A Small Macroeconomic Model of the EU-Accession Countries*

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Abstract

This paper develops a small-scale macro-economic model of the CEECs to analyze various aspects of integration with the current EU and the role of monetary and exchange rate strategies during the accession phase. The model gives insight into both the adjustment of the internal balance (as for output and employment) and the external balance (as for exports and competitiveness) in a number of accession countries. The model provides more insight into the basic macroeconomic relationships governing macroeconomic adjustment in the accession countries and also the role of the integration with the EU in that adjustment. We perform empirical simulations of different scenarios and analyze the resulting macroeconomic adjustment. In particular, we compare how a macroeconomic shock in the current EU is transmitted to the accession countries under a flexible euro exchange rate and under a fixed euro exchange rate.

Keywords:
JEL codes: EU accession, macroeconomic modeling, macroeconomic policy

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1. Introduction

The countries in Central and Eastern Europe (CEECs) are in a process of rapid transformation during the early 1990s. Firstly, there is the ongoing process of transformation from the former planned economy towards a market economy. This process has currently progressed so far that the institutional structures in these countries are increasingly similar to those in other market economies. Secondly, these countries have filed applications to become member of the European Union (EU) in the near future[1]. Therefore, it has become increasingly important to have a better insight into the macroeconomic structure of these countries and their integration in the EU.

During this phase countries are also preparing for an eventual entering of the euro-area. With EU-accession, the countries are expected to participate in the ERM framework. In their preparation to that entry, countries remain unrestricted in the monetary and exchange rate policies that they implement. During recent years the CEECs have implemented a broad range of monetary and exchange rate strategies. Various studies have been produced on monetary strategies and monetary transmission in the CEECs. Detailed studies as OENB (1997) and Vinhas de Souza (1999) reveal the large variation in the policy strategies that have been followed and the changes and complications that have resulted. Roughly speaking, the monetary policy strategies that have been adopted in the CEECs -and may be adopted in the future- fall into the following categories: (i) monetary targeting, (ii) interest rate targeting, (iii) exchange rate targeting, (iv) direct inflation targeting, (v) currency board and (vi) unilateral euroization[2].

This paper develops a small-scale macro-economic model of the CEECs to analyze various aspects of integration with the current EU and the role of monetary and exchange rate strategies during the accession phase. The model gives insight into both the adjustment of the internal balance (as for output and employment) and the external balance (as for exports and competitiveness) in a number of accession countries. The model provides more insight into the basic macroeconomic relationships governing macroeconomic adjustment in the accession countries and also the role of the integration with the EU in that adjustment. The latter plays an important role since the economic integration of the CEECs and the EU is already fairly high: trade integration is rather deep as up to 75% of CEECs' exports are directed to the EU. Similarly, the bulk of FDI in CEECs originate from EU countries.

The model is based on an extension of the Mundell-Fleming framework, includes a modeling of the labor market, a wage-price spiral and the splitting-up of expenditure categories (see Douven and Plasmans (1995)). Cross-country comparisons will allow similarities and dissimilarities in the adjustment patterns to be discerned. The model is estimated and then used for policy analysis during the accession phase. We perform empirical simulations of different scenarios and analyze the resulting macroeconomic adjustment. In particular, we compare how a macroeconomic shock in the current EU is transmitted to the accession countries under a flexible euro exchange rate and under a fixed euro exchange rate.

Until now a limited number of estimated macroeconomic models for the CEECs exists. Hall *et al*. (2000) survey the main technical and practical problems that macroeconomic models of transition countries face. Charemza (1994) develops a macroeconomic model for the CEECs and uses it for forecasting and simulation of the economies of the Czech Republic, Hungary, Lithuania, Slovak Republic and Poland. Juszcak *et al.* (1993) and Klein *et al.* (1999) develop quarterly models for Poland and discuss their main properties. Golinelli and Rovelli (1999) estimate a small macroeconomic model for the case of Hungary and Poland. The relation between monetary policy and disinflation in Hungary and Poland is then analyzed by simulating alternative interest rate policies. Basdevant (2000) estimates a macroeconomic model for the Russian Federation and uses the model to analyze the consequences of a number of alternative economic policies. Plasmans (1999) estimates a macroeconomic model for the three Baltic States to study their trade and employment patterns. Vinhas de Souza and Ledrut (2001) use a macroeconomic model of the accession countries to analyze macroeconomic adjustment under alternative exchange rate systems.

The paper is organized as follows: Section 2 discusses macroeconomic adjustment in ten accession countries during the period 1994-2001. Section 3 presents a small log-linear macroeconomic model of accession countries. Section 4 estimates a dynamic version of the small macroeconomic model outlined in Section 3. Section 5 uses the model for macroeconomic policy experiments and presents numerical simulations of enlargement scenarios. The concluding section summarizes our main results.

2. Macroeconomic Adjustment in the Accession Countries

The aim of this section is to provide a broad overview of some macroeconomic trends that can be distinguished from our quarterly data set of the most important macroeconomic variables. Figure 1 displays real output growth, inflation, exchange rate changes against the euro, short-term interest rates, money growth, employment growth, wage inflation, the fiscal deficit to GDP ratio, and trade and capital flows during the nineties for the ten EU-accession CEECs: Bulgaria (BUL), the Czech Republic (CZR), Estonia (EST), Hungary (HUN), Latvia (LAT), Lithuania (LIT), Poland (POL), Romania (ROM), Slovak Republic (SLO), and Slovenia (SLV).

[Insert Figure 1 here]

While there are significant cross-country variations in macroeconomic adjustments there appear to be some similarities as well. First, in most cases growth of real GDP (panel (a)) has been positive since 1994, following the initial transition period 1990-1992 which was in practically all cases marked by a collapse in economic activity and a surge in inflation. In the case of Bulgaria and Romania there has remained a larger volatility of output than in the other countries. In particular, the severe economic

downturn of 1996 stands out in both countries. The Baltic states display some similarities in their adjustment patterns, a reflection perhaps of their similarities in terms of size (comparatively small and highly open), structure, and initial conditions. Output growth has been accompanied in most cases by negative employment growth (panel (f)), a phenomenon that is likely to reflect the ongoing process of privatization, restructuring and rationalization of the economy.

As concerning inflation (panel (b)), a gradual disinflation trend is clearly present in all countries. The adjustment of inflation is disturbed in the case of Bulgaria and Romania by large inflationary bursts in 1994 and 1996. Apart from a small Latvian inflation hike in 1999, again largely similar adjustment is seen in the Baltic states. Following Arratibel *et al.* (2002), it is possible to discern some groups at the country level. The observed inflation dynamics also reflect different policy choices and different policy responses to political or economic crises (both domestically and externally). The different policy choices refer particularly to monetary policy strategies and -associated with this choice- the choice of the exchange rate regime.

The Baltic states experienced an extremely pronounced "L"-pattern (nearly hyperinflation, drastic output fall). The extremely high inflation rates were tackled by currency board arrangements and hard pegs in Latvia, Estonia and Lithuania. The Czech Republic, Hungary, Poland, Slovakia and Slovenia experienced a less pronounced "L"-shaped pattern in inflation (lower peak, more gradual decline). Except for Slovenia, these countries opted for an exchange rate peg at the start of transition, but switched to more flexible regimes as transition progressed. This allowed policy-makers more room for macroeconomic policy and also allowed some appreciation of the nominal exchange rate. Bulgaria and Romania stand out as exceptions. Bulgaria coped with its 1996 currency crisis by means of the introduction of a currency board. Romania, however, has not yet been able to achieve 'full' macroeconomic stabilization[3].

The dynamics of inflation are to a significant extent -as to be expected- transmitted in the rate of change of nominal exchange rates (panel (c)), short-term interest rates (panel (d)), money growth (not shown) and wages (panel (g)). On the other hand, it is also clear that considerable fluctuations of the real exchange rate (panel (e)), real interest rates (not shown), real money balances (not shown), and real wages (not shown) have marked the recent macroeconomic adjustment in the accession countries, and have directly affected adjustment in the real economy. It is observed that in particular Bulgaria and the Baltic States have witnessed a gradual deteriorating competitiveness vis-à-vis the EU (panel (e)), whereas Hungary and Slovenia have outperformed the other accession countries in this respect[4]. An important reason for this difference is likely to be the exchange rate systems in place and amount of capital inflows.

Fiscal balances (not shown) tend to loosen in some countries, recently. The fiscal loosening appears to be most important in Hungary, Poland and the Baltic states. Also trade deficits tend to increase during the period as seen in panel (h) in Figure 1: after 1996 trade deficits widen in most cases as a result of strong import demand which exceeds an also strong export growth. The deficits on

the current account are in most cases compensated by the considerable net capital inflows into the accession countries. A significant amount of these capital flows occurred in the form of inflows of foreign direct investment.

Finally, Table 1 presents an overview of historical exchange rate regime choices in the accession countries. Nearly all CEECs started with a conventional peg, except for Slovenia which still maintains the managed float chosen at the beginning of transition. By the end of the nineties all countries had moved to a more flexible regime, except for Bulgaria. The mid nineties' currency crisis of the Czech Koruna forced the Czech Republic to abandon its hard peg. Bulgaria tackled its currency crisis of the mid nineties by adopting a currency board. Estonia opted for a currency board from the beginning of transition, while Latvia and Lithuania started with a float regime, switching in 1994 to a currency board and a conventional hard peg respectively. The Baltic states did not change their regimes since then. One notable difference between the accession countries and the other countries in transition is that the tendency to adopt corner solutions, i.e. a very hard peg or a very flexible exchange rate, is much less prevalent in the former (von Hagen and Zhou (2002)). The currency crises in the 1990s (Mexico, South-East Asia, Brazil) that countries confronted with large capital flows should avoid intermediate regimes. Apparently, accession countries are by now more able than the other transition countries to control large flows of capital.

Table 1: Exchange rate regimes in accession countries

	1990	***1991***	***1992***	***1993***	***1994***	***1995***	***1996***	***1997***	***1998***	***1999***
Central and Eastern European Countries										
Bulgaria	3	8	8	8	8	8	8	2	2	2
Czech R.	3	3	3	3	3	3	4	7	7	7
Hungary	3	3	3	3	3	6	6	6	6	6
Poland	3	5	5	5	5	6	6	6	6	6
Romania	3	7	8	8	8	8	8	8	7	7
Slovak R.	3	3	3	3	3	3	4	4	7	7
Slovenia	NA	(7)	7	7	7	7	7	7	7	7
Baltics										
Estonia	NA	NA	2	2	2	2	2	2	2	2
Latvia	NA	NA	8	8	3	3	3	3	3	3
Lithuania	NA	NA	8	8	2	2	2	2	2	2

Note: end-year observations, codes in parentheses refer to periods when the newly-introduced currency had not yet assumed the status as the sole legal tender. Codes have the following meaning: NA: not available, 1: currency union (no separate legal tender, e.g. euroization), 2: currency board arrangement, 3: conventionally fixed pegs (adjustable pegs, de facto pegs), 4: horizontal bands, 5: crawling pegs, 6: crawling bands, 7: managed floating without preannounced path, and 8: independent floating. Source: von Hagen and Zhou (2002).

3. A Small Macroeconomic Model of Accession Countries

The model that will be estimated for the accession economies in the next section is a small open economy AD-AS model and is based on the long-term structural relations and definitions found in Table 2. In Section 3 the model will be estimated in error-correction form which will provide both the long-run equilibrium relations in the model and the short-run adjustment dynamics towards it.

Table 2

Structural Relations and Definitions of the Macroeconomic Model of the Accession Countries

$$c = \alpha_1 y_d - \alpha_2 (r - \Delta p_c) \quad (1)$$

$$i = \beta_1 y - \beta_2 (r - \Delta p) \quad (2)$$

$$x = \gamma_1 s + \gamma_2 y_{EU} + \gamma_2 WTR - \gamma_3 (p - p_{EU}) \quad (3)$$

$$z = -\delta_1 s + \delta_2 y - \delta_4 (e + p_{EU}) \quad (4)$$

$$p = \phi_1 w + \phi_2 (e + p_{EU}) + \phi_3 (y - \bar{y}) \quad (5)$$

$$p_c = \kappa_1 p_y + \kappa_2 (e + p_{EU}) \quad (6)$$

$$w = \lambda_1 p_c + \lambda_2 (y - n) - \lambda_3 u - \lambda_4 (p_c - p) \quad (7)$$

$$n = -\mu_1 (w - p) + \mu_2 y + \mu_3 s \quad (8)$$

$$e = \zeta_1 (r - r_{EU}) + \zeta_2 (\Delta p - \Delta p_{EU}) + \zeta_3 (y - y_{EU}) + \zeta_4 (m - m_{EU}) + \zeta_5 (f - f_{EU}) \quad (9)$$

$$r = \pi_1 \Delta p + \pi_2 (y - \bar{y}) + \pi_3 u + \pi_4 \Delta m + \pi_5 r_{EU} \quad (10)$$

$$Y \equiv C + I + G + X - Z + CIN \quad (11)$$

$$s \equiv e + p_{EU} - p \quad (12)$$

$$u \equiv n_s - n \quad (13)$$

$$Y_d \equiv W.N + Q - T \quad (14)$$

$$\log(C) \equiv c + p_c, \log(Y) \equiv y + p, \log(Y_d) \equiv y_d + p_c, \log(I) \equiv i + p, \quad (15)$$
$$\log(X) \equiv x + p, \log(Z) \equiv z + e + p_{EU}, \log(W) \equiv w, \log(N) \equiv n$$

All the parameters are assumed to be non-negative, according economic theory. (1) gives real private consumption, *c*, as a function of the real interest rate, $r - \Delta p$, and real disposable income, y_d. p denotes the domestic output price level. Real private investment, *i*, in (2) is assumed to be a function of the real interest rate and real output, *y*. Real exports, *x*, in (3) depend on competitiveness vis-à-vis the EU, *s*, real output in the EU, y^{EU}, world trade, *WTR*, and the terms of trade with the EU, $p - p_{EU}$. Real imports, *z*, in (4) depend on the real euro exchange rate, real output and the import price level, $e + p_{EU}$, where p_{EU} denotes the EU-price level and *e* the euro exchange rate. Direct linkages

between the domestic and the EU are modeled in the exports and import functions through the effects of EU-real output, the EU-price level and the euro exchange rate. Also output prices, consumer prices, the exchange rate and the interest rate are directly affected by the adjustment of the EU economy. The "EU" subscript refers to an EU-variable and Δ is the first difference operator.

(1)-(4) together form the IS curve. (11) is the equilibrium condition equalizing aggregate supply and aggregate demand which equals the sum of the nominal equivalents of (1)-(4) plus the exogenous government consumption and investment, *G*, and the change in inventories, *CIN*. (14) defines disposable income as the sum of wage and non-wage income, where *W* denotes the nominal wage, *N* the level of employment, *Q*, the households' gross non-wage income, *T*, total taxes/net-transfers paid/received by the households.

The domestic output price level (5) is a non-decreasing function of domestic factor costs, approximated by the nominal wage, and EU-prices (import prices), these two factors standing for cost-push inflation. The effect of demand pull inflation is measured by the output gap, the deviation of gross domestic product from its equilibrium, $\bar{y}$. Consumer prices, p_c, in (6) are defined as a weighted basket of domestic and EU prices.

Nominal private per capita wages in (7) are assumed to depend positively on the consumer prices, according to the price-indexing elasticity λ_1, and labor productivity, *y*-*n*, and negatively on the unemployment rate (Phillips curve), defined as the difference between the exogenous labor force, n^s, and total employment. With rising unemployment, workers are more concerned about their jobs than about their wages, so their wage claims will be restrained. Moreover, employers will have a larger number of employable workers at their disposal, so their wage offers can be expected to decline. Finally, the nominal per capita wages depend negatively on the overall terms of trade, represented by $p_c - p$. Three factors explain labor demand (8): the real wage rate, $w - p$, real output, and the real euro exchange rate. Output and the real exchange rate are assumed to have a positive effect on labor demand and the real wage a negative effect.

Equation (9) is a structural nominal exchange rate equation, expressing the domestic nominal euro exchange rate as a function of differentials of inflation rates (PPP-hypothesis), interest rates (covered interest rate parity hypothesis), outputs, money stocks, and the (cumulated) foreign trade balances, f [5]. The flexible-price monetary model of exchange rates includes only the three terms (r-r_{EU}),(y-y_{EU}), and (m-m_{EU}), while the sticky-price monetary model adds the inflation rate differential (Δp-Δp_{EU}) to this set of variables. Finally, the portfolio balance model concentrates on the money holdings and on the domestic and foreign trade balances. Obviously, this equation is of no value if the domestic currency is completely pegged to the euro. Equation (10) is a monetary policy rule combining elements from Taylor's (1993) simple feedback interest rate rule, which includes the rate of inflation and the output gap, and an empirical interest rate rule proposed by Fair (2001) which adds unemployment, money growth, Δm and the EU interest rate, r_{EU} to the Taylor rule.

4. Empirical Estimation of the Macro-Economic Model

In this section we estimate empirical variants of the model of Section 3 for Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic, and Slovenia. When estimating we need to take into account a number of aspects: (i) the limited quality of the data (e.g. the restricted number of observations), (ii) the seasonal pattern in the unadjusted raw data, (iii) the non-stationarity of almost all variables. Given the presence of seasonal patterns in most variables, the Census X12-method is used to obtain seasonally adjusted data (this method has the advantage that the seasonal component can change from year to year). Once seasonal adjustments are made the non-stationarity of almost all variables, is taken into account by estimating the equations (1)-(10) in error-correction form (ECM), according to the Engle-Granger representation theorem, which can be expressed for K explanatory variables as follows:

$$\Delta y_t = \alpha_0 + \alpha_1 y_{t-1} + \sum_{k=1}^{K} \beta_k x_{k,t-1} + \sum_{k=1}^{K} \sum_{l=0}^{L_k} \delta_{k,l} \Delta x_{k,t-l} + \sum_{m=1}^{M} \gamma_m \Delta y_{t-m} + \varepsilon_t \quad (16)$$

where ε_t is a white noise error term. Given the restricted number of observations in our quarterly (seasonally adjusted) dataset we assume in our case that M is equal to 1 and L_k is equal to 0 for all k.

The estimated first-order ECMs of all the structural macroeconomic models are presented in Tables 3-12 for the ten accession countries. The period of estimation is 1994:1-2001:4, in several cases one or a few observations are lacking at either the beginning or the end of the sample, making in those cases the sample slightly shorter than 32. Parameter testing occurred both on statistical (level of significance, parameter coherency for the ECM-expressions) and economic (correct signs and sizes) grounds. Dummy variables are sometimes introduced when extreme observations have too strong biasing impacts. The macroeconomic model is estimated for each country as a complete system using the method of Seemingly Unrelated Regressions (SURs). The SUR-method pays attention to the contemporaneous correlations between unobserved error terms belonging to different behavioral equations of the same country. Hence, by estimating these correlations the dependency between the different endogenous variables of a country's model becomes visible.

A first look reveals at the same time important similarities and substantial differences between the structural coefficients among the accession countries. This points to the fact that CEECs have both common features and ideosyncracies in their macroeconomic structures, so that a different treatment of each country is the only appropriate way of study. We will not discuss here in detail all the observed patterns in the accession countries (the interested reader is referred to the Tables 3-12), but restrict ourselves to a broad summary.

In general, the real private consumption functions exhibit strong and significant long-term effects $-a_2/a_1$ and $-a_3/a_1$[6]. The direct impact of real disposable income is everywhere

prominently present. The real short-term interest rate has in significant negative effects on real private consumption in case of Bulgaria, the Czech Republic, Hungary, Latvia, Romania and Slovenia. Short-term effects, a_5, and a_6 are often comparable and in line with the long-run effects. The estimated real private investment functions also show significant long-term effects, but somewhat less pronounced than for private consumption. Output has in almost all cases a positive effect in the short-run and long-run. Effects of the real interest rates are -if present- more important in the long-run than in the short-run.

The real exchange rate vis-à-vis the EU is one of the crucial factors that explain exports. It has in almost all cases a positive effect both in the short-run and long-run. The effect of integration with the EU can also be remarked from the significant impact of the EU-GDP. Real imports display the expected negative effect from the real exchange rate at least in the long-run. Real GDP is another important determinant of real imports in practically all cases.

Producer prices are fairly well explained by the error-correction form. Note the important cost-push elements (wages and EU prices) in most countries. In the case of Bulgaria, Latvia, Poland and Slovakia also the demand pull inflation argument seems to be relevant. The estimations of consumer price inflation display a considerable variation. Except for the Czech Republic, Estonia and Poland links between consumer prices and domestic producer prices and foreign prices are somewhat imprecise. In most cases, either one of them is important in explaining consumer prices. Wage inflation is explained pretty well for the eight CEECs considered. In all countries wage growth is especially linked to the evolution of consumer price inflation, somewhat to productivity, whereas the effect of unemployment is practically absent. The estimated employment functions are rather diverse and not always the expected effects are found or only in an insignificant manner, in particular in the short-run.

Nominal exchange rate changes are explained fairly well by the monetary model of the exchange rate, except for the currency boards in Estonia and Latvia. The effects of interest rate, inflation, output and money growth differentials vis-à-vis the EU can most of the time account for the observed adjustment of the exchange rate against the euro. Trade balance effects according to the portfolio balance model of exchange rate behavior, are less pronounced, possibly also because the included trade balance -because of lack of data- is the total trade balance rather than the trade balance with the EU. In most cases the estimated nominal (short-term) interest rate rules perform fairly well in explaining observed interest rate paths. Especially, output gaps and inflation rates form important explanations in most CEECs, confirming the basic elements of the Taylor rule, which is a special case of the more generally formulated interest rate rule employed here.

5. Policy Experiments

The estimations in the previous section provided the main macroeconomic relations governing macroeconomic adjustment in the accession countries. While useful as such, we can take the analysis a step further and construct -based on the estimated relations- a model to analyze the effects of possible alternative adjustment scenarios during the accession phase (under the assumption that the estimated relationships remain valid during this period). To get some flavor of the model properties, this section develops a simulation analysis.[7]

The models of the CEECs are simulated for the period 2000:I 2007:IV. In a baseline scenario, Scenario 1, we have defined a set of assumptions about the adjustment of the exogenous variables in the models. In particular, it is assumed that inflation in the EU is equal to 2%, real GDP growth 1%, the nominal EU interest 4.5%, growth of world trade 2.6% during the period 2001:III-2003:IV. From the first quarter of 2004 onwards, we assume that real GDP growth in the EU increases to 2.3% and inflation to 2.4%, the interest rate remains at 4.5%, and the growth of world trade is set at 3%. We assume that this high EU-growth scenario is due to inflationary monetary policy by the ECB inducing a higher rate of inflation. In this way, it is possible to demonstrate how such growth changes in the EU impact on the macroeconomic adjustment in the CEECs. Scenario 2 simulates the same shock to EU variables but under the assumption that the euro exchange rate is held fixed by the monetary authorities as of 2001:II. By comparing both scenarios we are able to analyze the effects of the EU shock under both the fixed and flexible exchange rate regime. In Figure 2 the simulated adjustments are displayed. The analysis is restricted to the Czech Republic, Estonia, Hungary, Lithuania, Poland, and Slovenia.[8] The graphs also give insight into the in-sample properties of the models: during the period 2000:I-2001:II we can compare actual data (thick lines) and simulated adjustment by the model, with the "–--" lines representing scenario 1 and the "----" lines scenario 2. As a general rule, the in-sample simulations of the model are in most cases fairly accurate, giving us confidence that the produced out-of-sample forecasts are most likely to carry a fair degree of plausibility in them. Out-of-sample forecasts are then made for the period 2002:I-2007:IV.

[Insert Figure 2 here]

In Czech Republic, Estonia, and Poland the resulting adjustment under both regimes is similar in ouput growth, inflation, the real exchange rate, wages and employment. In Hungary, Lithuania, and Slovenia the differences between both regimes are much larger. This suggests that the choice of the exchange rate regime is more crucial in the latter countries. In fact in the case of Lithuania, the floating exchange rate regime produces a highly unstable adjustment, and in the case of Slovenia it produces an (slightly widening) oscilatory adjustment. For the former countries both scenarios produce a fairly consistent picture.

Conclusion

Macroeconomic analysis, macroeconomic policy evaluation and cross-country comparisons of CEECs require the presence of macroeconomic models with an elaborated framework of goods-, labor- and financial markets and international linkages. To develop such a framework has been the main task of this paper. Notwithstanding the limited quality of the data and all the ideosyncracies inherent to the transition process that the CEECs are going through, it was found that it is possible to obtain useful estimates of macroeconomic relations and the effects of integration with the EU for these countries. In particular, we found evidence of important trade effects, implying that trade with the EU acts as an important transmission channel of macroeconomic policies in the accession countries. The estimation in the form of error-correction models gives estimations of both the long-run equilibrium relationships and the short-run dynamics towards these long-run relations. Sizeable long- and short-term effects were observed, but in a very different manner among countries. The ten accession countries studied do not at all form a homogeneous block so that a different treatment of each country is absolutely necessary. Of course, there are similarities but the difference are prominent.

The estimated macroeconomic models of the CEECs served as the input for the macroeconomic simulation models of these countries that can be applied for in-sample simulation and out-of-sample forecasting and policy evaluation. We analyzed the effects on the CEECs of different growth scenarios in the EU and the role of the exchange rate against the euro. In this way a fairly good insight can be obtained on the interaction between the CEECs and the EU-economy.

Apppendix: Description of the Dataset and Variables.

Table A.1: Variables and Data Sources

	Variable	*Name*	*Units*	*Source*
C	*CON*	Private consumption	mln/bln n.c., quarterly	IMF IFS line 96F..ZF and nat.stat.off.
c	*RCON*	Real consumption	mln/bln n.c., quarterly	calculated as *RCON≡CON/PPI*
p	*PPI*	Producer price index	1995=100	IMF IFS line 63...ZF
r	*SIN*	Money market interest rate	%	IMF IFS line 60B..ZF
	YDP	Disposable income	mln/bln n.c., quarterly	calculated as *YDP≡GDP-REV+GEX-GCO*
y_d	*RYDP*	Real disposable income	mln/bln n.c., quarterly	calculated as *RYDP≡YDP/PPI*
	INV	Gross fixed capital formation	mln/bln n.c., quarterly	IMF IFS line 93E..ZF and nat.stat.off.
I	*RINV*	Real Investment	mln/bln n.c., quarterly	calculated as *RINV≡INV/PPI*
	GDP	Gross domestic product	mln/bln n.c., quarterly	calculated as *GDP≡CON+INV+EXP-IMP+CIN+GCO*
y	*RGDP*	Real gross domestic product	mln/bln n.c., quarterly	calculated as *RGDP≡GDP/PPI*
	EXP	Exports of goods and services	mln/bln n.c., quarterly	IMF IFS line 90C..ZF and nat.stat.off.
x	*REXP*	Real exports	mln/bln n.c., quarterly	calculated as *REXP≡EXP/PPI*
	EUR	Exchange rate vs euro	per.avg	calculated from IMF IFS line ..RF.ZF
s	*REUR*	Real exchange rate vs euro	per.avg	calculated as $REUR \equiv EUR * PPI^{EU}/PPI$
	WTR	World trade	bln US$	calculated from IMF IFS
	IMP	Imports of goods and services	mln/bln n.c., quarterly	IMF IFS line 98C..ZF and nat.stat.off.
z	*RIMP*	Real imports	mln/bln n.c., quarterly	calculated as *RIMP≡IMP/PPI*
	OIL	Oil price	$ per barrel	IMF IFS line
m	*M2*	Money, M2	mln/bln n.c	IMF IFS line 35...ZF and nat.stat.off.
n	*EMP*	Employment	1000	IMF IFS line 67E..ZF and nat.stat.off.
w	*WAG*	Wages	1995=100	IMF IFS line 65...ZF and nat.stat.off.
u	*UNE*	Unemployment	1000	IMF IFS line 67C..ZF and nat.stat.off.
	REV	Government revenue	mln/bln n.c., quarterly	IMF IFS line 81...ZF and nat.stat.off.
	GEX	Government expenditure	mln/bln n.c., quarterly	IMF IFS line 82...ZF and nat.stat.off.
G	*GCO*	Government consumption	mln/bln n.c., quarterly	IMF IFS line 91F..ZF and nat.stat.off.
	CIN	Change in inventories	mln/bln n.c., quarterly	IMF IFS line 93L..ZF and nat.stat.off.
	CUA	Trade balance	mln euro, quarterly	calculated as *CUA≡(EXP-IMP)/EUR*
n_s	*LAB*	Labour force	1000	calculated as *LAB≡EMP+UNE*

References

Arratibel, O., D. Rodríguez-Palenzuela and C. Thimann (2002) "Inflation Dynamics and Dual Inflation in Accession Countries: a 'New Keynesian' Perspective," ECB Working Paper no.132, European Central Bank, Frankfurt.

Buracas, A. and V. Sakalauskas (2001) "Exchange Rates and Structural Changes: Baltics in Pre-Accession," mimeo

Basdevant, O. (2000) "An Econometric Model of the Russian Federation," Economic Modelling 17, 305-336.

Charemza, W. (1994) "LAM models for East European Economies: General description," Discussion Paper, University of Gdansk.

Douven, R. and Plasmans, J. (1995) "SLIM, a small linear interdependent model of eight EU-member states, the USA and Japan," Economic Modelling 13, 185-233.

Fair, R.C. (2001) "Estimates of the Effectiveness of Monetary Policy," Yales Cowles Foundation Discussion Paper no. 1298, Yale University.

Golinelli, R. and R. Rovelli (1999) "Monetary Policy and the Convergence to Low Inflation: A Small Macro Model for Hungary and Poland," 1991-1998, mimeo

Hagen, J. von and J. Zhou (2002) "The choice of exchange rate regimes: An empirical analysis for transition economies," CEPR Discussion Paper No. 3289.

Hall, S., G. Myzon and A. Welfe (2000) "Modelling Economies in Transition: An Introduction," Economic Modelling 17(3), 339-357.

Juszczak, G., Kazmierska, M., Lapinska-Sobczak, N. and W. Welfe (1993) "Quarterly Model of the Polish Economy in Transition (with Special Emphasis on Financial Flows)," Economic Modelling 10(2), 127-149.

Klein, L., A. Welfe and W. Welfe (1999) "Principles of Macroeconometric Modeling". Advanced Textbooks in Economics, vol.36. Amsterdam: Elsevier Science BV.

Lättemäe, R. and R. Pikkani (2001) "Monetary Transmission Mechanism under Currency Board Arrangement. Theoretical Considerations and Empirical Estimation on Estonian Data," Bank of Estonia, Central Banking Policy Department and Research Department.

Nenovsky, N., V. Yotzov and K. Hristov (2000) "Inflation under a Currency Board. The Case of Bulgaria," mimeo.

OENB (1997) "Monetary Policy in Transition in East and West: Strategies, Instruments and Transmission Mechanisms", Vienna: Austrian National Bank.

Plasmans, J. (1999) "Towards a Strategic Multi-Country Model for Trade and Employment in the Baltics," mimeo.

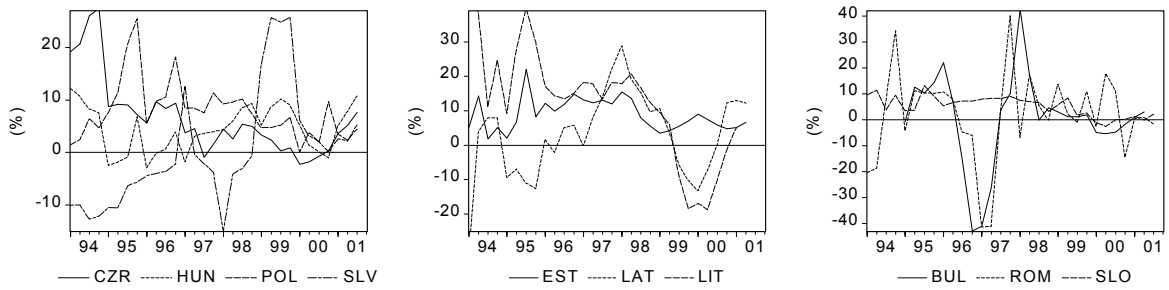
Schoors, K. (2001), "The EU and its Eastern European Accession Countries. Should They Adopt the Euro before or after Accession," mimeo.

Taylor, J.B. (1993) "Discretion versus Policy rules in Practice", Carnegie-Rochester Conference Series on Public Policy 39, 195-214.

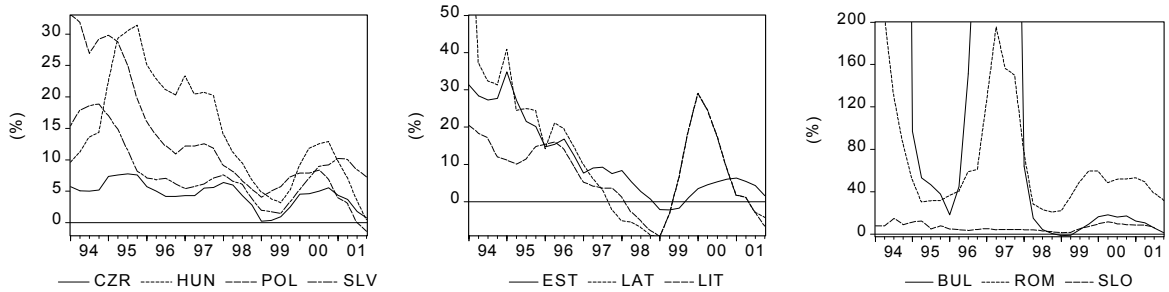
Vinhas de Souza, L. (1999) "Strategies of Exchange Rate Linkages of EU Application Countries and Their Likely Future Developments", mimeo.

Vinhas de Souza, L. and E. Ledrut (2001) "Alternative Exchange Rate Regimes for pre-EMU Integration: Individual Estimations for the Accession Countries," mimeo.

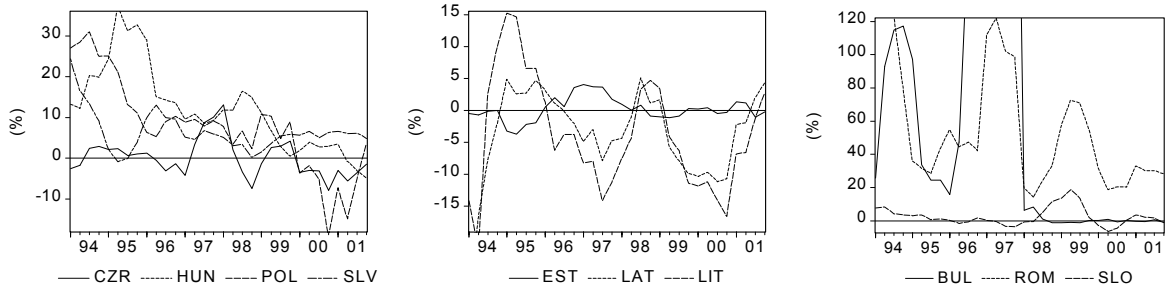
Vinhas de Souza, L. (2002) "Integrated Monetary and Exchange Rate Frameworks: Are There Empirical Differences?," Working Paper no.2 Bank of Estonia.



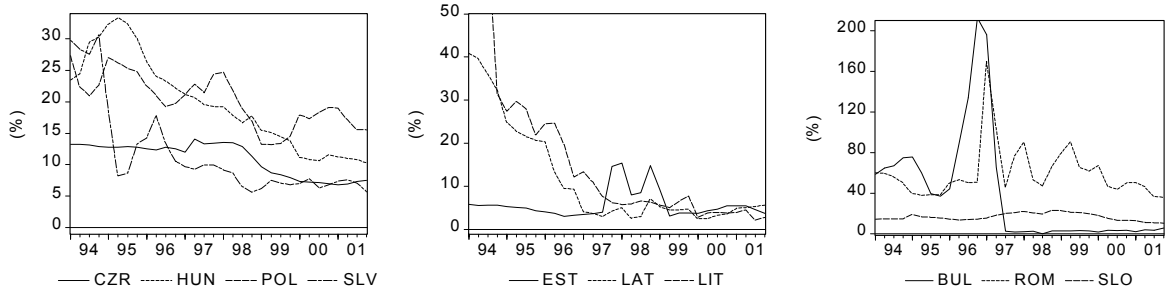
(a) Real GDP Growth (%, y-to-y)



(b) Inflation (PPI, %, y-to-y)

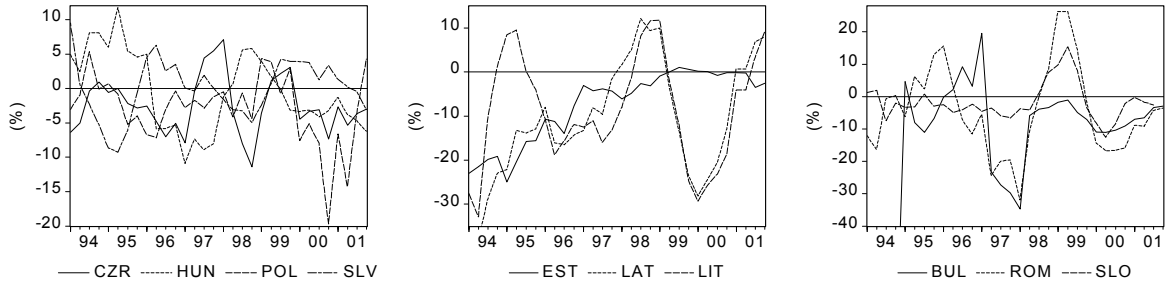


(c) Depreciation (+)/Appreciation (-) against the Euro (%, y-to-y)

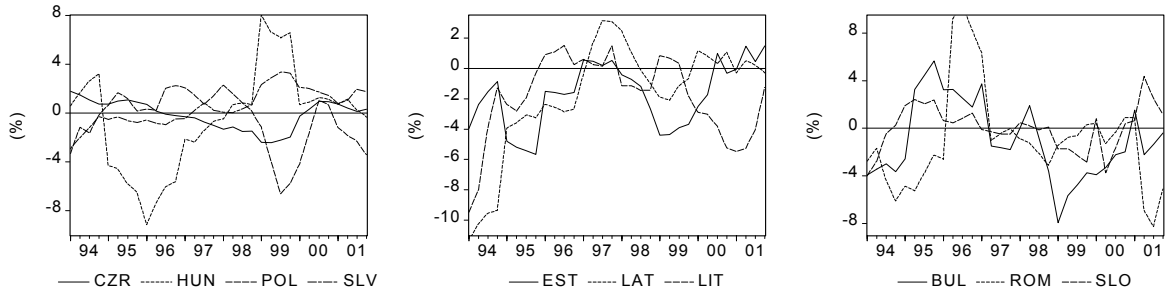


(d) Short Term Interest Rate (%)

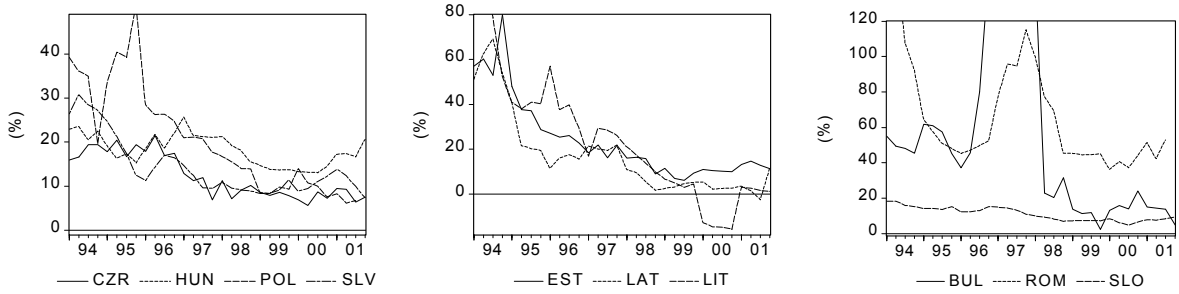
Figure 1
Macro-economic Adjustment in Accession Countries, 1994-2001



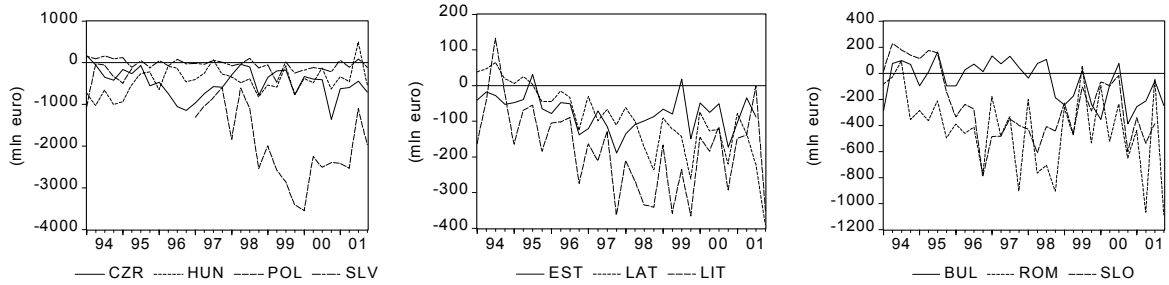
(e) Real Depreciation (+)/Appreciation (-) against the Euro (%, y-to-y)



(f) Employment Growth (%, y-to-y)



(g) Wage Growth (%, y-to-y)



(h) Trade Surplus (+)/Deficit (-) (mln euro)

Figure 1 (cont.)
Macro-economic Adjustment in Accession Countries, 1994-2001

Table 3 - Consumption: $\Delta c_t = a_0 + a_1 c_{t-1} + a_2 y_{d,t-1} + a_3 (r - \Delta p_c)_{t-1} + a_4 \Delta c_{t-1} + a_5 \Delta y_{d,t} + a_6 \Delta (r - \Delta p_c)_t$

	BUL	CZR	EST	HUN	LAT	LIT	POL	ROM	SLO	SLV
a_0	-0.1918	0.0457	0.5493	0.2772	0.0810	0.2629	-0.4891	0.3955	0.4481	0.4822
	-3.91	*0.62*	*3.12*	*1.14*	*1.20*	*1.61*	*-3.53*	*0.81*	*1.66*	*6.14*
a_1	-0.9667	-0.5552	-0.6042	-0.2545	-0.2535	-0.9949	-0.5898	-0.3963	-0.2180	-0.6431
	-7.69	*-3.51*	*-6.48*	*-3.23*	*-2.66*	*-16.47*	*-5.00*	*-3.28*	*-2.73*	*-7.81*
a_2	1.0928	0.3128	0.4448	0.1193	0.1851	0.8722	0.6373	0.2980	0.1438	0.2123
	6.84	*2.66*	*6.06*	*0.93*	*3.18*	*14.60*	*5.09*	*2.92*	*2.08*	*4.73*
a_3	-0.2559	-0.3102	0.1252	-0.3281	-0.0349	0.0782	0.0224	0.0331	-0.0738	-0.2242
	-6.51	*-1.14*	*1.18*	*-2.06*	*-0.41*	*4.04*	*0.29*	*0.53*	*-0.84*	*-4.08*
a_4	-0.0054	-0.2000	0.2587	0.0186	-0.2215	0.1594	-0.0880	-0.0664	-0.0876	0.0794
	-0.06	*-1.78*	*2.72*	*0.18*	*-2.27*	*4.57*	*-1.36*	*-0.62*	*-0.83*	*1.02*
a_5	0.7532	0.4756	0.3918	0.3208	0.0500	0.7411	0.5243	0.4803	0.1366	0.0728
	8.68	*4.82*	*6.61*	*2.25*	*1.00*	*11.59*	*9.26*	*6.18*	*2.42*	*1.36*
a_6	-0.0587	-0.0941	0.3312	-0.4971	-0.0591	-0.1735	0.2041	-0.0132	0.2009	-0.1738
	-1.68	*-0.26*	*4.22*	*-1.23*	*-0.47*	*-4.29*	*2.07*	*-0.27*	*1.65*	*-3.37*
Adj. R^2	0.74	0.52	0.72	0.68	0.58	0.93	0.74	0.53	0.48	0.67
D.-W.	1.70	1.81	1.71	2.45	2.58	2.04	1.83	2.06	1.76	1.99

Table 4 – Investment: $\Delta i_t = a_0 + a_1 i_{t-1} + a_2 y_{t-1} + a_3 (r - \Delta p)_{t-1} + a_4 \Delta i_{t-1} + a_5 \Delta y_t + a_6 \Delta (r - \Delta p)_t$

	BUL	CZR	EST	HUN	LAT	LIT	POL	ROM	SLO	SLV
a_0	-0.9853	0.2681	-0.0945	-0.2200	-3.1546	-0.9536	-0.3249	-3.8824	0.1074	-0.4852
	-3.53	*1.45*	*-0.50*	*-1.26*	*-3.48*	*-1.60*	*-0.31*	*-2.60*	*0.17*	*-2.59*
a_1	-0.5101	-0.1588	-0.2566	-0.0674	-0.8906	-0.2404	-0.1113	-0.5138	-0.2770	-0.3689
	-3.94	*-1.82*	*-2.36*	*-1.49*	*-4.03*	*-2.06*	*-0.94*	*-5.69*	*-3.07*	*-4.62*
a_2	0.4708	-0.1622	0.2067	0.1227	1.8293	0.3686	0.1333	1.1120	0.2227	0.3686
	1.85	*-1.27*	*2.16*	*1.71*	*3.62*	*1.93*	*0.55*	*3.48*	*1.56*	*3.11*
a_3	-0.0439	-0.1948	0.3090	0.0196	-0.6924	0.2122	-0.2098	-0.0663	-0.0401	-0.1795
	-0.58	*-0.64*	*1.20*	*0.13*	*-2.14*	*1.91*	*-0.56*	*-0.44*	*-0.14*	*-3.00*
a_4	0.3172	-0.2959	0.1162	-0.1680	-0.0777	-0.2021	0.0961	-0.0207	0.0718	-0.2754
	2.25	*-3.27*	*0.90*	*-1.50*	*-0.52*	*-1.28*	*1.69*	*-0.34*	*0.67*	*-4.51*
a_5	0.5788	-0.0559	0.0973	0.1808	1.2718	1.7602	3.4650	2.2796	0.0130	0.1331
	2.96	*-0.34*	*0.68*	*1.60*	*2.78*	*6.00*	*16.15*	*10.73*	*0.05*	*0.92*
a_6	0.0395	-0.0344	0.3685	-0.7847	0.2577	0.6160	-0.5764	0.0356	0.8016	-0.2309
	0.47	*-0.06*	*1.82*	*-2.85*	*0.49*	*3.75*	*-1.26*	*0.28*	*2.34*	*-2.54*
Adj. R^2	0.23	0.43	0.18	0.41	0.46	0.54	0.90	0.83	0.48	0.85
D.-W.	1.75	1.58	1.89	1.95	1.91	2.05	2.01	1.92	1.69	1.61

Table 5 – Export: $\Delta x_t = a_0 + a_1 x_{t-1} + a_2 s_{t-1} + a_3 (p - p_{EU})_{t-1} + a_4 y_{EU,t-1} + a_5 wtr_{t-1} + a_6 \Delta x_{t-1} + a_7 \Delta s_t + a_8 \Delta (p - p_{EU})_t + a_9 \Delta y_{EU,t} + a_{10} \Delta wtr_t$

	BUL	CZR	EST	HUN	LAT	LIT	POL	ROM	SLO	SLV
a_0	-6.4075	-7.0094	-14.442	-2.5885	-2.8067	2.4885	1.9182	-9.2744	6.3162	-2.6181
	-2.00	*-4.93*	*-3.83*	*-1.35*	*-3.29*	*1.31*	*1.22*	*-3.15*	*3.37*	*-1.76*
a_1	-0.3953	-0.4585	-0.5919	-0.0669	-0.3371	-0.3474	-0.1823	-0.4183	-0.7008	-0.2773
	-3.80	*-3.04*	*-5.44*	*-1.05*	*-4.65*	*-3.99*	*-2.62*	*-4.79*	*-6.26*	*-3.79*
a_2	0.3369	0.2989	2.3833	0.1531	0.7548	0.4211	0.7508	0.6038	0.0710	0.2021
	2.74	*1.40*	*3.05*	*0.44*	*3.68*	*1.13*	*3.84*	*5.47*	*0.43*	*1.16*
a_3	-0.0453	-0.2190	1.9581	0.0217	0.5433	0.9481	0.2721	0.0212	1.2626	0.0569
	-2.84	*-0.88*	*2.85*	*0.17*	*2.89*	*1.76*	*3.89*	*0.89*	*3.63*	*0.57*
a_4	0.5011	0.4208	0.5918	0.0434	0.5429	0.1646	0.2967	0.5417	0.3689	0.3575
	3.43	*4.23*	*3.69*	*0.22*	*3.60*	*0.55*	*2.36*	*2.76*	*3.34*	*3.62*

a_5	0.7519	0.6539	1.1440	0.2367	0.2599	-0.2985	-0.3265	0.5905	-0.3643	0.1129
	1.71	*4.70*	*4.27*	*0.82*	*2.38*	*-1.06*	*-1.56*	*2.13*	*-2.04*	*0.98*
a_6	0.1372	-0.1680	0.0207	-0.3212	0.1400	0.0940	-0.0428	-0.2828	0.0825	-0.0745
	1.88	*-1.16*	*0.20*	*-3.12*	*2.14*	*0.84*	*-0.52*	*-4.64*	*1.47*	*-0.85*
a_7	0.7763	0.5763	2.6243	0.9568	1.1556	0.1965	0.0375	1.0598	0.3993	0.8427
	14.28	*2.77*	*3.47*	*2.23*	*5.38*	*0.53*	*0.14*	*11.15*	*1.99*	*4.10*
a_8	0.0139	1.4829	2.0895	-0.4209	0.4739	-0.7670	-1.4597	0.0778	-0.5956	0.4161
	0.36	*1.40*	*2.40*	*-1.00*	*1.79*	*-1.27*	*-2.20*	*0.64*	*-1.43*	*0.93*
a_9	0.6831	0.2127	0.4122	0.4622	0.1987	-0.4193	0.1667	1.1355	-0.2040	0.5799
	1.48	*1.22*	*1.79*	*1.40*	*1.19*	*-0.76*	*0.61*	*2.64*	*-1.09*	*5.01*
a_{10}	0.5214	0.2404	0.3749	0.9464	-0.1771	-0.0569	0.3612	0.2283	-0.0904	0.6357
	0.81	*0.78*	*1.11*	*2.17*	*-0.64*	*-0.09*	*7.38*	*0.37*	*-0.32*	*3.92*
Adj. R²	0.91	0.38	0.46	0.38	0.92	0.40	0.60	0.84	0.57	0.44
D.-W.	2.26	2.29	2.37	1.66	1.46	2.50	1.61	1.84	2.08	2.23

Table 6 – Import: $\Delta z_t = a_0 + a_1 z_{t-1} + a_2 s_{t-1} + a_3 y_{t-1} + a_4 (e + p_{EU})_{t-1} + a_5 \Delta z_{t-1} + a_6 \Delta s_t + a_7 \Delta y_t + a_8 \Delta (e + p_{EU})_t$

	BUL	**CZR**	**EST**	**HUN**	**LAT**	**LIT**	**POL**	**ROM**	**SLO**	**SLV**
a_0	-0.4906	0.0776	-6.4401	-2.7151	-2.2202	-1.1584	-1.8601	-0.2144	1.2087	1.7170
	-1.15	*0.05*	*-2.03*	*-1.85*	*-1.77*	*-0.97*	*-1.79*	*-0.27*	*1.27*	*1.69*
a_1	-0.2506	-0.3234	-0.4264	-0.4082	-0.2946	-0.4650	-0.3182	-0.2150	-0.2792	-0.3852
	-2.45	*-3.07*	*-4.16*	*-2.81*	*-2.47*	*-3.67*	*-3.21*	*-2.80*	*-3.74*	*-3.32*
a_2	-0.1626	-1.1056	0.1679	-0.2437	-0.1493	-0.0778	0.1119	0.0127	-0.7414	0.2970
	-1.09	*-4.39*	*2.08*	*-1.09*	*-2.82*	*-0.53*	*0.54*	*0.12*	*-4.10*	*1.49*
a_3	0.1733	-0.1181	0.5039	0.3515	0.3123	0.3209	0.2670	0.1077	0.1763	0.8849
	0.97	*-1.12*	*3.67*	*1.63*	*1.67*	*2.45*	*1.37*	*1.00*	*1.30*	*5.45*
a_4	-0.0067	0.5112	0.7552	0.3891	0.4653	0.2683	0.2970	0.0346	0.2579	-0.4429
	-0.41	*2.20*	*1.65*	*3.24*	*1.80*	*1.09*	*2.93*	*1.48*	*1.87*	*-3.84*
a_5	0.1665	-0.2865	0.3451	-0.0043	-0.1189	0.1260	-0.1685	-0.0843	-0.2879	0.0908
	4.71	*-2.14*	*2.97*	*-0.03*	*-1.14*	*1.10*	*-1.45*	*-0.73*	*-5.54*	*0.79*
a_6	0.2983	-4.9713	-0.0431	0.9061	0.1445	0.4955	0.7231	0.4670	0.0827	0.2959
	1.37	*-5.38*	*-0.11*	*1.57*	*0.56*	*1.01*	*0.94*	*2.54*	*0.22*	*0.57*
a_7	0.0061	-0.0467	0.3866	0.4823	0.4121	0.8922	0.1023	0.1238	0.0522	-0.1652
	0.04	*-0.33*	*3.01*	*2.61*	*1.85*	*3.82*	*0.65*	*1.52*	*0.31*	*-0.90*
a_8	0.0634	5.1971	2.0482	0.2303	0.8957	-0.7828	-0.4505	0.0722	0.4415	-0.2018
	0.68	*5.69*	*3.07*	*0.44*	*2.42*	*-1.27*	*-0.56*	*0.54*	*1.00*	*-0.33*
Adj. R²	0.58	0.41	0.50	0.47	0.82	0.40	0.32	0.58	0.68	0.44
D.-W.	2.51	2.08	2.43	1.81	2.23	2.72	1.59	1.87	1.22	2.13

Table 7 – Producer prices: $\Delta p_t = a_0 + a_1 p_{t-1} + a_2 w_{t-1} + a_3 (e + p_{EU})_{t-1} + a_4 (y - \bar{y})_{t-1} + a_5 \Delta p_{t-1} + a_6 \Delta w_t + a_7 \Delta (e + p_{EU})_t + a_8 \Delta (y - \bar{y})_t$

	BUL	**CZR**	**EST**	**HUN**	**LAT**	**LIT**	**POL**	**ROM**	**SLO**	**SLV**
a_0	1.9525	0.5221	0.5403	-0.6517	-1.1659	0.5920	0.1634	-4.1675	-0.5962	-0.4464
	6.92	*1.64*	*0.58*	*-1.84*	*-1.66*	*1.94*	*2.31*	*-3.63*	*-2.37*	*-1.04*
a_1	-0.7959	-0.3762	-0.1324	-0.1240	-0.5018	-0.1845	-0.2744	-0.2085	-0.3481	-0.4962
	-7.02	*-4.58*	*-1.94*	*-1.76*	*-5.20*	*-3.15*	*-5.81*	*-1.98*	*-4.00*	*-5.33*
a_2	0.4365	0.1283	0.0355	-0.0323	0.4839	0.0581	0.0451	-0.2257	0.1327	0.1692
	4.98	*3.87*	*0.80*	*-0.76*	*3.79*	*2.58*	*3.04*	*-1.33*	*3.06*	*2.67*
a_3	0.4060	0.0763	-0.0253	0.1634	0.2890	-0.0018	0.1469	0.4954	0.1254	0.2015
	5.65	*2.42*	*-0.18*	*3.45*	*2.40*	*-0.05*	*4.53*	*3.52*	*2.76*	*3.66*
a_4	-0.5148	-0.0461	-0.0595	0.0447	-0.5177	-0.1317	-0.1713	-0.1018	-0.4211	0.0322
	-4.02	*-2.01*	*-0.55*	*0.69*	*-4.38*	*-1.59*	*-3.61*	*-0.91*	*-3.31*	*0.51*
a_5	0.0267	0.3909	0.1872	0.2144	-0.0643	0.4537	-0.0249	0.0810	-0.1838	0.3862

	1.25	*2.91*	*1.14*	*1.48*	*-0.84*	*4.15*	*-0.19*	*0.47*	*-2.21*	*6.68*
a_6	0.4579	0.1530	0.0579	0.1865	0.2847	0.0248	-0.0127	0.0708	-0.0328	0.1628
	6.06	*3.06*	*0.79*	*1.08*	*1.42*	*0.42*	*-0.41*	*0.27*	*-0.20*	*1.99*
a_7	0.4503	0.0094	0.1302	0.3266	0.6437	-0.1113	0.0138	0.6529	-0.0065	0.0468
	9.48	*0.30*	*0.55*	*3.60*	*3.19*	*-1.99*	*0.35*	*6.42*	*-0.09*	*0.61*
a_8	-0.5334	-0.0267	-0.1109	-0.0767	-0.7298	-0.1759	-0.1031	-0.1899	-0.2675	-0.0632
	-8.27	*-1.13*	*-1.47*	*-1.73*	*-9.11*	*-2.68*	*-3.01*	*-2.44*	*-3.49*	*-1.01*
Adj. R²	0.96	0.51	0.62	0.67	0.95	0.61	0.88	0.76	0.64	0.95
D.-W.	2.25	1.94	2.03	1.82	1.82	1.18	2.17	2.25	1.30	1.25

Table 8 – Consumer prices: $\Delta p_{c,t} = a_0 + a_1 p_{c,t-1} + a_2 p_{t-1} + a_3 (e + p_{EU})_{t-1} + a_4 \Delta p_{c,t-1} + a_5 \Delta p_t + a_6 \Delta (e + p_{EU})_t$

	BUL	**CZR**	**EST**	**HUN**	**LAT**	**LIT**	**POL**	**ROM**	**SLO**	**SLV**
a_0	1.2034	-1.7455	-4.1870	0.0662	1.0673	0.0628	0.0395	-0.7531	0.1534	-0.1942
	5.30	*-4.23*	*-2.92*	*0.43*	*3.41*	*0.14*	*0.76*	*-2.33*	*0.48*	*-0.50*
a_1	-0.5392	-0.2803	-0.9847	-0.0185	0.0065	-0.2120	-0.1537	-0.1556	0.0333	-0.0499
	-4.91	*-4.23*	*-7.90*	*-0.71*	*0.17*	*-4.81*	*-3.55*	*-2.35*	*0.49*	*-0.82*
a_2	-0.0198	0.3129	1.2945	0.0063	-0.1504	0.1433	0.1512	0.0731	-0.0760	0.0170
	-0.91	*3.06*	*6.93*	*0.16*	*-4.08*	*1.91*	*2.42*	*0.98*	*-0.81*	*0.23*
a_3	0.6268	0.1993	0.3816	0.0011	-0.0869	0.0491	0.0010	0.0921	0.0073	0.0367
	5.37	*3.40*	*1.80*	*0.04*	*-1.20*	*1.00*	*0.04*	*2.37*	*0.17*	*0.56*
a_4	0.0539	-0.0553	0.3740	0.1984	0.0357	-0.0007	0.0359	0.1867	0.1078	0.2191
	1.01	*-0.41*	*4.86*	*2.15*	*0.50*	*-0.01*	*0.42*	*2.41*	*1.41*	*3.77*
a_5	-0.0228	0.0150	0.6493	0.3795	-0.0713	0.3911	0.5288	0.7293	0.0945	0.4917
	-0.64	*0.07*	*1.99*	*5.95*	*-0.84*	*2.56*	*7.28*	*8.50*	*1.08*	*4.23*
a_6	0.8068	0.1257	-0.1081	-0.0144	0.3951	0.1944	-0.0459	0.0263	0.0581	0.1425
	15.18	*2.66*	*-0.23*	*-0.36*	*3.48*	*2.53*	*-1.46*	*0.55*	*1.02*	*1.99*
Adj. R²	0.94	0.49	0.64	0.80	0.94	0.95	0.95	0.86	0.63	0.96
D.-W.	2.12	1.86	1.29	2.25	2.01	1.66	2.00	1.82	2.04	2.39

Table 9 – Wages: $\Delta w_t = a_0 + a_1 w_{t-1} + a_2 p_{c,t-1} + a_3 (y-n)_{t-1} + a_4 u_{t-1} + a_5 (p_c - p)_{t-1} + a_6 \Delta w_{t-1} + a_7 \Delta p_{c,t} + a_8 \Delta (y-n)_t + a_9 \Delta u_t + a_{10} \Delta (p_c - p)_t$

	BUL	**CZR**	**EST**	**HUN**	**LAT**	**LIT**	**POL**	**ROM**	**SLO**	**SLV**
a_0	8.1460	0.6833	1.3760	2.5466	0.5173	2.8719	0.9419	0.1286	0.6594	3.2038
	4.63	*1.07*	*1.96*	*2.25*	*1.45*	*4.04*	*0.99*	*0.64*	*2.09*	*2.85*
a_1	-1.2416	-0.3584	-0.2323	-0.2199	-0.4878	-0.5876	-0.4393	-0.2647	-0.1925	-0.3461
	-7.65	*-4.25*	*-1.45*	*-2.09*	*-4.11*	*-5.32*	*-2.82*	*-5.18*	*-2.23*	*-3.96*
a_2	1.2612	0.7165	0.1761	0.1506	0.4666	0.4677	0.6307	0.2518	0.2473	0.2806
	7.56	*3.67*	*0.88*	*2.47*	*3.30*	*2.53*	*3.05*	*5.19*	*2.04*	*2.29*
a_3	1.5819	0.3142	0.1636	0.1446	0.0997	0.6201	0.3248	-0.0148	-0.0139	0.2394
	5.38	*4.67*	*1.24*	*2.71*	*1.64*	*4.01*	*1.26*	*-0.33*	*-0.23*	*3.06*
a_4	-0.0001	0.0001	-0.0004	-0.0002	0.0013	-0.0010	0.0000	0.0000	-0.0002	0.0000
	-0.80	*1.53*	*-0.41*	*-0.74*	*2.89*	*-2.61*	*0.31*	*-0.13*	*-2.25*	*-1.56*
a_5	-1.9259	-1.2989	-0.1188	-0.0796	-0.0156	-0.2102	-0.6174	-0.3039	0.0326	-0.2517
	-4.87	*-4.42*	*-0.49*	*-0.87*	*-0.19*	*-1.09*	*-1.29*	*-3.79*	*0.22*	*-2.12*
a_6	0.0787	-0.6705	-0.4032	-0.1218	0.2043	-0.1913	-0.0272	-0.4524	0.0043	0.1879
	1.70	*-6.61*	*-2.37*	*-0.71*	*1.41*	*-1.55*	*-0.22*	*-5.23*	*0.03*	*2.95*
a_7	0.9313	0.6600	0.9251	0.0066	0.4277	1.5537	1.2376	0.3456	0.1020	0.3077
	15.97	*1.99*	*1.93*	*0.04*	*2.18*	*3.04*	*1.47*	*5.42*	*0.59*	*2.11*
a_8	0.9794	0.2148	0.2347	0.1518	0.1353	0.3781	0.4383	-0.0524	-0.1482	-0.0031
	5.35	*3.76*	*2.14*	*3.80*	*1.55*	*2.62*	*2.81*	*-1.61*	*-2.80*	*-0.04*
a_9	0.0001	0.0003	-0.0020	0.0000	-0.0008	-0.0016	0.0002	0.0002	0.0001	0.0000
	0.27	*1.71*	*-1.53*	*-0.16*	*-0.86*	*-2.29*	*3.22*	*3.38*	*1.41*	*-1.51*

a_{10}	-1.1993	-0.7774	-1.0978	-0.2242	0.0234	-0.8304	-0.3703	-0.0453	0.1173	-0.5827
	-4.25	*-1.97*	*-2.58*	*-1.61*	*0.18*	*-2.50*	*-0.55*	*-0.41*	*0.93*	*-3.28*
Adj. R²	0.95	0.60	0.47	0.45	0.87	0.72	0.42	0.72	0.42	0.95
D.-W.	1.88	1.87	2.15	1.78	2.64	2.11	2.10	2.34	2.35	2.10

Table 10 – Employment: $\Delta n_t = a_0 + a_1 n_{t-1} + a_2 (w - p_y)_{t-1} + a_3 y_{t-1} + a_4 s_{t-1} + a_5 \Delta n_{t-1} + a_6 \Delta (w - p_y)_t + a_7 \Delta y_t + a_8 \Delta s_t$

	BUL	**CZR**	**EST**	**HUN**	**LAT**	**LIT**	**POL**	**ROM**	**SLO**	**SLV**
a_0	3.5094	0.7466	1.5793	1.2845	2.1028	1.1497	1.2210	2.7575	1.5114	0.9274
	5.45	*3.80*	*2.83*	*5.48*	*4.36*	*2.20*	*2.81*	*2.28*	*3.29*	*2.54*
a_1	-0.5777	-0.0814	-0.2413	-0.1419	-0.3104	-0.1800	-0.1760	-0.2536	-0.2210	-0.0692
	-6.20	*-3.35*	*-3.05*	*-6.29*	*-4.36*	*-2.68*	*-3.04*	*-2.29*	*-4.42*	*-2.38*
a_2	-0.3319	-0.0186	0.0073	-0.0082	-0.0364	-0.0012	-0.0606	0.0117	-0.2417	-0.0368
	-6.29	*-2.16*	*0.26*	*-0.20*	*-1.31*	*-0.05*	*-3.09*	*0.40*	*-5.13*	*-1.80*
a_3	0.3816	0.0055	-0.0306	0.0616	0.0302	0.0266	0.0856	-0.0137	0.2090	0.0454
	5.96	*0.61*	*-1.25*	*1.76*	*1.56*	*0.76*	*2.74*	*-0.44*	*4.83*	*2.92*
a_4	0.0191	-0.0172	0.0405	-0.0554	0.0063	0.0491	0.0159	-0.0435	-0.0827	-0.0152
	1.56	*-1.52*	*2.87*	*-1.98*	*0.77*	*3.11*	*0.67*	*-2.70*	*-3.58*	*-0.88*
a_5	-0.1137	0.3390	0.3230	0.0278	0.1099	0.1698	0.6437	0.1985	0.0191	0.0663
	-0.91	*4.04*	*3.13*	*0.88*	*1.03*	*1.18*	*6.78*	*1.57*	*0.34*	*0.55*
a_6	-0.2032	-0.0390	0.0114	-0.1309	-0.0411	-0.0279	-0.0457	-0.0708	-0.0866	-0.0438
	-6.14	*-2.55*	*0.37*	*-2.59*	*-1.08*	*-0.75*	*-2.32*	*-2.14*	*-1.49*	*-1.39*
a_7	0.2133	0.0004	-0.0246	0.0233	0.0275	0.0293	0.0376	0.0300	0.0538	0.0121
	5.68	*0.04*	*-1.07*	*1.04*	*1.02*	*0.80*	*1.71*	*1.53*	*1.81*	*0.61*
a_8	0.0162	-0.0052	0.1399	0.0494	-0.0419	0.1016	-0.0071	-0.0604	-0.0617	-0.0212
	1.05	*-0.45*	*1.89*	*1.12*	*-1.45*	*4.23*	*-0.31*	*-2.08*	*-1.73*	*-1.02*
Adj. R²	0.32	0.76	0.51	0.89	0.42	0.45	0.53	0.76	0.87	0.73
D.-W.	2.06	1.66	1.53	2.45	2.39	1.98	1.72	2.00	2.28	1.95

Table 11 – Exchange rate: $\Delta e_t = a_0 + a_1 e_{t-1} + a_2 (r - r^{EU})_{t-1} + a_3 (\Delta p - \Delta p_{EU})_{t-1} + a_4 (y - y_{EU})_{t-1} + a_5 (m - m_{EU})_{t-1} + a_6 f_{t-1} + a_7 \Delta e_{t-1} + a_8 \Delta (r - r^{EU})_t + a_9 \Delta (\Delta p - \Delta p_{EU})_t + a_{10} \Delta (y - y_{EU})_t + a_{11} \Delta (m - m_{EU})_t + a_{12} \Delta f_t$

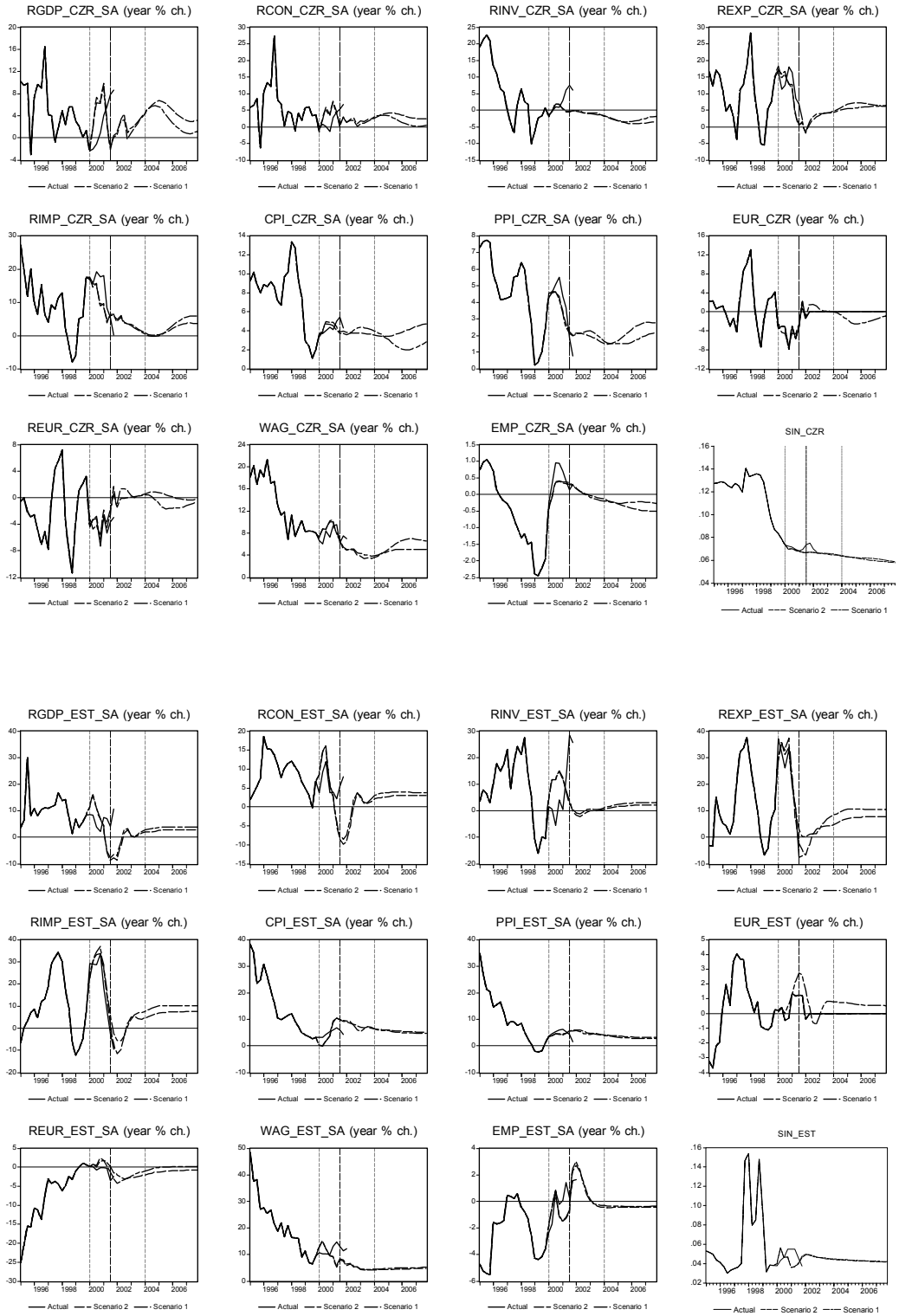
	BUL	**CZR**	**EST**	**HUN**	**LAT**	**LIT**	**POL**	**ROM**	**SLO**	**SLV**
a_0	0.6030	1.0914	0.8652	1.2941	-0.1058	0.0007	-0.1065	1.7813	1.3177	2.9768
	2.06	*1.92*	*1.87*	*4.23*	*-0.83*	*0.00*	*-0.27*	*1.83*	*8.52*	*5.41*
a_1	-0.1782	-0.3441	-0.2885	-0.2584	-0.3919	-0.3626	-0.2280	-0.2424	-0.3834	-0.5584
	-2.29	*-2.27*	*-1.84*	*-4.44*	*-2.34*	*-2.14*	*-2.51*	*-1.92*	*-8.30*	*-5.69*
a_2	0.0571	1.2128	-0.0614	0.3205	-0.3244	0.2351	-0.3872	-0.0048	-0.0851	0.0535
	0.67	*3.69*	*-1.01*	*3.04*	*-2.98*	*2.13*	*-2.34*	*-0.09*	*-1.86*	*0.95*
a_3	0.8754	-3.9766	-0.2256	1.5577	0.4734	1.0183	1.4773	0.2894	-0.3347	0.6796
	8.35	*-3.12*	*-1.80*	*5.33*	*2.57*	*2.43*	*2.20*	*1.79*	*-1.78*	*1.52*
a_4	0.2738	-0.0808	-0.0530	-0.1353	0.2595	0.4007	0.0663	-0.0759	-0.0576	-0.1529
	2.08	*-1.79*	*-1.82*	*-1.78*	*2.99*	*4.23*	*0.86*	*-1.08*	*-2.81*	*-2.71*
a_5	0.2972	0.0395	0.0152	0.2302	-0.1360	-0.0114	0.0368	0.2150	0.0791	0.2158
	2.64	*0.75*	*1.77*	*4.17*	*-2.20*	*-0.09*	*0.68*	*1.94*	*4.42*	*5.01*
a_6	0.3987	-0.2702	-0.1703	0.0483	0.3523	0.9310	-0.5747	0.0358	0.1105	-0.2281
	1.11	*-1.20*	*-3.67*	*0.26*	*1.70*	*2.59*	*-2.28*	*0.08*	*2.69*	*-1.30*
a_7	-0.2210	0.0648	0.1104	-0.0834	0.2245	0.1830	-0.4062	0.1791	0.6959	0.6032
	-2.63	*0.48*	*0.63*	*-0.71*	*1.66*	*1.64*	*-3.18*	*1.68*	*8.68*	*5.10*
a_8	0.2090	1.4201	-0.0697	0.2257	-0.0621	0.2972	-0.3746	0.1388	-0.2056	0.0808
	4.77	*2.20*	*-1.35*	*1.38*	*-0.36*	*1.75*	*-1.59*	*3.23*	*-1.91*	*1.36*
a_9	0.8508	-0.8455	-0.1254	0.9332	0.3099	0.2015	0.6239	0.4932	-0.0412	0.2046
	7.31	*-1.05*	*-1.48*	*4.34*	*1.98*	*0.42*	*1.26*	*4.24*	*-0.38*	*0.61*

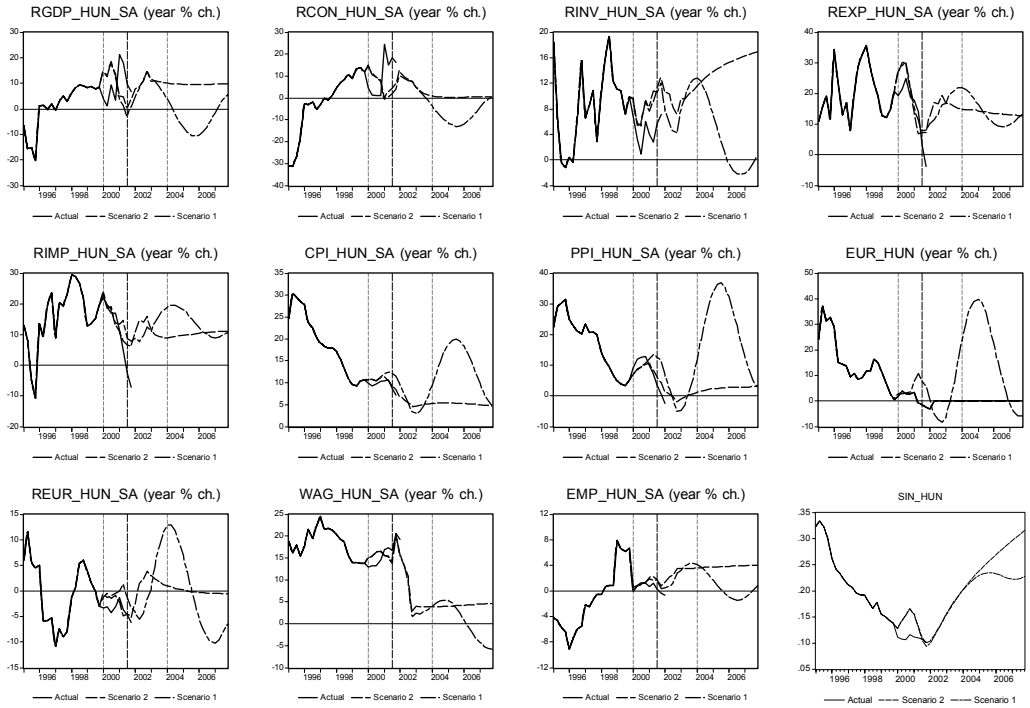
a_{10}	0.5266	-0.1466	-0.0589	0.0824	0.3655	0.6831	0.1428	0.0563	-0.2501	0.0001
	4.33	*-2.17*	*-1.71*	*1.32*	*4.84*	*4.12*	*1.91*	*0.85*	*-6.39*	*0.00*
a_{11}	0.6783	0.0749	0.0529	0.0536	-0.1223	-0.1145	0.5323	0.5389	0.1136	0.0382
	3.23	*0.57*	*1.35*	*0.35*	*-1.69*	*-0.45*	*2.22*	*2.34*	*1.25*	*0.32*
a_{12}	0.0191	-0.0630	-0.0771	-0.1392	-0.0202	0.6377	-1.3096	-0.0572	0.1562	0.2291
	0.06	*-0.29*	*-1.58*	*-1.10*	*-0.13*	*2.70*	*-3.54*	*-0.19*	*3.78*	*2.24*
Adj. R²	0.91	0.35	-0.03	0.62	0.01	0.38	0.66	0.79	0.78	0.51
D.-W.	2.42	2.40	2.20	2.15	2.31	2.11	2.13	2.07	1.87	2.36

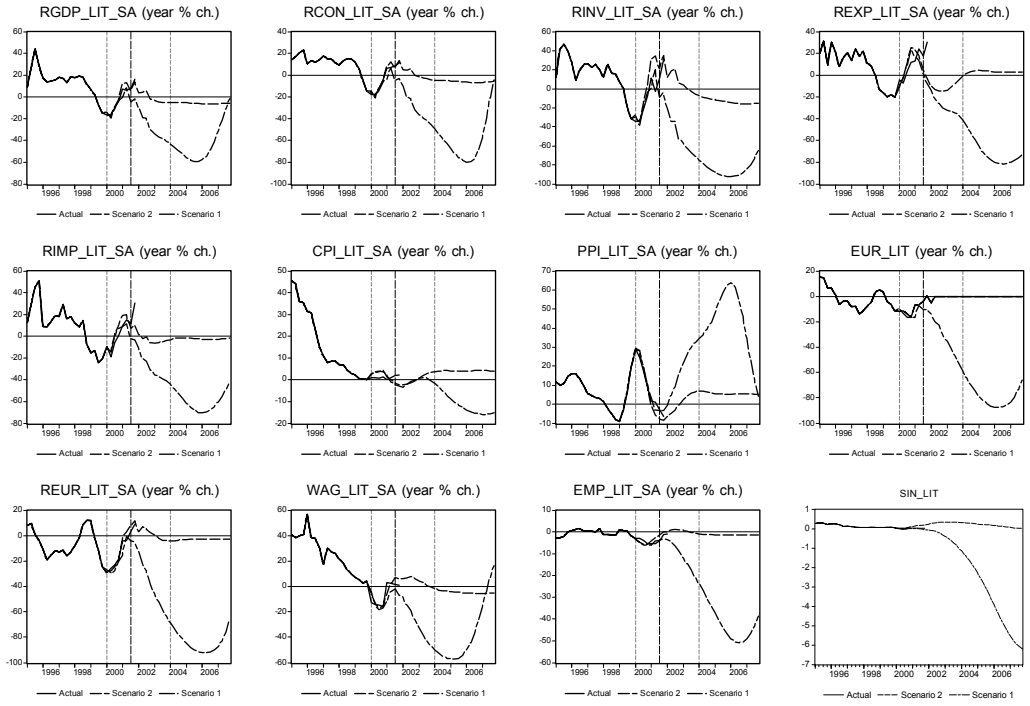
Table 12 – Interest rate: $\Delta r_t = a_0 + a_1 r_{t-1} + a_2 \Delta p_{y,t-1} + a_3 (y - \bar{y})_{t-1} + a_4 u_{t-1} + a_5 \Delta m_{t-1} + a_6 r_{EU,t-1} + a_7 \Delta r_{t-1} + a_8 \Delta^2 p_{y,t} + a_9 \Delta (y - \bar{y})_t + a_{10} \Delta u_t + a_{11} \Delta^2 m_t + a_{12} \Delta r_{EU,t}$

	BUL	**CZR**	**EST**	**HUN**	**LAT**	**LIT**	**POL**	**ROM**	**SLO**	**SLV**
a_0	3.9285	0.0930	0.1196	-0.4827	-0.2825	-0.7398	0.6391	0.7922	0.1844	-1.9809
	2.71	*2.36*	*1.35*	*-4.05*	*-0.88*	*-2.44*	*4.91*	*0.83*	*3.78*	*-3.06*
a_1	-0.6141	-0.1855	-0.4575	-0.3287	-0.2771	-0.3118	-0.7417	-0.8827	-0.2419	-0.7178
	-2.76	*-4.04*	*-6.05*	*-4.09*	*-4.93*	*-3.56*	*-7.69*	*-4.44*	*-3.34*	*-9.76*
a_2	0.0472	0.2713	0.1200	0.2167	0.2522	0.9852	0.3564	0.4196	-0.8853	4.2184
	0.17	*2.18*	*0.65*	*1.13*	*1.59*	*2.68*	*2.43*	*0.75*	*-6.46*	*6.37*
a_3	-0.9211	0.0038	-0.0070	0.1606	0.0526	0.6861	-0.0926	-0.4974	0.1637	0.8339
	-2.03	*0.20*	*-0.08*	*2.63*	*0.87*	*2.80*	*-1.54*	*-1.67*	*1.29*	*4.15*
a_4	-0.6902	-0.0128	-0.0215	0.0893	0.0459	0.1179	-0.0741	-0.0148	-0.0222	0.1685
	-2.90	*-2.34*	*-1.15*	*3.87*	*0.73*	*2.02*	*-4.37*	*-0.11*	*-2.60*	*3.04*
a_5	0.1481	-0.0822	-0.0509	0.1385	-0.0171	0.9786	-0.2271	1.9555	-0.2433	0.4388
	0.17	*-2.37*	*-0.73*	*1.25*	*-0.22*	*4.00*	*-1.35*	*2.55*	*-1.89*	*1.18*
a_6	12.490	-0.0424	-0.0682	0.2757	1.9434	3.0585	1.8908	-9.5109	0.1751	-0.2912
	2.65	*-0.37*	*-0.24*	*1.18*	*2.07*	*2.87*	*5.08*	*-3.07*	*1.09*	*-0.50*
a_7	0.4905	0.1257	0.2156	0.2222	-0.0007	-0.0065	0.3184	0.0395	0.1014	0.2629
	4.77	*1.48*	*3.35*	*1.60*	*-0.01*	*-0.06*	*3.47*	*0.35*	*0.88*	*2.78*
a_8	-0.1993	0.0666	0.0458	0.0005	0.2129	0.7056	0.0755	2.0137	-0.1628	2.2222
	-0.62	*0.68*	*0.33*	*0.00*	*1.84*	*1.64*	*0.56*	*5.31*	*-1.91*	*3.75*
a_9	-0.9162	0.0201	-0.0261	-0.0309	0.1342	-0.0381	0.0684	-0.1804	0.0947	0.5688
	-3.15	*1.12*	*-0.45*	*-0.63*	*1.77*	*-0.20*	*1.71*	*-0.77*	*1.14*	*2.88*
a_{10}	0.8710	-0.0343	-0.0898	0.0008	0.1551	-0.2371	-0.2212	0.2622	0.0020	0.1633
	1.22	*-2.54*	*-2.37*	*0.01*	*1.65*	*-2.26*	*-5.25*	*1.03*	*0.06*	*0.78*
a_{11}	0.9632	-0.0537	-0.1382	0.1234	0.0215	0.4480	-0.2288	1.0883	-0.1897	0.3683
	1.64	*-2.57*	*-2.16*	*1.42*	*0.34*	*2.27*	*-2.48*	*1.88*	*-2.48*	*1.59*
a_{12}	1.1375	-0.3254	1.4596	0.6587	0.9083	-0.1697	0.8868	-11.869	2.8462	-6.4657
	0.14	*-1.97*	*2.62*	*1.05*	*0.75*	*-0.06*	*1.74*	*-2.17*	*7.53*	*-5.09*
Adj. R²	0.56	0.62	0.77	0.43	0.47	0.46	0.70	0.75	0.71	0.75
D.-W.	1.41	1.84	2.81	2.12	2.09	1.69	1.97	2.03	2.16	2.46

Figure 2
Simulated Macro-economic Adjustment in Accession Countries, 1995 Q1-2007 Q4




RGDP_HUN_SA (year % ch.)
RCON_HUN_SA (year % ch.)
RINV_HUN_SA (year % ch.)
REXP_HUN_SA (year % ch.)
RIMP_HUN_SA (year % ch.)
CPI_HUN_SA (year % ch.)
PPI_HUN_SA (year % ch.)
EUR_HUN (year % ch.)
REUR_HUN_SA (year % ch.)
WAG_HUN_SA (year % ch.)
EMP_HUN_SA (year % ch.)
SIN_HUN
Actual
Scenario 2
Scenario 1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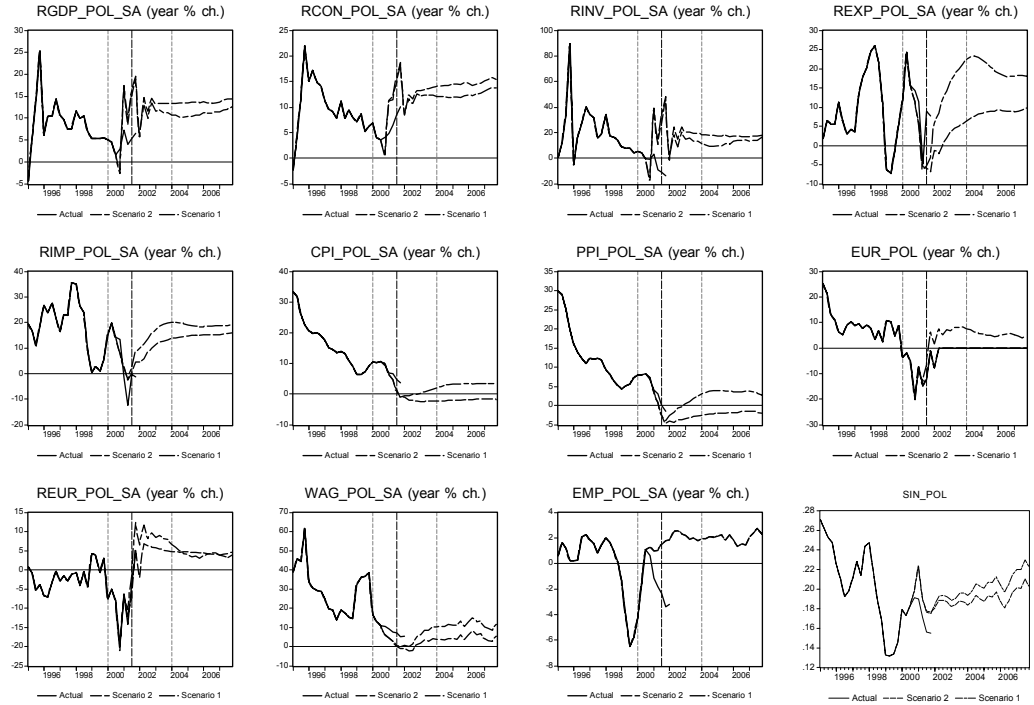
RINV_LIT_SA (year % ch.)
REXP_LIT_SA (year % ch.)
RIMP_LIT_SA (year % ch.)
CPI_LIT_SA (year % ch.)
PPI_LIT_SA (year % ch.)
EUR_LIT (year % ch.)
REUR_LIT_SA (year % ch.)
WAG_LIT_SA (year % ch.)
EMP_LIT_SA (year % ch.)
SIN_LIT
Actual
Scenario 2
Scenario 1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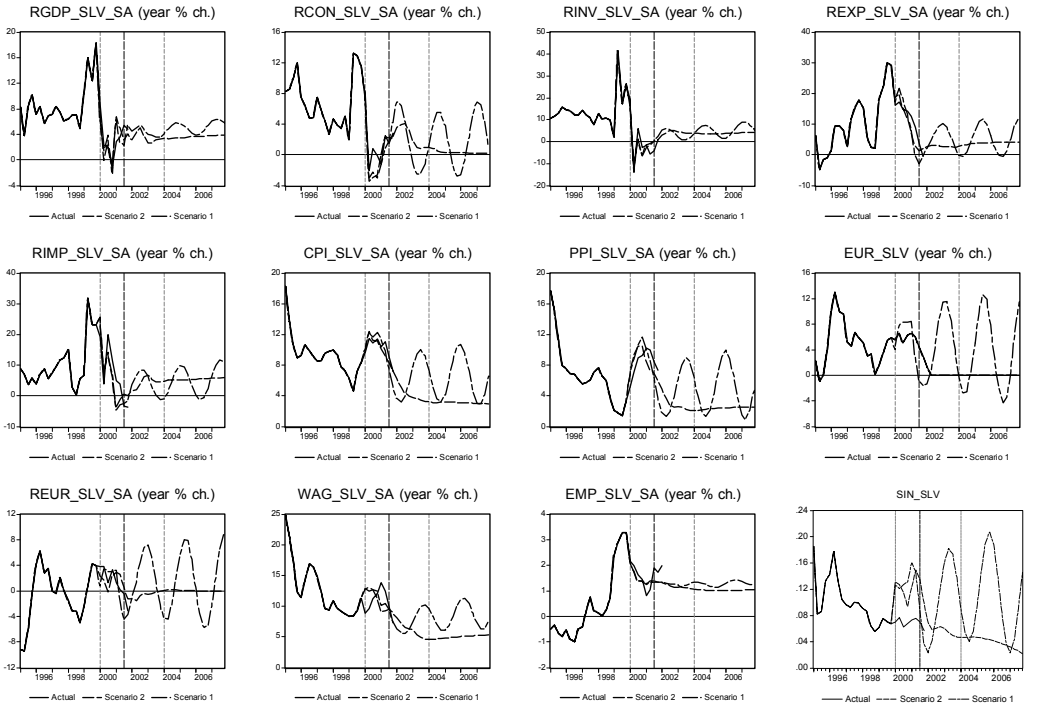
RCON_POL_SA (year % ch.)
RINV_POL_SA (year % ch.)
REXP_POL_SA (year % ch.)
RIMP_POL_SA (year % ch.)
CPI_POL_SA (year % ch.)
PPI_POL_SA (year % ch.)
EUR_POL (year % ch.)
REUR_POL_SA (year % ch.)
WAG_POL_SA (year % ch.)
EMP_POL_SA (year % ch.)
SIN_POL
Actual
Scenario 2
Scenario 1


RGDP_SLV_SA (year % ch.)
RCON_SLV_SA (year % ch.)
RINV_SLV_SA (year % ch.)
REXP_SLV_SA (year % ch.)
RIMP_SLV_SA (year % ch.)
CPI_SLV_SA (year % ch.)
PPI_SLV_SA (year % ch.)
EUR_SLV (year % ch.)
REUR_SLV_SA (year % ch.)
WAG_SLV_SA (year % ch.)
EMP_SLV_SA (year % ch.)
SIN_SLV
Actual
Scenario 2
Scenario 1

Endnotes

[1] The CEECs are called "accession countries", i.e. countries in Central and Eastern Europe negotiating access to the EU. Note that the accession countries' goal of applying for euro area membership over the medium term requires further nominal convergence in inflation rates with the EMU and, yet, furthering disinflation from upper single digits to lower single digits.

[2] A monetary targeting strategy implies that the long-run price level will be given by the equilibrium in the money market. With interest rate targeting, the policymaker targets the short-term interest rate to determine the price level in the long-run. Under fixed nominal exchange rates, the price level would be pinned down by foreign prices. With a currency board, the country maintains a fixed exchange rate against a designated foreign currency and the monetary base is backed 100% by foreign currency reserves. Any change in reserves will translate into a change of the monetary base. Currency boards may help to gain confidence in a new currency or in extreme situations of high inflation. The design and functioning of currency boards in transition countries is analyzed in detail by Buracas and Sakalauskas (2001), Lättemäe and Pikkani (2001) and Nenovsky et al. (2000). Schoors (2001) analyses the scope for and the consequences of unilateral euroization in transition economies.

[3] Though the inflation record looks quite good, Arratibel et al. (2002) warn that "... inflation is still rather persistent and more sensitive to energy prices and cyclical conditions than in industrial economies. Furthermore, domestic factors, including macroeconomic policies, ongoing liberalization, wage policies and inflation expectations as well as factors attributable to ongoing price adjustments and the catching up of prices and real incomes seem to put a floor on the short-term decline in inflation and may remain relevant for inflation over the medium run."

[4] An important discussion in the literature concerns the question to which extent the real appreciation observed in many transition countries, constitutes an equilibrium phenomenon, reflecting the Balassa-Samuelson effect.

[5] Note that the nominal exchange rate equation (35) implies the constraint that domestic and foreign variables enter the structural model in differential form, assuming that the parameters of the corresponding domestic and foreign variables are equal in absolute size in a linear regression context. While this parsimony assumption is conventional in empirical applications, it is a potential source of misspecification.

[6] By comparing short-run and long-run elasticities we get an idea about the amount of time that elapses before a unit shock is absorbed.

[7] Dynamic simulations for the different countries for the period 1995:I-2000:I, starting from actual values for the endogenous variables in 1995:I and actual values for the exogenous variables during the entire sample period, suggests that the models track the historical paths of the different endogenous variables accurately.

[8] The models for Bulgaria and Romania failed to converge due to the very erratic paths of the different variables in the past. At the moment, the cases of Latvia and the Slovak Republic the models proved to be unstable and are still subject to further testing and analyzing.