

Dibooglu, Selahattin; Kutan, Ali M.

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Sources of real exchange rate fluctuations in transition economies: The case of Poland and Hungary

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Zentrum für Europäische Integrationsforschung
Center for European Integration Studies
Rheinische Friedrich-Wilhelms-Universität Bonn



Selahattin Dibooglu and Ali M. Kutan

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**SOURCES OF REAL EXCHANGE RATE
FLUCTUATIONS IN TRANSITION ECONOMIES:
THE CASE OF POLAND AND HUNGARY**

by

Selahattin Dibooglu* and Ali M. Kutan**

* Dibooglu --- Department of Economics, Southern Illinois University, Carbondale.
E-mail: dibo@siu.edu

** Kutan --- Department of Economics, Southern Illinois University, Edwardsville.
E-mail: akutan@siue.edu

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ABSTRACT

This paper examines Brada's (1998) conjecture about the path of real exchange rates in two successful transition economies, Hungary and Poland. He argues that, as a result of the very diverse fiscal and monetary policies to be found among these economies, real exchange rates in some economies should follow a path that mirrors mainly the effect of real shocks and others a path reflecting the monetary shocks. To test this hypothesis, we use a popular structural VAR model and, assuming long-run neutrality of nominal shocks, we decompose real exchange rate and price movements into those attributable to real and nominal shocks. Using monthly data from 1990 to 1999 for Hungary and Poland, we find that nominal shocks had a major influence in explaining real exchange rate movements in Poland, while real shocks had a larger influence on real exchange rate movements in Hungary.

Key words: nominal and real exchange rates, inflation, transition economies, structural VARs, exchange rate regimes, and exchange rate modeling.

JEL classification: C5, F3, and P5

I. Introduction

The exchange rate has been an important policy tool for many transition economies, serving as a nominal anchor for stabilization efforts. At the same time, 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 depreciation of their currency. This was followed by real appreciation as domestic inflation exceeded subsequent nominal depreciation over the course of transition (Brada, 1998).

The transition process involves the dismantling of old production structures and initiating structural reforms; as such, productivity growth and real wage changes can be expected to exert an upward pressure on the real exchange rate (Halpern and Wyplosz, 1997), due to the Balassa-Samuelson hypothesis, which posits that real exchange rate appreciation occurs in fast -growing, innovative economies. The liberalization of capital accounts and subsequent capital inflows can also lead to the appreciation of the real exchange rate (Orlowski, 1998 and Brada, 1998). Finally, nominal shocks can influence real exchange rates in high inflation countries. For example, Desai (1998) argues that much of the real appreciation was due to fiscal imbalances in transition economies and Nemenyi (1997, p.160) concludes that "fiscal policy changes are indeed the main driving forces of real economic fluctuations in Hungary".

Movements in the real exchange rate are of great importance for transition economies.¹ They play a significant role in altering international competitiveness, which is critical to the ongoing trade reorientation toward the West, and real appreciation encourages short-term portfolio inflow, possibly at the expense of long-term portfolio capital inflows or foreign direct investment (Orlowski, 2000). In addition, movements in real exchange rates may significantly affect inflation and output in transition economies. Real exchange rate movements can also signal

a currency crisis. For example, in his analysis of the Czech exchange rate crisis of 1997, Begg (1998) shows the critical role of the real appreciation of the koruna in the years leading up to the crisis even though the koruna was still somewhat undervalued at the time the crisis broke out. Drabek and Brada (1998) analyze how commercial policy has been used to slow down the effects on trade of the real appreciation of currencies in transition economies.

Because many transition economies have followed different fiscal and monetary policies (see Desai 1997 and 1998), we expect the path of exchange rate appreciation to be different across countries. In fact, Brada (1998) argues that “if we accept Begg’s (1998) evidence of slow productivity growth in the Czech Republic as a characteristic of other transition economies, then Desai’s (1998) evidence of the very different fiscal and monetary policies to be found among the transition economies suggests that monetary shocks should predominate over productivity shocks in both frequency and intensity “ (p. 620).

By decomposing real exchange rate and price movements into those attributable to real and nominal shocks, we examine Brada’s (1998) conjecture. In addition, this exercise provides insight into the sources of movements in real exchange rates and prices. Such decomposition is accomplished by imposing a long-run neutrality restriction that nominal shocks have no long -run effect on the real exchange rate. This restriction is consistent with economic theory. Because real exchange rates tend have a permanent component, Lastrapes (1992) and Enders and Lee (1997) used the assumption of long run neutrality of nominal shocks to discern the temporary and permanent components of the real exchange rate.

This decomposition is also useful to gauge the effectiveness of monetary and exchange rate policies in transition economies. A 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 policy makers the ability to influence the real exchange rate and to alter competitiveness. It also raises the possibility of increased real exchange rate variability induced by nominal shocks.

In this paper we decompose real exchange rate and price movements in Poland and Hungary to those attributable to nominal shocks and to real shocks for the transition period from January 1990 to present.² We also investigate the statistical significance of some country- and period-specific events such as regime changes and the financial crises in the East Asia and Russia to account for potential structural breaks in data due to these events. Based on the decomposition results, we explore the validity of Brada's (1998) argument and also judge the ability of policy makers to affect real exchange rates through adherence to nominal anchors such as monetary and exchange rate policies.

The rest of the paper is organized as follows. In the next section, we provide an overview of monetary policy in Hungary and Poland. Section III provides an explanation of data employed and describes our methodology. In Section IV, we present empirical results. Section V concludes and offers suggestions for future research.

II. Monetary Policy in Hungary and Poland³

A. Hungary

Hungary initially followed a gradualist macroeconomic policy at the beginning of 1990s. The authorities sought to balance the desire for reducing inflation with the need to control the government deficit and to service a large external debt. Too sharp a deflation would have reduced government revenues and increased expenditures on the social safety net; thus increasing the

government's need to borrow abroad. At the beginning of 1990 and 1991, the main concern of policy was to reduce the inflation rate. An adjustable peg system was thus adopted as an intermediate target and the official exchange rate was tied to a basket of 50 percent U.S. dollar and 50 percent German mark until May 1994, when the reference basket changed to 70 percent ECU and 30 percent the U.S. dollar. In the early 1990s, monetary policy involved an active exchange rate management based on a currency peg with a narrow band of permitted fluctuations (Kutan and Brada, 2000).

The monetary policy for the 1990-94 period had two important weaknesses. The first was a loose fiscal policy brought about by growing budget deficits and a high level of foreign debt at the beginning of 1990s. The disinflation policy combined with a fixed exchange rate resulted in continuous real appreciation, causing a loss of competitiveness and continuing current account deficits (Table 1). The conflicting priorities of the government, inflation and international competitiveness, led to speculation against the forint and thus undermined the credibility of the exchange rate regime.

The second policy weakness was an ineffective monetary policy. The liberalization of foreign exchange operations and continuous real appreciation of the forint, resulting in significant capital inflows, along with an unstable money demand function, gradually narrowed the scope of monetary policy in controlling the money supply. Moreover, during this period, there was no coordination between monetary and fiscal policy (Nemenyi, 1997).

The initial exchange rate policy that aimed at a real appreciation of the forint so as to help combat domestic inflation was seen as too costly over time because of the declining competitiveness of Hungarian exports and sluggish growth. Moreover it failed to provide a

nominal exchange rate anchor for inflationary expectations. These costs began to appear in 1993, when the current account deficit reached 9% of GDP and then increased to 9.4 % the following year. At the same time, the government's budget deficit remained unacceptably high (Table 1). Financing this deficit required monetary expansion as well as high interest rates to attract commercial banks to government securities, thus fueling the inflation that the "strong forint" policy had sought to reduce. The persistence of these twin deficits (Table 1) created uncertainty among Hungary's foreign creditors as well as concerns about the stability of the forint. The fact that the foreign exchange debt was also growing steadily put Hungary at a risk of insolvency. The macroeconomic situation was certainly not sustainable. The 1994 Mexican crisis further worsened Hungary's ability to borrow in international markets as the risk premium increased for emerging markets. The government realized that they could not sustain the dual objectives of controlling inflation and focusing on current account balance at the same time. As a result, the government announced a major fiscal adjustment program in March 1995 [Szapary and Jakab (1998)].

The adjustment program introduced a tight fiscal policy and aimed at building a credible monetary policy. The main concern of fiscal policy was to reduce the twin deficits through lower government expenditures, higher import tariffs, and by reduced government borrowing. These measures cut the budget deficit from 13.4 % of GDP in 1994 to 8.7 % in 1995 and 7.1 % in 1996 (Table 1). Economic growth first slowed as the result of the March 1995 measures, but it soon resumed and then accelerated. This growth has somewhat strained the macroeconomic balance, and the current account deficit increased to 4.8% of GDP in 1998 (Table 1). Inflation has declined steadily, in part due to falling prices of imports and also because of the slowing rate of depreciation of the forint. With respect to monetary policy, inflation reduction was given priority

over the current account balance and price stability was declared the key goal of monetary policy in the long run.

The March 1995 measures brought a major change in the nominal exchange rate regime as an intermediate target. The main objective of the new regime was to build some credibility for economic policy that would reduce the uncertainty associated with future policy measures and restore investors' confidence in the system (Nemenyi, 1997). Following a 9 percent devaluation of the official exchange rate, a preannounced crawling band exchange rate system was introduced in March 1995 (Table 2). The band of permitted fluctuations was set at 2.25 percent on either side of the parity, and the band has been maintained since then. The rate of crawl was set according to a target inflation rate. The initial monthly rate of crawling devaluation was 1.9 percent and then gradually reduced to 1.3 percent in June 1995, to 1.2 percent in January 1996, 1.1 percent in January 1997, 1.0 percent in August 1997, 0.9 percent in January 1998 and finally to 0.5 percent in January 1999. Table 2 provides a summary of the exchange rate measures in Hungary during the 1990-99 period.

The rate of devaluation preannounced in the crawling peg regime through 1999 served as a more effective nominal anchor for monetary policy than had the previous regime, and it also served to reduce speculation and the timing of foreign exchange transactions to anticipate devaluation. Hungary sterilized some of the inflows of short-term foreign capital as interest rates rose in the post-stabilization period, but in smaller amounts and at lower costs (Szapáry and Jakab, 1998).

B. Poland

The stabilization of the Polish economy began under much less favorable conditions than those found in Hungary. In 1989, inflation peaked at 54.8% per month, the government deficit was nearly 8% of GDP and both loss-making Polish firms and the government deficit were financed by the rapid expansion of money and credit. Although the government began to deal with the crisis in late 1989, a major stabilization began on January 1, 1990 with the introduction of the so-called Balcerowicz Plan. This plan had several components. The zloty (zl) was devalued from 5,560 zl/US\$ to 9,500 zl/US\$ and pegged at the latter rate. Monetary and fiscal policies were tightened, enabling the government to achieve a surplus equivalent to 0.4% of GDP, and credit creation was sharply curtailed (Kutan and Brada, 2000).

The consequences of this, the first stabilization and liberalization effort in a transition economy, were sufficiently virulent, both in the upsurge in prices and in the decline in production, to lead to an easing of macroeconomic policy late in 1990. However, the effects of this policy change were felt more in an acceleration of inflation than in real output growth (Wellisz, 1997), and the government soon abandoned this effort. As the recession deepened in 1991, the fiscal deficit reappeared and high inflation reduced the competitiveness of Polish exports. The zloty was devalued by 16.8 %, and its peg was shifted to a basket of currencies.

Policy priorities gradually shifted from stabilization to stimulating growth (Krzak, 1996). Although the fiscal deficit was cut from 6.7 % of GDP in 1992 to 3.1 % in 1993 (Table 3), a level around which it has fluctuated since, monetary policy was relatively expansionary. While interest rates remained positive, money supply and credit growth consistently outpaced targets set by the NBP. The zloty's peg was abandoned in October of 1991, replaced by a crawling peg with a preannounced devaluation of 1.8% per month against a basket of currencies. Table 4 provides a

summary of exchange rate policy regimes in Poland during 1990-1999.

Over time, the rate of depreciation has been reduced, and there have also been one-off devaluations and revaluations to accommodate exogenous shocks. In 1995, the band within which the zloty could fluctuate was widened to $\pm 7\%$. Poland's exchange rate policy was sufficiently credible to foreign investors that short-term capital inflows began to be a problem for the NBP by 1995, when, even with some NBP sterilization, capital inflows accounted for 59% of the growth of the money supply (Krzak, 1996, p. 57).

Although Poland has had the higher rate of inflation than Hungary over the decade of the 1990s, it has also had the fastest growth of real GDP (Table 3). This may be due as much to its earlier start in implementing economic reforms as to better economic policy, just as its higher rate of inflation may better reflect its higher pre-stabilization situation than a poorer ability to restrain the growth of the money supply than displayed by Hungary. Recently, this output growth has slowed somewhat due to a fall in exports to Russia and the Ukraine caused by the financial crises in those countries. As inflation has slackened and as the nominal anchor of the crawling peg has decreased in importance with a further widening of the bands, Poland has adopted inflation targeting as the framework for its monetary policy (Brada and Kutan, 1999). In 1998, the Monetary Policy Council has set a goal of lowering Polish inflation to 6.8-7.8% in 1999 and 4% as measured by the CPI by the year 2003. As shown in Table 3, the projected inflation rate for 1999 is 6.5 %, which is much lower than the estimates made by the Council in 1998 for 1999.

C. Variant monetary policies and real exchange rate movements

Brada (1998) and Desai (1997, 1998) argue that the different initial conditions and the different starting times of stabilization programs resulted in different paths for real exchange rates and prices. The variant approaches to monetary policy also likely resulted in different behavior of real exchange rates movements. For example, the post-1995 exchange rate regime of Hungary has strongly focused on the stability of the nominal exchange rate as a tool of disinflation and of preventing significant real appreciation of the forint in order to sustain the current account balance and to control capital inflows (Orlowski, 2000). In addition, the real exchange rate movements of the forint should have been mainly driven by real shocks because Hungarian authorities followed limited monetary discretion, and geared monetary and exchange rate policy towards nominal exchange rate stability.

On the other hand, Poland gradually moved from an exchange rate targeting regime to a more flexible exchange rate system. For example, Poland exited the pegged exchange rate in May 1991 much earlier than Hungary and introduced a crawling peg regime as early as in October 1991. The crawling devaluation was gradually reduced from the initial monthly rate of 1.8 percent in 1991 to 0.3 % in 1999. In addition, the Polish authorities gradually widened the initial band of 2.5 % in 1993 to 7.0 % in 1996, to 10 % in 1998 and finally to 15 % in 1999. This emphasis on a choice of a more flexible exchange rate policy over time was very evident in the annual reports of the National Bank of Poland, and more recently, in the Monetary Policy Assumptions for 2000 (Orlowski, 2000). Thus, given price inertia, a higher level of nominal exchange rate volatility that was evident in Poland can be expected to bring about a higher level of real exchange rate fluctuations (Figure 2). On the other hand, Hungary's strong focus on stability of nominal

exchange rates and absence of major inflationary shocks in this country during 1990-99 can be expected to result in real exchange rates mainly driven by real shocks⁴ (Orlowski, 2000). The next section offers empirical evidence regarding the sources of real exchange rate movements in Hungary and Poland.

III. Data and Methodological Issues

Because both Poland and Hungary implemented managed exchange rate regimes, the nominal exchange rate may not be stochastic. Thus, we consider the log price level p_t measured by the Consumer Price Index and the log real exchange rate, q_t , in our bivariate decompositions⁵. The latter is the CPI-based real effective exchange rate index, that is, the relative price of domestic goods in terms of foreign goods. The data are monthly observations from 1990:01 to 1999:03 taken from the CD ROM edition of *International Financial Statistics*. In order to properly specify the VAR, we test for unit roots, stationarity and cointegration. Table 5 presents Augmented Dickey-Fuller (ADF), KPSS, and cointegration test statistics.

The maximum lag in the ADF test is specified using the general to specific procedure (Hall, 1994). Starting from a maximum lag of 16, the lag length is pared down depending on the significance of the last coefficient. In testing for a unit root, we consider the possibility of a linear trend in price levels. The ADF test statistics indicate that a unit root cannot be rejected for real exchange rates and prices. KPSS tests in Table 5 confirm that stationarity can be rejected at conventional significance levels. Table 5 also presents the two step test for cointegration. In the first step, the real exchange rate is regressed on a constant and the price level. Then, the residuals are tested for unit roots using an ADF test. The test statistic in both Poland and Hungary indicate

that the price level and the real exchange rate are not cointegrated, hence a VAR in the first differences is appropriate.

While the sample period may be too short to assess mean reversion in real exchange rates, we believe that it is appropriate to model exchange rates as a unit root process within the sample period. This assumption allows us to estimate the exchange rate variability attributable to nominal and to real shocks. Assuming non-stationary real exchange rates is reasonable for 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 with the West and as productivity and real wages increase over time. Because such shocks are generally random (stochastic) in nature, we expect that real exchange rates will have a permanent (stochastic) component during this period.

Consider two types of orthogonal shocks that are the source of variation in the observed movements in real exchange rates and prices: a real shock, ϵ_{rt} , reflecting changes in endowment, productivity shocks, technology, and a nominal shock, ϵ_{nt} , caused by nominal money supply shocks or devaluation of the exchange rate). Because the vector $y_t = [q_t \ p_t]'$ is stationary, it can be written as an infinite moving average in the structural shocks

$$\begin{pmatrix} \ddot{A}q_t \\ \ddot{A}p_t \end{pmatrix} = \begin{pmatrix} A_{11}(L) & A_{12}(L) \\ A_{21}(L) & A_{22}(L) \end{pmatrix} \begin{pmatrix} \dot{a}_{rt} \\ \dot{a}_{nt} \end{pmatrix} \quad (1)$$

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 assumption can be imposed by restricting the coefficients in $A_{12}(L)$ to sum to zero; if $a_{ij}(k)$ is the k th coefficient in $A_{ij}(L)$, the restriction is equivalent to

$$\sum_{k=0}^{\infty} a_{12}(k) = 0 \quad (2)$$

so that the cumulative effect of \dot{a}_{nt} on q_t is zero. Note that the effects of nominal and real shocks on prices are not restricted. It is known that this method of decomposing a series into its permanent and temporary components is valid provided the joint behavior of real and nominal exchange rates contains reliable information about the underlying sources of fluctuations (Lastrapes, 1992).

IV. Empirical Results

A finite order bivariate vector autoregressive model (VAR) is estimated for Poland and Hungary with 12 lags. Starting with a maximum lag of 16, a likelihood ratio test indicates that the VAR can be pared down to 12 lags. In order to examine the possibility of exogenous shifts in the variables and regime changes, we test for the significance of period and policy specific dummies. First, for both countries, the period 1990-91 presents a period of price liberalizations

and frequent devaluations. Second, the Asian and Russian crisis in 1997-98 might have influenced the time path of the endogenous variables. Moreover, the implementation of the crawling peg in Hungary after March 1995 and the various exchange rate regimes in Poland are considered. Table 6 presents definitions of various dummies and likelihood ratio tests and p-values for the significance of these dummies. In each case, the resulting likelihood ratio test statistic is distributed as a χ^2 with 2 degrees of freedom.

It is evident from the table that the initial transition dummy d1 is significant for both Hungary and Poland at the 10 percent significance level. However, the Asian and Russian crisis dummy, d2, is not significant for either country. This evidence is broadly consistent with the findings of Orlowski (1999) who study the effects of the Asian and Russian crises on the economies of Poland, Hungary and the Czech Republic. The dummy variable d3, which represents the implementation of the preannounced crawling peg regime in Hungary in March 1995 and dummy variable d4, which represents three different exchange rate regimes in Poland are statistically significant at the 5 percent level. Hence in the final VAR model, we include d1 and d3 for Hungary and d1 and d4 for Poland.

After properly specifying the VARs, the restriction in equation (2) is imposed and the shocks are identified. 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 7 presents the VDC results for Poland and Hungary.

By construction, the effects of nominal shocks on real exchange rate necessarily die out; 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 volatility in

the short run. The results in Table 7 indicate that a sizable proportion of real exchange rate variability is due to nominal shocks in Poland. Specifically, at short-term forecasting horizons such as a month, nominal shocks are able to explain 63.1 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 finding lends some empirical support for disequilibrium models of the exchange rate (e.g., Dornbusch 1976) that 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, which will be examined shortly. Notice also that nearly all of the variation in the price level in the short run is due to real shocks in Poland.

The significance of nominal shocks in explaining real exchange rate movements is consistent with evidence reported in Enders and Lee (1997) for Brazil and Argentina. A key policy implication of the results for Poland is that, to the extent that nominal shocks are interpreted to stem from monetary policy actions, monetary policy has had a significant role in influencing the real exchange rates.

VDC results for Hungary are quite different from those for Poland. Although nominal shocks explain over 20 percent of real exchange rate variability at a 1-month horizon, there is little effect of nominal shocks after one year. Changes in real exchange rates are mostly dominated by real shocks in Hungary.

On the other hand, the relative contribution of nominal shocks to the price level variability in Hungary is higher than in Poland. In Poland real shocks explain 43 percent of the price level in the long run, while the effect of real shocks on the price level is negligible in Hungary. A possible

explanation for the relative preponderance of real shocks in explaining price levels in Poland is the pervasive imbalances in the real economy (Pujol and Griffiths, 1998). These imbalances have often resulted in relative price changes. In order to improve profitability, certain sectors (e.g., utilities and rental prices) increased prices well above other sectors to remain in business. Moreover, some sectors with large loss-making firms did not face hard budget constraints as these firms accounted for sizable employment and wielded substantial political powers. With widespread indexation, sectoral price changes are magnified. Based on a wage-price model of the Polish economy, Pujol and Griffiths (1998) estimate that after four years, the initial inflationary impact of a CPI shock is quadrupled, even if the exchange rate remains the same.

Given nominal exchange rate targeting in Hungary, it is interesting to find that the effect of real shocks on the price level is negligible. This result may provide important insight into the rate of the crawl and the price-setting behavior of domestic agents⁶. There is evidence that inflation in Hungary is to a large extent driven by expectations (Brada and Kutan (1999) and Suranyi and Vincze, 1998). Accordingly, Hungarian authorities have traditionally resorted to inflation to correct supply and demand imbalances. In the initial phase of the transition, this policy has helped avoid a surge of inflation when prices were fully liberalized but in the subsequent period, the smallest sign of external imbalances has immediately generated expectations of accelerating inflation. For example, worsening external imbalances in the 1992-95 period generated substantial inflationary expectations. As the public expected inflationary solutions to the deficit problem, price makers kept inflation higher than would otherwise have been warranted. Moreover, price setting firms did not let inflation fall in line with the decline in the rate of devaluation in 1992-93 (Suranyi and Vincze, 1998).

V. Further Analysis: Indicators of Real Exchange Movements

We have argued that different policy approaches taken by each country toward their economic liberalization provide a plausible cause for the differences in results. For instance, Hungary introduced partial price reforms in the 1980s prior to the start of the stabilization program. Recall that Hungarian authorities resorted to inflation in the central planning period to correct supply and demand imbalances. Therefore, Hungary did not experience a large, one-time increase in its price level. Many transition countries, including Poland, liberalized prices all at once and experienced significant inflation shocks during the early stages of reform. Although both countries introduced a fixed exchange rate regime at the beginning of stabilization program, the Polish zloty appreciated much more in real terms than did the Hungarian forint because Poland exited the pegged regime strategy much earlier than Poland and used a more flexible exchange rate regime. On the other hand, Hungary limited real exchange rate fluctuations by focusing on nominal exchange rate stability.

For the earlier years, the real exchange rate movements in Poland can be expected to be driven by the large initial undervaluation of the nominal exchange rate in relation to the its purchasing power estimate. Many claimed that the initial disequilibrium between the actual exchange rate and the exchange rate suggested by 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 fold less than 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. These devaluation rates can be expected to have dominated movements in the real exchange

rate, at least, at the beginning of the economic reforms in early 1990s. In contrast, Hungary did not have this problem. Thus, we expect that real forces such as the upgrading old technologies through foreign direct investment and the increase in product quality and structure were the main driving forces of observed real exchange rate appreciation in Hungary during our sample period. In fact, Szapary and Jakab (1998) report that, during the 1992-1997 period, the productivity of labor in Hungarian manufacturing industry rose by an average of 14 percent per year, and the recent improvement in the trade balance reflects not only increases in productivity but also diversification toward new exports of machinery, electronics, and other products that have emerged as a result of foreign direct investment and privatization.

In order to provide more insight into the real exchange rate developments in both countries, Table 8 reports data on measures of unit labor costs, productivity and real wages. The table indicates that both countries experienced significant productivity gains in the transition period. Because firms in both countries can be seen as price takers in international markets, productivity and real wage developments largely determine relative competitiveness.⁷

Although unit labor costs declined in Poland until 1993, with the exception of 1991, they increased continuously starting in 1995. The opposite holds for Hungary. Although unit labor costs increased until 1992, they have declined steadily in Hungary since then. Thus, declining labor costs played an important role in the appreciation of the forint in the 1990s. For Poland, while there seemed to be little wage pressure in the 1990-93 period, recent real wage increases have exceeded productivity gains, with increases in unit labor costs that 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 unit labor costs and increasing

competitiveness.⁸ Thus, the recent leveling off of the competitiveness of Polish exports and the continuing increase in competitiveness in Hungary seem to corroborate the hypothesis that there is a sizable transitory component in the real exchange rate in Poland but not in Hungary.⁹

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. The IRF's are presented with a 90 percent confidence interval obtained by bootstrapping based on 10,000 draws. It is evident from the figure that the real exchange rate increases in response to a real shock in both countries with a similar time path. Notice that the response appears to be significant. In response to a real shock that raises the relative price of domestic goods, the price level in both countries increases. However, except for the initial response, the response of the price level is not significant.

The response to a nominal shock exhibits interesting patterns. First, in both countries, the real exchange rate depreciates in response to a nominal shock. This points to nominal inertia in commodity prices and some overshooting of the nominal exchange rate. Since the real exchange rate is the relative price of domestic goods, a nominal shock leads to a nominal depreciation of domestic currency that exceeds the increase in the price level hence the real exchange rate depreciates. Indeed, an examination of data reveals that in both countries the standard deviation of the percentage change in the nominal exchange rate exceeds that of inflation¹⁰. However this overshooting does not seem to be significant for Hungary.

Second, the price level increases in response to a nominal shock as expected. The responses of prices to a nominal shock seem to be significant in both countries. However the point estimates of responses in Hungary lie outside the confidence interval. Given the fact that

confidence intervals give an idea about the true response, one should focus on the interval itself and not the sample response.

Finally, a historical decomposition of the real exchange rate is given in Figure 2. 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 2 presents the decomposition for Poland. Notice that real exchange rate movements due to real shocks seems to be smoother than those due to nominal shocks. Historical decomposition of the real exchange rate for Hungary indicates that nominal shocks had no major impact on the real exchange rate, particularly after 1995. Moreover, nominal shocks contributed little to real exchange rate variability in Hungary.

VI. Comparing Evidence from other Countries

The dynamic effects of nominal and real shocks in Poland and Hungary can be compared with those reported by Lastrapes (1992) for selected industrial countries such as Germany, Japan, Canada and Italy and Enders and Lee (1997) for low-inflation countries, Canada, Germany and Japan and for high-inflation, developing countries, Argentina and Brazil. For industrial countries with low-inflation rates, both studies concluded that real shocks explain the bulk of real exchange rate movements in all cases. Our evidence for Hungary is quite consistent with their finding. It suggests that, in a relatively low- or moderate-level of inflationary environment like Hungary's, nominal shocks do not affect real exchange rate movements.

For high inflation economies, Enders and Lee (1997) report that nominal shocks dominated the time path of both real and nominal exchange rates in Argentina and Brazil. The evidence here for Poland complements their finding that nominal shocks played a significant role in explaining real exchange rate fluctuations in Poland. Although the inflation rate declined significantly over time in Poland, the significant initial price shocks and probably large persistent inflationary expectations have played an important role in the determination of the zloty real exchange rate.¹¹

VII. Policy implications of empirical findings

The importance of nominal shocks for real exchange rate movements has important policy implications. First, as nominal shocks have a sizable impact on real exchange rates, it is important to minimize nominal shock variability, perhaps by following a 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, the authorities can 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. Nevertheless, authorities should avoid excessive devaluations since these tend to contribute to real exchange rate instability.

Our results have also implications for modeling exchange rates in transition economies. It seems, at least for Poland, that sticky-price, disequilibrium models (i.e., Dornbusch, 1976) are able to explain the behavior of the real exchange rate. For Hungary, because the findings suggest that exchange rate fluctuations 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.

VIII. Conclusions

This paper has investigated the sources of the real exchange movements in Poland and Hungary. The results show nominal shocks had a larger influence in explaining the short-run changes in the real exchange rates in Poland, whereas real shocks had a larger influence on the Hungarian real exchange rate movements. Although these results support

Brada's (1998) thesis that transition economies ought to have different exchange rate paths, they do not lend support for the notion that one type of shocks, such as monetary shocks, should necessarily dominate over other type of shocks, productivity shocks. Indeed, our results indicate that real shocks such as productivity shocks have predominated over nominal shocks such as monetary and nominal exchange rate shocks in terms of affecting exchange rate movements in Hungary, but the opposite was true for Poland.

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 role in determining the behavior of 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 particularly on the real side of the economy, such as improving efficiency and productivity.

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Table 1 – Hungary: Macroeconomic Indicators 1991-1999

	1991	1992	1993	1994	1995	1996	1997	1998	1999
GDP real growth rate (%)	-11.9	-3.1	-0.6	2.9	1.5	1.3	4.6	5.1	4.2
CPI rate of inflation (%)	34.2	23.0	22.5	18.9	28.3	23.5	18.3	14.4	10.6
In % of GDP:									
Current account balance	0.8	0.9	-9.0	-9.4	-5.6	-3.7	-2.1	-4.8	-4.3
Government deficit	9.6	9.8	15.4	13.4	8.7	7.10	7.0	6.9	Na
Consolidated Public debt	67.8	57.6	63.7	53.9	52.0	40.9	30.2	30.2	31.4

Note: Figures for 1999 are estimates.

Sources: Central Statistical Office Hungary and National Bank of Hungary

Table 2 – Exchange rate policy measures in Hungary: 1990-1999

Dates	Currency basket	Rate Adjustment
January 1, 1990	Introduction of an adjustable fixed rate regime based on the currency composition of previous year's foreign trade until December 8, 1991	
December 9, 1991	50% USD-50% ECU	-
March 16, 1992		1.90
June 24		1.60
November 19		1.90
February 12, 1993		1.90
March 26		2.90
June 7		1.90
July 9		3.00
August 2	50% US\$-50% DM	
September 29		4.50
January 3, 1994		1.00
February 16		2.60
May 13		1.00
May 16	70% ECU-30% US\$	
June 10		1.20
August 5		8.00
October 11		1.10
November 29		1.00
January 3, 1995		1.40
February 14		2.00
March 13		9.00
March 16	Introduction of preannounced crawling peg adjustments	Daily devaluations
March 16		0.060
July 1		0.042
January, 1 1996		0.040
January 1, 1997	70% DM-30% US\$	-
April 1		0.036
August 15		0.033
January 1, 1998		0.030
June 15		0.026
October 1		0.023
January 1, 1998	70% EURO-30% US\$	
January 1		0.020
July 1		0.016
October 1		0.013

Source: National Bank of Hungary, Annual Report, 1999.

Table 3. Poland: Macroeconomic Indicators 1990-1999

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
GDP real growth rate	-11.6	-7.0	2.6	3.8	5.2	7.0	6.1	6.9	4.8	3.5
CPI rate of inflation (end year)	249.0	60.4	44.3	37.6	29.4	21.6	18.5	13.2	8.6	6.5
In % of GDP:										
Current Account balance	5.2	-2.8	-3.7	-2.7	-1	4.3	-0.9	-3	-4.3	-6.7
General government balance*	3.1	-6.7	-6.7	-3.1	-3.1	-2.8	-3.3	-3.1	-3.0	-3.0
Public Debt	na	na	147.3	108.6	69.0	59.0	53.6	49.4	43.0	Na

Notes:

* General government includes the state, municipalities and extra-budgetary funds. General government balance excludes privatization receipts.

Figures for 1999 are estimates only.

Sources: *EBRD Transition Report, various issues, EIU and national statistics.*

Table 4. Exchange Rate Policy in Poland 1990-1999

Date	Regime
January 1990	Fixed exchange rate against the US \$ (After a 31.6% devaluation on January 1, 1990)
May 1991	Fixed rate against a basket of 5 currencies (after a 17% devaluation). Currency basket: 45% US\$, 35% DM, 10% British Pounds, 5% French franc, 5% CHF
October 1991	Crawling peg, pre-announced crawling devaluation at a monthly rate of 1.8%
February 1992	10.7% Devaluation
August 1993	7.4% Devaluation; monthly crawling rate 1.6%
September 1994	Monthly crawling rate 1.5%
November 1994	Monthly crawling rate 1.4%
February 1995	Monthly crawling rate 1.2%
May 1995	Crawling band, widened band (+/- 7%), same crawling rate
December 1995	6% Revaluation
January 1996	Monthly crawling rate 1.0%
February 1998	Band widened to +/- 10%, monthly crawl 0.8%
July 1998	Monthly crawling rate 0.65%
September 1998	Monthly crawling rate 0.5%
October 1998	Band widened to +/- 12.5%
January 1999	New currency basket: 55% EURO, 45% US\$
March 1999	Band widened to +/- 15%, monthly crawling rate 0.3%.

Source: Adapted from Nuti (2000)

Table 5. Unit Root, Stationarity and Cointegration Tests

	Poland		Hungary	
	REER ^a	CPI ^b	REER ^a	CPI ^b
ADF statistic	-2.40	-0.67	-2.49	-0.26
Lag length	11	13	10	14
KPSS statistic ^c	1.842	0.540	1.525	0.330
Cointegration ADF statistic ^d	-2.76		-1.37	
Lag length	10		10	

Notes:

^a The test assumes a constant in the ADF and KPSS procedures. The ADF critical values for 100 observations are -2.89 (5 percent) and -3.51 (1 percent). The KPSS critical values are 0.463 (5 percent), and 0.739 (1 percent).

^b The test assumes a constant and a linear trend in the ADF and KPSS procedures. The ADF critical values for 100 observations are -3.45 (5 percent) and -3.73 (1 percent). The KPSS critical values are 0.146 (5 percent), and 0.216 (1 percent).

^c Lag truncation is set at 4.

^d Cointegration test is the residual ADF statistic from the regression of REER on a constant and CPI. The critical value of the test for 2 variables and 100 observations at the 5 percent significance level is -3.37. The critical value is from Engle and Yoo (1987), p. 157.

Table 6. Likelihood ratio tests of period-specific dummies

	Poland			Hungary		
	d1	d2	d4	d1	d2	d3
Likelihood Ratio $\chi^2(2)$	5.70	0.66	6.63	5.21	0.86	7.42
p-value (%)	5.79	71.79	3.64	7.37	64.97	2.44

Definition of dummies:

d1 (price liberalizations and devaluations): 1990:1-1991:12 = 1, 0 otherwise

d2 (Asian and Russian crisis): 1997:5-1998:8 = 1, 0 otherwise

d3 (crawling peg in Hungary): 1995:5-1999:3 = 1, 0 otherwise

d4 (Polish exchange rate regimes):

a. Peg 1990:1-1991:5 = 0,

b. Crawling peg 1991:6-1995:4 = 1,

Table 7. Variance decomposition of real exchange rates and price levels

	Poland				Hungary			
	Real exchange rate		Prices		Real exchange rate		Prices	
Step	Percent of forecast error variance attributable to							
Month	r	n	r	n	r	n	r	n
1	36.9	63.1	92.9	7.1	77.9	22.1	8.7	91.3
3	54.7	45.3	77.3	22.7	83.6	16.4	10.3	89.7
6	67.6	32.4	61.2	38.8	89.5	10.5	9.0	91.0
9	67.6	32.4	46.3	53.7	89.7	10.3	6.7	93.3
12	66.2	33.8	41.7	58.3	90.9	9.1	7.0	93.0
18	73.5	26.5	48.5	51.5	92.3	7.7	3.7	96.3
24	76.0	24.0	45.1	54.9	93.4	6.6	5.3	94.7
30	79.0	21.0	45.0	55.0	94.2	5.8	4.9	95.1
36	81.2	18.8	44.4	55.6	94.8	5.2	5.9	94.1
LR	100.0	0.0	43.1	56.9	100.0	0.0	8.6	91.4

Table 8. Indicators of real exchange rate movements: Hungary and Poland (Annual % Change)

HUNGARY							
Unit Labor Costs (ULC) manufacturing sector	1991	1992	1993	1994	1995	1996	1997
DM ULC	29.4	7.6	-9.6	-1.0	-8.7	na	na
US\$ ULC				-3.6	-19.1	-3.4	0.6
Productivity	0.4	5.8	5.9	4.0	6.2	4.1	3.4
Real Wages	-8.2	-1.1	2.5	1.3	-5.6	-1.7	2.7
POLAND							
Unit labor costs Manufacturing sector	1991	1992	1993	1994	1995	1996	1997
DM ULC	66.5	-8.7	-8.8	-7.3	15.1	na	na
US\$ ULC				-6.2	2.9	9.0	3.0
Productivity	-2.6	6.1	3.3	5.2	3.3	1.3	4.4
Real Wages	0.7	-6.2	-2.2	2.7	3.8	5.9	6.7

Sources: DRI, IMF, EBRD Transition Report and own calculations.

Figure 1. Impulse response functions with 90 % confidence interval

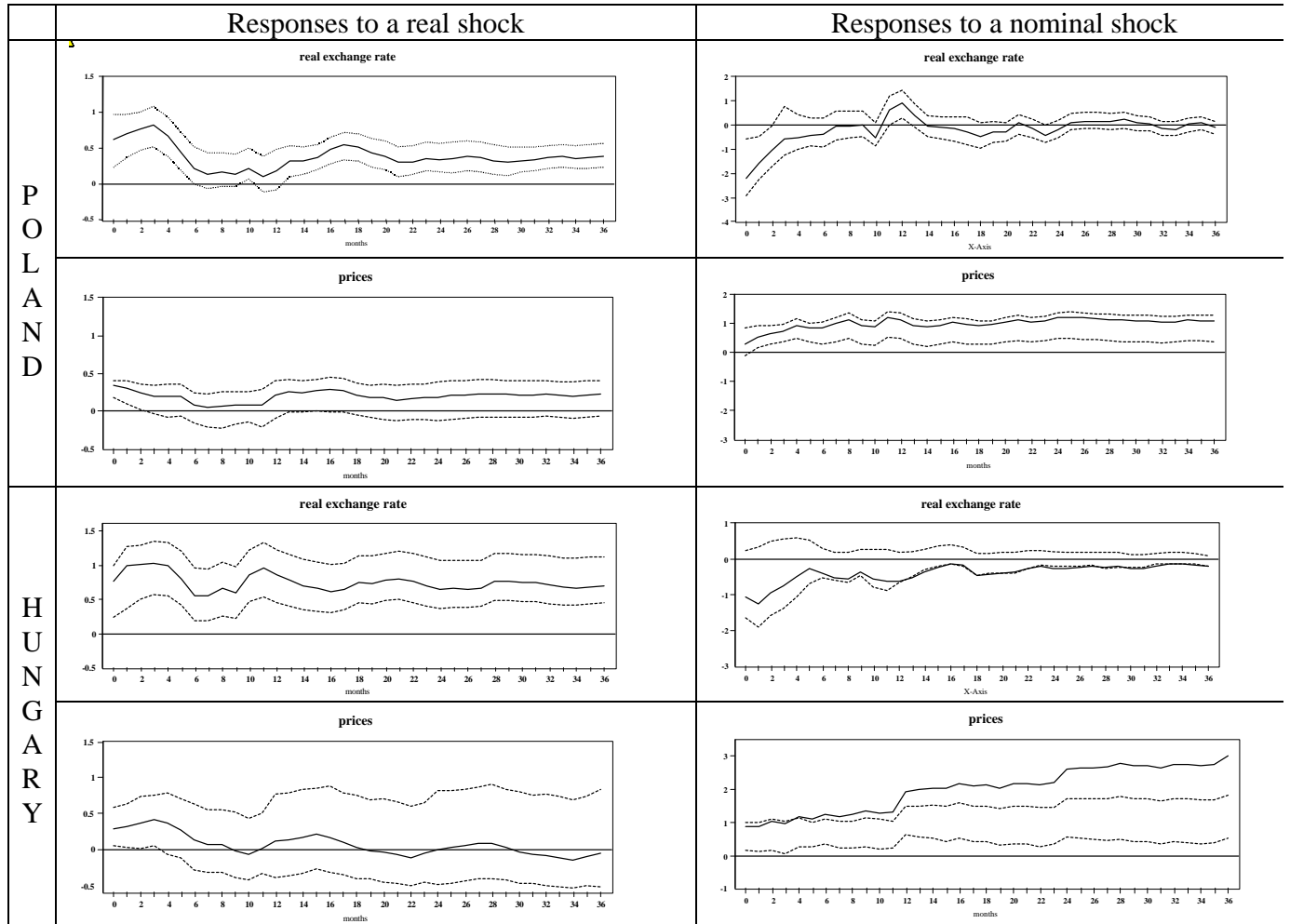
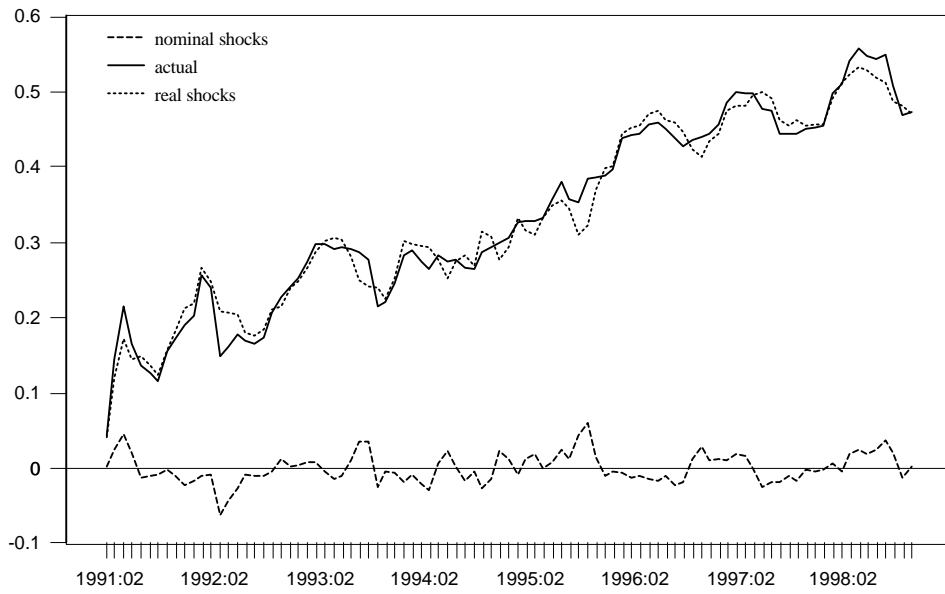
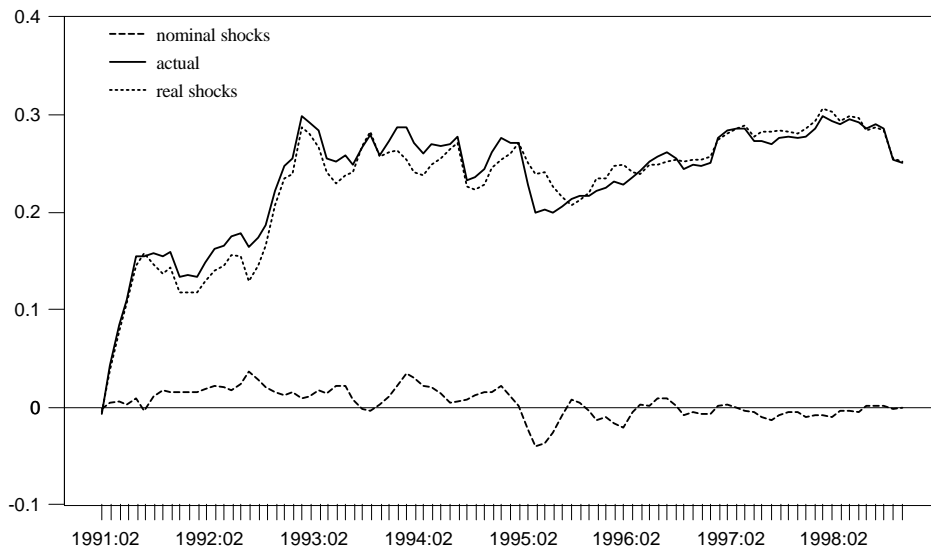


Figure 2. A historical decomposition of the real exchange rate

a. Poland



b. Hungary



ENDNOTES

¹ For a recent analysis of the role of real exchange rates in transition economies, see Halpern and Wyplosz (1997), Orlowski and Corrigan (1997), and Orlowski (1998,2000).

² 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.

³ This section draws on Kutan and Brada (2000).

⁴ In general, fixed exchange rate arrangements (including a currency board) provide commitment mechanisms that limit discretionary policies, and given price inertia, they limit real exchange rate variability as compared to flexible exchange rates.

⁵ An initial version of this paper used decomposition based on real and *nominal* exchange rates instead of real exchange rates and *price levels*. We are thankful to a referee for suggesting that it may not be proper to use nominal exchange rates in our analysis, because of the managed nature of these rates during our sample period.

⁶ We are grateful to a referee for pointing out the role of expectations.

⁷ Krajnyak and Zettelmeyer (1998) give a detailed assessment and the extent of the change in competitiveness.

⁸ For further evidence on quantifying productivity gains in selected transition economies, see Brada and Kutan (2000a,b).

⁹ Indeed, the most recent ranking by the World Economic Forum showed Hungary much more competitive than other transition economies (see below). Poland, as expected from our discussion and evidence in Table 8, lagged behind Poland.

World Economic Forum Economic Global Competitive Ranking

Hungary	38 th
Czech Republic	39 th
Poland	43 rd
Slovakia	45 th
Bulgaria	56 th
Ukraine	58 th
Russia	59 th

Source: <http://www.eerg.com/>

¹⁰ The standard deviation of inflation in Hungary is 0.0060 as compared to percent change in the nominal exchange rate, which has a standard deviation of 0.0075. The figures for Poland are 0.0096 and 0.0104, respectively.

¹¹ Brada and Kutan (1999) provide evidence for persistent inflationary expectations in Poland and in other transition economies

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Zentrum für Europäische Integrationsforschung
Center for European Integration Studies
Rheinische Friedrich-Wilhelms-Universität Bonn

Walter-Flex-Strasse 3
D-53113 Bonn
Germany

Tel.: +49-228-73-1732
Fax: +49-228-73-1809
www.zei.de