Pilgrims to the Eurozone: How Far, How Fast?

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Abstract

This paper examines convergence of recent European Union (EU) members to the EU standards. Novel features of the paper include more complete measures of convergence, in particular fiscal convergence, a broader examination of inflation convergence with respect to the Maastricht benchmark as well as the European Central Bank's inflation objective, and more appropriate tests of convergence, allowing for structural breaks. The results indicate slow but steady per-capita income convergence towards the EU standards. We find significant inflation and interest rate convergence. However, progress on fiscal convergence is discouraging, indicating lack of fiscal sustainability. An important policy implication of the results is that current fiscal practices may delay the new members' entry to the Exchange Rate Mechanism II (ERM2) and hence their adoption of the euro. Authorities need to better coordinate monetary and fiscal policies to address their reasons for lack of fiscal convergence and, therefore, they should not to rush to enter the Eurozone.

Keywords: convergence, European Union, integration, fiscal discipline, transition, Eurozone

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1. Introduction and Motivation

In May 2004, ten new members joined the European Union (EU). Eight of them were Central and Eastern European countries (hereafter CEE8), namely the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, the Slovak Republic, and Slovenia. The other new members were Cyprus and Malta. These countries all must join the Eurozone at some point when they satisfy the Maastricht criteria. Although EU accession leaves new members some freedom to select how to link their national currencies to the euro, policymakers in the new member countries appear to be inclined to adopt the euro sooner rather than later (McKinnon, 1999, Buiter and Grafe, 2002, and Buiter, 2004). The sooner that the new EU countries complete their restructuring process and become more like the core EU members in terms of a broad range of macroeconomic indicators, the more likely they are to adopt unilaterally the euro (e.g., Salvatore, 2004). This paper quantifies where the new members stand in terms of the convergence process and, based on a comprehensive analysis of all new EU countries, outlines specific risks that must be overcome in the process of these countries' joining the Eurozone.

One of the ways to test the convergence of the new members towards the EU is to measure their level of economic development in terms of GDP per capita relative to the EU average, as well as their distance from convergence criteria set in the Maastricht Treaty. Real per-capita income convergence is the ultimate objective of economic integration. In the spirit of the neoclassical growth model, the convergence of new member countries' per capita GDP to the levels of the core EU countries suggests a significant improvement in the standard of living of citizens of the new countries. In addition, monetary convergence has significant implications for interim optimal exchange rate and monetary policies before a formal link to the euro. But perhaps most importantly, we believe that prudent fiscal performance is the most important condition for the new members to satisfy before adopting the euro.

The empirical literature on real and monetary convergence, which is reviewed in the next section, yields mixes results. The results are sensitive to the sample period used, selection of countries, and the methodology employed. This paper takes an innovative and comprehensive approach to the issue of convergence. We carry out an inclusive study that covers all the recently admitted ten EU members to examine not only nominal and real economic convergence, but also fiscal convergence. We contribute to the related literature of nominal and real convergence in several unique

ways. First, in a spirit of a PPP based approach, we start with measuring real convergence in terms of an aggregate output expressed in a common currency (euro). Previous studies measure convergence based solely on domestic currency using official exchange rates; to our best knowledge, this is the first study to use such an approach. There are two good reasons to use the common currency approach. First, it makes economic sense to use the common currency approach because firms in the new EU economies are selling and will sell more and more in euro markets. As von Hagen and Hofmann (2004) argue, "it is the aggregate euro-area price level that matters for them" (p. 18), Given the large degree of market integration in the euro area, it makes more sense to use euro area prices, rather than national currency, to gauge aggregate demand in the euro area, which, given a production level, directly affects real GDP. In addition, most of the new EU members already tie their national currencies to greater or lesser extent to the euro since such arrangements benefit their economic integration through extensive international trade. The second reason is political: the CEE8 countries only recently emerged from their transition past and their citizens do not share equal sentiments with respect to the monetary subordination; this is namely because of the fear of increase in prices after adopting the euro. For this reason a finding of faster convergence measured in a common currency than the one in domestic currency would create a stronger argument in favor of entering the EMU sooner than later.

Second, we take an innovative approach to measuring inflation convergence from two different angles by using two benchmarks. The first is framed in terms of a strict interpretation of the well-known Maastricht inflation criterion. The second reflects the European Central Bank's (ECB) price stability approach, which excludes inflation "outliers" when computing the inflation benchmark. Because several new EU member states, i.e., the Czech Republic, Hungary, and Poland, have already adopted a regime of inflation targeting as a disinflation tool, results from the ECB's inflation target tests allow us to infer whether the new members, at least, those that adopted an inflation targeting regime, are ready to follow an inflation targeting approach that is similar to the ECB's. Considering convergence towards both benchmarks potentially affects the admission process into the Eurozone. For instance, it is frequently argued that the inflation targeting regime is incompatible with an exchange rate band arrangement (see Mishkin 2004); ERM2 is such arrangement, and confirming to it is one of the Maastricht conditions. Further, an individual member's

inflation rate will differ depending on which inflation policy, the Maastricht criterion or the ECB's inflation approach, is followed, affecting the entry dates to the Eurozone, especially of countries with fiscal indiscipline

Third, in conjunction with the above arguments, and for the first time in the literature, we test for fiscal convergence. Previous work, which mainly focused on monetary and real convergence, neglected this issue. However, several observers raised concerns about the fiscal indiscipline in some new members. For example, Berger et al. (2004) point out that the deteriorating fiscal performance, especially in Central European countries, may constrain these members from satisfying the Maastricht criteria successfully because large fiscal deficits can create inflationary pressures. Further arguments in the same spirit are voiced by De Grauwe and Schnabl (2004b). More important and related to our findings, Buiter (2004) argues that achieving fiscal sustainability is not only a necessary but also a sufficient condition for the new EU members to achieve full EMU membership.

Fourth, we use a novel and what we consider to be the most appropriate methodology to analyze the issue of "catching up" of the new entrants to the older EU members. Until recently, the cross-sectional tests used to analyze absolute convergence were criticized for over-rejection of the null hypothesis of no convergence (Bernard and Durlauf, 1996), shifting the emphasis to conditional and stochastic convergence. However, the need to meet the EU criteria for full EMU membership has regenerated interest in absolute convergence. A recent test developed by Vogelsang (1998, 1999) and applied in the context of Carlino and Mills (1993) by Tomljanovich and Vogelsang (2002) is particularly suitable for analyzing absolute convergence. In addition to the flexibility of this test, which is able to derive convergence estimates reliably, it is also possible to allow for structural breaks, which is critical in drawing correct inferences about convergence. The growing literature[1] on the presence of structural breaks in emerging economies further motivates and validates the appropriateness of this methodology. Using this methodology also allows checking the robustness of previous studies' findings of nominal and real convergence.

In assessing real convergence, we use a widely recognized measure, namely real GDP per-capita. However, almost all previous studies used industrial production

[1] Dibooglu and Kutan (2001), Fidrmuc and Tichit (2004), Kočenda (2005) among others.

as a proxy for GDP in measuring real convergence (see the next section). Real GDP per-capita is a better measure of living standards because industrial production represents a narrow measure of economic activity and changes in industrial production is more cyclical than is GDP. Real GDP per capita convergence is measured with respect to two benchmarks: (1) Germany's per-capita GDP as a benchmark for the EU core and (2) an average of the last six EU15 members per-capita GDP's as a proxy for the EU periphery.[2] Further, the real GDP per-capita is measured in euros as well as in a local currency to analyze the impact of exchange rate effects on convergence.

For nominal convergence we use benchmarks based on the Maastricht criteria.[3] We first test for monetary convergence, measured in terms of inflation and interest rates. Aside from the two benchmarks derived from the Maastricht criterion (that we define presently in the Section 4.2), we test for inflation convergence with respect to (1) inflation in Germany and (2) average inflation in six periphery member states. Due to the lack of comparable long-term interest rates for the new EU countries, we only provide a graphical treatment of the interest rate convergence rather than undertaking formal empirical tests.[4] Next, we investigate fiscal convergence with respect to the benchmarks of (1) fiscal deficit up to 3% of GDP and (2) national debt up to 60% of GDP. In addition, we test whether any of the accession countries are performing like the EU countries by using a third criterion: the deficit and debt ratios as percentages of the (old) EU GDP. This tells us whether the accession countries are as disciplined fiscally as are the EU15 countries.

In the next section, we provide a review of the literature. Section 3 describes our methodology and data. Empirical results are reported in Section 4. The last section concludes with policy implications of the results.

[2] Austria, Finland, Greece, Portugal, Spain, Sweden.
[3] The Maastricht criteria require that: the national central bank of the country should be independent, the country's currency should have participated without stress in the Exchange Rate Mechanism for at least two years, the country's inflation rate should have been below a reference value given by a range of 1½ percentage points above that of the best three inflation performers, the country's long-term interest rate should have been within two percentage points of that of the three best inflation performers, the ratio of the budget deficit to gross domestic product (GDP) should not exceed 3%, and its debt-to-GDP ratio should not exceed 60%. In our analysis we use two monetary and two fiscal criteria and leave the question of exchange rate stability and central bank independence aside.
[4] For many new EU members comparable long-term instruments exist only from the late 1990's. For Estonia it does not exist yet.

2. A Brief Review of Literature

Convergence of the new EU members towards the core EU has been studied from two major angles. One strand of the convergence literature is based on the concept of the optimal currency area (for a recent survey, see Horvath, 2003, and Fidrmuc and Korhonen, 2004a). The seminal paper by Bayoumi and Eichengreen (1993) form the methodological basis of much of this work on this issue. These authors test whether EU members displayed sufficient correlation of their supply (real) and demand (monetary) shocks over the period 1960-1988. They find that their sample of EU member countries divided into a core group for which the magnitude and correlations of shocks seem to meet the criteria for the existence of an optimal currency area and a group of outsider countries for which the correlation of shocks with the core group was so weak as to suggest that the conditions for their participating in an optimal currency area made up of the core countries were not met. Korhonen and Fidrmuc (2001) update the findings of Bayoumi and Eichengreen. They find that a number of the countries that failed to meet the convergence criteria for membership in an EU-based optimal currency area during Bayoumi and Eichengreen's sample period now displayed considerably more convergence, and hence could be considered as potential members of an EU optimal currency area.[5] In a follow-up study, Fidrmuc and Korhonen (2004b) find that the economic slowdown between 2000 and 2002 increased the heterogeneity of business cycles between the euro area and the new EU members. Boone and Maurel (1998, 1999) report that business cycles in the new EU members are similar to the euro area cycles, suggesting that the full EMU membership would be fruitful. Based on a time- varying analysis of the correlation of demand and supply shocks, Babetskii et al. (2004) report significant convergence of demand shocks, but divergence of supply shocks.[6] Horvath and Rátfai (2004) show that shocks among the core and the candidate EU countries tend to be uncorrelated. Sayek and Selover (2002) find that EU-wide shocks have a relatively small influence on business cycles in Turkey.

A second strand of the literature focuses on the nominal convergence of the candidate countries and the existing EU members. Brada and Kutan (2001) examine

[5] Giannetti (2002) provides account of the coexistence of convergence across countries and the lack thereof at the regional level in the European Union based on the different specialization level in various regions.

[6] The issue of aggregate demand and supply shocks with regard to the monetary transmission mechanism within the European Monetary Union itself is recently investigated by Vlaar (2004).

monetary policy convergence between the candidate economies and the EU, proxied by Germany, and find no convergence between base money in Germany and the transition-economy candidates for EU membership. Janáčková (2000), Richards and Tersman (1996), and Backé et al. (2003) find weak price-level convergence between the EU and the transition-economy candidates. Kočenda (2001), Kutan and Yigit (2004a, b), Brada et. al (2005) study not only nominal level convergence, but also real convergence. Kočenda (2001) examines real convergence based on industrial output and monetary convergence using data on producer price index, consumer price index, narrow money, and nominal and real interest rates during the period from January 1991 to December 1998. His results indicate considerable real and monetary convergence. In considering a more stable, post-1993 period, and adopting a more recent panel estimation approach, Kutan and Yigit (2004) find less convergence than does Kočenda. Kutan and Yigit (2005) observe that price and monetary convergence of the new EU members to the core EU standards is quite idiosyncratic. Brada et al (2005) use rolling cointegration tests of real and nominal convergence, to conclude that a peg to the euro soon after accession is feasible for the East European countries, but the benefits of joining the Eurozone are as yet limited.

Overall, the results on nominal and real convergence seem mixed. Besides different sample periods and country coverage used, the divergences in results appear to be driven by different methodologies. In addition, structural breaks in series may further distort the findings. We already mentioned that there exists an empirical evidence of structural breaks in many economic indicators portraying the landscape of transition and pre-accession process in the CEE countries. Not to mention the fact that the transition alone represented a massive structural shift by definition. Therefore, a comprehensive study including the entire new EU members and a methodology that detects structural breaks are necessary to draw more reliable inferences about convergence.

3. Methodology and data

3.1 Convergence methodology

The analysis of convergence has been an active but challenging field of interest since the late 1980s.[7] A variety of methods has been used to analyze different measures of

[7] For recent discussions, see Taylor (1999) and de la Fuente (2002).

convergence, namely absolute or conditional β-convergence, sigma convergence, and stochastic convergence. While the former types analyzed the issue of catching up, the latter and more recent focused on the synchronization of shocks and cross-sectional units moving together in time. The enlargement of the EU has motivated researchers and policymakers to revisit the issue of "catching up" of the new entrants to the core EU members. Carlino and Mills's (1993) argument that both β- and stochastic convergence are necessary for real convergence further motivated the literature on β-convergence. Cross-sectional tests, which were used to analyze β-convergence until recently, were criticized on the grounds of over-rejecting the null hypothesis of no convergence (Quah, 1996; Bernard and Durlauf, 1996).

A new test by Vogelsang (1998, 1999) and Tomljanovich and Vogelsang (2002) deals with the β-convergence issue by relying on time-series methodology. Following this literature, we consider a simple model of convergence towards a benchmark as

$$y_t = \mu + \delta t + u_t \tag{1}$$

where y_t is the difference of the natural logarithm of a variable minus a benchmark, in our case, for example, the per capita GDP of country i minus the European benchmark at time t would be the y_t variable, while μ is an intercept to capture the initial level of the deviation, t is a deterministic time trend, and u_t is the residual term. In such a set-up, β-convergence requires that for countries where μ is initially significantly negative, so the country is lagging behind, the trend coefficient δ should be positive and statistically significant. Carlino and Mills (1993) developed this test with a very restricted form of serial correlation for the residual term, namely AR(2). Vogelsang (1998) extended the analysis of this specification to u_t with an unknown form of serial correlation by allowing a span of stationary and non-stationary serial correlation specifications for the error term ranging from order of zero, $I(0)$, to of order one, $I(1)$. Since the possibility of no convergence implies nonstationarity of the error terms, one can draw false inference on the trend coefficient when the errors are assumed to be stationary AR(2).[8] Vogelsang (1998) corrects for this problem by developing a trend function hypothesis test with undetermined degree of serial

[8] When u_t is $I(1)$, the estimate of β obtained from the above regression is not related to the true trend, and information on β must be obtained from the estimate of the intercept in the autoregressive representation of y_t.

correlation. To explain his methodology in the spirit of Equation 1, consider two specifications

$$\begin{aligned} y_t &= X_{yt}\beta + u_t \\ z_t &= X_{zt}\beta + S_t \end{aligned} \tag{2}$$

where z_t is $\sum_t y_j$ and $S_t = \sum_{j=1}^{t} u_j$,while X_{yt} and X_{zt} consist of $\begin{bmatrix} 1 & t \end{bmatrix}$ and $\begin{bmatrix} t & \sum_t j \end{bmatrix}$, respectively. For more than one coefficient restriction, the tests can be summarized as:[9]

$$T^{-1}W_T = T^{-1}\left(R\hat{\beta} - r\right)'\left[R\left(X_y'X_y\right)^{-1}R'\right]^{-1}\left(R\hat{\beta} - r\right)\Big/ s_y^2 \tag{3.1}$$

$$PS_T = T^{-1}\left(R\hat{\beta} - r\right)'\left[R\left(X_z'X_z\right)^{-1}R'\right]^{-1}\left(R\hat{\beta} - r\right)\Big/\left(s_z^2\exp\left(bJ_T\left(m\right)\right)\right) \tag{3.2}$$

$$PSW_T = T^{-1}\left(R\hat{\beta} - r\right)'\left[R\left(X_y'X_y\right)^{-1}R'\right]^{-1}\left(R\hat{\beta} - r\right)\Big/\left(100T^{-1}s_z^2\exp\left(bJ_T\left(m\right)\right)\right) \tag{3.3}.$$

where J_T is the Park and Choi (1988) unit root test statistic obtained from the following regression

$$\begin{aligned} y_t &= X_{yt}\beta + \sum_{i=2}^{m} c_i t^i + u_t \\ J_T\left(m\right) &= \left(RSS_y - RSS_J\right)\Big/ RSS_J \end{aligned} \quad . \tag{4}$$

J_T is the Wald statistic that tests the joint hypothesis of $c_2 = c_3 = \cdots = c_m = 0$. In Monte Carlo simulations, Vogelsang (1998) finds the values of *b* and *m* for which the above tests would be comparable and valid for every type of serial correlation form, including unit roots.

Despite the great flexibility of these tests in deriving the mean and trend coefficient estimates in time series with varying stationarity properties, one needs to be careful in using this methodology in the analysis of transition economies. The reason stems from the volatile nature of these economies and presence of structural shifts that are documented in the empirical literature. The problem of structural breaks during the transition process is given serious empirical consideration in Fidrmuc and Tichit (2004) who provide evidence of significant breaks for macroeconomic data. They argue that empirical analyses of transition economies must account for the

[9] See Vogelsang (1998) for a deeper elaboration on the tests.

possibility of structural changes; otherwise inferences are misleading. However, only a few papers consider the structural breaks on transition issues (see for example Dibooglu and Kutan, 2001, and Kočenda, 2005).

We obtain robust results by using Vogelsang's (1999) extension of his 1998 paper, allowing for structural breaks in the modification of the statistics by including the possibility of shifts in the trend function. Spanning the standard set of breaks introduced by Perron (1989), namely the mean, trend, and the mean and trend, Vogelsang (1999) derives the asymptotics in cases of both known and unknown break dates.[10] We prefer not to impose a break date for our sample countries, favoring the second approach that endogenously determines a break date. In these tests, first the break date is estimated by maximizing $T^{-1}W_T$ (T-inverse Wald test from Equation 3) for a break date $T_b \in \Lambda$ where Λ is the trimmed sample (from both ends). Second, using the estimated break date, normalized *t*-statistics are obtained using the altered versions of Equation (2) as follows (only y_t version is displayed):

$$y_t = \mu_1 DU_{1t} + \mu_2 DU_{2t} + \delta_1 DT_{1t} + \delta_2 DT_{2t} + u_t \tag{5}$$

where $DU_{1t} = 1$ if $t \le T_b$ (the break date) and zero otherwise, $DU_{2t} = 1$ if $t > T_b$ and zero otherwise, $DT_{1t} = t$ if $t \le T_b$ and zero otherwise, and finally $DT_{2t} = t - T_b$ if $t > T_b$ and zero otherwise. Vogelsang (1999) derives asymptotic critical using 10,000 iterations. His analysis, using Maddison's 1991 data, and a later application (Tomljanovich and Vogelsang, 2002)[11] that focuses mainly on convergence issues, provide interesting exploitation of this methodology.

3.2 Data

We analyze the performance of the CEE8, Cyprus and Malta in satisfying the convergence criterion of the Maastricht Treaty. For monetary convergence, we use data on inflation (based on harmonized CPI) inflation and interest rates (government bond yield), while, deficit-to-GDP and debt-to-GDP ratios are used for fiscal convergence. Specifically, we use the lowest three inflation rates of EU15 plus 1.5%, the same three countries' average government bond yield plus 2%, the fiscal deficit ratio below 3%, and debt ratio below 60%, respectively.

[10] Interestingly, one of the supremum statistics he suggests performs better than some popular statistics in identifying shifts in slope.
[11] We are grateful to the authors for providing us with the Gauss routine used in this paper.

We analyze real convergence using GDP per capita figures, both real and in euros, to draw implications as to how long it would take for the new EU countries to catch up to the standards of their Western counterparts. For this purpose, we examine two benchmarks: the core of the EU, represented by Germany, and the periphery represented by average values of the last six members of the EU15.[12]

We use quarterly data from 1995:1 through 2003:4. This time span was chosen because i) official EU membership applications started in 1995, and ii) the EuroStat began using the harmonized time series on prices and other macroeconomic variables at that time. In addition, the post-1995 period excludes the major transition-related shocks in early 1990s. Table 5 documents the major milestones in pre-accession process: the date when an application to join the EU was submitted and the beginning and end of the admission negotiations. The data are obtained from the International Financial Statistics of the IMF and EuroStat. In case of missing or incomplete observations, data are gathered from the individual central banks and finance ministries. In some cases, quadratic interpolation of annual data was necessary to fill some missing data points because the empirical methodology we use relies on uninterrupted data. Seasonality in GDP data is eliminated by using a moving average GDP (g_t) of the four quarters ($g_t = \sum_{s=1}^{4} \frac{1}{4} GDP_{t-s}$), while inflation rates (π_t) are annualized (hence de-seasonalized) based on annual growth rates in CPI ($\pi_t = \ln CPI_t - \ln CPI_{t-4}$).[13] We also annualize the quarterly debt and deficit data by summing the four quarters and then using this sum to obtain the debt-to-GDP and deficit-to-GDP ratios. Real GDP per capita data in euros is given in Figure 1. The euro denominated variables, when not available, are generated by multiplying the local currency values by the euro (for the 1999-2003 period) and ECU (for the 1995-1998 period) exchange rates. Finally, we create a real-GDP, per-capita index using 1996 as the base year to be able compare real GDP per capita data measured in different local currencies to each other (see Figure 2). Since the recent ten members should grow faster in real terms to "catch up" with the benchmarks, observing divergence in the indexes away from the benchmark would indicate convergence.

[12] Austria, Finland, Greece, Portugal, Spain, Sweden.

[13] Our methodology helps alleviate the potential problem of the error term in de-seasonalized variables being polluted by leading and lagged errors. The error term will not be correlated with the explanatory variables since we only have deterministic regressors (the mean and the trend). The serial correlation also should not matter since the Vogelsang test is robust against any form of serial dependence.

4. Estimation and Results

The results are displayed in Tables 1 through 4. They display the results for both *TW* (*T* inverse Wald test) and *PSW* (Partial Sums With *J* correction) tests, given by the specification in Equations 3.1 and 3.3, respectively. Despite the better power performance of the *TW* test, one should note that our limited sample size may limit the inferences from this specific test. Due to the very conservative nature of the *TW* test, we base our inferences about convergence more on the *PSW* test results. However, we report both tests results to check the sensitivity of results to different specifications.

Vogelsang (1999) emphasizes that interpretation of the coefficients should always be done using the *y*-regression with *PSW* and *TW* statistics (note the matrices in Equation 3) since the *z*-regression in *PS* is merely a way to get useful estimates of the parameters. The last column in each table contains the estimated break date using the maximum $T^{-1}W_T$ statistic. Following the theoretical grounds of the methodology employed, we apply a 10% trimming from each end of the sample since the break dates close to the endpoints are unreliable and should mostly be disregarded. We display the asymptotic critical values for the endogenous break option of the *PSW* and *TW* tests at the bottom rows of each table, respectively. One should also note that, at the bottom of each table, we indicate the dependent variable used and provide a brief relevant guideline to interpret the results easily.

4.1 Real convergence

We report results of the real convergence measured by the developments of real per-capita GDP in several panels of Table 1. Significance indicates statistical difference of the coefficients from zero. As described earlier in section 3.2, we use Germany's per-capita GDP as the benchmark for the EU core and the average of the last six members of EU15 as a proxy for the EU periphery. Thus, our dependent variable is difference between per-capita GDP of each new member and Germany or the periphery average. Due to a lower initial level of the per-capita GDP in the new EU members, such a difference is inevitably a negative number. Further, the real per-capita GDP is expressed in euros as well as in a local currency. To avoid the problem associated with local currency incompatibilities, we equalize the absolute numbers at an arbitrarily chosen base year (1996 = 100). Since all the new member countries

begin the sample with a per-capita GDP level lower than the benchmark countries, we expect the mean to be negative in euro levels; convergence to a higher per-capita GDP level would be reflected in a positive and significant trend. In the case of local currency comparisons, we expect all countries to start from the same level (hence a zero mean), and to have a faster growth rate than the benchmark countries (positive trend).

The results in Table 1a and 1b confirm that all new EU members start below the per-capita GDP level of Germany and the periphery in euros, and the difference is understandably larger with respect to Germany. There is an endogenously detected break date in the first quarter of 2000 in the majority of countries. Before the break, none of the countries with statistically significant trends displays convergence towards Germany or to the periphery. Finding a negative trend does not suggest a decline in the real per-capita GDP; it indicates that the distance from Germany or the periphery is widening. During the post-break period, the trends become positive for several countries. We find evidence that convergence is taking place towards Germany (Table 1a), but not with respect to the periphery (Table 1b), as suggested by the negative trend coefficients.

This is an important finding and requires further elaboration. After careful examination of the data, we detect that German GDP per-capita was stagnant after 2000 and the periphery growth slowed down, while the new EU countries recorded low but continuous growth on average (Figures 3 and 4). Thus, the break observed in our dependent variable should not be attributed to the new EU countries, but rather to Germany and the periphery. Despite the fact that the structural breaks are of moderate magnitudes, they show important differences between the benchmarks. When we compare the percentage growth rates of the recent members and the periphery, the recent members have higher rates. However, since we are looking at the nominal values, even with a lower growth rate, the periphery still has a larger per capita increase in absolute terms than do the newcomers. The increasing difference between GDP per capita levels is indicative of a very slow absolute convergence. The convergence is faster due to the stagnation in Germany. Overall, our results suggest that new EU members have a higher per-capita GDP growth rate than do the EU15 countries, and the difference in growth rates will have to continue for decades for full convergence to occur. This phenomenon can be illustrated on a real-life example: a simple linear approximation shows that per-capita GDP difference of, say, 18

thousand euros between "rich" and "poor" EU country will be closed in 81 years if the poorer country per-capita GDP grows at 5% and the richer country grows at a constant rate of 2%. Using a different set of assumptions and methodology, Fischer et al. (1998, Table 11) claim that time needed to close the per-capita GDP gaps ranges in accession countries and other transition economies is between 17 and 75 years with an average of 31 years.

Tables 1c and 1d report the results when the per-capita real GDP are measured in local currencies. Similar to the euro-based results, we find negative intercept coefficients, indicating a lower pre-break initial level of GDP in the new EU members. However, the positive trend coefficient implies convergence during both pre-break and post-break periods both towards Germany and the periphery. The positive post-break mean is also in accord with the observed development. Since we scale nominal values in various currencies and observe higher growth rate in new EU members, we essentially look for divergence in such a case (see again Figure 2). Divergence should be understood in a positive sense, however. This result basically means that all countries, including Germany, start from the same point (1996 = 100) and begin growing. Those who grow faster, the new EU members, will naturally have a higher trend value than Germany or the periphery. These findings in Tables 1c and 1d look quite encouraging.

4.2 Convergence related to Maastricht criteria

Monetary convergence

According to the Maastricht Treaty criterion of price stability, "a Member State has a price performance that is sustainable and an average rate of inflation, observed over a period of one year before the examination that does not exceed by more than 1½ percentage points that of, at most, the three best performing Member States in terms of price stability" (Art. 109j(1) of the EC Treaty and the respective protocol, Art. 1; see The Treaties, 1999 for additional details on other criteria). To construct the benchmark, the common practice is to use an arithmetic average of the three lowest inflation rates over the period plus 1.5%. Following the European Central Bank approach, an alternative benchmark is constructed excluding "outliers" (see ECB,

2004).[14] The alternative benchmark effectively means 1.5% above an arithmetic average of the three best performers with non-zero and non-negative inflation.[15]

Inflation convergence towards the first Maastricht benchmark, the lowest 3 inflation rates plus 1.5%, is clearly observed for most of the new member countries (Table 2a). Inflation convergence towards the second Maastricht benchmark, the lowest 3 non-zero and non-negative inflation rates plus 1.5%, is also evident (Table 2b) and follows a pattern similar to the former case. Our results indicate that inflation convergence is a feature of present development in the EU, regardless of which definition of the Maastricht benchmark is employed.

Reduction of inflation rates is observed also with respect to inflation in Germany (Table 2c) and average inflation in the periphery (Table 2d). New EU countries start with much higher inflation rate and reduce it over the time[16] (Figure 5). This is documented on a dramatically smaller post-break mean and negative trend coefficient in both pre-break and post-break periods. Such decrease in inflation is understandably more pronounced during the pre-break period when inflation was still quite high in many countries, economic development was still much affected by ongoing transition process and financial problems, if not crises, were not uncommon.

These findings on inflation convergence are consistent with recent studies (e.g., Kočenda , 2001; Kutan and Yigit 2004a, 2004b; Brada et. al., 2005) and should be confronted with disinflation strategies in several new member states that adopted distinct forms of inflation targeting.[17] The problem lies in the fact that

[14] It should be noted that the concept of "outlier" was already included in earlier convergence reports. It does not imply any mechanical approach to the exclusion of certain inflation rates, but it was introduced in the 1998 EMI (European Monetary Institute) Convergence Report to appropriately deal with potential significant distortions in individual countries' inflation developments.

[15] Yet another benchmark is possible if "three best-performing Member States in terms of price stability" are considered as those nearest to the ECB's inflation objective, which is inflation rate close but below 2 percent. In our analysis, we concentrate on the first two definitions of the benchmark. Further, Buiter and Grafe (2002) suggest interpreting inflation criterion in terms of only the inflation rate of traded goods prices due to Balassa-Samuelson effects. This approach would require a change in the Maastricht Treaty or derogation, and it is therefore beyond the scope of this paper.

[16] Malta is an exception with respect to criterion benchmark.

[17] Orlowski (2001) proposed a sequence of monetary convergence to the Euro zone, based on autonomous monetary policy rather than on an early application of the euro-peg. The gradual adjustment process begins with a relatively strict variant of inflation targeting, followed by flexible inflation targeting, and ends with exchange rate targeting. Orlowski (2004) proposed the adoption of money growth rules as indicator variables of monetary policies by the countries converging to a common currency system, in particular, by the Euro zone candidate countries. The analytical framework assumes an inflation target as the ultimate policy goal. The converging countries act in essence as "takers" of the inflation target (the Euro zone's inflation forecast). Feasibility of adopting money growth rules depends on stable relationships between money and target variables, which are low inflation and stable exchange rate.

combination of convergence criteria creates a constraint affecting the compatibility of the inflation targeting with the exchange rate convergence criterion embodied in the ERM2 arrangement. Arguments on this issue were voiced from various angles by Natalucci and Ravenna (2002), Buiter (2004), and de Grauwe and Schnabl (2004a), among others. New EU members who currently operate under flexible exchange rate regimes and pursue inflation targeting may be confronted with an unpleasant policy shift in favor of exchange rate targeting when entering ERM2. When leaving the ERM2, the reverse shift towards inflation-targeting-like regime under the euro is an imperative. This double shift may be avoided at some costs. However, the viability of such conduct is underlined by specific conditions.[18] Jonáš and Mishkin (2005) address the future perspective of monetary policy in the transition economies and conclude that even after the EU accession, inflation targeting can remain the main pillar of monetary strategy during the time before the Czech Republic, Hungary and Poland join the EMU. Our results indicate that satisfying the inflation criterion should not pose a problem for majority of the transition countries now.[19] The reality of potential dual-targeting or the need for policy shifts in the future remains an open question, though.

As mentioned earlier, due to the lack of adequate data in the new EU countries, we are not able to perform analysis with respect to the interest rate criterion.[20] Figure 6 illustrates the general trend calculated based on the government bond yield data. It is evident that convergence towards the required benchmark, long-term interest rate in three lowest inflation countries plus 2%, is achieved in the majority of the new EU members. Actually, since 2002 the interest rates have been declining further in most of the countries.

The key issue remains, however, that no matter how successful the new members are in complying with the two monetary criteria, inflationary fiscal deficits may affect the dynamics of inflation and interest rates in the future.

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[18] Dual targeting strategy assumes entering the ERM2, at a central parity close to equilibrium level, only for the shortest possible period. Country should have a low inflation (and subdued pressures), sustainable external balance, sound fiscal policy and a credible program for long-term fiscal consolidation as the most important characteristics. For more details see Frait (2004).

[19] Chen (2004) examines whether the purchasing power parity holds among EU members. Even for the core countries, he finds that relative PPP does not hold. In this regard, new EU members are less likely to worry about inflation convergence problems.

[20] With the exception of the Czech Republic and Slovenia, 2001 is the first year for which data are available on the reference long-term interest rate. For the Czech Republic, data are available from April 2000, for Slovenia from March 2002 (ECB, 2004).

Fiscal convergence

The outlook of fiscal convergence is not as bright as nominal convergence when we examine the performance of the new EU members. The results show that there is more work to be done in reaching fiscal discipline. The dependent variables in the analyses are the ratio of the budget deficit (surplus) to GDP and total debt to GDP in a new member country minus the benchmarks, 3% for deficit and 60% for total debt. Since all deficits (debt) are indicated by a negative number (e.g., minus 2% stands for two percent deficit), all mean values that are positive indicate surplus or deficit (debt) ratios below (less negative) 3% (60%), having a value zero means deficit (debt) of exactly 3% (60%), and negative values indicate deficit (debt) ratios greater than 3% (60%). Accordingly, negative trend coefficients depict deficit (debt) increases (or declining budget surpluses) with respect to the benchmark, and positive coefficients suggest just the opposite.

Although many coefficients in Table 3a lack statistical significance in the deficit analysis, which precludes unambiguous judgment (see also Figure 7), the following pattern emerges for the Maastricht benchmark: most of the countries start with surplus or low deficit ratios and about half of them reduce the surplus during the pre-break period; in fact five countries with statistically significant surplus coefficients proceeded with a reduction in surplus. In the post-break period, the statistically insignificant coefficients preclude a qualified judgment, but countries in general start with a higher deficit ratio or lower surplus ratio and half of the countries further increase their deficit ratio. A pattern that emerges entails two different groups of countries: those that improved their deficit (or surplus) compared to the pre-break period and those whose deficit situation became worse. The former countries tend to relax a bit but start spending after the break period, whereas the latter countries start to discipline their fiscal position, and their deficit ratio shows a positive trend as the deficit ratio declines. In any event, the results suggest that the deficit-to-GDP ratio condition seems to be a challenging criterion to meet.

The deficit to GDP ratio with respect to the benchmark of Germany shows in essence similar development as to the 3% benchmark in the pre-break period (Table 3b). The post-break period is characterized by primarily negative and large means, and positive trend coefficients, which indicate that most new EU members start the post-break period with much larger deficit to GDP ratios than Germany. This

tendency is also observed when we compare the new members with the periphery, albeit less pronounced (Table 3c).

Convergence of the general government debt-to-GDP ratio towards the Maastricht benchmark of 60% is displayed in Table 4a and Figure 8. Further, Tables 4b and 4c show the test results in comparison with the core (Germany) and the periphery (in a similar fashion as with the budget deficit). The dependent variable in Table 4a is the consolidated debt–to-GDP ratio in a new member country minus the 60% benchmark. A positive number indicates a debt ratio below 60% since the negative 60% benchmark subtracted form a less negative debt ratio yields positive values (thus, for example mean of 40 means 20% debt-to-GDP ratio). All countries, except Hungary, start with a debt-to-GDP ratio lower than the Maastricht benchmark of 60% since the mean coefficients are all positive. Mostly positive trend coefficients in the pre-break period suggest that a member country is actually not converging to the 60% benchmark but rather further decreasing its debt-to-GDP ratio. However, countries like Cyprus, Malta and Slovenia increase their indebtedness towards the benchmark prior to the break period.

The increase in the debt-to-GDP ratio is a dominant feature of the post-break period, especially in the case of the three countries mentioned above. A similar tendency, with even more negative trend coefficients, is observed when 60% benchmark is replaced by the actual debt-to-GDP ratio in the periphery. As Figure 8 clearly displays, the continuous decline in the periphery's debt to GDP ratio is the underlying reason behind the results in Table 4c. German benchmark results in Table 4b display a better picture with more positive trend coefficients, which is indicative of fiscal discipline; however, another quick glance at Figure 8 shows that the decline in the German debt situation is the culprit behind this result. Such results keep the new members within acceptable debt positions for the time being, but we can hardly call it a success story because their indebtedness increases in general and its dynamics are discomforting.

Reform of the public finances' systems in the whole EU25 is an agenda that is not to be underestimated. In the new EU members it is even more important since the neglect of public finance reforms and lack of fiscal discipline could lead to serious consequences for these countries, well beyond the satisfaction of the Maastricht criteria and consideration of entry into the Eurozone. Our results have other important implications. One implication is for the authorities in the new EU members to better

coordinate fiscal and monetary policies to improve fiscal discipline.[21] Second is to implement polices to improve fiscal consolidation.[22] For the latter, von Hagen et. al. (2002) study the experience of the European countries, regarding fiscal consolidations. They find that successful experiences, leading to budget surpluses, include policies that focus on expenditure reductions rather than on revenue-raising polices such as higher taxes. To further improve fiscal balances, they also suggest supply-side measures in the labor market, such as cutting wages and improving competitiveness.

Fiscal convergence criteria may be understood as a proxy to guarantee a sound fiscal state of economy. Without excessive deficits inflationary pressures are less likely to materialize and tension between the inflation and exchange rate convergence criteria during the ERM2 period are to be reduced.[23] Our empirical results are supportive of the arguments that fiscal sustainability is not only a necessary but also a sufficient condition for the new EU members to enter the Eurozone (e.g., Buiter, 2004).

5. Conclusions

We have examined economic convergence of recent EU members towards the EU standards. Our paper contributes to the convergence literature in several significant methodological and conceptual ways. Compared to earlier studies, our study provides a more comprehensive look at the convergence performance and prospects of the new members, not only because it includes measures of fiscal convergence and broader measures of inflation convergence, but also uses vastly flexible tests of convergence, allowing for structural breaks, hence, providing improved inferences. Instead of using industrial production as a measure of real convergence, we also employ data on real GDP per capita. We also measure real convergence using not only local currencies but also PPP exchange rates to capture the impact of euro-area aggregate demand changes.

[21] For a review of the literature on the interaction of monetary and fiscal policies in a monetary union, see Dixit (2001) and Dixit and Lambertin (2001). For supporting empirical evidence, see Darnaut and Kutos (2005).
[22] Daviddi and Ilzkovitz (1997) provide a discussion of this and other related issues.
[23] Our findings are in line with argument of de Grauwe and Schnabl (2004b) that "while a restrictive fiscal policy helps to simultaneously achieve the Maastricht monetary and exchange rate criteria, it also contributes to fiscal stability as budget deficits are constrained and the stock of public debt are reduced. This could be crucial for these countries whose budgets deficits have increased considerably recently".

Our results regarding real convergence are promising for the new EU members. Despite the observed widening of the gap between GDP per capita levels in euros, closer inspection of the growth rates show that the faster growth rate in the new members will help narrow this gap, leading to the "catching-up" in the next few decades. Especially the stronger growth rates after the beginning of the accession talks (post-break) are indicative of the benefits of the membership prospects or the membership itself, strengthening convergence to the Union. The outcome of the tests examining per-capita real GDP in local currencies confirms convergence projections with respect to Germany as well as to the periphery. Especially, the results of the post-break period indicate that the introduction of the euro has increased the real-per capita convergence process. However, our finding of slow but steady per-capita convergence towards the EU standards suggests that it will take several decades for the convergence to be fully completed. Policymakers can shorten this process by designing further structural reforms and encouraging more FDI and trade flows into the new members.

We also find significant nominal and monetary policy convergence, which is consistent with recent studies. Results on inflation and interest rates show significant success of the new members in achieving the criteria set by the Maastricht Treaty as well progress towards the ECB's interpretation of price stability. On the other hand, we observe serious deficiencies in meeting the criteria on deficit-to-GDP and debt-to-GDP ratios. Such lack of fiscal discipline should raise warning signals for both the new and old members. The newcomers should try to emulate the discipline and success of the last six members of EU15 in reducing their deficit and debt ratios. Fiscal consolidation through expenditure-reduction policies, along with a supply-side-oriented policy, reducing unit labor costs and increasing competitiveness, are some policy choices in this regard. Otherwise, current fiscal practices may delay the entry of the new EU members to the ERM II and hence their adoption of the euro.

In conclusion, our results indicate that new EU members have achieved significant nominal convergence and are making steady progress for real convergence; however, progress on fiscal convergence has been discouraging. Therefore, countries especially with significant fiscal deficits should not rush to join the Eurozone faster. Instead, they should address their reasons for lack of fiscal discipline.

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Table 1a: Euro Real GDP Per Capita Convergence (to Germany)

Countries	*PSW test with endogenous break selection (regression of y_t with J_T correction)*				*TW test with endogenous break selection (using y_t regression and $T^{-1/2}t_y$)*				*Break date*
	μ_1	δ_1	μ_2	δ_2	μ_1	δ_1	μ_2	δ_2	
Cyprus	**-13.66****	**-0.022****	**-14.38****	**0.050****	**-13.66****	**-0.022***	**-14.38****	**0.050****	2000Q1
Czech Rep	**-18.65****	**-0.078****	**-20.65****	0.017	**-18.65****	**-0.078****	**-20.65****	0.017	2000Q1
Estonia	**-20.85****	**-0.050****	**-22.40****	**0.037****	**-20.85****	**-0.050****	**-22.40****	**0.037****	2000Q1
Hungary	**-19.51****	**-0.050****	**-20.97****	**0.021****	**-19.51****	**-0.050****	**-20.97****	0.021	2000Q1
Latvia	**-21.28****	**-0.063****	**-23.07****	**0.031****	**-21.28****	**-0.063****	**-23.07****	0.031	2000Q1
Lithuania	**-21.45****	**-0.068****	**-23.39****	0.022	**-21.45****	**-0.068****	**-23.39****	0.022	2000Q1
Malta	**-16.31****	0.004	**-16.66****	**-0.027****	**-16.31****	0.004	**-16.66****	**-0.027****	1998Q3
Poland	**-20.24****	**-0.053****	**-21.84****	0.007	**-20.24****	**-0.053***	**-21.84****	0.007	2000Q1
Slovak Rep.	**-19.94****	**-0.062****	**-21.79****	0.022	**-19.94****	**-0.062****	**-21.79****	0.022	2000Q1
Slovenia	**-15.72****	0.002	**-15.97****	**0.076****	**-15.72****	0.002	**-15.97****	**0.076****	1999Q3

Table 1b: Euro Real GDP Per Capita Convergence (to last 6 members of the EU15)

Cyprus	**-5.96****	**-0.069****	**-7.21****	-0.020	**-5.96****	**-0.069****	**-7.21****	-0.020	2001Q1
Czech Rep	**-10.92****	**-0.129****	**-13.55****	-0.040	**-10.92****	**-0.129****	**-13.55****	-0.040	2000Q1
Estonia	**-13.11****	**-0.101****	**-15.29****	-0.020	**-13.11****	**-0.101****	**-15.29****	-0.020	2000Q1
Hungary	**-11.76****	**-0.104****	**-13.98****	**-0.031****	**-11.76****	**-0.104****	**-13.98****	**-0.031***	2000Q3
Latvia	**-13.55****	**-0.114****	**-15.97****	**-0.026****	**-13.55****	**-0.114****	**-15.97****	-0.026	2000Q1
Lithuania	**-13.71****	**-0.119****	**-16.29****	**-0.035****	**-13.71****	**-0.119****	**-16.29****	**-0.035***	2000Q1
Malta	**-8.73****	**-0.031****	**-9.51****	**-0.065****	**-8.73****	-0.031	**-9.51****	**-0.065****	1998Q3
Poland	**-12.51****	**-0.104****	**-14.73****	**-0.050****	**-12.51****	**-0.104****	**-14.73****	**-0.050***	2000Q1
Slovak Rep.	**-12.21****	**-0.113****	**-14.69****	**-0.035****	**-12.21****	**-0.113****	**-14.69****	-0.035	2000Q1
Slovenia	**-7.96****	**-0.053****	**-8.74****	**0.023****	**-7.96****	**-0.053****	**-8.74****	0.023	2000Q1
Crit. Value at 5%	1.51	1.88	1.92	1.81	0.88	2.00	3.00	2.01	
Crit. Value at 10%	1.21	1.58	1.65	1.54	0.67	1.47	2.37	1.48	

Note: Each number represents thousands of Euros. The dependent variable is the per capita output level in country *i* minus German (EU15's last 6 members') output per capita.

Table 1c: Local Currency Real GDP Per Capita Convergence (to Germany)

Countries	*PSW test with endogenous break selection (regression of y_t with J_T correction)*				*TW test with endogenous break selection (using y_t regression and $T^{-1/2}t_y$)*				*Break date*
	μ_1	δ_1	μ_2	δ_2	μ_1	δ_1	μ_2	δ_2	
Cyprus	0.000	0.008	0.001	**0.058****	0.000	0.008	0.001	**0.058****	1998Q1
Czech Rep	**-0.007****	0.091	**-0.007****	**0.034****	**-0.007****	0.091	-0.007	0.034	1997Q4
Estonia	**-0.007****	**0.179****	**0.013****	**0.231****	**-0.007****	**0.179****	**0.013****	**0.231****	1999Q2
Hungary	-0.001	0.017	**-0.001****	**0.087****	-0.001	0.017	-0.001	**0.087****	1996Q3
Latvia	**-0.005****	**0.132****	**0.020****	**0.280****	**-0.005****	**0.132****	**0.020****	**0.280****	2000Q3
Lithuania	**-0.005****	**0.120****	**0.008****	**0.247****	**-0.005****	**0.120****	0.008	**0.247****	2000Q1
Malta	-0.001	**0.028****	**0.009****	-0.019	-0.001	0.028	**0.009***	-0.019	2000Q2
Poland	**-0.007****	**0.140****	**0.006****	**0.054****	**-0.007****	**0.140****	**0.006****	**0.054****	1997Q4
Slovak Rep.	**-0.004****	**0.065****	0.001	**0.105****	**-0.004****	**0.065***	0.001	**0.105****	1999Q4
Slovenia	**-0.004****	**0.080****	**0.014****	**0.119****	**-0.004****	**0.080****	**0.014****	**0.119****	2000Q1

Table 1d: Local Currency Real GDP Per Capita Convergence (to last 6 members of EU15)

Cyprus	0.000	-0.003	**0.002****	0.001	0.000	-0.003	0.002	0.001	2001Q2
Czech Rep	-0.004	0.021	**-0.010****	0.004	-0.004	0.021	**-0.010****	0.004	1998Q2
Estonia	**-0.006****	**0.145****	**0.008****	**0.196****	**-0.006****	**0.145****	**0.008****	**0.196****	1999Q2
Hungary	**-0.002****	**0.045****	**0.003****	**0.055****	**-0.002****	**0.045****	**0.003****	**0.055****	1999Q1
Latvia	**-0.004****	**0.096****	**0.009****	**0.240****	**-0.004****	**0.096****	**0.009***	**0.240****	2000Q1
Lithuania	**-0.003****	**0.081****	0.002	**0.213****	**-0.003***	**0.081***	0.002	**0.213****	2000Q1
Malta	0.001	-0.010	0.003	**-0.054****	0.001	-0.010	0.003	-0.054	2000Q2
Poland	**-0.006****	**0.125****	**0.004****	**0.014****	**-0.006****	**0.125****	**0.004***	0.014	1997Q3
Slovak Rep.	-0.002	**0.035***	**-0.004****	**0.063****	-0.002	0.035	-0.004	**0.063***	1999Q3
Slovenia	**-0.002****	**0.044****	**0.010****	**0.077****	**-0.002****	**0.044****	**0.010****	**0.077****	2000Q2
Crit. Value at 5%	1.51	1.88	1.92	1.81	0.88	2.00	3.00	2.01	
Crit. Value at 10%	1.21	1.58	1.65	1.54	0.67	1.47	2.37	1.48	

Note: All real GDP figures have been equalized at the base year 1996 (beginning period for Maltese data). The dependent variable is the per capita output level in country *i* minus benchmark output per capita. Therefore, convergence would be reflected with a significant positive trend.

Table 2a: Inflation Convergence (to benchmark criterion = lowest 3 inflation rates plus 1.5%)									
	PSW test with endogenous break selection (regression of y_t with J_T correction)				*TW test with endogenous break selection (using y_t regression and $T^{-1/2}t_y$)*				*Break date*
Countries	μ_1	δ_1	μ_2	δ_2	μ_1	δ_1	μ_2	δ_2	
Cyprus	0.00	0.04	**-2.10***	**0.32****	0.00	0.04	-2.10	0.32	2000Q4
Czech Rep	**4.90****	0.19	**2.90***	**-0.25****	**4.90****	0.19	2.90	-0.25	1998Q3
Estonia	**26.60****	-1.37	**7.30****	**-0.33****	**26.60****	-1.37	7.30	-0.33	1996Q4
Hungary	**24.60****	**-0.95****	**8.90****	**-0.45****	**24.60****	**-0.95****	8.90	-0.45	1999Q2
Latvia	**23.20****	**-1.54****	0.60	-0.05	**23.20****	**-1.54****	0.60	-0.05	1998Q2
Lithuania	**39.10****	**-3.16****	**2.90***	**-0.31****	**39.10****	**-3.16****	2.90	-0.31	1997Q3
Malta	**0.90***	-0.05	**-5.10****	**1.48****	0.90	-0.05	-5.10	1.48	2002Q4
Poland	**23.70****	**-1.07****	**8.40****	**-0.73****	**23.70****	**-1.07****	8.40	**-0.73***	1999Q3
Slovak Rep.	**5.50****	-0.10	**9.90****	-0.48	5.50*	-0.10	9.90	-0.48	1999Q2
Slovenia	**17.00****	-2.92	**6.80****	**-0.10****	**17.00****	-2.92	**6.80****	-0.10	1995Q3
Table 2b: Inflation Convergence (to modified benchmark = lowest 3 "non-negative" inflation rates plus 1.5%)									
Cyprus	**0.10****	**0.02****	**-2.00***	**0.32****	0.10	0.02	-2.00	0.32	2000Q4
Czech Rep	**5.30****	0.13	1.60	-0.18	**5.30****	0.13	1.60	-0.18	1998Q4
Estonia	**26.60****	-1.35	**7.10****	**-0.32****	**26.60****	-1.35	**7.10***	-0.32	1996Q4
Hungary	**24.30****	**-0.89****	**9.00****	**-0.37****	**24.30****	**-0.89***	**9.00****	-0.37	1998Q3
Latvia	**23.00****	**-1.50****	-0.10	-0.01	**23.00****	**-1.50****	-0.10	-0.01	1998Q3
Lithuania	**38.20****	**-2.87****	**4.90****	**-0.36****	**38.20****	**-2.87***	4.90	**-0.36***	1996Q4
Malta	0.70	-0.04	**-4.60****	**0.97***	0.70	-0.04	-4.60	0.97	2002Q3
Poland	**23.80****	**-1.08****	**7.90****	**-0.69****	**23.80****	**-1.08****	7.90	**-0.69***	1999Q3
Slovak Rep.	5.50*	-0.11	**9.40****	-0.43	**5.50***	-0.11	9.40	-0.43	1999Q2
Slovenia	**17.00****	-2.92	**6.70****	**-0.10****	**17.00****	-2.92	**6.70****	-0.10	1995Q3
Crit. Value at 5%	1.51	1.88	1.92	1.81	0.88	2.00	3.00	2.01	
Crit. Value at 10%	1.21	1.58	1.65	1.54	0.67	1.47	2.37	1.48	

Note: Values represent percentage values. The dependent variable is the inflation level in country *i* minus the benchmark inflation rate (lowest 3 inflation rates plus 1.5%) and the modified benchmark inflation (lowest 3 non-negative inflation rates plus 1.5%).

Table 2c: Inflation Convergence (to German inflation)

Countries	*PSW test with endogenous break selection (regression of y_t with J_T correction)*				*TW test with endogenous break selection (using y_t regression and $T^{-1/2}t_y$)*				*Break date*
	μ_1	δ_1	μ_2	δ_2	μ_1	δ_1	μ_2	δ_2	
Cyprus	**1.10****	0.03	-1.30	**0.40****	1.10	0.03	-1.30	0.40	2000Q4
Czech Rep	**6.30****	0.13	**2.70***	-0.16	**6.30****	0.13	2.70	-0.16	1998Q4
Estonia	**27.80****	-1.37	**7.90****	**-0.29****	**27.80****	-1.37	7.90	-0.29	1996Q4
Hungary	**25.60****	**-0.95****	**9.30****	**-0.38****	**25.60****	**-0.95****	**9.30****	-0.38	1999Q2
Latvia	**24.50****	**-1.58****	1.50	-0.03	**24.50****	**-1.58****	1.50	-0.03	1998Q2
Lithuania	**39.40****	**-2.89****	**5.70****	**-0.34****	**39.40****	**-2.89***	5.70	**-0.34***	1996Q4
Malta	**1.70****	-0.03	-2.80	0.88	1.70	-0.03	-2.80	0.88	2002Q3
Poland	**29.80****	**-2.57****	**16.00****	**-0.58****	**29.80****	-2.57	**16.00****	**-0.58****	1996Q1
Slovak Rep.	**6.40****	-0.10	**10.40****	-0.40	**6.40****	-0.10	10.40	-0.40	1999Q2
Slovenia	**18.30****	**-3.02****	**7.50****	**-0.08****	**18.30****	-3.02	**7.50****	-0.08	1995Q3
Table 2d: Inflation Convergence (to inflation in the last 6 members of EU15)									
Cyprus	-0.70	0.09	-1.90	**0.33***	-0.70	0.09	-1.90	0.33	2000Q4
Czech Rep	**4.10****	0.24	2.10	-0.19	**4.10****	0.24	2.10	-0.19	1998Q4
Estonia	**23.90****	-0.75	**8.50****	**-0.36****	**23.90****	-0.75	8.50	**-0.36***	1996Q3
Hungary	**23.10****	**-0.77****	**9.50****	**-0.39****	**23.10****	**-0.77****	**9.50***	-0.39	1998Q3
Latvia	**21.80****	**-1.38****	0.40	-0.03	**21.80****	**-1.38****	0.40	-0.03	1998Q3
Lithuania	**36.90****	**-2.75****	**5.30****	**-0.37****	**36.90****	**-2.75***	5.30	**-0.37***	1996Q4
Malta	0.20	0.00	-4.70	1.06	0.20	0.00	-4.70	1.06	2002Q3
Poland	**22.80****	**-0.99****	**8.40****	**-0.71****	**22.80****	**-0.99****	8.40	**-0.71***	1999Q3
Slovak Rep.	2.20	0.31	3.50	0.04	2.20	0.31	3.50	0.04	2000Q2
Slovenia	**15.30****	**-2.55****	**6.70****	**-0.09****	**15.30****	-2.55	**6.70****	-0.09	1995Q4
Crit. Value at 5%	1.51	1.88	1.92	1.81	0.88	2.00	3.00	2.01	
Crit. Value at 10%	1.21	1.58	1.65	1.54	0.67	1.47	2.37	1.48	

Note: The dependent variable is the inflation level in country *i* minus German (EU15's last 6 members') inflation.

Table 3a: Budget Deficit Convergence (to 3% of GDP)

	PSW test with endogenous break selection (regression of y_t with J_T correction)				*TW test with endogenous break selection (using y_t regression and $T^{-1/2}t_y$)*				
	μ_1	δ_1	μ_2	δ_2	μ_1	δ_1	μ_2	δ_2	*Break date*
Cyprus	**2.20****	**-0.28****	0.90	-0.19	**2.20***	-0.28	0.90	-0.19	1999Q3
Czech Rep	**3.90****	**-0.14****	2.00	-0.53	**3.90****	**-0.14***	2.00	-0.53	2002Q1
Estonia	1.30	0.15	**-6.00***	**0.81****	1.30	0.15	-6.00	0.81	1999Q1
Hungary	2.40	**-0.31***	2.30	**-0.46****	2.40	-0.31	2.30	-0.46	1999Q3
Latvia	0.50	0.25	-0.40	**0.13****	0.50	0.25	-0.40	0.13	1998Q4
Lithuania	**3.70****	**-0.29***	1.50	0.05	**3.70****	-0.29	1.50	0.05	2000Q1
Malta	**-8.50****	**0.17***	0.00	**-0.37****	**-8.50****	0.17	0.00	-0.37	1999Q3
Poland	-0.10	**0.13****	**-1.40****	0.01	-0.10	**0.13***	-1.40	0.01	2001Q3
Slovak Rep.	**3.00***	**-0.78****	-0.50	0.15	3.00	-0.78	-0.50	0.15	1998Q2
Slovenia	**3.00****	**-0.07****	**3.20****	-0.01	**3.00****	-0.07	3.20	-0.01	2002Q2
Critical Values									
5%	1.51	1.88	1.92	1.81	0.88	2.00	3.00	2.01	
10%	1.21	1.58	1.65	1.54	0.67	1.47	2.37	1.48	

Note: The dependent variable is the budget deficit (surplus) to GDP ratio in country *i* minus 3% deficit benchmark (a positive number indicates a surplus or a deficit ratio below 3% since the negative 3% benchmark subtracted form a less negative deficit ratio yields positive values).

Table 3b: Budget Deficit Convergence (to German level)

Countries	*PSW test with endogenous break selection (regression of y_t with J_T correction)*				*TW test with endogenous break selection (using y_t regression and $T^{-1/2}t_y$)*				*Break date*
	μ_1	δ_1	μ_2	δ_2	μ_1	δ_1	μ_2	δ_2	
Cyprus	0.50	-0.13	**-3.60****	0.07	0.50	-0.13	-3.60	0.07	1996Q4
Czech Rep	**3.30****	**-0.22****	1.90	-0.35	**3.30****	**-0.22***	1.90	-0.35	2002Q1
Estonia	0.70	0.11	**-9.50****	**1.00****	0.70	0.11	-9.50	**1.00***	1999Q1
Hungary	1.20	**-0.31***	-1.50	-0.20	1.20	-0.31	-1.50	-0.20	1999Q3
Latvia	0.20	0.16	**-4.20****	**0.37****	0.20	0.16	-4.20	0.37	1999Q1
Lithuania	**1.50***	-0.14	**-5.90****	**0.51****	1.50	-0.14	**-5.90***	**0.51****	1999Q1
Malta	**-10.40****	**0.27****	**-8.20****	0.42	**-10.40****	0.27	-8.20	0.42	2001Q1
Poland	**-1.30****	**0.11****	**-2.70****	0.18	-1.30	0.11	-2.70	0.18	2000Q4
Slovak Rep.	1.20	**-0.70****	-3.30	**0.28***	1.20	-0.70	-3.30	0.28	1998Q2
Slovenia	**1.80****	-0.08	**-4.70****	**0.86****	**1.80****	-0.08	-4.70	**0.86***	2000Q4
Table 3c: Budget Deficit Convergence (to the last 6 members of EU15 level)									
Cyprus	**9.50****	**-0.94****	**-2.00****	-0.08	**9.50****	-0.94	-2.00	-0.08	1996Q4
Czech Rep	**9.80****	**-0.62****	-0.80	-0.14	**9.80****	**-0.62****	-0.80	-0.14	1999Q1
Estonia	**4.60***	-0.14	**-8.40****	**0.80****	4.60	-0.14	-8.40	0.80	1999Q1
Hungary	**7.80****	**-0.74****	-0.40	**-0.45****	**7.80****	**-0.74****	-0.40	-0.45	1999Q3
Latvia	**4.10****	-0.09	**-3.20****	**0.16***	**4.10****	-0.09	-3.20	0.16	1999Q1
Lithuania	1.80	-0.12	**-4.70****	**0.27****	1.80	-0.12	-4.70	0.27	1998Q4
Malta	**-8.90****	0.11	**-2.70****	**-0.36****	**-8.90****	0.11	-2.70	-0.36	1999Q3
Poland	**6.10****	**-0.39****	1.70	**-0.37****	**6.10****	**-0.39***	1.70	-0.37	1999Q2
Slovak Rep.	**9.40****	**-1.34****	-2.30	0.11	**9.40****	**-1.34****	-2.30	0.11	1998Q2
Slovenia	**9.20****	**-0.59****	-1.10	0.07	**9.20****	**-0.59****	-1.10	0.07	1999Q1
Crit. Value at 5%	1.51	1.88	1.92	1.81	0.88	2.00	3.00	2.01	
Crit. Value at 10%	1.21	1.58	1.65	1.54	0.67	1.47	2.37	1.48	

Note: The dependent variable is the budget deficit (surplus) to GDP ratio in country *i* minus German (or last 6 of EU15) budget deficit ratio (a positive number indicates a surplus or a deficit below benchmarks' levels).

Table 4a: Consolidated Debt/GDP Convergence (to 60%)

	PSW test with endogenous break selection (regression of y_t with J_T correction)				*TW test with endogenous break selection (using y_t regression and $T^{-1/2}t_y$)*				
	μ_1	δ_1	μ_2	δ_2	μ_1	δ_1	μ_2	δ_2	*Break date*
Cyprus	**9.10****	**-0.41****	**6.20****	**-1.05****	**9.10****	-0.41	6.20	-1.05	1999Q4
Czech Rep	**47.00****	**0.28****	**51.10****	**-0.52****	**47.00****	0.28	**51.10****	**-0.52****	1998Q2
Estonia	**50.30****	**0.20****	**54.50****	-0.04	**50.30****	**0.20****	**54.50****	-0.04	2001Q3
Hungary	**-22.50****	**1.56****	-0.80	**0.32****	**-22.50****	1.56	-0.80	0.32	1997Q3
Latvia	**49.10****	0.00	**46.50****	**-0.06****	**49.10****	0.00	**46.50****	-0.06	1999Q1
Lithuania	**36.70****	0.01	**28.10****	**0.42****	**36.70****	0.01	**28.10****	0.42	1999Q3
Malta	**25.00****	**-1.19****	3.00	**-1.20****	**25.00****	**-1.19****	3.00	-1.20	2000Q4
Poland	**8.90****	**0.81****	**20.70****	-0.20	**8.90****	**0.81***	**20.70****	-0.20	1998Q4
Slovak Rep.	**40.40****	-0.16	**23.60****	0.02	**40.40****	-0.16	**23.60****	0.02	2000Q4
Slovenia	**49.10****	**-0.83****	**36.30****	**-0.15****	**49.10****	**-0.83****	**36.30****	-0.15	1998Q2
Critical Values									
5%	1.51	1.88	1.92	1.81	0.88	2.00	3.00	2.01	
10%	1.21	1.58	1.65	1.54	0.67	1.47	2.37	1.48	

Note: Values are in percentages. The dependent variable is the consolidated debt to GDP ratio in country *i* minus the 60% benchmark (a positive number indicates a debt ratio below 60% since the negative 60% benchmark subtracted form a less negative debt ratio yields positive values).

Table 4b: Consolidated Debt/GDP Convergence (to German debt to GDP ratio)

Countries	*PSW test with endogenous break selection (regression of y_t with J_T correction)*				*TW test with endogenous break selection (using y_t regression and $T^{-1/2}t_y$)*				*Break date*
	μ_1	δ_1	μ_2	δ_2	μ_1	δ_1	μ_2	δ_2	
Cyprus	**6.10****	-0.04	1.80	**-0.50****	**6.10***	-0.04	1.80	-0.50	2000Q1
Czech Rep	**44.10****	**0.67***	**52.50****	**-0.42****	**44.10****	0.67	**52.50****	**-0.42***	1997Q4
Estonia	**47.30****	**0.57****	**54.30****	0.15	**47.30****	**0.57***	**54.30****	0.15	1998Q4
Hungary	**-24.20****	**1.87****	0.00	**0.54****	**-24.20****	**1.87****	0.00	0.54	1998Q4
Latvia	**50.90****	-0.06	**45.10****	**0.26****	**50.90****	-0.06	**45.10****	0.26	1999Q4
Lithuania	**36.30****	0.14	**27.40****	**0.66****	**36.30****	0.14	**27.40****	0.66	1999Q3
Malta	**18.90****	0.11	**12.80****	**-0.73****	**18.90****	0.11	**12.80***	**-0.73****	1996Q4
Poland	**7.50****	**1.20****	-4.80	-4.77	**7.50****	**1.20****	-4.80	-4.77	1999Q1
Slovak Rep.	**42.30****	-0.19	**21.70****	**0.58***	**42.30****	-0.19	**21.70****	0.58	2000Q4
Slovenia	**45.90****	**-0.44****	**34.40****	0.78	**45.90****	**-0.44****	**34.40****	0.78	2002Q2
Table 4c: Consolidated Debt/GDP Convergence (to EU15's last 6 members' debt to GDP ratio)									
Cyprus	**27.10****	**-1.02****	**15.10****	**-1.33****	**27.10****	-1.02	15.10	**-1.33***	1998Q4
Czech Rep	**61.10****	0.53	**65.70****	**-1.00****	**61.10****	0.53	**65.70****	**-1.00****	1996Q4
Estonia	**63.90****	**0.55***	**67.30****	**-0.50****	**63.90****	0.55	**67.30****	**-0.50****	1996Q2
Hungary	**-6.80****	**1.42****	**9.10****	-0.16	**-6.80****	**1.42***	9.10	-0.16	1998Q1
Latvia	**60.10****	-0.11	**53.80****	**-0.55****	**60.10****	-0.11	**53.80****	**-0.55****	1999Q1
Lithuania	**52.20****	**-0.39***	**33.80****	-0.01	**52.20****	-0.39	**33.80****	-0.01	1999Q3
Malta	**38.20****	-0.69	**23.60****	**-1.33****	**38.20****	-0.69	**23.60****	**-1.33****	1997Q1
Poland	**26.70****	**0.27***	**28.60****	**-0.70****	**26.70****	0.27	**28.60****	**-0.70****	1998Q4
Slovak Rep.	**49.00****	**-0.29***	**26.10****	-0.28	**49.00****	-0.29	**26.10****	-0.28	2000Q4
Slovenia	**65.70****	**-1.24****	**38.80****	**-0.50****	**65.70****	**-1.24****	**38.80****	-0.50	2000Q2
Crit. Value at 5%	1.51	1.88	1.92	1.81	0.88	2.00	3.00	2.01	
Crit. Value at 10%	1.21	1.58	1.65	1.54	0.67	1.47	2.37	1.48	

Note: The dependent variable is the consolidated debt to GDP ratio in country *i* minus the German (or last 6 members of EU15) debt ratio (hence a negative number indicates a debt ratio worse than that of Germany or last 6 members of EU15).

Table 5: Timing of the EU Admission Process

	Application Submitted	Admission Negotiations	
		Beginning	End
Czech Republic	January 17, 1996	March 31, 1998	December 13, 2002
Cyprus	July 3, 1990	March 31, 1998	December 13, 2002
Estonia	November 24, 1995	March 31, 1998	December 13, 2002
Hungary	March 31, 1994	March 31, 1998	December 13, 2002
Latvia	October 13, 1995	October 13, 1999	December 13, 2002
Lithuania	December 8, 1995	October 13, 1999	December 13, 2002
Malta	July 16, 1990	October 13, 1999	December 13, 2002
Poland	April 5, 1994	March 31, 1998	December 13, 2002
Slovakia	June 27, 1995	October 13, 1999	December 13, 2002
Slovenia	June 10, 1996	March 31, 1998	December 13, 2002

Source: European Commission

Figure 1: GDP Per Capita in Euros

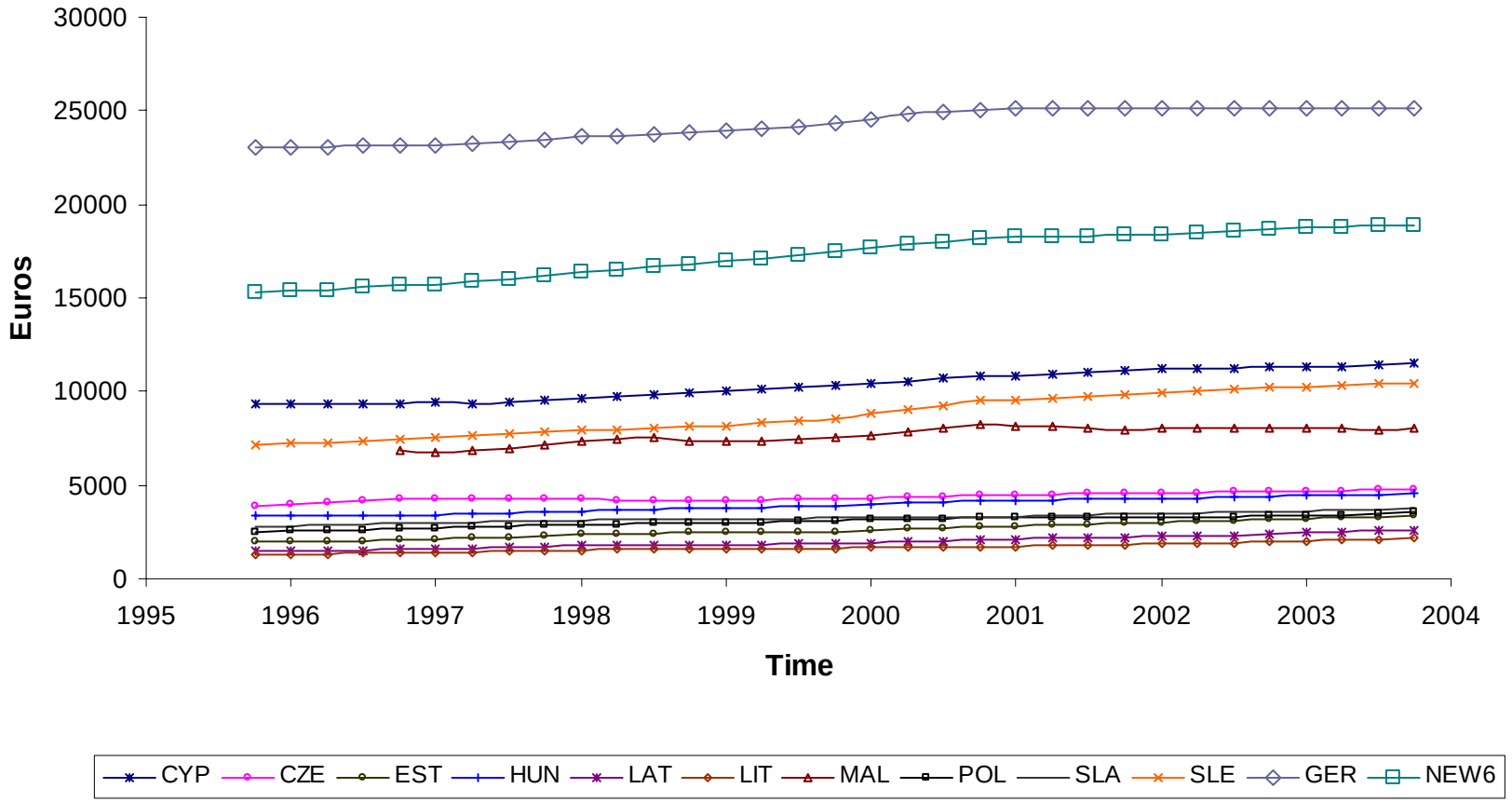

Figure 2: Real GDP per Capita Index (base 1996)

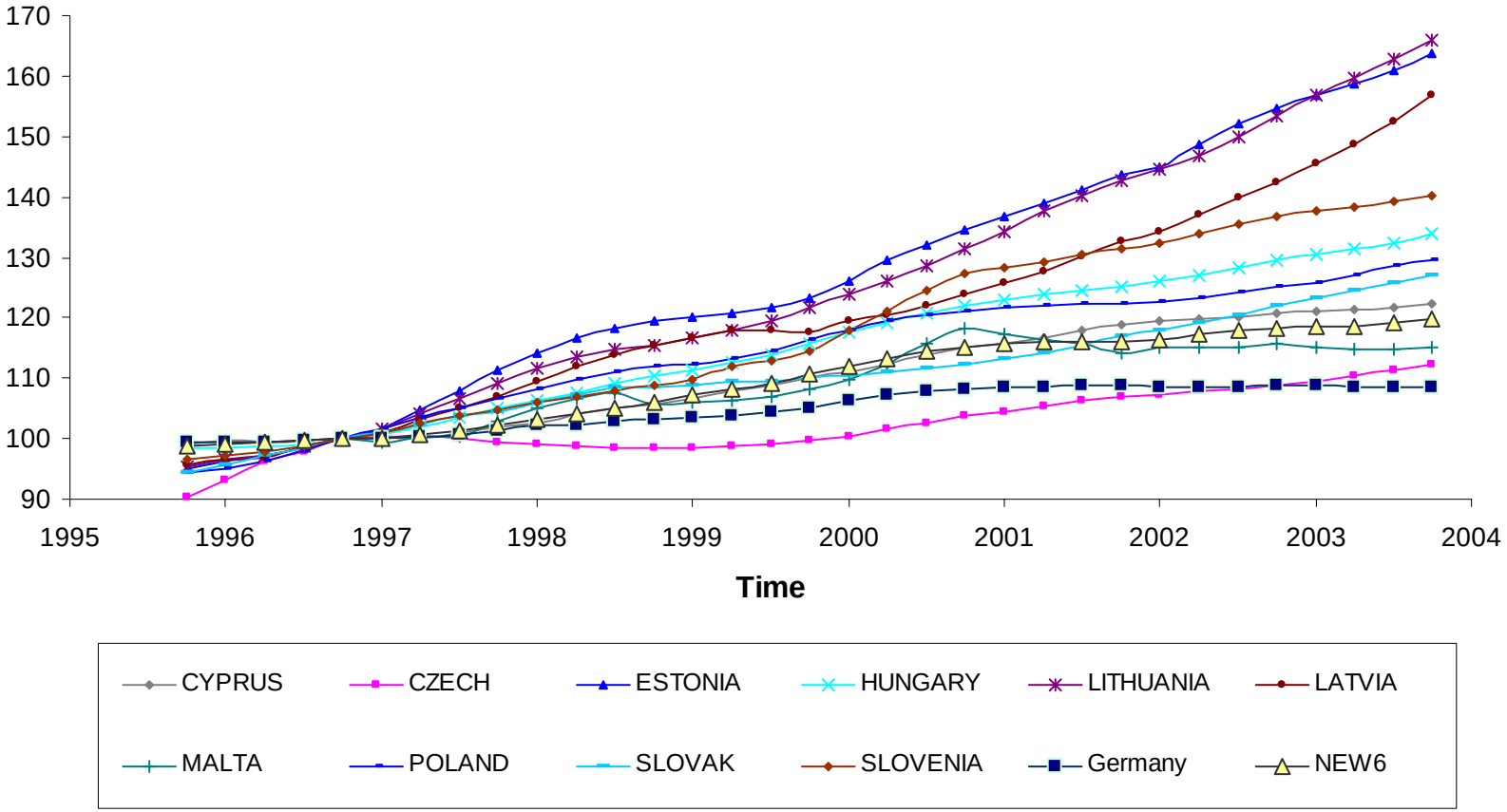

Figure 3: GDP/capita (in Euros) Convergence to Germany

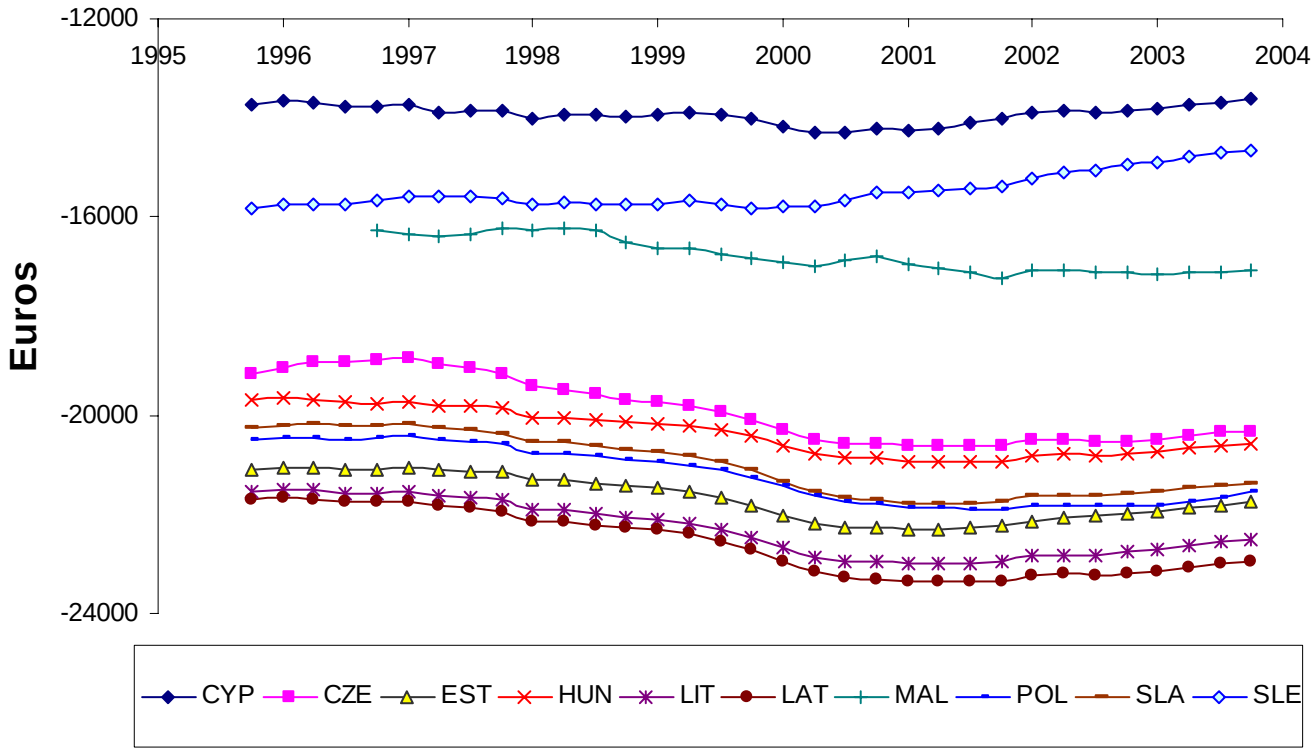

Figure 4: GDP-per-capita (in Euros) Convergence to the Last 6 Members of the EU 15

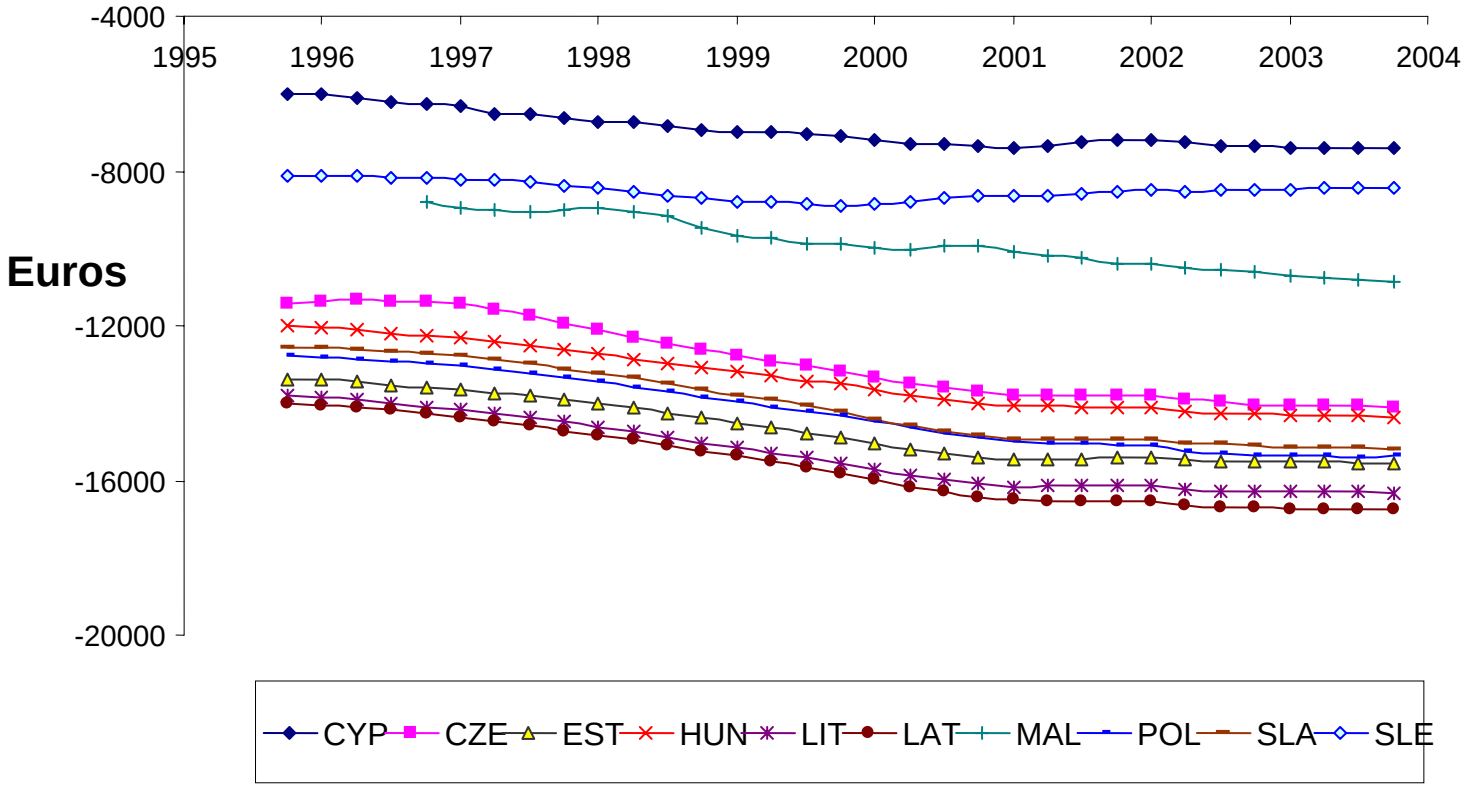

Figure 5: Inflation Convergence to Benchmark

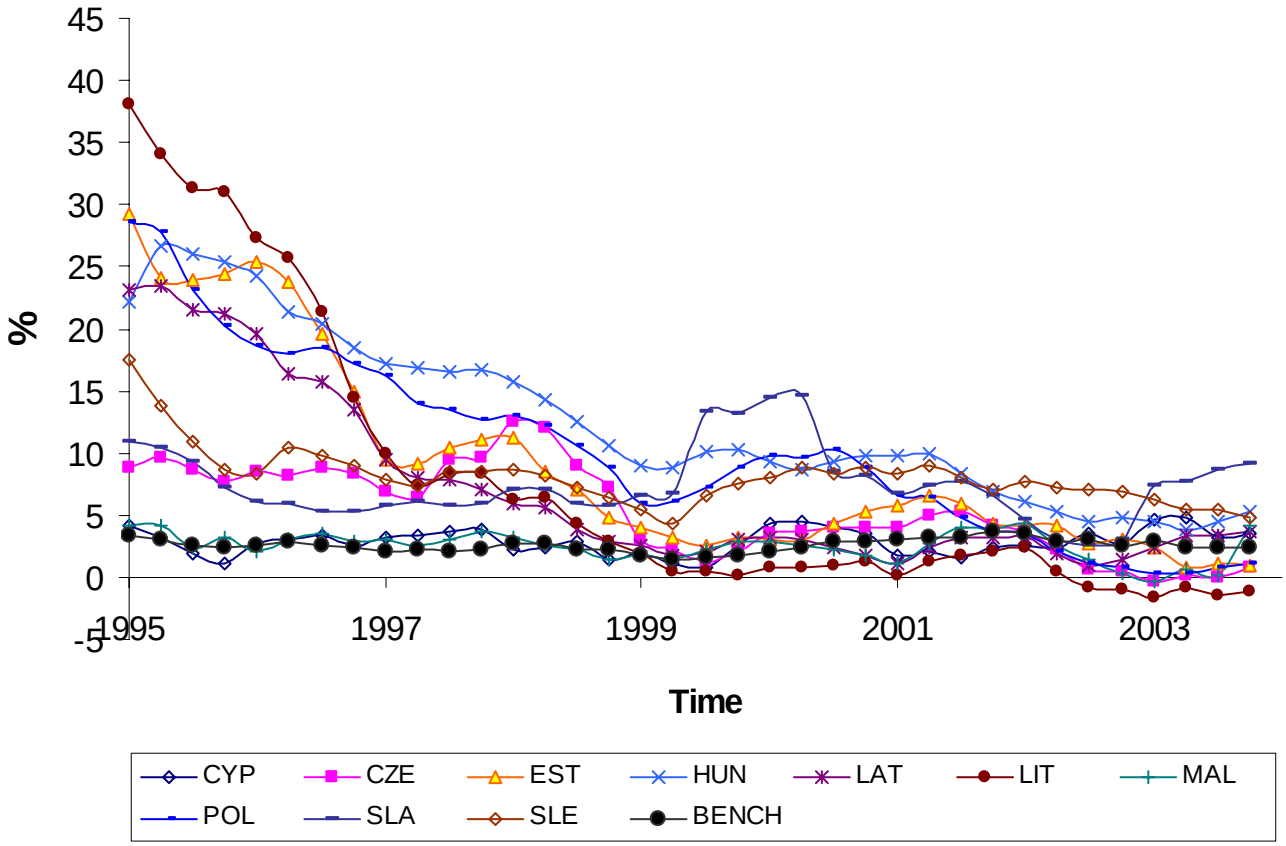

Figure 6: Government Bond Yield Rates

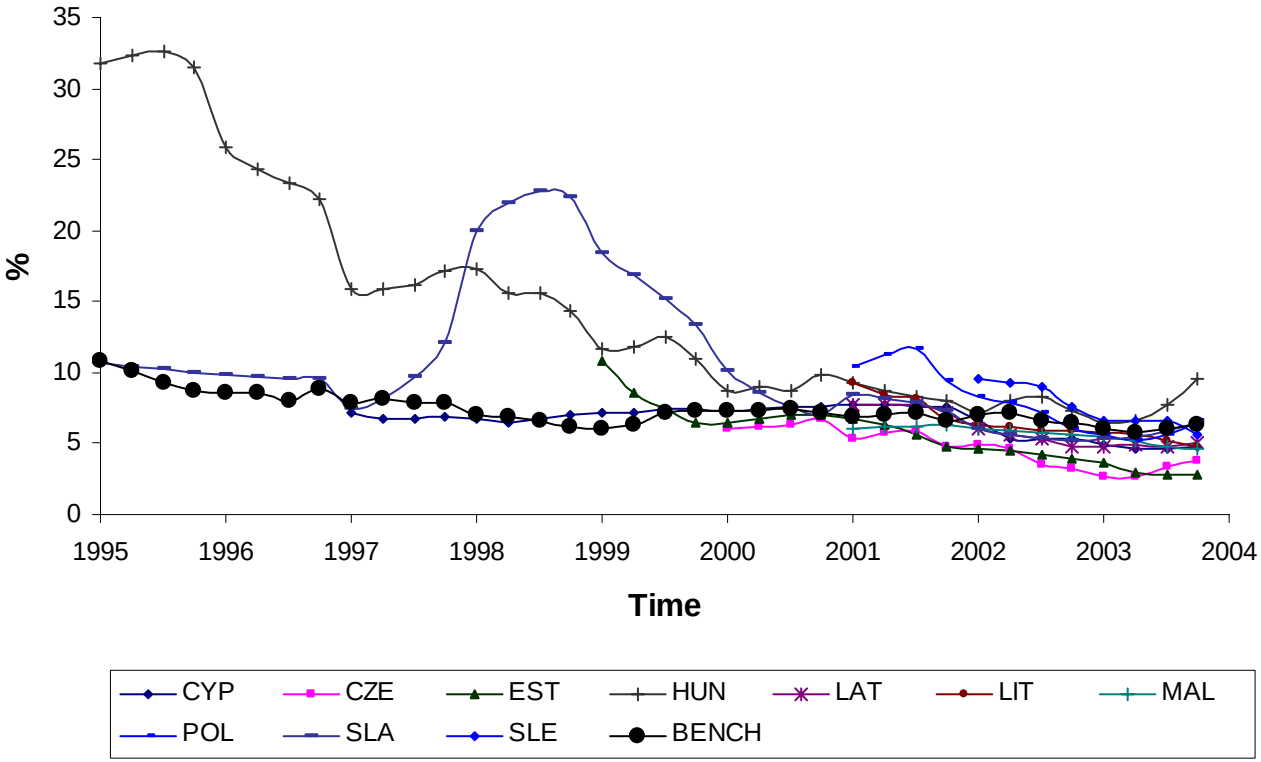

Figure 7: Budget Deficit to GDP Ratio

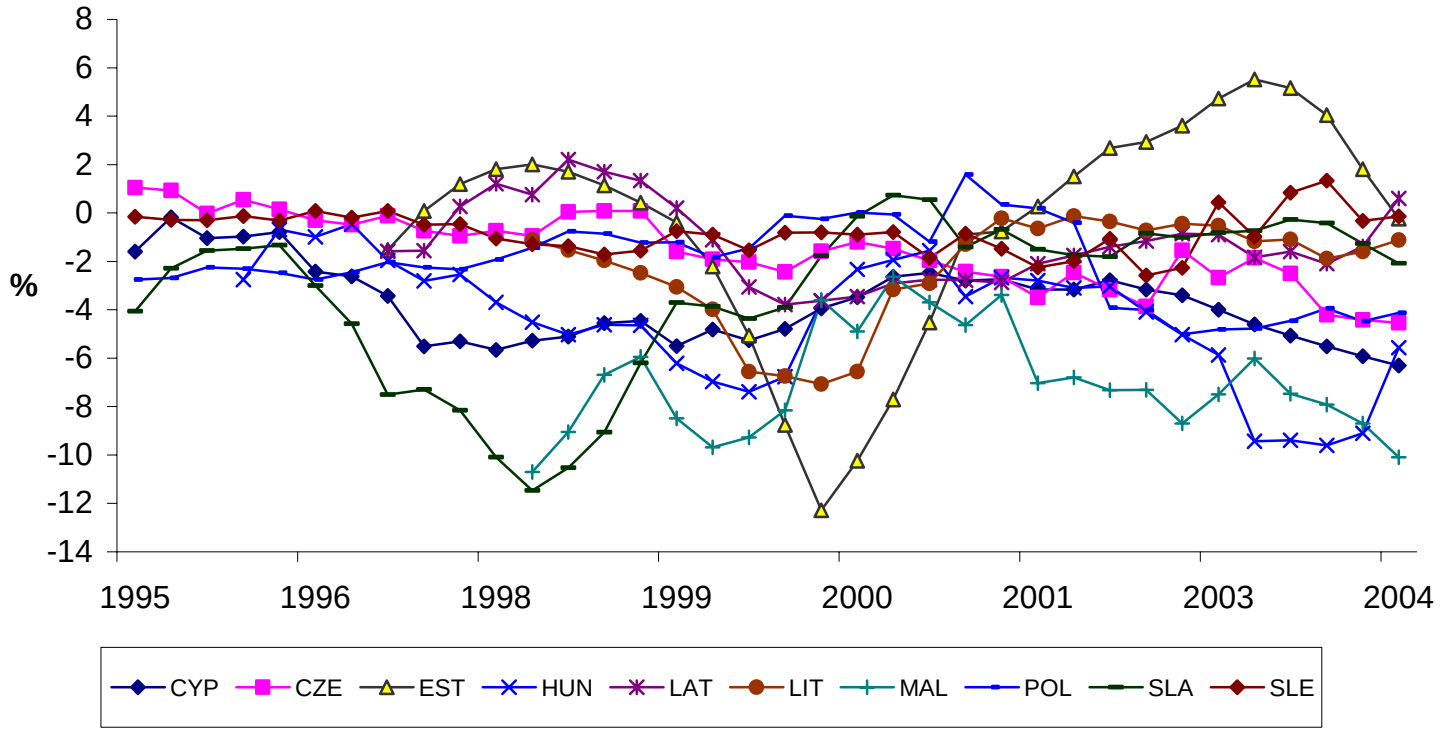

Figure 8: General Government Debt to GDP Ratio