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Sources of Real and Nominal Exchange Rate Fluctuations in Transition Economies

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I. Introduction

The exchange rate has been an important policy tool for many transition economies. It has served as a nominal anchor in stabilizing domestic economies and reducing inflation rate while foreign exchange rate management has been an important element in staving off external imbalances. Most transition countries began the transition with a sharp nominal and real appreciation of their currency. This was followed by real appreciation as domestic inflation exceeded subsequent nominal deprecation over the course of transition (Brada, 1998).

The transition process involves dismantling of old production structures and initiating structural reforms; as such productivity growth and real wages changes can be expected to exert an upward pressure on the real exchange rate (Halpern and Wyplosz, 1997). This is the Balassa-Samuelson hypothesis which predicts that real exchange rate appreciation occurs in fast growing, innovative economies. Besides productivity gains, the liberalization of capital accounts resulting in capital inflows can appreciate the real exchange rate (Orlowski, 1998 and Brada, 1998). Finally, nominal shocks can potentially influence real exchange rates for high inflation countries. For example, Desai (1998) argues that much of the real appreciation was due to fiscal imbalances in transition economies.

A key issue for transition economies is real exchange rate movements.[2] They play a significant role in altering competitiveness, which is critical to their ongoing trade reorientation toward the West. Real exchange rate movements can also signal currency crisis. For example, in his analysis of the Czech exchange rate crisis of 1997, Begg (1998) evaluates the behavior of the real appreciation of the koruna in the years leading up to the crisis. Lastly, movements in real exchange rates may significantly affect the behavior of inflation and output in transition economies.

By decomposing real exchange rate movements into those attributable to real and nominal shocks, one can provide important insight into the sources of movements in real exchange rates. Such a decomposition can be accomplished by imposing a long run neutrality restriction that nominal shocks have no long run effect on the real exchange rate. Economic theory predicts that such nominal shocks have no long run effect on the real exchange rate. Since real exchange rates seem to have a permanent component, Lastrapes (1992) and Enders and Lee (1997) use long run neutrality of nominal shocks to discern the temporary and permanent components of the real exchange rate[3].

This decomposition is also useful to gauge the effectiveness of monetary and exchange rate policies in transition economies. A significantly large temporary component in the real exchange rate due to nominal shocks may indicate a high degree of nominal inertia in commodity prices. This gives the ability to policy makers to influence the real exchange rate and alter competitiveness. It also raises the question of increased real exchange rate variability induced by nominal shocks.

In this paper we decompose real and nominal exchange rate movements in Poland and Hungary to those attributable to nominal shocks and real shocks for the transition period from January 1990 to the present. The resulting decomposition gives an idea about the ability of policy makers to affect real exchange rates through monetary and exchange rate policies.[4] The rest of the paper is organized as follows. Section II provides an explanation of data employed and describes methodology. In Section III, we present empirical results. Section IV concludes and offers suggestions for future research.

II. Data and Methodological Issues

The nominal exchange rate s_t is measured by the nominal effective exchange rate (NEER) index and the real exchange rate q_t is the CPI based real effective exchange rate index (relative price of domestic goods in terms of foreign goods) both expressed in logarithms. The data are monthly observations from 1990:1- 1998:2 taken from the CD ROM edition of the *International Financial Statistics.* Before decomposing real and nominal exchange rate movements, we test for stationarity. KPSS test results indicate that stationarity can be rejected for nominal and real exchange rates series; however, the test statistic does not reject stationarity for the first differences. [5]

While the sample period is short to assess mean reversion in real exchange rates, it is maintained that exchange rates contain a permanent component under the sample period so that exchange rate variability attributable to nominal and real shocks can be empirically estimated. Assuming nonstationary real exchange rates over the transition process is reasonable for at least two reasons. First, purchasing power parity, implying stationary real exchange rates, holds under very restrictive conditions and these conditions are extremely unlikely to be met in the case of the transition economies (Brada, 1998). Second, in their analysis of equilibrium real exchange rates in transition economies, Halpern and Wyplosz (1997) argue that equilibrium real exchange rates should exhibit an upward trend over time as these countries catch up and productivity and real wages increase over time. Because such shocks are generally random (stochastic) in nature, we expect real exchange rates to have a permanent, stochastic component during the catching-up process.

We can begin introducing our methodology by considering two types of orthogonal shocks that are the source of variation in the observed movements in real and nominal exchange rates: a real shock ε_{rt} (e.g., endowment, productivity shocks, technology), and a nominal shock ε_{nt} (e.g., nominal money supply and/or nominal exchange rate shock). Since the vector $\Delta y_t = [\Delta q_t$

$$\begin{vmatrix} \Delta q_t \\ \Delta s_t \end{vmatrix} = \begin{vmatrix} A_{11}(L) & A_{12}(L) \\ A_{21}(L) & A_{22}(L) \end{vmatrix} \begin{vmatrix} \varepsilon_{rt} \\ \varepsilon_{nt} \end{vmatrix}$$

$\Delta s_t]'$ is stationary, it can be written as an infinite moving average in the structural shocks where A_{ij} are polynomials in the lag operator, L. In order to identify the shocks, it is assumed that nominal shocks have no long run effect on the real exchange rate. This restriction can be imposed by restricting the coefficients in $A_{12}(L)$ to sum to zero; if $a_{ij}(k)$ is the kth coefficient in $A_{ij}(L)$, the restriction is equivalent to $\sum_{k=0}^{infinity} a_{12}(k) = 0$ so that the cumulative effect of ε_{nt} on Δq_t is zero. Note that the effects of nominal and real shocks on the nominal exchange rate are not restricted. It is known that this method of decomposing a series into its permanent and temporary components is valid provided that the joint behavior of real and nominal exchange rates contains reliable information about the underlying sources of fluctuations (Lastrapes, 1992).

III. Empirical Results

A finite order bivariate vector autoregressive model (VAR) is estimated for Poland and Hungary with 12 lags. The multivariate version of Akaike Information Criterion selects 12 lags for both Poland and Hungary. The VARs are then inverted to obtain the moving average representation and restriction in (2) is imposed. After identifying the shocks, the dynamic effects of the nominal and real shocks can be analyzed by variance decompositions (VDC) and impulse response functions (IRF) typical of VAR methods. Table 1 presents the VDC results for Poland and Hungary for the 1990-98 period.

By construction, the effects of nominal shocks on real exchange rate necessarily die down; in the long run (LR), nominal shocks are constrained to have no effect on the real exchange rate. However, nominal shocks can play a significant role in explaining real exchange rate variability. The results in Table 1 indicates that a sizable proportion of real exchange rate variability is due to nominal shocks in Poland. Specifically, at short term forecasting horizons, nominal shocks explain over 70 percent of real exchange rate forecast error variance. Nominal shocks continue to play an important role after 36 months, which may point to some inertia in relative commodity price adjustment in Poland. This lends some support to disequilibrium models of the exchange rate (e.g., Dornbusch 1976) which attribute short run excess volatility in nominal and real exchange rates to nominal shocks. The impulse response functions can shed a light on the dynamic path of the real exchange rate to nominal shocks. Notice also that nearly all of the variation in the nominal exchange rate is due to nominal shocks in Poland. If nominal shocks are interpreted to stem from monetary policy, then monetary policy have had a significant breadth in influencing nominal and real exchange rates in Poland. The significance of nominal shocks is consistent with evidence reported in Enders and Lee (1997) for Brazil and Argentina.

VDC results for Hungary are somewhat different from those for Poland. Although nominal shocks explain nearly 10 percent of real exchange rate variability at a 3-month horizon, there seems to be no scope for nominal shocks after one year. On the other hand, the relative contribution of real shocks to nominal exchange rate variability in Hungary is much higher than

Poland. Real shocks explain 50 percent of nominal exchange rate variability at 1-month horizon while the effect increases monotonically to 91 percent in the long run. The Hungarian authorities seem to have followed a passive exchange rate policy where the exchange rate was realigned in response to real shocks.

In order to assess the sensitivity of the results to the initial phases of the transformation, we re-estimated the model with a dummy variable for 1990-91. The results, reported in Table 2, indicate that accounting for initial large changes in real and nominal exchange rates during the 1990-91 period somewhat diminishes the effects of nominal shocks on the real exchange rate in Poland. Moreover, nominal shocks account for a higher proportion of nominal exchange rate variability in Poland relative to the base model. In Hungary, the inclusion of the dummy variable does not have a significant effect on the real exchange rate but the effect nominal shocks on the nominal exchange rate become negligible relative to the base model.[6] Overall, the preponderance of real shocks for Hungary for both nominal and real exchange rates and the sizable effect of nominal shocks for Poland are evident in all models.

What explains the differences in results? Certainly, the different approaches taken by each country toward their economic liberalization provide a plausible reason. For instance, Hungary, using a gradual approach, introduced partial price reforms in the 1980s prior to the start of the stabilization program and, therefore, did not experience a large, one-time increase in its price level. Many transition countries, including Poland, followed an active, shock approach, experiencing significant price changes during the initial stages of the reform process. Although both countries introduced a fixed exchange rate regime, the Polish zloty appreciated more in real terms than the Hungarian forint due to the impact of the large initial devaluations on the inflation rate.

Another potential reason is the initial undervaluation of the nominal exchange rate in Poland in relation to the its purchasing power estimate. Many claimed that the initial disequilibrium between the actual exchange rate and their inferred value based on the purchasing power parity (PPP) complicated the management of exchange rate regimes in transition countries [Desai (1997) and Portes (1994)]. Except for Hungary, the rest of the transition countries, including Poland, had exchange rate values that are at least 4-5 times below their PPP value measured in dollar terms. As a result, Poland had to announce larger devaluations to eliminate the initial disequilibrium in the exchange rate. This partly dominated the real exchange rate movements in those economies through the overshooting of exchange rates. In contrast, Hungary did not have this problem; real exchange rate movements were mainly driven by real variables such as upgrading old technologies through foreign direct investment and an increase in product quality and composition. In fact, Szapary and Jakab (1998) report that during the 1992-1997 period the productivity of labor in manufacturing industry rose by an average of 14 percent per year and the recent improvement in the trade balance reflected not only increase in productivity but also diversification of new exports in machinery, electronics, and other areas that have emerged as a result of foreign direct investment and privatization.

In order to gain an insight for the real exchange rate developments in both countries, Table 3 gives some background statistics on productivity, real wages, and real unit labor costs. The table indicates that both countries experienced significant productivity gains in the transition period. Since firms in both countries can be taken to be price takers in international markets, productivity and real wage developments largely determine relative competitiveness. While there seems to be little wage pressure in the early 1990-93, recent wage increases exceeded productivity gains in Poland with increases in unit labor costs which slowed down the appreciation trend in the real exchange rate. On the other hand, Hungary still enjoys productivity gains above real wage increases which result in decreasing in unit labor costs and increasing competitiveness. Thus recent leveling off of the competitiveness in Poland and continuing increase in competitiveness in Hungary seem to corroborate the sizable transitory component in the real exchange rate in Poland but not in Hungary.

The dynamic path of exchange rate responses can be explored by examining the IRFs. Figure 1 presents the response of the real and nominal exchange rates to nominal and real shocks in Poland. It is evident from panels a and b of the figure that both real and nominal exchange rates rise by a similar amount in response to a nominal shock. In response to a nominal shock, the nominal exchange rate rises approximately for one year and reaches its long run level after a slight decline. The response of the real exchange rate to a nominal shock is identical to the nominal rate for 3 months indicating short run commodity price inertia. The real exchange rate declines after the second month, but exhibits a hump around 9-13 months before dying down. The response confirms the persistence of the nominal shock presented in the VDCs. The effect of the real shock is to cause a gradual initial increase in the nominal and the real exchange rate. While the impact effect on the nominal rate is nearly zero, the initial impact effect on the real rate is positive. Both reach their long run value after approximately 15 months.

The response of the real and nominal exchange rates for Hungary are given in Figure 2; the real exchange rate response is given in panel a. The real exchange rate exhibits a hump shaped response to nominal and real shocks after a positive impact effect. The response to a real shock is much higher and seems to increase gradually over time while the response to the nominal shock dies down within a year. Similarly, in response to a nominal shock, the nominal exchange rate initially jumps then declines over time. The initial response of the nominal exchange rate to a real shock is similar to the response to a nominal shock except that the effect of the real shock is a permanent increase in the nominal rate.[7]

The dynamic effects of nominal and real shocks in Poland and Hungary are markedly different than those reported by Lastrapes (1992) and Enders and Lee (1997) for some industrial countries. First, nominal shocks play a significant role in explaining nominal and real exchange rates in Poland and to a lesser extent in Hungary. Second, nominal shocks explain almost all of nominal exchange rate movements in Poland and a sizable portion of nominal exchange rate movements in Hungary. For industrial countries, Lastrapes (1992) and Enders and Lee (1997) found that real shocks explain the bulk of real and nominal exchange rate movements in all cases and at all forecasting horizons.

The importance of nominal shocks for nominal and real exchange rate movements for transition economies has several implications. First, as nominal shocks have a sizable impact on nominal and real exchange rates, it is important to minimize nominal shock variability (perhaps by following stable monetary policy) in order to achieve exchange rate stability. Second, since real exchange rate responses to nominal shocks imply some degree of commodity price inertia especially in Poland, government policy can influence the real exchange rate. Finally, depending on trade elasticities these transition economies have some leverage in dealing with external balance problems arising from adverse terms of trade shocks, such as the CMEA shock, wherein the CMEA trade and payments arrangement between the former Soviet Union and East European countries was dismantled in September 1991. For example, Brada and Kutan (1997) estimate a model of Czech trade with the West and show that the redirection of Czech trade toward the West was in part the result of exchange rate policies followed by the Czech government. At the same time, the CMEA shock played a large, exogenous role in redirecting Czech exports toward Western markets However, authorities should avoid excessive devaluations since these tend to contribute to real exchange rate instability.

A historical decomposition of the real exchange rate is given in Figure 3. The decomposition is obtained by simulation based on the moving average representation and by assuming that the deterministic trend is due to real shocks. Panel a of Figure 3 presents the decomposition for Poland. Notice that real exchange rate due to real shocks seems to be smoother than that due to nominal shocks. Second, between 1992-95, had not it been for nominal shocks, the real exchange rate would have appreciated more. Thus nominal shocks seem to have slowed down the real exchange rate appreciation in this period. Historical decomposition of the real exchange rate for Hungary indicates that nominal shocks had no major impact on the real exchange rate, which confirms earlier results. Moreover, nominal shocks contributed little if any to real exchange rate variability in Hungary.

IV. Conclusions and Recommendations for Future Research

This paper has offered an investigation for the sources of the movements of the real exchange of Poland and Hungary. The response of the real exchange rate to real shocks as well as nominal shocks is empirically estimated. The results show the relative importance of nominal and real shocks in explaining the short-run variation of the Polish and Hungarian real exchange rate has been quite different. In the case of Poland, nominal shocks had a bigger influence in explaining the short-run changes in the real exchange rate, whereas real shocks had a larger influence on the Hungarian real exchange rate.

The finding for Hungary is consistent with the evidence reported for industrial countries in Lastrapes (1992) and Enders and lee (1997) that real factors play a key a dominant role in determining the long-term trend of the real exchange rate in industrial countries, while monetary variables have insignificant, short-lived effect. In contrast, the results for Poland imply that there is scope for the effectiveness of monetary and exchange rate policies in manipulating the real exchange rate, at least, in the short run. In other words, an exchange rate and/or monetary policy aimed at maintaining international competitiveness through realistic exchange rates by managing the nominal exchange rate has been possible in Poland. In contrast, our results imply that, to improve its competitiveness through a real exchange rate policy, the Hungarian government needs to focus on the real side of the economy, such as improving efficiency and productivity.

Finally, our results have implications for modeling nominal and real exchange rates in transition economies. It seems, at least for Poland, the sticky-price, disequilibrium models (i.e., Dornbusch, 1976) are suitable in explaining the behavior of the real exchange rates. For Hungary, because the findings suggest that fluctuations over the transition period in real and nominal exchange rates have been primarily due to real shocks, one can conjecture that equilibrium exchange rate models along the lines of Stockman (1980,1987) are more suitable. More evidence from other transition economies would allow researchers to draw broader conclusions.

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Table 1. Variance decomposition of nominal and real exchange rates: 1990-98

	Poland				Hungary			
	REER		NEER		REER		NEER	
step	Percent of forecast error variance attributable to							
month	ε_r	ε_n	ε_r	ε_n	ε_r	ε_n	ε_r	ε_n
1	29.9	70.1	0.9	99.1	89.3	10.7	50.0	50.0
3	41.7	58.3	9.9	90.1	89.5	10.5	50.1	49.9
6	51.8	48.2	15.7	84.3	93.8	6.2	58.2	41.8
9	51.5	48.5	13.4	86.6	95.2	4.8	66.9	33.1
12	51.3	48.7	12.4	87.6	96.6	3.4	69.9	30.1
18	59.4	40.6	11.9	88.1	97.8	2.2	78.1	21.9
24	64.3	35.7	11.0	89.0	98.5	1.5	81.8	18.2
30	69.1	30.9	10.4	89.6	98.9	1.1	84.1	15.9
36	72.7	27.3	9.9	90.1	99.2	0.8	85.6	14.4
LR	100.0	0.0	6.8	93.2	100.0	0.0	91.0	9.0

Table 2. Variance decomposition of nominal and real exchange rates: 1990-98 period with a dummy variable for 1990-91

	Poland				Hungary			
	REER		NEER		REER		NEER	
step	Percent of forecast error variance attributable to							
month	ε_r	ε_n	ε_r	ε_n	ε_r	ε_n	ε_r	ε_n
1	57.7	42.3	12.6	87.4	96.5	3.5	93.1	6.9
3	67.4	32.6	23.8	76.2	97.9	2.1	90.8	9.2
6	74.8	25.2	26.4	73.6	94.4	5.6	91.2	8.8
9	72.3	27.7	18.9	81.1	93.9	6.1	91.8	8.2
12	70.0	30.0	14.0	86.0	95.4	4.6	89.7	10.3
18	74.3	25.7	9.2	90.8	96.9	3.1	90.6	9.4
24	75.5	24.5	5.9	94.1	97.9	2.1	90.5	9.5
30	77.8	22.2	4.2	95.8	98.4	1.6	90.6	9.4
36	79.5	20.5	3.3	96.7	98.7	1.3	90.8	9.2
LR	100.0	0.0	2.0	98.0	100.0	0.0	91.1	8.9

Table 3. Selected statistics on indicators of real exchange rate movements

	Annual percentage changes					
	Productivity		Real wages		Real unit labor costs	
year	Poland	Hungary	Poland	Hungary	Poland	Hungary
1991	-2.57	0.41	0.69	na	0.29	na
1992	6.06	5.84	-6.22	na	-12.06	na
1993	5.30	5.96	-2.24	2.54	-8.20	-2.77
1994	5.22	4.01	2.66	1.30	-1.35	-3.92
1995	3.31	6.21	3.83	-5.62	-2.38	-8.93
1996	1.28	4.07	5.93	-1.69	1.86	-2.97
1997	4.40	3.41	6.71	2.69	3.31	-1.71

Source: DRI

ENDNOTES

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2. For an excellent analysis of the role of real exchange rates in transition economies, see Orlowski and Corrigan (1997) and Orlowski (1998).

3. The fact that both Poland and Hungary used an adjustable peg should not render the decomposition invalid. Monthly nominal effective exchange rate indices are not constant for any consecutive months in the sample period for either country. Moreover, given the endogeneity of the money supply in a fixed exchange rate environment, a nominal shock can be interpreted as a shock that prompts a nominal devaluation.

4.Other transition economies, including the Czech Republic, are not included in the analysis due to lack of sufficient observations. For example, for the Czech Republic, data start in 1993, which does not provide enough degrees of freedom to get reliable estimates using the employed structural VAR model. In a future study, we plan to include other transition economies to draw more general conclusions. In this sense, our paper can be considered as exploratory, providing an initial analysis on this issue.

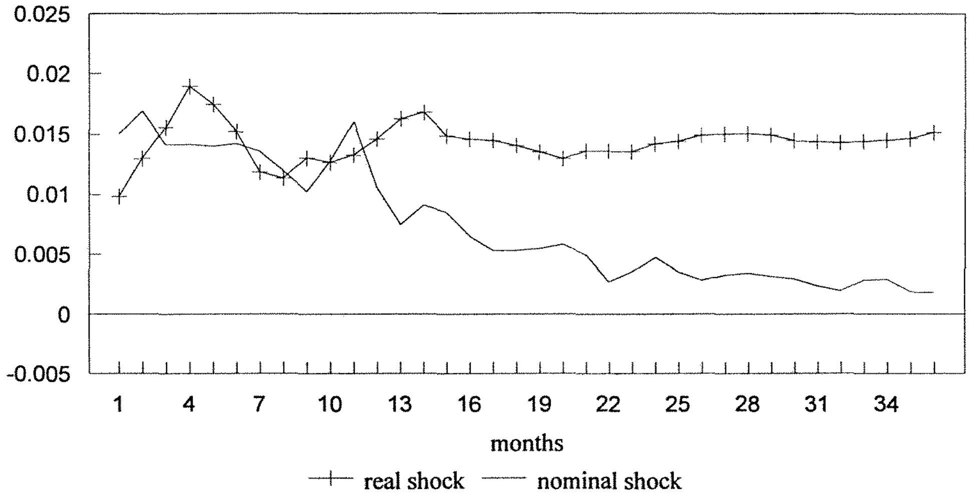
5. These results are not reported for space considerations, but they are available upon request from the authors.

6. We also estimated the model for 1992-98. The VDC results are almost identical to the model with a dummy variable.

7. Impulse response functions from the model with a dummy variable for the 1990-91 period and the model estimated over the 1992-98 sample yielded broadly similar results.

Figure 1. Response of the exchange rate to nominal and real shocks: Poland

a. Response of the real exchange rate



b. Response of the nominal exchange rate

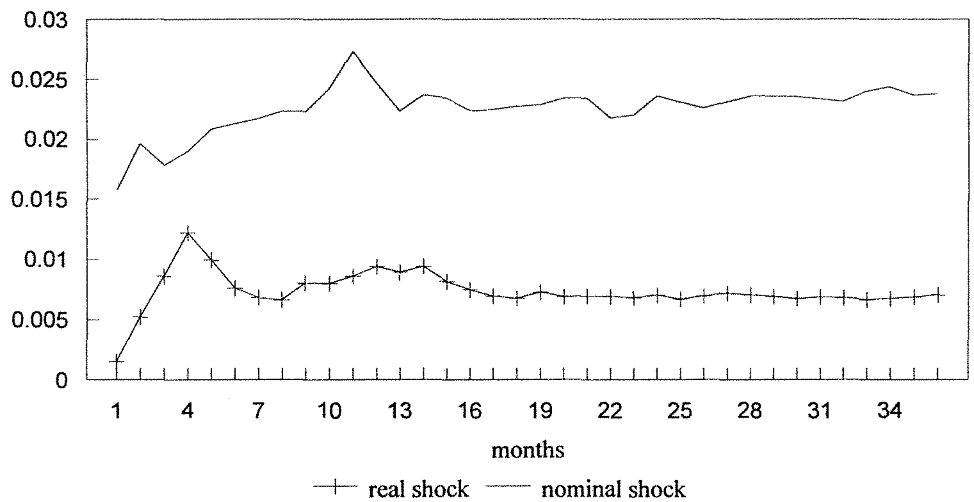
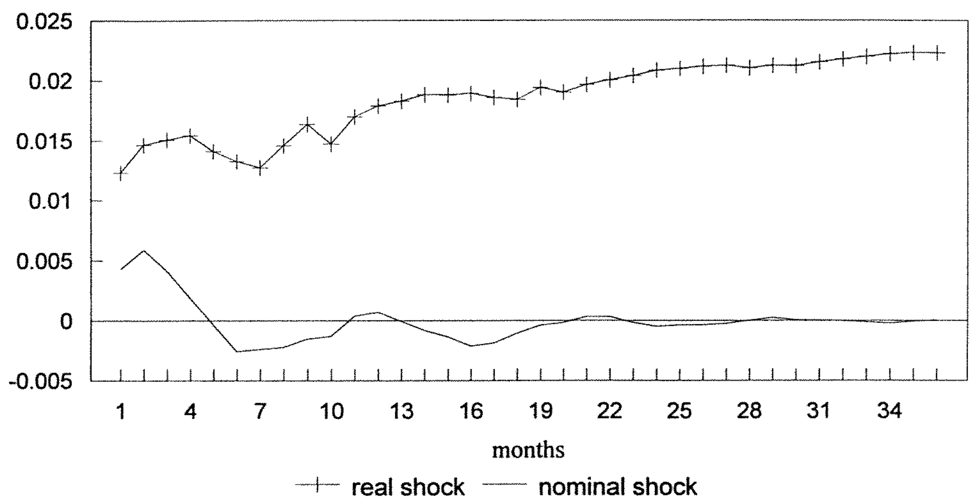


Figure 2. Response of the exchange rate to nominal and real shocks: Hungary

a. Response of the real exchange rate



b. Response of the nominal exchange rate

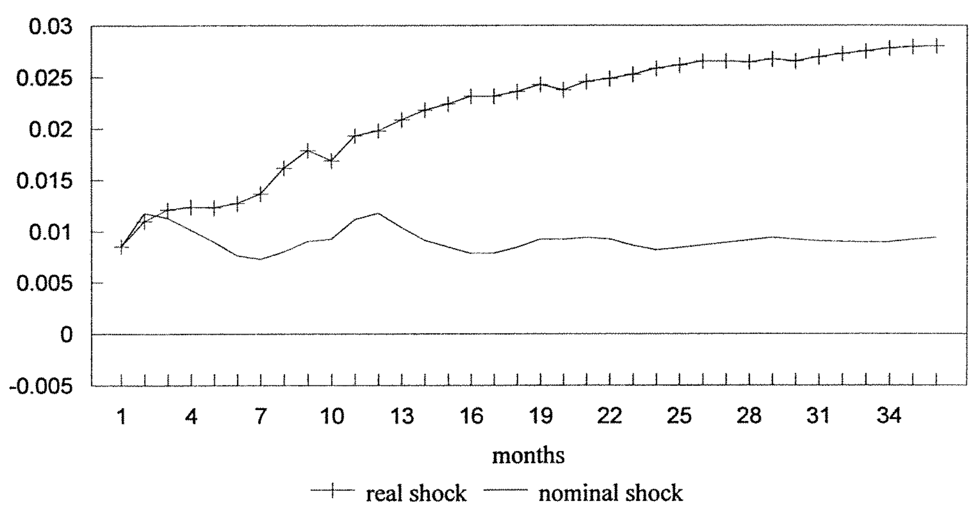
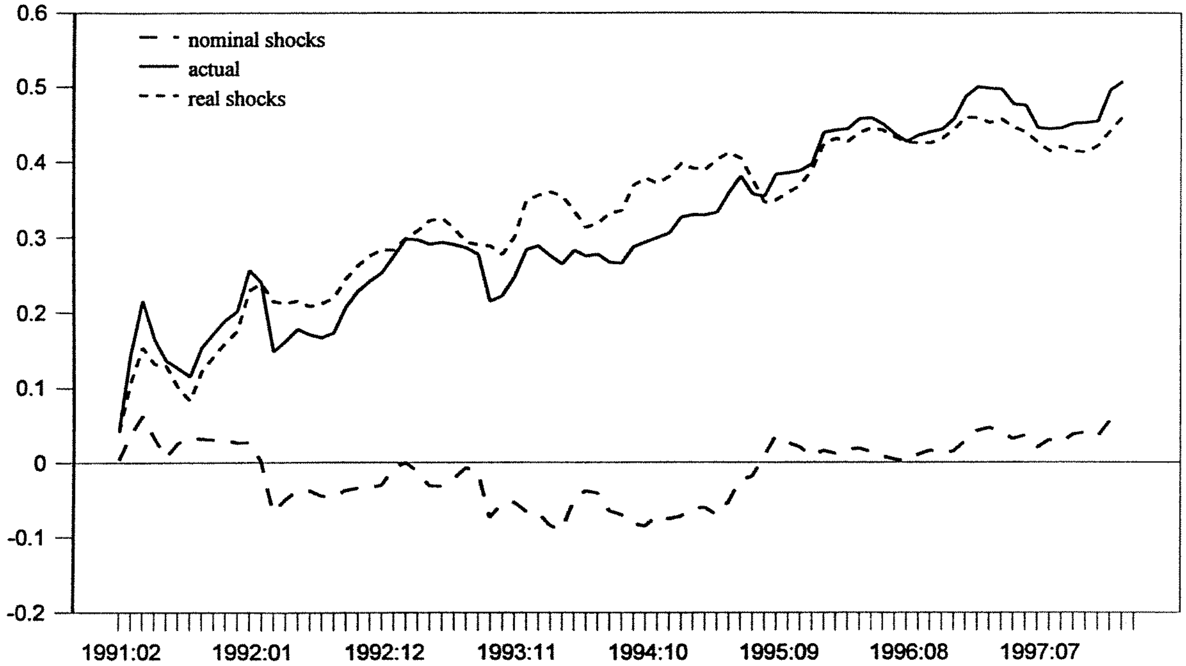


Figure 3. A historical decomposition of the real exchange rate

a. Poland



b. Hungary