CEEC growth projections: Certainly necessary and necessarily uncertain

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Abstract

In this paper we discuss the necessity for an indirect approach to assess the growth and convergence prospects of ten Central and Eastern European countries (CEEC10). Ongoing structural changes in these countries and the recent European Union membership of eight countries in the sample have to be taken into account in growth projections.

Our indirect approach consists of basing growth projections for the CEEC10 on growth equations estimated for the incumbent EU member states. The study improves upon current practice in two ways. First, growth equations are estimated for the EU14 and not on a large heterogeneous panel that includes many countries unrelated to the CEEC10. Second, by means of a variety of equations and scenarios we assess the uncertainty inherent in such projections.

We present growth-rate and convergence time distributions. The mean convergence times are in line with previous findings. The growth-rate and convergence time distributions are bi-modal, reflecting the possibility of two distinct growth paths, depending upon economic policy choices.

JEL classifications: F02, O40, O57, P21, P27.
Keywords: Real convergence, transition economies, growth projections, uncertainty analysis.

* Financial support from the Austrian Ministry of Economic Affairs is gratefully acknowledged. The authors would like to thank H. Hutter, M. Kotov and B. Meininger for their help with TEX and data issues and H. Delias, C. Osbat, T. Owen and A. Wörgötter for valuable discussions and suggestions. In particular also the very thoughtful comments and remarks of an anonymous referee that helped to improve the paper substantially are gratefully acknowledged. We would also like to thank seminar and conference participants at the Institute for Advanced Studies, the Vienna Institute for Comparative Economic Studies (WIIW), the Österreichische Nationalbank, the University of Bern, the ‘CEPR Transition Workshop’ in Portoroz, especially Laszlo Halpern, Miklos Koren and Mark Schaffer, the University of Ljubljana, the ‘First Vienna-Bratislava Economics Meeting’ and at the ‘Economic, Econometric and Cross-Disciplinary Aspects of European Enlargement’ Conference in Firenze, in particular Zsolt Darvas. All remaining errors and shortcomings are ours. This paper is a substantially revised, completely re-estimated and shortened version of our CEPR Discussion Paper No. 3318 entitled ‘The CEEC10’s Real Convergence Prospects’. Part of this work has been carried out whilst Martin Wagner was visiting the Economics Department of Princeton University, whose hospitality is gratefully acknowledged.
1. Introduction

Numerous studies have offered assessments of the growth perspectives of various groups of transition economies.\footnote{Examples are Berg \textit{et al.} (1999), Campos (2000), Campos and Coricelli (2002), DeMelo \textit{et al.} (1997), Estrin and Urga (1997), Fischer and Sahay (2000), Fischer \textit{et al.} (1998a,b) and Havrylyshyn \textit{et al.} (1998).} All these studies suffer from the fact that the transition process which these countries are undergoing renders growth projections difficult. This stems from the obvious fact that in all transition economies huge structural changes occur on their way from centrally-planned to market economies. For instance, in all countries, initially a transformational recession occurred with drastic falls in output, high unemployment and often hyperinflation (see Campos and Coricelli, 2002 or Kornai, 1994). As Fischer and Sahay (2000) point out, the growth process in transition economies depends upon two sets of factors. The first is in relation to transition, and the second is the long-run growth forces as laid out by neoclassical growth theory. The further along a country is in its transition process, the more important the latter set of factors will be. Thus, an assessment of the growth perspectives of transition economies has to start out by displaying the importance of the two sets of factors.

For the Central and Eastern European countries (CEECs), which are the focus of this paper, the growth perspectives are also shaped by the recent European Union (EU) enlargement. Eight of the countries in our sample joined the European Union on May 1, 2004, namely the Czech Republic (CZE), Estonia (EST), Hungary (HUN), Latvia (LVA), Lithuania (LTU), Poland (POL), the Slovak Republic (SVK) and Slovenia (SVN), while the remaining two, Bulgaria (BGR) and Romania (ROM),\footnote{This group of countries is referred to as CEEC10 throughout the paper.} are candidates for membership in a few years time. Thus, for all countries in our sample, long-run growth projections have to take into account the likely effects of EU membership on the new entrants’ growth process. EU membership leads to institutional or systemic convergence of the new entrants to the system prevalent in the incumbent EU member states. The new entrants have to adopt the acquis communautaire and there will also be convergence in the way economic policy is conducted in the incumbent EU member states and the new entrants. Eventual entry to the European Monetary Union is mandatory for the CEECs joining the EU. In meeting the mandatory requirement to join the European Monetary Union, the CEECs must meet clear quantitative bounds on fiscal and monetary policy and will have to obey the regulations laid out in the Stability and Growth Pact (SGP), also known as the Treaty of Maastricht. Furthermore, the already substantial degree of economic interaction between the incumbent EU member states and the new entrants is likely to increase further. Already the pre-enlargement EU15 is by far the largest trading partner and the main source of foreign direct investment in the CEECs. As a consequence of joining the EU, the CEECs have to (eventually) open their goods and service markets consistent with the principles and practices of the
so-called common market. All these effects can be expected to lead to substantial convergence between the incumbent and the new EU member states. Ben-David (1993, 1996) shows that previous EU enlargements induced significant subsequent convergence. Thus, most certainly also for the CEEC10, the future growth process will be substantially shaped by the effects of EU membership. This implies that assessments of the growth perspectives for these countries have to take into account that the endpoint of the transition process is known.

An indirect approach is often used in the literature for long-run growth projections, since, as discussed, up to now neoclassical growth theory does not adequately describe the growth process of transition economies like the CEEC10. This implies that growth scenarios based on equations estimated for transition countries over the last decade or so, lead to a projection of the turbulent behaviour observed up to now. To address this problem, growth assessments are often based on equations estimated for large samples of countries and the resulting coefficients are combined with the values of the independent variables from the countries being studied to obtain growth rate projections. Such an indirect approach induces, by construction, convergence of the sample of countries studied to the sample of countries for which the equations have been specified. Fischer et al. (1998b), for example, use specifications of Barro (1991) and Levine and Renelt (1992) to obtain their growth rate projections for a set of thirteen transition economies.

This approach is not without problems. First, it is based on the underlying assumption that convergence to a reference group of countries is a more likely scenario than a continuation of the observed patterns. Second, the relevance of the calibration procedure has to be addressed. Third, the specification uncertainty inherent in the growth and convergence literature (see Sala-i-Martin, 1997) has to be taken into account. This paper addresses these three main problems as follows. First, due to the recent EU enlargement, convergence of the new entrants towards the incumbent member states is more likely than a continuation of the trends seen thus far. Thus, some sort of indirect approach is indeed necessary. Second, growth equations are estimated only for the incumbent EU member states and not for large samples that include many countries at heterogeneous levels of development that are essentially unrelated economically to the CEECs. This reflects the assumption of a systemic convergence of the CEECs towards the EU in its pre-enlargement boundaries as compared to convergence towards the ‘statistical mean country’ from a worldwide sample. To be precise, the estimations of the growth equations are performed for the EU14 (the EU15 excluding Luxembourg). Luxembourg is excluded because of its small size, its dissimilarity to any of the CEECs and some problems with data availability. Third, the specification uncertainty is quantified by specifying a variety of growth equations, 18 in total.3 This is combined with an economic robustness

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3 The equations are estimated by panel methods, and not, as is common in the empirical growth literature, only cross-sectionally.
analysis by specifying seven scenarios for two economically important explanatory variables: the government consumption share and the gross fixed capital formation – briefly investment – share. This results in a total of 126 growth rate projections for each of the CEEC10, which allows the estimation of the distributions and the densities of the growth rate projections. The growth rate distributions form the basis for assessing the uncertainty inherent in the projections.

Based on growth rate distributions, we also compute convergence time distributions. We discuss convergence time distributions with respect to various country groups: the EU14, the EU24 (the EU14 plus the CEEC10), and the cohesion countries Greece, Portugal and Spain (C3). In addition to convergence time distributions, two scenarios are discussed in detail: the mean scenario, based on the mean convergence times, and the optimistic scenario, based on the first deciles of the convergence time distributions. The convergence time computations are based on the assumption that the EU14 and the C3 continue to grow at their historical averages over the period 1990–2001. A separate appendix, available upon request, contains similar computations with the growth rates assumed for the EU14 and the C3 given by the mean growth rates from the 18 equations. We also briefly discuss so called accelerated convergence time distributions. These are based on assuming that the GDP growth rate projections are increased by 0.4 percent and by 1.2 percent. The European Commission estimates the effect of EU payments on economic growth in the less developed countries to be in this interval. Full details are again given in the separate appendix.

The results are discussed in detail in Section 4. One of the main findings is that the growth rate distributions are bi-modal, see Figure 5. For all countries but Slovenia the larger of the two modes, i.e., the mode corresponding to the higher growth rate, has a higher value of the density. The separation in bi-modal distributions stems from the scenarios. Thus, it is the evolution of the policy variables, government consumption and investment, that is responsible for the realization of lower or higher growth rates. We discuss the plausibility of the specified scenarios and their compatibility with the SGP in Section 4.

The mean growth rates vary from 3.05 percent p.a. for Slovenia to 3.52 percent p.a. for Romania. The standard deviation of the growth rate distributions is around 0.5 percent annual growth for all countries. Regarding convergence times to 80 percent of the income level of the EU14, the results range from a mean convergence time of 9.4 years (standard deviation 4.3 years) for Slovenia to 71.4 years (standard deviation 18.9 years) for Romania. We thus find mean convergence times that are in line with some of the point estimates available in the literature. However, there is a substantial degree of uncertainty around these point estimates, which is highlighted by our analysis.

\footnote{With the assumption that the EU14 continue to grow at the average growth rate of real per capita GDP observed over the period 1990–2001, namely 1.74 percent.}
Section 2 discusses the growth process in the CEEC10 over the period 1991–2001. In Section 3 the growth process in the EU14 and the resulting growth or convergence equations are discussed. Section 4 discusses the growth and convergence scenarios for the CEEC10 and Section 5 provides a summary and conclusions. The Appendix provides a description of the data and their sources. As already mentioned, additional empirical results are reported in a separate appendix, available from the authors upon request.

2. The growth performance of the CEEC10

In this section we briefly review the growth performance of the CEEC10 over the period 1991–2001. Table 1 displays the growth rates of real per capita GDP. As already mentioned in the introduction, the beginning of transition was characterized by large output losses, the most drastic example being a fall in real per capita GDP in Latvia by 41.9 percent from 1991 to 1992. The Baltic countries were more severely hit than other transition economies by the dissolution of the Soviet Union, which restrained accessibility of input and output markets (compare Blanchard and Kremer, 1997). Table 1 also shows that with the exception of the two reform laggards Bulgaria and Romania, and to a certain extent the Czech Republic, the countries in our sample have achieved relatively good growth performance after the initial recession. The

| Year | BGR  | CZE  | EST  | HUN  | LVA  | LTU  | POL  | ROM  | SVK  | SVN  |
|------|------|------|------|------|------|------|------|------|------|------|
| 1992 | -6.30| -0.61| -20.51| -3.03| -41.90| -23.88| 2.18 | -9.01| -6.98| -5.53|
| 1993 | 1.11 | -0.05| -8.25 | -0.44| -16.18| -19.07| 3.38 | 1.25 | 1.49 | 2.64 |
| 1994 | 2.79 | 2.15 | -0.16 | 3.06 | 1.92  | -9.90 | 4.88 | 3.99 | 4.64 | 4.77 |
| 1995 | 3.85 | 5.83 | 5.70  | 1.64 | 0.63  | 6.49  | 6.65 | 7.03 | 5.97 | 3.78 |
| 1996 | -8.77| 4.32 | 5.28  | 1.55 | 4.58  | 2.49  | 5.78 | 4.22 | 5.46 | 3.15 |
| 1997 | -4.51| -0.66| 10.41 | 4.75 | 9.01  | 8.27  | 6.54 | -6.03| 5.29 | 4.26 |
| 1998 | 5.13 | -0.95| 5.48  | 5.07 | 5.67  | 6.59  | 4.71 | -4.71| 3.72 | 3.60 |
| 1999 | 3.44 | -0.29| -0.11 | 4.45 | 3.49  | -4.88 | 3.98 | -0.93| 1.73 | 4.87 |
| 2000 | 6.42 | 2.98 | 8.64  | 5.44 | 12.28 | 7.34  | 4.00 | 2.00 | 2.05 | 4.38 |
| 2001 | 4.04 | 3.57 | -1.39 | 4.04 | 8.41  | 7.21  | 1.10 | 5.18 | 3.05 | 2.40 |
| Aver.| 0.72 | 1.63 | 0.51  | 2.65 | -1.21 | -1.93 | 4.32 | 0.30 | 2.64 | 2.83 |

More detailed data analysis and empirical investigations are available from the authors upon request or in the working paper Wagner and Hlouskova (2002). See also the detailed account of the growth performance of transition economies given in Campos and Coricelli (2002) and the references therein.
last row of Table 1 displays the average growth rate over the period 1991–2001, which is positive with the exception of Latvia and Lithuania. This is equivalent to saying that the initial output losses in these two countries were so large that, despite their sound recent growth performance, they have not yet reached their 1991 income levels. The largest average growth rate is observed for Poland, with 4.32 percent (see DeBroeck and Koen (2000) for a detailed account of the Polish experience).  

The recent sound growth performance of the CEEC10 might suggest that the mechanisms laid out by the standard neoclassical growth model (see, for example, Barro and Sala-i-Martin, 1995) provides an apt description of the growth performance by now.

The standard neoclassical growth model, as well as a variety of extensions, have clear implications concerning the (long-run) correlations observed between key variables. To be clear, the intention is not to test or estimate a particular growth model, but merely to use growth theory as a reference framework that allows for a structured modelling process consistent with theory. In particular neoclassical growth theory is consistent with convergence of output across nations. This empirical fact has been observed for the EU15 and is likely to be extended also to the new members. Two key correlations derived for a set of homogeneous countries are: a negative correlation between initial real per capita GDP and subsequent growth, which is usually referred to as β-convergence; and a positive correlation between the investment share and growth. These unconditional correlations are displayed in Figure 1, which is structured as follows: the first row displays β-convergence or divergence and the second row displays the investment share–growth correlation. The first column corresponds to the period 1991–95, the second to the period 1996–2001 and in the third column the correlations are displayed for the total period 1991–2001. In the first sub-period β-convergence prevails, but it disappears when the Baltic countries are excluded from the sample. The correlation between the investment share and output growth is (insignificantly) negative. The correlation between the investment share and output growth disappears when the Baltic countries are excluded from the sample. Thus, as expected, the early years of transition do

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6 Note also that output started to decline in Poland before our sample period, which biases the comparison to a certain extent.

7 Starting with Baumol (1986) and DeLong (1988) the convergence literature has been rapidly growing, since its popularization due to Barro (1991, 1997), Barro and Sala-i-Martin (1992a, 1992b, 1995) and Sala-i-Martin (1990). For a critical assessment of the convergence literature and an apt description of its many limitations see Durlauf and Quah (1999). Bernard and Durlauf (1995, 1996) propose a time-series oriented analysis of convergence. Quah (1996a,b, 1997a–c) proposes to use Markov chain methods to study the distributional dynamics of income. Our working paper Wagner and Hlouskova (2002) contains investigations using all these methodologies. For the CEEC10, for instance, we found that over the period 1991–2001 the so-called twin-peaks property emerges. This is a reflection of the diverse income development in the CEEC10 over that period. Due to our more narrow focus in this paper, which is to assess growth perspectives, we have excluded these further investigations.
Figure 1. Correlations between the average real per capita GDP growth rate and the logarithm of initial real per capita GDP, and between the average real per capita GDP growth rate and the average investment share for the CEEC10

Note: The periods displayed are 1991–95 in the first column, 1996–2001 in the second column and 1991–2001 in the third column.
not display behaviour consistent with the long-run implications of the neoclassical growth model. The second column shows a roughly similar picture, but now with a positive correlation between the investment share and GDP growth. This positive correlation between the investment share and growth is robust with respect to sub-samples of countries. The final column shows that over the full period no significant or robust correlations between these key variables prevail. Thus, a first graphical inspection already shows that a standard neoclassical growth model does not sufficiently describe the growth process of this group of countries, and consequently, the next step is to include further explanatory variables.\(^8\) Also the conditional correlations could be inspected graphically. We, however, discuss the results equivalently in terms of a growth or convergence equation. This also sets the stage for the econometrics performed in the following section. A ‘typical’ equation is the following:\(^9\)

\[
\Delta \log GDP_i = \beta_1 + \beta_2 \log GDP_{0,i} + \beta_3 GC_i + \beta_4 GFCF_i + \beta_5 PRIM_i + \beta_6 TT_i + u_i \tag{1}
\]

with \(\Delta \log GDP\) denoting the average growth rate of real per capita GDP over the period investigated. \(GDP_0\) denotes initial real per capita GDP; \(GC\) denotes the average government consumption share; \(GFCF\) denotes the average investment share; \(PRIM\) is an indicator of primary school education and \(TT\) denotes the average ratio of exports plus imports to GDP. The error term is denoted by \(u\) and \(i\) is the country subscript. Equation (1) is estimated cross-sectionally for the shrinking periods 1991–2001 to 1998–2001, and the results are displayed in Figure 2. This figure displays the recursive coefficients over the shrinking estimation intervals and the 95 percent confidence bounds. Of course the periods are rather short for conducting growth analysis. Neoclassical growth theory predicts the following signs for the coefficients: \(\beta_2 < 0, \beta_3 < 0, \beta_4 > 0, \beta_5 > 0\) and \(\beta_6 > 0\). The first two of these sign restrictions correspond to the already discussed correlations. The negative coefficient for the government consumption share, \(\beta_3 < 0\), is not necessarily implied – as has been pointed out by a referee – by all specifications of neoclassical growth models. However, for the EU14, over all sub-periods and across all specifications of equations like (1) government consumption always exhibits negative conditional correlation with output growth. The latter two sign restrictions, \(\beta_5 > 0\) and \(\beta_6 > 0\) correspond to the positive effects of education and trade on growth. The results are quite clear: if the ‘correct’ sign prevails at all, it is only for a small patch of sub-periods. In particular, initial GDP is never significant, government consumption is negatively significant only when the equation is estimated over the periods 1994–2001 to 1996–2001. This is also approximately the set of periods which leads to a

\(^8\) The inclusion of further explanatory variables to study conditional correlations leads to conditional convergence concepts.

\(^9\) Qualitatively similar results prevail throughout a whole variety of specifications.
Figure 2. Recursive coefficient estimates (solid-circled lines) and 95 percent confidence intervals (dashed lines) for Equation (1) estimated for the CEEC10 over shrinking estimation intervals

Note: The horizontal axis indicates the starting point of the period used for averaging, 1991–2001 to 1998–2001.

significantly positive coefficient for the investment share. The figure also shows, with the caveat of very short time periods, that there is up to now no evidence that neoclassical growth theory is a good description of the growth performance of the CEEC10 group.

One more issue in relation to Figure 2 deserves to be discussed: the positive yet insignificant effect of initial GDP for the growth process. If initial GDP is accepted

10 In the separately available appendix we display in a similar figure the recursive coefficients for the same equation when estimated for 24 countries, the CEEC10 and the EU14 together. This figure shows that for that group of countries no coefficient is ever significant. Including dummies for the CEEC10 also fails to establish significant coefficients with theory-consistent signs.
as an admittedly crude measure for initial conditions, then in the sample of countries analyzed, initial conditions do not significantly shape the growth process throughout the period. This is in line with the finding that initial conditions have rapidly declining importance for the transition process (see DeMelo et al., 1997; Havrylyshyn et al., 1998 or Berg et al., 1999).

The results of this section imply that basing growth projections for the CEEC10 on growth or convergence equations estimated for the CEEC10, i.e., a direct approach, leads to projections of a divergent growth perspective for these economies. If one believes that this is not the most likely scenario, then an alternative approach that incorporates the EU accession of these countries and the likely subsequent convergence has to be sought. Note that a direct approach neglects in any case the effects of integration within the EU, even if it were based on a period of convergence within the CEEC10 themselves.

3. An indirect econometric approach

The above discussion exemplifies again that projecting GDP growth of the CEEC10 based on the developments from 1991–2001 implies projecting the rather heterogeneous and divergent growth process observed to date into the future. Therefore, such an approach generates growth scenarios that do not necessarily reflect the prospects that may materialize after successful completion of transition and in particular are bound to neglect the beneficial effects of integration within the enlarged EU.

Eight of the countries in our sample have been members of the EU since May 1, 2004 and Bulgaria and Romania are expected to become members within a few years. Furthermore, see Figure 3, the economic size of the CEEC10 with respect to the EU is small. The solid line in Figure 3 displays the average real per capita GDP in the CEEC10 compared to the average real per capita GDP in the EU14, which rose from about 35 percent in 1992 to almost 40 percent in 2001. The dashed line displays the ratio of total real GDP of the CEEC10 to total real GDP of the EU14. This share actually declined from about 15 percent in 1992 to about 13 percent in 2001. This decline, despite growing relative per capita GDPs, stems from extraordinarily low population growth in the CEECs over the last decade. The average annual population growth rate in the CEEC10 over the period 1991–2001 is −0.15 percent, compared to 0.33 percent for the EU14. This compares with almost identical population growth rates in the period 1960–90 of 0.68 percent in the CEEC10 and 0.67 percent in the EU14. The small economic size of the CEECs together with the continued systemic integration of these countries due to the recent EU enlargement, led to an increased similarity between the economic and policy environment in the CEECs and the economic environment prevalent in the incumbent EU member states. For instance the new member states have accepted the EU legal code, as specified in the acquis communautaire and their markets for goods and factors will have to be opened within the common market, at least after some transition period. Also,
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Economic policy will be conducted in an increasingly similar way to that prevailing in incumbent member states. Furthermore, about 70 percent of the CEEC10s exports are directed to the pre-enlargement European Union and the EU15 is the main source of foreign direct investment in the CEECs.

Thus, there have already been and there will be further important integration steps to be taken by the CEEC10 towards and within the EU along various dimensions, which will – unless a backlash occurs in some countries – lead to convergence of the CEEC10 as a group to the ‘old’ EU member states. Note here that Ben-David (1993) argues forcefully that historically EU integration contributed to convergence.

Therefore an assessment of the growth prospects of the CEEC10 certainly has to take into account two main issues: first, the on-going structural change due to economic transition, and second, the recent EU membership and the implied effects on integration and systemic convergence. To incorporate these two sets of effects, we base our growth projections on growth or convergence equations estimated for the incumbent European Union members excluding Luxembourg, the EU14. These

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11 Note here again that for the new entrants future membership in the European Monetary Union is not optional but automatic after fulfillment of certain criteria. Thus, the Maastricht criteria also impose relatively clear quantitative boundaries on the conduct of fiscal policy in the CEECs in the future.

12 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 GDP. See also Wagner and Hlouskova (2002) for an analysis of σ-convergence in the CEECs and the EU14.
equations form the basis for growth projections or simulations when combined with values for the independent variables taken from the CEECs or specified in scenarios. Such an indirect approach has been previously employed in the literature (see Fischer et al., 1998b). There are, however, two important differences between our study and existing ones. The first is the fact that we estimate growth equations for the EU14 and not for large worldwide country sets with heterogeneous countries, many of which are essentially unrelated to the CEECs. The second is that we try to assess the uncertainty in specifications for growth equations by specifying a variety of equations, 18 in total, and 7 scenarios. The specification of the equations follows the recommendation of Berg et al. (1999) to focus on specifications consistent with economic theory, because purely statistical approaches may lead to erratic and implausible conclusions. Thus, for each country we generate in total 126 growth rate projections. This allows for an uncertainty analysis by investigating the properties of the distributions of the projected growth rates.

Let us start by briefly discussing the growth process observed in the EU14. In Figure 4 we display the correlations between the real per capita GDP growth rate and the logarithm of initial real per capita GDP, and between the real per capita GDP growth rate and the average investment share for the EU14 over the period 1960–2001. Strongly significant correlations of the expected signs are clearly visible, in contrast to Figure 1 for the CEECs. This illustrates again the well-studied convergence process amongst the ‘old’ EU member states. Note that adding Luxembourg does not qualitatively change the picture and that similar pictures can also be drawn for sub-periods, for example, for the four decades in the sample. Thus, estimating equations of the type (1) for the EU14 can be expected to lead to significant parameter estimates of the correct sign. See Table 2 for the set of 18 equations that form the basis for the growth projections in the following section. The growth equations

Figure 4. Correlations between the average real per capita GDP growth rate and the logarithm of 1960 real per capita GDP, and between the real per capita GDP growth rate and the average investment share, 1960–2001
Table 2. Estimation results with dependent variable average real per capita GDP growth rate

| Λ log GDP | const | log GDP₀ | GC | GFCF | PRIM | TT | X | POPG | D₁ | D₁RL | D₁GER | Adj. R² |
|-----------|-------|----------|----|------|------|----|---|------|-----|------|--------|---------|
| (1)       | 0.045 | −0.003   | −0.089 | 0.061 | 0.010 | 0.003 |   |       | 0.013 |       |        | 0.639   |
|           | (2.620) | (−1.944) | (−7.066) | (4.975) | (1.813) | (2.508) |   |       |       | (3.724) |        |
| (1in)     | 0.096 | −0.007   | −0.084 | 0.029 | 0.004 | 0.002 |   |       |       | 0.011  |        | 0.616   |
|           | (7.163) | (−4.913) | (−6.397) | (2.845) | (1.186) | (1.464) |   |       |       | (3.574) |        |
| (2)       | 0.066 | −0.005   | −0.075 | 0.056 | 0.008 |       |   |       |       |       | 0.471   |         |
|           | (3.808) | (−3.055) | (−6.153) | (4.151) | (1.338) |        |   |       |       |        |         |
| (2in)     | 0.107 | −0.008   | −0.073 | 0.031 | 0.005 |       |   |       |       |       | 0.491   |         |
|           | (8.025) | (−5.873) | (−6.620) | (2.951) | (1.261) |        |   |       |       |        |         |
| (3)       | 0.058 | −0.004   | −0.074 | 0.060 | 0.009 |       |   |       |       | 0.012  |        | 0.640   |
|           | (3.336) | (−2.790) | (−6.142) | (4.419) | (1.436) |        |   |       |       | (3.657) |         |
| (4)       | 0.061 | −0.003   | −0.092 | 0.051 | 0.003 |       |   |       |       | 0.012  |        | 0.635   |
|           | (4.211) | (−2.091) | (−7.332) | (4.222) | (2.230) | (3.661) |   |       |       |         |         |
| (5)       | 0.085 | −0.007   | −0.046 | 0.066 |       | −0.149 | |       |       | 0.013  |        | 0.470   |
|           | (5.248) | (−4.002) | (−4.387) | (4.819) |        | (−1.065) | |       |       | (10.638) |         |
| (6)       | 0.074 | −0.006   | −0.058 | 0.065 | 0.006 | 0.004 |   |       |       | 0.205  |        | 0.463   |
|           | (5.042) | (−4.925) | (−6.623) | (5.939) | (1.549) | (4.865) | |       |       | (13.280) |         |
| (7)       | 0.058 | −0.005   | −0.064 | 0.068 | 0.008 | 0.003 |   |       |       | 0.012  |        | 0.449   |
|           | (4.028) | (−3.912) | (−8.344) | (7.059) | (2.125) | (4.308) | |       |       | (14.968) |         |
| (8)       | 0.049 | −0.004   | −0.088 | 0.061 | 0.010 | 0.006 |   |       |       | 0.012  |        | 0.646   |
|           | (2.922) | (−2.330) | (−6.933) | (4.912) | (1.818) | (2.427) | |       |       | (3.690) |         |
| (8in)     | 0.098 | −0.007   | −0.084 | 0.029 | 0.004 | 0.004 |   |       |       | 0.011  |        | 0.619   |
|           | (7.483) | (−5.229) | (−6.469) | (2.846) | (1.136) | (1.431) | |       |       | (3.562) |         |
| (9)       | 0.065 | −0.004   | −0.091 | 0.052 | 0.005 | 0.012 |   |       |       |       |        | 0.641   |
|           | (4.589) | (−2.440) | (−7.246) | (4.167) | (2.151) | (3.629) | |       |       |         |         |
| (9in)     | 0.098 | −0.007   | −0.085 | 0.024 | 0.004 | 0.011 |   |       |       |       |        | 0.623   |
|           | (7.869) | (−4.752) | (−6.730) | (2.407) | (3.622) | (3.622) | |       |       |         |         |
Table 2. (cont.) Estimation results with dependent variable average real per capita GDP growth rate

| Δ log GDP | const | log GDP₀ | GC | GFCF | PRIM | TT | X | POPG | D₁ | D_Irl | D_GER | Adj. R² |
|-----------|-------|----------|----|------|------|----|---|------|-----|-------|-------|--------|
| (10)      | 0.064 | −0.005   | −0.062 | 0.067 | 0.008 | 0.006 |    | 0.012 |     |       |       | 0.464  |
|           | (4.282) | (−4.286) | (−7.867) | (6.779) | (2.061) | (4.066) |    | (14.525) |     |       |       |        |
| (11)      | 0.030 | −0.002   | −0.075 | 0.074 | 0.015 | 0.004 | −0.453 | 0.003 |     |       |       | 0.293  |
|           | (1.835) | (−1.517) | (−7.477) | (6.892) | (2.938) | (2.339) | (−4.401) | (2.609) |     |       |       |        |
| (12)      | 0.030 | −0.003   | −0.073 | 0.077 | 0.017 | 0.004 | −0.525 | 0.013 |     |       |       | 0.593  |
|           | (2.089) | (−1.779) | (−6.223) | (7.483) | (3.174) | (1.888) | (−5.161) | (4.350) |     |       |       |        |
| (13)      | 0.028 | −0.002   | −0.074 | 0.077 | 0.017 | 0.002 | −0.513 | 0.013 |     |       |       | 0.600  |
|           | (1.883) | (−1.536) | (−6.272) | (7.483) | (3.149) | (1.933) | (−5.095) | (4.348) |     |       |       |        |
| (14)      | 0.043 | −0.003   | −0.083 | 0.064 | 0.010 | 0.003 | 0.013 | 0.003 |     |       |       | 0.621  |
|           | (2.353) | (−1.941) | (−7.595) | (5.221) | (1.926) | (2.858) | (3.784) | (3.041) |     |       |       |        |

Note: The equations are estimated for the EU14. The full sample period 1960–2001 is split into four sub-periods 1960–69, 1970–79, 1980–89 and 1990–2001. The t-values in brackets are heteroscedasticity corrected. All variables are described in the text. A suffix in indicates that in the respective equation the values of the independent variables are taken from the initial years.
are estimated by panel methods, compared to the usual cross-section regressions. The total sample period 1960–2001 is divided into the four sub-periods 1960–69, 1970–79, 1980–89 and 1990–2001. Periods of about 10 years may be considered a fair compromise between taking long-run averages (to assess long-run growth properties) and a sufficiently large number of observations (56 instead of 14 for a cross-sectional analysis). The equations are pooled for estimation with seemingly unrelated regression (SUR), where heteroscedasticity and error correlation between the different sub-periods are allowed for.

The variables, using the notation of Table 2, are the following and have mostly already been introduced in Section 2: $\Delta \log GDP$, the average annual growth rate of real per capita GDP (in constant PPP); $\log GDP_0$, the logarithm of real per capita GDP (in constant PPP) in the initial year; $GC$ denotes the average share of government consumption in GDP; $GFCF$ denotes the average share of investment (gross fixed capital formation including changes in inventories) in GDP; $PRIM$ is an indicator of primary school education; $TT$ is the average sum of exports and imports divided by GDP; $X$ denotes the average share of exports in GDP and $POPG$ is the average population growth rate. A number of the equations also contain dummies: $D_1$ is a dummy for the first period (1960–69) which was a period of very rapid growth (with annual real per capita GDP growth rate in the EU14 of 4.10 percent); a dummy for Ireland, $DIRL$, which has an average growth rate over the period 1960–2001 of 4.11 percent; and a dummy for unified Germany, i.e., a dummy for Germany for the period 1990–2001 only, $D_{GER}$. Taking average values of the independent variables is quite common in the literature. However, specifications that are based on the values of the independent variables over the first year are also commonly used, since these specifications may help to overcome potential endogeneity problems when using period averages (especially with respect to investment variables). In Table 2 we report four equations that are based on initial values for the independent variables, labelled with the suffix $\text{in}$. It turns out that in our case the results obtained from period average specifications and from initial period specifications are rather similar.

For most of the variables the expected signs of the coefficients have already been discussed in Section 2. Only exports and population growth still need to be discussed. The reason for including exports in a growth equation is quite similar to including total trade, namely the positive effect of trade on growth. Including exports instead of total trade puts particular emphasis on so called export-led growth. Thus, a positive coefficient is expected for this variable. Increasing the population growth rate has a negative impact on per capita GDP growth, since with growing population $ceteris paribus$ GDP has to be divided among a larger population. Hence a negative coefficient is expected. We have also experimented with other educational variables, like secondary school education indicators or the ratio of secondary to primary schooling, but of all education variables only $PRIM$ turns out to be statistically robust.

The results in Table 2 are all in line with the theoretical predictions, again confirming the fact that the growth (and convergence) process in the ‘old’ European
Union can be satisfactorily described by neoclassical growth theory and growth equations derived therefrom. The ‘quality’ of the estimated equations can, of course, be assessed by comparing the actual growth rates over the four sub-periods with the values implied by the equations, i.e., the fitted values (for each of the 18 equations). Summarizing this vast set of results, the following main observations emerge. Averaged over the four periods, there are no significant differences in the mean percentage error (MPE) obtained from the 18 different equations, i.e., the null hypothesis of equal MPE across equations cannot be rejected. The MPE (over all periods and equations) is given by 8.4 percent with a standard deviation across equations of 1 percent and a standard deviation across the four periods of 6.2 percent. Thus, indeed, the main share of variation is due to varying fit – similarly for all equations – across periods. The mean percentage errors (over equations) for the four sub-periods are 6.5, 1.6, 16.6 and 9.0 percent. The fit is worst in the third period and best in the second. The latter fact is remarkable, since no equation includes dummies for the second period. It may also be interesting to see the absolute magnitude of the errors. The largest MPE of 16.6 percent, for the third period, results in an average error of 0.3 percent growth around the actual value of a 1.96 percent growth rate for the EU14 over the period 1980–89. For the second period, with the smallest MPE, the average error is given only 0.04 percent annual growth. It is important to note that there are no systematic differences in the performance of the different equations. This implies that in the growth analysis for the CEECs systematic differences will be attributable to the scenarios specified rather than the equations (see the discussion in Section 4 below).

Let us close this section by computing the implied growth rates for the EU14 countries from the above equations. The growth rates for the EU14 are computed as follows. Log per capita GDP values in 2001 and the values of all other explanatory variables for the last sub-period are inserted in the equations. The results are averaged over the 18 equations. To obtain also the growth rate for the EU14, the population weights in 2001 are used when averaging the country growth rates. We obtain an implied growth rate of the EU14 of 2.14 percent, which compares with actual growth rates of the EU14 over the periods 1970–79, 1980–89 and 1990–2001 of 2.83, 1.96 and 1.74 percent. In exactly the same way, for the cohesion countries Greece, Portugal and Spain a growth rate of 2.65 percent is found from averaging over the equations. This compares with an actual growth rate of these three countries of 2.37 percent over the period 1990–2001.

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13 A full set of detailed empirical results and statistical analysis of the results, primarily by means of analysis of variance (ANOVA), is available from the authors upon request in an additional appendix. Since there are no significant country-specific effects in the fit of the equations, we report here only briefly some results for the EU14 group.

14 The mean percentage error is defined as $MPE = \frac{1}{n} \sum_{i=1}^{n} \left( \frac{y_i - \hat{y}_i}{y_i} \right)^2$, with $y_i$ denoting the actual value and $\hat{y}_i$ the fitted value.
4. Growth and convergence scenarios

In this section the equations estimated in the previous section are used to generate growth rate projections for the CEEC10. To do so, assumptions concerning the explanatory variables have to be made. We choose scenarios for two variables, the government consumption share \((GC)\) and the investment share \((GFCF)\), and take actual values over the period 1991–2001 for the other variables. The assumed value for the population growth rate is zero. This is done since we assume that the population growth differential that emerged between the EU14 and the CEEC10 over the period 1991–2001 is only temporary. Thus, in the long-run we assume re-emergence of basically identical population growth rates. Assuming a population growth rate of zero keeps the population weights of the individual countries fixed at the same values as with identical growth rates for all countries.\(^{15}\)

We have chosen to base the scenarios on the two variables \(GC\) and \(GFCF\) only, because these are among the most important variables for growth and are also directly policy-relevant variables. Another variable that might have been used for scenario analysis is total trade. Taking average values over 1991–2001 for the growth scenarios means that the positive effects of trade are not fully reflected in the scenarios. Similarly, neglecting the dummies for the growth scenarios also contributes to scenarios that may be considered moderately optimistic.

A more substantial open issue is that the effects of EU structural funds payments are not taken into account in the scenarios. The European Commission itself has estimates ranging from 0.4 to 1.2 percent additional annual growth due to EU payments.\(^{16}\) This interval, if accepted as realistic, can be added to the growth rate scenarios derived in this paper. In a separate appendix the corresponding accelerated growth rate and convergence time distributions are discussed in detail. Later in this section we discuss the effect of this acceleration on the convergence times to 80 percent of real per capita GDP in the EU14.

The seven scenarios for the government consumption shares and investment shares we consider are displayed in Table 3. Scenario 1 is based on the actual country-specific values for \(GC\) and \(GFCF\) excluding early transition (see Table 4 for details including the periods chosen for averaging). Substantial variations across countries are evident, although in general relatively high government consumption and investment shares prevail. Note that the average over the values realized in the CEECs so far is closest to scenario 4 specified below.

All other scenarios employ identical values for \(GFCF\) and \(GC\) for all the CEEC10. Scenario 2 takes the values chosen by Fischer et al. (1998b) and is very similar to

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\(^{15}\) This assumption affects only 5 of the 18 equations.

\(^{16}\) It is not entirely clear how the Commission obtains this range. However, the average growth of Ireland is 0.7 percent higher since Ireland’s entry in the EU in 1973 than before. It thus seems that the Commission numbers are somehow based on positive historical experiences and the assumption that EU policy is indeed an important determinant for the growth process.
scenario 6, which is based on average values for South East Asian\textsuperscript{17} countries over the period 1980–95. Thus, these two scenarios reflect the values observed in South East Asia over the period of rapid economic growth. Note that growth in South East Asia has been driven substantially by factor accumulation. Scenarios 3 to 5 are based on values observed in peripheral incumbent EU member states over various sub-periods. Finally, scenario 7 is based on the values observed for Ireland over the period 1987–2001. Note that, contrary to the South East Asian experience, the Irish growth performance has been achieved with a relatively low investment rate and a relatively high government consumption share.

The Irish example also shows that in order to understand the growth mechanisms of catching-up economies in detail a more disaggregated analysis might be required. For instance it is important to disaggregate investment into greenfield foreign direct

\textsuperscript{17} South East Asia here denotes Indonesia, Japan, Malaysia, South Korea and the Philippines.
investment (which often embodies the latest technology) and domestic investment. Similarly, the effects of government consumption can only be understood better in a more disaggregated analysis. These tasks, despite their importance, are beyond the scope of this paper, which solely provides an aggregate view on the growth prospects.

The 18 equations combined with the 7 scenarios lead to 126 growth rate projections for each country. We display this information in two ways. The first is graphical, showing estimated densities for the growth rate distributions, and the second is numerical, displaying several characteristics of the distributions of growth rates (in Table 6).

In Figure 5 the estimated densities of the projected growth rates are displayed. All density estimations performed in this paper are based on Gaussian kernels with bandwidths chosen according to Silverman’s rule of thumb. Most of the densities are bi-modal with the larger probability weight surrounding the mode corresponding

![Figure 5. Density estimates of annual real per capita GDP growth rate projections](image-url)
to the higher growth rate. The means range from 3.05 percent for Slovenia to 3.52 percent for Romania (see Table 6). The standard deviation is between 0.4 and 0.49, i.e., in the vicinity of half a percent growth per year, for all countries. The table also displays skewness and kurtosis, both negative for all countries. Furthermore, the first and ninth deciles of the distributions are also displayed in the table. The observed bi-modality can be clearly traced back to the scenarios. This is not really surprising, given the observation made in the previous section, that there are no significant differences across the equations with respect to their fit for the EU14 countries. The results obtained with the 18 equations and the 7 scenarios can be studied in a similar way to that described in the previous section. The results, focusing on each country separately now, are very clear. The hypothesis of equal mean growth rate prediction from all equations cannot be rejected for any country. The null hypothesis of equal growth rate projections across the seven scenarios can, however, be rejected for each of the 10 countries. Furthermore, if one computes for each scenario the mean growth projection over the 18 equations for each of the countries, the ranking over scenarios turns out to be almost identical for all the countries. For all countries the highest and second highest mean growth projection over equations is derived from scenarios 2 and 6. The lowest mean is given by either scenario 1 or 7. For all countries scenario 4 results in the third lowest mean growth rate projection. Thus, we observe in the results the clear link between scenarios and growth projections that is inherent in our approach.

Scenarios 2 and 6, generating the highest projections, are as already mentioned very closely related. Both are based on very low government consumption shares and high investment shares. The intermediate values for the growth projections are obtained from scenarios 3 to 5, which are based on peripheral Southern and Western European countries’ experience over roughly the periods 1960–80 or 1987–2001 (scenario 4). The lowest mean growth rates are achieved with scenario 7 based on Ireland’s historical values over a period of extraordinarily rapid growth and scenario 1 based on the countries’ own historical values, which are generally characterized by higher government consumption shares and lower investment shares than spelled out in scenarios 2 and 6. The impressive growth experience of Ireland, occurring despite a relatively high government consumption share and low investment share, already makes clear that the mere levels of government consumption and investment cannot alone explain the growth performance of European countries at the beginning of the 21st century.

Successful growth strategies for the CEECs will entail a combination of factor intensive growth as experienced in particular in South East Asia, but also in Europe since the 1960s (with negative estimated coefficients on government consumption and positive coefficients for investment in all equations) and a less factor accumulation based growth as experienced in Ireland. It is not, however, possible to

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18 A detailed understanding of the forces that led to the rapid Irish growth experience will most certainly prove valuable for designing policy in the CEECs. This is, however, beyond the scope of this paper.
quantify the relative importance of factor accumulation based growth and Ireland-type growth for the CEECs without studying the growth process in great detail for each country separately. This is not within the scope of this paper, which uses an aggregate view to assess the likely range of the growth performance. What can be discussed, however, is the feasibility of certain policies or scenarios, in light of compatibility with the Stability and Growth Pact.

To substantiate this discussion with numbers, we display in Table 5 data on the budgetary position, the debt to GDP ratio and the current account for the CEEC10. The numbers are averages over the period 2000–2003, with the exception of the current account for Hungary(*), where due to missing data the value for 2003 is displayed. The data are from the AMECO database and are provisional from 2002 onwards.

Table 5. Budget balances, debt ratios and current account balance for the CEEC10

|     | BGR | CZE | EST | HUN | LVA | LTU | POL | ROM | SVK | SVN |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Budget | −0.29 | −7.56 | 1.09 | −5.68 | −2.22 | −1.96 | −3.25 | −2.99 | −6.91 | −2.38 |
| Debt  | 59.80 | 27.45 | 5.29 | 56.62 | 15.32 | 23.10 | 39.99 | 23.05 | 46.18 | 27.14 |
| CA    | −6.23 | −5.65 | −9.45 | −5.70* | −8.30 | −5.58 | −3.36 | −4.76 | −4.77 | −0.20 |

Notes: Budget denotes the budget position in percentage of GDP (‘−’ indicates a deficit); Debt is the ratio of SGP relevant debt to GDP in percent; CA denotes the current account in percentage of GDP. All quantities are averages over the period 2000–2003, with the exception of the current account for Hungary(*), where due to missing data the value for 2003 is displayed. The data are from the AMECO database and are provisional from 2002 onwards.

Table 6. Moment and quantile characteristics of the distributions of the real per capita GDP growth rate projections

|     | Mean | Std.Dev. | Skewness | Kurtosis | 10%  | 90%  |
|-----|------|----------|----------|----------|------|------|
| BGR | 3.42 | 0.49     | −0.40    | −1.29    | 2.76 | 3.94 |
| CZE | 3.22 | 0.44     | −0.04    | −1.14    | 2.62 | 3.76 |
| EST | 3.42 | 0.46     | −0.16    | −1.40    | 2.81 | 3.99 |
| HUN | 3.29 | 0.40     | −0.43    | −0.90    | 2.68 | 3.75 |
| LVA | 3.34 | 0.45     | −0.25    | −1.55    | 2.73 | 3.86 |
| LTU | 3.31 | 0.47     | −0.22    | −1.51    | 2.71 | 3.85 |
| POL | 3.21 | 0.46     | −0.21    | −1.50    | 2.57 | 3.75 |
| ROM | 3.52 | 0.40     | −0.44    | −1.07    | 2.95 | 3.96 |
| SVK | 3.33 | 0.42     | −0.14    | −1.18    | 2.73 | 3.83 |
| SVN | 3.05 | 0.49     | −0.01    | −1.27    | 2.44 | 3.66 |
(for a detailed discussion see Krugman and Obstfeld, 1994). Of course, the financing side of the current account deficits has to be analyzed in detail (given that growth in the CEECs is importantly driven by foreign direct investment). Also, after entry to the European Monetary Union, current account imbalances – which occur mainly with other EMU member states – may well be less important, since then exchange rate risk is zero and thus there is no danger of a revaluation of outstanding foreign debt. For our aggregate discussion, however, the current account balance may serve well enough as an indicator of the sustainability of the external financing contribution to the CEECs catching-up process.

Looking at Table 5 one thing becomes clear: there are substantial differences between the countries, primarily with respect to the budget position and public debt as a share of GDP and less with respect to the current account deficit. Note again that differences across countries are also present for actual government consumption and investment over the late transition period, as displayed in Table 4. Let us start with a discussion of the fiscal criteria. First, the debt to GDP ratio is for most countries below 40 percent. Only Bulgaria and Hungary are close to the 60 percent boundary specified in the Maastricht criteria and Slovakia has a debt to GDP ratio of about 46 percent (note for completeness that the EU14’s average debt to GDP ratio over the period 2000–2003 is 63.5 percent). Second, the fiscal deficit is above the 3 percent bound only for four countries, namely the Czech Republic, Hungary, Poland and the Slovak Republic. Estonia even runs a budget surplus and, again for comparison, the EU14 aggregate has a deficit of 1.14 percent over the period 2000–2003. Thus, Hungary and the Slovak Republic are the countries most likely to be constrained in their conduct of fiscal policy by the Maastricht criteria. For all other countries, substantial financing of public infrastructure and other public investment projects aimed at increasing the productive potential of the countries does not seem to be limited by the fiscal Maastricht criteria over the medium-run. The recent discussion on increasing the flexibility of the SGP also indicates that the fiscal criteria may not be too tight a constraint on policy in most of the CEECs. Thus, from this perspective, scenarios with relatively high investment rates (being the sum of private and public investment) appear feasible. Of course, these expenditures have to be financed. Like almost all countries that undergo a period of rapid development, the CEECs run rather large current account deficits, with the exception of Slovenia. Large current account imbalances imply by definition substantial repayment obligations. As long as the capital inflows are channelled into productive investments that generate the growth in future income required to repay foreign investors, this is a beneficial development process. Here, there is a link to fiscal policy. If fiscal policy runs large deficits not for financing investments but rather for consumption,

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19 The large fiscal deficit observed in the Czech Republic over the last years has to be adjusted as well. We interpret this, however, more as a cyclical problem than a constraint on the medium-run growth prospects. Also note that the Slovak Republic has put a substantial tax reform in place in 2004, with all tax rates set to 19 percent. The impact of this reform cannot yet be quantified.
then repayment will require particularly prudent policies later on. However, looking at Estonia again, a high current account deficit is observed simultaneously with a budget surplus. Other countries, the Slovak Republic for instance, are in a typical twin-deficit situation, with resulting pressures on fiscal policy. Thus, across the CEECs a large variety of policy options is seen to be implemented, which again indicates that a fully detailed understanding requires an in-depth study of each country.

Current account deficits increase the vulnerability to foreign shocks, if the current account deficit is financed by more volatile (short-run) flows, which could both trigger exchange rate crises (thus postponing EMU entry) and lead to inflationary pressures or even to a banking crisis (see Begg et al., 2003). Both, Begg et al. (2003) and Lipschitz, Lane and Mourmouras (2002) discuss the impact of current account imbalances on transition economies in detail and conclude that macroeconomic policy should aim to reduce the vulnerabilities induced by the exposure to global capital markets (for instance through especially prudent banking supervision), acknowledging that these risks cannot be fully eliminated.20

What are the implications of the above discussion for the plausibility and compatibility with the SGP of the specified scenarios? First, a concise analysis of the plausibility for each country in detail has to be performed at the country level. This does not come as a surprise, given the substantial differences across countries. Such an analysis is beyond the scope of this paper. Second, the fiscal criteria of the SGP do not fundamentally constrain growth policies of the CEECs, with the exception of Hungary and to a lesser extent the Czech and the Slovak Republics. This said, of course, fiscal discipline is important in all these countries, due to the impact of fiscal deficits on the current account and potential risks emerging from large current account imbalances and for many other reasons. The observed current account deficits up to now seem to be mainly used for financing investment rather than (public or private) consumption (see Roubini and Wachtel, 1998, or Begg et al., 2003). Therefore, we conclude that, for all countries in our sample, the span of options covered by the scenarios seems to cover reasonably well the range of potential policies implementable in the CEECs. In this sense, the growth rate densities depict the range of potential growth outcomes, which is exactly what we are interested in. A detailed country-specific analysis is necessary to construct particular scenarios.

It is fair to say that the more central scenarios 3 to 5 are all highly plausible and achievable, if one looks at the government consumption shares and investment shares they are based on. These values are related to the actual path observed so far and thus do not necessitate too dramatic policy changes, as would be required by the more extreme scenarios. Thus, one of our point ‘estimates’ is given by the mean predictions. In order to show also the outcome of more ambitious policy choices, we discuss in detail an optimistic scenario, based on the ninth decile of the

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20 An earlier study of Roubini and Wachtel (1998) points out all potential problems associated with current account imbalances in transition economies. They also find that short-term portfolio inflows are relatively small in the first period of transition, limiting the possibility of sudden speculative outflows.
growth rate distributions. Loosely speaking, the difference between the two scenarios may be seen as a measure of the effect of strictly growth oriented policy.

The logic of basing the growth rate projections on linear growth equations estimated for the EU14, implies that poorer CEE countries are ceteris paribus projected to grow faster. It is therefore stressed at this point that these growth projections should best be viewed as linear approximations to the non-linear convergence process, towards the EU14 income levels, that the CEEC10 are likely to be experiencing. Perhaps more revealing than displaying the distributions of projected growth rates is a discussion of the implied convergence times. A discussion of convergence times requires the definition of the convergence level (for example 80 percent of income), the group of countries with respect to which convergence is measured (EU14, EU24 or C3) and also a growth assumption for the target country group. In this section we compute convergence times based on an assumed annual growth rate of real per capita GDP of 1.74 percent for the EU14 and 2.37 percent for the C3.21 Population weights are assumed constant at their 2001 levels. Note for completeness that these assumptions are also sufficient to compute convergence times with respect to the EU24.

Let us next discuss in detail the convergence time distributions of the CEECs to a level of 80 percent of real per capita GDP of the EU14. Figure 6 displays the densities. Following from the bi-modality of the growth rate distributions, the convergence time distributions are also bi-modal, although to a lesser extent. Some of the densities are relatively flat, corresponding to large standard deviations (see Table 7 for some characteristics of the distributions). For instance for Romania, with the largest mean convergence time of 71.4 years and a standard deviation of 18.9 years, the first decile of the distribution is at 54.1 years and the ninth decile is at 100.2 years. This compares with a mean convergence time of 9.4 years for Slovenia (with a standard deviation of 4.3 years) and first and ninth decile at 5.4 and 14.8 years, respectively. Thus, indeed, the uncertainty surrounding convergence projections is substantial.

In Table 8 we display the effect that the acceleration of the growth rate projections by 0.4 and 1.2 percent has on the mean convergence times to 80 percent of the level prevalent in the EU14. Adding 0.4 percent annual growth reduces the mean convergence time by between 20 percent for Romania and 29 percent for Slovenia. Adding 1.2 percent reduces the convergence times by about 45 to 55 percent.

In Table 9 we display the results for the two scenarios, the mean scenario and an optimistic scenario, in detail. We display in the table the convergence times to 100 percent, again 80 percent and 64.7 percent of the EU14; to 100 percent of the EU24 and to 100 percent of the C3 per capita GDP levels. 64.7 percent is chosen because this is the level of Portugal and Spain with respect to the incumbent member states.

21 In a separate appendix available upon request we report similar results when the growth rate assumptions concerning the EU14 and the C3 are chosen to be the average values predicted from the equations, namely 2.14 and 2.65 percent. Obviously, the convergence times are then larger.
when they joined the EU in 1986. There is probably no need to discuss all the numbers in this table in detail, but a few important observations can be made. The difference in convergence times between the mean and the optimistic scenario is about a third on average. Thus, we see that the reduction in convergence time between the mean and the optimistic scenario is about as large as the effect that the European Commission attributes to its policy effects. We, hence, find that domestic policy and EU policy may have effects of roughly the same magnitude. This seems plausible, given the high degree of integration within the European Union and the sizeable regional and structural policy measures adopted by the European Union. Since Slovenia has already surpassed the 64.7 percent relative

Figure 6. Density estimates of convergence time distributions to 80 percent of EU14 real per capita GDP

Note: The distributions are based on an assumed growth rate of real per capita GDP in the EU14 of 1.74 percent. The countries are indicated in the boxes with the abbreviations used throughout the paper.
level, the convergence times to this level are negative for Slovenia and by construction more negative for the faster growth rate at the ninth decile of the growth rate distribution for Slovenia.

Another interesting observation, that shows the limitations of a linear approach to convergence time computations, is the comparison of the rows corresponding to 100 percent income levels relative to EU14 and to EU24. Except for Slovenia and the Czech Republic, the two countries with the shortest expected convergence times, convergence to 100 percent of the income levels in the EU24 takes longer than convergence to 100 percent of EU14 income levels. This stems from the purely

Table 7. Moment and quantile characteristics of convergence time distributions for convergence to 80 percent of real per capita GDP in the EU14

|       | Mean  | Std.Dev. | Skewness | Kurtosis | 10%   | 90%   |
|-------|-------|----------|----------|----------|-------|-------|
| BGR   | 65.3  | 23.8     | 1.17     | 0.56     | 44.9  | 97.4  |
| CZE   | 21.1  | 7.1      | 0.87     | −0.25    | 13.9  | 31.9  |
| EST   | 45.2  | 14.2     | 0.80     | −0.35    | 31.0  | 64.5  |
| HUN   | 30.8  | 9.9      | 1.13     | 0.08     | 21.9  | 46.7  |
| LVA   | 59.0  | 18.9     | 0.65     | −1.03    | 40.6  | 88.2  |
| LTU   | 52.2  | 17.8     | 0.70     | −0.88    | 35.0  | 77.2  |
| POL   | 54.8  | 19.9     | 0.70     | −0.93    | 35.7  | 85.1  |
| ROM   | 71.4  | 18.9     | 1.08     | 0.27     | 54.1  | 100.2 |
| SVK   | 32.9  | 9.9      | 0.81     | −0.43    | 23.0  | 48.1  |
| SVN   | 9.4   | 4.3      | 1.19     | 1.10     | 5.4   | 14.8  |

Note: The distributions are based on the assumption of a real per capita GDP growth rate in the EU14 of 1.74 percent.

Table 8. Mean convergence times to 80 percent of real per capita GDP in the EU14

|       | BGR | CZE | EST | HUN | LVA | LTU | POL | ROM | SVK | SVN |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|       | 65.3| 21.1| 45.2| 30.8| 59.0| 52.2| 54.8| 71.4| 32.9| 9.4 |
| +0.4% | 50.6| 15.9| 35.3| 23.7| 45.5| 39.9| 41.1| 57.1| 25.5| 6.7 |
| +1.2% | 35.3| 10.8| 24.8| 16.3| 31.6| 27.5| 27.7| 41.0| 17.7| 4.3 |

Note: The first line displays the mean of the already discussed convergence time distributions, the second and third lines display the mean of the accelerated convergence time distributions, obtained by adding 0.4 and 1.2 percent, respectively to the 126 annual growth rate projections for the CEECs. The convergence times are based on the assumption of a real per capita GDP growth rate in the EU14 of 1.74 percent.
algebraic effect that the CEEC10 are growing significantly faster in these scenarios than the EU14, which implies that in the very long-run the average income in the CEEC10 is larger than in the EU14. This effect is also present in the last row, where convergence with respect to the C3 is displayed. Although the C3 are starting at a lower income level than the EU14, they are assumed to grow faster than the EU14 on average, which leads to the long convergence times of the CEEC10 towards the C3.

It is important to keep these limitations stemming from a linear approximation in mind. Therefore it may be most plausible to focus on the convergence time distributions with respect to lower relative income levels like 64.7 or 80 percent.

5. Summary and conclusions

In this paper we have discussed the necessity of an indirect approach in assessing the growth and convergence prospects of CEECs. This arises for two reasons. First, it has been shown that the growth process (of the CEEC10) over the period 1991–2001 is not well described by the long-run growth forces as identified by neoclassical
growth theory. It is unlikely that this non-standard behaviour of the growth process, which is due to the special circumstances prevalent in transition economies, continues to shape the growth process in the medium- to long-run. Thus, further on-going structural changes render growth projections based on the historical observations of the last decade misleading. Second, for the group of countries investigated, recent membership of the European Union influences the growth prospects of these economies significantly. Growth projections for the CEEC10 have to take these effects into account.

The indirect approach to the two issues proposed in this paper is to base growth projections for the CEEC10 on growth equations estimated for the ‘old’ EU member states. The validity of this calibration approach is a key question to be addressed. The small economic size of the CEEC10 compared to the EU14, the close links in trade of goods and assets, as well as the systemic convergence that the CEEC10 are undergoing with respect to the incumbent EU member states, have been discussed as arguments in favour of a calibration of the growth process of the CEEC10 to the EU14.

Previous studies that employ a similar approach differ in two respects. First, equations are often estimated for large worldwide country datasets including many countries that are essentially unrelated to the CEECs. Second, the uncertainty inherent in growth projections has not previously been addressed. We address the uncertainty by specifying eighteen economically meaningful growth equations and seven plausible scenarios for the evolution of two key variables, the government consumption share and the investment share. All other explanatory variables are taken at their country-specific averages over the period 1991–2001. The resulting 126 growth rate projections for each country yield empirical distributions of the growth rate projections. These distributions form the basis for assessing the uncertainty of the CEEC10 growth projections.

The uncertainty in the growth rate projections gives rise to a standard deviation of about half a percent growth per year for all countries. The growth rate distributions are all skewed and bi-modal. The bi-modality is due to the scenarios that have been specified. The highest growth rates are derived from the scenarios paralleling the period of high growth in South East Asia, with very low government consumption shares and very high investment shares. The scenarios based on the cohesion country experience lead to outcomes in the centre of the growth rate distributions. We have explicitly discussed the compatibility of the scenarios with the Stability and Growth Pact, and have concluded that in particular the more central scenarios are achievable for all countries without a conflict with the SGP criteria. However, the SGP criteria may imply some constraint on economic policy for Hungary, and to a lesser extent for the Czech and Slovak Republics. To find the most likely scenario for each of the countries requires an in-depth analysis for each country separately. This is indeed an interesting research question, that may be seen as a follow up of our aggregate study.

The largest mean growth rate is projected for Romania with 3.52 percent and the lowest for Slovenia with 3.05 percent. Based on the growth rate distributions,
convergence time distributions are also computed. These require an assumption concerning the future growth rate of the target country group, in our examples the EU14, the EU24 and the C3 (Greece, Portugal and Spain). These groups of countries are assumed to continue to grow at the average per capita GDP growth rate observed over the period 1990–2001, 1.74 percent (EU14) and 2.37 percent (C3). In particular we have displayed convergence time distributions to 80 percent of real per capita GDP in the EU14 (Figure 6).

Convergence to high relative income levels with respect to the EU14 (and similarly with respect to the EU24 or the C3) is for most of the countries a long-run perspective. Only for Slovenia (with a mean predicted convergence time to 80 percent of EU14 real per capita GDP of 9 years and a standard deviation of 4.3 years) and for the Czech Republic (with a mean of 21 years and a standard deviation of 7.1 years) is convergence a goal likely to be achieved within a generation. The largest mean convergence time is projected for Romania with 71.4 years with a standard deviation of 18.9 years. The availability of convergence time distributions allows us to study a variety of selected scenarios. In addition to the mean scenario, the paper discusses in detail a so-called optimistic scenario, based on the first deciles of the convergence time distributions. The difference in convergence times between the mean and the optimistic scenario is found to be roughly a third.

The results have to be interpreted with caution, since they are based on a linear approximation of the convergence process. Future research is directed towards overcoming this limitation, which in the long-run leads by construction to the CEEC10 being richer countries than the EU14. Results of this type are inherent limitations of a linear approach, which by construction is only a local approximation to the non-linear convergence process. It is therefore more plausible to focus on convergence with respect to lower relative income levels like 64.7 or 80 percent.

References

Barro, R. J. (1991). ‘Economic growth in a cross-section of countries’, Quarterly Journal of Economics, 106, pp. 407–45.
Barro, R. J. (1997). Determinants of Economic Growth: A Cross-Country Empirical Study, Cambridge, MA: MIT Press.
Barro, R. J. and Sala-i-Martin, X. (1992a). ‘Convergence’, Journal of Political Economy, 100, pp. 223–51.
Barro, R. J. and Sala-i-Martin, X. (1992b). ‘Regional growth and migration: A US – Japan comparison’, Journal of the Japanese and International Economies, 6, pp. 312–46.
Barro, R. J. and Sala-i-Martin, X. (1995). Economic Growth. New York: McGraw-Hill.
Baumol, W. J. (1986). ‘Productivity growth, convergence and welfare: What the long run data show’, American Economic Review, 76, pp. 1072–1085.
Begg, D., Wyplosz, Ch., Eichengreen, B., Halpern, L. and von Hagen, J. (2003). ‘Sustainable regimes of capital movements in accession countries’, CEPR Policy Paper No. 10, London: CEPR.
Ben-David, B. (1993). ‘Equalizing exchange: Trade liberalization and income convergence’, Quarterly Journal of Economics, 108, pp. 653–79.
Ben-David, B. (1996). ‘Trade and convergence among countries’, Journal of International Economics, 40, pp. 279–98.
Berg, A., Borensztein, E., Sahay, R. and Zettelmeyer, J. (1999). ‘The evolution of output in transition economies: Explaining the differences’, IMF Working Paper No. 99/73, Washington, DC: IMF.
Bernard, A. B. and Durlauf, S. N. (1995). ‘Convergence in international output’, Journal of Applied Econometrics, 10, pp. 97–108.
Bernard, A. B. and Durlauf, S. N. (1996). ‘Interpreting tests of the convergence hypothesis’, Journal of Econometrics, 71, pp. 161–73.
Blanchard, O. and Kremer, M. (1997). ‘Disorganization’, Quarterly Journal of Economics, 112, pp. 1091–1126.
Campos, N. F. (2000). ‘Back to the future: The growth prospects of transition economies reconsidered’, ZEI Working Paper B13, Rheinische-Friedrich-Wilhelms-Universität Bonn: Center for European Integration Studies.
Campos, N. F. and Coricelli, F. (2002). ‘Growth in transition: What we know, what we don’t and what we should’, Journal of Economic Literature, 40, pp. 793–836.
DeBroeck, M. and Koen, V. (2000). ‘The ‘Soaring Eagle’: Anatomy of the Polish take-off in the 1990s’, IMF Working Paper No. 00/6, Washington, DC: IMF.
DeLong, J. B. (1988). ‘Productivity growth, convergence and welfare: A comment’, American Economic Review, 76, pp. 1138–1155.
DeMelo, M., Denizer, C., Gelb, A. and Tenev, S. (1997). ‘Circumstance and choice: The role of initial conditions and policies in transition economies’, Washington: International Finance Corporation.
Durlauf, S. N. and Quah, D. T. (1999). ‘The new empirics of economic growth’, in Taylor, J. and Woodford, M. (ed.), Handbook of Macroeconomics, North-Holland: Amsterdam.
Estrin, S. and Urga, G. (1997). ‘Convergence in output in transition economies: Central and Eastern Europe, 1970–95’, CEPR Discussion Paper No. 1616, London: CEPR.
Fischer, S. and Sahay, R. (2000). ‘The transition economies after 10 years’, IMF Working Paper No. 00/30, Washington, DC: IMF.
Fischer, S., Sahay, R. and Vegh, C. A. (1998a). ‘From transition to market: Evidence and growth prospects’, IMF Working Paper No. 98/52, Washington, DC: IMF.
Fischer, S., Sahay, R. and Vegh, C. A. (1998b). ‘How far is Eastern Europe from Brussels?’ IMF Working Paper No. 98/53, Washington, DC: IMF.
Havrylyshyn, I., Ivorski, I. and van Rooden, R. (1998). ‘Recovery and growth in transition economies 1990–97: A stylized regression analysis’, IMF Working Paper No. 98/141, Washington, DC: IMF.
Krugman, P. and Obstfeld, M. (1994). International Economics: Theory and Policy, Third Edition, New York, NY: Harper Collins.
Kornai, J. (1994). ‘Transformational recession: The main causes’, Journal of Comparative Economics, 19, pp. 39–63.
Levine, R. and Renelt, D. (1992). ‘A sensitivity analysis of cross-country growth regressions’, American Economic Review, 82, pp. 942–63.
Lipschitz, L., Lane, T. and Mourmouras, A. (2002). ‘Capital flows to transition economies: Master or servant?’ IMF Working Paper No. 02/11, Washington, DC: IMF.
Quah, D. T. (1996a). ‘Regional convergence clusters across europe’, European Economic Review, 40, pp. 951–58.
Quah, D. T. (1996b). ‘Empirics for economic growth and convergence’, *European Economic Review*, 40, pp. 1353–1375.

Quah, D. T. (1997a). ‘Regional cohesion from local isolated actions: I. Historical outcomes’, *Centre for Economic Performance Discussion Paper No. 378*, CEP, London: London School of Economics and Political Science.

Quah, D. T. (1997b). ‘Regional cohesion from local isolated actions: II. Conditioning’, *Centre for Economic Performance Discussion Paper No. 379*, London: The London School of Economics and Political Science, CEP.

Quah, D. T. (1997c). ‘Empirics for growth and distribution: Stratification, polarization and convergence clubs’, *Journal of Economic Growth*, 2, pp. 27–59.

Roubini, N. and Wachtel, P. (1998). ‘Current account sustainability in transition economies’, *NBER Working Paper No. 6468*, Cambridge, MA: NBER.

Sala-i-Martin, X. (1990). ‘On growth and states’, Dissertation Harvard University.

Sala-i-Martin, X. (1997). ‘I just ran two million regressions’, *American Economic Review*, 87, pp. 178–83.

Wagner, M. and Hlouskova, J. (2002). ‘The CEEC10s real convergence prospects’, *CEPR Discussion Paper in Transition Economics No. 3318*, London: CEPR.
Appendix

Data and sources

Table A1. Data: Variables, definitions and sources

| Name  | Definition                                                                 | Source     |
|-------|---------------------------------------------------------------------------|------------|
| GDP   | GDP per capita, constant 1999 US$ (EKS PPP)                                | GGDC       |
| GC    | General government final consumption expenditure (% of GDP)               | WDI        |
| GFCF  | Gross fixed capital formation (% of GDP)                                  | WDI        |
| PRIM  | Primary school enrollment (% gross)                                       | WDI        |
| TT    | Trade (% of GDP)                                                          | WDI        |
| X     | Exports of goods and services (% of GDP)                                  | WDI        |
| POP   | Midyear population                                                        | OECD       |
| Budget| Budget position (% of GDP)                                                | AMECO      |
| Debt  | Public debt (according to SGP) (% of GDP)                                 | AMECO      |
| CA    | Current account (% of GDP)                                                | AMECO      |

Note: GGDC denotes the Groningen Growth and Development Center at the University of Groningen, WDI denotes the World Development Indicators (2003) and AMECO is the annual macro-economic database of the European Commission’s Directorate General for Economic and Financial Affairs (DG ECFIN).