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## Asymmetric growth and inflation developments in the acceding countries: a new assessment

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**NATIONAL BANK OF BELGIUM**  
**WORKING PAPERS - RESEARCH SERIES**

**ASYMMETRIC GROWTH AND INFLATION DEVELOPMENTS IN  
THE ACCEDING COUNTRIES: A NEW ASSESSMENT**

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The views expressed in this paper are those of the authors and do not necessarily reflect the views of the National Bank of Belgium.

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## **Abstract**

In this paper, we use a SVAR model in order to study the asymmetry of growth and inflation developments in the acceding countries vis-à-vis the euro area over the years 1995-2003. The model combines two strands of the literature, the explanation in terms of country-specific and euro area shocks, and a further split between supply and demand shocks. The four structural shocks may all create asymmetries vis-à-vis the euro area. It appears that country-specific shocks are the main source of growth or inflation divergence, rather than the distinct way in which acceding countries react to euro area shocks. But whereas country-specific supply shocks are mainly responsible for growth divergence, country-specific demand shocks are mainly responsible for inflation asymmetry. Hence, a low asymmetry in terms of growth does not necessarily imply a low asymmetry in terms of inflation, although the latter is particularly important for countries aiming to join the euro area. There is some evidence that both asymmetries were on the fall over the last years of the sample.

JEL-classification: E3, F42, F15 (C32).

Key words: Optimal currency area, Euro-area wide shocks vs. Country-specific shocks, Structural VAR.



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## 1. Introduction

In May 2004, ten countries joined the European Union. These new Member States, that we shall keep calling "acceding countries" in order to facilitate comparisons with earlier papers, are already facing a new challenge<sup>1</sup>. Under the Treaty, they are expected to ultimately adopt the euro. No derogation has been allowed during the accession negotiations. All acceding countries intend to adopt the euro, although with different timings. However, in order to be eligible for euro area membership, all provisions of the Maastricht Treaty must be satisfied.

In the economic literature, discussions about the readiness of acceding countries for joining the euro area often refer to the "optimal currency area" (OCA) theory. According to this theory, participating in a monetary union is beneficial if the gains exceed the costs of adjusting to asymmetries stemming from shocks through means other than monetary policy, that is labour mobility, wage and price adjustments or fiscal policy. While the fundamentals of this theory go back to the sixties with the seminal contributions of Mundell (1961), McKinnon (1963) and Kenen (1969), a renewed interest was noted in the run-up to EMU. More recently, several authors produced applications for the acceding countries to measure the degree of (a)symmetry of their business cycles and the possible sources of these asymmetries. Studies mainly concentrate on diverging developments in economic activity, but the asymmetric behaviour of inflation is equally important in the perspective of ERM II and ultimately, the adoption of the euro. In this paper, we study both growth and inflation asymmetries. To this end, we introduce a structural VAR model that combines the division between country-specific and euro area shocks with a further split between supply and demand shocks.

A survey of the literature is presented in part 2 of the paper. In part 3, we present the model and the measures used to quantify the asymmetries of the acceding countries vis-à-vis the euro area. The empirical results are presented in part 4, in terms of growth as well as in terms of inflation. The results will be compared to the asymmetries of current euro area members and so-called "pre-in" countries (Denmark, Sweden and the United Kingdom). Finally, we will try to assess whether the situation has evolved over the last few years.

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<sup>1</sup> Accordingly, the term "EU countries" will refer to the old 15 members.



## **2. Overview of the literature**

The comparison of business cycles can be based on simple methods such as the measurement of correlations between key aggregate variables. For example, Boone and Maurel (1998) calculate correlation coefficients between first differences or cyclical components of industrial production and unemployment for some of the acceding countries, taking Germany and the EU as benchmarks. Over 1991-97, they find a relatively high degree of business cycle correlation with Germany but not with the EU.

However, calculating correlation coefficients does not allow to ascertain whether differences between business cycles result from one type of shock rather than from another, although this could modify the assessment. For example, demand shocks may in some cases result from inappropriate economic policies that could be reversed. An assessment should take this into account if the policy framework can be adjusted to prevent such shocks. For technical reasons, it is rather difficult to identify more than a handful of structural shocks, which involves a compression of many shocks into a few. Typically in the literature, the shocks are identified as belonging to the demand or to the supply side and are estimated for each country separately by means of structural VAR models. This line of research was initiated by Bayoumi and Eichengreen (1993) in their comparative study on US states versus EU economies. They feared that working on growth statistics rather than on structural shocks could blur the picture because of the reallocation of production factors between US states after shocks, a process far less developed on the European level.

Once identified, the demand and supply shocks have been treated in much the same way as business cycles, with cross-correlations serving to measure the degree of similarity between the shocks experienced by the economies under study. Some applications have been made for the acceding countries. Fidrmuc and Korhonen (2001) examine the correlation of supply and demand shocks between ten Central and Eastern European Countries (CEECs) and the euro area as a whole from 1993/1995 to 2000, that is after the transitional recessions. As a benchmark, they compute the corresponding correlations for individual EU-countries. They find that the correlation of supply shocks may differ a lot from country to country and that a few CEECs (e.g. Hungary and Estonia) are just as correlated with the euro area as the majority of euro area members. On the demand side, a reasonable correlation is only found for Hungary and Poland but a low degree of

correlation is also the rule for the euro area members, large countries excepted. Latvia and Lithuania have demand shocks that are the opposite of euro area shocks.

The paper by Frenkel et al. (1999) examines demand and supply shocks in euro area countries and in 14 other countries including eight CEECs over 1992-98, taking on board some part of the transitional recessions in the CEECs. The correlations of shocks are computed with respect to Germany and France. Although the correlations differ significantly from one country to another, the overall picture suggests that they are the smallest for the CEECs. In 2002, Frenkel and Nickel repeated the exercise over 1993-2001, also with respect to Italy and the euro area as a whole. They concluded that on average, there were still differences in the shocks experienced by the CEECs. However, the more advanced CEECs were hardly different from the smaller countries of the euro area, especially in terms of supply shocks.

A few studies attempt to test whether the correlations of shocks have changed over time. Babetski et al. (2002) use time-varying coefficients in a regression of structural shocks on similar EU, Russian or German shocks with the US shocks maintained as the alternative attractor. Unfortunately, the time-varying coefficients on EU (or Russian or German) shocks and US shocks must add to one, which is a very restrictive assumption. Under this constraint, they find that the link between demand shocks and EU shocks has increased over 1990-2000 but that the link between supply shocks has deteriorated in several countries and is still rather low in many other cases. Another way to test whether the correlation of structural shocks has changed, is to estimate the SVAR models on subsequent time periods, as in Korhonen (2003), but the short data span does not allow to do this for all CEECs. Recently, Hall and Hondroyannis (2004) have applied orthogonal GARCH techniques - that are still feasible under a limited amount of data - to the correlations of shocks. Regarding inflation, correlations with the European Union have deteriorated over 1997-2001 to rebound somewhat since mid-2001. With respect to growth, correlations are very low since 1995 and no trend is visible in the correlations.

This line of research suffers from several drawbacks. Many papers only focus on contemporary correlations, discarding any possible transmission or reaction lag between countries. This could be a valid assumption on yearly data but in the case of acceding countries where data are necessarily of a monthly or quarterly frequency (to compensate for the short data span), important non-contemporary correlations might be overlooked. The "Frenkel papers" also highlight another important aspect. Differences between

business cycles do not only result from different shocks but also from different responses or adjustment dynamics to the same shocks. Hence, in these papers, a comparison is made between the impulse responses of the CEECs to supply and demand shocks and the responses of the benchmark country or area. However, as a supply shock to the euro area may differ from a supply shock to, for example, Slovakia, it seems difficult to draw any firm conclusion from the similarity of the adjustment processes to "a" supply shock. In a sense, one might prefer (and expect) different impulse responses to shocks when the latter are drawn from different distributions. A different transmission mechanism might in some cases enhance the similarity of the business cycles.

Boone and Maurel (1999) provide a solution to this shortcoming. They calculate correlations of impulse responses between some acceding and some EU-countries. But their calculations are not subject to the critique above since their impulse responses relate to a common shock, which is the same for every country. In their paper, they fit a regression for the unemployment rate of an accession country using shocks to EU or German unemployment derived from a separate regression. Then they compute the correlation of the impulse responses to this common shock. They also analyse the share of the variations in the unemployment rate that is explained by the common EU or German shocks, including both contemporary and lagged shocks. They find that CEEC cycles (especially in Hungary and Slovakia) are strongly influenced by the German cycle over 1991-97. The EU cycle, on the other hand, does not explain much over the period.

The comparison of impulse responses is similar in Korhonen (2003). He examines monthly indices of industrial production in the euro area and in nine acceding countries. One VAR is estimated per country. The model contains the industrial production in the euro area and in the acceding country and the identification of the two structural shocks -euro area wide and country specific- is achieved by a Cholesky decomposition with the euro area industrial production ordered first. The impulse responses of the two variables to the euro area shock can be compared. Korhonen also quantifies the share of the variation in industrial production of the acceding country due to euro area shocks<sup>2</sup>. In general, the results computed over periods ending in 2000 are disappointing, with low correlations of responses and/or low shares attributed to euro area shocks. However, the results are often in line with those found for euro area members like Greece or Ireland.

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<sup>2</sup> We will come back to the different (a)symmetry measures used by Korhonen in section 3.2.

One should notice that in these studies, the idea of discriminating between euro area shocks and country-specific shocks in order to assess the similarity of impulse responses in a proper way came at a cost: the supply / demand dimension was lost as well as the ability to discuss inflation asymmetries, which is unfortunate in the perspective of joining ERM II and adopting the euro. In the present paper, which builds on the same methodology as in Ide and Moës (2003), the two strands of the literature will be combined.

### **3. Model specification and asymmetry measurement**

In order to assess the asymmetry of growth and inflation developments in the acceding countries vis-à-vis the euro area, we estimate VAR models -one per acceding country- that include four variables: the growth rate of GDP and inflation, for the euro area and for the acceding country at hand respectively. Euro area and country variables are present in the same model, allowing to make a distinction between euro area shocks and country-specific shocks. Growth and inflation variables are present together, allowing to further discriminate between demand and supply shocks.

Once the four structural shocks have been identified, we can compute measures of growth and inflation asymmetries vis-à-vis the euro area, which can be attributed to each type of shock. An asymmetry assessment can be delivered not only in terms of the impact of the two country-specific shocks but also in terms of the possibly asymmetric reactions to the two common euro area shocks. Subsection 3.1 will elaborate on the technicalities of the model while subsection 3.2 will deal with the measures used to assess growth and inflation asymmetries.

#### ***3.1 Data, model specification and shock identification***

The analysis relies on the growth rate of GDP and on the inflation rate for the euro area and the acceding countries. Inflation is based on the GDP deflator, a variable that is more likely to reflect domestic supply and demand pressures. The data are quarterly and cover the period 1995q1-2003q2. They are seasonally adjusted. For some countries, data series were available from as early as 1993 but we kept 1995 as a starting date for two reasons. First, in order to discard the period of "transformational recession" at the beginning of the nineties and the most important turbulences due to the transformation process, including the price liberalisation of the early nineties. Second, in order to use the same sample

period across models, which should facilitate comparisons between countries<sup>3</sup>. This shorter sample period is however no absolute guarantee, as some countries were still undergoing deep structural changes over the period. It was necessary to adjust the inflation rate in several cases in order to remove important downward trends. In Hungary, inflation was adjusted for the controlled devaluation implied by the crawling peg until September 2001. This kind of "sophisticated" adjustment is not feasible in other countries. The Polish inflation rate was corrected by removing a linear trend over the whole sample period. The Estonian and Lithuanian inflation rates were adjusted for a downward linear trend over 1995-97. Charts of the time series before and after adjustment can be found in appendix 2.

The short sample period requires a parsimonious specification and all VAR models were estimated with one lag. We did not consider model specifications in terms of log levels of GDP and prices, which would allow for cointegration between variables. The sample is probably too small to deliver meaningful results. Working on monthly industrial production indices, Korhonen (2003) finds evidence of cointegration for some countries but only a few of the estimated cointegrating vectors look stationary and impulse responses are explosive. In the end, specifications in levels are discarded.

Without cointegration, our VAR model has the following MA structural representation:

$$X_t^j = \begin{pmatrix} \Delta y_t^{ea} \\ \Delta p_t^{ea} \\ \Delta y_t^j \\ \Delta p_t^j \end{pmatrix} = \begin{pmatrix} a_{11}^j(L) & a_{12}^j(L) & a_{13}^j(L) & a_{14}^j(L) \\ a_{21}^j(L) & a_{22}^j(L) & a_{23}^j(L) & a_{24}^j(L) \\ a_{31}^j(L) & a_{32}^j(L) & a_{33}^j(L) & a_{34}^j(L) \\ a_{41}^j(L) & a_{42}^j(L) & a_{43}^j(L) & a_{44}^j(L) \end{pmatrix} \begin{pmatrix} \varepsilon_{s,t}^{ea} \\ \varepsilon_{d,t}^{ea} \\ \varepsilon_{s,t}^j \\ \varepsilon_{d,t}^j \end{pmatrix}$$

leaving aside the constants for reasons of simplicity.

$j$  = Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland and Slovakia, "ea" stands for "euro area" and lower case variables are in logarithms. The  $a(L)$  are lag polynomials ( $a_0 + a_1 L + a_2 L^2 + a_3 L^3 + \dots$ ) where the  $a_{..}$  coefficients give the impulse responses to the structural shocks. All the structural shocks are assumed independent and are normalised:  $\text{Var-Cov}[\varepsilon] = I$ .

<sup>3</sup> Additional information on data availability and data sources can be found in appendix 1.

The identification of shocks will be achieved by imposing two sets of long-run restrictions. The first set will allow to distinguish between euro area wide shocks and country-specific shocks; the second set, between demand and supply shocks.

First we assume that the euro area output and price levels are only affected by euro area shocks in the long run, not by shocks specific to the acceding country. Conversely, both types of shocks can affect the levels of the acceding country variables in the long run. To this end, we introduce the long-run restrictions:  $a_{13}(1) = a_{14}(1) = a_{23}(1) = a_{24}(1) = 0$  (discarding the  $j$  for reasons of simplicity), where  $a_{ij}(1)$  is the sum of the polynomial coefficients.

In constraining the long run, we want to avoid the risk that -given our limited sample- acceding country shocks could by chance strongly impinge on euro area variables, over the medium to long run. It was technically impossible to impose a zero impact of acceding country-specific shocks on euro area variables at each horizon [ $a_{13}(L) = a_{14}(L) = a_{23}(L) = a_{24}(L) = 0$ ]. Country-specific shocks may still exert an impact on the euro area in the short run but this impact turned negligible in estimation. As a consequence, the estimated euro area shocks -as well as the corresponding impulse responses for the euro area  $a_{11}(L)$ ,  $a_{12}(L)$ ,  $a_{21}(L)$ ,  $a_{22}(L)$ - were very similar across country models (that is, almost independent of  $j$ ).

In Kouparitsas (1999) and Korhonen (2003), the identification of euro area and country-specific shocks is based on short-run restrictions, with no contemporary impact of acceding country shocks on euro area variables; in our setting, this would imply  $a_{13}(0) = a_{14}(0) = a_{23}(0) = a_{24}(0) = 0^4$ . Shocks that start at country level and finally impact on the whole euro area would be labelled country-specific in this setting. So country-specific shocks could weigh more. To check the validity of our assertion that euro area output and price levels are only affected by euro area shocks at all horizons and/or to see if the choice of long-run restrictions instead of short-run restrictions has a significant impact on our results, we shall also estimate our VAR models with short-run restrictions as our first set of restrictions.

The second set of restrictions is introduced in order to identify the demand and supply shocks. We follow Blanchard and Quah (1989), assuming that output is supply-driven in

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<sup>4</sup> However, Korhonen notes that the long-run impact of the country-specific shocks on euro area variables is low in his results.

the long run. Demand shocks have only a transitory effect on output. Both the supply and demand shocks may have a permanent impact on the price level, the former with a negative sign and the latter with a positive sign. We add the following long-run restrictions:  $a_{12}(1) = a_{32}(1) = a_{34}(1) = 0$ . The sign impacts are not imposed. The empirical results should verify them if our identification makes sense. This turned out to be true in the vast majority of cases. Where this was not the case, we imposed some extra zero long-run or short-run restrictions. The restrictions have an impact on the computed impulse response but do not really affect the results that are discussed below. We merely introduced these restrictions to reconcile the estimations with the underlying theory.

### **3.2 Measurement of growth and inflation asymmetries**

As already illustrated by the review of the literature, several measures can be used to appreciate the degree of similarity between countries or areas. In the first subsection, we shall focus on three measures taken from Korhonen (2003) since his theoretical setting is very close to ours. As the author makes no distinction between supply and demand shocks, we shall only consider a single euro area shock and a single country-specific shock and the discussion will concentrate on growth asymmetry. In the second subsection, we shall present our favourite measures of growth and inflation asymmetries.

3.2.1 Two of Korhonen's (a)symmetry measures relate to the similarity of the impulse responses to euro area shocks:

- the correlation of the impulse response functions of the euro area and of the country to a euro area shock (M1) and
- the ratio between the cumulative impulse responses to a euro area shock after 12 months<sup>5</sup> (M2).

As the correlation measure (M1) standardises the responses, the second measure allows to compare the relative size of the responses.

The third measure (M3) deals with the importance of euro area shocks in the country. The FEVD (forecast error variance decomposition) is used at several horizons to measure the share of (unexpected) country growth that is explained by euro area shocks. Its complement is the share explained by country-specific shocks.

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<sup>5</sup> Country response over euro area response.

In our notation and with a single euro area shock, the different measures can be written as:

$$M1(j) = \frac{\sum_t (a_{11,t}^j - \overline{a_{11}^j}) (a_{31,t}^j - \overline{a_{31}^j})}{\sqrt{\left( \sum_t (a_{11,t}^j - \overline{a_{11}^j})^2 \sum_t (a_{31,t}^j - \overline{a_{31}^j})^2 \right)}}$$

where the sums and averages are computed over the first 36 months (the responses are close to zero afterwards);

$$M2(j) = \frac{\sum_t (a_{31,t}^j)}{\sum_t (a_{11,t}^j)}$$

where the sums are computed over the first 12 months;

$$M3(j) = \frac{\sum_t (a_{31,t}^j)^2}{\sum_t (a_{31,t}^j)^2 + \sum_t (a_{33,t}^j)^2}$$

where the sums are computed over the horizon of the FEVD.

It is interesting to note that the more traditional divergence measures can (fortunately) be expressed as a function of these  $M_i$  measures. For example, the correlation between growth in country  $j$  and growth in the euro area can be expressed in terms of  $M1$  and  $M3$ :

$$\begin{aligned} \text{corr}(\Delta y^j, \Delta y^{\text{ea}}) &= \frac{\text{cov}(\Delta y^j, \Delta y^{\text{ea}})}{\sigma(\Delta y^j) \sigma(\Delta y^{\text{ea}})} = \frac{\text{cov}(\Delta y^j | \varepsilon^{\text{ea}}, \Delta y^{\text{ea}})}{\sigma(\Delta y^j | \varepsilon^{\text{ea}}) \sigma(\Delta y^{\text{ea}})} \cdot \frac{\sigma(\Delta y^j | \varepsilon^{\text{ea}})}{\sigma(\Delta y^j)} \\ &= \frac{\sum_t (a_{11,t}^j a_{31,t}^j)}{\sqrt{\left( \sum_t (a_{11,t}^j)^2 \sum_t (a_{31,t}^j)^2 \right)}} \cdot \frac{\sqrt{\sum_t (a_{31,t}^j)^2}}{\sqrt{\sum_t (a_{31,t}^j)^2 + \sum_t (a_{33,t}^j)^2}} \end{aligned}$$

where  $\Delta y^j | \varepsilon^{\text{ea}}$  is the part of  $\Delta y^j$  that is explained by euro area shocks. It is assumed that euro area shocks are the only driving force at euro area level. Hence, the covariance may only result from euro area shocks and  $\text{cov}(\Delta y^j, \Delta y^{\text{ea}}) = \text{cov}(\Delta y^j | \varepsilon^{\text{ea}}, \Delta y^{\text{ea}})$ .



We can see that the correlation is the product of the correlation between  $\Delta y^j|_{\varepsilon^{ea}}$  and  $\Delta y^{ea}$ , where only the euro area shocks are taken into account, and of the share of the variations in  $\Delta y^j$  (measured in terms of standard deviations) that can be explained by euro area shocks. The first term is close to M1 and the second term is the root of M3 (for an infinite horizon). The means are removed from M1, which un-standardises the responses and is a way to account for M2. The benefit of the SVAR setting is that the traditional divergence measures can be broken up into several factors. However the traditional measures give valuable insight into how these factors should be measured and weighted.

In the next subsection, we propose another divergence measure that can be broken up into several factors. The two sources of growth asymmetry vis-à-vis the euro area (the first resulting from the dissimilar way in which acceding countries react to euro area shocks, the second resulting from the extent of country-specific shocks) are still present. On top of that, it will be possible to break up the impact of euro area and country-specific shocks into supply and demand shocks. The introduction of supply and demand shocks, going hand in hand with the introduction of inflation rates among the variables, allows to put as much emphasis on inflation divergences as on growth disparities.

3.2.2 Our basic divergence measure will be the variance of the 4-quarter growth (inflation) differential between the country and the euro area<sup>6</sup>:

$$M4(j) = \text{Var}(\Delta y^j - \Delta y^{ea}).$$

Compared to the traditional correlation measure, we also take into account the possible discrepancies between growth (inflation) volatilities in the country and in the euro area. The correlation unfortunately normalises for volatility divergence. A high correlation with the euro area but with a much smaller country impact is a problem, as the monetary policy

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<sup>6</sup> The divergence is computed in terms of yearly growth rates (and inflations) because they usually look more appealing to policymakers and economists than their quarterly counterparts. In the rest of the paper,  $\Delta y$  should be understood as a year-on-year growth rate.

will be geared to the more affected euro area. A much larger country impact would be equally problematic. It is easy to show that

$$\text{Var}(\Delta y^j - \Delta y^{ea}) \equiv \left[ \sigma(\Delta y^j) - \sigma(\Delta y^{ea}) \right]^2 + 2 \left[ 1 - \text{corr}(\Delta y^j, \Delta y^{ea}) \right] \sigma(\Delta y^j) \sigma(\Delta y^{ea}).$$

The measure we propose not only accounts for the -lack of- correlation between growth rates (the second factor) but also penalises differences in volatility<sup>7</sup>. One can also favour measures like M4 on the ground that growth and inflation are the final objectives of the economic policy and that the differentials with the euro area are likely to cause problems once a single monetary policy is in place.

Due to the independence between structural shocks,

$$M4(j) = \text{Var}(\Delta y^j | \epsilon_s^{ea} - \Delta y^{ea} | \epsilon_s^{ea}) + \text{Var}(\Delta y^j | \epsilon_d^{ea} - \Delta y^{ea} | \epsilon_d^{ea}) + \text{Var}(\Delta y^j | \epsilon_s^j) + \text{Var}(\Delta y^j | \epsilon_d^j)$$

where we assumed that  $\Delta y^{ea} | \epsilon_s^j = \Delta y^{ea} | \epsilon_d^j = 0$ .

Divergence is the result of different reactions to euro area supply and demand shocks (the first two elements) and to country-specific supply and demand shocks (the last two elements). In the first case, we could further distinguish between the extent of the correlations and the differences in volatility, but this would take us too far. In order to compute the four elements, all we need are the impulse response coefficients of the SVAR models. For example,

$$\begin{aligned} \text{Var}(\Delta y^j | \epsilon_s^{ea} - \Delta y^{ea} | \epsilon_s^{ea}) &= \text{Var}\left( \left[ a_{31}^j(L) - a_{11}(L) \right] \epsilon_{s,t}^{ea} \right) = \sum_t \left[ a_{31,t}^j - a_{11,t} \right]^2 \text{Var}(\epsilon_{s,t}^{ea}) \\ &= \sum_t \left[ a_{31,t}^j - a_{11,t} \right]^2 \end{aligned}$$

where we assumed that  $a_{11}^j(L) = a_{11}(L)$ .

<sup>7</sup> Süppel (2003) mentions that the empirical literature sidesteps the issue of differences in volatility, an important phenomenon according to his computations.

In section 4, the results for M4 and the four elements will be presented. We shall give them in terms of standard deviations so that their units can be immediately interpreted as growth (inflation) differentials. However, the adding up of elements is only valid for the variances.

Before discussing the empirical results, it is worth mentioning that the constant or pervasive growth or inflation differentials between the acceding countries and the euro area are not considered problematic in this analysis: variances (standard deviations) remove the average differentials from the computations. Insofar as the average growth rate can qualify as a potential growth rate, this will not affect the output gap and therefore does not ask for a different monetary policy stance. As regards inflation, the disinflation process that some countries experienced over the period should be history once the countries enter the ERM II / euro area. Accordingly, an adjustment was made to inflation in several countries. Remaining systematic discrepancies between inflation rates should reflect cross-country differences in real variables, such as productivity growth differentials and catching-up processes, to which monetary policy would not be expected to react.

The remaining question is whether the limited time span was sufficient for the averages to accurately reflect the fundamental growth and inflation rates over the period. It is likely that an assessment based on variances will be somewhat too rosy because part of the differentials will be unduly removed when discarding the average differentials.

## 4. Empirical results

An acceding country would ideally have a perfectly synchronous business cycle and identical inflation patterns before giving up its independent monetary policy. In our setting, this means that in the acceding country, no country-specific shocks would occur and the reactions to euro area shocks would be identical to those of the euro area. These criteria are, of course, too strict. As a matter of fact, none of the present members satisfies these conditions. This is why we shall use the present euro area members and the pre-ins as benchmarks to evaluate the extent of the growth and inflation differentials of the acceding countries. For the EU-countries, the models were estimated over the period 1991q1-2003q2 to extend the degrees of freedom. Subsection 4.1 presents the results for all countries, first for growth, then for inflation. The results are based on the long-run restrictions with respect to the origin of shocks (euro area versus country-specific). In subsection 4.2, we check whether our results are sensitive to this assumption by recomputing differentials under short-run restrictions. Finally, in subsection 4.3, we try to assess whether the extent of country-specific shocks evolved over time.

### 4.1 *The driving factors behind growth and inflation asymmetries*

Table 1 and chart 1 give the results for growth. They report the values for the two forms of asymmetry: different reactions to euro area shocks versus country-specific shocks. A further breakdown has been effected in table 1 between the corresponding supply and demand shocks.

Total growth differentials<sup>8</sup> with regard to the euro area, stemming from the four structural shocks, vary considerably between acceding countries, as they cover a range from 0.8 pct. to 4.6 pct. Growth differentials seem to be particularly large in two Baltic States, i.e. Estonia and Lithuania, and in Malta. An intermediate group is formed by Latvia and three central European countries, i.e. the Czech Republic, Poland and Slovakia, while the growth cycles of Cyprus and Hungary are close to the euro area cycle. In the majority of EU-countries, the values are lower than those of the acceding countries but the best performing acceding countries show less growth asymmetry vis-à-vis the euro area than Portugal, Ireland, Greece and especially Finland, the latter country being only overrun by Estonia, Lithuania and Malta.

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<sup>8</sup> From now on, we will use the terms "differential" and "standard deviation of differential" interchangeably.

**Table 1: Standard deviations of annual growth differentials by type of shock<sup>12</sup>**

(in pct.)

<i>Type of shock</i>	<i>Acceding countries</i>											
	CY	CZ	EE	LV	LT	MT	HU	PL	SK			
<b>euro area</b>	<b>0.5</b>	<b>1.3</b>	<b>2.4</b>	<b>0.4</b>	<b>0.9</b>	<b>1.7</b>	<b>0.6</b>	<b>1.0</b>	<b>1.1</b>			
supply	0.4	1.2	1.4	0.4	0.9	1.6	0.5	0.8	1.1			
demand	0.2	0.6	2.0	0.3	0.2	0.3	0.2	0.6	0.3			
<b>country-specific</b>	<b>0.7</b>	<b>1.9</b>	<b>3.3</b>	<b>2.4</b>	<b>3.6</b>	<b>4.3</b>	<b>0.8</b>	<b>1.8</b>	<b>1.4</b>			
supply	0.7	1.9	3.3	2.4	3.6	4.0	0.7	1.7	1.3			
demand	0.0	0.3	0.4	0.2	0.0	1.5	0.2	0.7	0.7			
<b>TOTAL</b>	<b>0.8</b>	<b>2.3</b>	<b>4.1</b>	<b>2.4</b>	<b>3.7</b>	<b>4.6</b>	<b>0.9</b>	<b>2.1</b>	<b>1.8</b>			
	<i>Euro area countries</i>											
	BE	DE	AT	GR	ES	FR	IT	NL	PT	FI	IE	
<b>euro area</b>	<b>0.6</b>	<b>0.4</b>	<b>0.4</b>	<b>0.8</b>	<b>0.5</b>	<b>0.3</b>	<b>0.4</b>	<b>0.4</b>	<b>0.6</b>	<b>1.7</b>	<b>1.1</b>	
supply	0.6	0.1	0.4	0.7	0.2	0.3	0.3	0.2	0.6	0.4	1.1	
demand	0.2	0.4	0.0	0.4	0.4	0.1	0.3	0.3	0.3	1.6	0.2	
<b>country-specific</b>	<b>0.6</b>	<b>0.9</b>	<b>0.8</b>	<b>2.0</b>	<b>0.6</b>	<b>0.4</b>	<b>0.6</b>	<b>0.8</b>	<b>1.2</b>	<b>2.6</b>	<b>1.4</b>	
supply	0.6	0.8	0.7	1.8	0.5	0.3	0.6	0.7	1.2	2.5	1.3	
demand	0.1	0.5	0.4	0.8	0.3	0.3	0.2	0.5	0.4	0.5	0.4	
<b>TOTAL</b>	<b>0.9</b>	<b>1.0</b>	<b>0.9</b>	<b>2.1</b>	<b>0.8</b>	<b>0.5</b>	<b>0.8</b>	<b>0.9</b>	<b>1.4</b>	<b>3.1</b>	<b>1.8</b>	
	<i>Pre-ins</i>											
	UK	DK	SE									
<b>euro area</b>	<b>0.9</b>	<b>0.4</b>	<b>0.6</b>									
supply	0.8	0.2	0.5									
demand	0.2	0.3	0.3									
<b>country-specific</b>	<b>0.9</b>	<b>1.0</b>	<b>1.1</b>									
supply	0.9	1.0	1.1									
demand	0.1	0.2	0.2									
<b>TOTAL</b>	<b>1.2</b>	<b>1.1</b>	<b>1.3</b>									

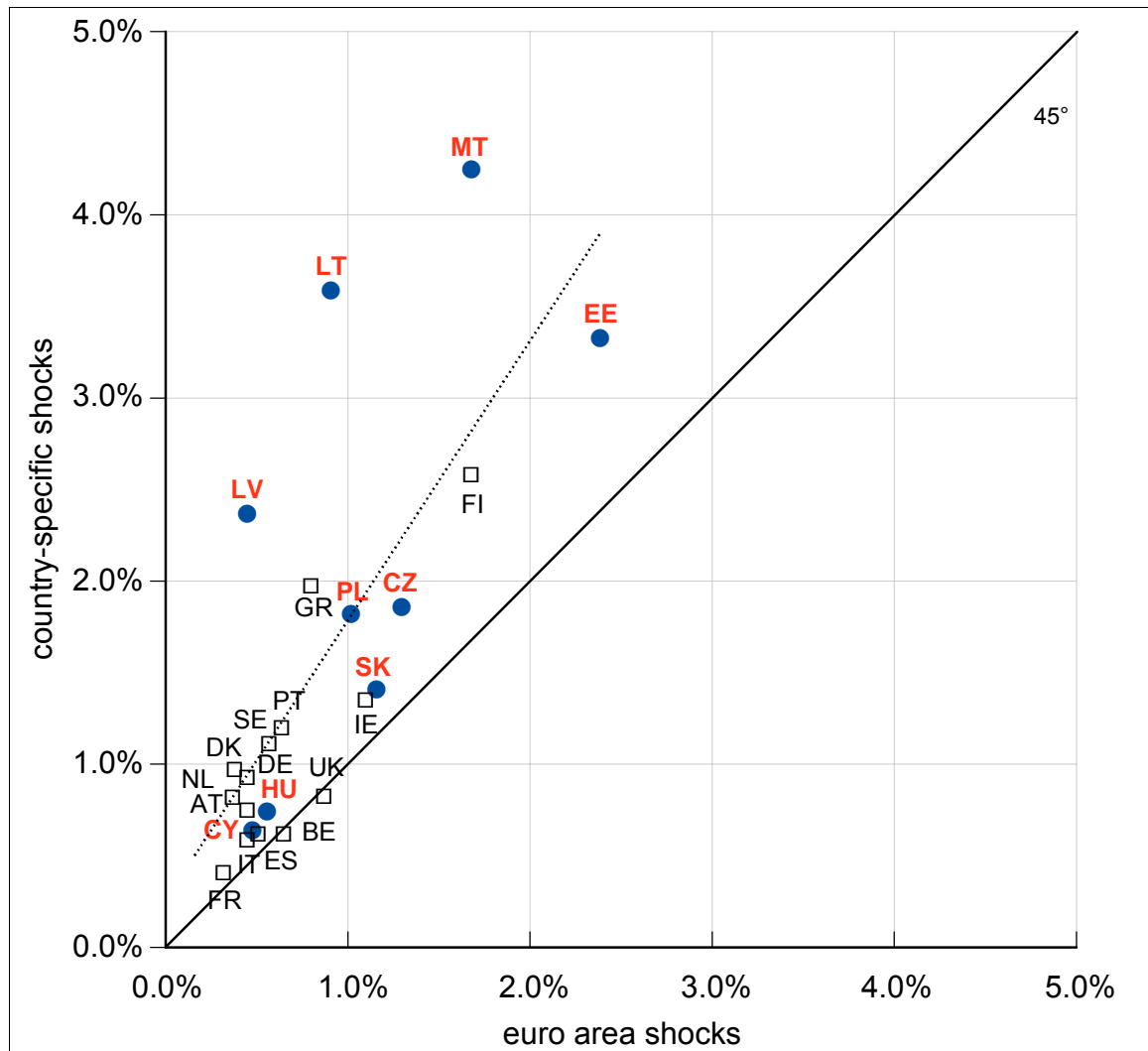
<sup>1</sup> Standard deviations do not add up.

<sup>2</sup> The list of countries and abbreviations can be found in appendix 1.

When analysing the sources of growth differentials (chart 1) in greater detail, we can see that in all acceding countries, the differentials are mainly driven by country-specific shocks. From table 1, it appears that the ranking made above can be repeated in terms of country-specific shocks alone and that country-specific supply shocks are the most

**Chart 1: Importance of euro area and country-specific shocks behind growth differentials**

(standard deviations)



problematic. Country-specific demand shocks have much less impact. The differences in response to euro area shocks are rather driven by differences in the reaction to euro area supply shocks, Estonia being an exception. This second source of asymmetry is not a major cause of divergence but values are not negligible in several countries where they exceed 1 pct. In most euro area countries and pre-ins, values are lower with the marked exceptions of Finland and Ireland. The dotted regression line on chart 1 however reveals that there is a tendency for country-specific shocks and asymmetric responses to euro area shocks to go hand in hand. The more country-specific shocks create divergence, the more asymmetric the response to euro area shocks is. Countries tend to be peculiar in either ways or none.

**Table 2: Standard deviations of annual inflation differentials by type of shock<sup>1</sup>**

(in pct.)

<i>Type of shock</i>	<i>Acceding countries</i>											
	CY	CZ	EE	LV	LT	MT	HU	PL	SK			
<b>euro area</b>	<b>0.7</b>	<b>0.6</b>	<b>1.5</b>	<b>1.1</b>	<b>0.7</b>	<b>0.6</b>	<b>1.1</b>	<b>0.4</b>	<b>0.6</b>			
supply	0.6	0.5	0.6	1.0	0.7	0.6	1.0	0.3	0.5			
demand	0.3	0.3	1.4	0.3	0.3	0.3	0.5	0.3	0.3			
<b>country-specific</b>	<b>2.0</b>	<b>2.9</b>	<b>1.8</b>	<b>4.6</b>	<b>1.1</b>	<b>1.0</b>	<b>2.1</b>	<b>1.3</b>	<b>2.0</b>			
supply	0.1	1.5	0.4	1.1	0.7	0.2	0.8	0.2	0.8			
demand	2.0	2.5	1.8	4.5	0.9	1.0	1.9	1.3	1.9			
<b>TOTAL</b>	<b>2.2</b>	<b>2.9</b>	<b>2.3</b>	<b>4.7</b>	<b>1.3</b>	<b>1.2</b>	<b>2.4</b>	<b>1.4</b>	<b>2.1</b>			
	<i>Euro area countries</i>											
	BE	DE	AT	GR	ES	FR	IT	NL	PT	FI	IE	
<b>euro area</b>	<b>0.3</b>	<b>0.2</b>	<b>0.2</b>	<b>0.5</b>	<b>0.2</b>	<b>0.3</b>	<b>0.3</b>	<b>0.5</b>	<b>0.7</b>	<b>0.9</b>	<b>0.8</b>	
supply	0.1	0.2	0.1	0.3	0.1	0.1	0.2	0.3	0.5	0.7	0.3	
demand	0.3	0.1	0.2	0.4	0.2	0.3	0.3	0.4	0.5	0.6	0.7	
<b>country-specific</b>	<b>0.7</b>	<b>1.0</b>	<b>0.6</b>	<b>3.0</b>	<b>0.6</b>	<b>0.3</b>	<b>0.9</b>	<b>1.0</b>	<b>2.1</b>	<b>1.7</b>	<b>1.5</b>	
supply	0.1	0.1	0.2	2.5	0.4	0.2	0.1	0.8	1.2	0.2	0.2	
demand	0.7	1.0	0.6	1.5	0.5	0.3	0.9	0.6	1.6	1.7	1.5	
<b>TOTAL</b>	<b>0.8</b>	<b>1.0</b>	<b>0.6</b>	<b>3.0</b>	<b>0.7</b>	<b>0.4</b>	<b>0.9</b>	<b>1.1</b>	<b>2.2</b>	<b>1.9</b>	<b>1.7</b>	
	<i>Pre-ins</i>											
	UK	DK	SE									
<b>euro area</b>	<b>0.5</b>	<b>0.6</b>	<b>0.6</b>									
supply	0.3	0.5	0.3									
demand	0.4	0.4	0.5									
<b>country-specific</b>	<b>0.7</b>	<b>0.7</b>	<b>1.0</b>									
supply	0.4	0.2	0.3									
demand	0.6	0.7	0.9									
<b>TOTAL</b>	<b>0.9</b>	<b>1.0</b>	<b>1.1</b>									

<sup>1</sup> Standard deviations do not add up.

Table 2 presents the values for inflation. A first observation is that total inflation differentials, ranging from 1.2 pct. to 4.7 pct., are comparable with total growth differentials in the acceding countries (as is also the case within the EU). At country level, we can see that inflation developments in Malta, Lithuania and Poland are relatively well in line with those of the euro area, while the first two countries were very asymmetric in terms of growth. This shows that different factors are involved and that growth asymmetry is not the only discrepancy to consider. An intermediate group consists of Cyprus, the Czech Republic, Estonia, Hungary and Slovakia. The high value for Latvia indicates that its inflation pattern is very different from that of the euro area. Within the EU, only the

peripheral countries of Ireland, Finland, Portugal and Greece report inflation differentials that are comparable with the values of the intermediate group.

**Chart 2: Importance of euro area and country-specific shocks behind inflation differentials**

(standard deviations)

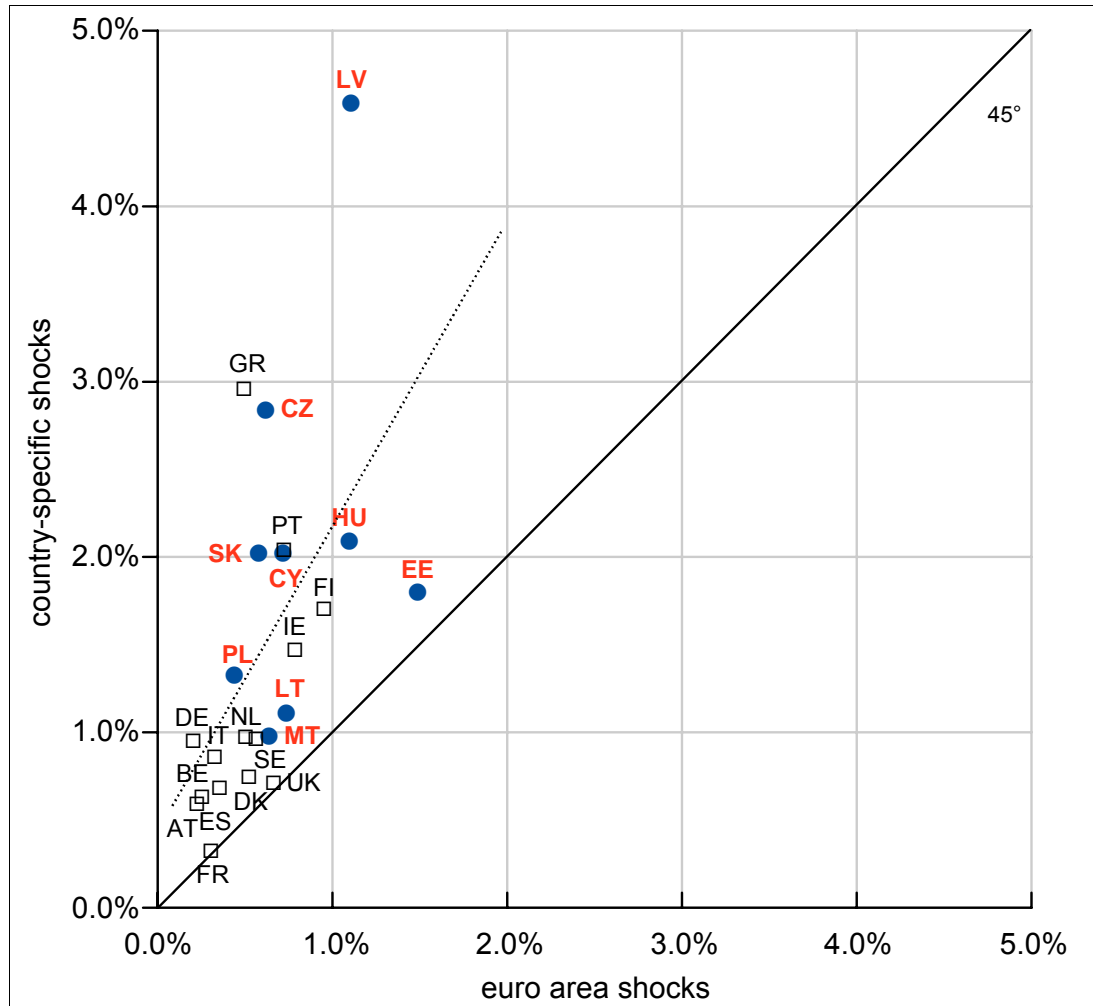


Chart 2 shows that country-specific shocks are again the most important source of divergence but as shown by table 2, this type of asymmetry is now mostly driven by country-specific demand shocks. Only in the Czech Republic and Lithuania do country-specific supply shocks compete with demand shocks, although they have an impact in some other acceding countries as well. The impact of asymmetric demand shocks is generally much higher in the acceding countries than in the EU-countries, Malta, Lithuania and Poland excepted, contributing substantially to the higher inflation asymmetries. The differences in response to euro area shocks, demand and supply, are not the major source of divergence, but they do play a role, especially in Estonia, Latvia and Hungary, which is

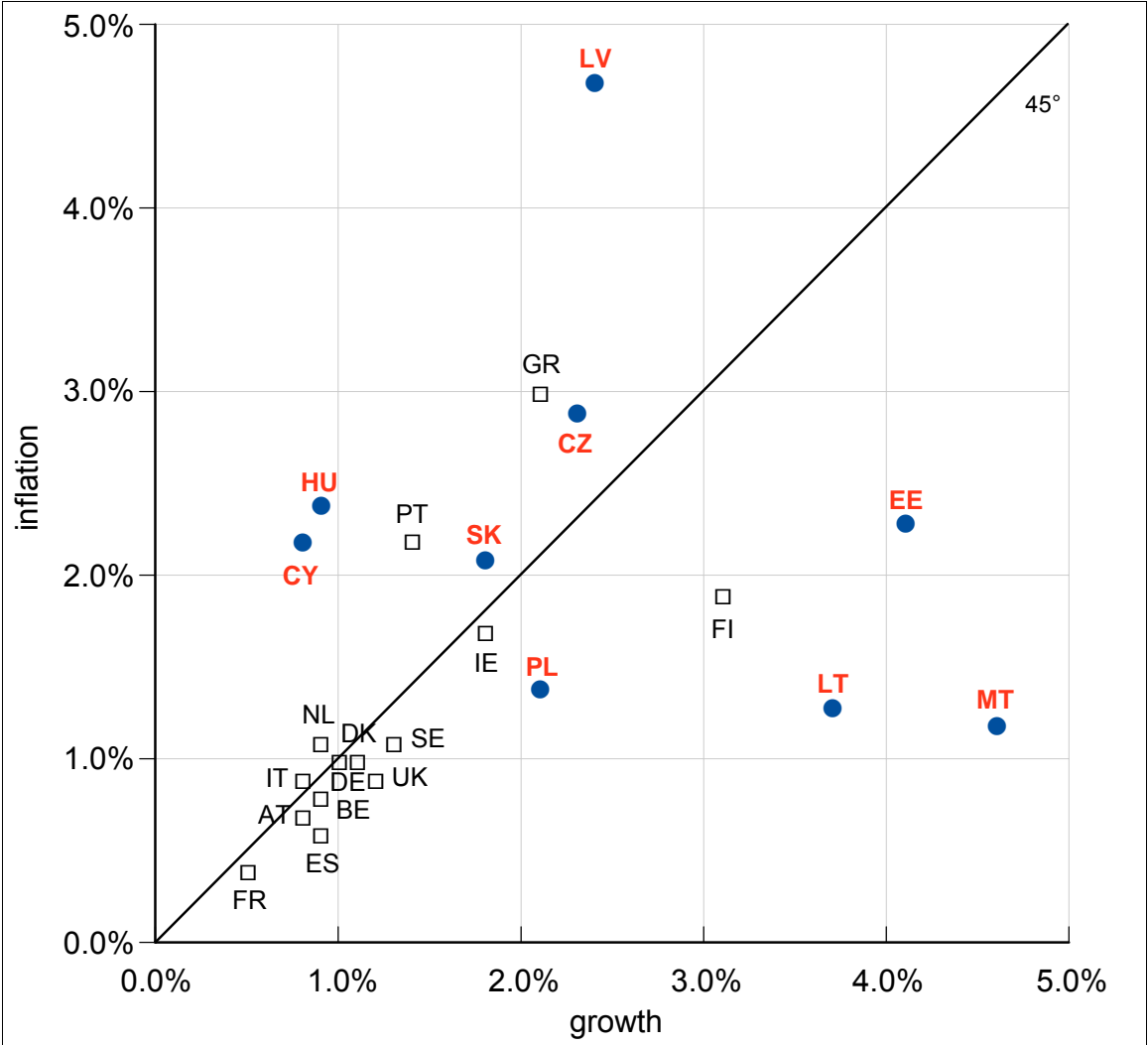


less the case within the euro area or for the three pre-ins (chart 2). Like for growth, a regression line reveals a positive correlation between the impact of the asymmetric responses to euro area shocks and the impact of country-specific shocks. When countries diverge, they tend to diverge on both counts.

Up to now, growth and inflation differentials have been analysed almost separately. We only mentioned contrasting results for Lithuania and Malta. It is instructive to combine the two differentials on one graph (chart 3).

**Chart 3: Growth and inflation differentials**

(totals, standard deviations)



Three broad groups of countries emerge. A first group is made of countries with differentials for growth or, in the case of Latvia, for inflation unknown to EU-countries. The

Baltic States and Malta belong to that group. A second group consists of the remaining acceding countries and of the four countries of the EU periphery: Greece, Finland, Portugal and Ireland. The third group is made of the remaining EU countries with both differentials within the range of 0.5 pct. to slightly above 1 pct.

In their analysis on growth and inflation differentials in the euro area, Ide and Moës (2003) noted that euro area countries were spread "along a line going from less asymmetric to more asymmetric". Here too, as far as EU countries are concerned, high inflation and growth differentials go hand in hand and a 45-degree line could represent them rather accurately. A high differential on one account implies a high differential on the other. This is much less the case for acceding countries. It is not possible to infer from a low growth differential that the country also has a low inflation differential. The opposite is also true. As both differentials matter to a common monetary policy, growth analysis of acceding countries is necessary but not sufficient for assessing the true state of these countries. This result is not surprising, since the structural shocks behind these two differentials turn out to be of a different nature. In a sense, the result for the EU countries is more surprising and could reflect the influence of some generic factors, such as distance or size, that are still dominated by other factors in the case of acceding countries.

Although the acceding countries form a heterogeneous group, the same broad picture emerged with regard to the underlying sources of growth and inflation asymmetries, and hence similar policy observations can be formulated at a general level. Activist demand management will not be able to do a lot against growth differences as these are mainly driven by country-specific supply shocks. As these shocks are very likely an integral part of the catching-up process experienced by these countries, only the passage of time will be able to bring their impact down<sup>9</sup>. Inflation differentials, on the other hand, are largely attributable to country-specific demand shocks. Differences in exchange rate and monetary regimes may partly explain why the acceding countries have larger inflation differentials than many euro area members who experienced more equivalent regimes throughout the period, first through the ERM and later on, as a full currency area. Other elements such as fiscal policy, price liberalisation, oil price dependency, price and wage structures, etc, also play a role. Differences in monetary policy may be expected to recede under ERM II as well as other sources of price discrepancies.

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<sup>9</sup> It should be observed once again that our measures are free from constant or pervasive growth or inflation differentials that may be linked to a catching-up process. The measures only account for shocks on top of the average growth or inflation (differentials).

Part of the asymmetries may nevertheless be unavoidable when they are the result of the country size. Sectoral or even company shocks may have a strong impact on small countries. This seems to be the case within the EU and is also likely to be the case in the acceding countries. Malta is so small that its current degree of (a-)symmetry may already be acceptable, whereas Poland, the largest acceding country, does not yet reach the levels of asymmetry found in Austria or Sweden, countries smaller in magnitude in terms of PPP-adjusted GDP. The Slovakian achievements (only 40 p.c. of the Czech GDP) also raise the threshold for the Czech Republic. In the small Baltic States, asymmetry levels almost unknown to the EU members can be expected. From that point of view, their current results are not that surprising.

#### **4.2 Sensitiveness of the results to the identification restrictions**

In section 4.1, we assumed that the euro area output and price levels were only affected in the long run by euro area shocks, not by shocks specific to the acceding country. To this end, we introduced the long-run restrictions:  $a_{13}(1) = a_{14}(1) = a_{23}(1) = a_{24}(1) = 0$ . Some authors, like Kouparitsas (1999) and Korhonen (2003), used short-run restrictions with no contemporary impact of acceding country shocks on euro area variables:  $a_{13}(0) = a_{14}(0) = a_{23}(0) = a_{24}(0) = 0$ . In this section, we check whether our results are robust by estimating the SVAR-models under the latter short-run restrictions, while maintaining the standard long-run restrictions to identify supply and demand shocks.

Country-specific shocks could have more impact as some were previously labelled "euro area shocks" when their final impact concerned the whole euro area. But we saw in section 4.1 that country-specific shocks were already contributing most to the asymmetries under long-run restrictions. Hence, short-run restrictions could have a limited influence on the previous results. Table 3 shows the new growth and inflation differentials under short-run restrictions.

**Table 3: Alternative estimation with short-run restrictions to identify euro area and country-specific shocks**

<b>Growth differentials (st. dev., in pct.)</b>									
<i>Type of shock</i>	CY	CZ	EE	LV	LT	MT	HU	PL	SK
<b>euro area</b>	<b>0.5</b>	<b>1.2</b>	<b>2.2</b>	<b>0.3</b>	<b>0.9</b>	<b>1.8</b>	<b>0.6</b>	<b>1.1</b>	<b>1.0</b>
supply	0.5	1.1	1.1	0.2	0.8	1.8	0.6	1.1	1.0
demand	0.2	0.6	1.8	0.2	0.2	0.3	0.2	0.3	0.2
<b>country-specific</b>	<b>0.8</b>	<b>1.9</b>	<b>3.3</b>	<b>2.3</b>	<b>3.0</b>	<b>4.2</b>	<b>1.1</b>	<b>2.3</b>	<b>1.4</b>
supply	0.8	1.9	3.1	2.3	3.0	3.9	1.1	2.3	1.2
demand	0.1	0.2	1.2	0.2	0.1	1.5	0.2	0.2	0.5
<b>TOTAL</b>	<b>0.9</b>	<b>2.2</b>	<b>4.0</b>	<b>2.3</b>	<b>3.1</b>	<b>4.6</b>	<b>1.3</b>	<b>2.6</b>	<b>1.7</b>
<b>Inflation differentials (st. dev.,in pct.)</b>									
<i>Type of shock</i>	CY	CZ	EE	LV	LT	MT	HU	PL	SK
<b>euro area</b>	<b>0.4</b>	<b>0.7</b>	<b>1.3</b>	<b>1.1</b>	<b>0.4</b>	<b>0.5</b>	<b>0.6</b>	<b>0.5</b>	<b>0.5</b>
supply	0.4	0.5	0.4	1.1	0.3	0.4	0.5	0.5	0.4
demand	0.2	0.5	1.2	0.2	0.2	0.2	0.3	0.2	0.3
<b>country-specific</b>	<b>2.1</b>	<b>2.8</b>	<b>2.1</b>	<b>4.3</b>	<b>0.7</b>	<b>1.0</b>	<b>2.2</b>	<b>1.1</b>	<b>1.8</b>
supply	0.1	1.2	0.3	0.8	0.2	0.2	1.0	0.1	0.8
demand	2.1	2.5	2.1	4.2	0.7	1.0	2.0	1.1	1.7
<b>TOTAL</b>	<b>2.2</b>	<b>2.9</b>	<b>2.5</b>	<b>4.4</b>	<b>0.9</b>	<b>1.1</b>	<b>2.3</b>	<b>1.2</b>	<b>1.9</b>

The first point to mention (not documented here) is that the long-run impact of the country-specific shocks on the euro area turned negligible in the vast majority of impulse responses. Korhonen (2003) makes the same claim in his setting. This gives us additional evidence that the euro area output and price levels are only affected by euro area shocks at all time horizons, independently of the kind of restriction used to identify the country shocks. This result is also evident from the analysis of growth and inflation differentials in table 3. The values of our measures of asymmetry are largely independent of the restrictions chosen.

When comparing the total growth and inflation differentials with the values reported in tables 1 and 2, it can be seen that the values are broadly identical. Growth differentials are somewhat higher in Hungary and Poland while growth and inflation differentials are somewhat lower in Lithuania and, in terms of growth, more in line with the differentials of peripheral countries from the euro area. But for this latter result, the overall picture from section 4.1 remains unaltered<sup>10</sup>.

<sup>10</sup> The fact that the totals may change -and not only the distribution between structural shocks- is due to the computation of differentials on the basis of impulse response coefficients. Totals relying on rough growth and inflation data would be unique. However, given the small sample size, they are implicitly contaminated by pre-sample shocks dating back to the transformational episodes.

As regards the type of shocks behind the differentials, the results are almost the same as in tables 1 and 2. So all conclusions regarding the breakdown into euro area and country-specific shocks on the one hand, and supply and demand shocks on the other, remain valid. In short, these conclusions stated that the differentials were mainly driven by country-specific shocks and, while for growth differentials it was the country-specific supply shock that contributed most, for inflation differentials it was the country-specific demand shock. In the case of Hungary and Poland, the country-specific supply shock explains the rise in the growth differential. For Lithuania, the loss of impact of the country-specific supply shock regarding growth is a fall from a very high level whereas the similar loss regarding inflation brings Lithuania more in line with the other countries where the specific demand shock dominates. So our previous conclusions remain unaltered.

The picture that we have presented so far is based on an average over 1995q1-2003q2. It is quite possible that the situation has changed over time. This possibility is investigated in the next section.

### **4.3 *Are country-specific shocks becoming less important over time?***

It is often argued that the significant structural changes that occurred in the 1990s lost momentum towards the end of the decade and in recent years. There was also growing trade intensity, which for some authors is the main explanation for the extent of business cycle correlations. A currency area could become optimal ex-post due to increased bilateral (intra-industry-)trade among members following its creation (endogeneity issue). The "Krugman specialisation hypothesis", on the other hand, states that trade integration which occurs as a result of economies of scale could lead to regional concentration of industrial activities and hence induce more asymmetry between countries. In fact, an increasing diversification of trade and production structures has been observed that could have reduced the occurrence or importance of country-specific shocks. Other more institutional elements might also have played a role as the acceding countries evolved over the years into viable market economies, a process which was spurred by the fulfilment of the Copenhagen criteria and the adoption of the "acquis communautaire". On the monetary side, some countries linked their currency more closely to the DEM/euro and acceding countries that abandoned their peg often established an inflation-targeting regime in order to control inflation expectations and bring inflation down. On the fiscal side, the picture is more mixed as some acceding countries now have a budget close to balance while others have a large and still growing deficit.

So, for many reasons, asymmetries might have diminished over the years. Some papers tried to measure this by introducing a time-varying dimension. As shown in section 2, this was done either by introducing time-varying coefficients or by estimating the models over subsequent time periods. Given the limited data sample, we follow the first approach but we proceed in an informal way, by simply computing the RMSE of our previously estimated country-specific shocks by sub-periods<sup>11</sup>. We know that the variance of the structural shocks is normalised to one and that  $E(\varepsilon_t) = 0$  over the sample. So  $\text{Var}(\varepsilon_t) = E(\varepsilon_t^2) = 1$ . The result holds for the whole sample period but not by sub-periods as the mean may be different from zero over sub-periods. That is why we compute RMSE instead of standard deviations. A value above (below) one means that the country-specific shocks were more (less) important during that sub-period than over the whole sample. The values are given in tables 4 and 5, respectively, for the supply and demand shocks.

Country-specific supply shocks, which dominate growth divergence, were clearly on the fall over the last four years of the sample in almost every country. The cases of Estonia and Malta are less obvious and the huge growth differentials recorded in table 1 should still remain. The evolution is also less obvious in Poland where no steady improvement from its EU-periphery status is visible. Otherwise, strong improvements can be observed in the Czech Republic, Slovakia and Lithuania. The first two countries are now probably in the neighbourhood of the best EU performers, with Lithuania joining the EU-periphery. There is some improvement in Cyprus, Hungary and Latvia, the first two countries, from an

**Table 4: RMSE of country-specific supply shocks**

	1995q3-1997q2	1997q3-1999q2	1999q3-2001q2	2001q3-2003q2
Cyprus	1.15	1.10	<b>0.91</b>	<b>0.80</b>
Czech Republic	1.43	1.22	<b>0.54</b>	<b>0.44</b>
Estonia	1.17	1.12	<b>0.47</b>	1.08
Latvia	1.25	<b>0.95</b>	<b>0.91</b>	<b>0.84</b>
Lithuania	<b>0.96</b>	1.49	<b>0.67</b>	<b>0.65</b>
Malta	<b>0.99</b>	1.10	1.16	<b>0.69</b>
Hungary	1.56	<b>0.65</b>	<b>0.99</b>	<b>0.41</b>
Poland	N/A.	1.25	<b>0.68</b>	<b>0.98</b>
Slovakia	<b>0.84</b>	1.52	<b>0.79</b>	<b>0.59</b>

<sup>11</sup> We take the shocks from section 4.1 (long-run restrictions). The conclusions remain unaltered if we take the shocks from section 4.2 (short-run restrictions).

already very good level, Latvia struggling with its EU-periphery status. For the Czech Republic, the fall is also important for inflation developments as country-specific supply shocks had an impact on inflation divergence.

In terms of country-specific demand shocks (table 5), developments are quite favourable in the majority of countries, which is good news for inflation divergence. However, Hungary witnessed a deterioration over the last few years while its performance was already poor (table 2). The recent improvement in Latvia is encouraging as this country reported the largest inflation asymmetry over the whole sample period, although asymmetry should still remain high. All other countries should have reached (at least) an EU-periphery status, even better for Cyprus. Poland confirms its good performance. Lithuania and Malta (to be confirmed) are probably now among the "best" performers in terms of inflation.

**Table 5: RMSE of country-specific demand shocks**

	1995q3-1997q2	1997q3-1999q2	1999q3-2001q2	2001q3-2003q2
Cyprus	1.20	1.40	<b>0.53</b>	<b>0.56</b>
Czech Republic	1.17	1.35	<b>0.41</b>	<b>0.79</b>
Estonia	1.32	<b>0.93</b>	<b>0.74</b>	<b>0.92</b>
Latvia	1.31	<b>0.92</b>	<b>0.95</b>	<b>0.73</b>
Lithuania	1.29	1.17	<b>0.72</b>	<b>0.68</b>
Malta	<b>0.86</b>	1.20	1.23	<b>0.56</b>
Hungary	<b>0.75</b>	1.01	<b>0.96</b>	1.22
Poland	N/A.	1.08	<b>0.95</b>	<b>0.91</b>
Slovakia	1.19	1.06	<b>0.89</b>	<b>0.82</b>

All in all, there is a clear improvement in many countries in terms of both growth and inflation. In the case of Malta, this has occurred only recently. Estonia, on the other hand, has suffered a setback, after having made some progress over 1999-2001. This is also true for Poland regarding growth and for Hungary regarding inflation. As already stated, country-specific demand shocks may become less of a source of divergence once countries conduct economic policies, both fiscal and monetary, that allow them to maintain their exchange rate under ERM II and ultimately join the euro area. The recent experience of Hungary, mimicking the ERM II while country-specific demand shocks were on the rise, is a reminder that inappropriate policies can quickly put the exchange rate regime under stress.

## 5. Conclusion

In this paper, we used a SVAR model in order to study the asymmetry of growth and inflation developments in the acceding countries vis-à-vis the euro area, over the period 1995q1-2003q2. The extent of these asymmetries is an important indicator of the costs these countries might incur when entering the euro area and adopting the single monetary policy. If an acceding country is subject to considerable asymmetries, there may even be a case for keeping more independent monetary or exchange rate policies as an adjustment mechanism.

The model specification re-introduces the supply / demand dimension inside the dichotomy country-specific shocks / euro area shocks, giving a total of four structural shocks: two euro area supply and demand shocks and two country-specific supply and demand shocks. Accordingly, four variables are used per country model: growth and inflation, both in the acceding country and in the euro area. The inclusion of euro area variables allows to discriminate between euro area-wide shocks and country-specific shocks, assuming that the former explain long-run developments at euro area level and very likely also some part of the long-run developments at country level, whereas country-specific shocks only matter at country level. The inclusion of growth and inflation variables allows to discriminate between supply and demand shocks, assuming -as usual- that only the supply shocks matter for output in the long run.

The four structural shocks may all create asymmetries vis-à-vis the euro area. It is evident for country-specific shocks but euro area shocks may also create asymmetries if the response of the acceding countries to the euro area shocks differs from the euro area response. More specifically, we measured asymmetries by computing the standard deviations of growth (inflation) differentials vis-à-vis the euro area that can be attributed to each type of shock. Using this kind of measure, we not only look at correlations between growth (inflation) rates in the acceding country and the euro area but we also take into account differences in growth (inflation) volatility that may require different monetary policies. Inflation asymmetries received as much attention as growth asymmetries since they are very important in the perspective of the ERM II period and the adoption of the single monetary policy. The same model was applied to the EU members in order to get a better insight into the true extent of the asymmetries faced by the acceding countries.



## ***Empirical Results***

- Growth asymmetries stemming from the four shocks vary considerably among the different acceding countries. They cover a range from 0.8 pct. to 4.6 pct. These are non-negligible amounts. Growth asymmetries seem to be particularly large in the Baltic States and Malta. They are mainly driven by country-specific shocks, with the country-specific supply shocks being almost the sole contributors. Here, most of the EU countries report lower values but the best performing acceding countries, Cyprus and Hungary, show less growth asymmetry than the peripheral countries of the euro area.

The differences in response to euro area shocks are not a major cause of concern but values are not negligible in several countries. There is a tendency for country-specific shocks and asymmetric responses to euro area shocks to go hand in hand. The more country-specific shocks create divergence, the more asymmetric the response to euro area shocks is.

- Inflation asymmetries are comparable with growth asymmetries. They cover a range from 1.2 pct. to 4.7 pct. The country-specific shocks are again the most important contributors, but differences are mostly driven by country-specific demand shocks. Their impact is generally much higher than in the EU countries. Malta, Lithuania and Poland are exceptions, with asymmetry levels lower than the levels reached by euro area peripheral countries.

Although they are not the major source of inflation asymmetry, the differences in response to euro area shocks generate significant divergence in many acceding countries. The picture is different for the current euro area members, which are less affected. As in the growth case, there is a positive correlation between the impact of country-specific shocks and the asymmetric response to euro area shocks.

- When inflation and growth asymmetries are taken together, it appears that the close correlation between the two measures that exists for EU-members is not valid for the acceding countries. From a low growth asymmetry, it cannot be concluded that a country also succeeds on the inflation side. As both elements matter for a common monetary policy, the growth analyses that can be found in the literature are necessary but not sufficient to assess the readiness of a given acceding country to adopt the

euro. This result is not very surprising as the structural shocks behind inflation and growth asymmetries are of a very different nature.

The economic and institutional developments in the acceding countries over the last decade suggest that country-specific shocks might be on the fall. The quantitative analysis confirms the intuition. Country-specific supply and demand shocks, which dominate growth and inflation asymmetries respectively, were clearly lower over the last four years in a majority of acceding countries. However, the recent developments of the supply shocks in Estonia and Poland or of the demand shocks in Hungary testify that the trend may break and that improvements cannot always be taken for granted.

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## Appendix 1: Data description and country abbreviations

- \* All data were obtained from Eurostat (New Cronos database).
- \* For Slovenia, real GDP is available since the early nineties but nominal GDP is only available since 1999 on a quarterly basis, so no GDP deflator could be calculated.
- \* Data for Poland only start in 1996.
- \* The aggregate "euro area" does not include Luxembourg.
- \* The following abbreviations were used:

### Acceding countries

CY	Cyprus
CZ	Czech Republic
EE	Estonia
LV	Latvia
LT	Lithuania
MT	Malta
HU	Hungary
PL	Poland
SK	Slovakia

### Euro area countries

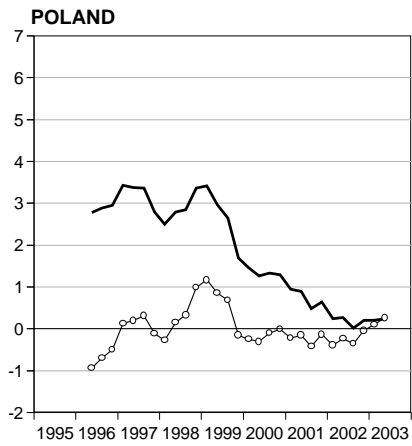
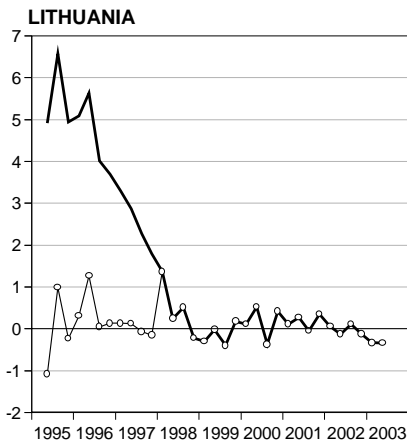
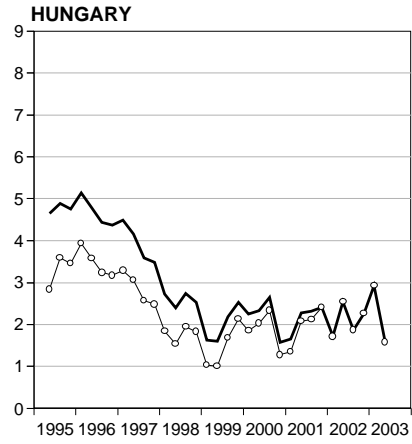
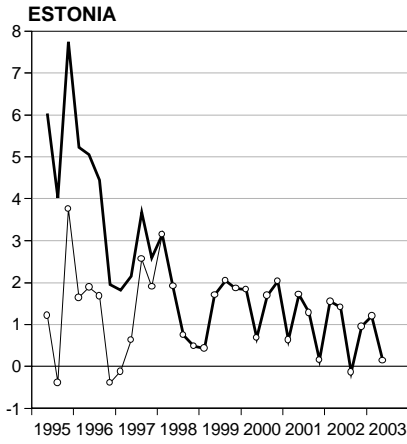
BE	Belgium
DE	Germany
AT	Austria
GR	Greece
ES	Spain
FR	France
IT	Italy
NL	Netherlands
PT	Portugal
FI	Finland

### Pre-in countries

UK	United Kingdom
DK	Denmark
SE	Sweden

## Appendix 2: Adjustment of inflation rates for a downward trend

(Percentage changes compared to the previous quarter)



— Inflation rate

—○— Adjusted inflation rate

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