Pilgrims to Eurozone: How Far, How Fast

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Abstract

This paper examines fiscal, nominal, and real per capita GDP convergence of recent EU members towards the EU standards. Novel features of the paper include more complete measures of convergence, in particular, fiscal convergence, and suitable tests of convergence, allowing for structural breaks in data. Incorporating structural change permits us to compare how convergence has progressed over time before and after a break period, such as the introduction of the euro. The results indicate slow but steady per-capita income convergence towards the EU standards, which may take several decades to be fully completed. We recommend policy strategies that may shorten the catching up process. Regarding convergence towards the Maastricht benchmarks, we find significant inflation and interest rate convergence, especially during the post-euro period. On the other hand, the results suggest weak fiscal convergence, 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 and hence their adoption of the euro. Authorities need to better coordinate monetary and fiscal policies to make sufficient progress towards satisfying the fiscal convergence to be able to join the euro zone soon.

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1. Introduction and Motivation

On May 2004, ten new members joined the European Union (EU). Eight of them (CEE8), namely the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, the Slovak Republic, and Slovenia, are the former transition economies. These countries all must join the euro zone at some point when convergence with a set of the Maastricht criteria is achieved. 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 (e.g, McKinnon, 1999). To the extent that the new EU countries complete their restructuring process and become more like the core members of the European Union in terms of a broad range of indicators, they are more likely to unilaterally adopt the euro sooner (e.g., Salvatore, 2004).

One of the ways to test the convergence of the new members towards the core EU is to measure their economic development in terms of GDP per capita towards the EU, as well as their distance from convergence criteria set in the Maastricht Treaty. In the spirit of the neoclassical growth model, the convergence of new member countries' per capita GDP to the levels of the core EU suggests a significant improvement in the standard of living of citizens of the new countries, which is the ultimate objective of economic integration. In addition, monetary convergence has significant implications for interim optimal exchange rate policies before a formal link to the euro. Last but not least, prudent fiscal performance is a necessary condition to avoid failure of the whole single-currency system.

Empirical literature on real and monetary convergence (reviewed in the next section) yields mixes results. The results are sensitive to the sample period used and methodologies employed. In this paper, we execute a comprehensive study that covers all the recent EU members and examine both nominal and real economic convergence, as well as fiscal convergence. The studies on the latter are scant. We contribute to the related literature of nominal and real convergence in several unique ways. First, we employ a PPP based approach to measure real convergence. To our best knowledge, this is the initial study that uses such an approach; previous studies measure convergence based solely on domestic currency. We hypothesize that growth of the GDP converted to the euro should look different from the one measured in domestic currency. A finding of faster convergence measured in a common currency than the one in domestic currency would create a strong argument in favor of entering

the EMU at a sooner than a later horizon. Because firms in the new EU economies are selling and will sell more and more in euro markets, von Hagen and Hofmann (2004) argue that "it is the aggregate euro-area price level that matters for them"(p. 18), They suggest that, given the large degree of market integration in the euro area, it is more sensible to use euro-area prices, rather than the national price level, to gauge aggregate demand in the euro area, which, given a production level, directly affects real GDP.

Second, we emphasize, the so far neglected issue of, fiscal convergence. Previous work, focusing mainly on monetary and real convergence, does not examine fiscal convergence thoroughly, neglecting the implications for fiscal sustainability. Berger et. al (2004) argues that the deteriorating fiscal performance, especially in Central European countries, has important implications for the Maastricht criteria and hence fiscal sustainability. Fiscal indiscipline (excessive deficits) may create inflationary pressures that hamper developments of inflation and interest rates. More importantly, and related to our findings, Buiter (2004) strongly 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.

Third, the methodology utilized in the paper is new and particularly suitable to analyze the issue of "catching up" of the new entrants to the older members. Until recently, the cross-sectional tests, which were used to analyze absolute convergence, were criticized for over-rejection of the null of no-convergence (Bernard and Durlauf, 1996), shifting the emphasis to conditional and stochastic convergence. However, the requirement to meet the EU criteria for full membership to the Union regenerates the discussions about absolute convergence. Recent introduction of a new test by Vogelsang (1998, 1999) and its application to the Carlino and Mills's (1993) idea by Tomljanovich and Vogelsang (2002) illustrates the benefits that can be gained from using this test for analyzing absolute convergence. In addition to the flexibility of this test in deriving speeds of convergence estimates reliably for varying countries (including the non-converging ones), it enables one to allow for the possibility of structural breaks. The growing literature[1] on presence and analysis of the structural breaks in emerging economies further motivates and validates the appropriateness of the use of this methodology in this paper.

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

In assessment of the real convergence, we use a widely recognized measure, namely real per-capita GDP. Real GDP per capita convergence is measured with respect to two benchmarks: (1) Germany's per-capita output as the 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 per-capita GDP is expressed in euros as well as in a local currency to analyze the impact of exchange rate effects on the inferences. For nominal (criterial) convergence we use benchmarks based on Maastricht criteria[3] as well as real economic development in the EU. Starting with monetary convergence, measured in terms of inflation and interest rates, we continue with investigating the fiscal convergence to the budget deficit and government debt ratio levels set at Maastricht. Inflation convergence is examined with respect to (1) inflation in Germany and (2) average inflation in six old member states with the highest inflation rates. Due to the lack of comparable long-term interest rates for the new EU countries, we provide some graphical treatment of the interest rate convergence rather than undertaking formal empirical tests.[4]

Fiscal (budget deficit, government debt) criteria are measured with respect to (1) deficit up to 3% GDP and (2) debt up to 60% GDP. In addition, we examine fiscal performance with respect to some factual performance in the EU: deficit/debt as percent of GDP in the EU. This helps us to test whether the accession countries are becoming similar in these criteria to EU countries (and which ones), rather than similar in terms of the existing percentage criteria.

The paper is organized as follows. 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.

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[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 issue, as far as the former transition economies are concerned, 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). The seminal paper by Bayoumi and Eichengreen (BE hereafter, 1993) form the methodological basis of much of this work on this issue. They test whether EU members displayed sufficient correlation of their supply (real) and demand (monetary) shocks over the period 1960-1988. The authors 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. The findings of BE are updated and extended by Korhonen and Fidrmuc (2001). In their analysis covering the period 1991-2000, they find that a number of the countries, which failed to meet the convergence criteria for membership in an EU-based optimal currency area during BE's sample period now displayed considerably more convergence, hence could be considered as potential members of an EU optimal currency area.[5] In a follow-up study, Korhonen and Fidrmuc (2004) find that the economic slowdown between 2000 and 2002 increase heterogeneity of business cycles between the euro area and the EU candidate economies.

Later work by Boone and Maurel (1998, 1999) report that business cycles in CEEs are similar to the German and the euro area cycles, suggesting that the full EMU membership would be fruitful. Babetskii et al. (2004) study the time varying correlation of demand and supply shocks between these countries and the euro area and report significant convergence of demand shocks, but divergence of supply shocks.[6] Horvath and Rátfai (2004) analyze the correlation of supply and demand shocks among the core EU and eight CEEs. They show that shocks among the core and the candidate EU countries, in particular Germany tend to be uncorrelated. Sayek and Selover (2002) find that EU-wide shocks have a relatively small influence on

[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).

business cycles in Turkey. Despite the mixed messages one gets from the business cycle correlations on convergence of the new members to the euro area, the overall trend seems to be that of increasing convergence.

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 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) examine the issue of price-level convergence between the EU and the transition-economy candidates.

Kočenda (2001), Kutan and Yigit (2004a, b), Brada et. al (2005) further study not only the nominal level convergence, but also real convergence. Kočenda (2001) examine 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. The 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 (2004a) show that results are sensitive to the choice of econometric methodology and find less convergence than those of Kočenda. Kutan and Yigit (2004b) analyze the price and monetary convergence of the new EU members to the core EU standards and conclude that that the degree of nominal convergence among the new EU economies is quite idiosyncratic. Brada et. al. (2005) use rolling cointegration to measure real and nominal convergence. Their results suggest that a peg to the Euro soon after accession is feasible for the East European countries, but the benefits of joining the Euro zone are as yet limited.

3. Methodology and data

3.1 Convergence methodology

Analysis of convergence has been an active but challenging field of interest since the late 1980s.[7] What started out as a bipolar undertaking of the question, namely cross-sectional vs. time series analysis, recently took the form of panel data analysis with methodologies ranging from panel unit roots and cointegration to dynamic panel and

[7] For a recent discussion of issues in the convergence literature, see Taylor (1999) and de la Fuente (2002).

maximum likelihood analyses. These varying methods were used to analyze differing concepts in convergence, namely absolute or conditional beta convergence, sigma convergence, and stochastic convergence. While the former types analyzed the issue of catching up, the latter focused on the synchronization of shocks and cross-sectional units moving together in time. Lately, the concept of stochastic convergence attracted more attention because of the advancements in panel data methodologies in the recent years.

However, the recent expansion of the European Union has motivated the researchers (and policymakers) to revisit the issue of "catching up" of the new entrants to the older members. Carlino and Mills's (1993) argument that both β- and stochastic convergence are necessary for real convergence only added to the desire of getting more inference in β-convergence. Until recently, the cross-sectional tests, which were used to analyze this question, were criticized for over-rejection of the null of no-convergence (Quah, 1996; Bernard and Durlauf, 1996).

Recent introduction of a new test by Vogelsang (1998, 1999) and Tomljanovich and Vogelsang (2002) enables us to tackle the β-convergence issue again relying on time series methodology. Following this segment of the methodological literature, we consider a simple model of convergence towards a benchmark as

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

where y_t is the difference of natural logarithm of variable minus a benchmark (in our case for example output per capita of country *i* minus the European benchmark at time *t*), μ is an intercept to capture initial level, t is is a time trend, and u_t is residual. 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 β should be positive and significant.

Such a methodology was initially employed by Carlino and Mills (1993), but only with u_t having a specific serial correlation in the form of AR(2). Vogelsang (1998) extended the analysis of this specification to u_t with unknown form of serial correlation, spanning all possibilities from $I(0)$ to $I(1)$. If one fails to do so, one can

face false inference on the trend coefficient when the errors are integrated.[8] To prevent this Vogelsang (1998) devised a trend function hypothesis test with undetermined degree of serial correlation. His statistics in model (1) are composed of

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

where z_t is $\sum_t y_j$, $S_t = \sum_{j=1}^{t} u_j$ while X_{yt} and X_{zt} are made up of $\begin{bmatrix} 1 & t \end{bmatrix}$ and $\begin{bmatrix} t & \sum_t j \end{bmatrix}$, respectively. For more than one coefficient restriction, his tests are

$$\begin{aligned} T^{-1}W_T &= T^{-1}\left(R\hat{\beta}-r\right)'\left[R\left(X_y'X_y\right)^{-1}R'\right]^{-1}\left(R\hat{\beta}-r\right)\Big/ s_y^2 \\ PS_T &= T^{-1}\left(R\hat{\beta}-r\right)'\left[R\left(X_z'X_z\right)^{-1}R'\right]^{-1}\left(R\hat{\beta}-r\right)\Big/\left(s_z^2\exp\left(bJ_T(m)\right)\right) \\ PSW_T &= T^{-1}\left(R\hat{\beta}-r\right)'\left[R\left(X_y'X_y\right)^{-1}R'\right]^{-1}\left(R\hat{\beta}-r\right)\Big/\left(100T^{-1}s_z^2\exp\left(bJ_T(m)\right)\right) \end{aligned} \tag{3}$$

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

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

This is the Wald statistic that tests the joint hypothesis of $c_2 = c_3 = \cdots = c_m = 0$. Vogelsang (1998) found the values and adjusted *b* and *m* in such a way so that the statistics would be comparable and valid for every type of serial correlation, including the unit root.

Despite the vast flexibility of these tests in deriving mean and trend 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 volatile nature of these economies and presence of structural shifts that are documented in empirical literature. The problem of structural breaks during transition is given a serious empirical consideration in Fidrmuc and Tichit (2004) who provide abundant

[8] When u_t is *I*(1), the estimate of β one gets 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 .

evidence of them on a macroeconomic level. They argue that presence of structural breaks implies that empirical analyses of transition must account for the changing nature of the relationships studied; otherwise the findings will be misleading. However, only a few papers considered the structural breaks in applied research on transition issues so far (see for example Dibooglu and Kutan (2001) or Kočenda (2005)). For these reasons, we prefer the methodology presented in Vogelsang (1999) that extends the technique in Vogelsang (1998) and accounts 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 mean, trend, mean and trend, Vogelsang (1999) derives the asymptotics of his tests, both in cases of known and unknown break dates.[9] Without imposing a break date for our sample countries, we favor endogenously determining the break date despite the loss in power by not imposing an arbitrary break date. In these tests, first the break date is estimated by maximizing $T^{-1}W_T$ for $T_b \in \Lambda$ where Λ is the trimmed sample. Second, using the estimated break date, normalized *t*-statistics are obtained using the altered versions of Equation (2) (only y_t version is displayed)

$$y_t = \delta_1 DU_{1t} + \delta_2 DU_{2t} + \gamma_1 DT_{1t} + \gamma_2 DT_{2t} + u_t \tag{4}$$

where $DU_{1t} = 1$ if $t \le T_b$ and 0 otherwise, $DU_{2t} = 1$ if $t > T_b$ and 0 otherwise, $DT_{1t} = t$ if $t \le T_b$ and 0 otherwise, and finally $DT_{2t} = t - T_b$ if $t > T_b$ and 0 otherwise. Asymptotic critical values derived in Vogelsang (1999) by 10,000 iterations are displayed below the coefficient estimates in each table. His analysis (that uses Maddison (1991) data) and a later paper by Tomljanovich and Vogelsang (2002)[10], specifically on the convergence issue, provide applications and interesting results of this methodology.

3.2 Data

We analyze the recent ten EU members' performances, namely, Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, the Slovak Republic, and Slovenia, in satisfying the convergence criterion of the Maastricht

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

Treaty. Therefore, the variables under scrutiny are inflation and interest rates for monetary convergence, and deficit- and debt-to-GDP ratios for fiscal convergence. Specifically, we use the nominal benchmarks of the lowest three inflation rates of EU15 plus 1.5%, same three countries' average government bond yield plus 2%, deficit ratio below 3%, or debt ratio below 60%.

We also analyze real convergence in GDP per capita figures (both real and in Euros) to approximate on how long it will take for these countries to "catch up" to the standards of their Western counterparts. We utilize two benchmarks in general: the core of the EU is represented by Germany and the periphery by average values of the six members of the EU15 (Greece, Spain, Portugal, Austria, Finland, and Sweden) that entered the EU as the last ones before the recent enlargement.

The time span of the quarterly data is from 1995:1 to 2003:4. This time span was chosen since in 1995 the first new EU members begun officially applying for the EU membership. This year was also taken as a point of time from which the EuroStat begun to complete harmonized time series on prices and other variables. In addition, pre-1995 period includes major shocks associated with the beginning of transition in many economies under our survey. Major bulk of the quarterly data is obtained from the International Financial Statistics of the IMF, and the EuroStat. Supplements and completions were made by contacting individual central banks and finance ministries of individual countries.

In addition, some quadratic interpolation from annual data was used to fill some missing data points since the empirical methodology relies on uninterrupted data. Seasonality in level GDP is eliminated by using a moving average of the four quarters $\left(X_t = \sum_{s=1}^{4} \frac{1}{4} V_{t-s}\right)$ while inflation rates are annualized (hence de-seasonalized) by finding the annual growth rate in CPI $\left(X_t = \ln V_t - \ln V_{t-4}\right)$. 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. The Euro denominated variables, when not available (e.g., GDP in Euros in Figure 1), are generated by multiplying the local currency values by the Euro (for 1999-2003 period) and ECU (for 1995-1998 period) exchange rate of the local currency.

The only time we deviate from the use of actual levels of the data is with real GDP derived from local currency and the harmonized CPI. In order to make these very different values in local currencies comparable to the benchmarks expressed in

euros, we convert them to form a volume index (base 1996) for all countries (Figure 2). Since the recent 10 members should grow faster in real terms to "catch up" with the benchmarks, we conclude for convergence when we observe divergence in the indexes away from the benchmark. Next section elaborates on the estimation process and results.

4. Estimation and Results

Results of the estimations are displayed in Tables 1 to 4. We display the results for *PSW* and *TW* tests given by specification (3), both because of their superior power properties and ease of interpretation of the coefficients. Despite the better power performance of the *TW* test, one should note the limited size of the sample for this specific test and its resulting conservative nature under such conditions. In general, the values of coefficients are robust for both procedures, but *TW* test tends to under-reject the null-hypothesis. We base our interpretation on the *PSW* results but report both for robustness control.

Vogelsang (1999) emphasizes that interpretation of the coefficients should always be done using the *y*-regression (*PSW*, *TW*) since the *z*-regression (partial sums, *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. Also displayed at the bottom two rows of each table are the asymptotic critical values for the endogenous break option of the *PSW* and *TW* tests, respectively. Notes at the bottom of each table display the dependent variable and a brief relevant guideline for interpretation of results.

4.1 Real convergence

Previous studies measure real convergence, using industrial production data (see Kočenda, 2001; Kutan and Yigit, 2004 a, b; Brada et. al., 2005). In this paper, we report results of the real convergence measured by the developments of real per-capita GDP in several panels of Table 1. We use Germany's per-capita output as the benchmark for the EU core and an average of the six per-capita GDP's defined in section 3.2 as a proxy for the EU periphery. Thus, our dependent variable is difference

between per-capita output 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 necessarily a negative number. Further, the real per-capita GDP is expressed in euro as well as in a local currency; to avoid problem of local currency incompatibilities we equalize absolute numbers at the base year of 1996 (as described in section 3.2). Since none of the new member countries begins the researched period with the per-capita GDP higher than the lowest per-capita GDP in any old EU member country, we expect the mean to be negative (for Euro levels) and convergence to higher per-capita GDP would be reflected in a positive and significant trend. In the local currency comparison, we expect all countries to start from the same level (hence a zero-mean), and have a faster growth rate than the benchmark countries (positive trend).

All new EU members start below the per-capita GDP level of Germany as well as the periphery (Tables 1a and 1b) when measured in euro; the difference is understandably larger with respect to Germany. There is an endogenously detected break date in the first quarter of 2000 in majority of countries. Before the break, none of the countries for which we have statistical significance of the trend display convergence towards Germany or to the periphery, as the coefficients are all negative. The negative trends are reflected in lowered means at the beginning of the post-break period. This does not mean that the real per-capita GDP decreased: rather, the distance from Germany or the periphery widened. During the post-break period the trends are positive for several countries, and convergence is taking place with respect to Germany (Table 1a). The same is not true, however, with respect to the periphery (Table 1b), since trend coefficients are negative.

This is an important finding and requires further elaboration. After careful examination of the data, we detect that German GDP per-capita is stagnant after 2000 and slows down in case of the periphery, while new EU countries record low but continuous growth on average (Figures 3 and 4). Thus, the materialized break in our dependent variable should not be attributed to the transition countries, but rather to Germany and 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 between the recent members and the periphery, the recent members have higher growth rates. However, since we are looking at the nominal values, even with a smaller growth, the periphery still has a higher per capita

increase than the newcomers in absolute terms. The increasing difference between GDP per capita levels is indicative of absolute convergence not being close. The chances are better with respect to stagnating Germany, of course, only as long Germany is stagnating, which is not a very realistic assumption. To summarize, new EU members must maintain the higher per-capita GDP growth than the old EU countries and the difference in growth rates will have to continue for decades for the 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 per-capita GDP growth is (and also stays at) 5% and that of the richer country is 2%. Using different set of assumptions and methodology Fischer et al. (1998, Table 11) claim that time needed to close the per-capita GDP gaps ranges from 17 to 75 years with 31 years on average.

In case of the per-capita real GDP measured in local currencies, the starting point is similar as in the former case: negative intercept coefficient meaning lower pre-break initial level of output in the new EU members. However, the positive trend coefficient means convergence during both pre-break and post-break periods with respect to Germany as well as to periphery (Tables 1c and 1d). 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, though. The result basically means that all countries (including Germany) start from the same point (100 at 1996) and start growing. Those who grow faster (new EU members) will naturally have a higher trend value than Germany or the periphery. These findings in Tables 1c and 1d are thus encouraging.

4.2 Convergence related to Maastricht criteria

Monetary convergence

Inflation convergence towards the Maastricht benchmark (the lowest 3 inflation rates plus 1.5%) is clearly observed for most of the new member countries (Table 2a). Reduction of inflation rates is observed also with respect to inflation in Germany (Table 2b) and average inflation in the periphery (Table 2c). New EU countries start

with much higher inflation rate and reduce it over the time[11] (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) The issue of price level convergence is important because it is related to the broader issue of convergence in exchange rates between the candidate countries and the EU. If new EU members have different price levels than do existing EU members and that the gap is quite large, then such a long-run inflation differential has implications for exchange rate policy in the former countries because it brings the viability of a pegged regime into question as the inflation differential may not be offset by productivity increases due to Balassa-Samuelson (BS) effects. Égert (2002) and Égert et al. (2003) report significant BS effects in the countries of central and Eastern Europe. However, our results indicate that satisfying the inflation criterion should not pose a problem for majority of the transition countries. [12]

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 interest rate criterion. 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 an accomplished task for majority of the new EU members. Actually, since 2002 the interest rates have been further lowered in most of the countries.

Fiscal convergence

The outlook of convergence is not as bright when we examine the fiscal performances of the new EU members. Despite the inspection of fiscal convergence to multiple criteria, the results show that there is more work to be done in reaching fiscal discipline. The dependent variables in the analyses are the budget deficit (surplus)

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

[12] 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.

ratio to GDP and total debt to GDP ratio 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., -2% for two percent for deficit), all mean values that are positive indicate surplus or deficit (debt) ratios below (less negative) 3% (60%), 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 mean just the opposite.

Although many coefficients lack statistical significance in the deficit analysis, which precludes unambiguous judgment (Table 3a and 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 5 countries with (statistically significant) surplus coefficient proceeded with its reduction. In the post-break period statistical insignificance precludes a qualified judgment, but countries in general start with higher deficit ratio (or lower surplus ratio) and half of the countries further increase their deficit ratio. A pattern we can trace is that we have two groups of countries: the countries that improved its deficit (or surplus) situation when compared to the pre-break period and those whose deficit situation is worse off. The former countries tend to relax a bit and start spending after the break, whereas, the latter countries start to discipline their fiscal position and their deficit ratio shows a positive trend (deficit ratio declines). In any event, deficit-to-GDP ratio seems to be a challenging criterion to meet.

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). Post-break period is characterized by primarily negative and large means and positive trend coefficients, which indicates that most new EU members start 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 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 mean that 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 debt to GDP ratio is a dominant feature of the post-break period (more in the case of the 3 countries mentioned above). Similar tendency, with even more negative trend coefficients, is observed when 60% benchmark is replaced by actual debt to GDP ratio in the periphery. Figure 8 clearly displays, that 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 (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 since their indebtedness increases in general.

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 finances' reforms and lack of fiscal discipline could lead to sinister consequences for these countries, well beyond the satisfaction of the Maastricht criteria and consideration of entry into the euro zone.

Our results have important implications. One implication is for the authorities to better coordinate fiscal and monetary policies to improve fiscal discipline.[13] Second is to implement polices to improve fiscal consolidation.[14] 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 revenue-raising polices, such as higher taxes. To further improve fiscal balances, they also suggest

[13] 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).
[14] Daviddi and Ilzkovitz (1997) provide a discussion of this and other related issues.

supply-side measures in the labor market, such as cutting wages and improving competitiveness. These arguments are in line with those of Buiter (2004) who strongly argues that achieving fiscal sustainability is not only a necessary but also a sufficient condition for the new EU members to enter the Eurozone.

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, but also uses a vastly flexible test of convergence, allowing for structural breaks, and hence providing improved inferences. Instead of using industrial production as a measure of real convergence, we 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.

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 helped the real-per capita convergence. In short, the slow but steady per-capita convergence towards the EU standards looks like that it will take several decades to be fully completed. However, policymakers may shorten this process by designing further structural reforms and encouraging more FDI and trade flows into the new members to be able to speed up the real convergence process.

We also find significant nominal and/or 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. On the other hand, we observe serious deficiencies in meeting the criteria on deficit-to-GDP and debt-to-GDP ratios. We note that the new members' neglect 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, can be some useful policy choices in this regard. Otherwise, the current fiscal practices may delay their entry to the Exchange Rate Mechanism and hence the adoption of the euro.

In conclusion, our results indicate that new EU members have achieved significant nominal convergence and made some progress for real convergence. This may have been at the expense of some lack of fiscal discipline, however. Therefore, authorities need to better coordinate monetary and fiscal policies to improve their progress towards satisfying the fiscal convergence if they desire to join the euro zone faster. Overall, despite the significant progress of the new members towards adapting the euro, it seems premature for them to adopt the euro yet. Instead, they should focus their efforts on achieving fiscal discipline and introducing additional supply side reforms that would help them join the euro zone sooner.

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

	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	**-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
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: Each number represents thousands of Euros. The dependent variable is the per capita output level in country *i* minus German output per capita.

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

	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 $T^{-1/2}t_y$)*				
Countries	μ_1	δ_1	μ_2	δ_2	μ_1	δ_1	μ_2	δ_2	*Break date*
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
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 per capita output level in country *i* minus the average output per capita of the last 6 members of the EU15.

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

	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 $T^{-1/2}t_y$)*				
Countries	μ_1	δ_1	μ_2	δ_2	μ_1	δ_1	μ_2	δ_2	*Break date*
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
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: 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 German output per capita. Therefore, convergence would be reflected with a significant positive trend.

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

	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 $T^{-1/2}t_y$)*				
Countries	μ_1	δ_1	μ_2	δ_2	μ_1	δ_1	μ_2	δ_2	*Break date*
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
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: 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 output per capita level of the last 6 members of EU15. Therefore, convergence would be reflected with a significant positive trend.

Table 2a: Inflation Convergence (to benchmark criterion)

	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	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
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 represent percentage values. The dependent variable is the inflation level in country *i* minus the 3% benchmark.

Table 2b: Inflation Convergence (to German inflation)

	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	**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
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 inflation level in country *i* minus German inflation.

Table 2c: Inflation Convergence (to last 6 members of EU15)

	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	-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
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 inflation level in country *i* minus the inflation level in the last 6 members of EU15.

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)

	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	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
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 German budget deficit ratio (a positive number indicates a surplus or a deficit below German levels).

Table 3c: Budget Deficit Convergence (to new 6 level)

	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	**9.50****	**-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
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 the average deficit ratio in the last 6 members of EU15 (hence a positive number indicates a surplus or a deficit ratio below their average).

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)

	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	**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
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 consolidated debt to GDP ratio in country *i* minus the German debt ratio (hence a negative number indicates a debt ratio worse than that of Germany).

Table 4c: Consolidated Debt/GDP Convergence (to EU15's last 6 members' debt to GDP ratio)

	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	**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
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 consolidated debt to GDP ratio in country *i* minus the debt to GDP ratio of EU15's last 6 members (hence a negative number indicates a debt ratio worse than theirs).

Figure 1: GDP Per Capita in Euros

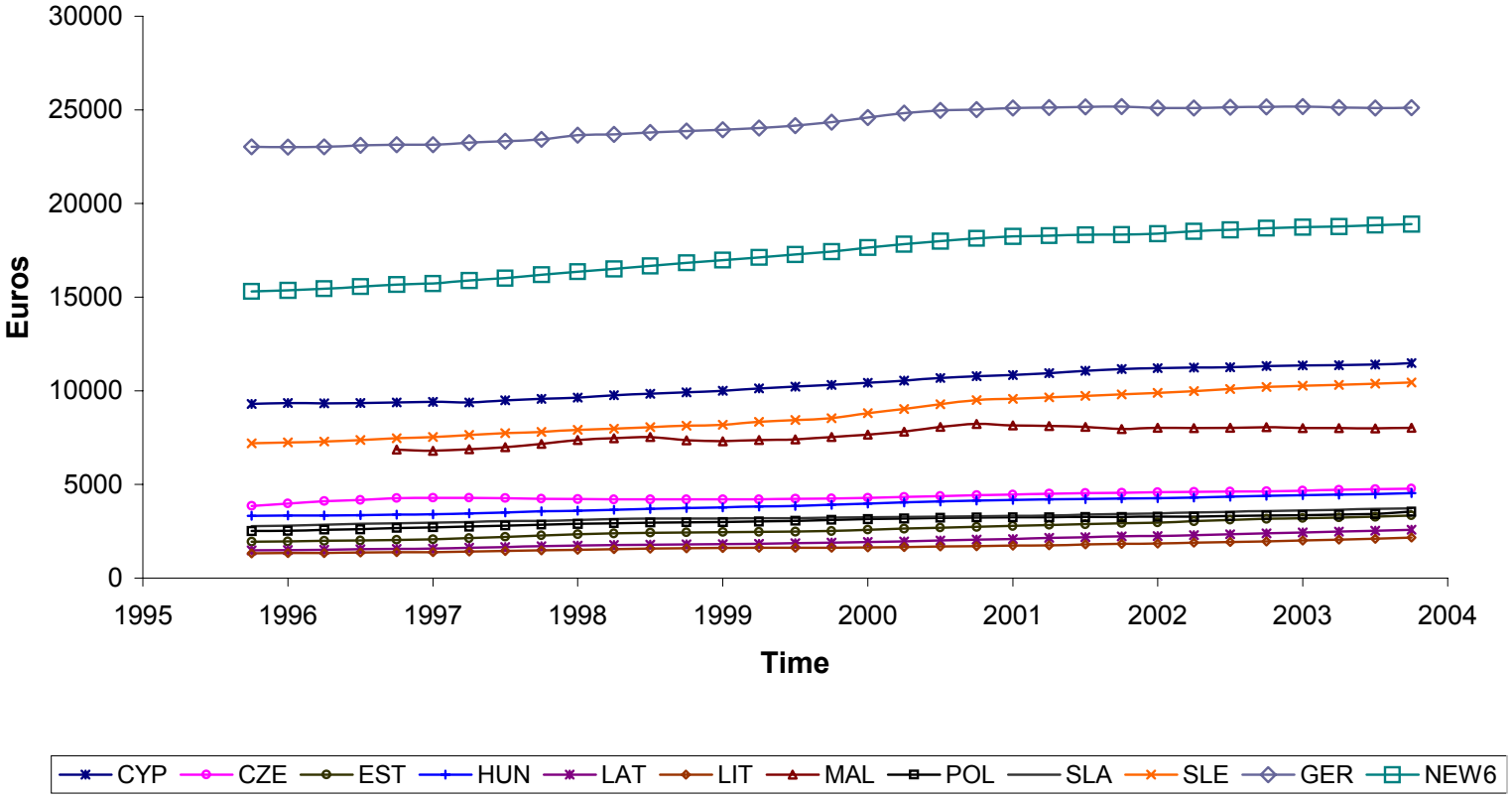

Figure 2: Real GDP per Capita Index (base 1996)

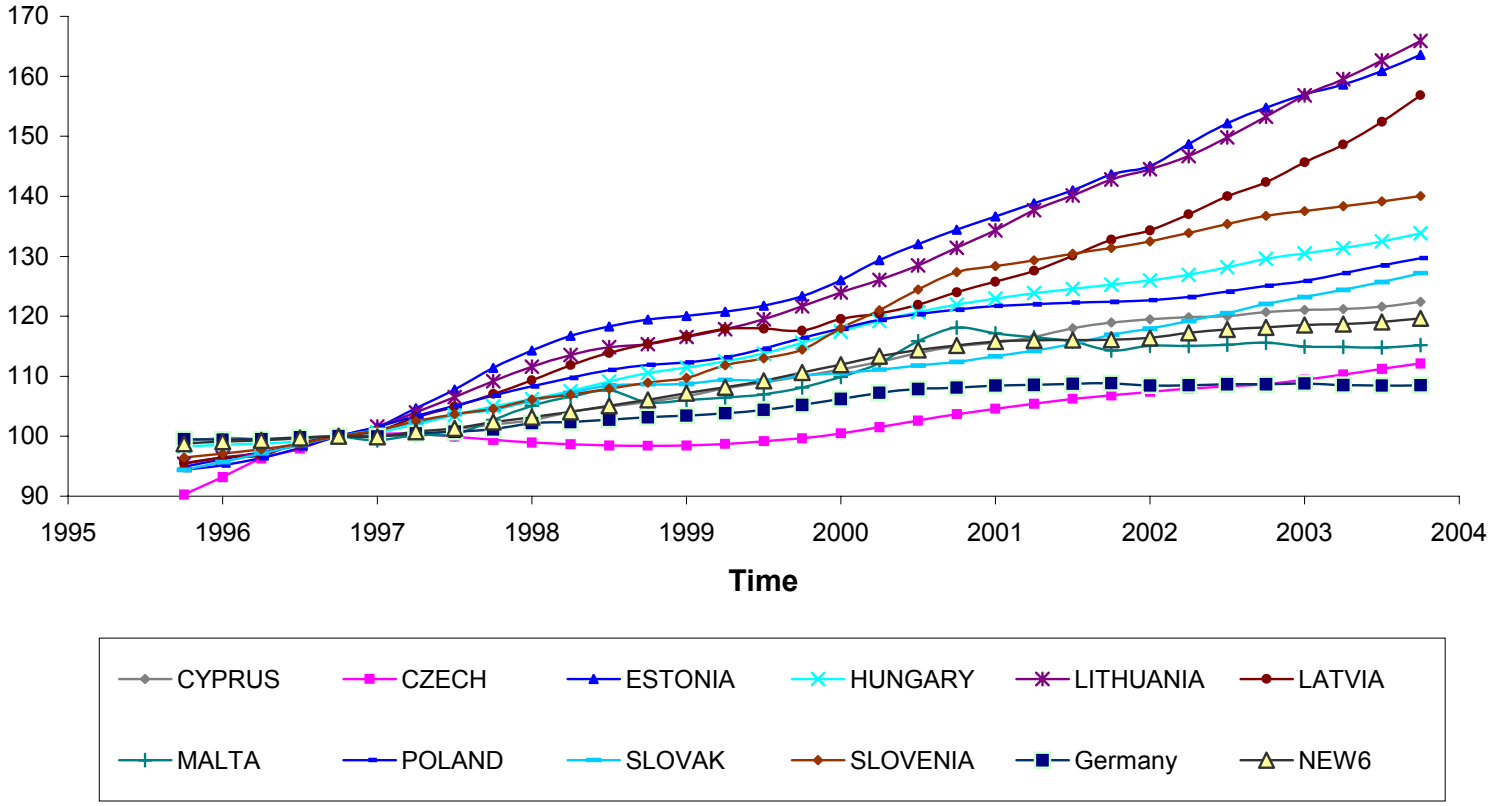

Figure 3: GDP/capita (in Euros) Convergence to Germany

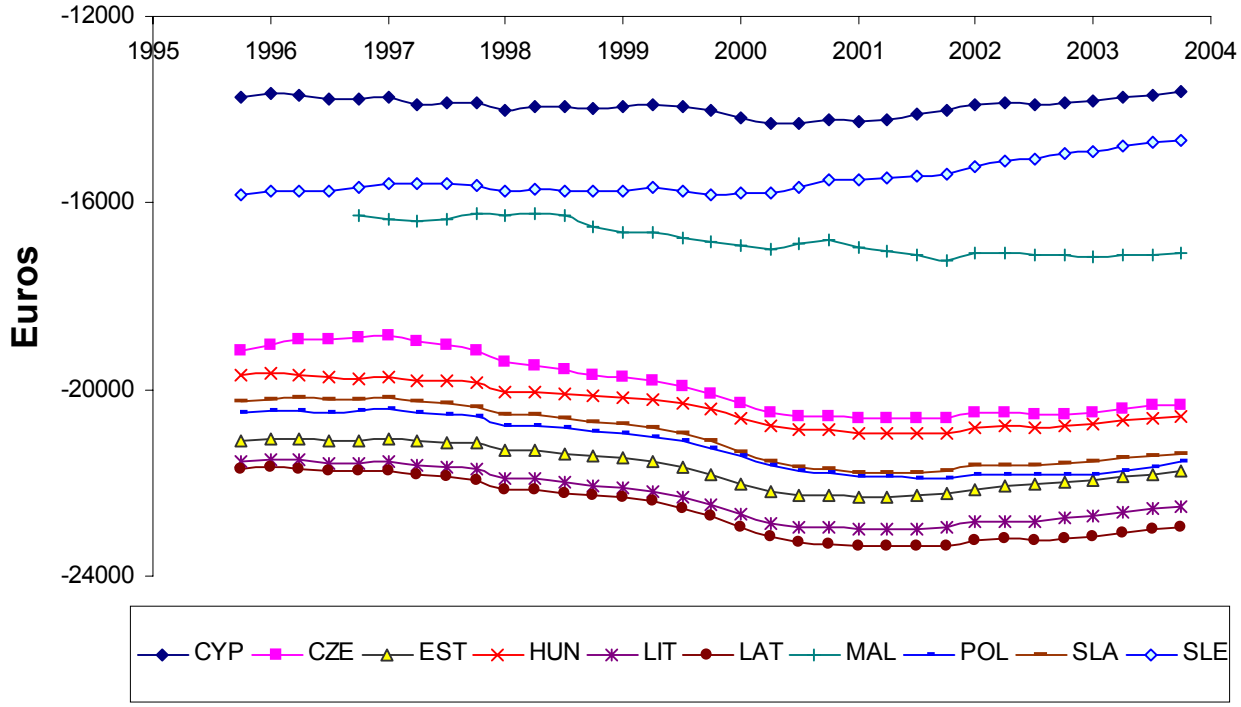

Figure 4: GDP/capita (in Euros) Convergence to New 6 Members of EU15

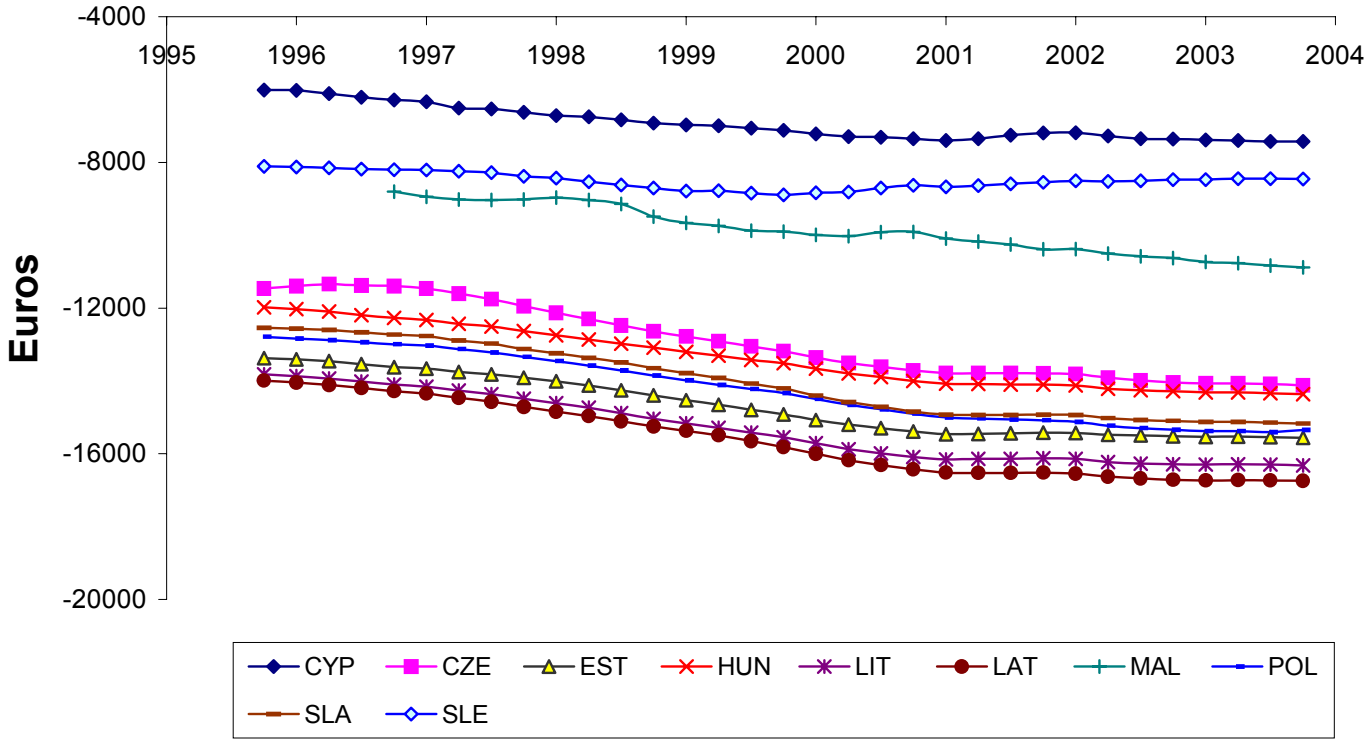

Figure 5: Inflation Convergence to Benchmark

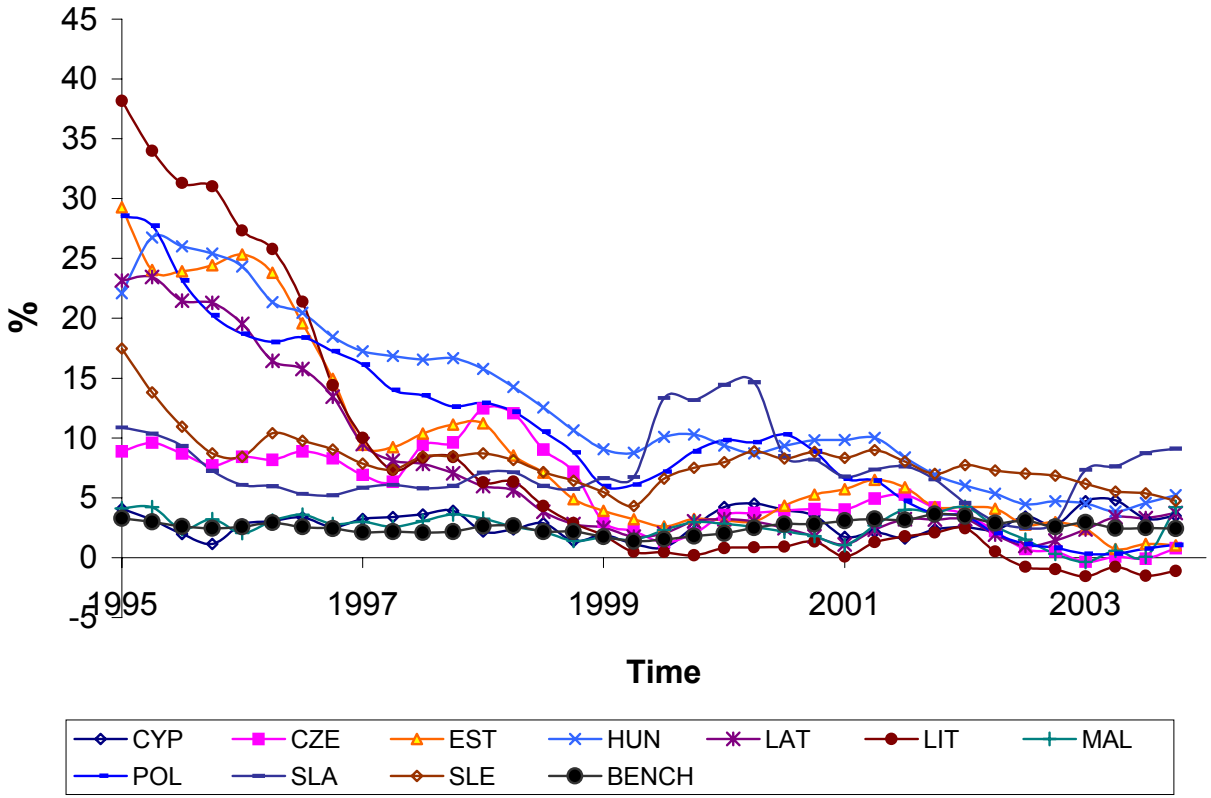

Figure 6: Government Bond Yield Rates