Next, these movements have been contrasted with GDP growth rates in Figures 5 and 6.

## 7 Shift in Factor Intensity and GDP Growth

Is there any correlation between the changes depicted above and GDP growth rate? The graphs below indicate that this may be possible. However, before making too strong conclusions, we should remember that the way weighted factor intensity has been calculated here is somewhat arbitrary. An econometric analysis might reveal more insights to the issue.

Figure 5 combines on the vertical axis the average GDP growth rates of the EU15 and CEE countries and on the horizontal axis the change in the skill intensity (above) and capital intensity (below) of these countries' revealed comparative advantage between 1993 and 2002.

Keeping in mind the caveats, we may however discern a trend of higher growth rates given an increase in the skill intensity of the countries' comparative advantage. This is shown for both the EU15 countries and the CEE countries. However, the  $R^2$ s of the linear trends are quite low, 0.37 for the EU15 countries and 0.10 for the CEE countries. Still, this may offer some evidence, however weak, that more skill-intensive exports support GDP growth. This would also be compatible with the results that show increased human capital to have a positive effect on growth.<sup>6</sup> At least for the EU15 countries this looks likely. On the other hand, some CEE countries have reached high growth rates also without any or even with a small negative change in the skill-intensity of their revealed comparative advantage.

The lower graph depicts average GDP growth rates and the change in capital intensities. Here, the trend for the EU15 countries is declining. The trend indicates a slight negative connection between the change in capital intensity and GDP growth rate. However, the trend is rising for the CEE countries indicating that higher capital intensity has been compatible with higher GDP growth rates there. The different phases of economic development may very well allow for this difference in the slopes. The  $R^2$ s are just 0.08 for the EU15 countries and a 0.11 for the CEE countries.

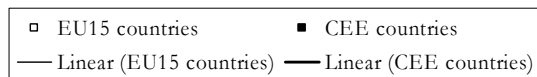
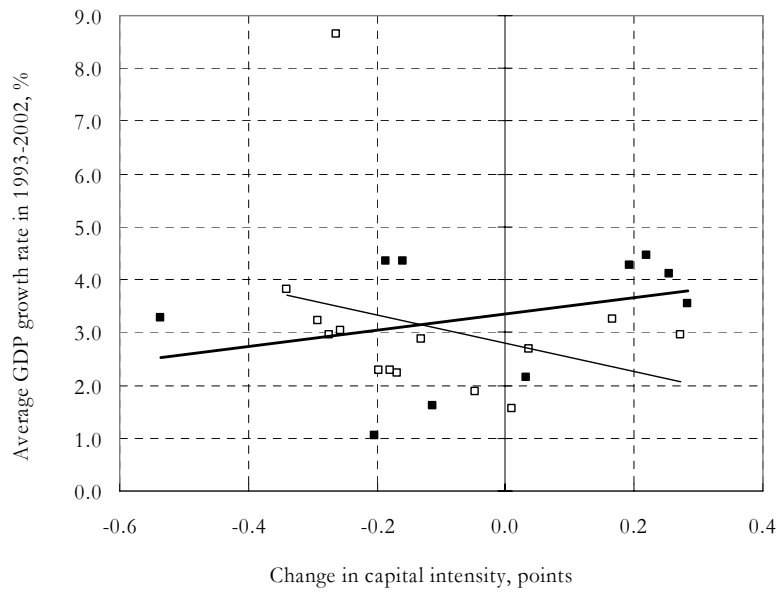
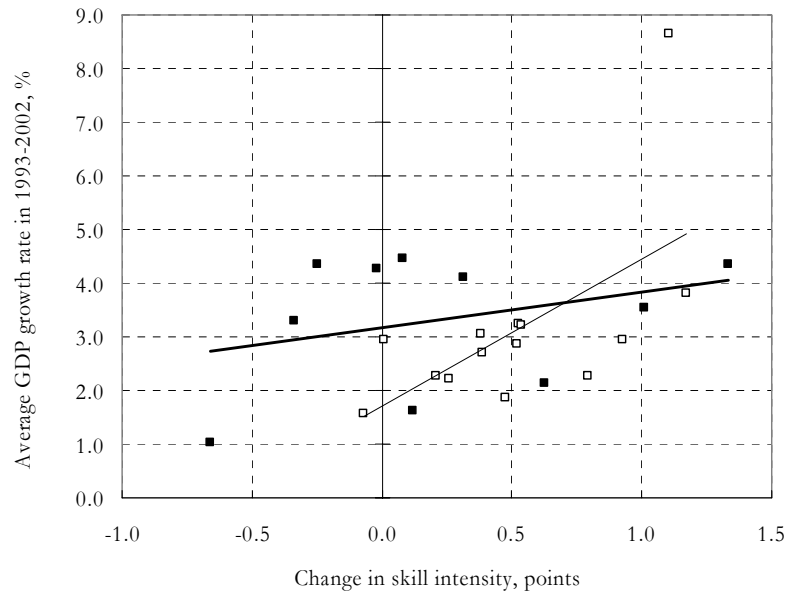
At least for the EU15 countries a second-order polynomial trend would offer a higher explicatory power. This would be compatible with the first picture as a decline in capital intensity is likely to follow from increased skill intensity. That is, investment in either skills or physical capital would lead to a higher GDP growth rate.

We can also draw a graph showing that the more a country's weighted position has changed for the EU15 area, regardless of the direction of the change, the faster its average GDP growth has been during 1993-2002 (see Figure 6). The  $R^2$ s are 0.41 for the EU15 countries but a flat 0.00 for the accession countries. Whether this is evidence of a positive impact from structural change, cannot be analysed within the limited space of this article.

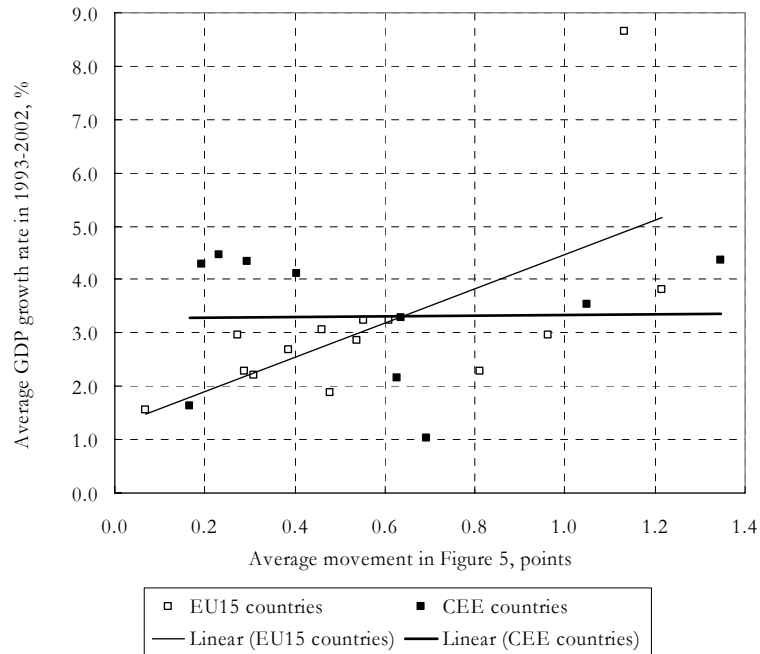
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<sup>6</sup> See e.g. Mankiw et al. (1992) and Bassanini and Scarpetta (2001).

**Figure 5** Growth and change in the skill/capital intensity between 1993 and 2002



**Figure 6** Average movement as shown in Figure 4 between 1993 and 2002 and GDP growth rates



## 8 Impact of EU Membership

Eight of the ten accession countries that we have discussed in this article joined the European Union in May 2004. One of the fundamental principles in the Union is the free movement of goods. By and large, this has already been achieved, so the comparative advantage in 2002 already reflected free trade to a large extent. Trade in foodstuffs, however, were still largely restricted.

EU membership will further decrease trade barriers between countries, and especially between the new EU countries. Consequently, it will further enhance trade relations in Europe. Because EU15 is much more important for the CEE countries as an export market than vice versa, the CEE countries will gain more from lower trade barriers than the EU15 countries. A further effect in this direction will be the CEE countries' eventual membership in Economic and Monetary Union.

As members of the Union, the CEE countries will be eligible for funding from EU structural and other funds. These funds have often been used to improve infrastructure and enhance competitiveness. Central European countries are obvious gainers from an improvement in their infrastructure and transport connections with their major export markets within the EU. Revenue from these funds may not exceed four per cent of a country's GDP, and the annual flow is likely to be smaller than this, but even as such the impact is likely to be substantial. The impact of these funds, if well managed, is also likely to be more substantial in the

CEE countries than it has been in their current receivers Ireland, Spain, Portugal and Greece. This is because the CEE countries are poorer and because their geographical position in central Europe (basically near Germany) gives them an edge over such distant countries as Greece and Portugal.

According to Ederveen et al. (2002), structural funds are beneficial if the country receiving them has the 'right' institutions, for example openness, institutional quality, low corruption and good governance. Largely this reflects the economic success in Ireland as opposed to e.g. Greece. Corruption is rife in the new EU countries, and this may hinder the effectiveness of the funds. However, Beugelsdijk and Eijffinger (2003) conclude on the basis of data from 1995-2001 that corruption does not seem to affect economic growth adversely from the point of view of structural funds. Clearly, however, the issue of transparency has to be high on the list of priorities when funding projects in the receiving countries.

EU membership will thus both increase the competition faced by CEE manufacturing industries and increase their competitiveness as well as boost these countries' GDP growth. Foreign direct investment will play an important role in this process. The clustering of certain type of know-how in a particular region will have the effect of attracting further investment into sectors that use similar know-how. Declining transport costs are also likely to enhance CEE countries' comparative advantage. Rising production costs in the countries geographically closest to the EU15 area will encourage certain industries to move to those countries that have so far been shadowed by the relative success of others.

## 9 Conclusions

This study analysed the skill and capital intensity of the comparative advantage of the accession countries of Central and Eastern Europe (CEE) and of the EU15 countries in their exports to the EU15 area in 1993-2002. The Central and Eastern European countries' comparative advantage in the internal market is based more on low-skill-intensive manufacturing sectors than that of the incumbent EU countries.

Of the EU15 countries, low-skill intensive goods are the most important for Portugal, Spain and Italy. Consequently, the CEE countries are still competing more, on average, with southern EU15 countries than with northern ones as regards the factor intensity of their comparative advantage.

Generally, the EU15 countries whose comparative advantage was either particularly capital-intensive or who had high skill intensity in 1993 have moved towards a less capital-intensive and more skill-intensive comparative advantage by 2002. On the other hand, those EU15 countries with a comparative advantage marked by low capital and skill intensity, have moved towards a more capital intensive comparative advantage. The capital intensity of revealed comparative advantage has converged, while its skill intensity has diverged among the EU15 countries.

Also the CEE countries' comparative advantage has become more heterogeneous in the intensity of labour skills since 1993. The CEE countries have moved in

different directions, or remained still, in the skill-capital space. Hungary and Estonia have moved towards a more skill-intensive comparative advantage. Largely due to an expansion in car manufacturing industries, Poland, Slovenia and Slovakia have, on average, moved towards a more capital-intensive comparative advantage, while Lithuania has generally moved towards a less capital-intensive comparative advantage. Bulgaria's comparative advantage seems to have become both less skill intensive and less capital intensive. Meanwhile, Romania and Latvia have not really moved in this respect. The Czech comparative advantage was on average relatively unchanged in 1993-2001, but became more skill intensive in 2002.

In 2002, Romania's comparative advantage was the least capital intensive and based on very low-skilled-labour industries. Of the CEE countries, Latvia's comparative advantage was based on very low-skilled-labour industries but it was also quite capital intensive. Hungary, Estonia and the Czech Republic had the most skill-intensive comparative advantage in 2002.

Furthermore, we find some evidence of a positive link between an increase in the skill intensity of the countries' comparative advantage and higher GDP growth rates in 1993-2002. This is shown for both the EU15 countries and the CEE countries. On the other hand, some CEE countries have reached high GDP growth rates also without any or even with a small negative change in the skill-intensity of their revealed comparative advantage. In the CEE countries also increased capital intensity has been compatible with higher GDP growth rates.

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## Appendix 1 Classification of sectors (NACE CLIO) according to factor intensities as calculated by Neven (1995)

Proxy variables for cluster analysis:

var1 = 08/11, var2 = 18/11, var3 = 18/73, var4 = 80/73

(08): Employees, including commercial and technical apprentices (men + women)

(11): Occupied people, including home workers listed on pay file

(18): Total staff spending

(73): Raw added value at factor prices

(80): Total investment

**Table A1.1 Factor intensities in Germany, descriptive**

Category	t/l	w/l	w/y	i/y
1	high	high	high	high
2	high	high	high	low
3	low	low	high	low
4	low	low	low	high
5	high	high	low	high

Source: Neven (1995).

t/l = share of white collar workers in total industry labour force

w/l = medium wage

w/y = the ratio of all labour costs to value added

i/y = the ratio of fixed investment to value added

**Table A1.2 Factor intensities in Germany, numerical**

Category	t/l	w/l	w/y	i/y
1	0.489	0.032	0.774	0.146
2	0.355	0.026	0.796	0.134
3	0.223	0.023	0.857	0.080
4	0.240	0.023	0.751	0.147
5	0.379	0.028	0.643	0.210

Source: Neven (1995).

### Category 1

- 2500 Chemical industry
- 2510 Manufacture of basic industrial chemicals
- 2550 Manufacture of paint, varnish and printing ink
- 2560 Manufacture of other chemical products, mainly for industrial and agricultural purposes
- 2570 Manufacture of pharmaceutical products
- 2580 Manufacture of soap, synthetic detergents, perfume and toilet preparations
- 2590 Manufacture of other chemical products, chiefly for household and office use
- 2601 Chemical and man-made fibres
- 3300 Manufacture of office machinery and data processing machinery
- 3440 Manufacture of telecommunications equipment, electrical and electronic measuring and recording equipment and electro-medical equipment
- 3450 Manufacture of radio and television receiving sets, sound reproducing and recording equipment and of electronic equipment and apparatus, manufacture of gramophone records and pre-recorded magnetic tapes
- 3640 Aerospace equipment manufacturing and repairing



**Category 2**

- 2430 Manufacture of concrete, cement of plaster products for constructional purposes
- 2460 Production of grindstones and other abrasive products
- 3200 Mechanical engineering
- 3220 Manufacture of machine tools for working metal, and of other tools and equipment for use with machines
- 3230 Manufacture of textile machinery and accessories; manufacture of sewing machines
- 3240 Manufacture of machinery for the food, chemical and related industries
- 3250 Manufacture of plants for mines, the iron and steel industry and foundries, civil engineering and the building trade; manufacture of mechanical handling equipment
- 3270 Manufacture of other machinery and equipment for use in specific branches of industry
- 3280 Manufacture of other machinery and equipment
- 3400 Electrical engineering
- 3420 Manufacture of electrical machinery
- 3460 Manufacture of domestic type electrical appliances
- 3480 Assembly and installation of electrical equipment
- 3600 Manufacture of other means of transport
- 3700 Instrument engineering
- 3710 Manufacture of measuring, checking and precision instruments and apparatus
- 3720 Manufacture of medical and surgical equipment and orthopaedic appliances
- 3730 Manufacture of optical instruments and photographic equipment
- 4110 Manufacture of vegetable and animal oils and fats
- 4150 Processing and preserving of fish and other seafood fit for human consumption
- 4170 Manufacture of spaghetti, macaroni etc.
- 4190 Manufacture of bread and flour confectionery
- 4290 Manufacture of tobacco products
- 4380 Manufacture of carpets, linoleum and other floor coverings, including leather cloth and similar supported synthetic sheeting
- 4930 Photographic and cinematographic laboratories

**Category 3**

- 2220 Manufacture of steel tubes
- 2480 Manufacture of ceramic goods
- 3110 Foundries
- 3140 Manufacture of structural metal products
- 3150 Boilermaking, manufacture of reservoirs, tanks and other sheet-metal containers
- 3210 Manufacture of agricultural machinery and tractors
- 3520 Manufacture of bodies for motor vehicles and of motor-drawn trailers and caravan
- 3610 Shipbuilding
- 3620 Manufacture of standard and narrow-gauge railway and tramway rolling stock
- 3740 Manufacture of clocks and watches and parts thereof
- 4350 Jute industry
- 4360 Knitting industry
- 4400 Leather and leather goods industry
- 4420 Manufacture of products from leather and leather substitutes
- 4500 Footwear and clothing industry
- 4510 Manufacture of mass-produced industry
- 4530 Manufacture of ready-made clothing and accessories
- 4560 Manufacture of furs and of fur goods
- 4630 Manufacture of carpentry and of joinery components and of parquet flooring
- 4670 Manufacture of wooden furniture
- 4920 Manufacture of musical instruments
- 5000 Building and civil engineering
- 5010 Construction of flats, office blocks, hospitals and other buildings, both residential and non-residential
- 5020 Civil engineering, construction of road, bridges, railway
- 5030 Installation
- 5040 Building completion work
- 5100 Building and civil engineering without specialisation

**Category 4**

- 2200 Production and preliminary processing of metals
- 2210 Iron and steel industry excluding integrated coke ovens
- 2230 Drawing, cold rolling and cold folding of steel

- 2240 Production and preliminary processing of non-ferrous metals
- 2400 Manufacture of non-metallic mineral products
- 2410 Manufacture of clay products for constructional purposes
- 2440 Manufacture of articles of asbestos
- 2450 Working of stone and of non-metallic mineral products
- 2470 Manufacture of glass and glassware
- 3100 Manufacture of metal articles (except for mechanical, electrical and instrument engineering and vehicles)
- 3120 Forging, closed-died forging, pressing and stamping
- 3130 Secondary transformation, treatment and coating of metals
- 3160 Manufacture of tools and finished metal goods, except electrical equipment
- 3190 Other mechanical workshops not elsewhere specified
- 3260 Manufacture of transmission equipment for motive power
- 3470 Manufacture of electric lamps and other electric lightning equipment
- 3500 Manufacture of motor vehicles and of motor vehicles parts and accessories
- 3510 Manufacture and assembly of motor vehicles, manufacture of motor vehicle engines
- 3530 Manufacture of parts and accessories for motor vehicles
- 3630 Manufacture of cycles and motorcycles and parts and accessories thereof
- 3650 Manufacture of transport equipment not elsewhere specified
- 4120 Slaughtering, preparing and preserving of meat
- 4210 Manufacture of cocoa, chocolate and sugar confection
- 4300 Textile industry
- 4320 Cotton industry
- 4330 Silk industry
- 4370 Textile finishing
- 4390 Miscellaneous textile industries
- 4410 Tanning and dressing of leather
- 4550 Manufacture of household textiles other make-up textile goods
- 4600 Timber and wooden furniture industries
- 4610 Sawing and processing of wood
- 4620 Manufacture of semi-finished wood products
- 4640 Manufacture of wooden containers
- 4650 Other wood manufacture
- 4660 Manufacture of articles of cork and articles of straw and other plant materials, manufacture of brushes and brooms
- 4720 Processing of paper and boards
- 4730 Printing and allied industries
- 4800 Processing of rubber and plastics
- 4810 Manufacture of rubber products
- 4830 Processing of plastics
- 4900 Other manufacturing industries
- 4910 Manufacture of articles of jewelry and goldsmiths' and silversmiths' wares
- 4940 Manufacture of toys and sports goods
- 4950 Miscellaneous manufacturing industries

#### Category 5

- 2300 Extraction of minerals other than ferrous metals and energy-producing minerals; peat extraction
- 2420 Manufacture of cement, lime and plaster
- 4100 Food, drink and tobacco industry
- 4130 Manufacture of dairy products
- 4140 Processing and preserving of fruits and vegetables
- 4160 Grain milling
- 4180 Manufacture of starch and starch products
- 4200 Sugar manufacturing and refining
- 4220 Manufacture of animal and poultry food
- 4230 Manufacture of other food products
- 4240 Distilling of ethyl alcohol from fermented materials; spirit distilling and compounding
- 4250 Manufacture of wine of fresh grapes and of beverages based thereon
- 4270 Brewing and malting
- 4280 Manufacture of soft drinks, including the bottling of natural spa water
- 4700 Manufacture of paper and paper products; printing and publishing
- 4710 Manufacture of pulp, paper and board

## Appendix 2 CEE Countries' Revealed Comparative Advantage

The CEE countries' RCA has mostly become more centralised in a smaller number of products. The ten most important products accounted for a larger share in revealed comparative advantage (RCA) in 2002 than in 1993 in all countries except Lithuania, Latvia and Romania with the share almost unchanged in Poland. Furthermore, in the case of Latvia and Lithuania this can largely be explained by a decrease in the importance of transit exports of Russian oil. Typically therefore, RCA has become more concentrated in a smaller number of products. Table A2.1 shows the most important products with RCA in 2002.

**Table A2.1 Product groups in CEE countries' exports to EU15 in 2002 in which the countries had a revealed comparative advantage and whose share in total exports to EU15 exceeded 3 per cent. Also find the share of this product group in total exports to EU15 in 1993. An asterisk (\*) shows that the country did not have a comparative advantage in these products in 1993.**

CEE Country	HS4 Product Group	Category	Share in 1993	Share in 2002
<b>Bulgaria</b>	6204 Women's/girls' suits, jackets, etc.	3	0.032	0.075
	7402 Unrefined copper; copper anodes	4	0.026	0.065
	6203 Men's or boys' suits, jackets, etc.	3	0.018	0.046
	7208 Flat-rolled products of iron etc.	4	0.009	0.045
<b>Czech Republic</b>	8703 Motor vehicles for transporting persons	4	0.041	0.090*
	8708 Parts & accessories of motor vehicles	4	0.010	0.075*
	8471 Automatic data processing machines; optical readers	1	0.001	0.054*
<b>Estonia</b>	2710 Petroleum oils etc., not crude		0.084	0.143
	8529 Part for telephones, radios, TVs	1	0.006	0.094
	8525 Transmission apparatus for radio-telephony etc.	1	0.000	0.059*
	4407 Wood sawn or chipped	4	0.019	0.054
	9403 Other furniture and parts thereof	3	0.022	0.038
	4403 Wood in the rough	4	0.062	0.036
	2709 Petroleum oils etc., crude		0.000	0.031*
<b>Hungary</b>	8407 Piston engines	4	0.015	0.072
	8471 Automatic data processing machines; optical readers	1	0.005	0.069*
	8703 Motor vehicles for transporting persons	4	0.003	0.063*
	8408 Piston engines	4	0.000	0.043*
	8708 Parts & accessories of motor vehicles	4	0.009	0.038*
	8544 Insulated wire or cable etc.	2	0.030	0.032
<b>Lithuania</b>	2710 Petroleum oils etc., not crude		0.448	0.144
	6204 Women's/girls' suits, jackets, etc.	3	0.015	0.063
	3102 Mineral or chemical fertilisers, nitrogenous	1	0.052	0.047
	9403 Other furniture and parts thereof	3	0.011	0.046
	4407 Wood sawn or chipped	4	0.010	0.039
	6203 Men's or boys' suits, jackets, etc.	3	0.017	0.038
	2709 Petroleum oils etc., crude		0.003	0.038*

<b>Latvia</b>	4407 Wood sawn or chipped	4	0.036	0.187
	2710 Petroleum oils etc., not crude		0.445	0.163
	4403 Wood in the rough	4	0.032	0.080
	2709 Petroleum oils etc., crude		0.137	0.041
	9403 Other furniture and parts thereof	3	0.005	0.039*
	4412 Plywood, veneered panels, etc.		0.016	0.032
<b>Poland</b>	8408 Piston engines	4	0.002	0.054*
	8708 Parts & accessories of motor vehicles	4	0.004	0.046*
	8528 Television receivers, videos		0.000	0.040*
	8703 Motor vehicles for transporting persons	4	0.053	0.036*
	9403 Other furniture and parts thereof	3	0.032	0.033
<b>Romania</b>	6204 Women's/girls' suits, jackets, etc.	3	0.069	0.095
	6203 Men's or boys' suits, jackets, etc.	3	0.081	0.070
	6403 Footwear	3	0.038	0.070
	6110 Jerseys, pullovers, cardigans, etc.	3	0.032	0.042
	8544 Insulated wire or cable etc.	2	0.006	0.042
	6406 Parts of footwear	3	0.040	0.040
	9403 Other furniture and parts thereof	3	0.097	0.037
	6206 Women's or girls' blouses, shirts, etc.	3	0.019	0.032
	2710 Petroleum oils etc., not crude		0.022	0.030
<b>Slovakia</b>	8703 Motor vehicles for transporting persons	4	0.016	0.240*
	8544 Insulated wire or cable etc.	2	0.013	0.050
	8708 Parts & accessories of motor vehicles	4	0.004	0.042*
<b>Slovenia</b>	8703 Motor vehicles for transporting persons	4	0.069	0.135*
	8708 Parts & accessories of motor vehicles	4	0.020	0.044*

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