THE MONETARY APPROACH TO EXCHANGE RATE DETERMINATION: THE CASE OF ARGENTINA, BRAZIL, TAIWAN AND TURKEY

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Abstract
This study evaluates the short-run and long-run performance of the monetary model approach of exchange rate determination for emerging economies like Argentina, Brazil, Taiwan and Turkey. The study is based on whether there is a cointegration relationship between the nominal exchange rate and monetary variables such as money supply, output, nominal interest rate and price differentials. Various estimation techniques are used for testing long-run relationships both for single-country analysis and panel analysis.
JEL: F31
Keywords: Exchange rates, monetary fundamentals, cointegration, panel analysis

1.Introduction

Several studies have tested the validity of the monetary approach in exchange rate determination, however, the results of these studies remain controversial. For example, Dornbusch (1976) supported the sticky-price monetary model for exchange rate determination. Bilson (1978) studied the fluctuations of Deutsche mark-pound sterling exchange rates and found evidence to support the validity of the monetary approach in the long run. Another study by MacDonald and Taylor (1992) examined the fluctuations of pound sterling-US dollar exchange rates and found evidence to support the validity of the monetary approach. Alternatively, Mark (1995) pointed out a new approach for the monetary model by stating that the departures from a simple set of monetary fundamentals, like relative money supply and relative real output level, were useful in predicting exchange rates at longer horizons. However, Berben and van Dijk (1998) and Berkowitz and Giorgianni (2001) proved that Mark's tests were based on the strict assumption of the stable cointegration relationship among nominal exchange rates, relative money supplies and relative output levels. Thus, if Mark's assumption was not considered, the supposed cointegration relationship between the nominal exchange rate and the monetary fundamentals would not hold.

The monetary approach worked well until 1978. However, when the period was expanded, the results of the studies became inconsistent, as the theory suggested. This means some of the variables were not signed correctly, the equations had little explanatory power and there was a problem in the residual's autocorrelation. For instance, MacDonald and Taylor (1991) studied the long-run behaviors of US dollar-pound sterling, US dollar-Deutsche mark and US dollar-Japanese yen exchange rates. They used the flexible-price monetary model and found that unrestricted a monetary model supports the long-run nominal exchange rate for all exchange rates. However, monetary restrictions were rejected not only in one exchange rate. This led to a reconsideration of the monetary approach at least in the long run.The existence of a long-run relationship between the exchange rate and the monetary variables was a biased

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estimation in their study. In another study, Rapach and Wohar (2002) found evidence for monetary variables in some but not all countries.

In studies where the monetary model was conducted for a single country, it was realized that the results obtained did not match the theory directly. Therefore, in order to avoid these misleading results, most of the studies employed panel analyses including several countries, especially for the post-Bretton Woods period. For example, Levin and Lin (1992) and Im, Pesaran and Shin 1997) worked on panel data and their results of the unit root and the cointegration tests became more accurate compared to the results of the single-country analyses. In studies like Groen (2000), Mark and Sul (2001) and Uz and Ketenci (2008) panel analyses were carried out to testing a stable long-run relationship between nominal exchange rates and monetary variables.

This study first evaluates the validity of the monetary approach in exchange rate determination for emerging economies such as Argentina, Brazil, Taiwan and Turkey. The questions that will be answered are as follows: (1) How well does the monetary model explain fluctuations in nominal exchange rates? (2) Is there any cointegration relationship between exchange rates and monetary variables? (3) Does panel analysis outperform single-country estimations?

The paper is structured as follows. Section 2 explains the monetary model of exchange rate. Section 3 reports the unit root and cointegration test results and the VEC model estimation results. Finally, section 4 gives the concluding remarks for this study.

2. The Model

This study investigates the long-run validity of the monetary approach and existence of the cointegration relationship between the exchange rate and the monetary variables. The derivation of the monetary model is as follows: initially, money supply functions are supposed for the domestic and foreign countries:

$$m_t - p_t = \alpha_1 i_t + \alpha_2 y_t \tag{1}$$

$$m_t^* - p_t^* = \alpha_1 i_t^* + \alpha_2 y_t^* \tag{2}$$

where "*m*" is the money supply at home, "*p*" is the domestic price level, "*i*" is the nominal interest rate at home and "*y*" is the real income at home. All variables are considered at time *t*. Asterisks imply foreign variables. Alternatively, purchasing power parity takes form as follows:

$$e_t = p_t - p_t^* \tag{3}$$

where "*e*" is the nominal exchange rate. The asterisk denotes the foreign fundamental. When equation 1 and equation 2 are solved for p_t and p_t^* and the final expression becomes as follows:

$$e_t = (m_t - m_t^*) - \alpha_1 (y_t - y_t^*) + \alpha_2 (i_t - i_t^*) \tag{4}$$

Alternatively, the monetary approach takes into account the uncovered interest rate parity (UIRP) condition that is explained in equation 5:

$$i_t^* - i_t = \mathrm{E}(\Delta e_{t+1} | I_t) \tag{5}$$

where $\mathrm{E}(\Delta e_{t+1}|I_t)$ is the expectations operator conditional on information available at time *t*. The final equation that is tested in this study is as follows:

$$e_t = (m_t - m_t^*) - \alpha_1(y_t - y_t^*) + \alpha_2(i_t - i_t^*) - \alpha_3(p_t - p_t^*) \quad (6)$$

The monetary fundamentals in exchange rate determination include the variables of money, output, interest rate and price differentials. First, the unit root tests will be conducted and, depending on the existence of the unit root tests, the cointegration tests will be conducted. The empirical analysis estimates the cointegration relationship for the following variables:

$$e_t = \beta_0 + \beta_1(m_t - m_t^*) + \beta_2(y_t - y_t^*) + \beta_3(i_t - i_t^*) + \beta_4(p_t - p_t^*) \quad (7)$$

Equation 7 is used for estimating the cointegration residuals, the cointegration coefficients and the vector error correction (VEC). We followed Rapach and Wohar (2002) and used different estimation procedures such as the ordinary least square (OLS), the dynamic ordinary least square (DOLS) and the multivariate maximum likelihood procedure of Johansen Cointegration (JOH-ML) tests both for the single-country analyses and panel analysis.

3. Estimation Results

a. The unit root test results

The cointegration relationship is tested for non-stationary variables. In this respect, the analysis starts with testing whether these variables are stationary or not. Table 1 gives the unit root test results.

Table 1. Unit Root Test Results

Country	Variables	ADF Test	Stationarity	Country	Variables	ADF Test	Stationarity
Turkey	*E*	-1.74	*I*(1)	Brazil	*E*	-1.45	*I*(1)
	*m-m**	-1.49	*I*(1)		*m-m** (trend)	-1.23	*I*(1)
	*y-y**	-1.50	*I*(1)		y-y*(trend)	-0.59	*I*(1)
	*i-i**	-1.92	*I*(1)		*i-i**	-2.43	*I*(1)
	*p-p**	-2.39	*I*(1)		*p-p**	-1.69	*I*(1)
Taiwan	*e*	-2.21	*I*(1)	Argentina	*e*(trend)	-1.94	*I*(1)
	*m-m**	-2.09	*I*(1)		*m-m**	-3.88	*I*(0)
	*y-y**	-2.41	*I*(1)		y-y*	-4.49	*I*(0)
	*i-i**	-1.03	*I*(1)		*i-i**	-1.48	*I*(1)
	*p-p**	0.64	*I*(1)		*p-p**(trend)	-2.26	*I*(1)

Note: "trend" denotes that there is a constant with time dummy in the regression. The decision of stationarity is based on 5 percent significance level. Trend component is added by the author's preference for some of the variables.

It is concluded that all five variables e_t, $m_t - m_t*$, $y_t - y_t*$, $i_t - i_t*$ and $p_t - p_t*$ are non-stationary *I(1)* for all the selected countries except Argentina. However, for Argentina, e_t, $i_t - i_t*$ and $p_t - p_t*$ are non-stationary *I(1),* while

$m_t - m_t*$ and $y_t - y_t*$ are stationary *I(0)*. Therefore, the study excludes variables $m_t - m_t*$ and $y_t - y_t*$ from the cointegration analysis for Argentina.

Table 2. The Panel Unit Root Test Results

	c			c,t		
	LLC[a]	IPS[a]	Hadri[ß]	LLC[a]	IPS[a]	Hadri[ß]
e	-2.81 I(0)	-1.31 I(1)	10.56 I(1)	-0.63 I(1)	0.68 I(1)	6.25 I(1)
m-m*	-4.03 I(0)	-2.92 I(0)	10.33 I(1)	-2.27 I(0)	1.86 I(1)	9.93 I(1)
y-y*	-6.44 I(0)	-6.74 I(0)	9.76 I(1)	-3.99 I(0)	-2.52 I(0)	10.11 I(1)
i-i*	0.73 I(1)	-0.22 I(1)	5.96 I(1)	1.11 I(1)	0.47 I(1)	3.14 I(1)
p-p*	-1.52 I(1)	-0.06 I(1)	9.60 I(1)	-0.37 I(1)	1.11 I(1)	7.53 I(1)

Note: "c" and "ct" denote that there is a constant and a constant with time dummy in the regression. "[a]" null of non-stationarity (unit root) "[ß]" null of stationarity (no unit root)

Additionally, Table 2 shows the panel unit root test results. The methods used in testing panel unit root are different from those used testing the unit root for a single-country. Levin, Lin and Chu (1992); Im, Pesaran and Shin (1997); and Hadri (2000) estimations are used for panel unit root tests. As long as two out of three estimations confirm the existence of unit root, then we may assume variable is non-stationary. The results of panel unit root tests verify that the considered variables e_t, $m_t - m_t*$, $i_t - i_t*$ and $p_t - p_t*$ confirm the presence of unit root, which means they are non-stationary *I*(1). However, $y_t - y_t*$ is found stationary *I*(0). So, there is enough evidence to assume that all variables but output differential have unit root at five percent significance level. Therefore, we exclude this variable from the panel cointegration analysis.

In the following section, the cointegration relationship between the nominal exchange rate and the monetary fundamentals, which are monetary, output, interest rate and price differentials for Argentina, Brazil, Taiwan and Turkey, and the panel analysis will be discussed.

b. Cointegration residual results

Different estimation procedures are used for testing the cointegration relationship between exchange rates and monetary fundamentals by using equation 7. These estimations are OLS, DOLS and JOH-ML. The OLS estimates give consistent coefficients of long-run models, but standard errors are unreliable where long-run model estimates suffer from small-sample bias. Therefore OLS estimators show little proof of efficiency. In DOLS estimates, however, leads and lags abolish asymptotically any possible bias due to endogenous or serial correlation. Therefore, the DOLS estimates are more efficient than the OLS estimates. In DOLS estimates, we follow Stock and Watson (1993) and Rapach and Wohar (2002) and include two lags and leads in our model.

Additionally, the JOH-ML estimates are also asymptotically efficient and yield covariance matrices suitable for inference. Nevertheless, the JOH-ML method is responsive to a number of lags included, but this method does not work very well in small samples. In JOH-ML estimates, we use Schwarz criterion (SC) for selecting the appropriate lag order. The number of lags used in the analysis is nine for Brazil, seven for Argentina and Turkey, two for Taiwan and three for the panel analysis.

The cointegration residual test is used whether there is a long-run relationship between the nominal exchange rate and the monetary variables or not. The null hypothesis of no cointegration is tested. For Turkey, Taiwan and Brazil, the variables e_t, $m_t - m_t*$, $y_t - y_t*$, $i_t - i_t*$ and $p_t - p_t*$ and for Argentina, the variables e_t, $i_t - i_t*$ and $p_t - p_t*$ are found non-stationary, however, we tested whether their linear combination is stationary.

Table 3. Cointegration Residual Results

	OLS [a]	DOLS [a]	JOH-ML [b]
Turkey	-0.25	-0.31	111.76***
Taiwan	-0.34	-0.39**	86.18***
Brazil	-0.17	-0.26	189.98***
Argentina	-0.19	-0.16	80.50***
Panel	-0.09***	-0.14***	122.99***

Note: ** and *** refers to 5 and 1 percent significance levels, respectively. "[a]" OLS test of H_0: No Cointegration, significance based on MacKinnon (1991) "[b]" Johansen one-sided upper-tail test of H_0: No Cointegration, 5 and 1 percent critical values equal to 68,52 percent and 76,07 percent, respectively.

The results of the cointegration residual estimates both for the single-country analysis and the panel analysis are presented in Table 3. In single-country estimates, there is weak evidence to assume cointegration relationships between the nominal exchange rates and the monetary variables (monetary differential, output, interest rate and price differentials) for countries other than Taiwan. However, in Turkey, Brazil and Argentina only one estimation procedure, JOH-ML, confirms the cointegration relation. On the other hand, in the panel analysis, there is enough evidence to assume a cointegration relationship between the nominal exchange rate and the monetary variables. All tests confirm the long-run relationship at one percent significance level. These results are consistent with the literature.

c. Cointegration coefficient results

The theoretical values implied by the simple monetary model are β_1=1 (the monetary differential), β_2= -1 (the output differential), β_3=1 (the nominal interest rate differential) and β_4= -1 (the price differential). According to the theory, the monetary and the nominal interest rate differentials are positively related, where the output and the price differentials are negatively related to the nominal exchange rate.

Table 4. The Cointegration Coefficient Results

	OLS	DOLS	JOH-ML		OLS	DOLS	JOH-ML
Turkey				Brazil			
β1	0.89*** (0.01)	0.91*** (0.01)	0.076	β1	0.57** (0.26)	0.26 (0.45)	12.03*** (-1.92)
β2	-0.10 (0.10)	-0.70*** (0.24)	-18.72*** (-6.13)	β2	-0.44*** (0.16)	-0.21 (0.28)	-8.42*** (-1.32)
β3	0.32*** (0.03)	0.30*** (0.04)	0.42 (-0.49)	β3	-0.14*** (0.04)	0.28*** (0.09)	1.68*** (-0.25)
β4	0.03* (0.02)	0.05** (0.02)	-1.83*** (-0.41)	β4	0.60*** (0.12)	0.77*** (0.19)	-5.33*** (-0.67)
Taiwan				Argentina			
β1	-2.03*** (0.32)	-2.73*** (0.37)	1.46** (-0.61)	β1	-	-	-
β2	2.10*** (0.33)	2.85*** (0.39)	-1.62** (-0.63)	β2	-	-	-
β3	-0.18*** (0.03)	-0.20*** (0.03)	0.10** (-0.05)	β3	0.14*** (0.02)	0.16*** (0.05)	0.85** (-0.42)
β4	2.34*** (0.52)	3.42*** (0.59)	1.6878	β4	1.21*** (0.02)	1.24*** (0.03)	-1.82*** (-0.17)
Panel							
β1	0.59*** (0.03)	0.61*** (0.03)	0.11 (-0.28)	β3	-0.17*** (0.04)	0.38*** (0.07)	0.82 (-1.62)
β2	-	-	-	β4	-0.09 (0.06)	-0.27*** (0.05)	-8.86*** (-1.11)

Note. *, ** and *** refer to 10 percent, 5 percent and 1 percent significance levels, respectively. The standard errors are in parentheses.

Table 4 shows the cointegration coefficient results for the single-country analysis and the panel analysis. The focus is based on testing whether or not the magnitudes are close to one, having the correct signs, and statistically significant. For Turkey and Brazil, monetary differentials have correct signs with the theory. Additionally, Turkey has a magnitude that is closer to what the theory suggests. This is also similar to income differentials for these countries. While they have the correct signs, they have smaller values in magnitudes in the OLS and the DOLS estimates, but very high magnitudes in the JOH-ML estimates. In interest rate differential, Turkey, Brazil and Argentina have similar signs. Yet, the OLS and the DOLS estimates produce very similar results for Turkey with 0.32 and 0.30, and for Argentina with 0.14 and 0.16, respectively. In the OLS and the DOLS estimates, the price differential has an opposite sign when compared to what the theory suggests in all countries. However, in the JOH-ML estimate price differential has the right sign and the magnitude is slightly higher in all countries. In Taiwan, even though coefficients are statistically significant in all estimation procedures, only in the JOH-ML estimate does it have the correct sign. Also, the magnitudes are slightly larger except for the interest rate differential. In addition, the dummies show there is enough evidence to assume that the Russian and Asian crises are statistically significant in Argentina, Brazil and Turkey, but not in Taiwan.

Finally, the panel analysis shows that there is enough evidence to assume that the coefficients have the correct sign that complies with the theory. The monetary differential gave similar signs and magnitudes in the OLS and the DOLS estimates at one percent significance level, respectively. The interest rate differential is also statistically significant in the OLS and the DOLS estimates at 1 percent significance level. However, it has the correct sign only in the DOLS estimate. The price differential has the correct sign in the DOLS and the JOH-ML estimates with varying magnitudes.

Our results show that in single-country analyses neither the signs nor the magnitudes reflect a homogeneous behavior. Furthermore, the mix results are obtained under different estimation procedures for single countries. However, the results show that coefficients have statistically high significance levels. In the panel analysis, there are more similarities between coefficients than the single countries. For the monetary and the price differentials, the signs confirm the theory, but the magnitudes vary under different estimates. The following part presents the results of the VEC model and examines how the long-run equilibrium is restored between the nominal exchange rate and the monetary variables in the short-run.

d. The VECM

The VECM implies the short-run dynamics of each variable in the simple monetary model and anchors the dynamics to long-run equilibrium relationships that are recommended by the economic theory. In order to examine how the deviation from long-run equilibrium is corrected between the exchange rate "e_t" and the set of monetary fundamentals, which are $m_t - m_t*$, $y_t - y_t*$, $i_t - i_t*$ and $p_t - p_t*$, the VEC model needs to be estimated. In the VEC model, the Johansen approach is applied Harris (1995).

$$\Delta z_t = \sum_{j=1}^{k-1} \Gamma_j \Delta z_{t-j} + \Pi z_{t-k} + u_t \qquad (9)$$

where z_t is (nx1) vector, Γ_j and Π are (nxn) matrices of parameters representing short-run and long-run impacts, respectively. $\Pi = \alpha\beta'$, where α reflects the speed of adjustment toward equilibrium, while β is a matrix of long-run coefficients.

The estimates of the VEC coefficients for e_t, $m_t - m_t*$, $y_t - y_t*$, $i_t - i_t*$ and $p_t - p_t*$ for four countries and the panel are derived from the following equations:

$$\Delta e_t = \eta_0 + \sum_{i=1}^{p} \eta_{1i} \Delta e_{t-i} + \sum_{i=1}^{p} \eta_{2i} (m - m^*)_{t-i} + \sum_{i=1}^{p} \eta_{3i} (y - y^*)_{t-i} + \sum_{i=1}^{p} \eta_{4i} (i - i^*)_{t-i} +$$
$$\sum_{i=1}^{p} \eta_{5i} (p - p^*)_{t-i} + \lambda_1 z_{t-1} + \varepsilon_{1t}$$

$$\Delta(m - m^*)_t = \theta_0 + \sum_{i=1}^{p} \theta_{1i} \Delta e_{t-i} + \sum_{i=1}^{p} \theta_{2i} (m - m^*)_{t-i} + \sum_{i=1}^{p} \theta_{3i} (y - y^*)_{t-i} + \sum_{i=1}^{p} \theta_{4i} (i - i^*)_{t-i} +$$

$$\sum_{i=1}^{p}\theta_{5i}(p-p^*)_{t-i}+\lambda_2 z_{t-1}+\varepsilon_{2t}$$

$$\Delta(y-y^*)_t=\varphi_0+\sum_{i=1}^{p}\varphi_{1i}\Delta e_{t-i}+\sum_{i=1}^{p}\varphi_{2i}(m-m^*)_{t-i}+\sum_{i=1}^{p}\varphi_{3i}(y-y^*)_{t-i}+\sum_{i=1}^{p}\varphi_{4i}(i-i^*)_{t-i}+$$

$$\sum_{i=1}^{p}\varphi_{5i}(p-p^*)_{t-i}+\lambda_3 z_{t-1}+\varepsilon_{3t}$$

$$\Delta(i-i^*)_t=\mathrm{K}_0+\sum_{i=1}^{p}\mathrm{K}_{1i}\Delta e_{t-i}+\sum_{i=1}^{p}\mathrm{K}_{2i}(m-m^*)_{t-i}+\sum_{i=1}^{p}\mathrm{K}_{3i}(y-y^*)_{t-i}+\sum_{i=1}^{p}\mathrm{K}_{4i}(i-i^*)_{t-i}+$$

$$\sum_{i=1}^{p}\mathrm{K}_{5i}(p-p^*)_{t-i}+\lambda_4 z_{t-1}+\varepsilon_{4t}$$

$$\Delta(p-p^*)_t=\mu_0+\sum_{i=1}^{p}\mu_{1i}\Delta e_{t-i}+\sum_{i=1}^{p}\mu_{2i}(m-m^*)_{t-i}+\sum_{i=1}^{p}\mu_{3i}(y-y^*)_{t-i}+\sum_{i=1}^{p}\mu_{4i}(i-i^*)_{t-i}+$$

$$\sum_{i=1}^{p}\mu_{5i}(p-p^*)_{t-i}+\lambda_5 z_{t-1}+\varepsilon_{5t}$$

where $\boldsymbol{\lambda_n}$ reflects the speed of adjustment toward the equilibrium where "n" is from 1 to 5 and the equilibrium relations are determined by;

$$z_t = e_t-\beta_0-\beta_1(m-m^*)_t-\beta_2(y-y^*)_t-\beta_3(i-i^*)_t-\beta_4(p-p^*)_t \qquad (10)$$

Table 5. VEC Model for e_t, m_t-m_t*, y_t-y_t*, i_t-i_t* and p_t-p_t*

	k	λ_1	λ_2	λ_3	λ_4	λ_5
Turkey	7	0.01	0.02**	0.01	-0.05*	0.21***
Taiwan	2	-0.10***	-0.08*	0.02	-0.38*	-0.03**
Brazil	9	0.01	0.11***	0.11	0.14	-0.01
Argentina	7	0.07***	-	-	0.27***	-0.01
Panel	3	-0.01***	0.01***	-	0.01	0.01***

Note: The data is taken from the "Cointeq 1" results in the VEC estimate. "*k*" is the number of lags used in equations. *, ** and *** refers to 10 percent, 5 percent and 1 percent significance levels, respectively.

Based on the results stated in Table 5, error correction coefficients of the exchange rate are found statistically significant only for Taiwan and Argentina at 1 percent significance level. In Taiwan, 10 percent of the disequilibrium is corrected by changes in the exchange rate when deviation from the long-run equilibrium takes a place. Furthermore, the changes in money supply, interest rate and the CPI are also responsible for correcting the long-run equilibrium by 8, 38 and 3 percent, respectively. In Argentina, 7 percent of the disequilibrium is adjusted by changes in exchange rate, while 27 percent is adjusted by changes in interest rate. In Brazil, only the error correction coefficients of the money supply are found statistically significant. Therefore, 11 percent of the disequilibrium is corrected by changes in the money supply. On the other hand, in Turkey, the changes in money supply, interest rate and the CPI are also responsible for correcting the long-run disequilibrium by 2, 5 and 21 percent, respectively. In the panel analysis, the error correction coefficients of the exchange rate, money supply and the CPI are found statistically significant. However, the disequilibrium is corrected only by one percent.

4. Summary and conclusions

In this study, our major concern was to test the monetary model of the exchange rate, as an equilibrium relationship, in the emerging economies of Argentina, Brazil, Taiwan and Turkey. The long-run and the short-run behaviours of the exchange rates were tested by using two approaches: single-country analysis and panel analysis. In sum, this study shows that in the long run the monetary approach acquits itself well in the panel context. We find weak evidence for the monetary approach in single-country analysis. More specifically, the estimation results for long-run coefficients in single-country analyses show that neither the signs nor the magnitudes reflects a homogeneous behavior. Additionally, the cointegration coefficient tests show that Turkey, Brazil and Argentina have more common characteristics than Taiwan. However, the panel analysis shows that the signs of the coefficients are closer to what the theories suggest.

The VEC model examines the short-run behavior of the exchange rates with monetary fundamentals. In the short-run, single-country analyses show that interest rates are more responsive than other monetary variables. For example, in Taiwan and Argentina, interest rate is an important variable for correcting the disequilibrium in the model whereas the price for Turkey and the money supply for Brazil are the important variables for correcting the long-run disequilibrium. In the panel, the exchange rate, the money supply and the price differentials correct the disequilibrium at the same level. We conclude that our panel monetary approach results would seem to provide some credence for policy makers in making proposals which rely on the coordination of monetary policies across emerging markets.

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Appendix 1. The Data: Quarterly data are used and the period includes 1986Q1- 2006Q4. The selected variables of the model are the nominal exchange rate, the money supply, the real GDP, the nominal interest rate and the CPI. The nominal exchange rate is used as US dollar per domestic currency. For the money supply, M2 and for the output seasonally adjusted real GDP are used. The nominal interest rate is chosen as the 3-months interbank rate. Turkey, Taiwan, Brazil and Argentina are the domestic countries and the US is the foreign country. The period between 1986 and 2006 covers several crises and various international monetary arrangements. Thus, dummy variables are used in the tests in order to get more accurate results. In Turkey, the dummy variable includes the Russian Crisis (1998:Q2-1998:Q4 as 1 and otherwise zero), the Asian Crisis (1997:Q4 as 1 and otherwise zero) and the Turkish Crises (1994:Q2-1994:Q3 as 1 and otherwise zero and 2000:Q1-2001:Q3 as 1 and otherwise zero). In Taiwan, the dummy variable consists of the Russian Crisis (1998:Q2-1998:Q4 as 1 and otherwise zero), the Asian Crisis (1997:Q4 as 1 and otherwise zero) and the Taiwan Crises (1995:Q2-1995:Q4 as 1 and otherwise zero and 1998:Q2-1999:Q2 as 1 and otherwise zero). In Argentina, the dummy variable implies the Russian Crisis (1998:Q2-1998:Q4 as 1 and otherwise zero), the Asian Crisis (1997:Q4 as 1 and otherwise zero), the Brazilian Crises (1999:Q3-2000:Q2 as 1 and otherwise zero) and the Argentinean Crises (1999:Q3-2002:Q1 as 1 and otherwise zero). Finally, in Brazil, the dummy variable uses the Russian Crisis (1998:Q2-1998:Q4 as 1 and otherwise zero), the Asian Crisis (1997:Q4 as 1 and otherwise zero), the Argentinean Crises (1999:Q3-2002:Q1 as 1 and otherwise zero) and the Brazilian Crises (1994:Q2-1994:Q4 as 1 and otherwise zero and 1999:Q3-2000:Q2 as 1 and otherwise zero). In the panel data, dummies are not used. For each country, the data are taken either from the national central banks or national statistical departments. All variables are measured in log levels.

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