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Explaining Real Exchange Rates Fluctuations

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RESUMEN

Este trabajo tiene como objetivo analizar las fuentes de fluctuación del tipo de cambio real para un conjunto de economías avanzadas y economías europeas en transición. Para ello, en primer lugar, se obtienen dos medidas de la proporción de la varianza del tipo de cambio real explicada por los movimientos en el precio relativo de los bienes comerciables entre países. En segundo lugar, se estiman modelos VAR estructurales (SVAR) para descomponer los movimientos en los tipos de cambio real y nominal en los causados por perturbaciones reales y nominales. Finalmente, los dos pasos anteriores se completan con un análisis de impulso- respuesta. Los resultados sugieren que: (1) para las economías en transición, bajo regímenes de tipo de cambio controlados, el precio relativo de los bienes no comerciables explica un importante porcentaje de la varianza del tipo de cambio real; (2) hay evidencia de inestabilidad en la descomposición de la varianza del tipo de cambio real para las economías avanzadas entre submuestras y (3) como resultado de las diferentes políticas fiscales y monetarias de las economías en transición, el tipo de cambio real viene explicado en algunas de ellas, principalmente, por perturbaciones reales, mientras que en otras, por perturbaciones nominales.

Palabras clave: tipo de cambio real, tipo de cambio nominal, perturbaciones reales, perturbaciones nominales, modelos SVAR, economías avanzadas, economías en transición.

JEL classificación: C10, F31, P52

ABSTRACT

This paper attempts to explain the sources of real exchange rate fluctuations for a set of advanced economies and Central and Eastern European transition economies. To address this, firstly, we compute two measures of the share of the variance in the real exchange rate accounting for movements in the relative prices of traded goods between countries. Secondly, we estimate structural (identified) vector autoregression (SVAR) models, and decompose real and nominal exchange rate movements into those caused by real and nominal shocks. Thirdly, we complete the previous steps with an impulse-response analysis. The results suggest that: (1) for transition economies, under regimes of managed nominal exchange rates, the relative price of non-traded goods explains a large percentage of the variance in the real exchange rate; (2) there is evidence of instability in the variance decomposition of real exchange rates for advanced economies across samples; and (3) as result of diverse fiscal and monetary policies in transition economies, real exchange rates in some economies are driven mostly by real shocks while in others they are driven mostly by nominal shocks.

Keywords: real exchange rate, nominal exchange rate, real shocks, nominal shocks, SVAR models, advanced economies, transition economies.

JEL classification: C10, F31, P52

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1. Introduction

Recent empirical literature on real exchange rate fluctuations for advanced economies has focused mainly on three approaches: the analysis of real exchange rate volatility, the computation of several measures of the share of the variance in the real exchange rate and variance decomposition analysis. In this context, from papers based on the two former approaches, empirical evidence suggests that real exchange rates movements could be explained by the relative price of traded goods between countries, so the non-traded component of the real exchange rate accounted for little of the movements in the real exchange rate (Engel, 1993; Rogers and Jenkins, 1995; Engel 1999; Engel and Rogers, 2000). This result provides evidence in favour of sticky price models (Dornbusch, 1976) where nominal shocks would explain real exchange rate fluctuations.

However, from papers based on the relative importance of real and nominal shocks for explaining variance in the real exchange rate –variance decomposition analysis– results suggest that fluctuations in real and nominal exchange rates are due primarily to real shocks. Thus, real shocks dominate nominal shocks for both exchange rate series over short and long frequencies (Lastrapes, 1992; Enders and Lee, 1997). This empirical evidence would have implications on modelling exchange rates: models focused on the properties of price levels would be adequate (Balassa, 1964; Samuelson, 1964).

On the other hand, recent empirical papers for transition economies attempt to explain the strong real exchange rate appreciation observed in a number of transition economies during the so called transition period: following a sharp initial depreciation, real exchange rates have continuously appreciated over the course of transition (Halpern and Wyplosz, 1997; Begg et al. 1999). Part of this literature is focused on testing the Balassa-Samuelson effect on these economies (Halpern and Wyplosz, 2001; Broeck and Sløk, 2001; Égert, 2002). These papers suggest, in general, that there is clear evidence in favour of productivity-based exchange rate movements –in favour of the Balassa-Samuelson effect– in the European Union accession countries. This evidence would imply that real shocks might be the main force that explains movements in the real exchange rate.

However, other papers suggest that the similar path followed by the real exchange rate in transition economies is surprising given the differences in monetary and real shocks in different countries (Brada, 1998; Desai, 1998; Dibooglu and Kutan, 2001). This approach is based on the experience of all transition economies with respect to productivity growth, liberalization and capital inflows have not been the same. Moreover, the very different fiscal and monetary policies among the transition economies suggest that monetary shocks could dominate over productivity shocks in both frequency and intensity. Thus, not only real shocks but nominal shocks too could explain real exchange rate movements in transition economies during the transition period.

The central lesson from this previous literature is that there is ~~a~~ mixed empirical evidence for explaining the sources of real exchange rate fluctuations in advanced and transition economies. Thus, this paper tries to shed some light on what we could call the real exchange rate fluctuation puzzle. In other words, the main goal of this paper is to analyze the sources of real exchange rate fluctuations for a set of advanced economies during the period 1973:1 to 2000:1 (distinguishing two subperiods from 1973:1 to 1990:12 and from 1991:1 to 2000:1), and for a set of selected Central and Eastern European transition economies, during the transition period, from 1991:1 to 2000:1.

To address this, we follow three steps. In a preliminary step, we compute two measures of the share of the variance in the real exchange rate which accounted for movements in the relative prices of traded goods between the countries. One measure is based on R^2 coefficient and the other is based on the mean-squared error (MSE) of changes in the real exchange rate. In a second step, we estimate structural (identified) vector autoregression (SVAR) models, and decompose real and nominal exchange rate movements into those caused by real and nominal shocks. In this step we try to identify the main forces that explain the behaviour of the real exchange rate in advanced and transition economies. In a third step, we complete the previous ones with an impulse-response analysis.

The final goals of the empirical analysis are to compare results on the sources of real exchange rate movements between subperiods for advanced economies, between advanced and transition economies during the transition period from plan to market and, finally, to draw some conclusions on how to model the exchange rates.

The remainder of the paper is organized as follows. Section 2 presents our theoretical starting point, describes the data set and reports the empirical results on real exchange rate fluctuations in three subsections: the R^2 coefficient and MSE measures, the variance decomposition analysis and the impulse-response analysis. Section 3 concludes the paper.

2. Explaining Variance in the Real Exchange Rate

In this section we develop the analysis of the sources of fluctuations in the real exchange rate in three steps. Firstly, we compute two measures of the share of the variance in the real exchange rate which accounted for movements in the relative prices of traded goods between the countries. Secondly, we estimate SVAR models, and decompose real and nominal exchange rate movements into those caused by real and nominal shocks. Thirdly, we use the impulse-response analysis to study the effects of a shock to an endogenous variable on the variables in the SVAR.

Our theoretical starting point is to break down the real exchange rate into two components: the relative price of traded goods between countries and a weighted difference of the relative price of non-traded to traded goods prices in each country. Let p_t be the log of a general price index for a country:

$$p_t = (1-a)p_t^T + ap_t^{NT} \tag{1}$$

where p_t^T is the log of traded goods price index, p_t^{NT} is log of the non-traded goods price index and *(1-a)* and *a* are the weights on traded and non-traded goods in the general price index, respectively. Similarly, the foreign general price index can be written as

$$p_t^* = (1-b)p_t^{T*} + bp_t^{NT*} \tag{2}$$

where *(1-b)* and *b* are the weights on traded and non-traded goods in the general price index in the foreign country, respectively. If s_t denotes the log of the nominal exchange rate, the real exchange rate could be written as

$$q_t = s_t + p_t^* - p_t = (s_t + p_t^{T*} - p_t^T) + b(p_t^{NT*} - p_t^{T*}) - a(p_t^{NT} - p_t^T) \qquad (3)$$

or, similarly, as

$$q_t = q_t^T + z_t \qquad (4)$$

where

$$q_t^T = (s_t + p_t^{T*} - p_t^T)$$
$$z_t = b(p_t^{NT*} - p_t^{T*}) - a(p_t^{NT} - p_t^T)$$

If from equation (4) we obtained that movements in the real exchange rate are explained by the relative price of traded goods between countries, q_t^T, this result would imply that models which focus on nominal exchange rate determination in a framework of sticky prices (sticky price disequilibrium models) would be a good approximation to model exchange rates. In other words, nominal shocks would cause short-run excess volatility in exchange rates (Dornbusch, 1976). On the other hand, if we obtained that movements in the real exchange rate are explained by the relative price of non-traded to traded goods prices in each country, this result would suggest that we could model the exchange rates using models based on the properties of price levels. Thus, real shocks would play a central role in explaining real exchange rate fluctuations (Balassa, 1964, Samuelson, 1964).

To carry out our empirical analysis, we use two sets of data. The first set is monthly data of the consumer price index, the food consumer price index, the consumer services price index and the end of period nominal exchange rates, for a set of advanced economies. In particular, for Canada, Japan and The United States the sample size covers the period from 1973:1 to 2000:1, for all time series. For France and Italy, from 1973:1 to 1998:12 for all series. For Germany from 1973:1 to 1998:12 for all series, except for the consumer services price index that covers from 1976:1 to 1998:12, and for United Kingdom from 1973:1 to 2000:1 for all series, except for the consumer services price index that covers the period from 1975:1 to 2000:1. We construct the general real exchange rate using the consumer price index. Moreover, we use the food

price index as proxy of traded goods prices, and construct the relative price of traded goods between countries from it, and the services price index as proxy of non-traded goods prices.

The second data set is similar to the previous one but for a selected set of Central and Eastern transition economies. In particular, the series covers the period from 1991:1 to 2000:1, the transition period, for The Czech Republic, Hungary, Poland and Romania, and from 1991:12 to 1999:12 for Slovenia[1]. As in the previous data set, we construct the general real exchange rate from the consumer price index and consider the food price index as proxy of traded goods prices and the services price index as proxy of non-traded goods prices.

The data have been obtained from the OECD database, and, in particular, from the Main Economic Indicators database for all countries.

2.1. Preliminary Analysis

In this subsection, we compute two measures of the share of the variance in the real exchange rate q_t, due to the relative price of traded goods between countries, q_t^T. The first one is a very simple measure based on the R^2 coefficient from the ordinary least square regression on the changes of q_t on q_t^T, at four different horizons.

The second measure is based on the MSE of the change in the real exchange rate[2]. We try to compute how much of the MSE of changes of q_t is attributable to changes in q_t^T, at four different horizons. In particular, we use the next decomposition

$$\frac{MSE(q_t^T - q_{t-n}^T)}{MSE(q_t^T - q_{t-n}^T) + MSE(z_t - z_{t-n})} \tag{5}$$

where the MSE is defined as the sum of the square drift and the variance,

$$MSE(q_t^T - q_{t-n}^T) = \text{var}(q_t^T - q_{t-n}^T) + \left[mean(q_t^T - q_{t-n}^T)\right]^2 \tag{6}$$

[1] These countries have been selected depending on the data availability.
[2] See Engel (1999).

with

$$mean(q_t^T - q_{t-n}^T) = \frac{n}{N-1}(q_N^T - q_1^T)$$

$$\text{var}(q_t^T - q_{t-n}^T) = \frac{N}{(N-n-1)(N-n)} \sum_{j=1}^{N-n} \left[q_{j+n}^T - q_j^T - mean(q_{j+n}^T - q_j^T) \right]^2$$

where N is the sample size and n is the horizon.

Tables 1 and 2 report the empirical results regarding the simple R^2 measure at four different horizons, for the full sample, 1973:1–2000:1, and for the subsamples 1973:1–1990:12 and 1991:1–2000:1.

Table 1 reports the values of the R^2 measured for the advanced economies of Canada, France, Germany, Italy, Japan, United Kingdom and United States. We observe that, for example, the average value of the R^2 measure is 0.86 for horizon 1, during the subperiod 1973:1–1990:12 while for the transition period it increases to 0.93. It would suggest some evidence in favour of a more important role of sticky prices in the subperiod 1991:1–2000:1. Table 2 reports the results of the R^2 measure for the transition economies of The Czech Republic, Hungary, Poland, Romania and Slovenia, during the transition period. We can see that the relative prices of non-traded goods seem to explain the movements in the real exchange rate as a greater percentage than in advanced economies.

These preliminary results are confirmed when the measure of the share of the variance in the real exchange rate, attributed to the movements in the traded real exchange rate based on the MSE, is used. Tables 3 and 4 show the results. From Table 3 we observe that, for the full sample and subsample 1973:1–1990:12, the relative price of non-traded to traded goods prices plays some role in explaining the movements in q_t. For example, it could be observed in the MSE measure values of the bilateral relationships between Canada and United States, Germany and France, Japan and Canada, Japan and the three Euro Zone countries and those bilateral relationships that include The United Kingdom. However, when we analyze the transition period from 1991:1 to 2000:1, q_t^T causes the majority of the variance of q_t.

Table 4 reports the measure of the share of the variance in the real exchange rate attributed to movements in the traded real exchange rate based on the MSE, for transition economies. We observe that the results change strongly: in general, the relative prices of non-traded goods explain much more than in advanced economies. This, then, would suggest an important result: in these economies, under managed nominal exchange rates, the relative prices of non-traded goods could account for 50% to 70% of the variability of the real exchange rate. For example, for the bilateral relationship between The Czech Republic and The United States we observe that the relative prices of non-traded goods cause the 50%, 51%, 57% and 70% for 1, 6, 12 and 36 months, respectively, of the variability of the real exchange rate.

In conclusion, two central messages are derived from this first approximation towards explaining fluctuations in the real exchange rate: (1) for advanced economies, using food and services price indexes as proxies of traded and non-traded goods prices, respectively, we observe that the relative price of traded goods explains the majority of the variance in the real exchange rate for the transition period. In other words, it looks as if nominal shocks play a much more central role during the period 1991:1–2000:1 than during the full period and subperiod 1973:1–1990:12. (2) For transition economies, the evidence would suggest that under regimes of managed nominal exchange rates, the relative price of non-traded goods explains a large percentage of the variance in the real exchange rate.

2.2. The Variance Decomposition Analysis

In this subsection we estimate structural (identified) vector autoregression SVAR models, and decompose real and nominal exchange rate movements into those caused by real and nominal shocks. In this step, we try to identify the main forces that account for the behaviour of the real exchange rate in advanced and transition economies, and compare it between the two during the transition period from plan to market.

We assume that there are two types of shocks affecting nominal and real exchange rates. The first shock has an effect on both exchange rates and we will call it real shock. The second one, which we will call nominal shock, has no long-run effect on real exchange rate. This assumption is consistent with the notion of long-run money neutrality. Thus, real shock affects the real and nominal exchange rate while nominal shock affects the nominal exchange rates, although it has transitory but no permanent

effect on the real exchange rate. Therefore, neutrality restriction forces real shock to account for all the variance in the real exchange rate at an infinitive forecast horizon, so we are interested in the explanatory power of real and nominal shocks over short horizons. This assumption allows us to identify the model and decompose the exchange rate series. The two disturbances are uncorrelated at all leads and lags.

We present now the joint process followed by the real exchange rate, q_t, and nominal exchange rate, s_t, for advanced economies[3]. We will call this empirical model the SVAR(q_t, s_t) model. In addition, as nominal exchange rates are managed during the transition period for transition economies, we will compute the decomposition on real exchange rates and prices levels, instead of nominal exchange rates, for transition economies[4]. We will refer to this empirical model as the SVAR(q_t, p_t) model. As the series are non-stationary in levels, stationary in differences[5] and not cointegrated series, using the Johansen's (1988, 1992) cointegration methodology[6], then a bivariate autoregression model in the first differences is appropriate.

Let u_{rt} and u_{nt} denote the real and nominal shocks in *t*, respectively. Since the vector of the first differences in real and nominal exchange rates $x_t \equiv \left[\Delta q_t, \Delta s_t\right]'$ is stationary, it has the next bivariate moving average representation,

$$x_t \equiv \left[\Delta q_t, \Delta s_t\right]' = C(L)u_t \tag{7}$$

or, similarly

$$\begin{bmatrix} \Delta q_t \\ \Delta s_t \end{bmatrix} = \begin{bmatrix} C_{11}(L) & C_{12}(L) \\ C_{21}(L) & C_{22}(L) \end{bmatrix} \begin{bmatrix} u_{rt} \\ u_{nt} \end{bmatrix} \tag{8}$$

where Δ is the first-difference operator and $C_{ij}(L)$, for *i,j*=1,2, are polynomials in the lag operator, *L*. To identify the shocks, we have assumed that nominal shocks have no

[3] See Blanchard and Quah (1989), Lastrapes (1992) and Enders and Lee (1997) among others.
[4] As Dibooglu and Kutan (2001) suggest.
[5] The results of unit root analysis, based on the Dickey-Fuller and Phillips-Perron unit root tests, are available upon request.
[6] Cointegration results are available upon request.

long-run effect on the real exchange rate. In terms of equation (8), this restriction is equivalent to imposing that the sum of coefficients in $C_{12}(L)$ equals zero. Thus,

$$\sum_{k=0}^{\infty} c_{12}(k) = 0 \tag{9}$$

where $c_{12}(k)$ is the *kth* coefficient in $C_{ij}(L)$.

The empirical model in equation (8) is completed for each transition economy by introducing a dummy variable to capture the effects on endogenous variables of changes in the exchange rate regimes during the transition period (see Table 5).

Finally, we carry out our empirical analysis for advanced economies for the period 1973:1 to 2000:1, and the subperiods 1973:1–1990:12 and 1991:1–2000:1, and for transition economies for the period 1991:1–2000:1. Moreover, we calculate the real exchange rates taking The United States as the reference country for advanced economies, and we calculate the real exchange rates for transition economies, taking not only The United States as a reference country but Germany too.

Empirical results on the variance decomposition analysis are reported in Tables 6 and 7. Table 6 shows the results of variance decomposition of real and nominal exchange rates for advanced economies, for the full sample 1973:1–2000:1 and for the subsamples, taking The United States as the reference country to construct the real exchange rates. From panels (a) and (b) we observe that, for all the countries, real shocks seem to cause almost all forecast error variance in the real and nominal exchange rates. Results for the period 1991:1–2000:1 are reported in panel (c). We notice that the importance of nominal shocks increases substantially to explain the variance in the real and nominal exchange rates. In particular, for Canada we observe that nominal shocks dominate real shocks and cause almost all the variance in the real and nominal exchange rates. For example, nominal shocks explain about 85% of the variance in the real exchange rate at a horizon of 1 month and this percentage increases about 95% at a horizon of 9 months. For France, nominal shocks explain a large percentage of the variance in the real exchange rate and are central to explaining the variance of the nominal exchange rate at any horizon. For Germany, nominal shocks explain an important percentage of the variance of the real exchange rate, especially, in short run

horizons. Similar results are obtained for the nominal exchange rate. Finally, for Italy, Japan and United Kingdom the importance of nominal shocks increases in comparison with the full sample and subsample 1973:1–1990:12, but it is weaker than in Canada, France and Germany. In particular, for Italy nominal shocks explain somewhat more of the variance in the real exchange rate at 12, 24 and 36 horizons, and for Japan and United Kingdom nominal shocks explain somewhat more of the variance in the real exchange rate at short horizons.

From the evidence of the variance decomposition analysis of the real and nominal exchange rates for advanced economies, we can draw several main conclusions: (1) the evidence suggests that, in general, for the full sample and subsample 1973:1–1990:12 real shocks play a central role in explaining the movements of the real exchange rate, so changes in the real exchange rate would be dominated by real shocks. Nominal shocks are slightly more important for explaining the forecast variance in nominal exchange rates; (2) for the period 1991:1–2000:1, results suggest that a large proportion of the real exchange rates movements is due to nominal shocks; (3) these results suggest evidence in favour of instability in the variance decomposition in real exchange rates across samples. In other words, the sources of fluctuations of exchange rates depend on the sample that we consider. It would have a clear implication for modelling exchange rates in advanced economies. For the period 1973:1–1990:12 real shocks seem to dominate nominal shocks and so, this result would suggest that models that emphasize the importance of real shocks to explain the sources of fluctuations in the real exchange rate, such as Balassa's (1964) and Samuelson's (1964) models, would be adequate. However, for the subperiod 1991:1–2000:1, in general, nominal shocks play a central role in explaining fluctuations in exchange rates, so the sticky price models, such as Dornbusch's (1976) model, would be more adequate to model exchange rate behaviour.

Next, we present the results of the variance decomposition analysis for transition economies, during the transition period from 1991:1 to 2000:1. The analysis has been carried out from our empirical model in equation (8) but using the real exchange rate and the price levels as endogenous variables, the SVAR(q_t, p_t) model. We take The United States and Germany, alternatively, as reference countries to construct the real exchange rates.

Table 7 illustrates results for the SVAR(q_t , p_t) model where The United States is the reference country. The dummy variable that captures the specific regime changes in each of the transition economies, has been significant only for Hungary and Romania. Results suggest that for The Czech Republic real shocks dominate the changes in the real exchange rates. For example, real shocks explain about 79% of the variance in the real exchange rate at a 1-month forecasting horizon. Moreover, nominal shocks explain almost all the error variance of prices levels, although its importance decreases over the horizons. The results are similar for Hungary: real shocks explain almost all the variance in the real exchange rate, especially, over short horizons. For example, real shocks explain 97% of the variance in the real exchange rate at a horizon of 1 month. Nominal shocks cause a large percentage of the variance of the prices over short horizons. However, for Poland the results have changed from the previous ones. We observe that nominal shocks dominate real shocks to explain the variance in the real exchange rate at short horizons. For example, nominal shocks explain about 73% of the variance in the real exchange rate at a horizon of 1 month. However, prices are dominated by real shocks at short horizons. For Romania results show how changes in the real exchange rate are dominated by nominal shocks over short horizons. For example, nominal shocks explain about 92% of the variance in the real exchange rate at a horizon of 1 month. However, real shocks seem to explain almost all of the variance in prices. Finally, for Slovenia the results show a clear dominance of real shocks to explain the variance in the real exchange rate. In addition, if we consider Germany as a reference country to construct the real exchange rates[7], the results hardly differ from the previous ones: for The Czech Republic, Hungary and Slovenia real shocks mostly explain the fluctuations in the real exchange rate while nominal shocks are the main force which explain the fluctuations in the real exchange rates for Poland and Romania.

In short, two main conclusions can be drawn from the variance decomposition analysis carried out for transition countries: (1) the sources of fluctuations of real exchange rates depend on the transition economy under consideration. In particular, real shocks mostly explain movements in the real exchange rates for The Czech Republic, Hungary and Slovenia while nominal shocks play a central role in explaining the variance in the real exchange rate for Poland and Romania. Thus, our results support

[7] Results are available upon request.

previous literature (Brada, 1998; Desai, 1998; Dibooglu and Kutan, 2001), which suggests that as a result of diverse fiscal and monetary policies, real exchange rates in some accession economies could be driven mostly by real shocks, while in others they could be driven mostly by nominal shocks. So, these results suggest that different monetary and fiscal policies in transition economies imply different results from the variance decomposition analysis. (2) From this analysis we can see implications for modelling the real exchange rate in transition economies. For The Czech Republic, Hungary and Slovenia real shocks dominate and it would suggest models such as Balassa's (1964) and Samuelson's (1964) models would be adequate. Thus, during the transition period, as a consequence of the transformation of sizable industrial sectors, whose capital stocks have proven largely obsolete, these economies have presented an important increase in productivity growth in their industrial sectors, during the transition from plan to market. This could explain the strong appreciation of real exchange rate in these transitions economies. However, nominal shocks would largely explain the movements in real exchange rates for Poland and Romania, so disequilibrium models would be adequate to model the real exchange rate. Thus, it seems that monetary policy has had an important role in influencing the real exchange rate in Poland and Romania.

2.3. Impulse-Response Analysis

In this subsection, we use the impulse-response analysis to study the effects of both types of shocks on the endogenous variables in the SVAR models. In general, we observe several features:

(1) For advanced economies, during the full period[8], results in Figure 1 suggest that real shocks cause a smooth increase in real and nominal exchange rates. Moreover, nominal shocks cause an unnoticeable effect on real exchange rates, thus, there is no evidence of overshooting. However, during the transition period, in general, nominal shocks tend to cause, an increase in real exchange rates: there is some evidence in favour of overshooting.

(2) For transition economies, in general, Figure 2 shows that the real exchange rate raises are due to a real shock. For The Czech Republic and Poland the real exchange rate depreciates smoothly in response to a nominal shock. For Romania we observe

[8] Similar results are obtained for the subperiod 1973:1-1990:12.

a more important depreciation of the real exchange rate in response to a nominal shock. Thus, for these accession economies there is evidence in favour of overshooting.

3. Concluding Remarks

This paper has analyzed the sources of real exchange rate fluctuations for a set of advanced economies and Central and Eastern transition economies. The central messages drawn from the results suggest that:

(1) For advanced economies, previous empirical evidence, which suggests that fluctuations in the real exchange rate are explained by the relative price of traded goods between countries, does not hold for transition economies: under regimes of managed nominal exchange rates, the relative price of non-traded goods explains a large percentage of the variance in the real exchange rate.

(2) There is evidence in favour of instability in the variance decomposition of the real exchange rates across samples for advanced economies. In other words, sources of fluctuations of real exchange rates depend on the sample that we have considered: for the period 1973:1–1990:12 the real shocks appear to dominate nominal shocks and for the period 1991:1–2000:1, in general, nominal shocks play a central role in explaining fluctuations in exchange rates. This result would imply that models which emphasize the importance of real shocks to explain the sources of fluctuations of the real exchange rate, would be more adequate for the subsample 1973:1–1990:12, while sticky price disequilibrium models would be more adequate for the period 1991:1–2000:1

(3) For the Euro Zone countries we observe that nominal shocks seem to dominate real exchange rate fluctuations during the subperiod 1991:1–2000:1. This reveals the central role of the Single Monetary Policy for these Euro Zone countries. However, as result of diverse fiscal and monetary policies in transition economies, real exchange rates in some economies are driven mostly by real shocks, while in others they are driven mostly by nominal shocks.

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Table 1
Measure of the share of the variance in the real exchange rate attributed to movements in the relative price of traded goods based on R^2

(a) Advanced Economies[a]
Sample: 1973:1-2000:1[b]

1/6	USA	CAN	FRA	GER	ITA	JAP	UK
USA		0.80	0.96	0.96	0.96	0.93	0.76
CAN	0.78		0.94	0.95	0.94	0.90	0.74
FRA	0.96	0.95		0.88	0.94	0.91	0.66
GER	0.96	0.95	0.88		0.93	0.89	0.66
ITA	0.95	0.95	0.94	0.93		0.92	0.67
JAP	0.96	0.95	0.96	0.96	0.97		0.74
UK	0.90	0.89	0.87	0.88	0.86	0.91	

12/36	USA	CAN	FRA	GER	ITA	JAP	UK
USA		0.83	0.96	0.96	0.96	0.97	0.93
CAN	0.84		0.94	0.94	0.94	0.96	0.91
FRA	0.97	0.94		0.95	0.93	0.97	0.91
GER	0.97	0.94	0.96		0.95	0.97	0.93
ITA	0.96	0.93	0.95	0.96		0.98	0.95
JAP	0.98	0.95	0.96	0.94	0.98		0.96
UK	0.96	0.94	0.91	0.93	0.93	0.97	

(b) Advanced Economies[a]
Sample: 1973:1-1990:12

1/6	USA	CAN	FRA	GER	ITA	JAP	UK
USA		0.77	0.96	0.96	0.94	0.92	0.78
CAN	0.68		0.94	0.95	0.93	0.90	0.75
FRA	0.96	0.94		0.91	0.94	0.90	0.70
GER	0.95	0.94	0.90		0.93	0.89	0.70
ITA	0.94	0.93	0.93	0.91		0.90	0.70
JAP	0.96	0.94	0.96	0.96	0.97		0.70
UK	0.90	0.87	0.88	0.89	0.87	0.91	

12/36	USA	CAN	FRA	GER	ITA	JAP	UK
USA		0.72	0.96	0.95	0.94	0.97	0.93
CAN	0.76		0.93	0.93	0.93	0.96	0.90
FRA	0.97	0.94		0.96	0.91	0.97	0.90
GER	0.97	0.94	0.97		0.93	0.97	0.93
ITA	0.96	0.93	0.94	0.94		0.98	0.89
JAP	0.98	0.95	0.94	0.90	0.95		0.95
UK	0.96	0.94	0.90	0.92	0.89	0.95	

(c) Advanced Economies[a]
Sample: 1991:1-2000:1[c]

1/6	USA	CAN	FRA	GER	ITA	JAP	UK
USA		0.89	0.97	0.96	0.99	0.95	0.92
CAN	0.90		0.97	0.98	0.97	0.95	0.92
FRA	0.98	0.98		0.68	0.96	0.94	0.85
GER	0.96	0.98	0.65		0.96	0.92	0.84
ITA	0.98	0.98	0.97	0.95		0.96	0.85
JAP	0.98	0.98	0.98	0.97	0.99		0.94
UK	0.96	0.96	0.95	0.94	0.92	0.98	

12/36	USA	CAN	FRA	GER	ITA	JAP	UK
USA		0.98	0.98	0.99	0.98	0.98	0.96
CAN	0.98		0.98	0.98	0.98	0.98	0.96
FRA	0.98	0.97		0.85	0.97	0.99	0.96
GER	0.98	0.98	0.93		0.98	0.98	0.96
ITA	0.98	0.97	0.98	0.99		0.99	0.98
JAP	0.99	0.98	0.98	0.99	0.99		0.98
UK	0.94	0.93	0.97	0.97	0.94	0.98	

Notes
a. USA: United States, CAN: Canada, FR: France, GER: Germany, ITA: Italy, JAP: Japan, UK: United Kingdom.
b. Sample period for France, Germany and Italy: 1973:1-1998:12.
c. Sample period for France, Germany and Italy: 1991:1-1998:12.

Table 2
Measure of the share of the variance in the real exchange rate attributed to movements in the relative price of traded goods based on R^2

Transition Economies[a]
Sample: 1991:1-2000:1[b]

1/6	USA	CREP	HUN	POL	ROM	SLOV
USA		0.83	0.83	0.86	0.92	0.88
CREP	0.82		0.80	0.86	0.91	0.89
HUN	0.74	0.77		0.88	0.89	0.86
POL	0.82	0.82	0.79		0.91	0.84
ROM	0.91	0.88	0.90	0.89		0.94
SLOV	0.86	0.87	0.72	0.74	0.94	

12/36	USA	CREP	HUN	POL	ROM	SLOV
USA		0.91	0.74	0.88	0.93	0.98
CREP	0.96		0.72	0.79	0.94	0.88
HUN	0.93	0.71		0.80	0.94	0.71
POL	0.96	0.89	0.87		0.92	0.76
ROM	0.75	0.87	0.88	0.87		0.94
SLOV	0.96	0.77	0.23	0.51	0.88	

Notes
a. CREP: Czech Republic, HUN: Hungary, POL: Poland, ROM: Romania, SLOV: Slovenia.
b. Sample period for Slovenia: 1991:12-1999:12.

Table 3
Measure of the share of the variance in the real exchange rate attributed to movements in the relative price of traded goods based on MSE

(a) Advanced Economies[a]
Sample: 1973:1-2000:1[b]

1/6	USA	CAN	FRA	GER	ITA	JAP	UK
USA		0.80	0.96	0.94	0.97	0.90	0.85
CAN	0.82		0.90	0.92	0.88	0.80	0.72
FRA	0.97	0.93		0.73	0.85	0.81	0.67
GER	0.95	0.91	0.75		0.84	0.82	0.67
ITA	0.98	0.89	0.86	0.83		0.81	0.67
JAP	0.89	0.83	0.80	0.80	0.80		0.77
UK	0.82	0.67	0.60	0.60	0.60	0.68	

12/36	USA	CAN	FRA	GER	ITA	JAP	UK
USA		0.85	0.97	0.95	0.97	0.90	0.81
CAN	0.74		0.93	0.91	0.90	0.83	0.66
FRA	0.97	0.90		0.73	0.86	0.77	0.60
GER	0.93	0.94	0.70		0.80	0.78	0.61
ITA	0.96	0.89	0.84	0.81		0.75	0.60
JAP	0.91	0.80	0.80	0.81	0.80		0.68
UK	0.87	0.75	0.70	0.64	0.67	0.80	

(b) Advanced Economies[a]
Sample: 1973:1-1990:12

1/6	USA	CAN	FRA	GER	ITA	JAP	UK
USA		0.82	0.96	0.95	0.94	0.90	0.85
CAN	0.83		0.89	0.91	0.85	0.77	0.69
FRA	0.98	0.93		0.77	0.80	0.76	0.65
GER	0.96	0.91	0.77		0.82	0.79	0.64
ITA	0.97	0.89	0.82	0.81		0.74	0.64
JAP	0.90	0.78	0.74	0.77	0.74		0.73
UK	0.81	0.63	0.57	0.57	0.56	0.63	

12/36	USA	CAN	FRA	GER	ITA	JAP	UK
USA		0.83	0.98	0.96	0.97	0.90	0.80
CAN	0.85		0.94	0.91	0.90	0.77	0.63
FRA	0.97	0.89		0.75	0.84	0.74	0.55
GER	0.93	0.93	0.66		0.80	0.77	0.55
ITA	0.91	0.84	0.76	0.76		0.71	0.53
JAP	0.91	0.74	0.74	0.77	0.70		0.64
UK	0.89	0.73	0.70	0.61	0.64	0.78	

(c) Advanced Economies[a]
Sample: 1991:1-2000:1[c]

1/6	USA	CAN	FRA	GER	ITA	JAP	UK
USA		0.84	0.96	0.95	0.98	0.92	0.81
CAN	0.88		0.95	0.96	0.96	0.91	0.82
FRA	0.95	0.94		0.69	0.93	0.92	0.73
GER	0.96	0.95	0.70		0.94	0.90	0.72
ITA	0.97	0.95	0.92	0.95		0.95	0.73
JAP	0.93	0.94	0.93	0.91	0.93		0.88
UK	0.76	0.81	0.77	0.71	0.75	0.86	

12/36	USA	CAN	FRA	GER	ITA	JAP	UK
USA		0.89	0.94	0.95	0.97	0.93	0.78
CAN	0.73		0.94	0.95	0.94	0.94	0.84
FRA	0.95	0.95		0.71	0.89	0.90	0.82
GER	0.92	0.95	0.72		0.94	0.88	0.72
ITA	0.98	0.98	0.94	0.94		0.90	0.75
JAP	0.92	0.92	0.90	0.84	0.95		0.90
UK	0.76	0.80	0.72	0.72	0.75	0.89	

Notes
a. USA: United States, CAN: Canada, FR: France, GER: Germany, ITA: Italy, JAP: Japan, UK: United Kingdom.
b. Sample period for France: 1973:1-1998:12 for all series, for Germany from1 973:1 to 1998:12 for all series except for the service price index: 1976:1-1998:12; for United Kingdom from 1973:1 to 2000:1 for all series except for the service price index: 1975:1-2000:1.
c. Sample period for France and Germany: 1991:1-1998:12.

Table 4
Measure of the share of the variance in the real exchange rate attributed to movements in the relative price of traded goods based on MSE

Transition Economies[a]
Sample: 1991:1-2000:1[b]

1/6	USA	CREP	HUN	POL	ROM	SLOV
USA		0.50	0.76	0.61	0.75	0.72
CREP	0.49		0.49	0.53	0.79	0.55
HUN	0.88	0.47		0.62	0.78	0.70
POL	0.59	0.41	0.64		0.89	0.56
ROM	0.70	0.76	0.81	0.90		0.75
SLOV	0.53	0.44	0.66	0.51	0.68	

12/36	USA	CREP	HUN	POL	ROM	SLOV
USA		0.43	0.85	0.60	0.73	0.51
CREP	0.30		0.42	0.31	0.79	0.40
HUN	0.61	0.39		0.53	0.88	0.62
POL	0.57	0.44	0.55		0.92	0.49
ROM	0.87	0.76	0.78	0.82		0.62
SLOV	0.73	0.41	0.57	0.52	0.77	

Notes
a. CREP: Czech Republic, HUN: Hungary, POL: Poland, ROM: Romania, SLOV: Slovenia.
b. Sample period for Slovenia: 1991:12-1999:12.

Table 5
Exchange Rate Arrangements in Transition Economies

	Peg	Crawling Peg	Crawling Bands	Managed Float	Independent Float
CREP[a]	1990:1-1995:12	-	1996:1-1997:5	1997:6-2000:1	-
HUN	1990:1-1995:4	-	1995:5-2000:1	-	-
POL	1990:1-1991:5	1991:6-1995:4	1995:5-1999:3	-	1999:4-2000:1
ROM	1990:1-1992:1	-	-	1992:2-2000:1	-
SLOV	-	-	-	1992:2-2000:1	-

Notes
a. CREP: Czech Republic, HUN: Hungary, POL: Poland, ROM: Romania, SLOV: Slovenia.

Table 6
Variance Decomposition of Real and Nominal Exchange Rates

Advanced Economies[a]												
	(a) Sample 1973:1-2000:1[b]				(b) Sample 1973:1-1990:12				(c) Sample 1991:1-2000:1[c]			
	RER[d]		NER[d]		RER		NER		RER		NER	
CAN												
Horizon	u_r[e]	u_n[f]	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n
1	98.36	1.63	85.21	14.78	97.90	2.09	82.70	17.29	15.15	84.84	31.86	68.13
3	99.24	0.75	86.65	13.34	98.20	1.79	80.24	19.75	8.71	91.28	22.63	77.36
6	99.43	0.56	86.09	13.90	96.26	3.73	74.17	25.82	5.15	94.84	17.20	82.79
9	99.56	0.43	87.58	12.41	97.04	2.95	74.60	25.39	4.75	95.26	15.90	84.09
12	99.24	0.75	90.85	9.14	98.00	1.99	79.24	20.75	5.50	94.49	14.12	85.87
24	99.27	0.72	92.88	7.11	98.88	1.11	82.46	17.53	13.85	86.14	22.25	77.74
36	99.52	0.47	93.43	6.56	99.12	0.87	83.63	16.36	17.99	82.00	26.90	73.09
FRA												
Horizon	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n
1	96.76	3.23	99.12	0.87	99.50	0.49	97.28	2.71	56.28	43.71	61.65	38.35
3	98.52	1.47	99.49	0.50	97.68	2.31	93.18	6.81	62.34	37.65	67.63	32.36
6	99.24	0.75	98.89	1.10	92.18	7.81	86.29	13.70	55.02	44.97	60.66	39.33
9	98.81	1.18	97.48	2.51	87.14	12.85	80.90	19.09	43.47	56.52	48.96	51.03
12	99.07	0.92	97.74	2.25	87.86	12.13	81.69	18.30	29.70	70.29	33.49	66.50
24	99.51	0.48	98.03	1.96	90.00	9.99	83.62	16.37	27.32	72.67	30.19	69.80
36	99.66	0.33	98.13	1.86	91.18	8.81	84.78	15.21	26.89	73.10	28.81	71.18
GER												
Horizon	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n
1	86.32	13.67	78.79	21.25	99.86	0.13	99.67	0.32	50.29	49.70	41.11	58.88
3	82.61	17.38	73.38	26.61	99.38	0.61	97.08	2.91	51.97	48.02	42.15	57.84
6	80.83	19.16	70.65	29.34	98.54	1.45	95.22	4.77	58.79	41.20	47.84	52.15
9	80.07	19.92	68.99	31.00	98.31	1.68	94.73	5.26	64.31	35.68	52.72	47.27
12	82.86	17.13	71.97	28.02	98.68	1.31	96.03	3.96	71.12	28.87	61.18	38.81
24	90.30	9.69	79.74	20.25	97.45	2.54	97.98	2.01	67.11	32.88	59.12	40.87
36	91.72	8.27	84.62	15.37	92.93	7.06	97.38	2.61	64.19	35.80	56.38	43.61
ITA												
Horizon	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n
1	99.97	0.02	97.97	2.12	80.37	19.62	67.29	32.70	97.17	2.82	98.76	1.23
3	99.83	0.16	96.57	3.42	79.69	20.30	63.29	36.07	98.15	1.89	99.34	0.65
6	99.87	0.12	97.04	2.95	81.13	18.86	65.12	34.87	96.96	3.03	98.66	1.33
9	99.91	0.08	96.97	3.02	81.33	81.66	65.79	34.20	91.74	8.25	94.88	5.11
12	99.92	0.07	97.12	2.87	82.48	17.51	67.53	32.46	85.07	14.92	89.05	10.94
24	99.92	0.07	96.04	3.95	83.59	16.40	69.29	30.70	82.96	17.03	86.97	13.02
36	99.88	0.11	94.88	5.11	83.46	16.53	69.74	30.25	78.70	21.29	82.42	17.57
JAP												
Horizon	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n
1	99.16	0.83	99.32	0.67	78.08	21.91	91.91	8.08	75.92	24.07	83.80	19.19
3	98.54	1.45	99.71	0.28	75.21	24.78	89.31	10.68	70.38	29.61	78.51	21.48
6	98.43	1.56	99.82	0.17	73.14	26.85	86.47	13.52	79.58	20.41	85.60	14.39
9	98.46	1.53	99.58	0.41	74.77	25.22	88.47	11.52	82.24	17.75	87.96	12.03
12	98.52	1.47	99.36	0.63	76.42	23.57	90.38	9.61	85.19	18.40	90.31	9.68
24	94.51	5.48	99.68	0.31	68.75	31.24	89.86	10.13	89.74	10.25	94.03	5.96
36	89.82	10.17	99.66	0.33	62.16	37.83	89.32	10.67	90.15	9.84	94.45	5.54
UK												
Horizon	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n	u_r	u_n
1	98.46	1.53	77.22	22.77	97.64	2.35	75.54	27.45	79.58	20.41	91.77	8.22
3	95.12	4.87	76.65	23.34	92.70	7.29	70.73	29.26	75.40	24.59	83.85	16.14
6	93.84	6.15	77.07	22.92	91.05	8.94	69.53	30.46	71.41	28.58	79.83	20.16
9	93.21	6.78	74.78	25.21	91.87	8.12	71.19	28.80	71.76	28.23	80.51	19.48
12	91.76	8.23	71.48	28.51	90.97	9.02	69.54	30.45	73.89	26.10	82.21	17.78
24	90.65	9.34	62.98	37.01	90.02	9.97	64.16	35.83	78.38	21.61	85.11	14.88
36	90.78	9.21	58.50	41.49	90.32	9.67	60.98	39.01	81.63	18.36	87.49	12.50

Notes
a. CAN: Canada, FRA: France, GER: Germany, ITA: Italy, JAP: Japan, UK: United Kingdom.
b. Sample period for France, Germany and Italy : 1973:1-1998:12.
c. Sample period for France, Germany and Italy : 1991:1-1998:12.
d. RER: real exchange rate, NER: nominal exchange rate.
e. Percentage of forecast error variance accounted for by real shocks.
f. Percentage of forecast error variance accounted for by nominal shocks.

Table 7
Variance Decomposition of Real Exchange Rates and Prices

Transition Economies[a] (USA reference country)				
Sample 1991:1-2000:1[b]				
	Real Exchange Rates		Prices	
CREP				
Horizon	u_r [c]	u_n [d]	u_r	u_n
1	78.88	21.11	2.80	97.19
3	78.20	21.79	5.23	94.76
6	79.75	20.24	18.10	81.89
9	77.39	22.60	27.58	72.41
12	77.34	22.65	37.54	62.45
24	76.92	23.07	58.35	41.64
36				
HUN				
Horizon	u_r	u_n	u_r	u_n
1	97.04	2.95	22.30	77.69
3	92.71	7.28	27.89	72.10
6	92.17	7.82	41.65	58.34
9	88.50	11.49	53.47	46.52
12	82.42	17.57	58.66	41.33
24	64.46	35.53	72.43	27.56
36	53.56	46.43	76.64	23.35
POL				
Horizon	u_r	u_n	u_r	u_n
1	27.03	72.96	98.92	1.07
3	47.25	52.74	97.50	2.49
6	61.44	38.55	96.60	3.39
9	66.05	33.94	90.31	9.68
12	70.60	29.39	81.47	18.52
24	70.00	29.99	60.39	39.60
36	66.70	33.29	55.30	44.69
ROM				
Horizon	u_r	u_n	u_r	u_n
1	7.56	92.43	56.75	43.24
3	26.82	73.17	91.67	8.32
6	33.58	66.41	97.16	2.83
9	34.86	65.13	98.37	1.62
12	35.41	64.58	97.99	2.00
24	59.46	40.53	92.93	7.06
36	60.29	39.70	93.38	6.61
SLOV				
Horizon	u_r	u_n	u_r	u_n
1	99.09	0.09	1.49	98.50
3	99.33	0.66	0.75	99.54
6	97.08	2.91	7.49	92.50
9	88.07	11.92	24.62	75.37
12	85.95	14.04	43.08	56.91
24	86.58	13.41	77.67	22.32
36	88.09	11.90	87.95	12.04

Notes.
a. CREP: Czech Republic, HUN: Hungary, POL: Poland, ROM: Romania, SLOV: Slovenia.
b. Sample period for Slovenia: 1991:12-1999:12.
c. Percentage of forecast error variance accounted for by real shocks.
d. Percentage of forecast error variance accounted for by nominal shocks.

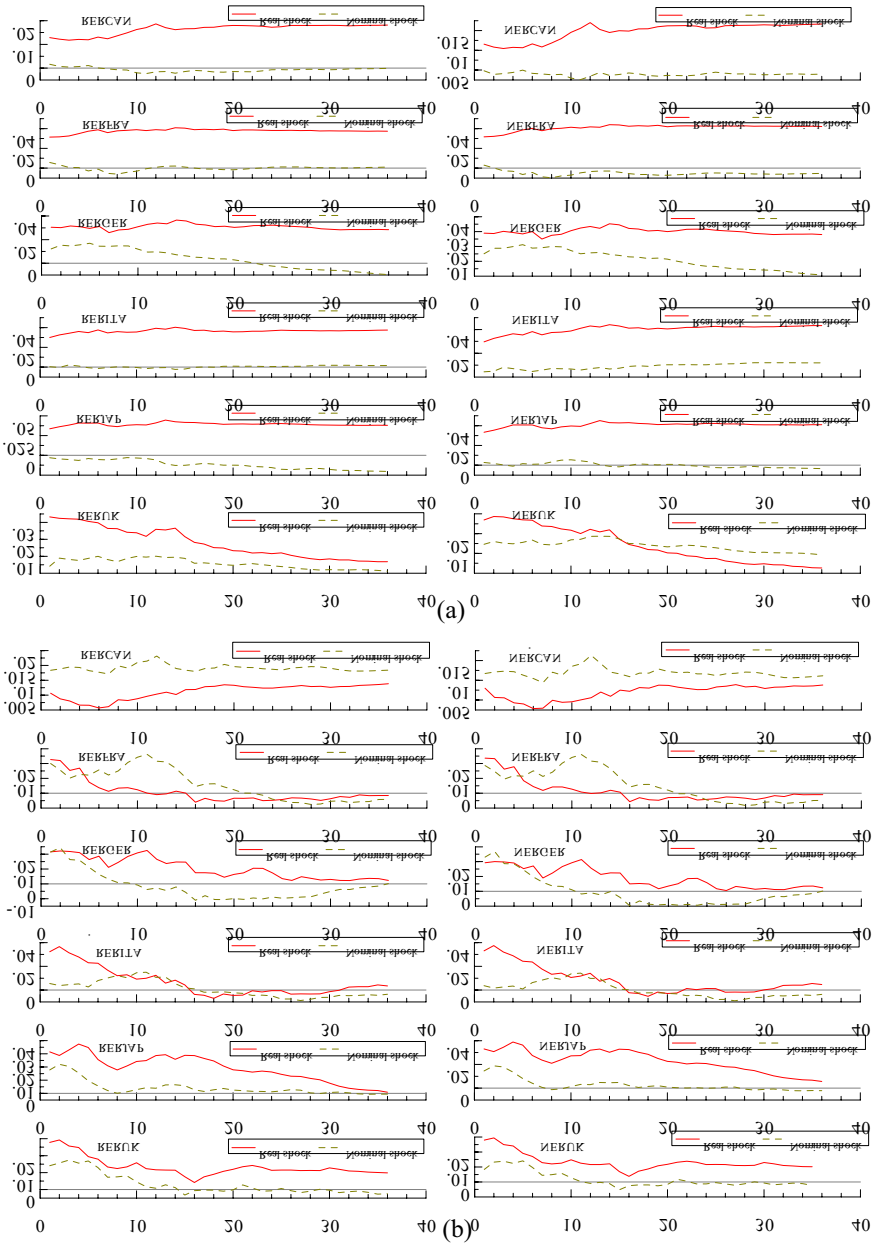

Figure 1. Response of real (RER) and nominal (NER) exchange rates to real and nominal shocks in advanced economies. Panel (a) sample period: 1973:1-2000:1. Panel (b) sample period: 1991:1-2000:1.

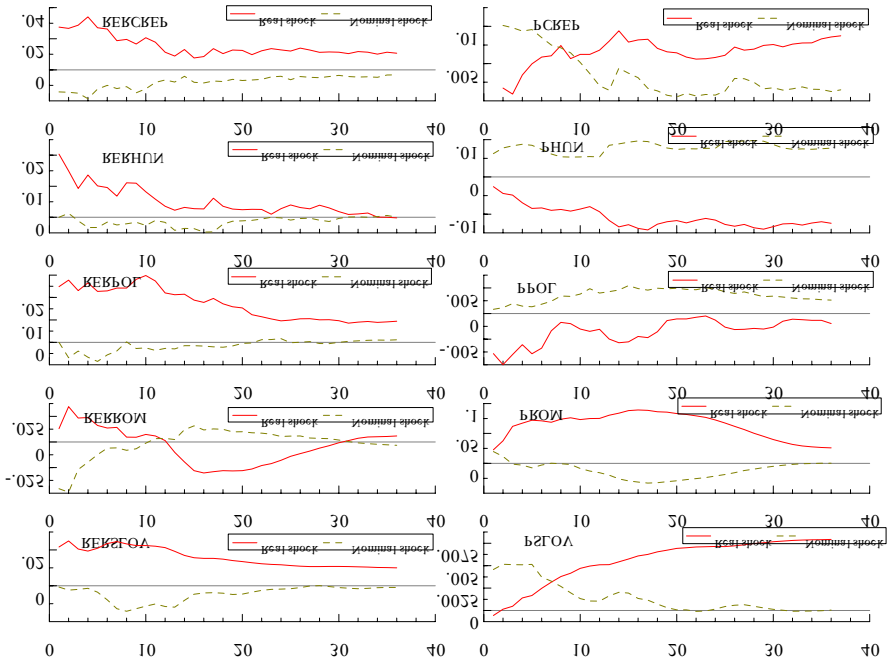

Figure 2. Response of real exchange rate (RER) and prices (P) to real and nominal shocks in transition economies. Sample period: 1991:1-2000:1.

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