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ABSTRACT

The CEEC10's Real Convergence Prospects*

The Central and Eastern European countries' prospects of becoming EU members depend heavily on, among other things, their per capita GDP levels. It is shown that the neo-classical growth model does not yet adequately describe the growth process in these countries. This makes a direct growth accounting exercise to assess these countries' growth prospects infeasible. Therefore an indirect approach is taken, which maps the Western European growth experience in 10 Central and Eastern European countries (CEEC10). This indirect approach is used to project growth rates of the CEEC10 and the time required to close or narrow the income gaps to the European Union (EU). The sensitivity of the results is analysed by presenting a wide variety of economically meaningful scenarios. Finally, possible beneficial effects of EU membership or pre-accession aids are studied. The effects of these measures on the reduction of the times to converge are computed.

JEL Classification: F02, F43, O11 and O19
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1 Introduction

Since the collapse of the Soviet Union and the induced major systemic transformation from centrally planned to market based economies, for nearly all the Central and Eastern European countries, membership within the European Union is one, if not the, primary goal of policy. However, the prospects of becoming a member of the EU depend strongly on the economic performance of the respective applicant country.[1] Thus, an assessment of possible timing of EU membership of the individual countries requires an assessment of their economic development. One primary indicator of economic development is (the evolution of) real per capita GDP. Of course other economic and political criteria also have to be fulfilled before membership can be achieved. As all potential entrants, the Eastern European applicant countries have to meet legal standards and have to achieve satisfactory levels of political developments. Criteria have been formulated at the Copenhagen summit.

In this paper we focus solely on economic growth and on relative per capita GDP levels of the Eastern European countries relative to the European Union, which is a very important economic criterion for the timing of potential entrance in the EU. The group of countries we investigate consists of Bulgaria (BGR), the Czech Republic (CZE), Estonia (EST), Hungary (HUN), Latvia (LVA), Lithuania (LTU), Poland (POL), Romania (ROM), the Slovak Republic (SVK) and Slovenia (SVN). This group of countries is, as indicated above, labeled CEEC10 throughout the paper. Compared to many other quantitative studies dealing with growth in transition countries, we restrict our attention to a smaller group of countries, those that have expressed their willingness to join the EU. Several studies include up to 26 countries, where the non-Baltic republics of the former Soviet Union are usually included. Sometimes, the People's Republic of China and Vietnam are also included (see e.g. deMelo et al., 1997 or Berg et al., 1999).

For all the Eastern European countries we investigate, the rough picture of the last decade is the following: The initial period of transition is characterized by drastic falls in output, high inflation and rising unemployment (see e.g. Kornai, 1994, Fischer, Sahay and Vegh, 1998a, Berg et al., 1999 or Fischer and Sahay, 2000). The most drastic example is real GDP growth of about -40 % in Latvia in 1992. For most countries in the sample, with the exception of Bulgaria and Romania, output started to grow sustainedly in 1994 or 1995. Inflation rates also soared up, with some countries experiencing hyper-inflations.[2] Again, with the exception of Bulgaria and Romania,

[1] Currently there are 13 applicant countries: The ten Central and Eastern European countries analyzed in this contribution and Cyprus, Malta and Turkey.

[2] The detailed numbers are given in table 1 in section 2.

by the end of the 1990s inflation had been brought down to one-digit or low two-digit numbers. Thus, among these countries, stabilization policy has been, grosso modo, successful and growth is now widely experienced.
Economic growth in these countries depends on two sets of factors, see e.g. Fischer, Sahay and Vegh et al. (1998b). On the one hand growth depends on factors directly in relation to the transition process, which can be further separated into initial conditions and reform policies. On the other hand it depends on the determinants of long-run growth as described by neoclassical growth theory. DeMelo et al. (1997) find that initial conditions do matter, but that the adverse effect of unfavorable initial conditions can be overcome by strict commitment to reform policy.
The further along a country is in its transition process towards a market economy, the more important the standard neoclassical determinants of economic growth become. If the growth process is described adequately by the neoclassical determinants of growth (along the lines of Ramsey, 1928, Solow, 1956 or Cass, 1965), then some clear predictions concerning the long-run comovement of macro-economic aggregates follow, e.g. a positive correlation between the investment share and output growth.
An assessment of possible ways to project the future evolution of GDP growth in these countries requires first an understanding of their experience so far. In section 2, we therefore investigate the relationships between some macro-economic variables like GDP, investment and government consumption, which figure prominently in the growth literature. The possible emergence of the *standard* correlations between these variables, e.g. the already above mentioned positive correlation between the investment share and growth, or a negative correlation between initial GDP and subsequent growth, will indicate whether the standard neoclassical growth model can be applied directly to assess growth prospects.[3] It turns out, not surprisingly, that especially during the first part of the transition period, these standard correlations cannot be observed. I.e. during this period, the systemic collapse puts these countries too far off a (balanced) neoclassical growth path, to observe standard neoclassical behavior. During the later years of the sample from 1994 to 1998, some emergence of expected relationships, for instance a positive correlation between the investment share and growth can be observed. Concerning the correlation between initial GDP and subsequent growth a *positive* correlation for the total period and also for the later sub-period from 1994 to 1998 is observed. Only for the initial period an

[3]This negative cross-section correlation between initial GDP and average growth is usually labeled unconditional β-convergence in the growth literature. If it prevails, one observes a tendency of narrowing income differences between the countries. For a more detailed discussion see the following sections.

insignificant negative correlation is observed. Thus, up to 1998, there is no tendency for convergence within this group.
To gain further understanding about the evolution of the incomes[4] of the CEEC10 since the beginning of transition, we also apply simple methods of distribution dynamics.[5] The results of these investigations complement the previously mentioned findings and indicate no tendency for narrowing income gaps in these countries. The implied ergodic distributions seem to be multi-modal, i.e. up until now a tendency for the separation of these countries into two groups can be observed.
The positive correlation between GDP in 1993 and the average growth rate since then indicates that countries in a favorable position in 1993 have been able to take advantage of this. This may be due to early reform that puts the respective countries in a favorable situation but in principle it could also be due to longer lasting effects of *positive* initial conditions.
An implication of the above observation is that growth projections cannot be based directly on estimated growth equations for the CEEC10 group. Using equations estimated for the transition countries over the years 1989 to 1998 would lead to project the observed divergent behavior also into the future.[6] This however, is not the most likely scenario to occur. Given that all these countries are preparing themselves for EU membership, similar experiences with previous enlargements lead us to conclude that it is very likely that a narrowing of income gaps, both between these countries and with respect to the European Union, will be observed. Ben-David (1996) shows that the prospect of EU membership has had a positive effect on the potential entrants' economic performance already before they entered the EU. Given the current experience of the macro-economic evolution in the CEEC10, an alternative approach to base growth projections has to be found. The approach followed in this paper is to generate growth projections for the CEEC10 based upon the historically observed growth process in the current EU member states since 1960. This means that in the first step, growth or convergence equations are estimated for the European Union. These equations are then used to compute implied growth rates for the Central and Eastern European countries by inserting values of some key variables as observed in the

[4]The term income is used as sloppy notation for real per capita GDP.

[5]We follow the line of argument developed by Quah in a series of papers to assess the *distribution dynamics*, i.e. the evolution of the joint distribution of GDPs over time. Due to the small amount of observations we are confined to estimate transition probabilities of discrete state Markov chains, see section 2.

[6]An extensive summary of the empirical, regression based growth literature is contained in Barro and Sala-i-Martin (1995) and in Barro (1997). A methodologically broader summary is given in Durlauf and Quah (1998).

CEEC10 or as specified in scenarios to be described later.
Section 3 therefore starts with an investigation of the growth and convergence behavior observed in the European Union. A variety of specifications of convergence equations is estimated for the EU14 countries (by which we denote the current EU15 excluding Luxemburg), which then serve as the basis for projecting the income prospects of the CEEC10. Luxemburg is excluded from the regressions, because with its economic structure it represents a rich outlier within the EU. It is the country with the least similarities to any of the CEEC10. This approach is inspired by Fischer, Sahay and Vegh (1998b). Compared to Fischer, Sahay and Vegh (1998b), our paper rests on a more sophisticated econometric investigation with a variety of equations estimated by panel methods (compared to pure cross-section regressions in Fischer, Sahay and Vegh, 1998a). The variety of specifications allows us to assess the *economic* robustness of the results. Note, that compared to other studies the equations are estimated for the EU countries only, not for a larger sample of countries, and growth projections are only based on this approach for countries that are applying for EU membership. We believe that for the group of countries investigated, this approach constitutes a feasible computational exercise, as the last decade has already witnessed a substantial amount of economic and systemic convergence of the Eastern European transition countries to the EU. Reforms in the CEEC10 are undertaken with reference to the institutional arrangements within the EU. The EU is the main foreign investor and trading partner of these countries. These strengthened linkages imply convergence in the economic structure of the countries involved.
Based on the array of growth projections derived from the different equations and scenarios (see section 3), the number of years it takes the countries of the CEEC10 group to reach a certain level of average EU income are computed. An example is 70 % of the EU25 average real per capita GDP, where with EU25 we denote all 15 current EU member states and the CEEC10 investigated together. This is an interesting relative level, as this is the percentage that Portugal and Spain had, relative to the EU12, when they entered the EU.[7] Computing convergence times is of course more illustrative than just presenting growth rate projections. All convergence time computations are based on an assumed real per capita GDP growth in the EU15 of 2 % per year. It turns out that, with the exceptions of Slovenia and the Czech Republic, most of the countries still have more than 20 or 30 years to go, depending on the scenario assumed, until they reach the specified relative levels of average European Union real per capita GDP.
As a final computational exercise, we try to assess the possible effects of

[7]I.e. this was the relative level including the new entrants Portugal and Spain.

EU structural funds and pre-accession aids on the convergence times. This is done by computing accelerating growth scenarios that take into account these growth enhancing measures. We find that these lead to a substantial shortening of the convergence period, where the size of the effect varies significantly between the countries.
The paper is organized as follows: In section 2, the experience in the CEEC10 between 1989 and 1998 is summarized and some investigations into the distribution of per capita GDPs are presented. In section 3, the equations estimated for the EU are presented and discussed.[8] In this section the scenarios and the results based on these scenarios are also reported. Finally in section 4 some conclusions are drawn. In the appendix some additional figures and tables related to section 3 are provided.

2 The Structural Shock of Transition

In figures 1 and 2 the growth rates of real per capita GDP are displayed for the CEEC10 for all years where data for the respective country are available.[9] These figures clearly show the dramatic impact of the breakdown of communism and central planning. The most dramatic picture is, as mentioned in the introduction, the one for Latvia, with the dramatic fall of real per capita GDP by about 40 % from 1991 to 1992. Concerning the two reform laggards, Romania and Bulgaria, one sees that the limited amount of economic reform in these countries has not been sufficient to achieve sustained growth. At the other extreme the Baltic republics, severely hit by the disintegration of the Soviet Union, have been able to achieve sustained growth since the mid 1990s. Thus, these pictures confirm the well known fact that the transition phase can be split in an early phase of contraction and a subsequent phase of stabilization and eventual growth.

In the early phase of transition inflation rates soared up, see table 1. Since the mid 1990s inflation has been under control, with the exception of Bulgaria and Romania. Many countries have achieved single-digit inflation rates by the late 1990s.
For an assessment of the growth prospects of the CEEC10 it is interesting to analyze the growth experience up to now. As pointed out by Fischer, Sahay and Vegh (1998a, 1998b) growth in transition depends on two sets of

[8] In a separate appendix, available from the authors upon request, some investigations concerning the dynamics of the distribution of incomes in the EU15 and for all 25 countries together are collected.

[9] The longest series are available for the Czech Republic and Romania back to 1961. All series used in this paper end in 1998.

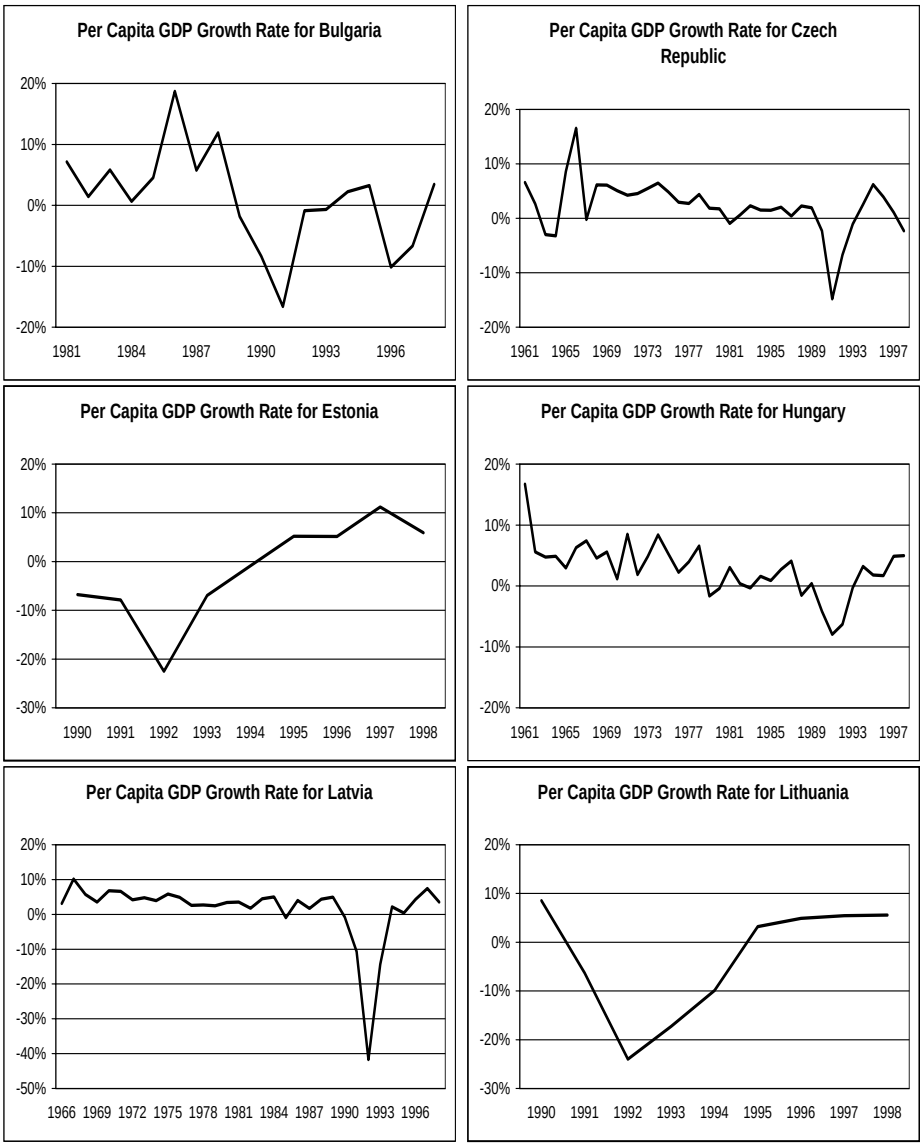

Figure 1: Growth rates of real per capita GDP for BGR, CZE, EST, HUN, LVA and LTU; for all years when data are available. Source: World Bank, own calculations.

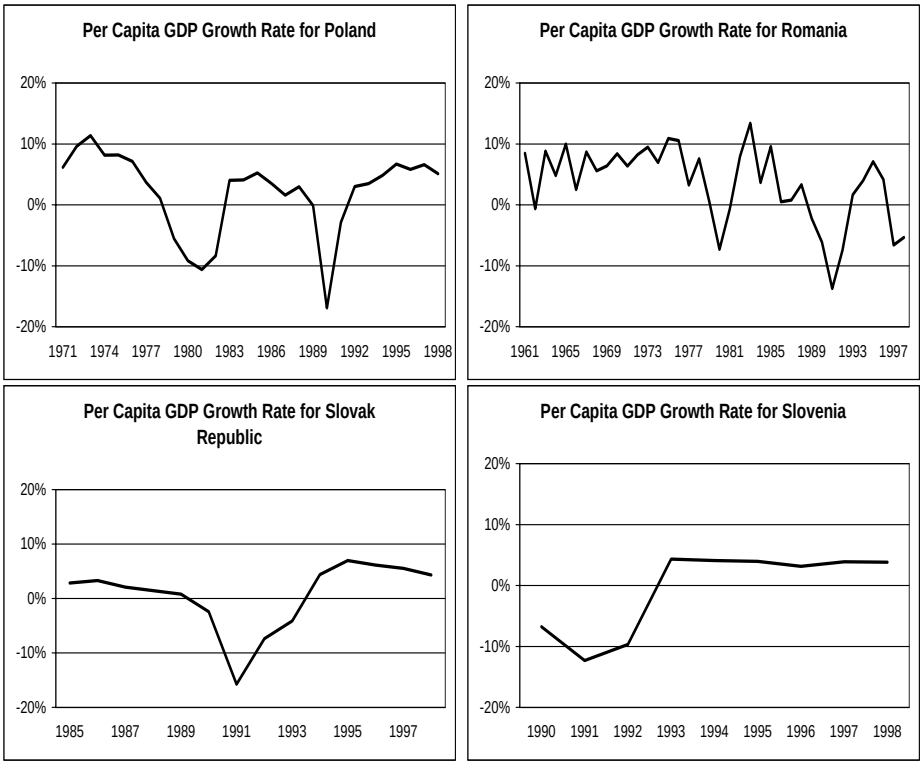

Figure 2: Continuation: Growth rates of real per capita GDP for POL, ROM, SVK and SVN; for all years when data are available. Source: World Bank, own calculations.

	1990	1991	1992	1993	1994	1995	1996	1997	1998
BGR	26.2	238.5	59.6	51.1	72.8	62.7	121.0	949.0	22.2
CZE	9.2	46.2	16.8	17.9	10.9	9.8	9.6	6.5	11.0
EST	–	304.0	954.0	36.0	42.0	29.0	14.6	12.5	4.4
HUN	25.7	25.4	21.6	21.3	19.5	25.5	21.2	18.5	13.4
LTU	–	383.0	1163.0	189.0	45.1	35.7	13.1	8.4	2.4
LVA	–	262.0	959.0	35.0	26.3	23.1	13.1	7.0	2.8
POL	480.1	55.3	38.5	30.5	28.4	27.9	18.7	14.0	12.0
ROM	13.6	195.0	200.1	227.4	138.9	35.2	45.3	147.0	45.9
SVK	6.6	34.6	11.2	15.4	13.8	9.7	4.5	6.6	5.1
SVN	490.8	94.9	208.2	37.1	22.6	15.2	11.1	8.8	7.3

Table 1: Annual inflation rate in the CEEC10. Source: WIIW, OECD.

factors. The first set consists of the effects of the transition process itself. This includes especially initial conditions and reform policy. Consensus in the literature is that initial conditions do have a significant effect at the beginning of transition, but that their importance is declining rapidly (see e.g. deMelo et al., 1997, Havrylyshyn, Ivorski and van Rooden, 1998 or Berg et al., 1999). It is found that countries with adverse initial conditions can nevertheless achieve a positive outcome by strong commitment to - and therefore a large extent of - reform. The second set of factors relevant for growth prospects of transition economies are the *standard* forces driving long-run economic growth as described by the (one-sector) neoclassical growth model dating back to Ramsey (1928), Solow (1956) and Cass (1965), i.e. factor accumulation (labor and capital) and technical progress. The further time proceeds, the more relevant will the neoclassical growth determinants be. Thus, unless a large backlash is observed in these countries, medium-run growth projections may be based around the neoclassical growth framework (with possibly allowing for transitional effects).

Empirical research on economic growth has witnessed an enormous amount of interest during the last 10 to 15 years. One of the reasons for this renewed interest is the general current interest of the profession on growth theory. Another reason is the formulation and empirical investigation of different notions of *convergence* within this framework. In essence, the neoclassical growth model in its standard formulation implies that all economies characterized by the same underlying parameters (e.g. in the aggregate production function) converge to the same steady state, regardless of the initial position. It furthermore implies a negative correlation between initial GDP and the average growth rate. This phenomenon is usually labeled as *β-convergence*, it has initially been defined in Sala-i-Martin (1990) and has been popularized by a series of papers by Barro (1991) and Barro and Sala-i-Martin (1992a, 1992b).[10] For economies described by different parameters, the steady state values may differ. This leads to the concept of *conditional* β-convergence, where a negative cross-section correlation between GDP growth and initial GDP is observed after controlling for cross country differences in parameters. Thus, convergence implies, conditional or unconditional, a tendency for narrowing income gaps within a group of countries.

In figures 3 and 4 the (unconditional) correlation between the average growth rate of real per capita GDP and (the log of) initial real per capita GDP, the average share of investment of GDP and the average share of public consumption of GDP are shown for the CEEC10. In figure 3 this is done for the

[10] Already Baumol (1986) and DeLong (1988) investigate long-run convergence between incomes of different countries.

whole period 1989 to 1998 and in figure 4 the correlations are displayed over the sub-periods 1989 to 1993 and 1994 to 1998.[11] Growth theory predicts a positive correlation between investment and growth, and a negative correlation between government consumption and growth:[12] Looking at the full sample period we observe a small *positive* correlation between initial GDP in 1989 and the average growth rate. Excluding Bulgaria and Romania from the sample makes this positive correlation even stronger. The remaining eight countries have a relatively comparable level of income in 1989 and very different growth experiences over the period from 1989 to 1998. Looking at the corresponding pictures for the sub-periods one sees an insignificant negative correlation between growth and initial GDP in the first sub-period and a positive correlation in the second sub-period. Thus, initial conditions, if adequately summarized by per capita GDP, are not the main or sole determinant of the economic performance, not even during the first period of transition.[13] The pictures confirm the well known fact of a very differential impact of the start of transition from a centrally planned to a market oriented economy on the individual countries. They clearly show that there is no evidence for a negative cross-section correlation between initial per capita GDP and growth over the first decade of transition.

Let us analyze the relationship between the investment share and growth next. For the full sample a very small positive correlation is observed, when the two sub-periods are distinguished, a *negative* correlation is observed in the first period and a positive correlation in the second period. The negative correlation in the first sub-period reflects the effects of the huge institutional change and the disorganization of the existing economic structure.[14] It is probably this picture that most clearly shows the dramatic consequences of the transition process.

Concerning government consumption, in both periods a *positive* correlation with GDP growth is observed. This again differs from observations made for groups of developed industrial nations.[15] Thus, during transition a sta-

[11]The timing convention in this paper is the following: The initial year is always the year prior to the period over which averages are computed, e.g. for the period 1994 to 1998 this is 1993. This timing is due to the computation of growth rates from levels data.

[12]The negative correlation between government consumption and growth is often referred to as *Wagner's law*. The empirical evidence is mixed. Ram (1987) and Levine and Renelt (1992) find opposite results.

[13]In the left upper graph of figure 4 only the Baltic countries are below the regression line. Removing them from the sample does not qualitatively change the picture, the correlation becomes insignificantly positive.

[14]See e.g. Blanchard and Kremer (1997). Even when the Baltic countries are removed from the sample the negative correlation persists.

[15]In the appendix the corresponding figures are displayed for the current EU member

bilizing influence of government consumption is observed. For an analysis of the effects of public spending on GDP growth the composition of public spending has to be taken into account, this is however beyond the scope of this paper.

Figures 3 and 4 show that it is useful and important to separate the transition period in an early and a later stage, if one wants to analyze the economic situation in these countries. The listed pieces of evidence make clear that medium- or long-run growth projections cannot be directly based on growth equations estimated for the CEEC10 with the transition period 1989 to 1998 as the sample. Applying these would imply the projection of the non-standard transitional behavior observed up to now into the future, which will in its growth behavior be more and more adequately described by standard neoclassical economic mechanisms and relationships.

Before assessing the possible future evolution of real per capita GDP in the CEEC10, it is interesting to try to gain further insights into the observed dynamics of income in these countries. A close relative of β-convergence is σ-convergence: σ-convergence is occurring when the cross-sectional standard deviation of incomes is decreasing.[16] In figure 5 the cross-sectional income distribution is displayed for increasing sub-samples of Central and Eastern European countries. Up to 1965 income data are only available for the Czech Republic, Hungary and Romania. In 1965 Latvia is added to the sample, etc. The picture clearly reveals that significant progress has been made in narrowing the income gaps between these countries up to 1989. Narrowing the income gaps, both within and between countries, has been an explicit goal of socialist economic policy in the Council of Mutual Economic Assitance (CMEA) member countries (see e.g. Estrin and Urga, 1997).[17] The figure shows that this goal has indeed been achieved to a significant extent.[18] Since 1989 the cross-sectional dispersion has increased substantially, reflecting the differential impact of transition on the CEEC10 up to now. For comparison

countries excluding Luxemburg.

[16]It is well known that β-convergence is a necessary although not sufficient condition for σ-convergence. Therefore in the period 1989 to 1998 σ-convergence cannot have occurred in the CEEC10, since we have already found no evidence for β-convergence.

[17]Slovenia, being part of Yugoslavia then, has only been a partial member of the CMEA. Yugoslavia joined the CMEA as a partial member in 1964. Also the Baltic republics have achieved their independence only after the dissolution of the CMEA in 1991. Applying time series based notions of convergence (as Estrin and Urga), which are proposed by Bernard and Durlauf (1995, 1996) one finds for our data set evidence for convergence between Hungary and the Czech Republic. Due to the fact that sufficiently long time series are only available for some countries, these methods, which resort to unit root and cointegration analysis, can only be applied to a very limited extent.

[18]We however refrain from a causal interpretation of this result here.

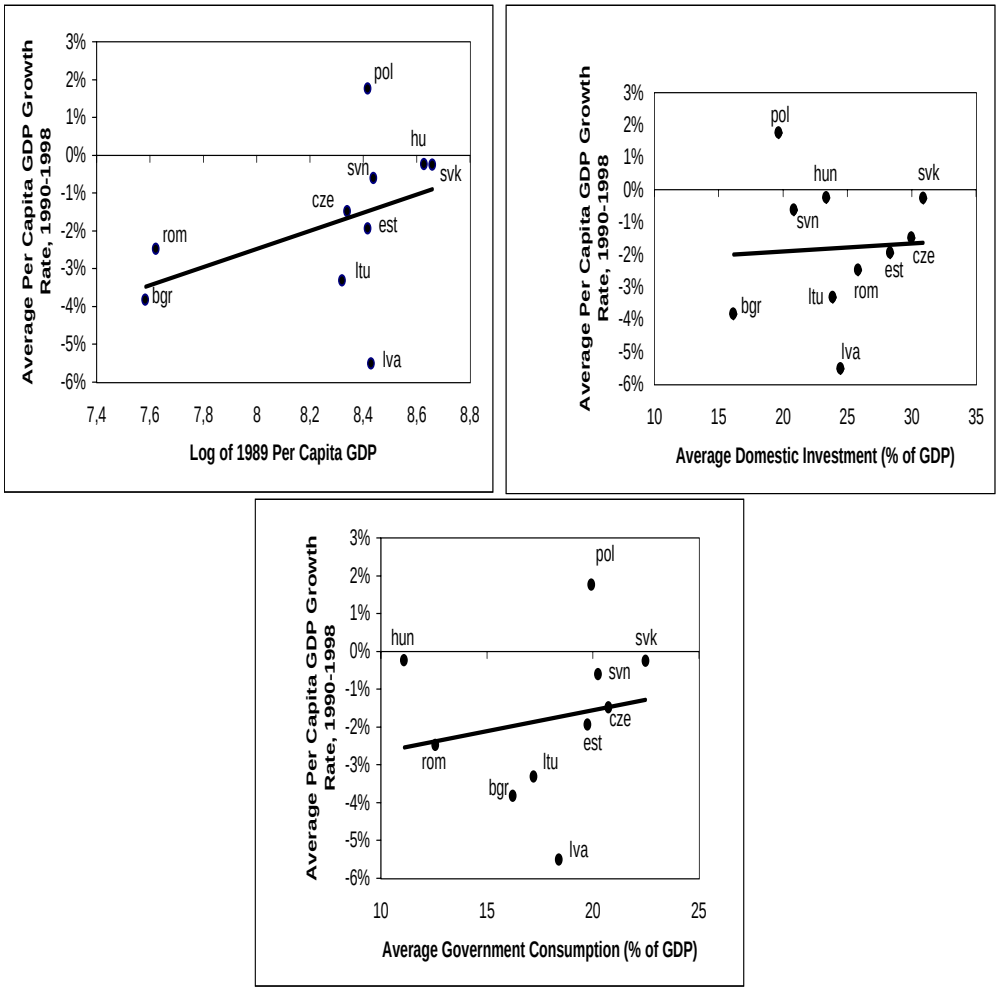

Figure 3: This graph shows in clockwise order the correlation between the average growth rate of real per capita GDP and log real per capita GDP in the initial year, the average investment share of GDP and the average share of public consumption of GDP. The averages are computed over the period 1990 to 1998.

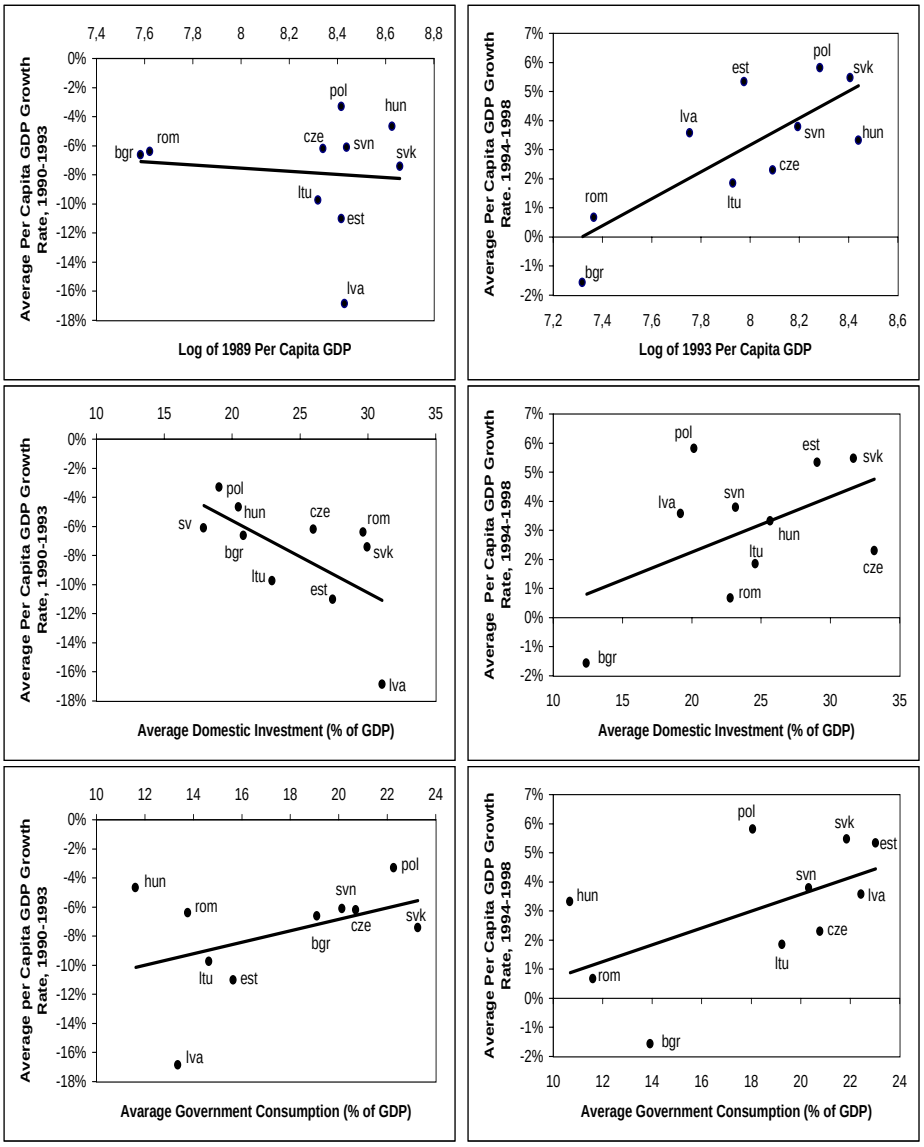

Figure 4: The left column corresponds to the period 1990 to 1993, the right column corresponds to the period 1994 to 1998: The first row displays the correlation between the average growth rate of real per capita GDP and initial real per capita GDP (1989 and 1993), the average investment share of GDP (2nd row) and the average share of public consumption of GDP (3rd row).

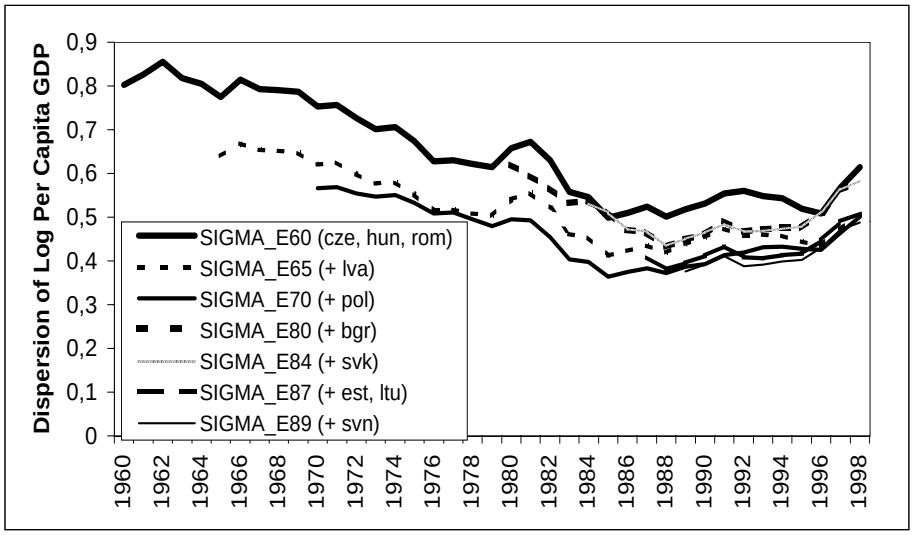

Figure 5: Cross sectional dispersion of log real per capita GDP in the CEEC10. The different lines are drawn for maximum samples of countries with available income data, i.e. SIGMA_E60 is for CZE, HUN and ROM, and SIGMA_E65 is for these three countries plus LVA, and so on.

the extent of σ-convergence in the CEEC10 countries (with growing sample), the European Union excluding Luxemburg and for both groups of countries together is displayed in figure 6. Figure 6 also clearly indicates the occurrence of σ-convergence within the current European Union member states (excluding Luxemburg), with the exception of the mid 1980s.

Looking at all 24 countries together reveals the full extent of the transitional shock: *Europe*[19] wide convergence up to the end of the 1980s. Then the early transition period leads to a significant increase of Europe-wide income dispersion, which has been approximately constant since about 1994. Let us next analyze the dynamics of the income distribution of the CEEC10 in more detail. Quah (1996a, 1996b, 1997a, 1997b, 1997c) has forcefully advocated the use of *distribution dynamics* methods for the analysis of the evolution of e.g. incomes over time. This approach tries to model the evolution of the joint distribution (of all analyzed countries) of the variables investigated. The underlying idea is to formulate statistical models to describe the evolution of the joint distribution of the variable of interest. By doing so, it becomes possible to study mobility and persistence in the distribution and

[19]In abuse of the word Europe, we refer to Europe as the following 24 countries: the current EU member states excluding Luxemburg and the 10 CEEC countries investigated.

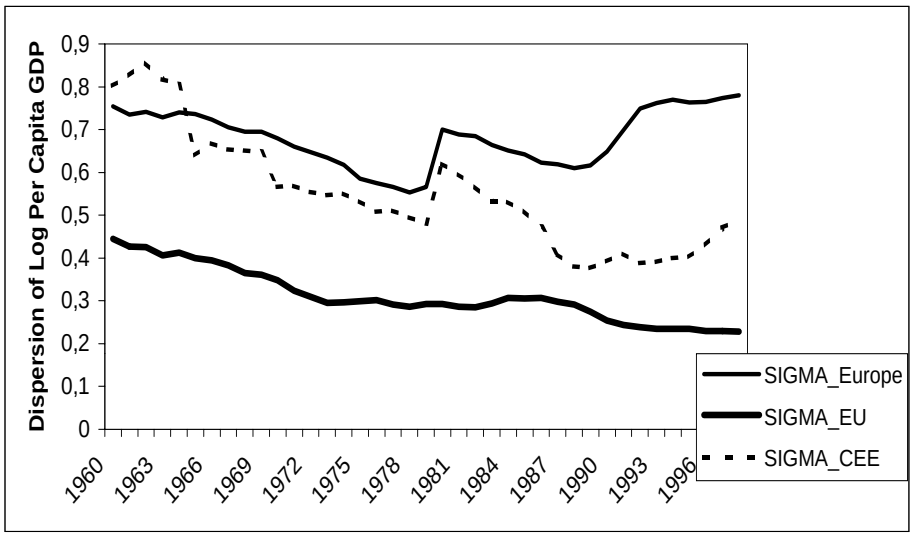

Figure 6: Cross-sectional dispersion of log real per capita GDP for the CEEC10 (SIGMA_CEE), EU14 (SIGMA_EU) and all countries together (SIGMA_Europe) , which in slight abuse of notation are labeled *Europe*. The dispersion is computed using the maximum available number of observations for Central and Eastern European countries in each period.

to compute a possibly existing *ergodic* distribution.[20] *Distribution dynamics* methods are in a way complementary to the concepts β- and σ-convergence: σ-convergence may be observed due to the convergence of the distribution of incomes to a uni- or multi-modal limiting distribution, where these two possibilities lead to very different conclusions, but cannot be distinguished by just looking at the second moments. Compared to the regression based concepts of convergence, which focus on the behavior of the first moment (β-convergence) or on the second moment of the cross-section (σ-convergence), the analysis of the distribution allows by construction to obtain a more complete picture. As a notion of convergence, based on the evolution of the joint distribution, one might think of e.g. convergence of the joint distribution towards a degenerated ergodic distribution.
A simple graphical device to investigate mobility within the income distribution over time is given by so called *cross profile plots* (Dolado et al., 1994): For a selection of years $t_1, \ldots, t_p$, the incomes in the first year $(y_{1,t_1}, \ldots, y_{n,t_1})$ are reordered according to increasing magnitude $(y_{l_1,t_1}, \ldots, y_{l_n,t_1})$, this induces an ordering $l = (l_1, \ldots, l_n)$. Then the incomes in the years $t_2, \ldots, t_p$ are also reordered along this ordering l. By construction, the first plot is monotonously non-decreasing, the more variability is in the later plots the more dynamic movement is present in the income distribution.[21]

In Figure 7 a sequence of cross profile plots is displayed for the CEEC10 for the years 1989, 1993, 1995 and 1998. The variable plotted in this figure is given by the log of relative real per capita GDP, i.e. the GDP values are normalized by the mean. By transforming incomes to quantities relative to the mean, the effects of (trend) income growth on the distribution are filtered. Only two changes in the ordering are observed. Latvia falls back from the

[20]The ergodic distribution, i.e. the long-run *steady state* distribution, then e.g. allows to assess whether there is a tendency for convergence clubs (Baumol, 1986) when it is bi- or multimodal. When the ergodic distribution has been attained, mobility within this distribution is still occurring.

[21]If the plots remain monotonous over the years, this means that no country has *overtaken* another country. Numerical measures in combination to the graphical evidence present in cross profile plots have e.g. been presented by Quah (1997b): For any given point of time, serCorr is the first order correlation coefficient of the differences of incomes, given the ordering l. If we denote by $\mathbb{E}\Delta^* y$ the empirical mean of the income differences $\Delta^* y_l = y_l - y_{l-1}$, then $\mathsf{serCorr} = (\sum_l (\Delta^* y_l - \mathbb{E}\Delta^* y)^2)^{-1} (\sum_l (\Delta^* y_l - \mathbb{E}\Delta^* y)(\Delta^* y_{l-1} - \mathbb{E}\Delta^* y))$. A variance type measure is given by $\mathsf{Vartn} = \frac{1}{N-2} \sum_l (\Delta^* y_l - \Delta^* y_{l-1})^2$, where N denotes the number countries analyzed. As serCorr is a correlation coefficient, it is always bounded by -1 and +1. Note that it is 0 for a straight line. serCorr is generally getting more negative with increasing variation in the cross profile plot. Vartn measures the variation around the squared mean, is non-negative and increases with increasing variation in the plot. As both measures are normalized by sample size, they can be compared across samples (e.g. country groups) with different sizes.

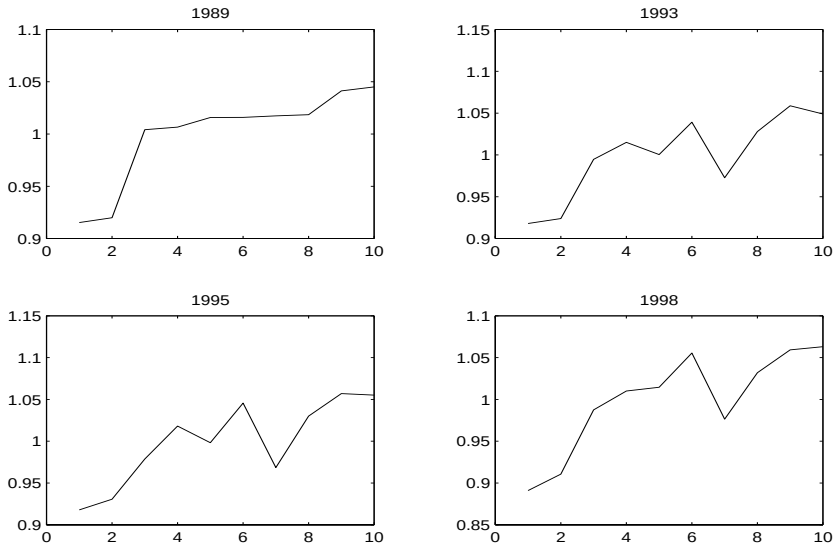

Figure 7: *Cross Profile Plots* of relative log real per capita GDP for the CEEC10 for the years 1989, 1993, 1995 and 1998. Clockwise ordering starting in the upper left corner.

7th position to the 3rd, and Estonia falls back one position. These changes already occur in the beginning of the transition period and are once again reflecting the dramatic impact of the break-up of the Soviet Union on the Baltic republics.[22] Thus, up to 1998, the initial GDP in 1989 remains by and large the factor determining the relative position of a country in a ranking of CEEC10 per capita real GDP.[23] This observation, together with the previously made observation of a positive correlation between growth and initial GDP, leads directly back to the conclusion that in the CEEC10 no form of convergence, regardless of the precise notion employed, is observed up to and including 1998.

Although cross profile plots deliver interesting *descriptive* insights into the evolution of the income distribution, they cannot be used to assess the likely future evolution of the joint income distribution. For that purpose one has to resort to statistically founded methods. The basic underlying idea of the distribution dynamics approach is to model the evolution of the joint dis-

[22]The quantitative measures serCorr and Vartn associated with the graphs in figure 7 are displayed in the appendix. For comparison, these measures are computed also for the EU15 countries and for the group of all 25 countries together.

[23]Due to relatively large differences between the countries and the short period analyzed, *overtaking* requires extreme events to occur, as has been the case in the Baltic countries.

tribution as governed by a functional. Thus the idea is that the evolution from e.g. t to $t+1$ is for all t described by a functional, say T. For a given initial income distribution F_0, the income distribution in time t is then given by $F_t = T^t(F_0)$. If for $t \to \infty$ a limiting distribution F_∞ exists, then this is called the ergodic distribution. Several possibilities for classes of functionals T are possible, the only requirement is that it transforms distributions to distributions.

Due to the small amount of available observations we consider in this paper for T only transition probability matrices of discrete state Markov chains, i.e. we think of the evolution of the distribution according to a Markov chain.[24] When modeling Markov chains, it is convenient to transform the observations to stationary quantities. This is achieved in this paper, as before, by normalizing incomes in each period by the average income. In addition to the choice of states or classes, also the transition horizon has to be selected (e.g. transition from t to $t+1$ or to $t+5$). Both, the number of classes as well as the partition of the distribution to generate the classes, have to be specified. The transition period is chosen to be one year, the number of classes is four and concerning the class boundaries the following choices are investigated.[25] One employed way of constructing the classes is as follows: The first class ranges from 0 to $\frac{1}{4}$, the second class from $\frac{1}{4}$ to $\frac{1}{2}$, the third from $\frac{1}{2}$ to $\frac{3}{4}$ and the fourth class corresponds to values larger than $\frac{3}{4}$.[26] The second possibility employed is to choose classes in order to achieve a uniform initial distribution over the classes. The results for these choices are presented in tables 2 and 3. In these tables also the implied *ergodic* distribution is shown in the final row.

The two sets of results give a quite similar picture: (i) a high degree of persistence, i.e. a high probability of staying in the same class[27] and (ii) a very broad limiting distribution, which is perhaps bi-modal (see especially the ergodic distribution displayed in table 3). This can be interpreted as follows: If the observed behaviour, with a lot of variation in the performance of the individual Central and Eastern European countries is to continue, a separation of the countries in two groups is going to emerge: The successful reformers on the one hand and the laggards that fail to achieve sufficient sustained growth to keep up on the other hand.

[24] If more observations become available, *stochastic kernels* can be estimated as transition functionals. These are, basically, the continuous state analogue to discrete state Markov chains.

[25] Note that the results depend on the transition horizon, the number of classes and also on the way the classes are constructed.

[26] Remember that incomes are normalized by the average.

[27] This is reflected by the large diagonal values in the transition matrices.

Obs.				
15	0.929	0.071	0.000	0.000
23	0.050	0.800	0.150	0.000
52	0.000	0.064	0.934	0.000
10	0.000	0.000	0.000	1.000
Ergodic	0.205	0.393	0.248	0.154

Table 2: Transition matrix for relative log real per capita GDP for the CEEC10. The transition period is 1 year and classes are constructed per year with boundaries 1/4, 1/2 and 3/4.

Obs./Upper limit	0.978	1.008	1.020	1.117
25	0.909	0.091	0.000	0.000
25	0.130	0.739	0.130	0.000
25	0.000	0.125	0.667	0.208
25	0.000	0.000	0.143	0.857
Ergodic	0.287	0.200	0.209	0.304

Table 3: Transition matrix for relative log real per capita GDP for the CEEC10. The transition period is 1 year and classes are constructed to achieve a uniform initial distribution.

3 An Indirect Approach to Assess Convergence Prospects

In the previous section it has been demonstrated that among the CEEC10, a pattern of very heterogeneous per capita GDP development has been observed in the last decade. The structural transformation process has the effect that the growth process in these countries is up to now not governed primarily by the neoclassical determinants of long-run growth. As time proceeds, the growth process will, unless great repercussions are experienced, increasingly be shaped by these determinants.

The process of transition manifests itself i.a. in the non-validity of standard relationships between key macro-economic variables, as has been shown in the detailed discussion in section 2. Up to now only tendencies for the establishment of the standard relationships (or correlations) can be observed. This implies that growth projections for the CEEC10 based on equations estimated for these countries over the period since 1989, necessarily *projects* growth scenarios reflecting the disequilibrium situation observed so far. Thus, this direct approach implies growth scenarios that not so much reflect the prospects that may materialize after a successful transition, but that project the current turbulent developments into the future.

Therefore an alternative indirect approach is required. Given that the *economic size* of these countries compared to the EU is small and that the destination of these countries is full membership in the EU, we may expect a *systemic* and economic convergence of these countries towards the European Union. Systemic convergence means e.g. that the applicant countries have to accept the legal system of the EU, as specified in the *acquis communautaire* or that their markets for goods and factors have to be organized in a way that is compatible with EU practice. Furthermore, it has to be noted that the markets of the CEEC10 will have to be opened within the *single market* of the EU after accession and a possible transition phase. Also economic policy will have to be conducted increasingly similar to the way economic policy is organized and carried out in the EU member countries.[28] Concerning direct economic integration measures, e.g. the fact that about 70 % of the CEEC10's exports are directed to the European Union and the fact that the European Union is the main source of FDI in Eastern Europe deserve mentioning. All in all, generally speaking, the applicant countries can be

[28] In a latter stage, when proceeding further to become also members of the European Monetary Union, the CEEC10 will have to fulfill the Maastricht criteria as well. This implies relatively clear quantitative boundaries for the conduct of fiscal and monetary policy.

expected to become economically more and more *similar* to the EU, which enforces possible convergence of the CEEC10 to the EU in its present form. Ben-David (1993) argues forcefully that the prospect of EU membership already may contribute to convergence. More precisely he analyzes the extent and timing of σ-convergence among the founding countries of the European Community and the reduction of trade barriers and tariffs between the countries. He finds a close correspondence between measures that decrease barriers to trade and reductions in the standard deviation of log per capita incomes.

Our quantitative assessment concerning income prospects of the CEEC10 is based on growth equations estimated for the European Union countries, excluding Luxemburg.[29] This approach, inspired by Fischer, Sahay and Vegh (1998b), basically amounts to a *mapping* of the stable structural relationships prevalent in the EU on the CEEC10 countries. Once again, an implicit assumption for the validity of this approach is the continuation of the reform process in the Eastern European applicant countries. This includes also the ongoing development and deepening of market institutions and transparency. To a certain extent, this approach internalizes the possible positive effects of integration with and eventually membership in the European Union. As the equations are estimated for the period 1960 to 1998, they catch the general growth and convergence picture within Western Europe. Only since 1995 are all 14 countries in the sample members of the European Union.[30] Given this, we see the equations as predicting moderately optimistic scenarios for the CEEC10, which may serve as baselines for more optimistic scenarios that take into account further effects of prospective membership. Later on in this section, this comparison will be made by computing *accelerated* growth scenarios, which are intended to capture additional beneficial effects of EU membership. The implied results of these faster growth scenarios are then compared to the results of the baseline scenarios.

The EU14 countries, for which the equations are estimated, show a substantial degree of unconditional β-convergence since 1960. In figure 8 the extent of unconditional β-convergence is displayed for the sub-periods 1961−1969, 1970−1979, 1980−1989 and 1990−1998. In all 4 periods convergence pre-

[29]Luxemburg is excluded from the regressions, because of its level of economic development and economic structure it is an outlier within the EU. Certainly it is the country which is *the furthest away* from the CEEC10, e.g. in terms of per capita GDP.

[30]The European Union started in 1957 with 6 member states: the BENELUX countries, France, Germany and Italy. In 1973 Denmark, Great Britain and Ireland became members. In the 1980s the EU was enlarged in the Mediterranean area, with Greece joining in 1981 and Portugal and Spain in 1986. Finally the latest enlargement has taken place in 1995 with Austria, Finland and Sweden joining the European Union.

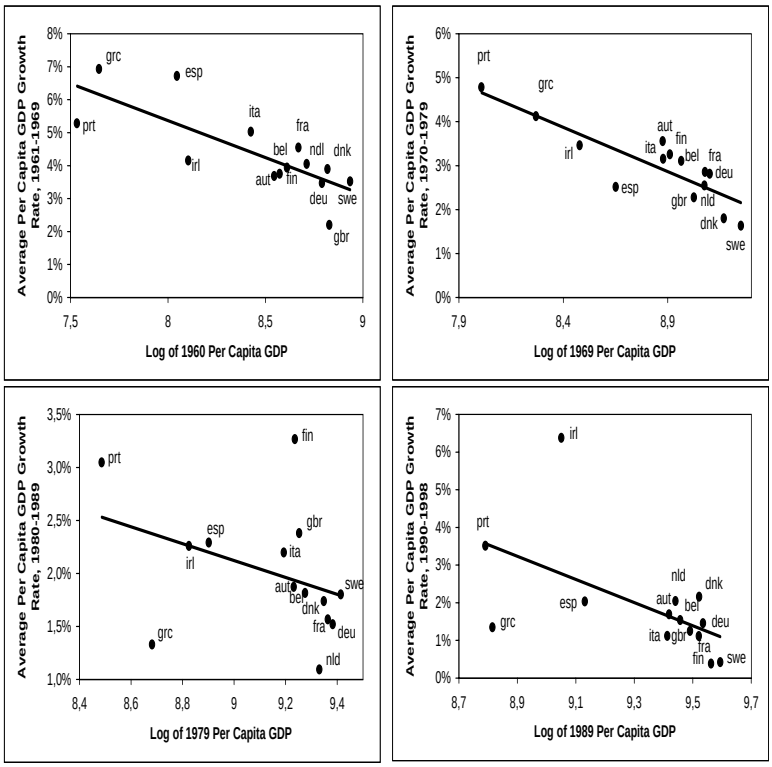

Figure 8: The sub-period correlations between the average growth rate of real per capita GDP and log real per capita GDP in the initial years (1960, 1969, 1979 and 1989) for the EU14. The averages are computed over the sub-periods 1961−1969, 1970−1979, 1980−1989 and 1990−1998. The regression lines indicate the unconditional β coefficients observed in the sub-periods: 2.506, 2.248, 0.831 and 3.593 %.

vails, with 2.506, 2.248, 0.831 and 3.593%. It is interesting to note that convergence was slowest in the 1980s and fastest in the 1990s. The average convergence speed over the total period is 2.046%.[31] Convergence with a speed of about 2% is a widely documented phenomenon occurring in different sets of regions or countries. Barro (1991) finds convergence in a large cross-section of countries, Barro and Sala-i-Martin (1992b) analyze convergence across the US and across Japanese prefectures and Sala-i-Martin (1996) and Quah (1996a) analyze European regions.

In the appendix the correlations between real per capita GDP growth and the investment share of GDP and between real per capita GDP growth and the share of government consumption of GDP are shown. This is done in figure 10 for the total period and in figures 11 and 12 for the 4 sub-periods. Significant correlations of the expected signs are observed throughout.

The equations, presented in table 4, are estimated pooled over the 4 previously mentioned sub-periods.[32]Therefore, the dependent variable is the average annual growth of real per capita GDP, with the averages taken over periods of about 10 years.[33] With this choice of variables, the dependent variable (ΔGDP) is directly the variable of interest, the average annual growth rate of real per capita GDP. The set of independent variables consists of the logarithm of real per capita GDP in the initial year (GDP_0),[34] the share of public consumption of GDP (GC), the share of (private and public) gross investment of GDP (DI), primary school education (PRIM), the share of total trade (i.e. exports plus imports) of GDP (TT), the average annual population growth rate (POPG), a dummy for the first decade (DUM1) and a dummy for Ireland (DUMIRL).

In table 4 several equations are reported. Berg et al. (1999) point out that the choice of economic theory compatible specifications is important, because purely statistically based approaches may lead to very versatile and implausible conclusions. The specification of several equations also allows us to assess the robustness of the results in a straightforward way. The pooled estimation is performed on 56 observations and the estimation method is SUR, where cross-sectional correlation as well as heteroskedasticity are allowed for.

[31]The corresponding figure 10 can be found in the appendix.

[32]The data are taken from the Worldbank data base and have been augmented by own calculations. The Worldbank data can be downloaded at `www.worldbank.org`.

[33]Fischer, Sahay and Vegh (1998b) only use a cross-section regression. This implies a loss of information due to long-run averaging over about 30 years. 10 years may be a sensible lower bound for long-run growth analysis. If higher frequencies are used, business cycle phenomena may be present in the data.

[34]For the average growth rate over 1961−1969 the initial GDP is GDP in 1960, as already explained before.

ΔGDP	(1)	(1in)	(2)	(2in)	(3)	(4)	(5)	(6)
const.	0.118	0.163	0.126	0.163	0.123	0.155	0.133	0.094
	(8.473)	(15.063)	(9.062)	(14.379)	(7.102)	(7.067)	(8.230)	(5.973)
GDP_0	-0.014	-0.018	-0.013	-0.017	-0.013	-0.015	-0.012	-0.011
	(-9.75)	(-11.384)	(-8.708)	(-10.449)	(-7.722)	(-6.571)	(-6.693)	(-8.346)
GC	-0.042	-0.043	-0.058	-0.058	-0.043	-0.036	-0.065	-0.040
	(-2.436)	(-2)	(-3.241)	(-2.595)	(-2.267)	(-1.750)	(-4.325)	(-3.496)
DI	0.075	0.041	0.064	0.035	0.060	0.054	0.053	0.081
	(5.194)	(3.582)	(4.585)	(3.024)	(3.672)	(2.398)	(3.423)	(6.030)
PRIM	0.021	0.018	0.015	0.016	0.016	–	–	0.022
	(3.493)	(4.959)	(2.577)	(4.302)	(2.236)			(3.877)
TT	0.003	0.003	–	–	–	0.003	–	0.003
	(1.832)	(1.614)				(1.460)		(2.277)
POPG	–	–	–	–	–	–	-0.003	-0.005
							(-1.689)	(-3.187)
DUM1	0.008	0.006	–	–	0.008	0.008	–	–
	(3.412)	(2.448)			(3.359)	(3.035)		
DUMIRL	–	–	–	–	–	–	0.005	0.008
							(2.906)	(6.482)
adj. R^2	0.669	0.613	0.599	0.569	0.667	0.668	0.579	0.560

Table 4: Regression results with dependent variable average real per capita GDP growth rate. The equations are estimated for the EU14. The full sample period 1960 to 1998 is separated in four sub-periods 1960−1969, 1970−1979, 1980−1989 and 1990−1998. The equations are estimated by SUR (Parks). The abbreviation "in" indicates that in the respective equation in all the sub-periods the initial values of the independent variables are employed. In the other equations sub-period averages of the independent variables are used. *DUM1* is a dummy variable for the period 1960−1969 and *DUMIRL* is a dummy variable for Ireland. t-values are displayed in parentheses.

The values in the initial years of the sub-periods have been employed for all independent variables in equations ($1in$) and ($2in$). In the empirical growth literature both variants, with initial values and average values of the independent variables, are commonly used. Initial values may help to overcome possible endogeneity problems, which may be present when using period averages (especially with respect to investment variables). In our case it turns out that both variants lead to very similar results. Thus, even if there are any endogeneity problems, they do not affect the estimates. All equations lead to coefficients that are well interpretable, both with respect to their signs and their magnitudes. Also, when specifying the equations, attention has been paid to restrict ourselves to equations that contain only variables that have been seen to be robust in the growth literature (see e.g. Sala-i-Martin, 1997) and on which scenarios can be reasonably based.

The estimated equations are used to compute growth scenarios for the CEEC10 as follows: Average annual growth rates are computed for the Central and Eastern European countries by assigning specific values to the variables investment share (DI) and government consumption (GC). For the other independent variables the actual values are inserted for each of the countries. In the equations where the values in the initial period are chosen for the independent variables in the estimation, i.e. for equations ($1in$) and ($2in$), the 1990 values are inserted. In the other equations the actual values are computed as averages over the period 1990 to 1998. The effects of the dummy variables are not included in the growth projections.

Thus, this way of generating growth projections is a linear approximation to the possibly *nonlinear* convergence path of the CEECs towards the EU.[35] The actual path is most likely a growth path that loses momentum as the Central and Eastern European countries' income differential to the EU narrows. Therefore higher growth are to be expected at the beginning of the catch-up process. As is usual in the literature our approach is trying to capture a first order approximation of this process, i.e we try to approximate the long-run average growth perspective. Trying to formulate models and estimate equations that incorporate this non-linearity, e.g. via a non-linear dependence of the growth prospects on the *gap* to the target countries, is an interesting task. This is however beyond the scope of the present paper and left for further research.

The variables investment share and government consumption, on which the scenarios are based, are two of the most important variables for growth. They are directly influenced by policy choices and developments.[36] Another

[35]The authors would like to thank Mark Schaffer for pointing this out.

[36]Government consumption in the accession countries will also depend on pre-accession

important variable for growth and development is trade, see e.g. Ben-David (1996). Total trade depends on the openness of the countries vis-a-vis especially the European Union, which is going to increase in the next decade. However, trade (especially) with the European Union is already at very high levels. Thus, no spectacular further increases are to be expected. Using the average values for TT over the period from 1990 to 1998 in the respective equations means that the positive effects of trade, which has grown over the period, are not fully reflected in the scenarios. The neglect of this favorable development is however small. The neglect of the dummies in the growth projections may also be seen to contribute to scenarios that are *moderately optimistic*.[37] Note that the effects of EU structural funds are not modeled explicitly in the scenarios. To a certain but unquantifiable extent they are contained in the equations due to the fact that countries and periods are covered, where substantial EU funds have been received.

The values for the variables GC and DI, as used in the scenarios, are presented in table 15 in the appendix for scenario 1 and in table 5 for the other scenarios. Scenario 1 is based on the averages over the period 1990 to 1998 for GC and DI for each of the 10 countries. This scenario represents a *lower baseline* case, as the variables GC and DI, averaged over 1990 to 1998, include both the early period of transition and the latter period of stabilization and growth. Thus, this scenario corresponds to a continuation of the experience to date. It is important to note that due to the fact that the equations are used with the convergence implying coefficients estimated for the EU countries, using the values of all variables of the CEEC10 does not imply to project an unstable or divergent evolution for these countries.

In all other scenarios, identical values for the variables GC and DI are used for all Central and Eastern European countries that are investigated. Scenario 2 ($GC = 0.1$ and $DI = 0.3$) is as in Fischer, Sahay and Vegh (1998b). This scenario can be seen as a *positive* scenario, as it is characterized by a high (private plus public) investment share and low government consumption. This scenario requires the financing of a large amount of investment. Thus, for the sustainability of this scenario, the current account will be of special importance. Only if the required external financing is provided in the form of FDI, and not in the form of short-term capital flows, this scenario can provide a *healthy* development.[38] Scenario 2 corresponds closely to Scenario 5, where for GC and DI the average values over the period 1980 to 1995 are

aid and structural funds of the EU.

[37] It is not implausible to expect that some very successful transition countries may experience a sustained high growth phase, as Ireland is currently experiencing.

[38] On current account sustainability issues in transition economies see e.g. Roubini and Wachtel (1997).

	Scenario	GC	DI
1	Actual 1990−1998	−	−
2	Fischer, Sahay and Vegh (1998b)	0.100	0.300
3	GRC, IRL, PRT, ESP 1961−1998	0.134	0.249
4	GRC, IRL, ITA, PRT, ESP 1961−1979	0.119	0.268
5	South East Asia 1980−1995	0.108	0.292
6	IRL 1992−1998	0.146	0.173

Table 5: Values for the variables GC and DI for the growth projections for equations (1) to (6). *South East Asia* contains Indonesia, Japan, Malaysia, South Korea and the Philippines.

taken for the South East Asian countries Indonesia, Japan, Malaysia, Philippines and South Korea ($GC = 0.108$ and $DI = 0.292$). The period 1980 to 1995 covers the period of rapid growth of these economies, where growth in these countries has been driven to a large extent by factor accumulation, both in physical and in human capital.
Given the scenario related to the South East Asian experience, it is suggesting itself to base growth scenarios also on European experiences, which may be more closely related to the expected Eastern European developments. The European scenarios are based on the historical experiences of the *cohesion* countries. The following choices have been made: Scenario 3 is based on the average values of the government consumption and investment shares for Greece, Ireland, Portugal and Spain over the period 1961−1998. Scenario 4 is based on the previously mentioned four countries plus Italy, with the averages taken over the period 1961−1979. Finally, scenario 6 is based on Ireland's recent period of extraordinary growth. Here the averages are computed over the period 1992−1998. It is interesting to note that the recent Irish growth experience is realized with a low investment share of only about 17% of GDP. This low investment share combined with the relatively large share of government consumption implies low projected growth rates for the CEEC10 for this scenario. For a further understanding of the Irish experience it seems to be necessary to investigate investment in more detail. Ireland has received extraordinary large amounts of foreign direct investment, which may be an especially important source of growth in a catching-up economy. The effect of FDI, which usually embodies more advanced technology than domestically available, on the growth performance of countries is an issue that deserves more attention also in the case of the CEECs.

With 8 equations and 6 scenarios in total 48 growth rate projections for each of the CEEC10 are produced. In figure 9 these 48 projected growth

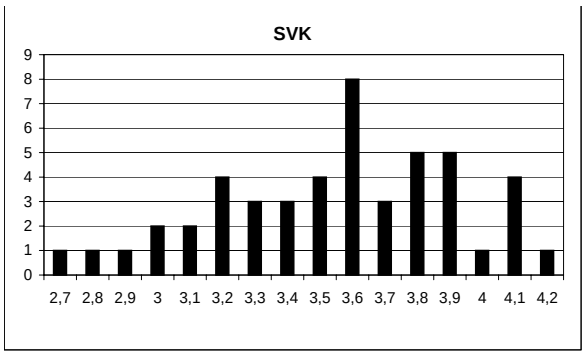

Figure 9: Empirical distribution of projected real per capita GDP growth rates for all scenarios and all equations for the Slovak Republic.

	BGR	CZE	EST	HUN	LTU	LVA	POL	ROM	SVK	SVN
MIN	3.9	3.2	3.0	2.7	3.0	2.7	2.8	4.0	2.7	3.0
MAX	5.6	4.6	4.9	4.3	4.5	4.7	4.8	5.6	4.2	4.6
MEAN	5.0	4.0	4.0	3.6	3.9	3.8	3.8	5.0	3.6	3.9

Table 6: Minimum, maximum and mean real per capita GDP growth rate projection for the CEEC10 for all 6 scenarios and all 8 equations.

rates are displayed in the form of a histogram for the Slovak Republic. The multitude of growth rates produced from different equations and assumptions concerning the evolution of investment and government consumption is a simple and effective device to assess the robustness of the projections. Considerable variation is observed, with the minimum range of 1.4 percentage points for the Czech Republic and the maximum range of 2 percentage points for Latvia and Poland. In table 6 the minimum, maximum and mean projected growth rates are displayed for all CEEC10. The detailed results for all equations and all scenarios are given in the appendix in tables 16 to 21.

The growth rate projections themselves are possibly not the most illuminating way for an assessment of the evolution of per capita GDP in the CEEC10 *relative* to the EU. To quantify the implications concerning possible catching-up of the CEEC10, the time periods it takes the individual CEEC10 members (and the whole group) to converge to relative levels of the European Union and to levels relative to the cohesion countries Greece, Ireland, Portugal and Spain (this latter group is referred to as C4) are computed.
Of course, when computing levels relative to the European Union, it has to

be taken into account that the EU membership of some of the Central and Eastern European countries changes the average real per capita GDP of the enlarged European Union. A wide variety of possibilities arises, according to which countries are assumed to join the EU. We present the two boundary cases: One is to compute levels relative to a hypothetical European Union consisting of 25 countries (the EU25), the other is to compute levels relative to the EU15. The latter possibility does not take into account the mean decreasing effect of low-income countries joining the European Union. The comparison with the cohesion countries' average income is interesting, as these are the countries most comparable to the applicants in terms of per capita GDP. They are therefore the countries to which income convergence, if it materializes, will be achieved first.

Given the large number of 48 scenarios, a choice has to be made for purpose of presentation. One possibility is to compute the implied convergence times for all scenarios and present the range of possible outcomes. Another one is to present results only for a few scenarios that may be of special interest, the approach followed here. We decide to use the following two scenarios: The scenario based on the *mean* growth rates as presented in table 6 on the one hand and a scenario with real per capita GDP growth rates implied by choosing $GC = 0.1$ and $DI = 0.3$ (i.e. the values chosen by Fischer, Sahay and Vegh, 1998b) and equation (6) on the other hand. The first choice presents, in statistical terms, our mean forecast and is chosen for that reason. The second choice is labeled as the *optimistic* scenario, because for about half of the countries it implies the maximum projected growth rate (see table 17 in the appendix). The optimistic scenario is seen as a realizable outcome if a favorable development continues.

When computing years to converge to relative levels with respect to the EU15, the EU25 or the C4 an assumption concerning the growth rate of the respective reference country group has to be made. For the EU15 a real per capita GDP growth rate of 2% per year is assumed.[39] The same growth rate is also applied to the cohesion countries, although it may be argued that these are going to grow faster than the EU average also in the years to come. Hence, the computed convergence times of the CEEC10 to the C4 countries may be seen as upper bounds. For the hypothetical EU25 the average per capita GDP growth rate depends on the assumed growth rates for the CEEC10. The population weighted 25 country average per capita growth rates are displayed in table 7 for both scenarios. The weighted average per capita GDP figures are computed with 1998 population data. In

[39]This corresponds closely to the observed average growth rate of about 1.9% over the period 1990 to 1998.

Scenario	–	+0.4%	+1.2%
Mean	2.47 %	2.55 %	2.73 %
Optimistic	2.57 %	2.66 %	2.83 %

Table 7: Implied growth rates for the EU25 area.

the projections population growth differentials and induced changes in the implied average per capita GDP figures are neglected. This however induces only a very small and negligible error.
For both, the mean and the optimistic scenario, two additional *accelerated* scenarios are computed. One where the growth rate is higher by 0.4 % and one where the growth rate is higher by 1.2 %. These additional scenarios are intended to illustrate possible additional beneficial effects of integration to or membership within the European Union. Remember that the equations and growth projections do not include explicitly growth enhancing policy measures that may be related to EU accession, e.g. the effects of substantial structural funds payments to the CEEC10. The precise quantitative effect of these and other growth enhancing measures is hard to assess, but the two cases with an additional 0.4% to an additional 1.2% per year seem to cover the plausible range.[40] Note again that the additional growth in the CEEC10 also raises the average growth rate in the EU25 area (see the respective columns in table 7).
The levels to which convergence of the CEEC10 is computed are 70 and 80% of the European Union (both for the EU15 and EU25) and 70, 80 and 100% for convergence to the average real per capita GDP levels prevalent in the cohesion countries. The 70% level with respect to the EU is chosen for the following reason: As mentioned before, when Portugal and Spain joined the European Union in 1986, their per capita GDP equaled approximately 70% of the EU12 average. The share of per capita income Portugal and Spain had with respect to the pre-enlargement EU10 in 1986 was about 67%.

Let us start with the mean growth projections: The results are presented in tables 8, 9 and 10.[41] It takes the countries on average 40 years to obtain 70% of the EU25 average real per capita GDP level. The variation between the countries is enormous, ranging from -4 years for Slovenia to 75 years for Latvia. Convergence is a short- or medium-run perspective only for Slovenia

[40] At least they cover the range reported in the literature and in public discussion.

[41] The detailed results for convergence to specified levels of the EU25 and C4 for the *accelerated* scenarios based on the mean scenario are reported in tables 22 and 23 in the appendix. In the appendix in table 26 also the convergence times to levels relative to the EU15 are given for the mean scenario and its accelerated versions.

	$EU25_{70\%}$	$EU25_{80\%}$	$C4_{70\%}$	$C4_{80\%}$	$C4_{100\%}$
BGR	42	48	34	39	47
CZE	8	17	5	11	23
EST	50	59	36	43	54
HUN	39	51	25	34	48
LVA	75	85	55	62	74
LTU	74	84	53	60	73
POL	41	51	28	36	48
ROM	43	48	35	39	47
SVK	31	43	20	28	43
SVN	-4	6	-5	2	14
Mean:	40	49	29	36	47

Table 8: Convergence time in years relative to levels of the EU25 and the C4 for the *mean* growth rates scenario.

	$EU25_{70\%}$	$EU25_{80\%}$	$C4_{70\%}$	$C4_{80\%}$	$C4_{100\%}$
Mean	40	49	29	36	47
+0.4%	33	41	24	30	39
+1.2%	25	30	18	22	30

Table 9: Average convergence time of the CEEC10 to levels relative to the EU25 and the C4 for the *mean* growth rates scenario and its accelerated versions.

and the Czech Republic. For Hungary and the Slovak Republic more than 30 years are to be expected. Even for convergence towards 70% or 100% of the level of the cohesion countries 29 and 47 years are projected on average. For the accelerated versions of the mean scenario the average number of years to achieve 70% of the EU25's average are reduced to 33 and 25 years respectively (see table 9). The effect of the acceleration on the convergence times varies substantially between the countries, see table 10. When the growth rate is increased by 1.2% as compared to the baseline the time to converge (to any of the specified levels) is reduced by between 28% (for Bulgaria and Romania) and 43% (for Hungary and the Slovak Republic). The average reduction of the convergence times is 37 % when the growth rates are accelerated by 1.2 % and still 17% if the growth rates are increased by 0.4 %. Thus, if the interpretation that the accelerated scenarios represent the beneficial effects of favorable policy within the countries and of European Union funds, is accepted, then these policies lead to a substantial reduction

	BGR	CZE	EST	HUN	LVA	LTU	POL	ROM	SVK	SVN	Mean
0.4%	-0.12	-0.17	-0.17	-0.20	-0.17	-0.18	-0.18	-0.12	-0.20	-0.17	-0.17
1.2%	-0.28	-0.37	-0.37	-0.43	-0.38	-0.40	-0.40	-0.28	-0.43	-0.38	-0.37

Table 10: Percentage reduction of convergence time for the *mean* growth rate scenarios when the growth rates are increased by 0.4% and 1.2%.

	$EU25_{70\%}$	$EU25_{80\%}$	$C4_{70\%}$	$C4_{80\%}$	$C4_{100\%}$
BGR	35	40	29	32	39
CZE	6	13	3	9	18
EST	33	39	25	30	38
HUN	26	34	18	24	34
LVA	59	67	43	49	59
LTU	49	56	37	42	51
POL	33	42	23	29	40
ROM	40	45	32	36	43
SVK	22	30	14	21	31
SVN	-3	4	-4	2	11
Mean:	30	37	22	27	36

Table 11: Convergence time in years relative to levels of the EU25 and the C4 for the *optimistic* growth rates scenario.

of the convergence times.[42]

For the optimistic scenario the results are presented in tables 11, 12 and 13. In the optimistic baseline case, the average convergence time to achieve 70% of the EU25's average real per capita GDP is given by 30 years, compared to 40 years for the baseline mean scenario. 70% of the cohesion countries' income is obtained after 22 years, see table 11. The differences between the mean and the optimistic scenario are quite dramatic for some countries. For Lithuania the time to achieve the 70% mark is reduced by 25 years from 75 to 49 years. On the other hand for Slovenia the convergence time is *reduced* from -4 to -3 years. This is due to the effect that the higher growth rate in the CEEC10, assumed in the optimistic scenario, leads to a faster growth of the 25 country average. This faster growth of all countries may lead to a deterioration of the relative position of some advanced transition countries (measured in convergence years).

[42]It has to be stated again that the quantitative assumptions concerning the *additional* effects are hypothetical. Therefore we suggest to interpret the result as follows: A relatively modest growth stimulus of a 0.4% higher growth rate reduces the convergence time substantially by about 20 % on average.

	$EU25_{70\%}$	$EU25_{80\%}$	$C4_{70\%}$	$C4_{80\%}$	$C4_{100\%}$
Optim.	30	37	22	27	36
+0.4%	26	32	19	24	31
+1.2%	21	25	15	19	25

Table 12: Average convergence time of the CEEC10 to levels relative to the EU25 and the C4 for the *optimistic* growth rates scenario and its accelerated versions.

	BGR	CZE	EST	HUN	LVA	LTU	POL	ROM	SVK	SVN	Mean
0.4%	-0.10	-0.13	-0.12	-0.15	-0.14	-0.13	-0.15	-0.11	-0.15	-0.13	-0.13
1.2%	-0.25	-0.31	-0.29	-0.34	-0.33	-0.31	-0.35	-0.26	-0.35	-0.31	-0.31

Table 13: Percentage reduction of convergence time for the *optimistic* growth rate scenarios when the growth rates are increased by 0.4% and 1.2%.

Also for the optimistic scenario accelerated versions have been computed.[43] The reductions of convergence times, shown in table 12, to levels relative to the EU25 and the C4 are smaller than for the mean scenario, both in relative and in absolute terms. This is due to the fact that the higher growth rates underlying the optimistic scenario (and the accelerated versions of it) project smaller convergence times. The effect of the higher growth rates outweighs the convergence time increasing effect of the higher implied EU25 growth rate considerably, given the small GDP per capita times population weights of the CEEC10 in the computation of the average over all 25 countries. Nevertheless, if growth is accelerated by 0.4%, compared to the optimistic baseline case, the average reduction of convergence time is still 13%. The strongest effects are found as before for Hungary and the Slovak Republic and additionally also for Poland, table 13.

4 Conclusions

The results of the previous section convey one message clearly: With the exception of Slovenia and the Czech Republic, the Central and Eastern European countries applying for EU membership have a long way to go before they achieve 70 or 80% of the enlarged EU's average real per capita GDP. Across a wide variety of equations and scenarios the average time over all 10

[43] The detailed results are given in the appendix in tables 24 and 25. In the appendix also the results for convergence times to levels relative to the EU15 are presented in table 27 for the optimistic scenario and its accelerated versions.

countries is projected to be in the vicinity of 30 to 40 years. These results once again reinforce the fact that many of the early estimates of an easy, fast and maybe painless convergence towards Western European standards and levels have been overly optimistic. After all, the results of 2 generations of central planning can be expected to be long lasting; about a generation on average, according to our results.

Due to the ongoing process of economic restructuring and reform, it has been shown that growth projections cannot directly be based on *growth accounting exercises* in the respective Eastern European countries. In this study the indirect way of basing the growth projections on a mapping of the Western European growth and convergence experience since 1960 on the CEECs is taken. The conclusions of this paper are therefore only as valid, as this approximation is a sensible approximation to the expected growth performance in the CEEC10. A *conditio sine qua non* is that the reform process in the CEECs is continued. Substantial progress has been made in several areas, e.g. with respect to the liberalization of prices (for the installment of a market price system in the first place), with respect to established foreign exchange markets or with respect to trade. In other areas further efforts are required. Examples include privatization and banking sector reform.[44]

Assuming that the reform process is continuing, our approach of basing growth projections on the *assumed* systemic convergence seems to be a reasonable computational exercise. This indirect approach is of course susceptible to the critique of ad-hoc imposing structural relationships observed in the current EU member states on the CEEC10s development. However, the EU is the explicit destination of these countries' development journey. Thus, if any indirect approach is feasible at all, it can only be based on the EU's experience. Only in the future, a sufficient amount of data over a time period of non-excceptional circumstances will become available. But then, when these countries are already on their neoclassical growth path towards the EU, the need for such an exercise is presumably less urgent. Given the deficiency of available observations some crude approximations and choices have to be made.

The individual countries vary substantially with respect to the projected convergence times. In our quantitative experiments the effects of integration with or possible accession to the EU are significantly positive. Substantial acceleration of the convergence times may be possible. It has to be noted that the future evolution of income is primarily dependent on domestic pol-

[44]The general focus of reform is shifting more towards micro-economic reforms, as in most countries macro-economic reforms have been undertaken and macro-stabilization has been achieved to a substantial degree.

icy choices of the individual countries. The EU opens opportunities, but it is in the discretion of the individual countries to take these – or to miss them. Compare for example the development of Greece with the development of Ireland. The Irish example also leads us to tentatively conclude that some especially successful reform countries may achieve relative income levels of 70 or 80% of the EU average faster than projected, maybe even faster than indicated by the accelerated optimistic scenario.

The highly aggregative approach of this paper also represents a short-coming. The process and the dynamics of economic reform depend strongly on the specific economic structure present in the individual countries. A more detailed analysis with sectoral disaggregation is required to obtain further understanding concerning the policy options in the CEEC10. Sectoral disaggregation is especially interesting when studying transition economies, as a substantial degree of sectoral reallocation is observed throughout the process of transition. A new private sector is emerging, the state sector is declining and the agricultural sector is also over-sized in some countries. We see our contribution not as a substitute for detailed investigations into the mechanics of sectoral adjustment, but more as a complement that is intended to give a bird-eye's view.

A second dimension where further disaggregation can be expected to shed further light on the growth prospects is regional disaggregation. In many of the CEECs it is observed that growth is based on a relatively small set of regions (as well as sectors), see e.g. DeBroeck and Koen (2000) for the case of Poland.

Further ongoing work is devoted to assess the extent and the implications of a possibly observable Harrod-Balassa-Samuelson effect in the CEEC10. Faster rising prices in faster growing countries may speed up (nominal) convergence towards the EU.[45]

As a final summarizing conclusion one may say that convergence of the CEEC10 towards the EU average income level is a long-run perspective. This perspective can be and is influenced both by domestic policy choices in the applicant countries and by the EU's policy approach towards enlargement and towards the candidate countries.

5 Appendix

In tables 16 to 21 in the last column the mean values over all equations are displayed for each of the countries for the scenario described in the respective table.

[45] See e.g. Halpern and Wyplosz (2001) for work along similar lines.

EU15			CEEC10			All 25 countries		
year	serCorr	Vartn	year	serCorr	Vartn	year	serCorr	Vartn
1960	0.0157	0.0004	1989	0.0490	0.0010	1989	0.0362	0.0003
1975	-0.4657	0.0009	1993	-0.2549	0.0025	1993	-0.2549	0.0025
1989	-0.5054	0.0007	1995	-0.1549	0.0047	1995	-0.2900	0.0027
1998	-0.0806	0.0006	1998	-0.2118	0.0067	1998	-0.3672	0.0044

Table 14: Descriptive statistics for the *Cross Profile Plots*.

	Period	BGR	CZE	EST	HUN	LTU	LVA	POL	ROM	SVK	SVN
GC	89	0.07	0.20	0.16	0.10	0.09	0.20	0.06	0.12	0.22	0.20
DI	89	0.33	0.27	0.33	0.27	0.36	0.34	0.39	0.27	0.32	0.18
GC	90-98	0.16	0.21	0.20	0.11	0.18	0.17	0.20	0.13	0.23	0.20
DI	90-98	0.16	0.30	0.28	0.23	0.25	0.24	0.20	0.26	0.31	0.21

Table 15: Values for the variables GC and DI for the CEEC10, for 1989 and averages over the period 1990 to 1998.

ΔGDP	(1)	(1in)	(2)	(2in)	(3)	(4)	(5)	(6)	
BGR	3.9	4.7	4.3	4.9	3.9	4.4	4.5	4.3	4.4
CZE	3.9	3.7	3.9	3.7	3.7	3.9	3.8	4.2	3.9
EST	3.6	4.0	3.8	4.2	3.5	3.7	4.0	4.4	3.9
HUN	3.3	3.5	3.7	3.8	3.3	3.4	3.8	3.7	3.6
LTU	3.4	3.7	3.7	3.8	3.4	3.7	3.7	3.6	3.6
LVA	3.1	4.1	3.4	4.4	3.1	3.4	3.9	3.9	3.7
POL	2.8	4.5	3.2	4.8	2.9	3.1	3.2	3.0	3.4
ROM	4.7	5.2	5.0	5.4	4.6	5.0	5.1	4.9	4.9
SVK	3.5	3.2	3.5	3.3	3.2	3.5	3.3	3.8	3.4
SVN	3.1	3.6	3.2	3.4	3.0	3.4	3.3	3.4	3.3
Mean	3.5	4.0	3.8	4.2	3.5	3.8	3.9	3.9	3.8

Table 16: Growth scenarios for real per capita GDP with the structural variables GC and DI as observed in the respective Central and Eastern European country over the period 1990 to 1998. Scenario 1.

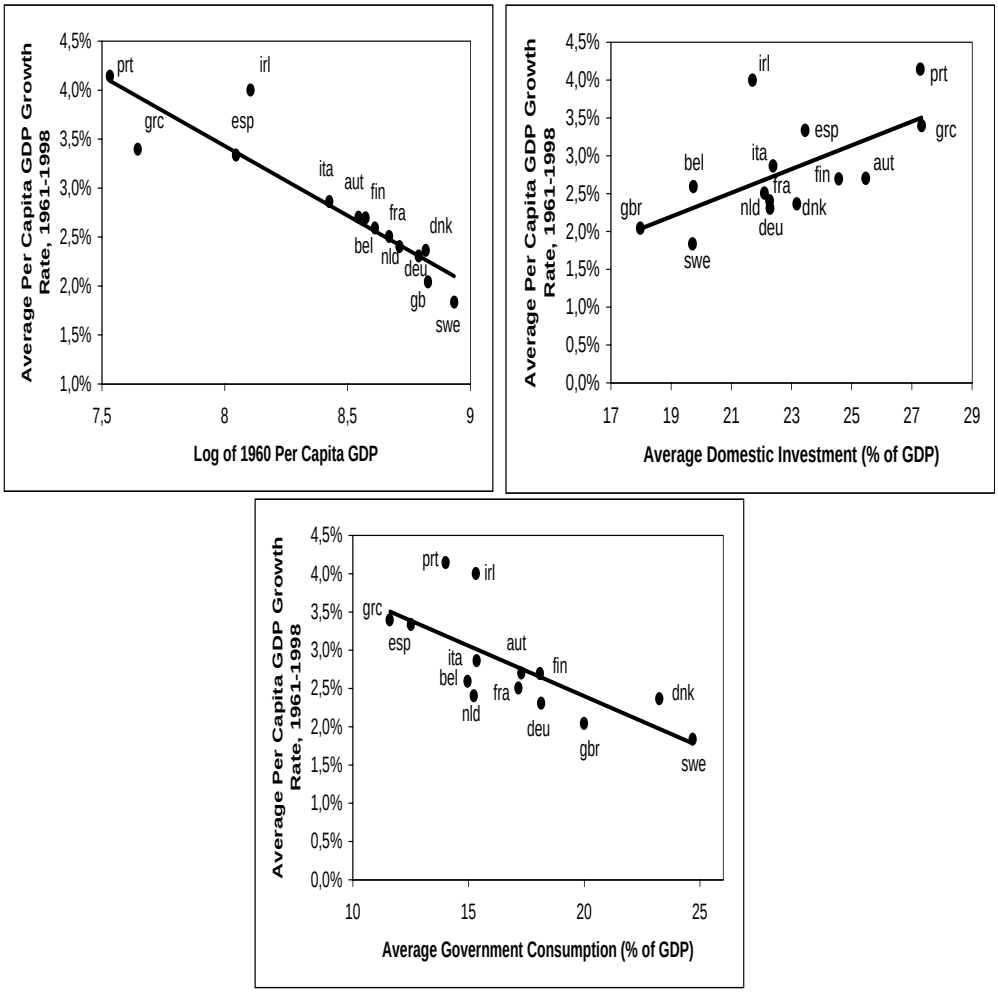

Figure 10: The correlation between the average growth rate of real per capita GDP and log real per capita GDP in the initial year (1960), the average share of investment of GDP and the average share of public consumption of GDP for the EU14. Averages are computed over the period 1961 to 1998. The regression line in the upper left picture shows the unconditional convergence coefficient over this period: $\beta = 2.046\%$.

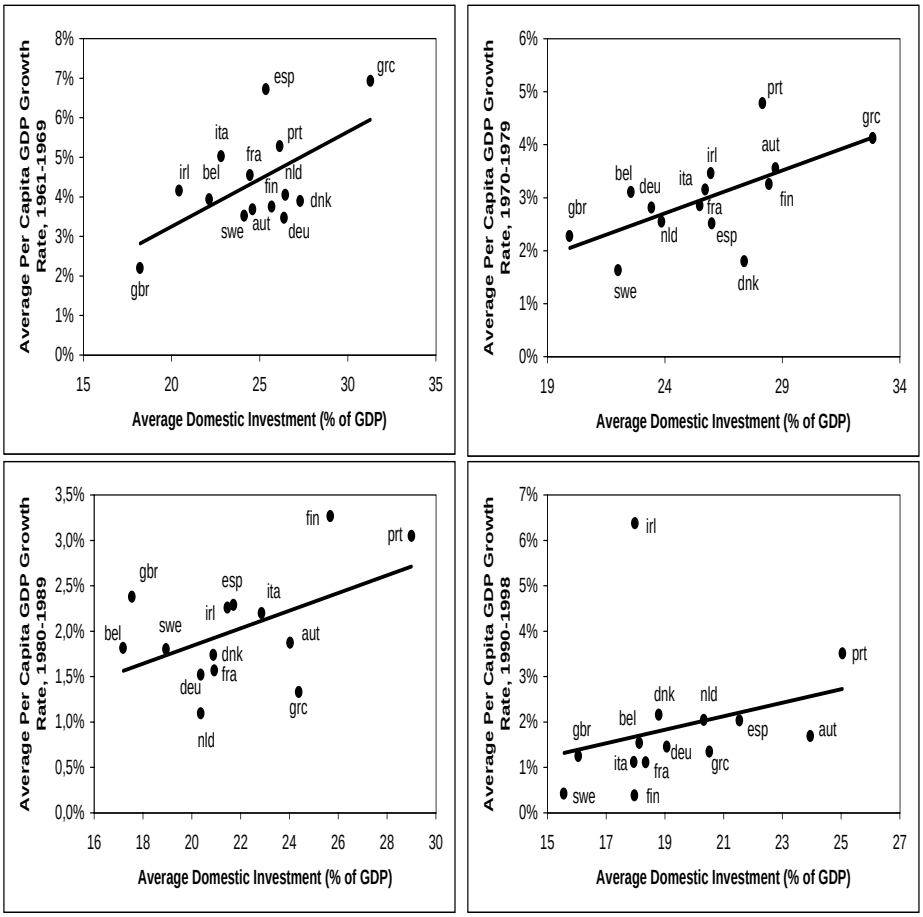

Figure 11: The sub-period correlations between the average growth rate of real per capita GDP and the average share of investment of GDP for the EU14 countries. The averages are computed over the sub-periods 1961−1969, 1970−1979, 1980−1989 and 1990−1998.

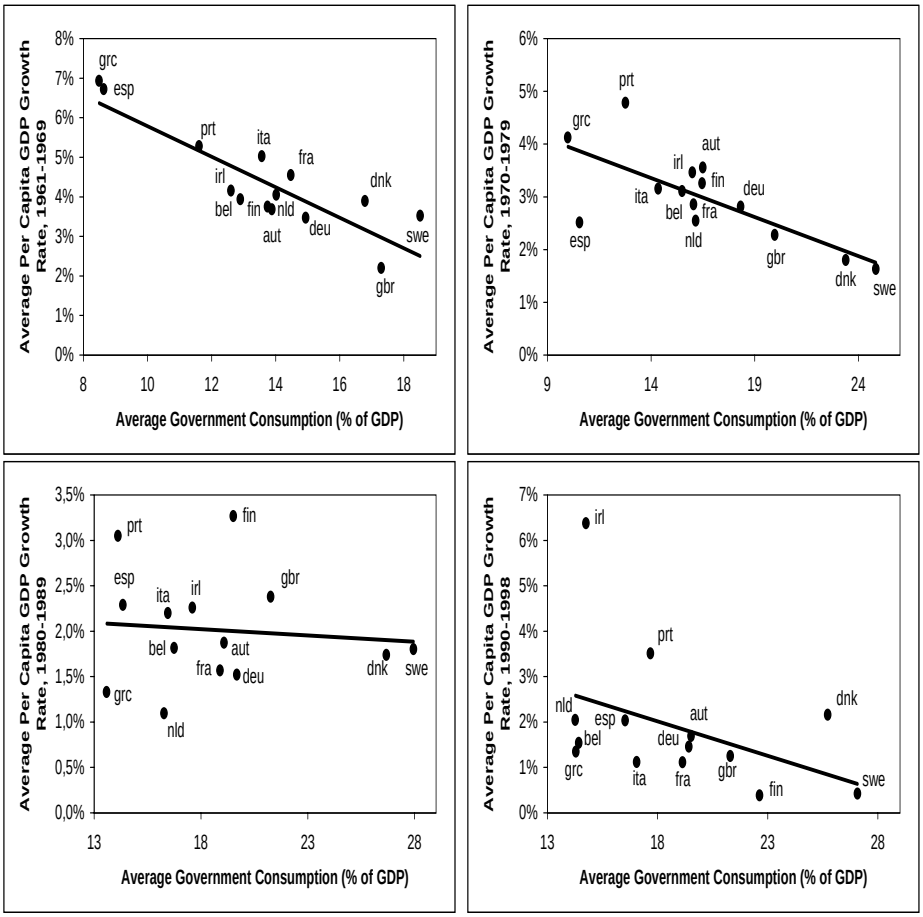

Figure 12: The sub-period correlations between the average growth rate of real per capita GDP and the average share of government consumption of GDP for the EU14 countries. The averages are computed over the sub-periods 1961−1969, 1970−1979, 1980−1989 and 1990−1998.

ΔGDP	(1)	(1in)	(2)	(2in)	(3)	(4)	(5)	(6)	
BGR	5.2	5.6	5.5	5.6	5.0	5.4	5.6	5.6	5.4
CZE	4.3	4.2	4.6	4.4	4.2	4.3	4.5	4.6	4.4
EST	4.2	4.2	4.4	4.5	4.0	4.2	4.7	4.9	4.4
HUN	3.8	3.7	4.2	3.9	3.7	3.8	4.3	4.3	4.0
LTU	4.1	4.0	4.5	4.3	4.0	4.3	4.5	4.4	4.3
LVA	3.9	3.8	4.3	4.2	3.8	4.0	4.7	4.6	4.2
POL	4.0	4.0	4.4	4.3	4.0	4.0	4.4	4.2	4.2
ROM	5.1	5.5	5.4	5.6	5.0	5.3	5.5	5.3	5.3
SVK	3.9	3.7	4.1	3.9	3.7	3.9	4.1	4.2	3.9
SVN	4.2	4.5	4.4	4.4	4.0	4.2	4.4	4.6	4.3
Mean	4.3	4.3	4.6	4.5	4.1	4.3	4.7	4.7	4.4

Table 17: Growth scenarios for real per capita GDP with the structural variables GC and DI as in Fischer, Sahay and Vegh (1998b) ($GC = 0.1$ and $DI = 0.3$). Scenario 2.

ΔGDP	(1)	(1in)	(2)	(2in)	(3)	(4)	(5)	(6)	
BGR	4.7	5.2	5.0	5.3	4.6	5.0	5.2	5.1	5.0
CZE	3.8	3.9	4.0	4.0	3.7	3.9	4.1	4.1	3.9
EST	3.6	3.8	3.9	4.1	3.5	3.8	4.2	4.4	3.9
HUN	3.3	3.3	3.6	3.5	3.3	3.4	3.8	3.8	3.5
LTU	3.6	3.6	4.0	3.9	3.6	3.9	4.0	3.8	3.8
LVA	3.3	3.4	3.8	3.8	3.4	3.6	4.2	4.1	3.7
POL	3.5	3.6	3.9	3.9	3.5	3.7	3.9	3.7	3.7
ROM	4.6	5.1	4.9	5.3	4.5	4.9	5.0	4.8	4.9
SVK	3.4	3.3	3.6	3.6	3.2	3.5	3.6	3.6	3.5
SVN	3.7	4.2	3.9	4.1	3.5	3.8	3.9	4.0	3.9
Mean	3.8	3.9	4.1	4.2	3.7	4.0	4.2	4.1	4.0

Table 18: Growth scenarios for real per capita GDP with the structural variables GC and DI as in the fast growing EU countries (Greece, Ireland, Portugal and Spain) over the period 1961−1998 ($GC = 0.134$, $DI = 0.249$). Scenario 3.

ΔGDP	(1)	(1in)	(2)	(2in)	(3)	(4)	(5)	(6)	
BGR	4.9	5.3	5.2	5.4	4.8	5.2	5.4	5.3	5.2
CZE	4.0	4.0	4.2	4.2	3.8	4.1	4.3	4.3	4.1
EST	3.8	4.0	4.1	4.3	3.7	3.9	4.4	4.6	4.1
HUN	3.5	3.4	3.9	3.7	3.4	3.6	4.0	4.0	3.7
LTU	3.8	3.8	4.2	4.1	3.8	4.0	4.2	4.0	4.0
LVA	3.5	3.6	4.0	3.9	3.6	3.8	4.4	4.3	3.9
POL	3.7	3.8	4.1	4.1	3.7	3.8	4.1	3.9	3.9
ROM	4.8	5.2	5.1	5.4	4.7	5.0	5.2	5.0	5.1
SVK	3.6	3.4	3.8	3.7	3.4	3.6	3.8	3.9	3.7
SVN	3.9	4.3	4.1	4.2	3.7	4.0	4.1	4.2	4.1
Mean	4.0	4.1	4.3	4.3	3.9	4.1	4.4	4.4	4.2

Table 19: Growth scenarios for real per capita GDP with the structural variables GC and DI as in the fast growing EU countries (Greece, Ireland, Italy, Portugal and Spain) over the period 1961−1979 ($GC = 0.119$, $DI = 0.268$). Scenario 4.

ΔGDP	(1)	(1in)	(2)	(2in)	(3)	(4)	(5)	(6)	
BGR	5.1	5.5	5.4	5.6	5.0	5.3	5.6	5.5	5.4
CZE	4.2	4.1	4.5	4.3	4.0	4.2	4.5	4.5	4.3
EST	4.1	4.1	4.3	4.4	3.9	4.1	4.6	4.8	4.3
HUN	3.8	3.6	4.1	3.8	3.6	3.7	4.2	4.2	3.9
LTU	4.0	3.9	4.4	4.2	4.0	4.2	4.4	4.3	4.2
LVA	3.8	3.7	4.2	4.1	3.8	4.0	4.6	4.5	4.1
POL	3.9	3.9	4.3	4.2	3.9	4.0	4.3	4.1	4.1
ROM	5.0	5.4	5.3	5.6	4.9	5.2	5.4	5.2	5.3
SVK	3.8	3.6	4.1	3.9	3.6	3.8	4.0	4.1	3.9
SVN	4.1	4.4	4.3	4.4	3.9	4.2	4.3	4.5	4.3
Mean	4.2	4.2	4.5	4.5	4.1	4.3	4.6	4.6	4.4

Table 20: Growth scenarios for real per capita GDP with the structural variables GC and DI as in the fast growing South East Asian countries (Indonesia, Japan, Malaysia, South Korea and the Philippines) over the period 1980−1995. ($GC = 0.108$, $DI = 0.292$). Scenario 5.

ΔGDP	(1)	(1in)	(2)	(2in)	(3)	(4)	(5)	(6)	
BGR	4.1	4.8	4.4	4.9	4.1	4.5	4.7	4.4	4.5
CZE	3.2	3.5	3.5	3.7	3.2	3.4	3.6	3.4	3.4
EST	3.0	3.5	3.4	3.8	3.0	3.3	3.7	3.7	3.4
HUN	2.7	2.9	3.1	3.2	2.7	3.0	3.3	3.1	3.0
LTU	3.0	3.2	3.4	3.6	3.1	3.4	3.6	3.2	3.3
LVA	2.7	3.1	3.2	3.4	2.9	3.2	3.7	3.4	3.2
POL	2.9	3.3	3.3	3.6	3.0	3.2	3.4	3.0	3.2
ROM	4.0	4.7	4.3	4.9	4.0	4.4	4.5	4.1	4.4
SVK	2.8	2.9	3.1	3.2	2.7	3.0	3.1	3.0	3.0
SVN	3.1	3.8	3.3	3.7	3.0	3.4	3.4	3.4	3.4
Mean	3.2	3.6	3.5	3.8	3.2	3.5	3.7	3.7	3.5

Table 21: Growth scenarios for real per capita GDP with the structural variables GC and DI as in Ireland over the period 1992−1998 ($GC = 0.146$, $DI = 0.173$). Scenario 6.

	$EU25_{70\%}$	$EU25_{80\%}$	$C4_{70\%}$	$C4_{80\%}$	$C4_{100\%}$
BGR	38	42	30	34	41
CZE	7	14	4	10	19
EST	41	49	30	36	46
HUN	31	40	20	27	39
LVA	62	70	45	51	61
LTU	60	68	43	49	60
POL	33	41	23	29	40
ROM	38	43	31	35	42
SVK	24	34	16	23	34
SVN	-3	5	-4	2	12
Mean:	33	41	24	30	39

Table 22: Convergence time in years to levels relative to the EU25 and the C4 for the *mean* growth rates scenario accelerated by 0.4%.

	$EU25_{70\%}$	$EU25_{80\%}$	$C4_{70\%}$	$C4_{80\%}$	$C4_{100\%}$
BGR	31	35	25	28	33
CZE	5	11	3	7	14
EST	31	37	23	27	34
HUN	21	28	15	19	28
LVA	46	52	34	38	46
LTU	44	50	32	36	44
POL	24	30	17	22	29
ROM	31	35	25	28	34
SVK	17	24	11	16	24
SVN	-2	3	-3	1	9
Mean:	25	30	18	22	30

Table 23: Convergence time in years to levels relative to the EU25 and the C4 for the *mean* growth rates scenario accelerated by 1.2%.

	$EU25_{70\%}$	$EU25_{80\%}$	$C4_{70\%}$	$C4_{80\%}$	$C4_{100\%}$
BGR	32	36	26	29	35
CZE	5	11	3	8	15
EST	29	34	22	26	33
HUN	22	29	15	20	29
LVA	51	57	37	42	50
LTU	42	48	32	36	44
POL	28	35	19	25	34
ROM	36	40	28	32	38
SVK	18	25	12	17	26
SVN	-2	4	-3	2	9
Mean:	26	32	19	24	31

Table 24: Convergence time in years to levels relative to the EU25 and the C4 for the *optimistic* growth rates scenario accelerated by 0.4%.

	$EU25_{70\%}$	$EU25_{80\%}$	$C4_{70\%}$	$C4_{80\%}$	$C4_{100\%}$
BGR	27	31	22	25	29
CZE	4	9	2	6	12
EST	24	28	18	21	27
HUN	17	22	12	16	22
LVA	39	44	29	33	39
LTU	34	38	25	29	35
POL	21	27	15	19	26
ROM	30	34	23	26	32
SVK	14	19	9	13	20
SVN	-2	3	-2	1	7
Mean:	21	25	15	19	25

Table 25: Convergence time in years to levels relative to the EU25 and the C4 for the *optimistic* growth rates scenario accelerated by 1.2%.

	Mean		+0.4%		+1.2%	
	70%	80%	70%	80%	70%	80%
BGR	41	46	36	40	29	33
CZE	14	21	12	18	9	13
EST	46	53	38	44	29	33
HUN	38	46	30	37	22	27
LVA	65	72	54	60	40	45
LTU	64	71	52	58	38	43
POL	39	47	32	38	24	28
ROM	41	46	37	41	30	33
SVK	32	41	26	33	18	23
SVN	6	13	5	11	3	8
Mean:	39	46	32	38	24	29

Table 26: Convergence time in years to income levels relative to the EU15 with *mean* growth rate scenario and the accelerated scenarios with additional growth rates of 0.4% and 1.2%.

	Optim.		+0.4%		+1.2%	
	70%	80%	70%	80%	70%	80%
BGR	34	38	31	34	26	29
CZE	11	16	10	14	8	11
EST	32	37	28	32	23	26
HUN	26	32	22	28	17	21
LVA	52	57	44	49	35	39
LTU	44	50	38	43	30	34
POL	32	38	27	32	21	25
ROM	38	42	34	38	28	31
SVK	23	30	20	25	15	19
SVN	4	9	4	8	3	6
Mean:	30	35	26	30	21	24

Table 27: Convergence time in years to income levels relative to the EU15 with *optimistic* growth rate scenario and the accelerated scenarios with additional growth rates of 0.4% and 1.2%.

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