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Domestic and external factors in interest rate determination: the minor role of the exchange rate regime

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Abstract

We compare the behavior of short term interest rates in hard-peg and floating-exchange-rate countries. We use a framework which allows both domestic and foreign factors to play a role in the determination of interest rates and assess them empirically for eight Latin American countries between January 1998 and April 2009. Two countries have hard peg while the remaining six follow alternative exchange rate regimes. We find empirical evidence that economies with rigidly-fixed exchange rates do not bear a loss of monetary autonomy above and beyond that of floating-exchange-rate economies, with the exception of the region's largest country, Brazil, the only floating-rate-economy of our sample that proves to benefit from monetary freedom.

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1. Introduction

The choice of the exchange rate regime is a fundamental macroeconomic policy decision, especially for small open economies. The decision to adopt fixed exchange rates or not may determine policy options and/or the ability to maintain open capital markets. This paper tests a basic proposition of international macroeconomics, the notion of the open-economy trilemma (see Mundell, 1963), which implies that countries cannot have fixed exchange rates, domestic monetary autonomy, and open capital markets all at once, but can only pursue two of these options.

The behavior of short-term interest rates can be explained with two different approaches (see for instance Barassi *et al*, 2005). On the one hand, interest rates can be treated as analogous to other asset prices, in which case their movements are interpreted as being determined by financial flows in profit-seeking capital markets, giving rise to a set of arbitrage conditions such as uncovered interest parity. On the other hand, they can be viewed as policy instruments and are then determined by decisions aiming at a policy objective such as an exchange rate or an inflation target. There is a long standing literature on the latter (see Clarida *et al*, 1998; 1999; 2001; Adam *et al*, 2005). In this paper, the objective is different in the sense that we study the interest rate behavior in the long run, taking into account both internal and external determinants and making a systematic link with exchange rate policy. Although monetary independence has been at the heart of the debate on exchange rate regimes, empirical evidence on this issue is still mixed. Shambaugh (2004) and Obstfeld *et al* (2004; 2005) find that the interest rates of floating-rate economies show far less connection to base country's interest rates than hard-peg countries. Borensztein *et al* (2001) also find some evidence consistent with the traditional view of more monetary independence for flexible-rate countries. On the opposite, Frankel (1999) and Hausmann *et al* (1999) report evidence on Latin American countries during the 1990's consistent with the alternative view, namely, the more firmly pegged is a country to the dollar, the smaller its reaction to changes in U.S. interest rates. The "fear of floating" literature, initiated by Calvo and Reinhardt (2002), states that only large countries can benefit, or choose to benefit, from an independent monetary policy, as many declared floating-rate countries de facto limit exchange rate flexibility and may not have or use the autonomy attributed to floating rates. For Frankel *et al* (2002), fixing the exchange rate does not generate a loss of monetary flexibility, as most countries would not have freedom even if they had floating rates. The question we pose is whether the exchange rate regime influences the extent to which local interest rates are determined by internal and/or external factors.

This paper extends the existing literature in that we not only look at relationships between domestic and base country's interest rates but we allow for a set of both internal and external factors as possible determinants of local interest rates in the long and short run while making a systematic link with the exchange rate regime. In the case of Latin American countries, by external factors, we refer to U.S. variables. We develop a revised version of Frankel's (1979) model to take into account emerging countries' specificities. Namely, we allow for imperfect substitutability of domestic and foreign assets and we model currency substitution in the domestic money demand specification. Using cointegration techniques, we assess empirically the role of both domestic conditions and U.S. factors in the determination of eight Latin American countries' interest rates, with monthly data over January 1998 through April 2009. Two are hard-peg countries, the remaining six have flexible or intermediate exchange rate regimes as calculated with our update of the Levy-Yeyati and Sturzenegger (2005) de facto classification method, based on data on exchange rates and reserves. We find empirical evidence that economies with fixed exchange rates do not bear a loss of monetary autonomy above and beyond that of floating-exchange-rate economies, with the exception of the region's largest country, Brazil, the only floating-rate-economy of our sample that proves to benefit from monetary freedom.

2. Conceptual framework

Based on Frankel's (1979) model, we develop a simple macroeconomic framework to study interest rate determination. Our first assumption is an interest rates parity condition distorted by a risk premium as we are considering emerging market economies:

$$i_t = i_t^* + x_t + \rho_t \qquad (1)$$

where i_t is the domestic nominal interest rate; i_t^* is the foreign nominal interest rate; x_t is the expected rate of depreciation of the domestic currency quoted as the number of units of domestic currency per unit of foreign currency; and ρ_t is a time-varying risk premium. We don't assume efficient markets in which sovereign bonds would be perfect substitutes. The empirical literature on the uncovered interest parity condition reveals that emerging countries deserve a special treatment due to specific macroeconomic conditions including incomplete institutional reforms, weaker macroeconomic fundamentals, and shallow financial markets (see Alper *et al*, 2007). As in Dornbusch's (1976) model, we distinguish between the long-run exchange rate, to which the economy will ultimately converge, and the current exchange rate. Denoting the logarithms of the current and long-run exchange rates by e_t and $\bar{e}$, respectively, we assume that:

$$x_t = \theta(e_t - \bar{e}) \qquad (2)$$

Equation (2) states that the expected rate of depreciation of the spot rate is proportional to the discrepancy between the long-run rate and the current spot rate. The long-run exchange rate is assumed known, and an expression for it will be developed below. We assume purchasing power parity holds in the long run:

$$\bar{e} = \bar{p} - \bar{p}^* \qquad (3)$$

where $\bar{p}$ and $\bar{p}^*$ are defined as the logarithms of the equilibrium price levels at home and abroad, respectively. We assume a domestic money demand specification that takes into account the most significant phenomenon in Latin America, namely currency substitution. Based on the long standing literature on currency substitution (see Miles, 1978; Arize, 1994; de Freitas and Veiga, 2006), we consider that the conventional money demand equation must be augmented with the exchange rate:

$$m_t = p_t + \Phi y_t - \lambda i_t - \psi e_t \qquad (4)$$

where m_t, p_t and y_t are defined as the logarithms of the nominal quantity of money, the price level and the real income. A conventional money demand function holds abroad:

$$m_t^* = p_t^* + \delta y_t^* - \lambda i_t^* \qquad (5)$$

As in Frankel's model, we assume that the interest rate semi-elasticities of money demands are the same for the domestic and foreign countries. Let us take the difference between the two equations (4) and (5):

$$m_t - m_t^* = p_t - p_t^* + \Phi y_t - \delta y_t^* - \lambda(i_t - i_t^*) - \psi e_t \qquad (6)$$

Using bars to denote equilibrium values, and remembering that in the long run, when $e = \bar{e}$, $\bar{i} - \bar{i}^* = \bar{\rho}$, we obtain:

$$\bar{e} = \frac{1}{1-\psi}\left(\bar{m} - \bar{m}^{*} - \Phi\bar{y} + \delta\bar{y}^{*} + \lambda\bar{\rho}\right) \tag{7}$$

Substituting (7) into (1), and assuming, as in Frankel's (1979) model, that the current equilibrium money supplies, income levels and risk premium are given by their current actual levels, we obtain a complete equation of interest rate determination:

$$i_t = i_t^{*} + \theta e_t - \frac{\theta}{1-\psi}(m_t - m_t^{*}) + \frac{\theta\phi}{1-\psi} y_t - \frac{\theta\delta}{1-\psi} y_t^{*} + \frac{1-\psi-\theta\lambda}{1-\psi}\rho_t \tag{8}$$

Simplifying with $\alpha = \frac{\theta}{1-\psi}$, $\beta = \frac{\theta\phi}{1-\psi}$, $\zeta = \frac{\theta\delta}{1-\psi}$, $\gamma = \frac{1-\psi-\theta\lambda}{1-\psi}$, we obtain:

$$i_t = i_t^{*} + \theta e_t - \alpha(m_t - m_t^{*}) + \beta y_t - \zeta y_t^{*} + \gamma\rho_t \tag{9}$$

The domestic interest rate is positively related to the foreign interest rate, the exchange rate, the external money supply, the domestic level of income and the risk premium and negatively related to the domestic money supply and the foreign level of income. This equation is tested empirically for a set of eight Latin American countries.

3. Data and empirical methodology

The monthly data set runs from January 1998 to April 2009. We look at the eight Latin American countries for which the JP Morgan Emerging Market Bond Index plus (EMBI+) spread is reported, namely Argentina, Brazil, Colombia, Ecuador, Mexico, Panama, Peru and Venezuela. The EMBI+ is a U.S. dollar emerging markets debt benchmark while the EMBI+ spread, commonly known as sovereign spread, measures the credit risk premium over U.S. Treasury bonds. Among these eight countries, we have two hard-peg experiences: Panama for the whole sample and Ecuador as of March 2000. Our sample is too short to consider Argentina during the currency board period[1]. The remaining countries follow either flexible or intermediate exchange rate regimes, and are used as control countries. The case of Argentina is restricted to the floating period. Our sample excludes hyperinflation periods which increases the probability that the domestic and the US time series have the same integration properties. The EMBI data has been obtained from JP Morgan and stands for the risk premium. As a measure of monetary policy, we use a short-term interest-rate, the 90-day interbank market rate when available or the deposit 90-180 day rate as an alternative. Data has mainly been extracted from the IMF's International Financial Statistics (IFS). We use the nominal exchange rate (expressed as national currency per U.S. dollars), a M1 index, the consumer price index and an industrial production index. More details on the data used and samples are given in the Appendix, Table A1.

The model of interest rate determination presented above is estimated for each country. We first check the order of integration of the data using ADF[2], Phillips-Perron (1988), KPSS[3] and Ng-Perron (2001) unit root tests. All series are integrated of order one. The results of these tests are presented in the Appendix, Table A2. Then we conduct the Johansen (1988) and Johansen and Juselius (1990) cointegration procedure to test for the presence of cointegrating vectors between the domestic interest rate, a set of internal variables and a set of foreign variables. The procedure is based on the maximum likelihood estimation of the vector error correction model (VECM):

[1] However results obtained (not reported) are similar to those obtained for the latter two countries.

[2] Augmented Dickey-Fuller (Dickey and Fuller, 1981).

[3] Kwiatkowski, Phillips, Schmidt and Shin (1992).

$$\Delta z_t = \Pi z_{t-1} + \Gamma_1 \Delta z_{t-1} + \ldots + \Gamma_{p-1} \Delta z_{t-p+1} + \kappa + u_t \quad (10)$$

where the matrix Γ captures the short-run aspects of the relationships between the elements of z_t and the matrix Π reflects the long-run information. The rank of Π, denoted by r, determines the number of cointegrating relations. The matrix Π can be decomposed into two matrices, α and β where $\Pi = \alpha\beta'$. The weights, also called the error coefficients, are contained in matrix α that forces the series back towards their underlying equilibrium relations while the cointegrating vectors are contained in matrix β that gives the underlying long-term relations. According to our theoretical framework, we have $z_t = [i_t, i_t^{US}, \rho_t, e_t, y_t, y_t^{US}, m_t, m_t^{US}]$, Π and $\Gamma_1, \Gamma_2, .., \Gamma_{p-1}$ are (8×8) matrices of parameters, κ is a (8×1) vector of parameters and u_t is a (8×1) vector of white noise errors. To determine the number of cointegrating vectors in z_t, we use the maximum eigenvalue test as, in comparison, the trace test may lack power (see Johansen and Juselius, 1990; Wadud, 2009). We test for possible instability in the long-term relations using a stability analysis of the recursive eigenvalues (see Hansen and Johansen, 1999). Finally, we check and validate the hypotheses on residuals, namely, no-serial correlation with the Ljung-Box statistic and normality of the distribution with the Jarque-Bera statistic.

4. Discussion of the results

We present the results of the Johansen cointegration tests as well as the test of linear restrictions on both α and β coefficients in the Appendix, Table A3. The weak exogeneity tests enable us to determine, for each country, whether the domestic interest rate is the dependent variable in one of the cointegrating vectors. Lag order selection criteria, recursive-eigenvalue stability tests and residual tests are not presented for a matter of space but are available upon request. We have introduced dummy variables where necessary to account for outliers, they are detailed in the Appendix, Table A4. We do find cointegrating relations with the local interest rate being driven by some of the system variables in all eight countries. We concentrate on these interest rate equations and present in Tables 1 and 2 the long and short-run dynamics of domestic interest rates.

Table 1: The long-run determinants of the domestic interest rates i_t

Country	Constant	i_t^{US} ^^^	ρ_t *	e_t **	y_t ***	y_t^{US} +	m_t ++	m_t^{US} +++	trend
Panama *(1998M2 – 2007M8)*	1.64 (6.66)^	0.35 (2.78)	0	N/A^^	0.11 (3.37)	0	0	-0.31 (-5.48)	
Ecuador *(2000M5 – 2009M2)*	-2.89	0.48 (2.90)	0	N/A	0	-0.32 *(-2.15)*	-0.07 *(-3.80)*	-0.14 *(-2.51)*	0.002 *(3.52)*
Argentina *(2003M8 – 2009M4)*		0	0	0.46 (6.64)	1.32 (11.96)	0	-0.44 (-10.25)	-0.25 (-3.14)	
Brazil *(1999M6 – 2009M2)*	-3.38	0	2.29 (13.10)	0	1.42 (6.29)	0	-0.27 (-5.30)	0	
Mexico *(1998M2 – 2009M2)*	-12.45 (-4.63)	2.01 (2.11)	0	0	1.01 (1.99)	0	-0.91 (-6.07)	2.81 (6.73)	
Colombia *(1999M8 – 2009M3)*	1.10 (6.75)	0	0	-0.07 (-4.04)	0	0	-0.04 (-7.01)	0	
Peru *(1998M2 – 2009M3)*	3.37 (4.96)	2.68 (7.01)	0	0	0	-0.76 (-5.07)	0	0	
Venezuela *(1998M2 – 2009M3)*	6.11	3.05 (2.46)	0	0.12 (2.00)	0	-1.34 (-2.21)	0	0	

^ Values in parentheses are t-statistics. ^^ Not Applicable. ^^^ U.S. interest rate. * Risk premium. ** Exchange rate. *** Domestic level of income. + U.S. level of income. ++ Domestic money supply. +++ U.S. money supply.

Table 2: The short-run determinants of the domestic interest rate dynamics Δi_t

Panama	$\Delta i_t = \underset{(4.33)^{\wedge}}{0.28}\Delta i_{t-1} + \underset{(2.10)}{0.05}\Delta y^{US}_{t-2} + \underset{(2.39)}{0.05}\Delta m^{US}_{t-2} - \underset{(-3.74)}{0.03}\varepsilon_{t-1}^{\wedge\wedge}$
Ecuador	$\Delta i_t = \underset{(-2.05)}{-0.001} + \underset{(3.09)}{0.02}\Delta\rho_{t-2} - \underset{(-6.56)}{0.14}\varepsilon_{t-1}$
Argentina	$\Delta i_t = \underset{(4.94)}{0.49}\Delta i_{t-1} + \underset{(2.51)}{1.20}\Delta i^{US}_{t-1} + \underset{(3.15)}{0.18}\Delta e_{t-1} - \underset{(-2.51)}{0.19}\Delta y_{t-1} - \underset{(-5.75)}{0.31}\varepsilon_{t-1}$
Brazil	$\Delta i_t = \underset{(12.09)}{0.68}\Delta i_{t-1} - \underset{(-4.07)}{0.20}\Delta i_{t-2} - \underset{(-3.89)}{0.10}\Delta\rho_{t-1} - \underset{(-3.33)}{0.08}\Delta\rho_{t-2} - \underset{(-2.72)}{0.02}\Delta e_{t-1} - \underset{(-5.27)}{0.09}\Delta y_{t-1} - \underset{(-2.65)}{0.05}\Delta y_{t-2} - \underset{(-9.94)}{0.05}\varepsilon_{t-1}$
Mexico	$\Delta i_t = \underset{(2.42)}{0.33}\Delta i_{t-2} - \underset{(-2.98)}{2.81}\Delta i_{t-2} + \underset{(3.65)}{1.80}\Delta\rho_{t-1} + \underset{(2.30)}{0.44}\Delta y^{US}_{t-1} - \underset{(-2.72)}{0.05}\varepsilon_{t-1}$
Colombia	$\Delta i_t = \underset{(11.63)}{0.74}\Delta i_{t-1} + \underset{(2.41)}{0.11}\Delta\rho_{t-1} - \underset{(-5.04)}{0.07}\Delta m_{t-1} - \underset{(-4.34)}{0.05}\varepsilon_{t-1}$
Peru	$\Delta i_t = \underset{(6.47)}{0.58}\Delta i_{t-1} + \underset{(3.15)}{0.08}\Delta\rho_{t-1} + \underset{(2.76)}{0.03}\Delta e_{t-2} + \underset{(2.33)}{0.02}\Delta m_{t-1} - \underset{(-2.71)}{0.01}\varepsilon_{t-1}$
Venezuela	$\Delta i_t = \underset{(2.20)}{0.17}\Delta i_{t-2} - \underset{(-2.46)}{5.68}\Delta i^{US}_{t-1} + \underset{(3.51)}{0.28}\Delta e_{t-1} - \underset{(-3.06)}{0.14}\Delta y_{t-1} - \underset{(-7.61)}{0.37}\varepsilon_{t-1}$

^ Values in parentheses are t-statistics. ^^ ε_t captures the errors of the cointegrating relationship of Table1.

The long-run equations are all stable during the observation period with the exception of Brazil at the end of 1998, beginning of 1999, corresponding to the deep financial crisis the country went through. As expected, in the long run, we have a positive impact of U.S. interest rates on both dollarized countries' interest rates, but we also notice the influence of domestic fundamentals, meaning that their monetary policy is not solely caused by U.S. variables but is also oriented towards internal goals. We observe a positive influence of the domestic level of activity in the long-run equation of Panama's interest rates. An increase in income raises the demand for money compared to the supply, generating an increase in the nominal interest rate. We also notice a negative impact of the domestic money supply on Ecuador's interest rate. When there is a contraction of money supply relative to money demand, without a matching fall in prices, the domestic interest rate rises. In terms of foreign influence, we observe a negative impact of the U.S. level of income on the country's rate, as expected theoretically. Finally, there is a negative influence of the U.S. money supply on both countries' interest rates, which is opposite to the sign given by the conceptual framework and may be due to full dollarization in the two countries. Our interpretation of this result is that a rise in U.S. money supply leads to a decline in the U.S. interest rate which directly spills-over to our dollarized countries' domestic interest rates. Hard-peg-countries' interest rate changes are determined by changes in both U.S. and internal variables as well as by an error-correction term. Changes in the risk premium are statistically significant in explaining changes in Ecuadorian interest rates. The adjustment coefficients range from 3% in the case of Panama to 14% for Ecuador. We also compute half-life[4] coefficients, namely, the required time for interest rates to adjust back towards their equilibrium level by 50%. It takes 16 months for the deviation of Panamanian interest rates from their long run value to fall by half while it only takes 2.6 months in the case of Ecuadorian interest rates.

The monetary policy of control countries does not exclusively pursue domestic aims as we observe a foreign influence on local interest rates in the long run. Mexican, Peruvian and Venezuelan rates all positively depend on U.S. interest rates. There is also a positive influence of the exchange rate on Argentinean and Venezuelan rates, which turns negative in the case of Colombian rates. According to our theoretical framework, an exchange rate depreciation causes a rise in the domestic nominal interest rate as stated in the uncovered interest parity condition. However, according to the currency-substitution phenomenon, an exchange rate

[4] The half-life coefficient is defined as HL = ln(0.5)/ln(μ) with $\varepsilon_t = \mu\varepsilon_{t-1} + \sum_{j=1}^{k}\tau_{j-1}\Delta\varepsilon_{t-j} + \eta_t$ (see Rossi, 2002).

depreciation generates a fall in money demand relative to money supply, leading to a temporary decline in the domestic interest rate. In terms of foreign influence, we also observe a negative influence of the U.S. level of activity on Peruvian and Venezuelan rates and a positive influence of U.S. money supply on Mexican rates. An expansion in the foreign money supply implies a depreciation of the exchange rate and then supposedly an increase of the domestic nominal interest rate. We also notice in each cointegrating equation the presence of internal factors. Namely, we observe a positive influence of the domestic level of activity for Argentinean, Brazilian and Mexican rates, as an increase in income raises the demand for money and generates an increase in the nominal interest rate. There is also a negative influence of the domestic money supply for Argentinean, Brazilian, Colombian and Mexican rates. When there is a contraction of money supply relative to money demand, the domestic interest rate rises. We only model Brazilian rates after the break date, as of June 1999. This last case stands apart as we don't find any direct foreign influence in the long run on domestic interest rates. They positively depend on the risk premium. A rise in country risk implies a rise in domestic interest rates as investors need to get a higher return for bearing the risk. Brazilian rates are also positively influenced by the domestic level of activity and negatively by the domestic money supply. The estimated error-correction models indicate that in the short run, changes in both U.S. and domestic variables are statistically significant in explaining changes in the control-countries' interest rates. As in the case of Ecuador, we observe an impact of changes in the risk premium on the domestic interest rates for most countries, namely, Brazil, Mexico, Colombia and Peru. The adjustment coefficient is only 1% in the case of Peru, 5% for Brazil, Mexico and Colombia and is as high as 31% for floating Argentina and, finally, 36% for Venezuela. It takes more than 10 years for Peruvian interest rates to revert back to half the distance of their deviation to the long run value while this same required time is a year and a half for Colombian interest rates and 7 months for Mexican rates. Half-lifes are much smaller for the remaining three countries, 3.8 months in the case of Brazil, 3.5 for Venezuela and, lastly, only slightly more than a month for Argentina. However this last case has to be interpreted with caution as the sample is substantially smaller. We can't really draw any conclusion from the computation of the half-life coefficients of the hard-peg countries, on one hand, the control-countries on the other hand, regarding any possible larger temporary autonomy for the ones or the others. Overall, among these eight countries, Brazil appears to be the only one to have true autonomy as its interest rate is only driven by domestic variables. In all other countries, whatever the exchange rate regime, both internal and external variables determine the domestic interest rates in the long and short run.

5. Conclusion

We find empirical evidence that in Latin America the exchange rate regime does not rigidly determine the degree of monetary policy independence. Indeed, on the one side, hard-peg countries enjoy some independence since their interest rates are not exclusively determined by U.S. variables but also by domestic fundamentals. On the other side, even perfectly-flexible rates may not guarantee monetary independence since the interest rates of floating-rate-economies, with the exception of Brazil, are not only determined by internal factors but also by U.S. variables. We conclude that economies with rigidly-fixed exchange rates do not bear a loss of monetary autonomy above and beyond that of floating-exchange-rate economies. The potential instability of floating rates does not seem to be effectively compensated by any meaningful monetary freedom. It would be valuable to investigate further whether countries are "learning to float" (see Hakura, 2005), in the way that they are strengthening their monetary and financial policy frameworks.

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Appendix

Table A1: Data description

		Interest rate	Price index	Exchange rate	Monetary aggregate	Risk premium	Production proxy
Panama	Description	6 month interest rate	CPI[*]	N/A[**]	M1	Spread EMBI+	IMAE[***] (s.a.[^])
	Sample	1998M1 2007M8	1998M1 2007M8		1998M1 2007M8	1998M1 2007M8	1998M1 2007M8
	Source	IFS[^^]	IFS		IFS	JP Morgan	CGRP[^^^]
Ecuador	Description	Short-term deposit rate	CPI	N/A	M1	Spread EMBI+	Crude petroleum production (s.a.)
	Sample	2000M3 2009M2	2000M3 2009M2		2000M3 2009M2	2000M3 2009M2	2000M3 2009M2
	Source	IFS	IFS		IFS	JP Morgan	IFS
Argentina	Description	Money market rate	CPI	Official rate, end of period	M1	Spread EMBI+	IMAE (s.a.)
	Sample	2003M6 2009M4	2003M6 2009M4	2003M6 2009M4	2003M6 2009M4	2003M6 2009M4	2003M6 2009M4
	Source	IFS	IFS	IFS	IFS	JP Morgan	BCRA[+]
Brazil	Description	Money market rate	CPI	Market rate, end of period	M1	Spread EMBI+	Industrial production (s.a.)
	Sample	1998M1 2009M2	1998M1 2009M2	1998M1 2009M2	1998M1 2009M2	1998M1 2009M2	1998M1 2009M2
	Source	IFS	IFS	IFS	IFS	JP Morgan	IFS
Mexico	Description	Treasury bill rate	CPI	Principal rate, end of period	M1	Spread EMBI+	Industrial production (s.a.)
	Sample	1998M1 2009M2	1998M1 2009M2	1998M1 2009M2	1998M1 2009M2	1998M1 2009M2	1998M1 2009M2
	Source	IFS	IFS	IFS	IFS	JP Morgan	IFS
Colombia	Description	Money market rate	CPI	Official rate, end of period	M1	Spread EMBI+	Manufacturing production (s.a.)
	Sample	1999M6 2009M3	1999M6 2009M3	1999M6 2009M3	1999M6 2009M3	1999M6 2009M3	1999M6 2009M3
	Source	IFS	IFS	IFS	IFS	JP Morgan	IFS
Peru	Description	Short-term deposit rate	CPI	Market rate, end of period	M1	Spread EMBI+	Indice mensual de producción (s.a.)
	Sample	1998M1 2009M3	1998M1 2009M3	1998M1 2009M3	1998M1 2009M3	1998M1 2009M3	1998M1 2009M3
	Source	IFS	IFS	IFS	IFS	JP Morgan	BCRP[++]
Venezuela	Description	Money market rate	CPI	Official rate, end of period	M1	Spread EMBI+	Indice mensual de producción (s.a.)
	Sample	1998M1 2009M3	1998M1 2009M3	1998M1 2009M3	1998M1 2009M3	1998M1 2009M3	1998M1 2009M3
	Source	IFS	IFS	IFS	IFS	JP Morgan	BCV[+++]
United-States	Description	Treasury bill rate	CPI	N/A	M1		Industrial production (s.a.)
	Sample	1998M1 2009M4	1998M1 2009M4		1998M1 2009M4		1998M1 2009M4
	Source	IFS	IFS		IFS		IFS

[*] Consumer Prices Index. [**] Not applicable. [***] Indice Mensual de Actividad Económica. [^] Seasonally adjusted. [^^] I.M.F. International Financial Statistics. [^^^] Contraloría General de la República de Panamá. [+] Banco Central de la República Argentina. [++] Banco Central de Reserva del Perú. [+++] Banco Central de Venezuela.

Table A2: Unit root tests results

		$i_t^{\wedge}$	$e_t^{\wedge\wedge}$	$y_t^{\wedge\wedge\wedge}$	M_t^{*}	ρ_t^{**}			i_t	e_t	y_t	M_t	ρ_t
Panama***	ADF+	I(1)	N/A°°	I(1)	I(1)	I(1)	**Ecuador**	ADF	I(1)	N/A	I(1)	I(1)	I(1)
	PP++	I(1)	N/A	I(1)	I(1)	I(1)		PP	I(1)	N/A	I(1)	I(1)	I(1)
	KPSS+++	I(1)	N/A	I(1)	I(1)	I(1)		KPSS	I(1)	N/A	I(1)	I(1)	I(1)
	NP°	I(1)	N/A	Inc°°°	I(1)	I(0)		NP	I(1)	N/A	I(1)	I(1)	I(1)
Argentina	ADF	I(1)	I(1)	I(1)	I(1)	I(1)	**Brazil**	ADF	I(1)	I(1)	I(1)	I(2)	I(1)
	PP	I(1)	I(1)	I(1)	I(1)	I(1)		PP	I(1)	I(1)	I(1)	I(1)	I(1)
	KPSS	I(1)	I(0)	I(1)	I(1)	I(0)		KPSS	I(1)	I(1)	I(1)	I(1)	I(1)
	NP	I(1)	I(1)	Inc	Inc	I(1)		NP	I(1)	I(1)	I(1)	I(1)	I(1)
Colombia	ADF	I(1)	I(1)	I(1)	I(1)	I(2)	**Mexico**	ADF	I(1)	I(1)	I(2)	I(2)	I(1)
	PP	I(1)	I(1)	I(1)	I(1)	I(1)		PP	I(1)	I(1)	I(1)	I(1)	I(1)
	KPSS	I(1)	I(1)	I(1)	I(1)	I(1)		KPSS	I(1)	I(1)	I(1)	I(1)	I(1)
	NP	I(1)	I(1)	I(1)	I(1)	I(1)		NP	I(1)	I(1)	Inc	I(1)	I(1)
Peru	ADF	I(1)	I(1)	I(2)	I(2)	I(1)	**Venezuela**	ADF	I(0)	I(1)	I(1)	I(1)	I(1)
	PP	I(1)	I(1)	I(1)	I(1)	I(1)		PP	I(1)	I(1)	I(1)	I(1)	I(1)
	KPSS	I(1)	I(1)	I(1)	I(1)	I(1)		KPSS	I(1)	I(1)	I(1)	I(1)	I(0)
	NP	I(1)	I(1)	I(1)	I(2)	I(1)		NP	I(1)	I(1)	I(1)	I(1)	I(1)
United States	ADF	I(1)	N/A	I(2)	I(2)								
	PP	I(1)	N/A	I(1)	I(1)								
	KPSS	I(1)	N/A	I(1)	I(1)								
	NP	I(1)	N/A	I(1)	I(1)								

^ Nominal interest rate, ^^ Exchange rate, ^^^ Real income, * Monetary aggregate, ** Risk premium, *** Samples are the same as in Table 1. + Augmented Dickey-Fuller. ++ Phillips-Perron. +++ Kwiatkowski, Phillips, Schmidt and Shin. ° Ng-Perron. °° Not Applicable. °°° Inconclusive.

Table A3: Cointegration tests results and coefficients restriction tests

	No. of CE^^	Trend assumption	ME^^^ statistic	5% critical value	α and β coefficients restriction tests	LR* test
Panama^	r = 0	No det.** trend	62.86	47.08	β(2,3)=β(1,1)=1, β(2,1)=β(2,2)=β(2,7)=β(2,5)= β(1,3)=β(1,5)=β(1,7)=0, α(1,2)=α(2,2)=α(5,2)= α(6,2)= α(2,1)=α(7,1)=α(4,1)=0	$\chi^2(12)$ = 20.53 [0.058]***
	r = 1		44.37	40.96		
	r = 2		32.03	34.81		
Ecuador	r = 0	Linear det. trend	62.36	50.60	β(1,1)=1, β(1,3)=β(1,4)=0, α(2,1)=α(3,1)=α(4,1)= α(5,1)=α(7,1)=0	$\chi^2(7)$ = 11.02 [0.138]
	r = 1		39.31	44.50		
Argentina	r = 0	No det. trend	102.91	53.19	β(2,7)=β(1,1)=1, β (1,2)=β(1,3)=β(1,6)=β(2,1)= β(2,3)=β(2,8)=0, (6,1)=α(2,2)=α(4,2)=α(5,2)= α(6,2)=α(4,1)= α(5,1)=α(7,1)=α(8,1)=α(1,2)=0	$\chi^2(14)$ = 23.32 [0.055]
	r = 1		66.95	47.08		
	r = 2		32.79	40.96		
Brazil	r = 0	Linear det. trend	98.41	52.36	β(1,1)=β(2,5)=1, β(2,2)=β(2,3)=β(1,8)=β(1,2)=β(1,6) =β(2,4)=β(2,7)=β(2,1)=β(1,4)=0, α(1,2)=α(8,1)= α(2,1)=α(3,1)=α(5,1)=α(6,1)=α(7,1)=α(6,2)=α(7,2)=0	$\chi^2(16)$ = 21.91 [0.146]
	r = 1		60.00	46.23		
	r = 2		39.98	40.08		
Mexico	r = 0	No det. trend	80.54	53.19	β(1,1)=β(2,7)=1, β(2,4)=β(2,3)=β(1,6)=β(2,2)=β(1,4) =β(1,3)=β(2,1)=0, α(8,2)=α(3,1)=α(4,1)=α(5,1)= α(6,1)=α(7,1)=α(1,2)=α(3,2)=α(4,2)=α(5,2)=α(6,2)=0	$\chi^2(16)$ = 25.08 [0.068]
	r = 1		52.00	47.08		
	r = 2		39.46	40.96		
Colombia	r = 0	No det. trend	75.12	53.19	β(1,1)=1, β(1,8)=β(1,6)=β(1,2)=β(1,5)=β(1,3)=0 α(6,1)=α(4,1)=α(8,1)=α(2,1)=α(3,1)=α(5,1)=0	$\chi^2(11)$ = 13.68 [0.251]
	r = 1		45.52	47.08		
Peru	r = 0	No det. trend	71.83	53.19	β(1,1)=β(2,3)=1, β(2,2)=β(2,6)=β(2,1)=β(2,5)=β(2,7)= β(1,4)=β(1,5)=β(1,7)=β(1,8)=β(1,3)=0, α(1,2)=α(5,2)= α(7,2)=α(8,2)=α(2,2)=α(6,1)=α(2,1)=α(3,1)=α(4,1)=0	$\chi^2(17)$ = 26.58 [0.064]
	r = 1		49.87	47.08		
	r = 2		38.15	40.96		
Venezuela	r = 0	Linear det. trend	72.17	52.36	β(1,1)=β(2,5)=1, β(2,2)=β(2,1)=β(2,8)=β(2,6)=β(1,3)= β(1,5)=β(1,7)=β(1,8)=0, α(4,2)=α(3,2)=α(1,2)=α(2,2)= α(7,2)=α(8,2)=α(5,1)=α(7,1)=α(2,1)=α(4,1)=α(6,1)= α(8,1)=0	$\chi^2(18)$ = 27.62 [0.068]
	r = 1		50.74	46.23		
	r = 2		38.33	40.08		

^ Samples are the same as in Table 1. ^^ Number of cointegrating equation(s). ^^^ Maximum-Eigenvalue. * Likelihood Ratio. ** deterministic. *** [p-values].

Table A4: Control variables details

Brazil	A dummy is necessary in August 1999 as a consequence of the financial crisis and currency devaluation the country faced at the beginning of that same year. The outlier in February 2003 is supposedly linked with Argentina's economic crisis.
Colombia	Outliers in August, October and December 1999 can be attributed to the country's move to a floating exchange rate regime in September 1999, after abandoning the crawling-peg band system introduced in 1992.
Ecuador	There are outliers in September and October 2007 as president Correa is changing the country's political landscape by rewriting the constitution. A dummy is necessary in November 2008, just before the president made good on months of threats by defaulting on a US$30 million coupon owed to Ecuador's global '12s, and on US$2.7 billion of global '30s.
Mexico	Outliers are present in 1999, February, April and October. We suppose they are a consequence of the Brazilian crisis.
Peru	There is an outlier in September 2001, just before the decision of the Central Bank to explicitly target a range for CPI inflation. The outliers in March and June 2008 are linked to the measures announced by the Central Bank in April 2008, namely, an increase in the fee charged to foreigners on the purchase of "Certificates of Deposits" to 400 basis points and a hike in the marginal reserve requirement on PEN deposits by foreigners in local banks.
Venezuela	We notice outliers in December 2001 and February 2002 as the country faces deep political troubles that have led to the "coup", on the 11^{th} of April, 2002. The dummy in December 2002 coincides with a 63-day strike the country faced. Strict capital controls have been in place since January 2003 as authorities have reacted to intense pressure on the currency and bank deposits generated by capital flight.