Preliminary Draft, Not to be Quoted

Exchange Rate Fluctuations in EU Accession Countries

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Abstract

As acceding countries prepare to apply for membership into ERM II, a prerequisite for adopting the euro, many academic researchers have stressed that volatile capital flows and trend real appreciation pressures may actually propagate shocks to the rest of the economy and lead to currency crises. If true, this would argue against a prolonged use of independent exchange policies in accession countries. At the same time, research from the optimal currency literature, has extolled the benefits of using national exchange rates as shock absorbers in the face of asymmetric shocks—a likely outcome in accession countries. A related issue is the nature of the shocks that drive real exchange rate movements and hence competitiveness in accession countries. Together, these issues suggest that a full understanding of exchange rate dynamics in accession countries is particularly important in choosing the optimal strategy countries should follow in the run-up to euro adoption. This paper attempts to explore these questions through an analysis of the relationship between real exchange rates and output fluctuations in accession countries.

I. INTRODUCTION

The ten accession countries that will join the European Union in 2004 are preparing to apply for membership into ERM II, a prerequisite for adoption of the euro. A number of these countries have indicated their intention to join ERM II immediately after accession to the EU and, after the minimum two years in ERM II, to join the euro area around mid-2006 or early 2007. In their view, early euro adoption offers a number of benefits. For example, euro adoption would most likely strengthen policy discipline and accelerate the pace of structural reforms, leading to an increase in potential growth. Moreover, by eliminating “national” nominal exchange uncertainty, transactions costs should be reduced and the likelihood of financial disturbances that could negatively impact trade and investment dramatically decreased.[2]

Work by many academic researchers has supported accession countries’ aspirations of an early adoption of the euro. Buiter and Grafe (2002), and Coricelli (2002) among others, have stressed that volatile capital flows and trend real appreciation pressures may actually propagate disturbances to the rest of the economy and lead to currency crises. Pelkman et. al, and Gros and Thygesen (1998) have also indicated that flexible exchange rates in transition countries tend to act as a poor buffer against external shocks. If true, these results would argue against a prolonged use of independent exchange policies in accession countries.

At the same time, the optimal currency literature would emphasize that there are important costs to an early euro adoption, stemming from the inability to use national exchange rates as shock absorbers in the face of asymmetric shocks.[3] Accession countries are clearly converging in real and nominal terms at different speeds to the euro area. Differences in the convergence process is likely to be reflected in differences in economic dynamics, which may require a stabilization instrument, e.g., an independent interest rate policy. This is especially important in transition economies given that trend real appreciation of real exchange rates due to Balassa-Samuelson effects imply higher domestic inflation, which would translate into a relatively low real domestic interest rate.[4] So an important question is whether exchange rates in transition countries are really shock absorbers or do exchange rates actually propagate shocks? The answer will have particular bearing on the optimal strategy countries should follow in the run-up to euro adoption.

A second issue important for accession countries relates to the factors that drive real exchange rates. Movements in real exchange rates determine competitiveness and current

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[2] See Kontolemis (2003) for a discussion.

[3] However, there is some evidence that this cost may not be so high. For example, Frenkel and Nickel (2002) and Fidrmuc and Korhonen (2002) have found a high correlation of accession and euro area shocks implying that many accession countries faced shocks that are very similar to euro area disturbances.

[4] Natalucci and Ravenna (2002) also show that under a fixed exchange rate, Balassa-Samuelson effects may prevent accession countries’ full compliance with the Maastricht inflation criterion.

account outcomes, and have a large impact on inflation and output in accession countries. And perhaps most importantly, participation in ERM II will require setting a central parity, hopefully close to equilibrium values. Early attempts at understanding real exchange rate movements have usually centered on decomposing real exchange rate changes into those due to real and nominal shocks in simple 2 variable models. As noted by Kutan and Dibooglu (2000), decompositions of this type can be very useful in determining the effectiveness of monetary and fiscal policy in transition economies. For example, a significantly large temporary component in the real exchange rate due to temporary shocks may indicate a high degree of nominal price inertia, suggesting that policymakers could affect competitiveness through the real exchange rate. Kutan and Dibooglu's results using Polish and Hungarian data suggest that in the case of Poland, monetary and exchange rate policies could effectively be used to manage competitiveness. Specifically, for Poland nominal shocks explained over 70 percent of the real exchange rate forecast error variance at short horizons, and continued to play an important role after 36 months.

This is in contrast to the findings in industrial countries (Lastrapes (1992) and Enders and Lee (1997), where real factors play by far the dominant role in determining real (and nominal) exchange rate variability, suggesting competitiveness can only be improved by focusing on improvements in productivity and efficiency.[5] Notwithstanding the importance of this issue, surprisingly little work has been done in this area for accession or transition countries.

In industrial countries, a more complex systems approach that take account of movements in other variables—e.g., relative output or relative prices—has also been used to examine exchange rate movements. The 3 variable structural VAR model allows consideration of a wider range of exogenous shocks and more closely fit traditional IS-LM structural exchange rate models found in the literature. Specifically, the use of 3 endogenous variables—relative output, real and nominal effective exchange rates—allows the determination of 3 exogenous structural shocks. These are: (i) real aggregate supply shocks (AS) which include labor market and productivity developments; (ii) real goods market (IS) shocks, encompassing exogenous changes to real relative domestic absorption; and (iii) nominal money market (LM) shocks, reflecting shifts in both relative money supplies and money demands.

Variants of this model have been empirically applied to bilateral rates in the U.S. by Clarida and Gali (1994), to Japan by Chadha and Prasad (1997), and to the U.K. by Astley and Garratt (2000).[6] We are unaware, at this time, of this model being empirically applied to transition country data. Finally, the innovation accounting techniques used in these SVAR

[5] A finding of sluggish price adjustment would provide support for the Dornbusch's (1976) disequilibrium view of real exchange rate adjustment. At least for industrial countries, most empirical work has supported the equilibrium view of Stockman (1987), i.e., real exchange rates appear to be driven by real shocks implying unit root behavior.

[6] In general, relative output, real exchange rates, and relative prices are the 3 variable used in this type of model, with nominal effective exchange rates left to be derived implicitly. Similarly, the use nominal effective exchange rates in place of relative prices in this setup, defines an implicit dynamic path for relative prices.

models allow one to examine the relationship between exchange rates and the business cycle. Thus some conclusions regarding the efficacy of exchange rates as shock absorbers—the first question discussed above—can be made.

Against this background, this paper attempts to address these issues through an analysis of the relationship between real and nominal exchange rates alone, and then between exchange rates and relative output fluctuations in nine accession countries (Malta is excluded for data reasons). We view this examination of first a two and then three variable model as a natural evolution when examining exchange rate dynamics. The empirical methodology employed here is a structural vector autoregression model (SVAR) along the lines of Blanchard and Quah (1989) and Clarida and Gali (1994). This methodology has been widely used to identify the different types of macroeconomic shocks that determine fluctuations in aggregate output and the real exchange rate.

Below is a summary of a few key preliminary conclusions:

- Real factors appear to be the main determinant of real exchange rates in Slovenia, Hungary, Latvia, and Cyprus. Nominal factors play little role if any, in these countries.

- There is only limited evidence that an independent monetary and exchange rate policy could be used to affect competitiveness in a small number of these accession countries. At the same time, in a few countries, the exchange rate does appear to have acted as propagator of shocks.

- The 2 variable analysis indicated that nominal shocks explained between 20 to 40 percent of real exchange rate variability in the Czech and Slovak Republics, Estonia , and Poland. In Lithuania nominal shocks explained about 60 percent of real exchange rate forecast error variance.

- When relative output is added to the analysis, nominal LM shocks remain an important determinant of real exchange rate variability in Estonia, Lithuania and the Czech Republic. In Poland, real shocks, which now include aggregate supply (AS) shocks, appear to drive real exchange rates.

- Exchange rate shocks play an important role—from 35 to 65 percent—in determining the forecast error variance of relative output in Estonia, Poland and the Slovak Republic. This would suggest that exchange rates may act as a shock propagator in these countries.

- However, the placement of dummy variables to reflect the sharp movements in these countries exchange rate and output data due to the transition does reduce the overall importance of the nominal component in real exchange rates, and in some cases, the importance of exchange rate shocks in explaining relative output movements.

II. STRUCTURAL VAR METHODOLOGY

Structural VARs are simultaneous equation systems that allow the dynamic impact of exogenous shocks on endogenous variables to be identified through the imposition of restrictions. There are a number of SVAR models that can be used to identify innovations. Here we use the Blanchard-Quah (BQ) structural VAR methodology which bases the identification restrictions on the long-run effect of the exogenous shocks on the endogenous variables. Given the consensus on these long-run restrictions, the BQ SVAR methodology can fit a number of theoretical models. Also, given the lack of consensus in the literature on the behavior of short-run dynamics in SVAR models, these dynamics are left completely unconstrained.

The 2 Variable SVAR Model

Standard open economy models recognize two distinct types of shocks, with different impacts on real and nominal exchange rates. Real shocks, which can come from supply or demand sources, can affect both real and nominal exchange rates. Nominal shocks, perhaps emanating from fiscal or monetary sources, can only affect real variables in the short-run, but can affect nominal variables in the long-run. In this regard, permanent innovations in supply and demand will result in permanent changes in real and nominal exchange rates. Thus, a permanent change in say, the money supply, can have a permanent effect on the nominal exchange rate, but only a temporary effect on the real rate.

To start the analysis, assume the VAR model can be represented by an infinite moving average representation of a vector of variables x_t, with an equivalent number of structural shocks ε_t:

$$\Delta x_t = A_0\varepsilon_t + A_1\varepsilon_{t-1} + ... = \sum_{i=0}^{\infty} A_i\varepsilon_{t-i} \qquad (1)$$

In this setup, the A_i matrices represent the impulse response functions of the shocks to the elements of x, while the ε vector contains real and nominal shocks. Letting x_t contain the logged change in real and nominal exchange rates, a more complete form of the model can be written as follows:

$$\begin{bmatrix} \Delta q_t \\ \Delta s_t \end{bmatrix} = \sum_{i=0}^{\infty} L^i \begin{bmatrix} a_{11i} & a_{12i} \\ a_{21i} & a_{22i} \end{bmatrix} \begin{bmatrix} \varepsilon_{qt} \\ \varepsilon_{st} \end{bmatrix} \qquad (2)$$

where

$$Var(\varepsilon_t) = \Sigma \qquad (3).$$

The fundamental shocks ε_{qt} and ε_{st} are assumed to be orthogonal and therefore, the variance-covariance matrix Σ is diagonal. The BQ framework contains the restriction that real shocks have permanent effects on the level of output while nominal shocks have only temporary effects—implying that the cumulative effect of nominal shocks on the change in output must be zero. Both shocks have permanent effects on the level of nominal rates. This restriction means that the matrix of long-run moving average coefficients, $C(1)$ must be lower triangular:

$$\sum_{i=0}^{\infty} a_{11i} \quad = \quad 0 \qquad (4).$$

The structural VAR model defined by equations (2) and (4) can be estimated in its reduced form version by ordinary least squares. In typical VAR format, this means that each element of x_t is regressed on lagged values of all the elements of x, with the estimated coefficients represented by B. That is:

$$x_t \quad = \quad B_1 x_{t-1} \quad + \quad B_2 x_{t-2} \quad + ... + B_n x_{t-n} \quad + \quad e_t \qquad (5)$$

where e_t represents residuals from the estimation of the reduced form VAR. Next, the following algebraic manipulation is used to find the matrix of long-run moving average coefficients:

$$x_t \quad = \quad (I - B(L))^{-1} e_t \quad = \quad (I + B(L) + B(L)^2 + ...+)\ e_t \qquad (6)$$

$$x_t \quad = \quad e_t + D_1 e_{t-1} + D_2 e_{t-2} + D_3 e_{t-3} + ... \qquad (7)$$

To move back into the structural model given by equations (2) and (4), the residuals from the reduced form VAR, e_t must be transformed into real and nominal shocks ε_t. This accomplished by the restricted factor matrix C, such that $e_t = C\varepsilon_t$. Given the two variable output growth and inflation case under consideration, four restrictions are required to define the four elements of C. Two of these restrictions are simple normalizations, which define the variance of the shocks ε_{qt} and ε_{st}. A third restriction comes from assuming that the real and nominal shocks are orthogonal. The final restriction regarding the temporary nature of nominal shocks, uniquely defines the C matrix and implies equation (4) in the structural model. For the reduced form VAR, this means:

$$= \sum_{i=0}^{\infty} \begin{bmatrix} d_{11i} & d_{12i} \\ d_{21i} & d_{22i} \end{bmatrix} \begin{bmatrix} c_{11} & c_{12} \\ c_{21} & c_{22} \end{bmatrix} = \begin{bmatrix} .. & 0 \\ .. & .. \end{bmatrix} \qquad (8)$$

The 3 Variable SVAR Model

Next, for each country we add their relative output (to the euro area) to the 2 variable VAR framework. This allows the identification of real shocks to be broken up into aggregate supply and demand components, in addition to the nominal shock. The increased complexity also moves the BQ SVAR model closer to more traditional structural exchange rate models, e.g. Obstfeld (1985) stochastic two-country version of the Dornbusch (1976) overshooting model.

The model is specified as:

$$\begin{bmatrix} \Delta y_t \\ \Delta q_t \\ \Delta s_t \end{bmatrix} = \sum_{i=0}^{\infty} L^i \begin{bmatrix} a_{11i} & a_{12i} & a_{13i} \\ a_{21i} & a_{22i} & a_{23i} \\ a_{31i} & a_{32i} & a_{33i} \end{bmatrix} \begin{bmatrix} \varepsilon_{yt} \\ \varepsilon_{qt} \\ \varepsilon_{st} \end{bmatrix} \tag{9}$$

In a similar fashion, the three shocks are again identified through restrictions on the long-run impact matrix. For example, IS and LM shocks to relative output are restricted to be temporary in nature, while only AS supply shocks are allowed to have permanent effects. Regarding real effective exchange rates, only AS and IS shocks are allowed to have a permanent impact. Shocks to nominal effective rates are left completely unrestricted, i.e., all disturbances are assumed to be permanent. Given the ordering of relative output, real and nominal effective exchange rates in the SVAR, a restriction on a long-run multiplier effectively imposes a restriction on the elements of the factor matrix. Thus the (1,2), (1,3), and (2,3) elements of C matrix are set to zero. The lower triangular structure of the factor matrix implies that the structural shocks can be interpreted as underlying supply, demand and nominal shocks, respectively.

III. Preliminary Data Analysis

Monthly observations on the nominal and CPI based real effective exchange rate index for each transition country on a trade-weighted basis relative to their euro area partners have been taken from the International Monetary Fund's INS database. A relative output series, defined as the level of industrial production in each accession country minus a trade-weighted average of industrial production in the euro area, was also constructed from IFS database. The table at right contains the exact dates of the sample periods used in the 2 and 3 variable models.

	Sample Period
Cyprus	1988:1-2003:1
Slovenia	1992:1-2003:2
Slovakia	1990:1-2002:10
Poland	1985:6-2002:12
Hungary	1986:1-2003:2
Estonia	1994:1-2003:2
Lithuania	1993:1-2003:2
Latvia	1992:12-2003:1
Czech Republic	1992:1-2003:2

Preliminary data analysis, not presented in detail here but available from the authors upon request, was undertaken on all 3 variables. Augmented Dickey-Fuller and Philips-Perron tests on the logged data have indicated that stationarity can be rejected for the nominal s_t and real e_t exchange rate series and relative output series y_t, however, these tests confirm stationarity of the series in first differenced form. In addition, the Johansen maximum likelihood test for cointegration indicated that the null hypothesis of cointegrating relationships among the two exchange rate series and for the variables in the 3 variable model can be rejected at the 5 or 10 percent level. Thus, the 3 variables considered are all found to be difference stationary and there is no strong evidence of cointegration among them. Therefore, we include the logged first differences of real and nominal effective exchange rates in the 2 variable SVAR model, and add the relative output in the 3 variable model. Finally, the results of Granger causality tests on exchange rates and relative output series indicated that no clear causal relationships that would require a formal reduced form approach to estimating these relationships. This leads one to believe that the structural decomposition approach applied here is the correct way to proceed.

The assumption of nonstationary real exchange rates in transition countries seems reasonable due to evidence of strong real wage and productivity catch up over time (Balassa-Samuelson effects), and general view that strict purchasing power parity conditions are not prevalent in transition countries. Thus it is expected that equilibrium real exchange rates to have a permanent stochastic component during the transition process.[7]

IV. The Results of the 2 Variable Model of Real and Nominal Exchange Rates

Impulse response functions

The dynamic path of exchange responses to real and nominal shocks can be evaluated by looking at impulse response functions.

Charts 1a-i present the response of real and nominal effective exchange rates to real and nominal shocks. As indicated by our identification restriction, the effect of a nominal shock on the real exchange rate is temporary and dies down to zero, in most cases, within 5 to 7 quarters. There are, however, some cases (e.g., Latvia and Lithuania) where real exchange rates show a greater degree of persistence to nominal shocks. In addition, in the Slovak Republic and Slovenia there was some evidence of real exchange overshooting in response to nominal shocks.

For each country, the immediate impact of a real shock is to cause an immediate increase in the real and nominal exchange rate. This also the case for nominal shocks, except in Cyprus, Poland, and Slovenia where nominal shocks to the real exchange rate are at first negative, suggesting a relative rapid negative price reaction. In most cases, exchange rates move to their new equilibrium levels relatively quickly, (about one year). However, adjustment in the real exchange due to real shocks, and in the nominal rate due to nominal shocks, appears to be rather slow in Lithuania. This may be due to the existence of currency boards in these countries.

The difference between the movement in the two exchange rates also provides the implied time path of the relative price ratio. For example, a real shock that induces a similar jump in real and nominal exchange rates, implies that the price ratio remains stable. Normally, we would expect a positive real shock would cause domestic prices to decline, and a depreciation in the real rate. Thus the movement in nominal rates should be above real rates in response to real shocks. However, outside of Poland and Slovenia, the movement in real

[7] See Kutan and Dibooglu (2000) for a discussion.

rates have been larger than nominal rates in response to real shocks, suggesting that the exchange rate has not been a good absorber of shocks.

The relative size of movements in real exchange rates to nominal and real shocks reflect, to some extent, the outcomes from the variance decompositions and the relative size of the permanent and temporary components in real exchange rates. For example, the initial size of the movements in real exchange rates in response to nominal and real shocks is of a similar magnitude in the Czech Republic and Estonia, and in Lithuania the size of the nominal shock is larger. This, again, points to the importance of the nominal component in real exchange rate movements in these countries. Other countries whose variance decompositions implied some role for the temporary component (Poland and the Slovak), either have slow decaying nominal components in the real exchange rate (Poland) or the effect of the nominal shock caused the real exchange rate to increase rather dramatically within the first few responses (Slovak Republic).

Forecast error variance decompositions

Results on using the 2 variable real and nominal effective exchange rate model are presented in Table 1. This table shows for each variable, the proportion of the forecast error variance at different forecast horizons which can be attributed to the temporary component. The permanent component is by construction, 100 minus the temporary component. The results indicate that nominal shocks play a somewhat important role in explaining real exchange rate variability at short horizons in Poland, the Czech Republic, Estonia, and in the Slovak Republic at longer horizons. Only in the case of Lithuania were temporary nominal shocks the dominant factor in explaining the variability in real exchange rate.[8]

Looking at shocks to nominal rates (lower panel), temporary nominal factors play a dominant role in the Czech and Slovak Republics, Estonia and Lithuania. Taken together these results would imply that nominal shocks clearly dominant exchange rate movements in Lithuania, and have more muted effects in Poland, the Czech and Slovak Republics, and Estonia. In sum, price persistence or inertia may be sizable enough in these countries to allow monetary and exchange rate policy to affect overall competitiveness. In Hungary, Slovenia, and Cyprus the dominance of real factors indicates that to improve competitiveness in these 3 countries requires a focus on the real side of the economy.

Historical decompositions

Historical decompositions of the structural VAR model, which are presented in Charts 2a-2i, can be used to represent the accumulated effects of the current and past shocks. The historical decompositions graph the actual path of the endogenous variables—rebased to zero in 1995—and the path each variable would have followed in response to the (accumulated) structural shocks. A comparison of the behavior of the actual endogenous series to the

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[8] The large temporary component in the real exchange rate in Estonia and Lithuania may be due to the hard pegs in these countries, as any nominal shock translates into a change in the real exchange rate.

simulated series that are driven by the accumulated shocks allows a determination of the relative importance of each of these shocks over historical episodes. A close alignment of the actual line with a particular accumulated shock path would imply that these shocks were the driving force behind these deviations.

As seen from the forecast error variance decompositions, the historical decompositions of the real effective exchange rates reflect the importance of the permanent component. Thus innovations in the real effective exchange rate have been the main factor explaining movements in real effective rates. Importantly, most of the turning points appear to have been captured by real innovations. Only in the case of Lithuania would it appear that nominal shocks drove the movement in the real effective exchange rates since 1995.

V. THE RESULTS OF THE 3 VARIABLE MODEL—INCLUDING RELATIVE OUTPUT TO REAL AND NOMINAL EXCHANGE RATES

Impulse response functions

The impulse response functions each of the three endogenous variables for each accession country are presented in Charts 3a-3i. The response of the real exchange rate is generally as expected, with IS shocks and LM shocks causing an appreciation of the real exchange rate and shocks to relative output causing a depreciation. As in the two variable model, there is evidence of overshooting, particularly in Slovakia and Slovenia. And generally, the largest response for each endogenous variable results from shocks to itself, thus real shocks dominate real variables and nominal shocks have the greatest impact on nominal variables.

For example, an examination of the responses of real exchange rates to these shocks clearly demonstrates that IS shocks have the largest impact on movements in real exchange rates. In most countries, IS shocks indicate a marked real exchange appreciation of about 0.8 percent upon impact, with a relatively quick movement to a new equilibrium within 5-10 months. In Cyprus and Estonia, the impact effect is smaller and the movement to a new equilibrium appears to be incomplete after 24 months. Nonetheless, the size of the appreciation with respect to IS shocks is larger (by a ¼ to ½) than the response to LM shocks. Only in Estonia is the impact effect of the LM shock larger than that of the IS shock. Real exchange rate responses to AS shocks were quite muted in the Czech Republic, Hungary, Lithuania, and Slovenia, and when larger, were negative as expected in a flexible price system.

Looking at the response of relative output to each shock reveals again the importance of the permanent component in relative output. Relative output responds positive one-to-one to positive AS shocks, and to a much smaller degree to IS or LM shocks. The Czech Republic, Hungary and Lithuania, in particular, have especially muted relative output responses to IS and LM shocks, implying little output affects emanating from exchange rate movements. Poland, the Slovak Republic, Estonia , and Latvia, however, do have non-trivial movements in relative output in response to IS or LM shocks. This may imply that exchange rates in these countries may be poor absorbers of shocks and may actually be a source of output fluctuations. In summary, while there were some cases in which the estimated structural shocks were not as expected, broadly speaking the impulse responses appear to be mostly in line with the model.

Forecast error variance decompositions

With the addition of relative output to the SVAR, the proportion of forecast error variance at various horizons can be attributed to the two real shocks and the one nominal shock. The 2 variable analysis indicated that a few countries' real exchange rates (Poland, Czech and Slovak Republics, Estonia and especially Lithuania) were influenced by nominal factors to some degree. For the most part, the addition of a third identified shock does not fundamentally change this evaluation.

Table 2 contains the forecast error variance decompositions for the real exchange rates. Nominal LM shocks were the dominant factor in explaining real exchange rate forecast error variance in Estonia (around 60 percent at very short horizons) and played an important role (around 30-40 percent) in Lithuania and the Czech Republic. In the Slovak Republic, LM and AS shocks explain around 20 to 25 percent each of real exchange rate forecast variance at various horizons. Only in Poland would it appear that the 2 variable analysis has not been confirmed; the temporary LM component only explains 10 percent of real exchange rate variability at long-horizons. One factor may be that aggregate supply shocks, which were absent in the 2 variable analysis (and in Kutan and Dibooglu), now appear to explain a substantial proportion of real exchange rate forecast error variance (about 45 percent by 4 months).

Table 3 contains the forecast error variance decompositions for relative output. Aggregate supply shocks are the main determinant of relative output forecast errors (explaining 70 to 99 percent) in Hungary, the Czech Republic, Slovenia, Cyprus, and Lithuania at all horizons. Shocks to nominal and real exchange rates have generally had a small impact on relative output forecast errors in these countries. In Hungary, Lithuania, and the Czech Republic, these shocks explain less than 3 percent of output forecast error. Only in Slovenia and Cyprus do nominal LM shocks explain about 18-20 percent of relative output forecast errors.

However, nominal LM shocks are an important contributor to relative output forecast error variance in Estonia, Poland and the Slovak Republic, especially at short horizons. Here, LM shocks can explain between 30 to 60 percent of relative forecast error. And IS shocks to relative output also appear to impact output forecast errors—explaining between 20 to 28 percent—in the Slovak Republic, Poland, Estonia and Latvia. In sum, it would appear that in these countries, exchange rates have been a source of shocks to the economy.

Historical decompositions

Charts 4a to 4i contain the historical decompositions for the 3 variable model. We again focus on the historical decompositions of the real effective exchange rate. As in the 2 variable case, comparisons of the behavior of the actual real exchange series to the simulated series that are driven by the accumulated shocks indicates the importance of each of the innovations. In most cases, the relative close alignment of the actual series with the accumulated shock path from the real exchange rate implies that these shocks were the driving force behind the dynamic behavior of real exchange rates.

A. Testing the sensitivity of the results

To assess the sensitivity of the results to the initial phases of the transformation and other extraordinary shocks to the macroeconomic environment, the 2 and 3 variable model was re-estimated using dummy variables or reductions in the sample size. In Cyprus, the Czech Republic and Hungary, there were no obvious places to insert dummy variables. To save space, we focus on the forecast error variance results for real exchange rates and relative output, which are reported in Tables 5 and 6. Regarding the variance decompositions for the real exchange rate, the results for the Baltic countries and Slovenia appear to be more or less the same as in the previous analysis. In Poland, however, the use of a shorter sample period suggests that nominal shocks are now more important (by about 25 percentage points), with all of this increase coming at the expense of reductions in the AS shocks. Also, the outcome for the Slovak Republic indicates that a shorter sample period would result in IS innovations now explaining the lion's share of error variance in real exchange rates.

SVAR Models: Sample Periods and Dummy Variables

	Sample Period	Restricted Sample/ Dummies (D)
Cyprus	1988:1-2003:1	--
Slovenia	1992:1-2003:2	1993:1-2003:2
Slovakia	1990:1-2002:10	1991:1-2002:10
Poland	1985:6-2002:12	1990:1-2002:12
Hungary	1986:1-2003:2	--
Estonia	1994:1-2003:2	D:1994:1-D:1996:12
Lithuania	1993:1-2003:2	1994:1-2003:2, D:1999:8
Latvia	1992:12-2003:1	D:1993:1-D:1995:12
Czech Republic	1992:1-2003:2	--

Turning to relative output forecast error variance decompositions, the results for Latvia, Lithuania, and Slovenia report very little difference from the longer sample period outcomes. In these countries, own shocks to aggregate supply drive most of the forecast errors in relative output. In the other three countries, Poland, Estonia, and the Slovak Republic however, the use of a shortened sample period or dummy variable dramatically reduced the role that nominal shocks play in explaining forecast error variance. In Poland, the contribution of nominal shocks has been cut from some 50-60 percent across all forecast horizons to less than 5 percent. Similarly, the contribution in the Slovak Republic has been cut from about 45 percent to less than 2 percent. In sum, these results would cast doubt on the previous observation that nominal exchange rate shocks propagated disturbances in the real economy.

VI. Observations and Next Steps

This paper used innovation accounting techniques from a BQ SVAR model to examine shock absorption properties of exchange rates as well as the shocks that drive real exchange rate movements in accession countries. Clearly the limited time frame and sharp movements in output and exchange rates associated with the transition process have made an analysis of this type difficult. Thus these results and conclusions discussed here should be considered exploratory at best.

In addition, it is important to point out that this study did not explicitly take into consideration the variety of exchange rate regimes in place over the sample set. As the accompanying table below indicates, only 2 countries have fully floating exchange rate regimes, while 2 more have some degree of a managed floating system. The remaining 5 countries have various types of hard pegged regimes, with 2—Lithuania and Estonia—actually having the ultimate hard peg in the form of currency boards.

Accession Country Exchange Rate Regimes	
Cyprus	Peg to euro, +/- 15% bands
Czech Republic	Free Float
Estonia	Currency board to euro (since 1992)
Hungary	Peg to euro, +/- 15% bands
Latvia	Peg to SDR, (euro weight 30%)
Lithuania	Currency board to euro (since 1994)
Poland	Free Float
Slovak Republic	Managed Float
Slovenia	Managed Float

1/ Repegged from US dollar to euro in February 2002.

In general, exchange rate studies of this type have not examined in much detail how the exchange regime would affect the response of exchange rates to shocks or the determination of which type of shocks dominated exchange rate variability.[9] Here, we found that nominal shocks appear to play a more prominent role in countries with pegged rates. To some extent, this may be due to the problem of identifying nominal shocks when the nominal rate does exhibit much volatility. In essence, nominal shocks affect prices depending on the degree of price rigidity and therefore real exchange rates alone, implying a simultaneity problem. Also, it may be that there is some, albeit small, mean reverting component in the real rates that shows up as a the nominal shock.

Therefore, one observation would be that in order to fully understand shock dynamics in these countries, the real and nominal components need to be lined up with possible sources from the data. For example, one should look at interest rate differentials and uncovered interest rate parity relationships (or monetary aggregate developments) and to see what lies behind the source of the nominal component in real exchange rates. Similarly, the identified real shocks should be linked to movements in other time series data, e.g., changes in productivity.

Finally, it is important to realize that the exchange rate regime each accession country adopts in the near-term will be based a number factors. Only one of these will be the types of shocks to which these countries are generally exposed. (Broadly speaking, nominal shocks, such as those originating from money market imbalances are best handled under a fixed exchange rate system. For example, an excess money supply imbalance would result in a loss of reserves but would not be able to affect the real economy through the exchange rate. Real shocks, such as an imbalance in real goods markets, are best addressed by flexible exchange rate systems which allow changes in the exchange rate to bring about offsetting changes to foreign demand.) And even then, shock dynamics examined using historical data cannot fully capture possible endogeneity effects of accession to the euro area.

[9] As one exception, Gallagher and Kavanagh (2002) provide an interesting study on how different exchange rate regimes affected the reaction of bilateral Irish pound-German mark, Irish pound-U.K. sterling, and Irish pound-U.S. dollar exchange rates to different shocks. They find that nominal shocks played a smaller role in determining the variation in real and nominal exchange rates under freely floating regimes (Pound-sterling and pound-dollar).

References

Astley, M. S., and A. Garratt, (2000), "Exchange Rates and Prices: Sources of Sterling Real Exchange Rate Fluctuations 1973-94," Oxford Bulletin of Economics and Statistics, September, Vol. 62, No.4, pp. 491-509.

Belke, A., and D. Gros, (1999), "Estimating the Costs and Benefits of EMU: The Impact of External Shocks on Labor Markets," Weltwirtschaftliches Archiv, January, pp. 1-47.

Braga de Macedo, J.D. Cohen and H. Reisen, 2001, "Don't Fix, Don't Float," OECD Development Centre Studies.

Braga de Macedo, J., and H. Reisen, 2003, "Float In Order to Fix? Lessons from Emerging Markets for EU Accession Countries," Conference on Monetary Strategies for Accession Countries, February 27-28, 2003, Budapest.

Branson, W., 2001, "Intermediate Exchange Rate Regimes for Groups of Developing Countries," in Braga de Macedo, J., D. Cohen and H. Reisen, pp. 55-76.

Buiter, W. and C. Grafe, 2002, "Anchor, Float or Abandon Ship: Exchange Rate Regimes for Accession Countries," CEPR Discussion Series, No. 3184.

Clarida, R. and J. Gali, (1994), "Sources of Real Exchange Rate Fluctuations: How Important Are Nominal Shocks?" Carnegie-Rochester Conference Series on Public Policy, Vol. 41, December, pp. 1-56.

Coricelli, F. (2002), "Exchange Rate Arrangements in Transition to EMU: Some Arguments in Favor of Early Adoption of the Euro", in Completing Transition: The Main Challenges. Tumpel-Gugerell, G., Wolfe, L. and P. Mooslechner (eds): pp. 203-214.

Dornbusch, R., (1976), "Expectations and Exchange Rate Dynamics", Journal of Political Economy, 84, pp. 1161-76.

Fidrmuc, J. 2002, "Strategic Aspects of Exchange Rate Regime Choice for the Accession Countries, unpublished, ECARES, Universite Libre de Bruxelles.

Fidrmuc, J., and I. Korhonen, 2002, "Similarity of Supply and Demand Shocks Between the Euro Area and the CEECs," Bank of Finland mimeo.

Frenkel, M., and C. Nickel, 2002, "How Symmetric Are the Shocks and the Shock Adjustment Dynamics Between the Euro Area and Central and Eastern European Countries?," IMF Working Paper 02/222 (Washington: International Monetary Fund).

Gallagher, L, and E. Kavanagh, 2002, "Real and Nominal Shocks to Exchange Rates: Does the Regime Matter?," The Manchester School, Vol. 70, No. 5, pp. 710-730.

Grafe, C. and C. Wyplosz, (1999), “A Model of Real Exchange Rate Determination in Transition Economies,” in Balance of Payments, Exchange Rates, and Competitiveness in Transition Economies, edited by Mario Blejer and Marko Škreb.

Kontolemis, Z., (2003), “Exchange Rates Are a Matter of Common Concern: Policies in the Run-Up to the Euro,” European Commission, European Economy, Economic Paper No. 191. (http://europa.eu.int/comm/economy_finance/publications/economic_papers/economicpapes191_en.htm).

Kutan, A., and S. Dibooglu, (2002), “Sources of Real Exchange Rate Fluctuations in Transition Economies: Evidence from Hungary and Poland,” Journal of Comparative Economics.

Lastrapes, W.D., (1992), “Sources of Fluctuations in Real and Nominal Exchange Rates,” Review of Economics and Statistics, pp. 530-539.

Natalucci, F. and F. Ravenna, (2002), “The Road to Adopting the Euro: Monetary Policy and Exchange Rate Regimes in EU Candidate Countries,” Board of Governors of the Federal Reserve System, International Finance Discussion Papers, No. 741, December.

Obstfeld, M., (1994), “International Capital Mobility in the 1990s,” International Finance Discussion Paper No. 472 (Washington: Board of Governors of the Federal Reserve System).

Pelkman, J., Gros, D., and J. Ferrer, (2000), “Long-Run Economic Aspects of the European Union’s Eastern Enlargement,” WRR Scientific Council for Government Policy, Working Document, No. 109.

Süppel, R., (2003), “Economic Dynamics in EU Accession Countries: A Case for Exchange Rate Flexibility,” ECB mimeo.

von Hagen, J., and Z. Zhou, 2003, “Exchange Rate Policies on the Last Stretch,” Conference on Monetary Strategies for Accession Countries, February 27-28, 2003, Budapest.

Table 1. Forecast Error Variance Decompositions
(Temporary Component in Real and Nominal Effective Exchange Rates) 1/

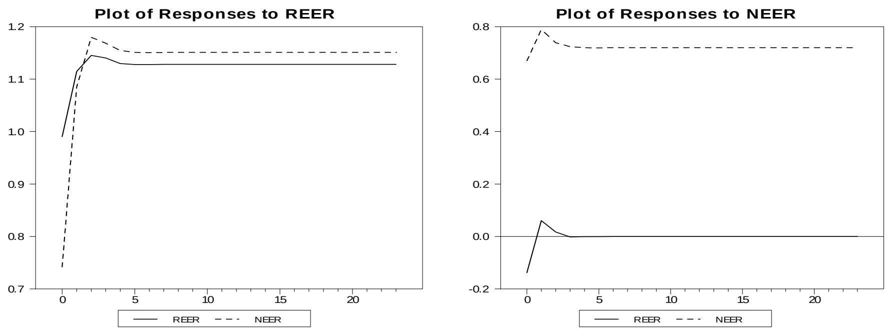
	Steps						
	1	4	8	12	16	20	24
				REER			
Hungary	7.4	9.9	10.3	10.3	10.3	10.3	10.3
Poland	21.6	26.3	26.7	26.8	26.8	26.8	26.8
Czech Republic	30.7	31.3	32.1	32.1	32.1	32.1	32.1
Slovak Republic	12.0	16.3	21.9	21.9	22.0	21.9	21.9
Slovenia	1.2	3.5	6.4	6.9	6.9	6.9	6.9
Cyprus	1.9	5.7	5.7	5.7	5.7	5.7	5.7
Estonia	35.4	41.8	41.7	41.7	41.7	41.7	41.7
Lativa	11.3	9.8	9.5	9.6	9.6	9.6	9.6
Lithuania	67.6	59.8	59.4	59.6	59.5	59.5	59.5
				NEER			
Hungary	38.1	39.0	39.1	39.1	39.1	39.1	39.1
Poland	12.6	25.0	30.0	30.9	31.1	31.2	31.2
Czech Republic	64.7	63.4	63.4	63.4	63.4	63.4	63.4
Slovak Republic	79.1	68.1	66.6	66.6	66.7	66.7	66.7
Slovenia	18.9	19.2	20.0	21.6	21.6	21.7	21.7
Cyprus	44.9	40.8	40.8	40.8	40.8	40.8	40.8
Estonia	97.0	96.8	96.8	96.8	96.8	96.8	96.8
Lativa	51.9	51.1	51.0	51.0	51.0	51.0	51.0
Lithuania	93.7	88.9	86.4	86.0	86.0	86.0	86.0

1/ The permanent component is 100 minus the temporary component.

Charts 1a-1c

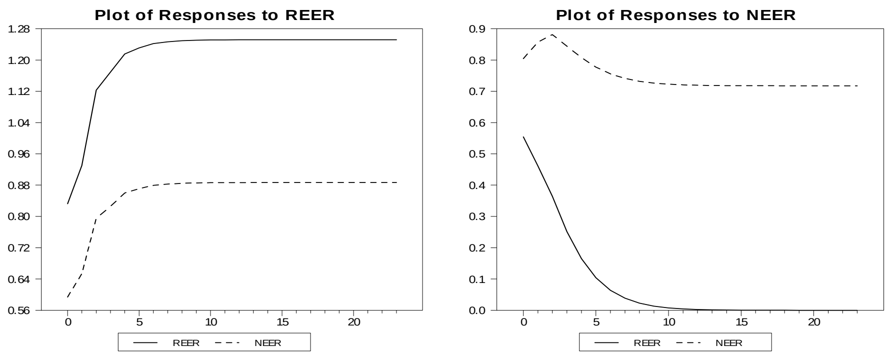
Cyprus

Impulse Response Functions (Cumulative)



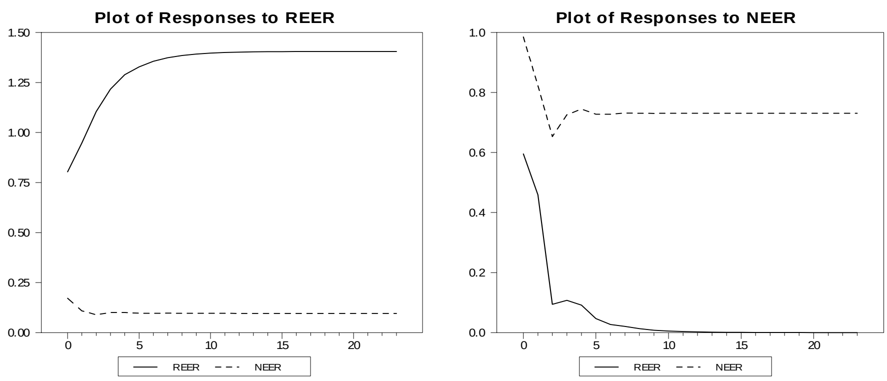
Czech

Impulse Response Functions (Cumulative)



Estonia

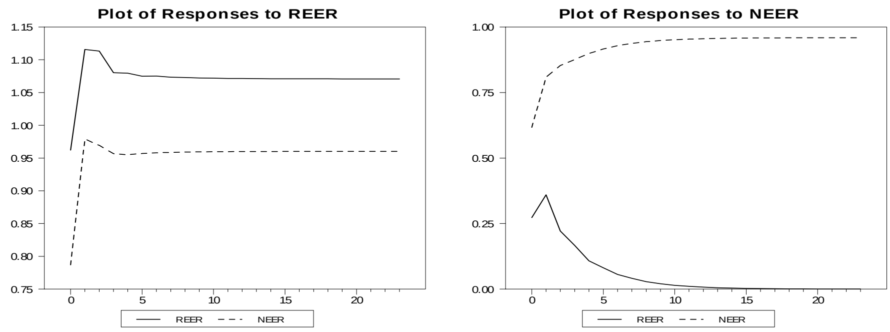
Impulse Response Functions (Cumulative)



Charts 1d-1f

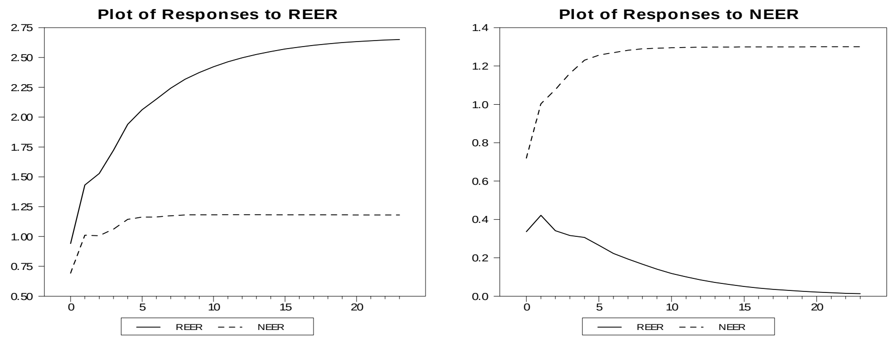
Hungary

Impulse Response Functions (Cumulative)



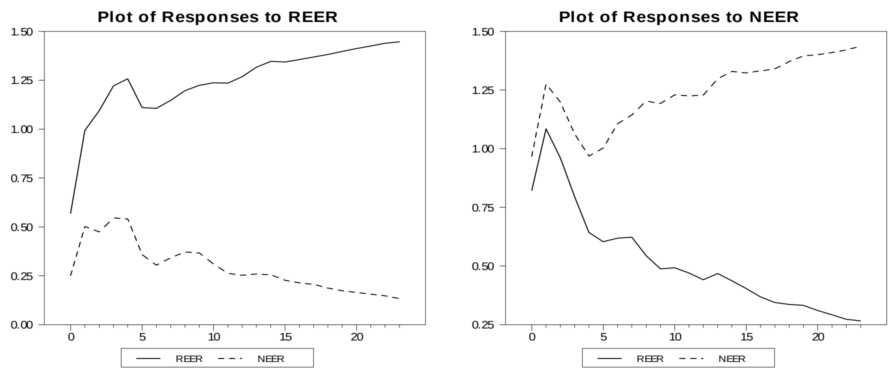
Latvia

Impulse Response Functions (Cumulative)



Lithuania

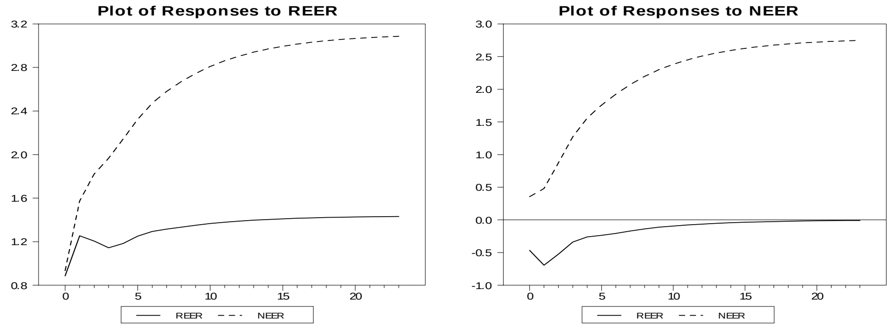
Impulse Response Functions (Cumulative)



Charts 1g-1i

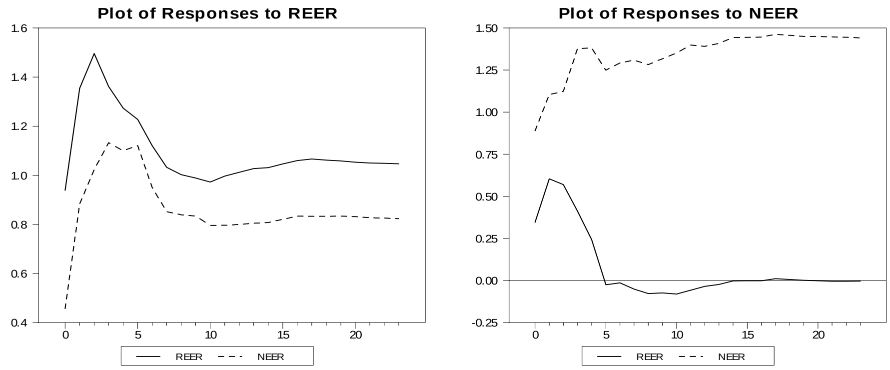
Poland

Impulse Response Functions (Cumulative)



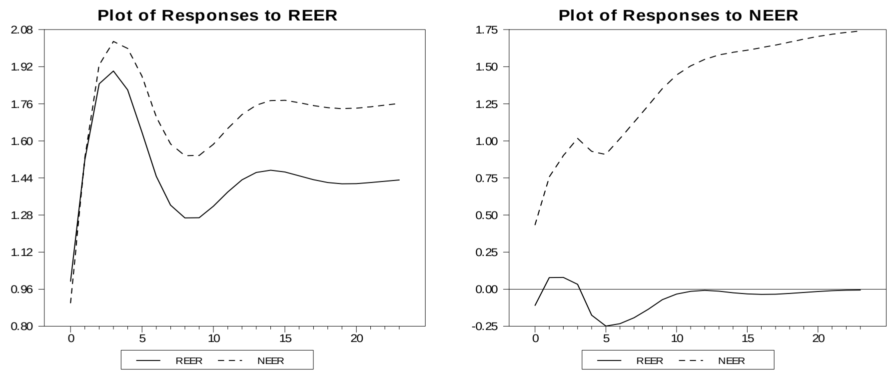
Slovakia

Impulse Response Functions (Cumulative)



Slovenia

Impulse Response Functions (Cumulative)

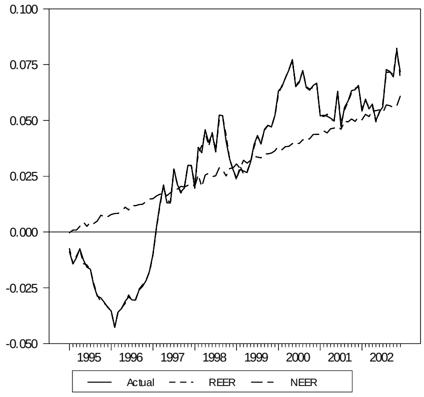


Charts 2a-2b

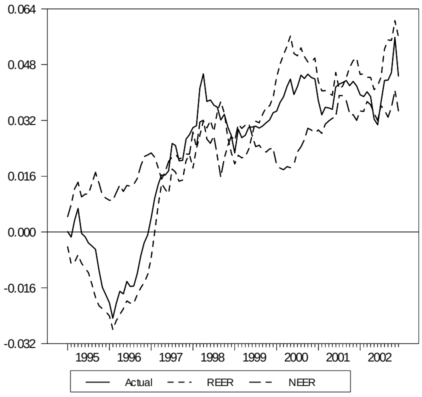
Cyprus

Historical Decompositions

of REER



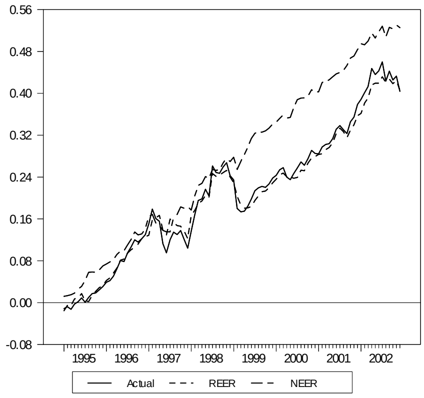
of the NEER



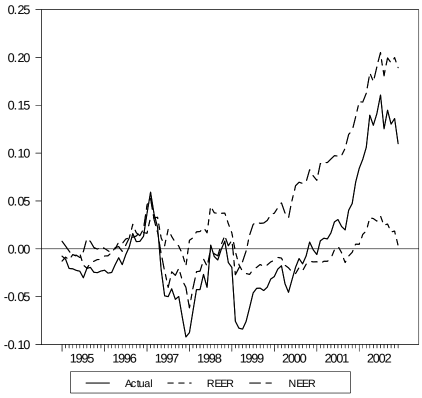
Czech

Historical Decompositions

of REER



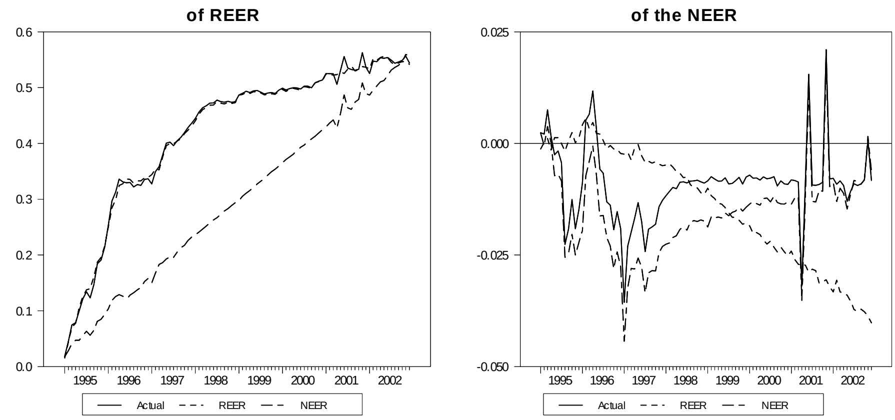
of the NEER



Charts 2c-2d

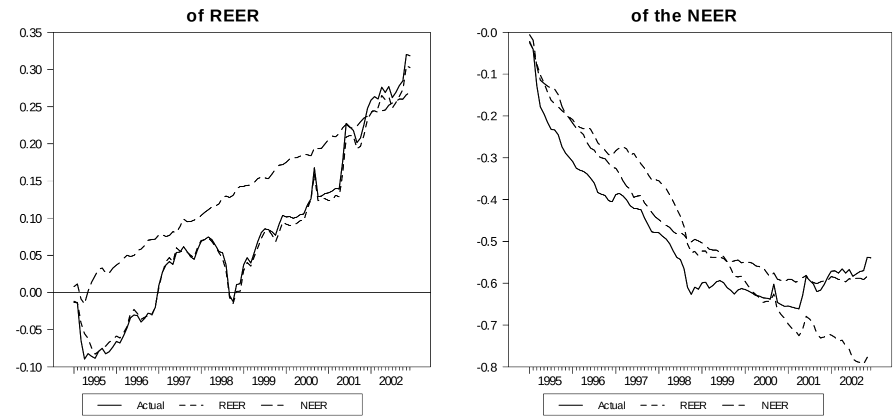
Estonia

Historical Decompositions



Hungary

Historical Decompositions

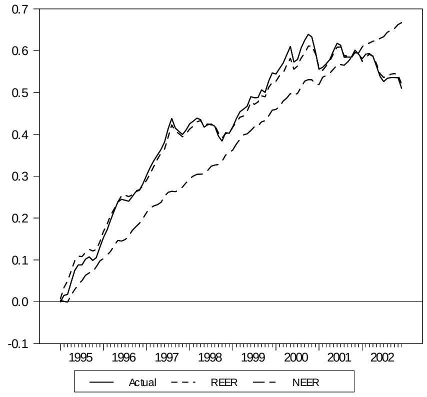


Charts 2e-2f

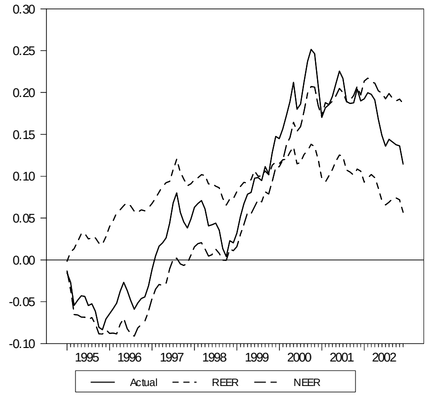
Latvia

Historical Decompositions

of REER



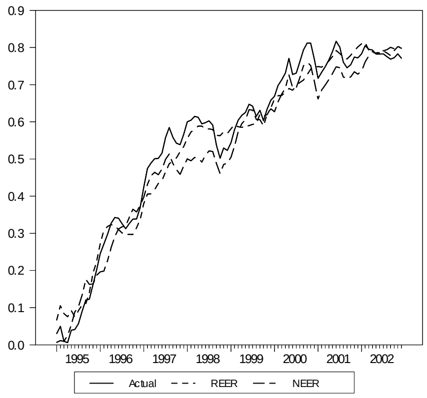
of the NEER



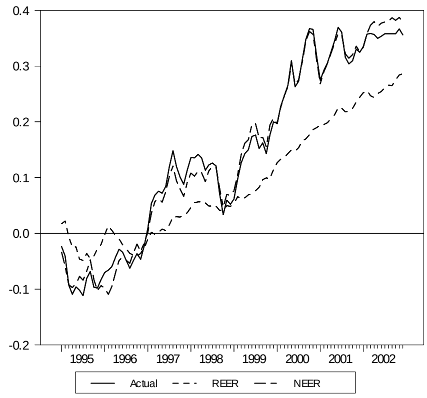
Lithuania

Historical Decompositions

of REER



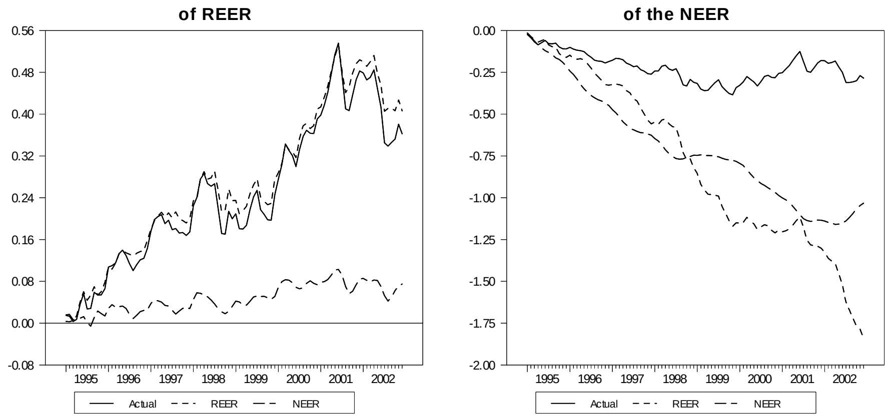
of the NEER



Charts 2g-2h

Poland

Historical Decompositions



Slovakia

Historical Decompositions

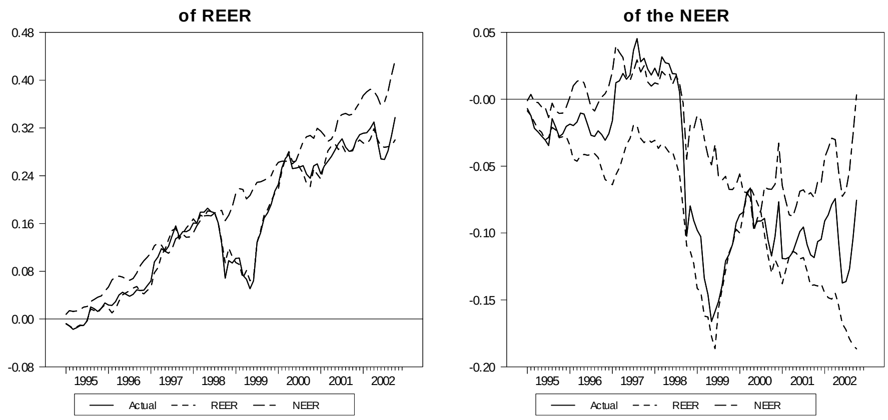


Chart 2i

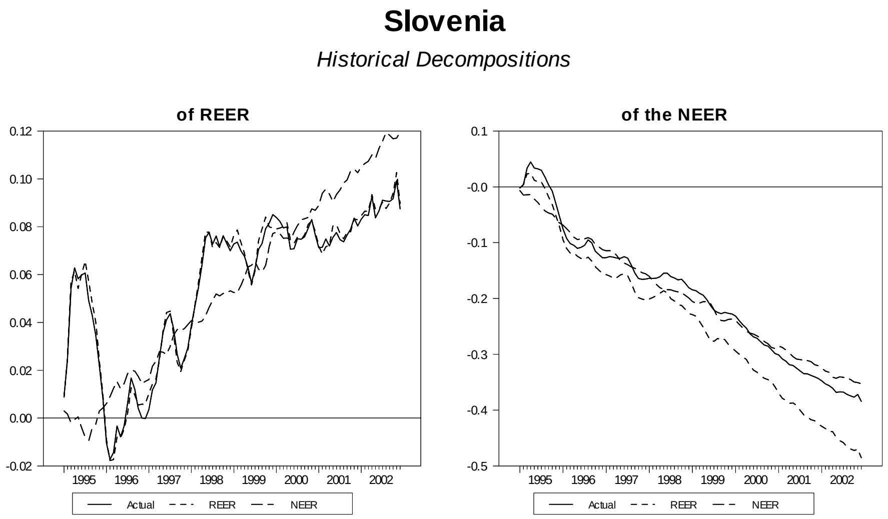

Slovenia
Historical Decompositions
of REER
of the NEER
0.12
0.10
0.08
0.06
0.04
0.02
0.00
-0.02
0.1
-0.0
-0.1
-0.2
-0.3
-0.4
-0.5
1995
1996
1997
1998
1999
2000
2001
2002
Actual
REER
NEER

Table 2. Forecast Error Variance Decompositions
(Real Effective Exchange Rates)

	Steps						
	1	4	8	12	16	20	24
Hungary							
AS shock	0.5	1.0	1.1	1.1	1.1	1.1	1.1
IS shock	92.2	89.4	89.0	88.9	88.9	88.9	88.9
LM shock	7.3	9.6	10.0	10.0	10.0	10.0	10.0
Poland							
AS shock	30.1	43.3	44.8	45.3	45.2	45.2	45.2
IS shock	66.1	50.1	46.1	45.7	44.8	44.8	44.8
LM shock	3.8	6.6	9.1	9.0	10.0	10.0	10.0
Czech Republic							
AS shock	0.1	0.6	0.6	0.6	0.6	0.6	0.6
IS shock	68.6	67.8	67.1	67.0	67.0	67.0	67.0
LM shock	31.3	31.6	32.3	32.4	32.4	32.4	32.4
Slovak Republic							
AS shock	15.9	18.4	23.9	24.1	24.9	25.4	25.4
IS shock	65.4	61.5	54.4	53.7	53.2	52.8	52.8
LM shock	18.7	20.1	21.7	22.2	21.9	21.8	21.8
Slovenia							
AS shock	0.6	0.9	1.4	1.7	1.8	1.8	1.8
IS shock	98.3	92.4	87.4	86.5	86.4	86.3	86.3
LM shock	1.2	6.6	11.2	11.8	11.8	11.9	11.9
Cyprus							
AS shock	14.7	16.3	16.6	16.2	16.1	16.3	16.5
IS shock	85.2	80.1	79.6	78.4	78.0	77.8	77.5
LM shock	0.1	3.6	3.8	5.4	5.9	5.9	6.0
Estonia							
AS shock	23.0	18.3	16.8	16.6	16.6	16.6	16.6
IS shock	15.7	23.6	32.4	33.3	33.5	33.6	33.6
LM shock	61.3	58.1	50.8	50.1	49.9	49.8	49.8
Lativa							
AS shock	16.1	13.0	12.3	12.2	12.1	12.1	12.1
IS shock	72.9	77.7	78.6	78.7	78.7	78.7	78.7
LM shock	11.0	9.3	9.1	9.1	9.2	9.2	9.2
Lithuania							
AS shock	0.0	0.3	0.7	0.7	0.7	0.7	0.7
IS shock	60.7	54.5	55.2	55.2	55.2	55.2	55.2
LM shock	39.3	45.2	44.1	44.1	44.1	44.1	44.1

1/ The forecast error variance decompositions are for logged first differences.

Table 3. Forecast Error Variance Decompositions 1/
(Relative Output)

	Steps						
	1	4	8	12	16	20	24
Hungary							
AS shock	98.9	97.4	97.3	97.3	97.3	97.3	97.3
IS shock	0.3	0.7	0.8	0.8	0.8	0.8	0.8
LM shock	0.8	1.9	1.9	1.9	1.9	1.9	1.9
Poland							
AS shock	24.5	26.1	28.2	27.9	27.2	27.3	27.2
IS shock	12.3	22.9	23.9	23.7	24.7	24.7	24.7
LM shock	63.2	51.0	47.9	48.4	48.1	48.0	48.1
Czech Republic							
AS shock	98.9	96.8	96.8	96.8	96.8	96.8	96.8
IS shock	0.2	0.4	0.4	0.4	0.4	0.4	0.4
LM shock	0.9	2.8	2.8	2.8	2.8	2.8	2.8
Slovak Republic							
AS shock	49.3	47.7	45.2	42.5	42.2	42.1	42.0
IS shock	4.3	7.9	13.0	18.3	21.0	21.0	21.6
LM shock	46.4	44.4	41.8	39.2	36.8	36.9	36.4
Slovenia							
AS shock	83.8	81.2	77.6	77.4	77.4	77.4	77.4
IS shock	4.3	4.9	4.6	4.6	4.6	4.6	4.6
LM shock	11.9	13.9	17.8	18.0	18.0	18.0	18.0
Cyprus							
AS shock	72.6	67.3	63.9	63.4	65.3	63.5	63.3
IS shock	15.3	17.1	16.8	16.9	18.5	18.5	18.5
LM shock	12.1	15.6	19.3	19.7	16.2	18.0	18.2
Estonia							
AS shock	63.0	55.1	45.6	44.5	44.4	44.3	44.3
IS shock	20.0	18.7	24.0	23.9	23.9	23.9	23.9
LM shock	17.0	26.2	30.4	31.6	31.7	31.8	31.8
Lativa							
AS shock	76.5	69.9	69.3	69.2	69.2	69.2	69.2
IS shock	21.2	26.7	27.1	27.1	27.1	27.1	27.1
LM shock	2.3	3.4	3.6	3.7	3.7	3.7	3.7
Lithuania							
AS shock	99.1	98.7	98.6	98.6	98.6	98.6	98.6
IS shock	0.0	0.1	0.1	0.1	0.1	0.1	0.1
LM shock	0.9	1.2	1.3	1.3	1.3	1.3	1.3

1/ The forecast error variance decompositions are for logged first differences.

Table 4. Forecast Error Variance Decompositions
(Nominal Effective Exchange Rates)

	Steps						
	1	4	8	12	16	20	24
Hungary							
AS shock	1.0	1.8	1.9	1.9	1.9	1.9	1.9
IS shock	61.5	60.0	59.9	59.9	59.9	59.9	59.9
LM shock	37.5	38.2	38.2	38.2	38.2	38.2	38.2
Poland							
AS shock	3.1	36.5	45.2	45.9	45.8	45.8	45.8
IS shock	56.2	33.0	27.2	26.7	26.6	26.6	26.6
LM shock	40.7	30.5	27.6	27.4	27.6	27.6	27.6
Czech Republic							
AS shock	0.0	0.2	0.2	0.2	0.2	0.2	0.2
IS shock	34.9	36.2	36.2	36.2	36.2	36.2	36.2
LM shock	65.1	63.6	63.6	63.6	63.6	63.6	63.6
Slovak Republic							
AS shock	54.1	52.8	50.5	49.6	49.6	49.9	49.9
IS shock	3.4	9.4	11.8	12.4	12.4	12.4	12.7
LM shock	42.6	37.8	37.7	38.0	38.0	37.7	37.4
Slovenia							
AS shock	3.8	3.1	4.0	4.0	4.0	4.1	4.1
IS shock	82.6	75.2	74.5	73.1	72.8	72.8	72.8
LM shock	13.6	21.7	21.5	22.9	23.2	23.1	23.1
Cyprus							
AS shock	32.3	31.9	30.5	29.8	29.5	29.5	29.5
IS shock	26.1	31.1	33.0	33.9	34.1	34.1	34.3
LM shock	41.6	37.0	36.5	36.3	36.4	36.4	36.2
Estonia							
AS shock	4.4	6.1	6.2	6.5	6.5	6.5	6.5
IS shock	6.5	7.4	8.8	8.8	8.8	8.8	8.8
LM shock	89.1	86.5	85.0	84.7	84.7	84.7	84.7
Lativa							
AS shock	8.8	8.2	8.1	8.1	8.1	8.1	8.1
IS shock	39.8	42.1	42.3	42.3	42.3	42.3	42.3
LM shock	51.4	49.7	49.6	49.6	49.6	49.6	49.6
Lithuania							
AS shock	0.1	0.6	0.9	0.9	0.9	0.9	0.9
IS shock	31.1	30.8	31.2	31.2	31.2	31.2	31.2
LM shock	68.8	68.6	67.9	67.9	67.9	67.9	67.9

1/ The forecast error variance decompositions are for logged first differences.

Table 5. Forecast Error Variance Decompositions (with dummy variables) 1/ 2/
(Real Effective Exchange Rates)

	Steps						
	1	4	8	12	16	20	24
Hungary							
AS shock	...	...	...	...	...	...	...
IS shock	...	...	...	...	...	...	...
LM shock	...	...	...	...	...	...	...
Poland							
AS shock	24.2	22.9	22.6	22.6	22.6	22.6	22.6
IS shock	42.4	41.1	41.1	41.1	41.1	41.1	41.1
LM shock	33.4	36.0	36.3	36.3	36.3	36.3	36.3
Czech Republic							
AS shock	...	...	...	...	...	...	...
IS shock	...	...	...	...	...	...	...
LM shock	...	...	...	...	...	...	...
Slovak Republic							
AS shock	3.0	3.3	3.3	3.3	3.3	3.3	3.3
IS shock	92.5	91.2	91.2	91.2	91.2	91.2	91.2
LM shock	4.6	5.5	5.5	5.5	5.5	5.5	5.5
Slovenia							
AS shock	8.0	7.4	7.3	7.3	7.3	7.3	7.3
IS shock	92.0	86.8	85.6	85.6	85.6	85.6	85.6
LM shock	0.0	5.9	7.1	7.1	7.1	7.1	7.1
Cyprus							
AS shock	...	...	...	...	...	...	...
IS shock	...	...	...	...	...	...	...
LM shock	...	...	...	...	...	...	...
Estonia							
AS shock	25.4	21.4	20.1	20.2	20.2	20.2	20.2
IS shock	32.4	31.5	32.9	33.0	33.0	33.0	33.0
LM shock	42.2	47.1	47.0	46.8	46.8	46.8	46.8
Lativa							
AS shock	16.2	14.6	14.4	14.4	14.4	14.4	14.4
IS shock	83.8	85.1	85.1	85.1	85.1	85.1	85.1
LM shock	0.0	0.3	0.5	0.5	0.5	0.5	0.5
Lithuania							
AS shock	0.0	1.0	1.1	1.1	1.1	1.1	1.1
IS shock	66.3	68.4	68.3	68.3	68.3	68.3	68.3
LM shock	33.7	30.6	30.6	30.6	30.6	30.6	30.6

1/ The forecast error variance decompositions are for logged first differences.
2/ See text table for dummy variable or changed sample set dates.

Table 6. Forecast Error Variance Decompositions (with dummy variables) 1/ 2/
(Relative Output)

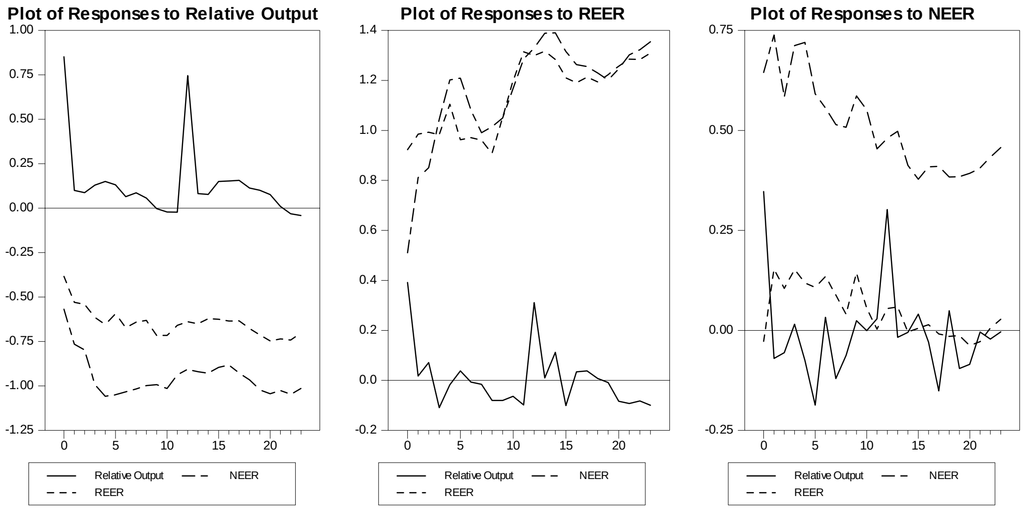
	Steps						
	1	4	8	12	16	20	24
Hungary							
AS shock	...	...	...	...	...	...	...
IS shock	...	...	...	...	...	...	...
LM shock	...	...	...	...	...	...	...
Poland							
AS shock	78.6	67.4	67.1	67.1	67.1	67.1	67.1
IS shock	21.2	29.2	29.4	29.4	29.4	29.4	29.4
LM shock	0.2	3.5	3.5	3.5	3.5	3.5	3.5
Czech Republic							
AS shock	...	...	...	...	...	...	...
IS shock	...	...	...	...	...	...	...
LM shock	...	...	...	...	...	...	...
Slovak Republic							
AS shock	98.0	94.5	94.5	94.5	94.5	94.5	94.5
IS shock	1.6	3.7	3.7	3.7	3.7	3.7	3.7
LM shock	0.4	1.8	1.8	1.8	1.8	1.8	1.8
Slovenia							
AS shock	91.3	90.0	89.8	89.8	89.8	89.8	89.8
IS shock	0.1	0.3	0.3	0.3	0.3	0.3	0.3
LM shock	8.6	9.8	10.0	10.0	10.0	10.0	10.0
Cyprus							
AS shock	...	...	...	...	...	...	...
IS shock	...	...	...	...	...	...	...
LM shock	...	...	...	...	...	...	...
Estonia							
AS shock	50.9	44.4	35.6	34.6	34.5	34.5	34.5
IS shock	46.1	48.3	53.3	53.1	53.0	53.0	53.0
LM shock	3.0	7.3	11.1	12.3	12.5	12.5	12.5
Lativa							
AS shock	78.6	70.1	69.7	69.7	69.7	69.7	69.7
IS shock	12.6	20.2	20.6	20.6	20.6	20.6	20.6
LM shock	8.8	9.7	9.7	9.7	9.7	9.7	9.7
Lithuania							
AS shock	99.4	98.9	98.9	98.9	98.9	98.9	98.9
IS shock	0.0	0.1	0.1	0.1	0.1	0.1	0.1
LM shock	0.6	1.0	1.0	1.0	1.0	1.0	1.0

1/ The forecast error variance decompositions are for logged first differences.
2/ See text table for dummy variable or changed sample set dates.

Charts 3a-3b

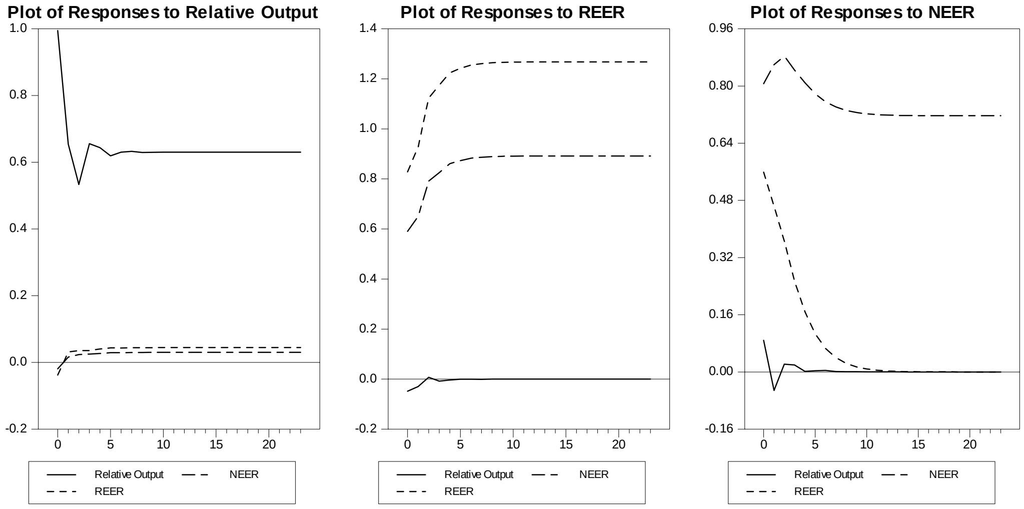
Cyprus

Impulse Response Functions (Cumulative)



Czech Republic

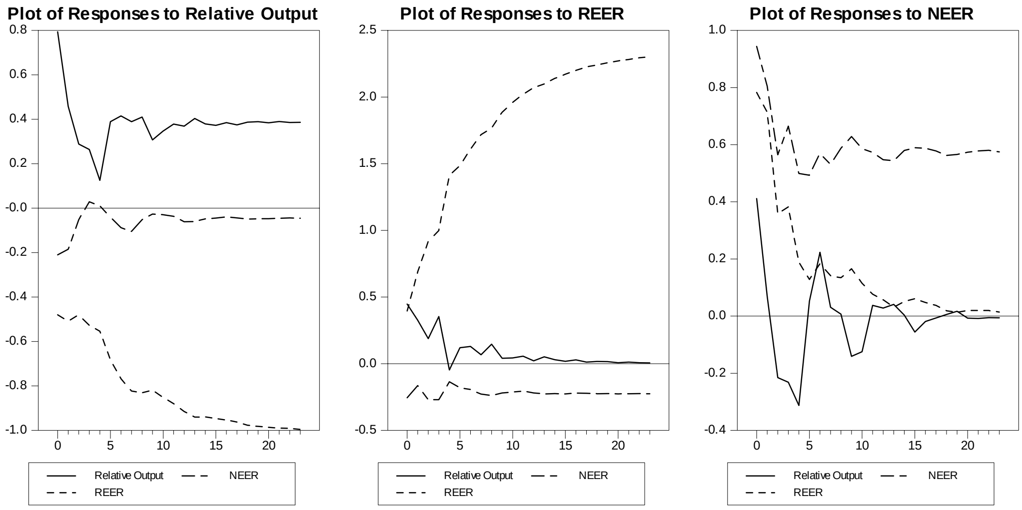
Impulse Response Functions (Cumulative)



Charts 3c-3d

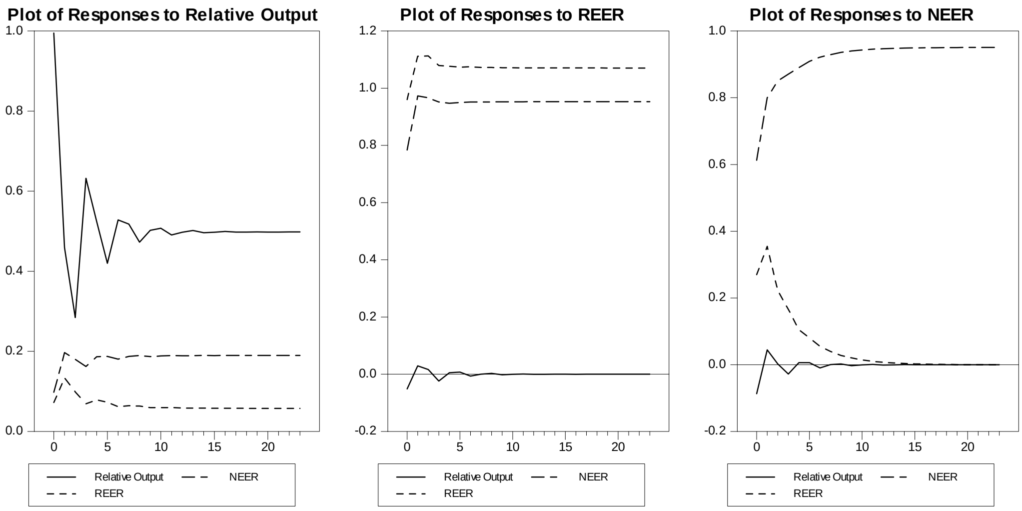
Estonia

Impulse Response Functions (Cumulative)



Hungary

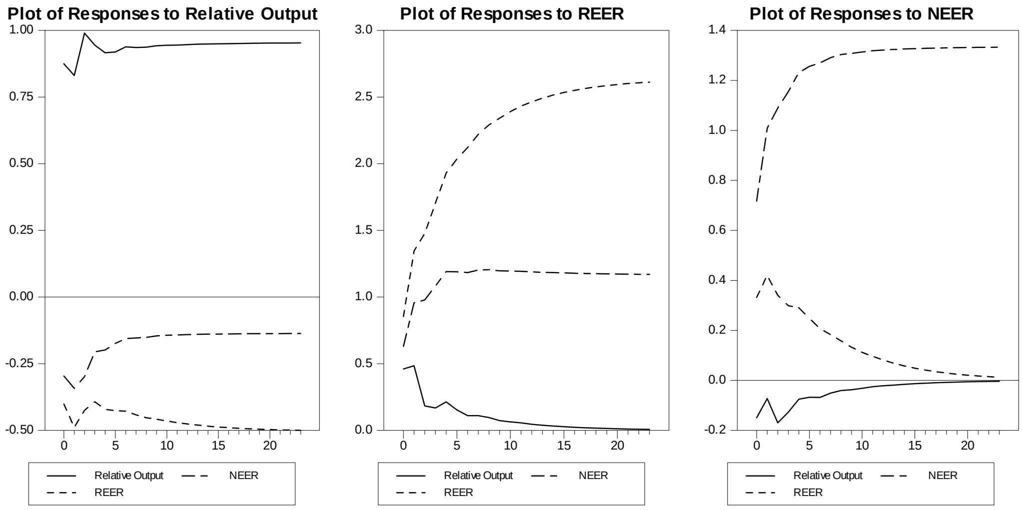
Impulse Response Functions (Cumulative)



Charts 3e-3f

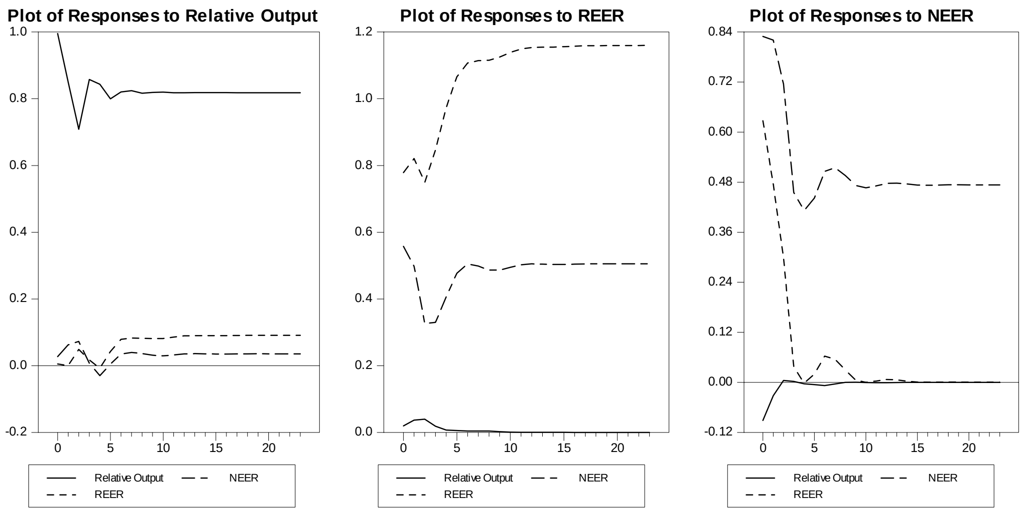
Latvia

Impulse Response Functions (Cumulative)



Lithuania

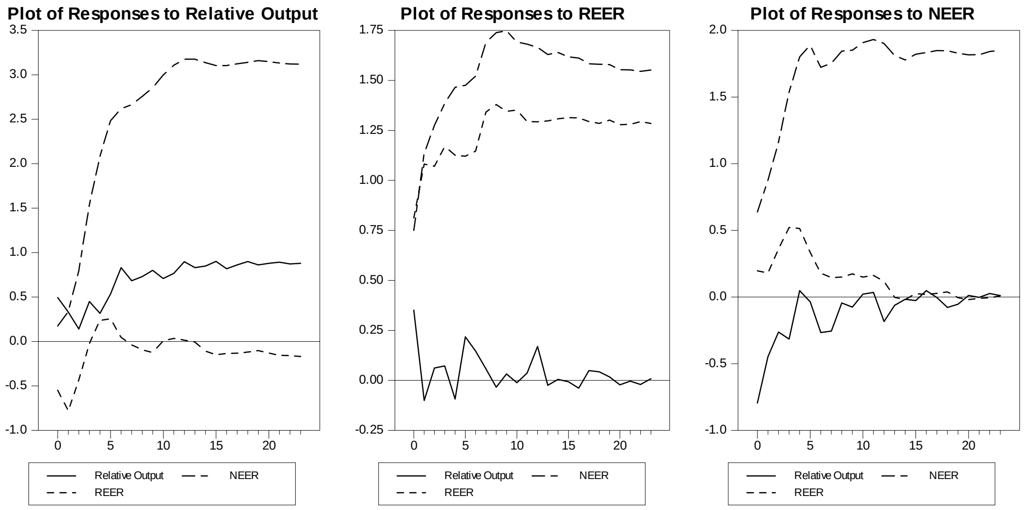
Impulse Response Functions (Cumulative)



Charts 3g-3h

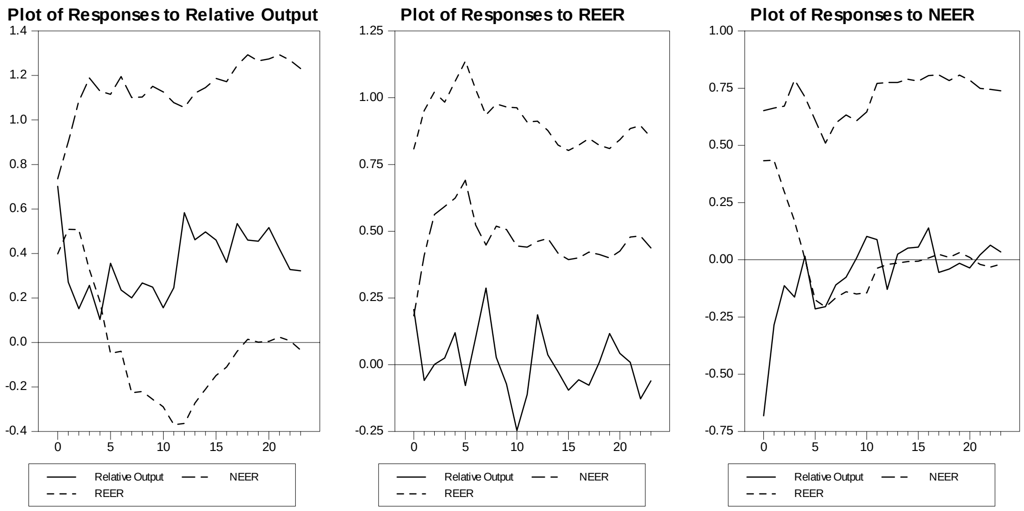
Poland

Impulse Response Functions (Cumulative)



Slovakia

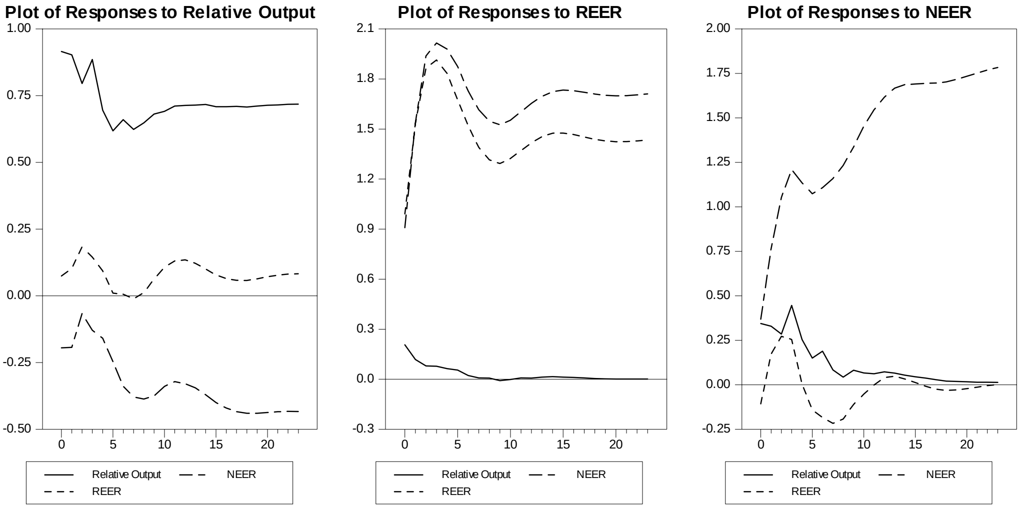
Impulse Response Functions (Cumulative)



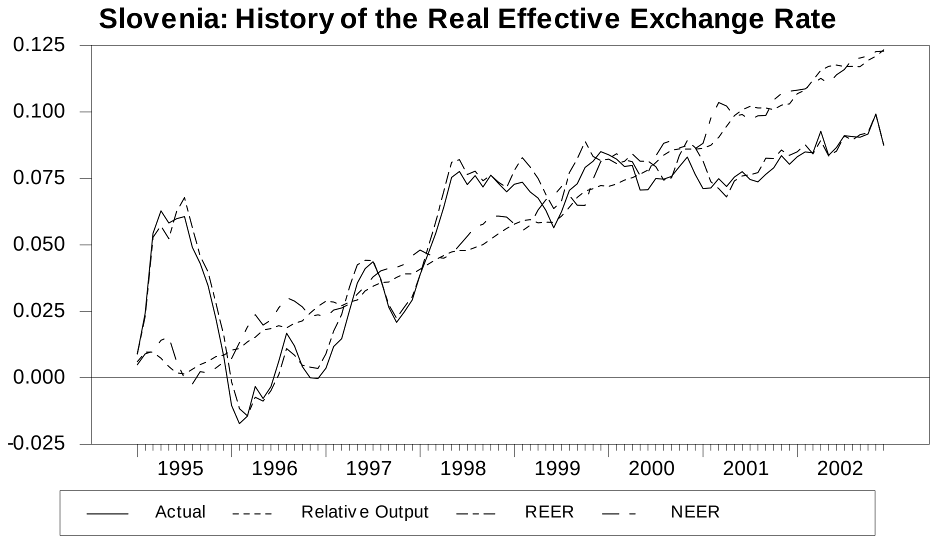
Charts 3i

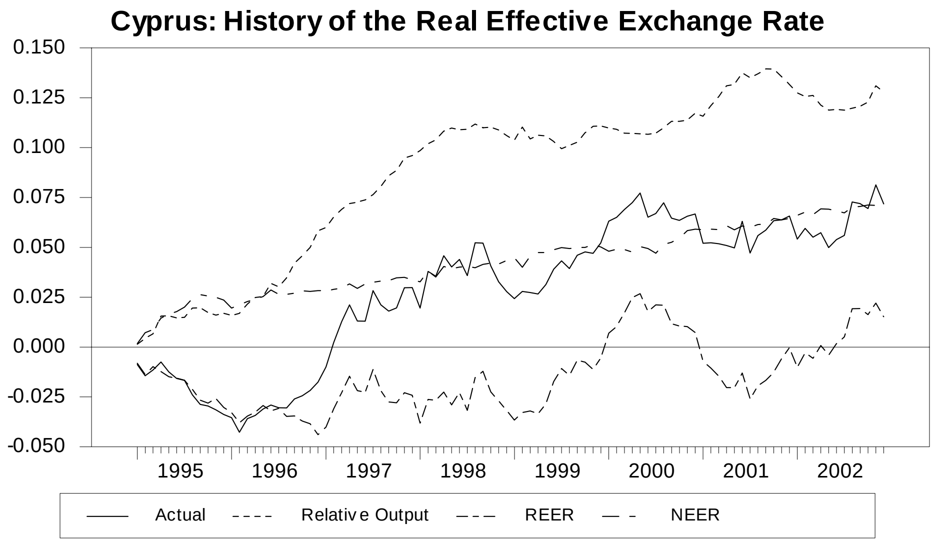
Slovenia

Impulse Response Functions (Cumulative)

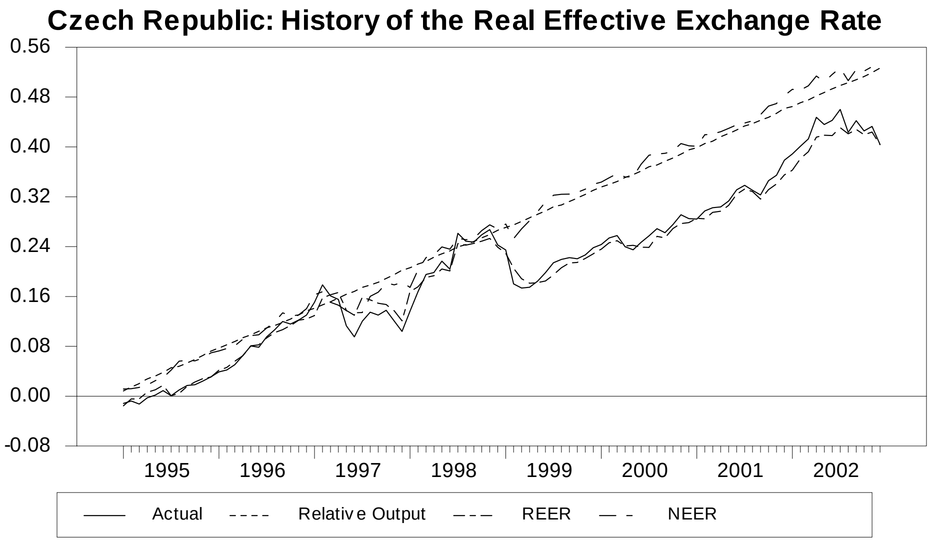


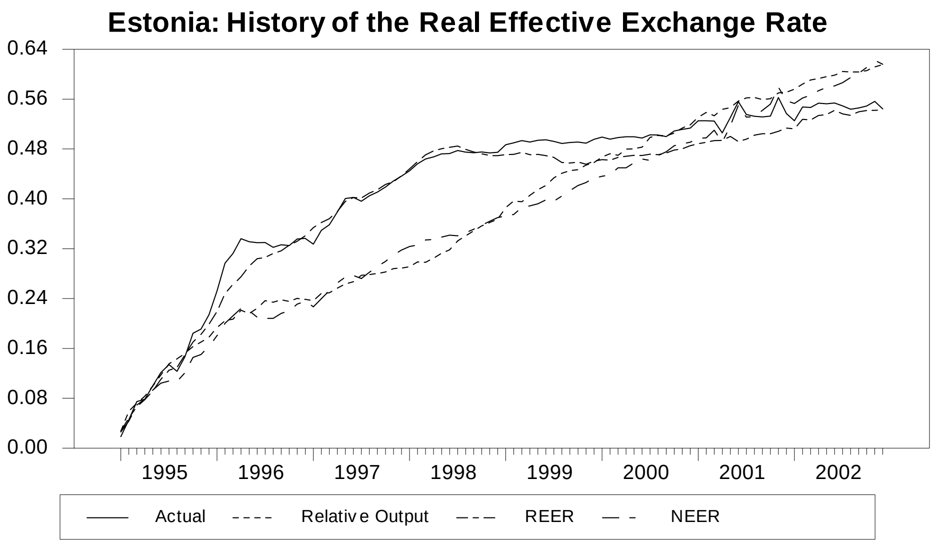
Charts 4a-4b


Slovenia: History of the Real Effective Exchange Rate
0.125
0.100
0.075
0.050
0.025
0.000
-0.025
1995
1996
1997
1998
1999
2000
2001
2002
Actual
Relative Output
REER
NEER

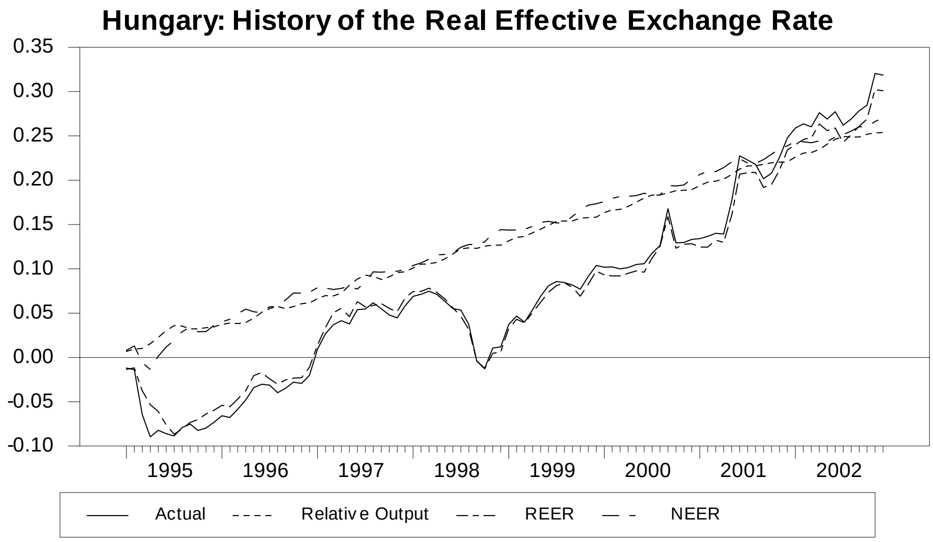

Cyprus: History of the Real Effective Exchange Rate
0.150
0.125
0.100
0.075
0.050
0.025
0.000
-0.025
-0.050
1995
1996
1997
1998
1999
2000
2001
2002
Actual
Relative Output
REER
NEER

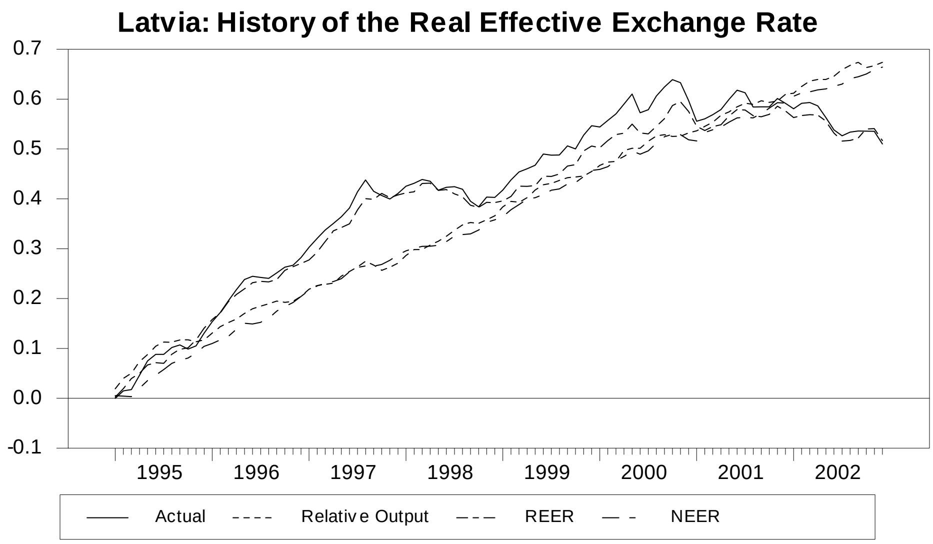
Charts 4c-4d


Czech Republic: History of the Real Effective Exchange Rate
0.56
0.48
0.40
0.32
0.24
0.16
0.08
0.00
-0.08
1995
1996
1997
1998
1999
2000
2001
2002
Actual
Relative Output
REER
NEER

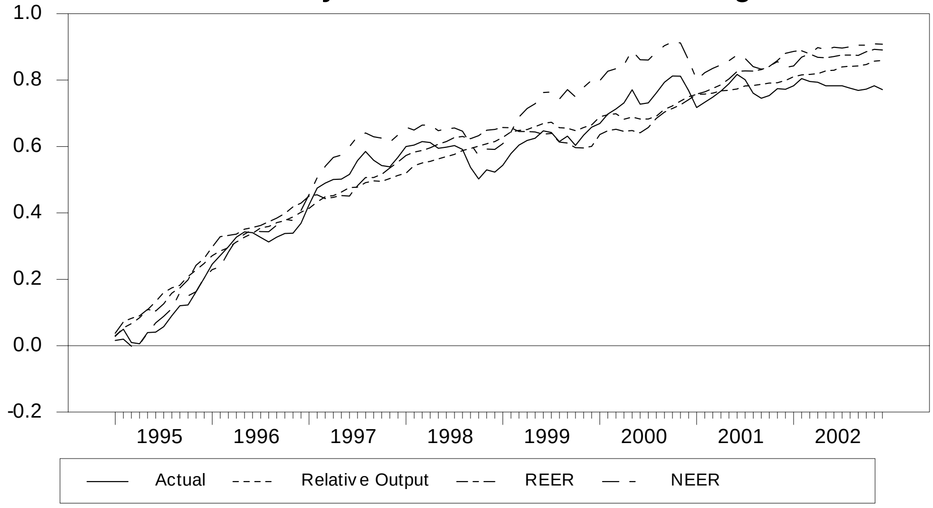

Estonia: History of the Real Effective Exchange Rate
0.64
0.56
0.48
0.40
0.32
0.24
0.16
0.08
0.00
1995
1996
1997
1998
1999
2000
2001
2002
Actual
Relative Output
REER
NEER

Charts 4e-4f

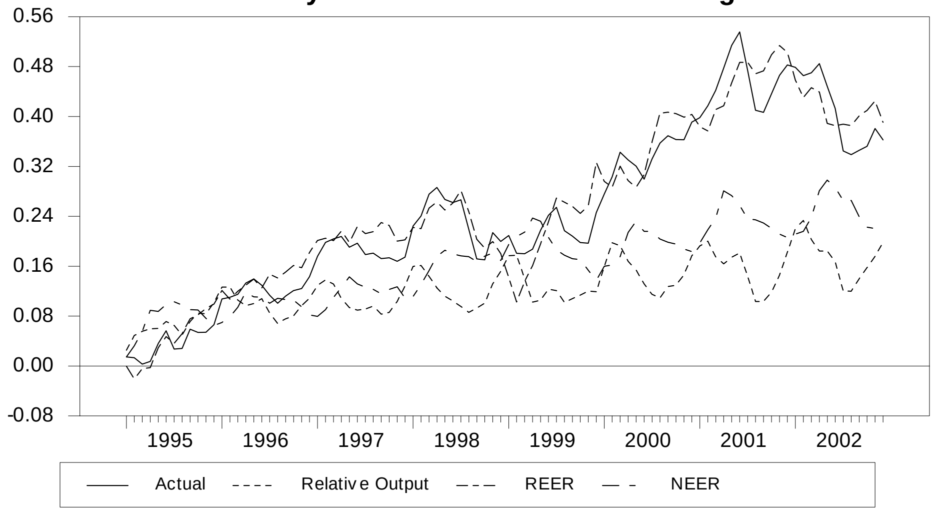

Hungary: History of the Real Effective Exchange Rate
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
1995
1996
1997
1998
1999
2000
2001
2002
Actual
Relative Output
REER
NEER


Latvia: History of the Real Effective Exchange Rate
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
1995
1996
1997
1998
1999
2000
2001
2002
Actual
Relative Output
REER
NEER

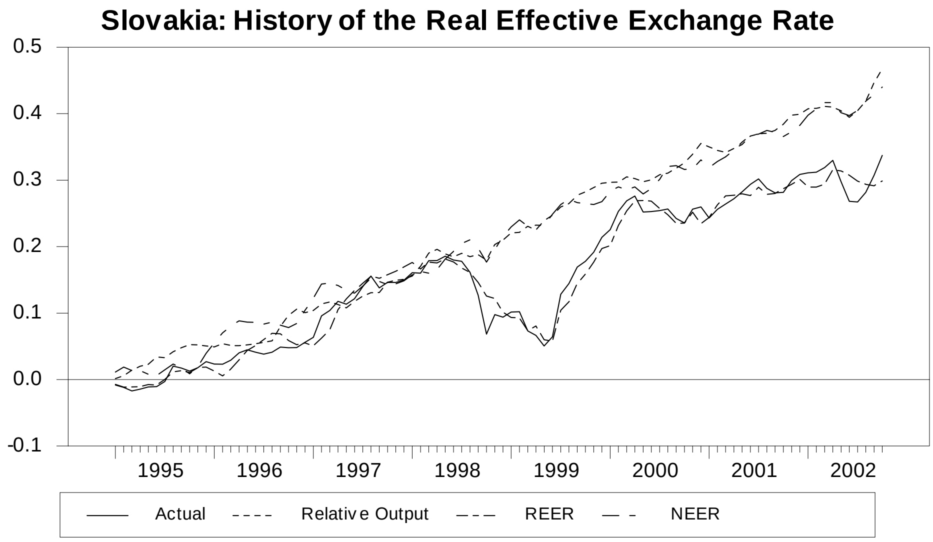
Lithuania: History of the Real Effective Exchange Rate

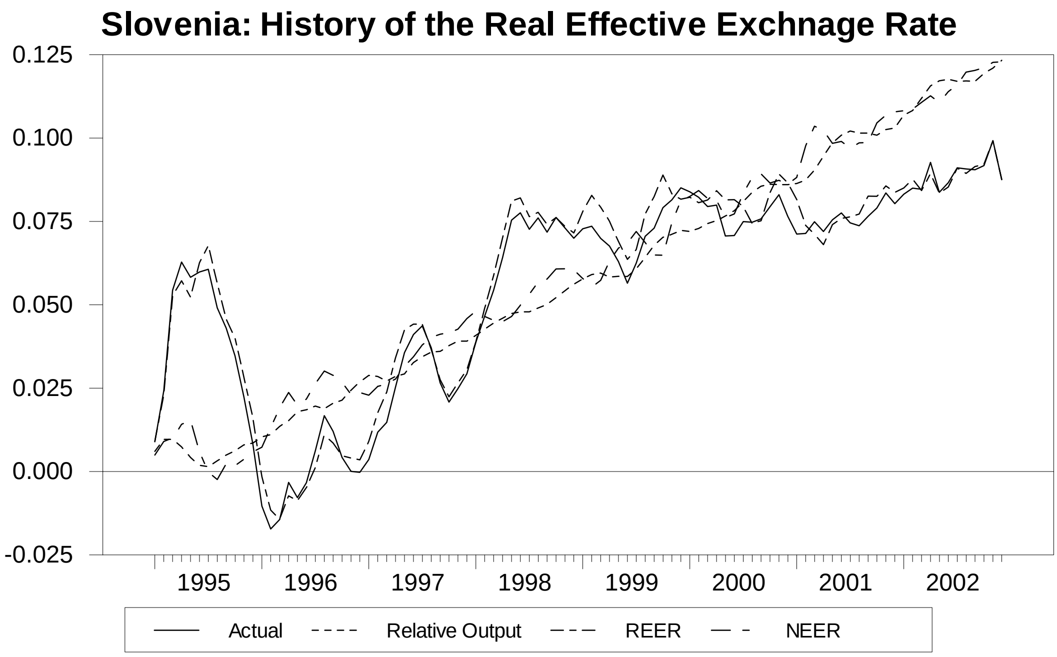


Poland: History of the Real Effective Exchange Rate



Charts 4i


Slovakia: History of the Real Effective Exchange Rate
0.5
0.4
0.3
0.2
0.1
0.0
-0.1
1995
1996
1997
1998
1999
2000
2001
2002
Actual
Relative Output
REER
NEER


Slovenia: History of the Real Effective Exchnage Rate
0.125
0.100
0.075
0.050
0.025
0.000
-0.025
1995
1996
1997
1998
1999
2000
2001
2002
Actual
Relative Output
REER
NEER