

ECONOMIC CONVERGENCE IN THE EU ACCESSION COUNTRIES

1. Introduction

One of the most important conclusions from neoclassical models of economic growth (see: Solow, 1956, and Mankiw, Romer, Weil, 1992) is their confirmation of growth convergence, or more precisely, conditional β -convergence. This means that a less developed economy (with a lower GDP *per capita*) tends to grow faster than a more developed one. The convergence is conditional because it takes place when both economies tend to reach the same steady-state. If the less developed economy always grew faster, we would deal with absolute convergence.

Another measure is σ -convergence. It appears if income differences between the economies decrease over time. Income differentiation can be measured by the variance or standard deviation of real GDP *per capita* levels. β -convergence is a necessary but not sufficient condition for the existence of σ -convergence. Income differences between countries can rise and at the same time less developed countries may develop faster (Barro and Sala-i-Martin, 1992).

The main argument behind the convergence hypothesis is that, given the same exogenous technology, countries with low *per capita* income and low capital per worker should have higher returns to capital. This would attract more foreign capital insuring a higher accumulation rate and faster growth. The evident condition is the assumption that the economies concerned are open.

Although neoclassical growth models only imply the existence of conditional convergence, in many empirical analyses absolute convergence is tested, or (what leads to the same) conditional convergence with the assumption that economies tend to reach the same steady-state. For this reason, better results are usually obtained when testing the convergence hypothesis between regions of the same country rather than between different countries. In cross-country analysis, better results will be obtained when considering more or less homogeneous groups (e.g. OECD members). The analysed group of the EU accession countries of Central Eastern Europe (CEE) largely fulfils this requirement.

The concept of economic convergence perceived as a tendency towards the equalisation of income and developments levels can be called growth convergence, or more precisely, income convergence. Another concept is cyclical convergence. This means a tendency among the countries towards conformity of their business cycles, i.e.

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the expansion and recession periods tend to be synchronised (in an ideal case, amplitudes of the fluctuation should also become similar).

Both concepts of economic convergence are basically independent and have to be tested separately. The countries coming closer as regards their income levels need not reveal similar cyclical fluctuations and *vice versa*, the countries with similar cyclical fluctuations need not come close as regards their income levels.

Even if income convergence may be derived from the intrinsic mechanism of economic growth, both types of economic convergence are closely related to international cooperation, including trade and capital flows, technology transfer, labour movement, increased competition, economies of scale, and sometimes also policy coordination. Thus, there may be some interdependence, or at least correlation, between the two aspects of economic convergence, especially among the countries subject to an advanced integration process, which is the case in the enlarged EU.

While the traditional trade theory (Viner, 1950) implied that economic integration will lead to more convergence, some newer theories based on the new geography approach (Krugman, 1991) warned that integration might also result in rising income inequalities. The same is suggested by some newer growth models (Romer, 1986; Lucas, 1988) referring to R&D efforts and brain drain. One of the most comprehensive empirical studies until now (Ben-David, 2002) concluded that *per capita* income levels throughout the world over the period 1960-1985 have rather diverged while the convergence in the countries opening up to international trade was also not so evident. Thus, the debate about development convergence and the effects of integration is by no way closed. This means that there is still much room for discussion about the factors conducive to economic convergence or divergence, and a need for empirical research focusing on different groups of countries.

This paper aims to assess growth and cyclical convergence among eight CEE countries now entering the EU: Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Republic, and Slovenia, as well as their convergence to the EU 'core' as represented by the euro area. Income convergence (a tendency to reduce the income gap) will be analysed by comparing real GDP *per capita* levels and growth rates, and cyclical convergence (a tendency towards a uniform pattern of cyclical fluctuations) will be assessed by industrial production indices and industrial confidence indicators.

There are many analyses of growth patterns in the CEE area, including our own (Matkowski, 2004).¹ There were also many analyses of income convergence of CEE countries towards the EU (e.g. Baldwin, Francois, Portes, 1997; Breuss, 2001; European Commission, 2001; Doyle, Kuis, Jiang, 2001; Lejour, Mooij, Nahujs, 2001; Martín, Velázquez, Funck, 2001; Sarajevs, 2001; Marini, 2003; EEAG, 2004). However, we saw no study devoted to both the growth and cyclical aspects of economic convergence between those countries and towards the EU. Most probably, this is the first such attempt. Therefore, even if our analysis is incomplete, it may stimulate further, more elaborate studies.

¹ For a comprehensive review see: Havrylyshyn (2001).

The paper consists of eight parts. Section 1 is this introduction. Section 2 explains the concept of income convergence in the light of Solow's model of economic growth. Section 3 indicates the data used and their transformation. The results on income convergence within the group are presented in Section 4. Section 5 brings the results on their cyclical convergence. Section 6 deals with the convergence of CEE countries towards the EU. Section 7 analyses trade links between CEE countries and the EU, which are essential in any reasoning about economic convergence. Section 8 presents main conclusions.

2. Growth convergence in the Solow model

Let us present the conclusions from the Solow model concerning the conditional β -convergence. In particular, we wish to show that (i) an economy starting from a low GDP *per capita* level (and a low capital per worker) and tending towards a steady-state may grow faster than the economy starting from a higher income and capital level; (ii) economies approaching different steady-states need not converge.

The basic equation which describes the drive of the economy towards a steady-state in the Solow model is:

$$\dot{k}_t = sf(k_t) - (n + x + \delta)k_t \quad \text{or} \quad g_k = s \frac{f(k_t)}{k_t} - (n + x + \delta), \quad (1a, 1b)$$

where:

- \dot{k} – increase of capital/labour ratio,
- g_k – growth rate of capital,
- n – growth rate of population,
- x – rate of exogenous technical progress,
- δ – rate of capital depreciation,
- s – saving rate,
- k – capital per unit of effective labour,
- $f(k)$ – production function.

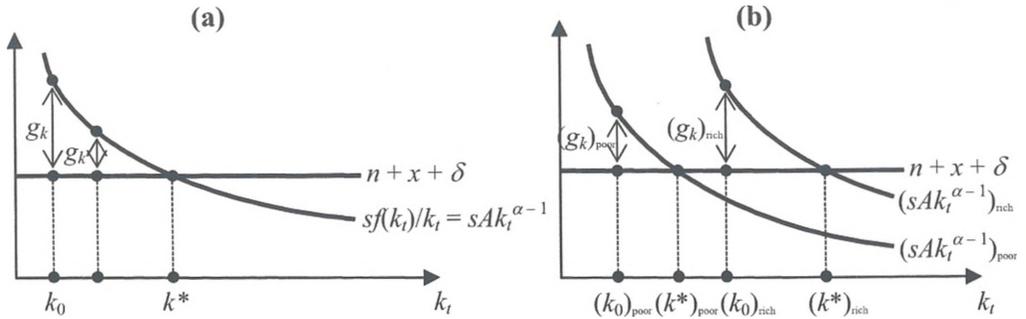
Since output is proportional to capital (according to the neoclassical production function), similar equations characterise the dynamics of total product.

The best way to prove (i) is to draw both parts of equation (1b) on the chart. This is shown in Figure 1a. The growth rate equals to the vertical distance between the curve $sf(k_t)/k_t$ and the line $n + x + \delta$. The economy starting from capital level k_0 and reaching the steady-state capital value k^* would reveal a decreasing growth rate. Thus, less developed economy would grow faster than a more developed one.

The convergence is conditional because it is limited to the situation when both economies tend to reach the same steady-state. In order to prove (ii), let us consider two countries: a poor one and a rich one, with different saving rates. Since saving rate in the rich country is higher, the steady-state value of capital in the rich country is also higher than in the poor country. This is shown in Figure 1b. Although the rich country starts from a higher capital level, now it also reveals a more rapid growth, because it

tends to a different steady-state than the poor country. Thus both economies do not converge. Thus, we have proved that β -convergence is conditional.

Figure 1. Economic growth in the Solow model



An important target of empirical research is to estimate the value of parameter β , which determines the speed of convergence towards the steady-state, according to the following equation:

$$g_y \approx \beta(\ln y^* - \ln y_t) \tag{2}$$

The parameter β informs what part of the distance from the steady-state the economy is covering during one period. For example, if $\beta = 0.02$, the economy covers annually 2% of the distance.

In order to calculate β in an empirical analysis, we have to estimate the following regression equation:

$$\frac{1}{T} \ln \frac{y_T}{y_0} = \alpha_0 + \alpha_1 \ln y_0 \tag{3}$$

This equation allows us to verify the existence of β -convergence. The explained variable is the average annual growth rate of real GDP *per capita* between period T and 0 while the explanatory variable is GDP *per capita* level in period 0. If parameter α_1 is negative, β -convergence exists. In such a case we can derive the value of β from:

$$\beta = -\frac{1}{T} \ln(1 + \alpha_1 T) \tag{4}$$

Estimating this equation enables us to verify the existence of β -convergence.

3. Data

For the purposes of our analysis we have compiled the following data:

- a) GDP *per capita* at PPP (2000 constant prices international \$) for the individual CEE countries as well as for the current EU members;
- b) GDP *per capita* at PPP (2000 constant prices international \$) for the whole group of CEE countries accessing the EU and for the EU and euro area, calculated by dividing total GDP and total population of all the countries included in a group;
- c) industrial production indexes for CEE countries and the euro area;

- d) industrial confidence indicators (based on survey data) for CEE countries and the euro area;
- e) trade flows between CEE countries and their major trade partners.

Annual GDP *per capita* data for the period 1993-2001 have been derived from *Euromonitor*. Monthly data on industrial production and industrial confidence are taken from OECD *Main Economic Indicators*, covering various periods (maximum 9 years: 1995-2003). Some quarterly data have been interpolated into monthly indices.

GDP *per capita* data are analysed in a natural-logarithm form. Time series of the industrial production index (2000 = 100) were transformed into growth rates against the same month of the previous year (in order to eliminate seasonality and to avoid instationarity), then smoothed with 12-month moving average and standardised. Time series of industrial confidence indicators were only transformed into 2000 = 100 form (assuming that they are stationary by their very nature), smoothed by 12-month moving average, and standardised.² After those transformations both the industrial production indexes and industrial confidence indicators (except perhaps for last year) do not reveal seasonal fluctuations and irregular movements, and they are comparable.

Data on trade flows come from the newest EBRD *Transition Report* and IMF *Direction of Trade Statistics*. They have been converted into percentage shares of total exports and imports of the countries concerned.

4. Income convergence among CEE countries

β -convergence

Here we wish to test the existence of β -convergence among the CEE countries accessing the EU. It is interesting to check whether less developed economies in this region grew faster than the more developed ones during the transition period.

The analysed group began the transition with a transformation crisis marked by an a deep fall of GDP in early 1990s. For example, in a single year 1992 real GDP *per capita* fell by 21.7% in Estonia, 21.3% in Lithuania, and 34.9% in Latvia (IMF, 2002). In most transition countries the crisis ended till 1993. Since then most CEE countries have revealed continuous economic growth.³

Due to the similarity of the starting point, similar economic structures, and largely the same course of economic reforms, but also due to quite intensive regional cooperation and common policies aimed at EU accession, we should expect a gradual convergence between those countries as regards their income levels. The more so because the EU has pursued a deliberate structure and regional policy aimed at

² Towards the end of period the moving average was successively shortened as to avoid cutting the series at the end.

³ However, over the period 1989-2002, only Poland, Slovenia, and Hungary have noticed a considerable increase in real GDP: by 30%, 18%, and 12% respectively. In the Czech Republic and Slovak Republic the increase was less than 10%. The Baltic states saw a decrease as compared to 1989: Estonia by 7%, and Latvia and Lithuania by 23% (EBRD, 2003).

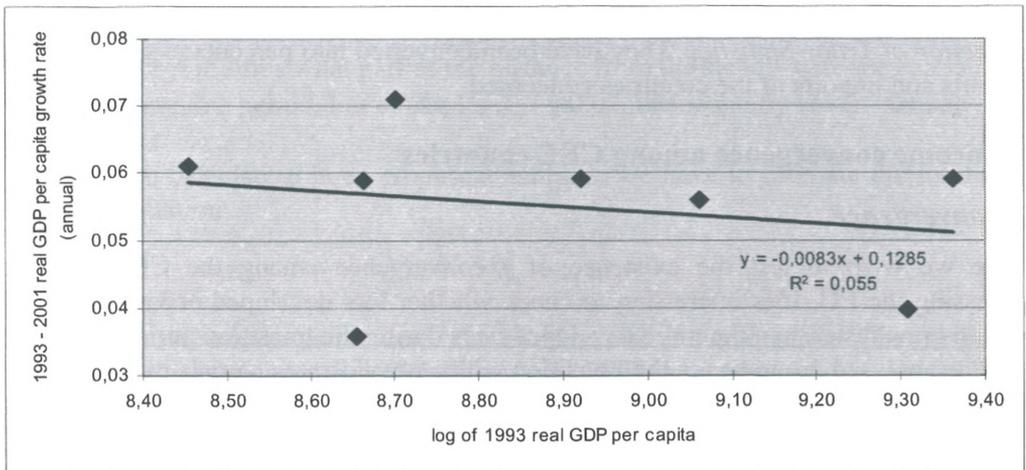
reducing development differences. Financial aid was mainly addressed to less developed regions and countries to stimulate their economic growth.

In order to verify β -convergence, we have to estimate the slope of regression equation (3). We did this for the whole period 1993-2001 as well as for two equal-length subperiods: 1993-1997 and 1997-2001. The results are presented in Table 1 and in Figure 2.

Table 1. Regression results for β -convergence

Period	$\hat{\alpha}_0$	$\hat{\alpha}_1$	$t_{\hat{\alpha}_0}$	$t_{\hat{\alpha}_1}$	$P > t_{\hat{\alpha}_0} $	$P > t_{\hat{\alpha}_1} $	R^2	β -convergence	$\hat{\beta}$
1993-2001	0.1285	-0.0083	1.03	-0.59	0.341	0.576	0.0550	yes	0.0085
1993-1997	0.0920	-0.0042	0.60	-0.24	0.571	0.815	0.0098	yes	0.0043
1997-2001	0.1528	-0.0107	0.87	-0.56	0.415	0.598	0.0491	yes	0.0109

Figure 2. Real GDP per capita growth rate over the period 1993-2001 vs. log of 1993 GDP per capita



The first column in Table 1 indicates the period. The next columns give the estimated values of parameters α_0 and α_1 , t -statistics, p -values, and R^2 . The last two columns inform about the existence of β -convergence (answer is 'yes' if GDP growth rate is negatively correlated with the initial income level) and give the estimated value of β coefficient.

For each analysed period the results confirm the existence of β -convergence. It means that less developed countries grew faster than more developed ones. However, the value of β coefficient for the whole period is quite low (0.85%), indicating a very weak convergence. Thus we should not expect a rapid equalisation of income levels between those countries and a quick approach to the same steady-state.

A more precise analysis shows that β coefficient in the second subperiod 1997-2001 (1.09%) was higher than in the first subperiod 1993-1997 (0.43%). It is very likely that a faster convergence in the second subperiod was linked to the planned EU

enlargement. In the early years of transition adjustment and structural policies were not yet strongly pursued. Approaching the EU accession, less developed countries within this group accelerated their growth.

Our findings are undermined by very poor regression statistics ($R^2 = 0.055$ for the whole period) and insignificance of explanatory variables ($p > 0.01$), which is also due to the small size of the sample. Nevertheless, negative values of α_1 seem to confirm some β -convergence.

Figure 2 shows negative correlation between the average annual GDP growth rate over the period 1993-2001 and the initial GDP *per capita* level. The points marked on the chart, indicating the position of individual countries, do not fit very well the trend line, but a negative tendency is quite clear.

σ -convergence

As our research has largely confirmed the existence of β -convergence among the CEE countries, we would also like to know whether the income differentiation among them has also decreased. In order to answer this question, we have to test σ -convergence.

Although the less advanced CEE countries grow in general faster than the more advanced ones, income dispersion between them need not to decrease systematically. There are various random shocks, such as wars and regional crises, that affect the individual economies and throw them out of the path towards the steady-state.

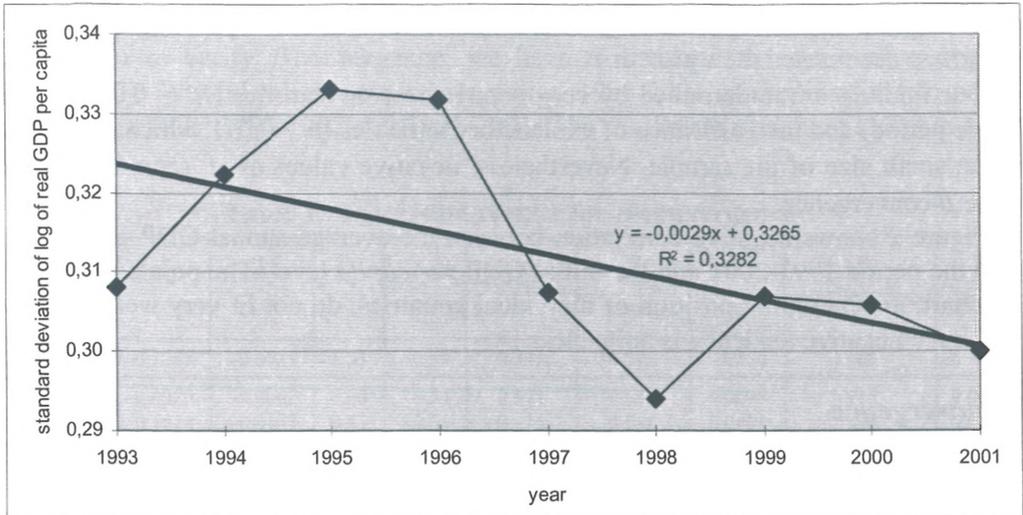
Table 2. Regression results for σ -convergence

Period	$\hat{\alpha}_0$	$\hat{\alpha}_1$	$t_{\hat{\alpha}_0}$	$t_{\hat{\alpha}_1}$	$P > t_{\hat{\alpha}_0} $	$P > t_{\hat{\alpha}_1} $	R^2	σ -convergence
1993 – 2001	0.3265	-0.0029	37.51	-1.85	0.000	0.107	0.3282	yes
1993 – 1997	0.3181	0.0008	21.45	0.18	0.000	0.871	0.0103	no
1997 – 2001	0.3038	-0.0003	43.78	-0.15	0.000	0.888	0.0077	yes

To test σ -convergence we analysed income dispersion by estimating the trend line of standard deviation of log GDP *per capita*. The calculations were made for the whole period 1993-2001 as well as for two subperiods: 1993-1997 and 1997-2001. The results are presented in Table 2 and Figure 3. σ -convergence exists if the trend line slope is negative, meaning that income dispersion tends to decline.

The results for the whole period confirm the existence of σ -convergence. The decreasing trend of income dispersion between these countries is also clearly visible in Figure 3.

Figure 3 also shows that even if income dispersion among CEE countries was generally falling, in some years it was rising. At the beginning of the period, in the years 1993-1995, income differentiation among those countries increased. Since 1996 (except of 1999) standard deviation of GDP *per capita* has been decreasing, as confirmed by regression results for the second subperiod 1997-2001.

Figure 3. Standard deviation of log real GDP per capita, 1993-2001

5. Cyclical convergence among CEE countries

The eight CEE countries included in this group are more or less similar as regards their development level, economic structure, progress of transformation, economic policies, international links, and the dependence on foreign markets. Thus, it is very likely that economic growth of these countries is determined by similar factors. We may also suppose that they would react similarly to external shocks. If our assumptions are correct, it is very likely that the analysed countries would also reveal similar cyclical fluctuations. However, this hypothesis should be explicitly proved.

Our analysis of cyclical convergence among the new EU entrants supplements the earlier studies on cyclical convergence within the EU. The study by J. Kröger *et al.* (2003), included in this book, brings a comprehensive review of the literature. The Eurostat colloquium in Luxembourg in October 2003 brought several new papers on business cycle synchronisation within the EU.

Conformity of industrial production

The industrial production index is a good tool in analysing cyclical convergence. Although it represents only one sector of the economy, it is available monthly and it reflects quite well cyclical fluctuations in the economy, sometimes better than the quarterly GDP index.

We analyse here smoothed and standardised growth rates (against the analogous month of previous year = 100) of the industrial production index. Cyclical conformity can be assessed by correlation coefficients. If correlation coefficients are significantly positive, we may assume that cyclical convergence exists, but we should be also aware of spurious correlations, resulting e.g. from the dependence of both countries on

cyclical developments in the same foreign market, which would mean that both countries concerned converge with a third party rather than with each other.

Correlation coefficients between industrial production growth rates in the analysed countries are presented in Table 3. The grey cells show significant positive correlations, suggesting cyclical convergence.

Table 3. Correlation coefficients of industrial production

	CZE	HUN	POL	SLK	SLO	EST	LAT	LIT
CZE	1.0000 (93)	-0.3382 (92)	<i>ns</i>	0.9014 (59)	0.6051 (47)	0.7371 (47)	0.9396 (46)	0.7633 (47)
HUN	-0.3382 (92)	1.0000 (92)	0.5206 (92)	<i>ns</i>	0.4714 (47)	<i>ns</i>	<i>ns</i>	-0.4734 (47)
POL	<i>ns</i>	0.5206 (92)	1.0000 (93)	<i>ns</i>	0.5759 (47)	0.5323 (47)	<i>ns</i>	-0.4935 (47)
SLK	0.9014 (59)	<i>ns</i>	<i>ns</i>	1.0000 (59)	0.6985 (47)	0.7427 (47)	0.8600 (46)	0.7993 (47)
SLO	0.6051 (47)	0.4714 (47)	0.5759 (47)	0.6985 (47)	1.0000 (47)	0.9489 (47)	0.6475 (46)	<i>ns</i>
EST	0.7371 (47)	<i>ns</i>	0.5323 (47)	0.7427 (47)	0.9489 (47)	1.0000 (47)	0.7650 (46)	<i>ns</i>
LAT	0.9396 (46)	<i>ns</i>	<i>ns</i>	0.8600 (46)	0.6475 (46)	0.7650 (46)	1.0000 (46)	0.8367 (46)
LIT	0.7633 (47)	-0.4734 (47)	-0.4935 (47)	0.7993 (47)	<i>ns</i>	<i>ns</i>	0.8367 (46)	1.0000 (47)

Number of available observations for each pair of indicators in brackets. *ns* – not significant.

The predominance of grey cells in the table means that the new EU entrants from the CEE area have generally revealed a good cyclical conformity among themselves. The best conformity is found between the neighbour countries, with close economic ties. This concerns, quite naturally, Czech Republic and Slovak Republic, two parts of the former Czechoslovakia. Much of the same applies to the Baltic states, even though Estonia diverges somewhat from the developments seen in Latvia and Lithuania. Poland and Hungary, although weakly or negatively correlated with the other CEE countries, are quite well correlated between themselves. Slovenia shows an almost perfect but rather spurious correlation with Estonia and quite a good correlation with most other countries, but it is rather the result of their common dependence on EU markets. In our graphical presentation, we have put Slovenia together with the Czech Republic and Slovak Republic, though it might be also compared with Hungary and Poland.

The conformity of cyclical fluctuations within the group, as reflected by the industrial production index, is illustrated by Figure 4. It has been split into three separate graphs showing cyclical developments in three subgroups: (a) Czech Republic, Slovak Republic and Slovenia; (b) Hungary and Poland; (c) Baltic states: Lithuania, Latvia and Estonia. The graphs show quite a good similarity of cyclical fluctuations in each subgroup.

This division of the analysed group does not mean that the group as a whole does not reveal any cyclical convergence. Since 1997 cyclical tendencies in all the CEE countries were more or less similar until the recent slowdown, which began in some countries earlier than in the other. Thus, we are allowed to say that the CEE countries as a group have revealed over the whole period quite a good cyclical convergence.

Figure 4. Industrial production growth rates

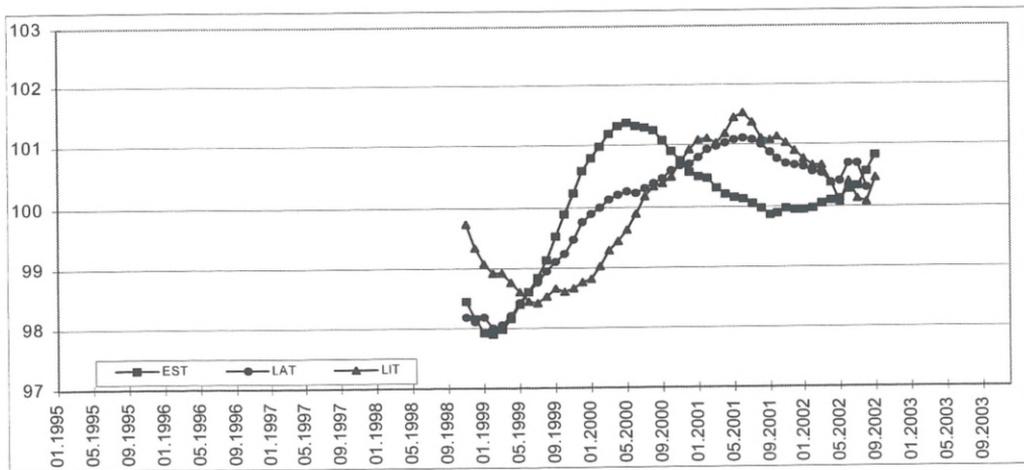
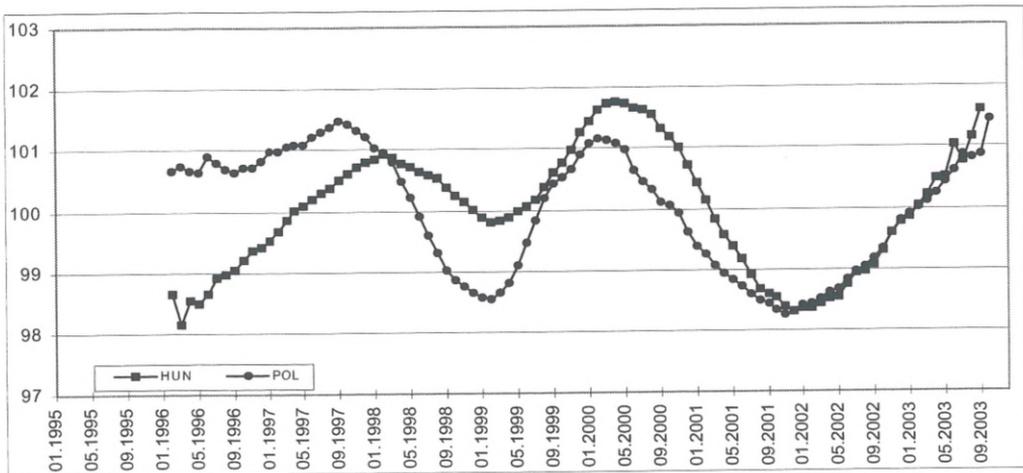
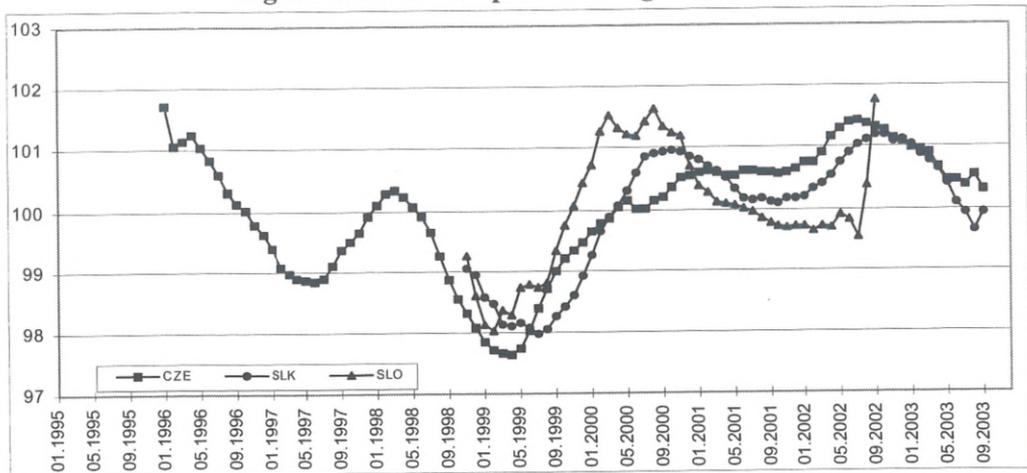
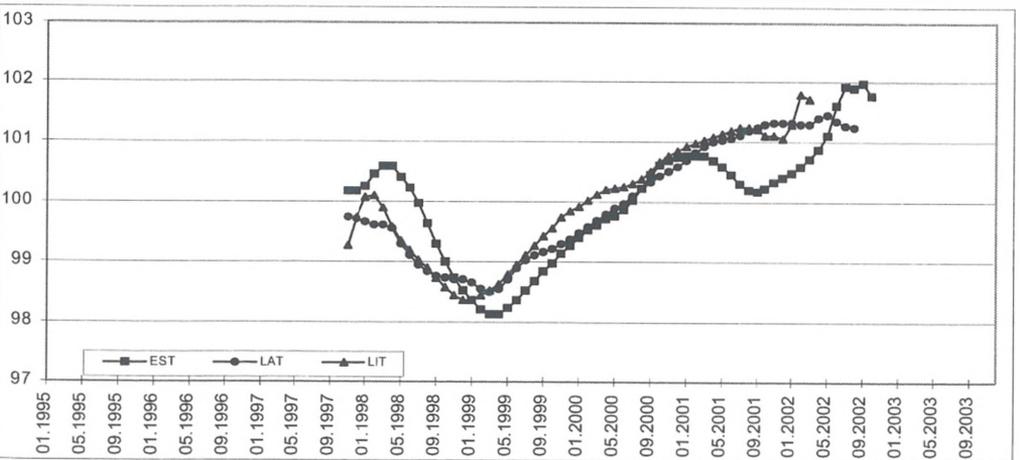
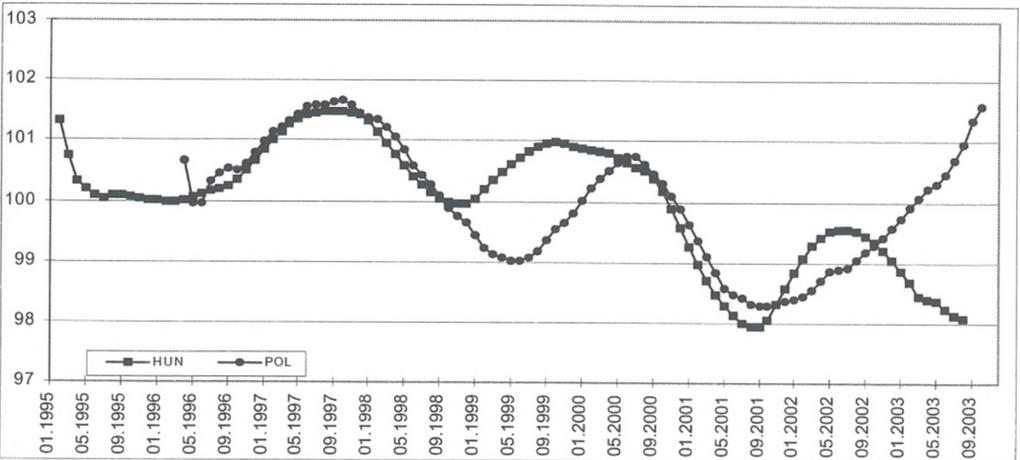
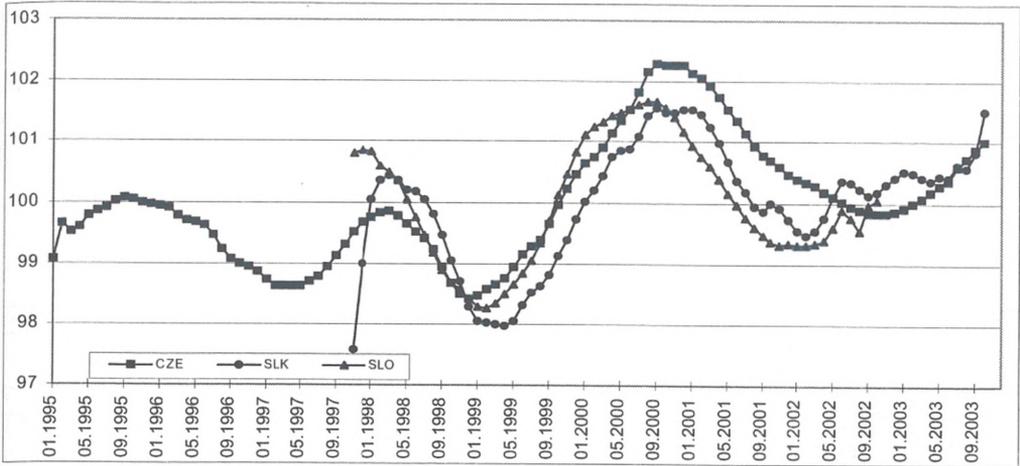


Figure 5. Industrial confidence indicators



Conformity of industrial confidence

It is also interesting to check cyclical convergence within this group in the light of the survey data on industrial confidence indicator.

Since industrial confidence indicators are usually stationary, we simply use their deseasonalised 2000 = 100 indexes, with no allowance for trend. Correlation coefficients between industrial confidence indicators in individual CEE countries are presented in Table 4, and their time series are shown in Figure 5.

Table 4. Correlation coefficients of industrial confidence indicators

	CZE	HUN	POL	SLK	SLO	EST	LAT	LIT
CZE	1.0000 (106)	-0.4378 (103)	<i>ns</i>	0.8328 (72)	0.7810 (60)	0.5027 (60)	0.6364 (58)	0.7978 (53)
HUN	-0.4378 (103)	1.0000 (103)	0.6577 (89)	<i>ns</i>	<i>ns</i>	-0.4304 (60)	-0.7267 (58)	-0.6350 (53)
POL	<i>ns</i>	0.6577 (89)	1.0000 (91)	<i>ns</i>	0.5465 (60)	<i>ns</i>	-0.4824 (58)	<i>ns</i>
SLK	0.8328 (72)	<i>ns</i>	<i>ns</i>	1.0000 (72)	0.7506 (60)	0.6782 (60)	0.5543 (58)	0.6550 (53)
SLO	0.7810 (60)	<i>ns</i>	0.5465 (60)	0.7506 (60)	1.0000 (60)	0.4058 (60)	<i>ns</i>	0.4543 (53)
EST	0.5027 (60)	-0.4304 (60)	<i>ns</i>	0.6782 (60)	0.4058 (60)	1.0000 (60)	0.8256 (58)	0.8054 (53)
LAT	0.6364 (58)	-0.7267 (58)	-0.4824 (58)	0.5543 (58)	<i>ns</i>	0.8256 (58)	1.0000 (58)	0.9727 (53)
LIT	0.7978 (53)	-0.6350 (53)	<i>ns</i>	0.6550 (53)	0.4543 (53)	0.8054 (53)	0.9727 (53)	1.0000 (53)

Number of available observations for each pair of indicators in brackets. *ns* – not significant.

In general, industrial confidence indicators reported by business surveys are well correlated with the industrial production index. This is why the results obtained from the analysis of both indicators are more or less similar.

The analysis of the industrial confidence indicators generally supports our findings based on the examination of the industrial production index. The group as a whole shows quite a good synchronisation of cyclical movements, the more so when it is divided into three subgroups as before.

The major limitation of our analysis is the shortness of the available time series, covering just 6-9 years. Therefore, the results should be interpreted with caution. We can hope that after the EU accession, the countries of this group will strengthen their economic ties with the EU and, at the same time, they will maintain their mutual links. If it is so, they may continue to display similar trends in their economic development, especially within the regional subgroups.

6. CEE convergence towards the EU

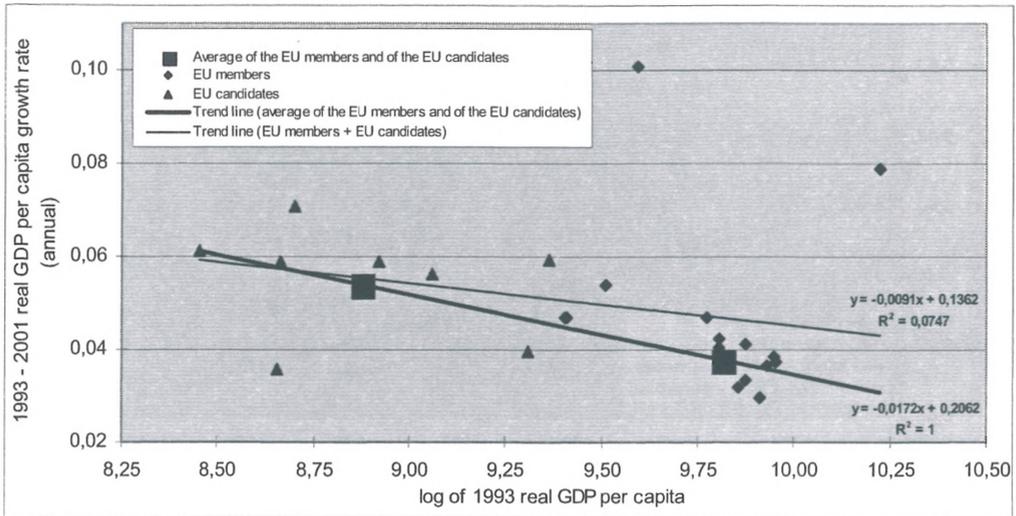
As the CEE countries reveal a significant growth and cyclical convergence between themselves, it is also worth to test their convergence towards the EU. We use here the same methods to check the existence of both types of convergence between the eight new EU entrants and the former EU-15 members.

Income convergence

Empirical analysis confirms the existence of β -convergence between CEE entrants and the former EU. β -convergence has been evidenced for both the individual countries as

well as for the whole region. Figure 6 shows that the average annual growth rate during 1993-2001 for both the current and enlarged EU was inversely related to the initial GDP *per capita* level.

Figure 6. Real GDP *per capita* growth rate over the period 1993-2001 vs. log of 1993 GDP *per capita*



In Figure 6, the position of individual countries has been marked by dark triangles (new entrants) and rhombuses (former EU members). As we can see, there is an evident negative relation between the initial income level and the growth rate. The estimated trend line for 23 countries, including 15 former EU members and 8 new entrants, has a slope -0.0091 , which implies that β -coefficient is 0.95%. The very low value of R^2 is mainly due to three countries which diverge from the common trend line: Lithuania, Ireland, and Luxembourg. If we could exclude these countries from our calculations, we would get significantly better regression results.

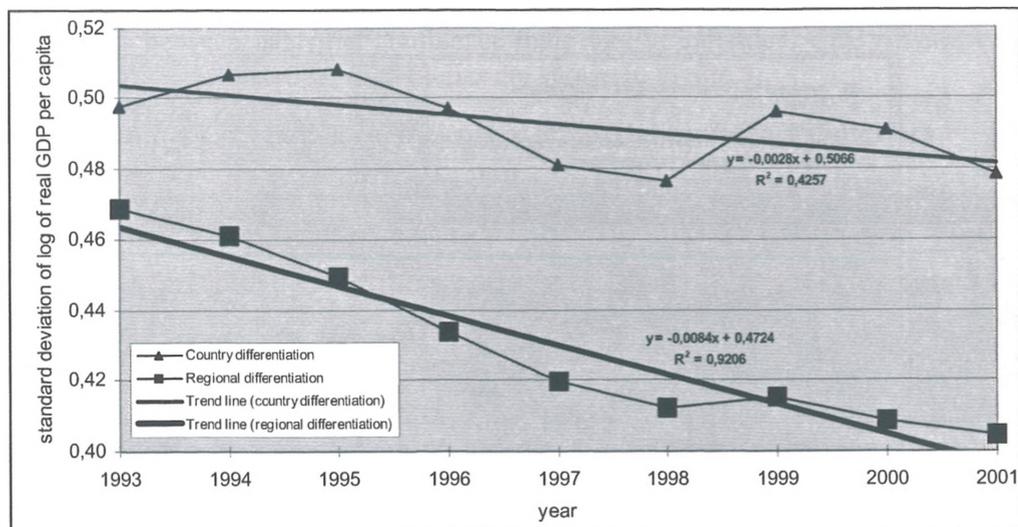
The convergence is also seen in a regional approach. The big squares in Figure 6 indicate the average GDP *per capita* levels and the average growth rates in the former EU and among the CEE accession countries. The average growth rate in the CEE was higher than in the EU-15 while the initial GDP *per capita* was considerably lower. The trend line for the two regions has a slope -0.0172 ($R^2 = 1$ is obvious) with β -coefficient equal to 1.85%.

The new and old EU members also reveal σ -convergence, both in the country-by-country examination and in a regional approach. Figure 7 presents the tendency of standard deviation of GDP *per capita* between 23 countries of the enlarged EU and between the two subgroups including the new and old EU members.

As we can see, differences between the average income level in CEE countries and the average income in the EU were clearly decreasing (slope of the trend line = -0.0084 , $R^2 = 0.9206$). It means that the income levels in the new EU countries become more and more close to the average income level in the EU (though the income

gap is still very large). The differences in income levels tend also to decrease in the country cross-section including all the 23 countries, although in this case the falling trend is less pronounced (slope -0.0028 , $R^2 = 0.4257$).

Figure 7. Standard deviation of log real GDP per capita, 1993-2001



Cyclical convergence

As the CEE accession countries are heavily engaged in economic cooperation and increasingly integrated with the EU, we may suppose that they also reveal a cyclical convergence towards the EU.

To verify this hypothesis, we compare industrial production indexes and industrial confidence indicators of each of the EU accession country of CEE with the analogous indices for the euro area (EU-12). Correlation coefficients are presented in Tables 5 and 6.

In terms of the industrial production growth rates Hungary, Slovenia, Poland, and Estonia reveal significantly positive correlation with the euro area. In terms of industrial confidence indicators almost all CEE countries, save the Baltic states, reveal quite a good correspondence with cyclical developments in the euro area.

Figures 8 and 9 show the similarity between cyclical fluctuations in the CEE countries and the euro area, as reflected by the industrial production growth rates and industrial confidence indicators, though at the end of period there is a divergence between the slack in the euro area and a continuous growth in most CEE countries.

Table 5. Correlation coefficients between industrial production growth rates in the euro area and in the EU accession countries

	CZE	HUN	POL	SLK	SLO	EST	LAT	LIT
EURO	<i>ns</i>	0.7726 (65)	0.4966 (65)	<i>ns</i>	0.5562 (47)	0.4282 (47)	<i>ns</i>	<i>ns</i>

Number of available observations for each pair of indicators in brackets. *ns* – not significant.

Table 6. Correlation coefficients between industrial confidence indicators in the euro area and in the EU accession countries

	CZE	HUN	POL	SLK	SLO	EST	LAT	LIT
EURO	0.5516 (62)	0.5821 (60)	0.4905 (62)	0.3958 (62)	0.8006 (50)	<i>ns</i>	<i>ns</i>	<i>ns</i>

Number of available observations for each pair of indicators in brackets. *ns* – not significant.

Figure 8. Industrial production growth rates in the euro area and in the selected EU accession countries

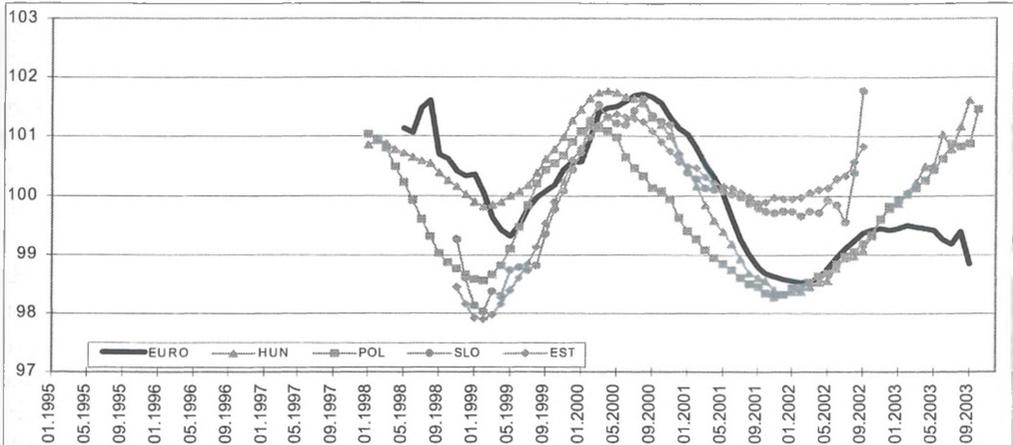
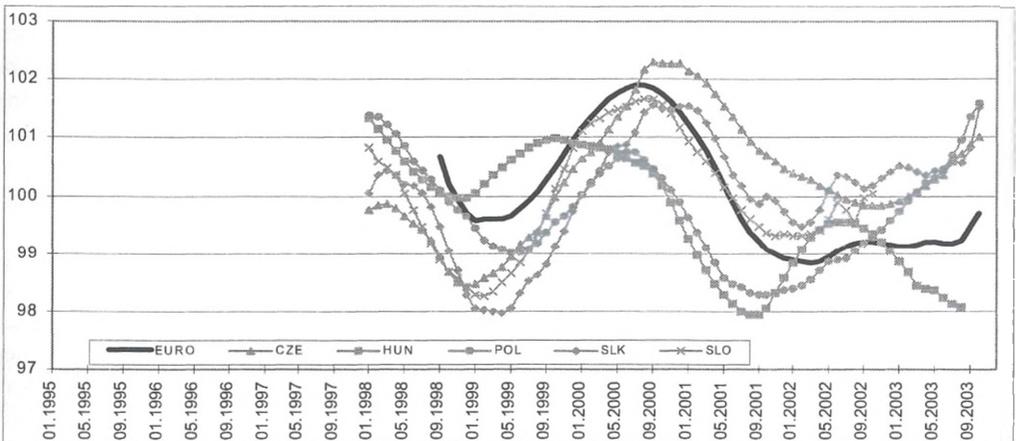


Figure 9. Industrial confidence indicators in the euro area and in the selected EU accession countries



Our analysis suggests that there is already a significant symmetry in business cycles between the CEE accession countries and the euro area. This is mainly due to intensive trade and capital flows, but also due to similar reactions to the external demand and

supply shocks. After EU accession this tendency should become even more pronounced.⁴

Earlier we proved that the CEE countries converge towards the EU in terms of income levels. If such convergence remains, income differences between the new and former EU members will decrease (but will not disappear soon),⁵ and business cycles in those countries will tend to be analogous.

7. Trade links

To assess the significance of our findings about economic convergence among the CEE accession countries and their convergence towards the EU, we should analyse their trade links which constitute the main transmission channel of international cooperation. Trade flows, notably exports, are especially important in any reasoning about cycle synchronisation while capital flows and labour movement may be more pertinent to growth convergence. Trade links of the CEE countries can be reconstructed on the basis of IMF data on the directions of merchandise trade.

Table 6 shows main directions of trade in CEE countries as percent of their total exports and imports. Within-the-region trade now represents by the average only about 10% of their total trade whereas the trade with the EU-15 amounts to more than 60% of the total. For the countries most integrated with the EU (Czech Republic, Poland, Slovenia, and Hungary) this share is between 65 and 70%, and for the remaining CEE countries it is between 50 and 60%. The share of intra-regional trade tends to be inversely related to the intensity of trade with the EU, ranging from 6% in Hungary and Slovenia, 10% in Poland, 12-14% in the Czech Republic and the Baltic states, to 24% in the Slovak Republic. There are many reasons for a relatively slight intra-regional trade, including substitutive rather than complementary production structures, low international competitiveness of many export products, and weak capital links. The common tendency to sell more than to buy from the neighbour is also hampering mutual exchange. As a result of this, despite all the attempts to promote regional trade,

⁴ The newest EBRD report on transition (EBRD, 2003, p. 49-51) brings another attempt to evidence cyclical convergence between the CEE accession countries and the euro area. Co-movements in business cycles in the period 1993-2003 are shown on graphs as the difference between output gaps in each CEE country and the eurozone. Output gaps have been calculated as the difference between actual and trend output as measured by the quarterly volume index of GDP and its HP trend. Though the interpretation of the alleged tendency towards cyclical conformity with EU is quite convincing, the empirical evidence is not so clear. The graphs reveal some similarity of business cycles between CEE countries, but no clear-cut tendency towards their convergence with the euro area.

⁵ The newest EEAG report (EEAG, 2004, p. 100) gives some estimates about the catching-up process. Under most optimistic assumptions, Slovenia would need some 30 years to reach 90% of the EMU income level. Over the same time, Czech Republic, Hungary and Slovak Republic can reach 75-80% of the EU-15 income level while Poland and the Baltic countries can attain 65-70%.

i.a. taken by CEFTA, its share in total CEE trade between 1995 and 2002 rather decreased while the share of trade with the EU increased considerably.

**Table 6. Directions of trade in CEE countries
(percent of total exports and imports)**

Country	Year	Within the group			With the EU		
		Exports	Imports	Avg.	Exports	Imports	Avg.
CZE	1995	25.4	14.8	20.1	54.0	55.9	55.0
	2002	15.8	8.7	12.3	68.8	71.7	70.3
SLK	1995	45.8	30.6	38.2	37.4	34.8	36.1
	2002	28.4	19.9	24.2	59.5	52.3	55.9
SLO	1995	5.0	6.2	5.6	67.3	69.3	68.3
	2002	7.7	6.8	7.3	61.9	72.0	67.0
HUN	1995	8.4	5.6	7.0	62.8	61.5	62.2
	2002	6.6	5.1	5.9	73.5	57.5	65.5
POL	1995	6.7	6.3	6.5	70.1	64.7	67.4
	2002	11.8	8.0	9.9	67.6	67.5	67.6
EST	1995	25.4	14.8	20.1	54.0	55.9	55.0
	2002	15.8	8.7	12.3	68.8	71.7	70.3
LAT	1995	12.3	12.4	12.4	44.2	50.0	47.1
	2002	13.8	15.0	14.4	62.3	52.3	57.3
LIT	1995	14.1	5.8	10.0	36.4	37.2	36.8
	2002	24.1	4.0	14.1	47.1	51.2	49.2
Avg. (unweighted)	1995	17.9	12.1	15.0	53.3	53.7	53.5
	2002	15.5	9.5	12.6	63.7	62.0	62.9

Source: EBRD, *Transition Report 2003: Integration and Regional Cooperation*, London 2003, p. 86, table A. 4. 1. 1. Averages were calculated by the authors.

Tables 7 and 8 bring more detailed information about the trade links between CEE countries and their major trade partners. There is some discrepancy between the data included in Table 6 (reproduced from the EBRD report) and the data appearing in Tables 7 and 8 (compiled by ourselves). Though all data are based on the same source (IMF), our own estimates as regards CEE intra-regional trade and their trade with EU differ from those calculated by the EBRD. For most countries the difference is not big, except for Estonia where the figures differ significantly, especially as regards its trade with the EU. One of the reasons may be the difference between the original data reported by this country and the IMF estimates derived from cross-country data.

Significant trade links of CEE countries, as reflected by the partner's share of more than 5% in their total exports and imports, have been marked by grey cells. Such links only exist between the Czech Republic and Slovak Republic and among the Baltic states. Slovakia has also significant exports to Hungary and Poland. For Slovenia, Hungary and Poland, the CEE market is less important. At the same time, all CEE countries are heavily dependent on EU markets. The share of CEE exports to EU ranges from 48% in Lithuania to 75% in Hungary while the share of imports from EU is between 49% in Lithuania and 62% in Poland.

Germany, as the largest single economy within the EU, is the major trade partner to all the CEE accession countries except of Estonia (which is more linked with Finland

and Sweden). For Lithuania, Germany is the main source of imports and the second biggest export market (after the U.K.).

Russia remains an important source of imports (mainly of oil, gas and other raw materials) for most CEE countries (except of Slovenia). Russia is also an important export market for the Slovak Republic and the Baltic states, but no more for the remaining CEE countries. However, all the CEE countries are quite sensitive to political and economic developments in Russia because of their dependence on energy supplies, substantial capital flows, and political events.

Table 7. CEE exports by trading partners in 2002 (percent of total exports)

*	CZE	HUN	POL	SLK	SLO	EST	LAT	LIT	CEE(8)	EU(15)	GER	RUS
CZE	-	2.4	4.7	7.7	0.6	0.1	0.2	0.4	16.1	68.6	36.6	1.3
HUN	1.9	-	2.1	1.5	0.9	0.1	0.1	0.2	6.8	75.0	35.5	1.3
POL	4.0	2.3	-	1.4	0.3	0.3	0.7	2.3	11.3	68.8	32.3	3.2
SLK	15.2	5.5	5.3	-	1.0	0.0	0.2	0.6	27.8	60.6	26.0	10.0
SLO	1.8	1.8	2.8	1.2	-	0.0	0.1	0.3	8.0	59.3	24.7	2.9
EST	0.3	1.0	0.9	0.1	0.0	-	7.7	4.1	14.1	57.2	8.3	10.0
LAT	0.6	0.4	1.5	0.4	0.1	5.9	-	8.2	17.1	59.6	15.3	5.8
LIT	0.5	0.5	3.5	0.1	0.0	3.8	9.7	-	18.1	48.4	10.4	12.1

* Exporting countries are listed in the first column and the recipient countries are shown at the head.

Source: Own calculations based on IMF, *Direction of Trade Statistics*, December 2003.

Table 8. CEE imports by trading partners in 2002 (percent of total imports)

*	CZE	HUN	POL	SLK	SLO	EST	LAT	LIT	CEE(8)	EU(15)	GER	RUS
CZE	-	2.0	4.1	5.3	0.6	0.0	0.0	0.1	12.1	61.0	32.9	4.6
HUN	2.3	-	2.5	1.8	0.6	0.1	0.0	0.1	7.4	56.2	24.2	6.1
POL	3.2	1.7	-	1.5	0.6	0.1	0.1	0.3	7.5	61.7	24.3	8.0
SLK	15.1	2.7	3.2	-	0.8	0.0	0.0	0.0	21.8	50.3	23.1	14.3
SLO	2.5		1.5	1.4	-	0.0	0.0	0.0	5.4	68.0	19.2	2.3
EST	0.9	0.4	2.4	0.2	0.2	-	2.3	2.8	9.2	54.8	11.1	12.0
LAT	1.4	0.9	5.0	0.7	0.3	6.2	-	9.8	24.3	52.9	17.2	8.8
LIT	1.4	0.8	5.0	0.3	0.5	1.1	1.7	-	10.8	48.6 ^a	17.8	22.2

* Importing countries are listed in the first column and countries of origin are shown at the head.

^a Authors' own estimate based on source data (including the estimated imports from France, reported as null).

Source: Own calculations based on IMF, *Direction of Trade Statistics*, December 2003.

This analysis indicates that all the CEE accession countries are heavily dependent on the EU market, so they are apt to follow the rhythm of the business cycle seen in the EU, especially in Germany. Intra-regional trade links may explain to some extent the similarity of business cycles between the Czech Republic and Slovak Republic, and among the Baltic states, but not between the other CEE countries.

Cyclical convergence between CEE countries and the EU is caused by the existing economic links as well as by a rising policy coordination. At the same time the conformity of cyclical patterns among CEE countries may be attributed to three factors: (a) echoing the fluctuations in the EU; (b) similar sequence of internal shocks caused by the transformation process; (c) subregional economic ties, e.g. between the Czech Republic and Slovak Republic, and between the Baltic states. The current size

of intra-regional economic cooperation among the CEE countries cannot explain their tendency towards cyclical convergence within the group.

Since the current shares of CEE trade with the EU-15 are already high and significant reductions in trade barriers have taken place before the actual enlargement, we should not expect a big increase in trade and capital flows after the EU accession. Cyclical convergence towards EU may nevertheless improve with the resulting more symmetry in cyclical movements among CEE economies.

8. Summary

1. There is a clear-cut convergence among the eight EU accession countries of CEE as to their income levels. The GDP growth rates in the period 1993-2001 were generally negatively correlated with the initial GDP *per capita* level. Income differences between individual countries tend to diminish, especially during the last few years.
2. As regards cyclical convergence, CEE countries should be divided into three subgroups: (a) Czech Republic and Slovak Republic; (b) Hungary and Poland; (c) the Baltic states. Slovenia may be included in one of the two first subgroups. Each subgroup reveals a good conformity of cyclical fluctuations while the correlation with other subgroups is weak.
3. All the considered CEE countries reveal a strong economic convergence towards the EU, both as regards income levels and business cycles. The accession countries tend to develop faster than the elder EU members. As the result, the income gap between CEE and EU is generally decreasing, although it still remains very large. Most CEE countries also reveal quite a good conformity of cyclical fluctuations with the euro area.
4. The existing trade and capital links between CEE countries and the EU are already quite strong. Therefore, we should not expect a major improvement in real economic convergence just after the accession. Moreover, some divergence tendencies cannot be excluded.
5. The research on the subject should be continued after EU accession.

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