# Inflation Targeting in Dollarized Economies

By

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**Abstract**

The shift to inflation targeting has contributed to the relatively low inflation observed in some emerging market economies although, as noted by many economists, the preconditions required for a successful implementation were not in place. The existence of managed exchange rate regimes, a narrow base of domestic nominal financial assets, the lack of market instruments to hedge exchange rate risks, together with fear of floating and dollarization, have been stressed as factors that might weaken the efficacy of monetary policy. By examining various aspects of monetary transmission and policy formulation in two highly dollarized economies (Peru an Bolivia) vis-à-vis two economies with low levels of dollarization (Chile and Colombia), we found that while dollarization imposes differences in both the transmission capacity of monetary policy and its impact on real and financial sectors, it does not preclude the use of inflation targeting as a policy regime.

JEL Classification Numbers: E31, E4, E5

Keywords: Monetary policy, inflation targeting, dollarization

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## I. INTRODUCTION

An increasing number of emerging market economies have been adopting inflation targeting (IT) as their monetary policy regime. There is reason to believe that this shift has contributed to the relatively low inflation observed in these economies.[2] This outcome has surprised those that maintained that these economies are far away from the preconditions required for implementing IT. In particular, the existence of managed exchange rate regimes under foreign exchange market intervention, a narrow base of domestic nominal financial assets, and the lack of market instruments to hedge exchange rate risks, together with fear of floating, have been stressed as factors that drastically weaken the efficacy of monetary policy. Accordingly, these factors have been frequently seen as obstacles to IT implementation in a typical emerging market economy.

Inflation targeting would seem even more difficult in a highly financially dollarized economy. Consider an emerging market country where debts are denominated in dollars while firms depend on local currency receipts. Under these conditions, private sector and banks' balance sheets can be vulnerable to the type of nominal and real exchange rate shifts that should occur for standard inflation targeting to work effectively. In particular, through balance sheet effects, large real exchange rate depreciations (e.g., due to a sudden stop) could have a contractionary impact on output and be associated with bank failures. This contrasts with their expansionary impact on net exports and output in standard small open economy analysis.[3] Another difficulty has to do with the exchange rate pass-through to prices, which has been argued to be relatively high for dollarized economies. Yet, if this is the case, this would make monetary policy more potent in terms of its impact on exchange rates and prices.

In spite of these difficulties, some highly dollarized economies such as Peru have successfully adopted IT as their monetary policy regime. The authorities of Bolivia, another highly dollarized economy, have also expressed their interest to gradually transit towards IT. In light of such revealed policy preference for IT, the question arises of whether this regime can successfully accommodate the special characteristics and dynamics of high dollarization.

This paper examines various aspects of monetary transmission and policy formulation in highly dollarized economies. We compare two highly dollarized economies, Peru and Bolivia, with two economies with low levels of dollarization, Chile and Colombia. We conclude that, while high dollarization does introduce significant differences in both the transmission capacity of monetary policy and its impact on the real and financial sectors, it does not seem per se to preclude the use of IT as an effective policy regime. Moreover, the way in which the IT regime is implemented can be adapted to reflect the limitations and risks associated with a dollarized environment. In addition, we find that the way in which an

[2] For recent references on the issue, see Mishkin and Schmidt-Hebbel (2005), and Batini and Laxton (2005).

[3] See Calvo (1999 and 2001), Krugman (1999), Stein et al. (1999), and Aghion, Bachetta, and Banerjee (2000), among others.

economy responds to monetary policy is very much regime dependent. Thus, a regime shift towards IT will tend over time to induce shifts in underlying behavioral parameters that magnify the response to policy signals, thereby facilitating the conduct of monetary policy.

We start, in Section II, by identifying the key differentiating factors in terms of monetary transmission and monetary policy formulation in a highly dollarized environment. We then briefly review in Section III the overall monetary performance of Peru and Bolivia in recent years and conclude that in both cases it was quite good, although of a very different nature.

In Section IV, we compare the dynamics of key transmission variables for Chile (an IT economy with very low financial dollarization) against Peru. As expected, we find that the degree of exchange rate pass-through has been higher for Peru than for Chile. Moreover, while in Chile interest rate shocks tend to dominate exchange rate shocks in terms of their impact on inflation, we find the reverse for Peru. However, we also find that Peru's pass-through has diminished with the implementation of IT, while the impact of interest rates has increased. We also examine whether there are indications of increased financial sector fragility in a dollarized economy that could limit the scope of monetary policy. Indeed, we find that the real bilateral exchange rate Granger causes nonperforming loans (NPLs) in Peru but not in Chile. We view these findings to be consistent with balance sheet effects reflecting the higher vulnerability of loan portfolios in more dollarized economies.

In Section V, we estimate monetary policy reaction functions (Taylor rules) for Chile, Colombia, Peru, and Bolivia. Monetary policy in Chile and Colombia has reacted quite strongly to movements in inflation. Furthermore, we find that monetary policy in the two highly dollarized economies, Bolivia and Peru, has responded actively to pressures in the exchange market, as reflected in changes in international reserves or changes in the exchange rate. Section VI concludes with some remarks about further topics for research and a discussion of some policy implications.

## II. How Does Dollarization Affect Monetary Policy?

Standard small open-economy inflation targeting models, such as Ball (1999) and Svensson (2000), embody a central role for the exchange rate in the transmission from monetary policy to inflation. Accordingly, a rise in the domestic interest rate—aim, for example, at dealing with potential inflationary pressures—typically leads in the short term to nominal and real exchange rate appreciation, which in turn helps attenuate inflationary pressures through both direct and indirect channels. The direct channel reflects the impact of the exchange rate change on the change in the consumer price index (e.g., through the domestic price of tradables). The indirect channel works through the contractionary impact of real exchange appreciation on aggregate demand, output, and prices. In some cases, these changes may be accompanied by fluctuations in the country risk premium.

Turning to the case of a financially dollarized economy, where a substantial fraction of deposits and loans are denominated in dollars, the main differences we see as regards the monetary transmission mechanism are as follows. First, we would generally expect the exchange rate to play a more important anchoring role than in a nondollarized economy,

thereby inducing a higher pass through of exchange rates on prices. Such effects might possibly be nonlinear as larger depreciations may raise credibility issues. Second, it is plausible to argue that balance sheet effects would give rise to contractionary devaluations and induce financial stress. That is, instead of real exchange rate depreciation having a positive impact on output, one would observe a negative impact; quite a different dynamic than in the standard case.

In turn, the potentially adverse impact of large exchange rate fluctuations is likely to induce fear of floating by the authorities and require that they closely target the exchange rate, even when the underlying shocks are transitory.[4] To facilitate such targeting, the authorities may consider using direct foreign exchange market intervention as an additional policy instrument. Such "leaning against the wind" can be consistent with, and even strengthen, an inflation targeting framework, as long as such intervention is not aimed at targeting a specific trend for the real exchange rate.

The possible monetary policy responses to dollarization can be characterized with the help of a simple typology that broadly summarizes recent monetary experiences in Latin America, as shown in Table 1.[5]

Table 1. Alternative Flexible Monetary Frameworks

| | Full-Fledged Inflation Targeting (FFIT) | Intermediate Inflation Targeting (IIT) | Fear of Floating Competitiveness Targeting (FFCT) |
|---|---|---|---|
| Primary Final Target | Inflation | Inflation | Competitiveness |
| Secondary Final Target | Competitiveness | Competitiveness | Inflation |
| Operational Target | Interest Rate | Monetary Aggregate | Rate of Crawl |
| Primary Shock Absorber | Exchange Rate | Interest Rate | Foreign Assets |
| Secondary Shock Absorber | Foreign Assets | Exchange Rate/Foreign Assets | Interest Rate |

Under a conventional full-fledged inflation targeting (FFIT) regime, the primary final target is inflation and the operational target is the interest rate. Thus, shocks are primarily absorbed by the exchange rate and foreign exchange interventions are only used occasionally to help smooth out exceptionally large shocks. Instead, under fear of floating competitiveness targeting (FFCT), the primary final target is competitiveness and monetary authorities limit exchange rate fluctuations by using the rate of crawl as the operational target. Thus, foreign exchange intervention is the norm rather than the exception, and international reserves must bear the brunt of the adjustment against shocks. To help reduce the burden of adjustment on international reserves, FFCT countries also need to adjust the interest rate in response to shocks. To boost and speed up this response, some countries have used an intermediate

[4] See, for example, the papers that started this discussion: Calvo and Reinhart (2002), and Stein et al. (1999).

[5] Our special thanks to Alain Ize who provided this useful categorization.

inflation targeting (IIT) regime, such that a monetary aggregate (typically bank reserves) replaces the interest rate as the operational target. Thus, a decline in demand for bank reserves caused by an incipient capital outflow immediately and automatically boosts interest rates.

The recent (post 1999) policy regimes followed by Chile and Colombia can be classified as FFIT. Both countries experienced relatively high exchange rate volatility but relatively low international reserves volatility (Table 2).

Table 2. Volatility of Selected Variables

| | Real Effective Exchange Rate (REER) | | GDP | | International Reserves | | Interest Rate | |
|---|---|---|---|---|---|---|---|---|
| | 1995–99 | 2000–05 | 1995–99 | 2000–05 | 1995–99 | 2000–05 | 1995–99 | 2000–05 |
| Bolivia | 3.6 | 4.9 | 1.6 | 2.3 | 39.7 | 23.9 | 5.1 | 2.6 |
| Chile | 5.7 | 7.4 | 4.6 | 1.6 | 15.9 | 4.6 | 2.8 | 2.5 |
| Colombia | 10.5 | 11.1 | 3.9 | 1.3 | 13.8 | 7.7 | 8.0 | 2.2 |
| Peru | 5.2 | 3.1 | 4.2 | 1.2 | 21.5 | 11.3 | 2.6 | 0.5 |

Source: IMF, International Financial Statistics. IFS. Volatility is defined as the standard deviation of the following variables: GDP growth (1994=100 for Peru and Colombia and 2000=100 for Chile; for Bolivia the GDP series corresponds to IMF staff's estimates); the annual change in US$ billions of international reserves net of gold; the annual arithmetic average of monthly short-term interest rates, and the annual change of the REER index. For Peru, the periods considered were 1995–2001 and 2002–2005.

The current regime (post 2002) in Peru also approximates FFIT, although it has included more substantial foreign exchange market intervention, resulting in much lower exchange rate volatility than in Chile or Colombia. Peru's previous regime used bank reserves as the operational target, resulting in higher interest rate volatility. Last, the monetary regime in Bolivia during most of the past decade exhibited clear FFCT characteristics, with a large volatility in international reserves and interest rates. Overall, the evidence for the 2000–2005 period in Table 2 conforms to the notion that there is a trade-off between real exchange rate volatility and international reserves volatility. As the degree of dollarization increases, i.e., as we move from countries like Chile and Colombia to cases like Bolivia and Peru, one observes a drop in real exchange rate volatility accompanied by a rise in international reserves' variability.

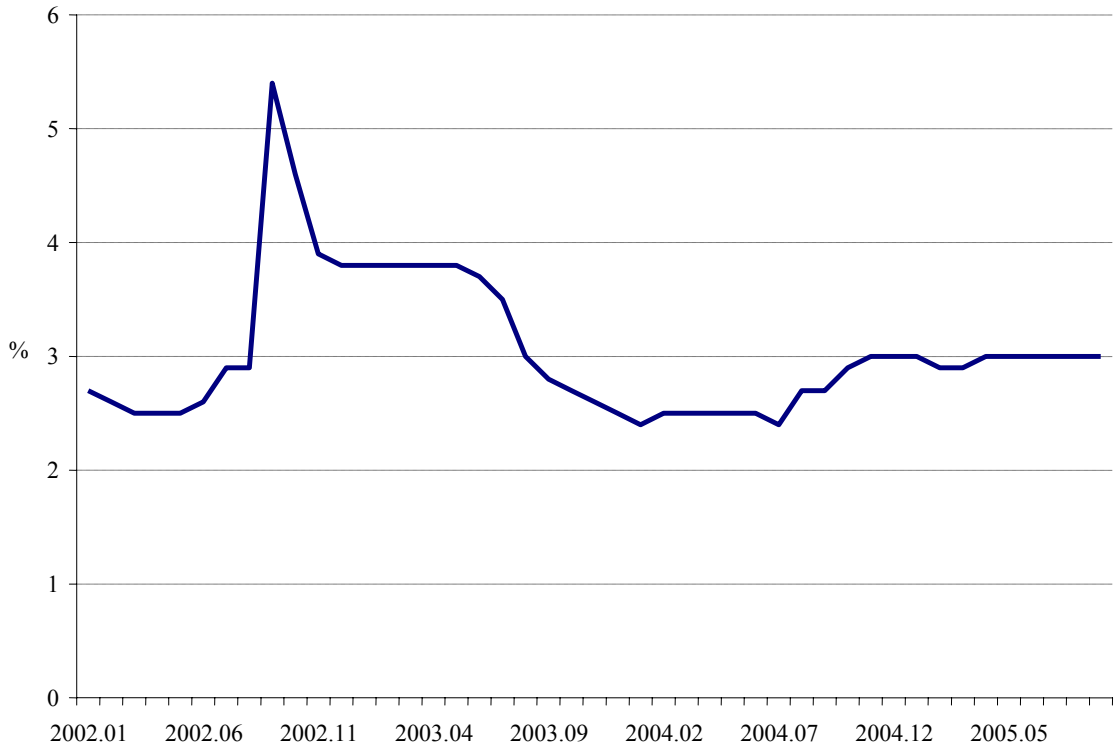
## III. The Recent Monetary Experiences of Peru and Bolivia

To assess whether FFIT can work in a dollarized economy, Peru's experience since it formally adopted its IT regime in 2002 is worth reviewing in some detail.[6] For about a year, up to the first half of 2002, monetary policy faced deflationary risk in the context of an

[6] See Armas and Grippa (2006).

almost zero growth economy, leading to a gradual cut in the policy rate to 2.5 percent (Figure 1).

Figure 1. Peru: Interbank Rate, 2002–2005

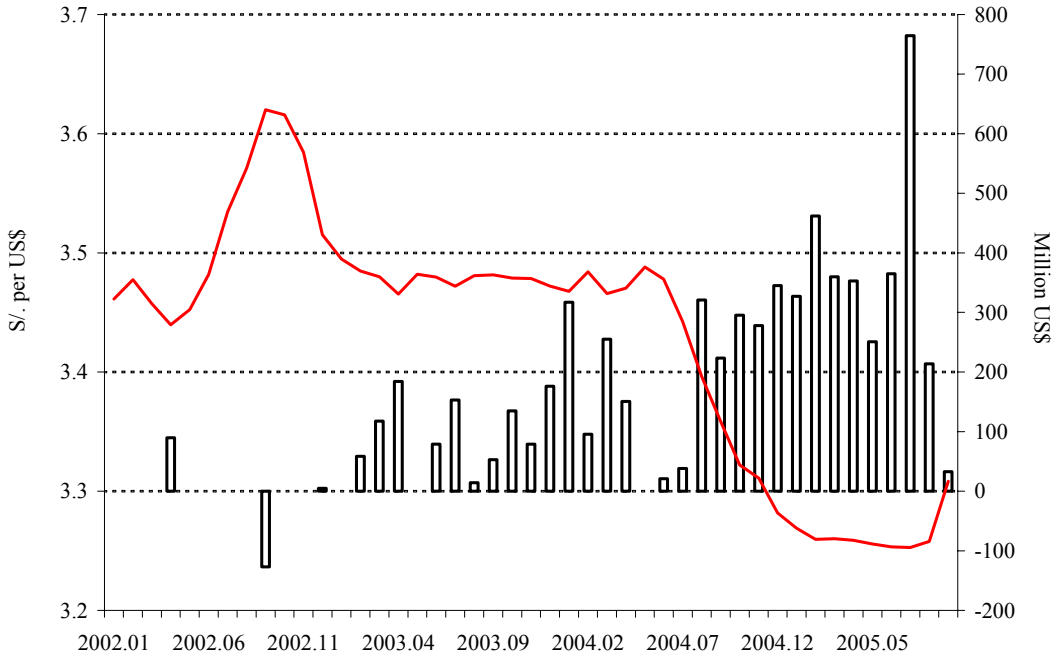



Source: Central Reserve Bank of Peru.

However, due to rising inflation risks (see below), preventive steps taken by the authorities resulted in a rise in the interbank rate to 2.9 percent in July 2002 and then to 5.4 percent in September of that year. Later on, monetary conditions were eased and the interbank rate reached the level of 3.8 percent at the end of 2002. After holding the rate at this level for half a year, underlying conditions allowed for a succession of interest rate cuts, which brought the interest rate to 2.5 percent at the end of 2003. These cuts were compatible with the impressive outcome that the inflation target of 2.5 percent was achieved in that year. The next turn in the policy stance occurred in 2004, when inflation accelerated mainly as the result of supply shocks. These led to hikes in the interest rate up to 3 percent toward the end of 2004, a level that was maintained during the first half of 2005.

The more restrictive monetary policy stance in the second half of 2002 was certainly influenced by the nominal exchange rate depreciation that resulted, as in other Latin American economies, from pressures mainly caused by the uncertainty about elections in Brazil. That was about the only time when the authorities sold foreign exchange out of their reserves, in an attempt to lean against the wind. The interest rate hikes appear to have had some impact on capital inflows in the second half of 2004. Notwithstanding persistent intervention by the authorities, a nominal exchange rate appreciation was then observed (Figure 2).

Figure 2. Peru: Exchange Rate and BCRP Intervention, 2002–2005




Source: Central Reserve Bank of Peru.

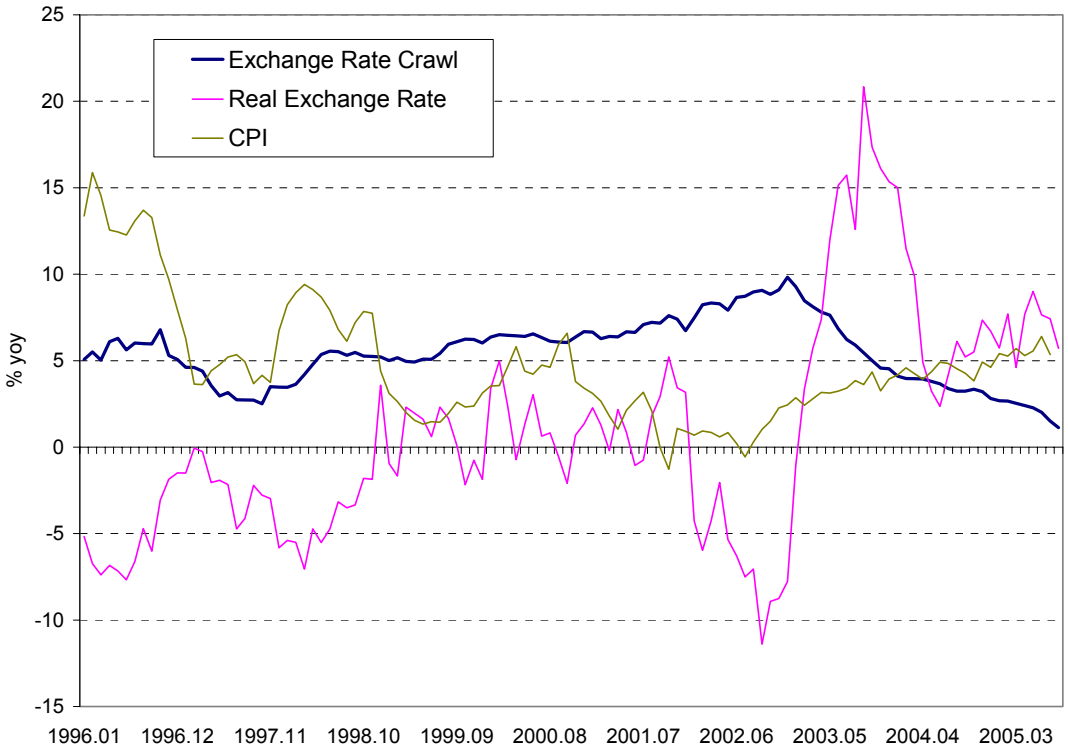
In sum, a casual look at Peru's conduct of monetary policy exhibits patterns typical of any other standard (i.e., nondollarized) economies. The policy rate was changed from time to time based on the forward-looking inflation outlook and these changes were implemented in a gradual, serially correlated, manner. Having said that, it is remarkable how small the degree of interest rate variability has been, compared with other IT countries such as Chile or Israel. The policy rate varied from a high of 5.4 percent to a low of 2.5 percent. At the same time, nominal exchange rate variability has also been relatively low, partly reflecting the impact of abundant foreign exchange market intervention. The gap between the most depreciated level of the nominal exchange rate, in the second half of 2002, and its most appreciated value, in mid-2005, is only 11 percent. These features suggest that FFIT in Peru, while overall quite successful, remains characterized by substantial fear of floating. The latter, in turn, is likely to reflect the high dollarization.

Bolivia's recent monetary experience is also worth reviewing. Unlike Peru, Bolivia has been unable so far to let its exchange rate float. Perhaps in part due to credibility concerns, the monetary authorities have continued to consistently target the exchange rate through a slowly adjusting crawl that informally targets the multilateral real exchange rate, subject to inflation remaining low.[7] In the wake of the switch to floating rate regimes in Bolivia's large neighboring

[7] See Morales (2005).

countries, notably Brazil and Argentina, and the large subsequent depreciations of their currencies vis-à-vis the dollar, Bolivia faced a strong appreciation of its real effective exchange rate. To fend off the resulting pressures on Bolivia's trade and economic activity, the monetary authorities acted countercyclically, by accelerating the rate of crawl. This policy has been seemingly successful in maintaining a competitive exchange rate (albeit with some lag). Although rising in recent years, inflation has remained moderate (Figure 3).

Figure 3. Bolivia: Exchange Rate Crawl, Inflation and Real Exchange Rate, 1996–2005 1/




Sources: IMF, International Financial Statistics; and Central Bank of Bolivia (BCB).

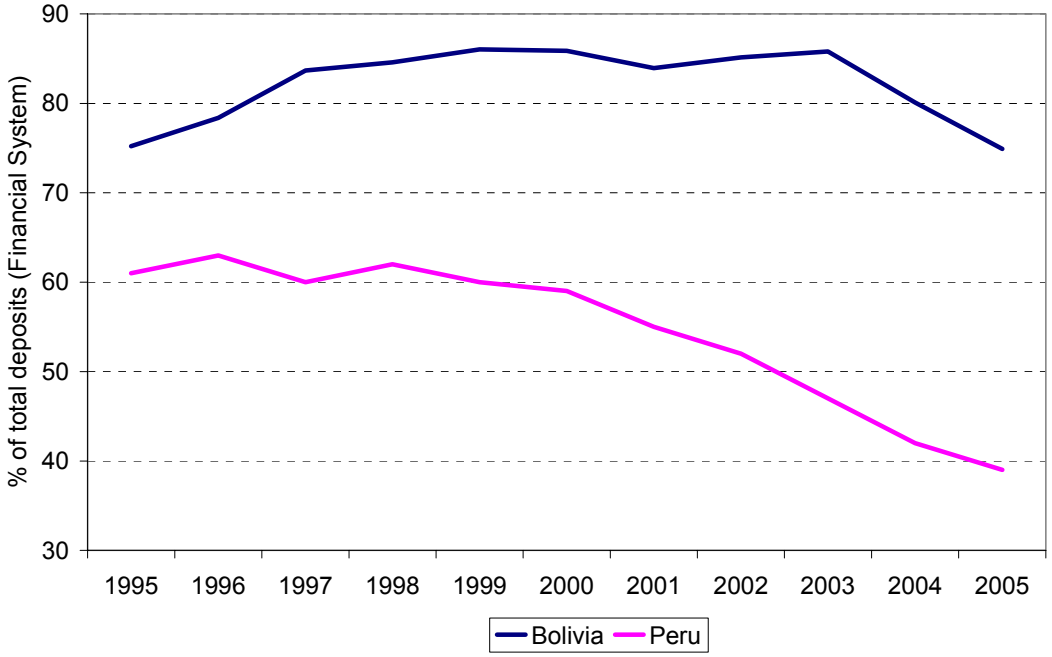
1/An increase in the REER reflects a depreciation.

However, a main potential drawback of the FFCT regime (in addition to the delayed exchange rate adjustments) is that the close targeting of the exchange rate tends to promote dollarization. Instead, FFIT should tend to reduce dollarization.[8] While we do not conduct formal tests of such linkages, the much stronger decline in dollarization in Peru than in Bolivia, following the adoption in Peru of the FFIT regime, is consistent with this hypothesis (Figure 4).

[8] Ize and Levy Yeyati (2003) show that financial dollarization should be related to the ratio of the volatilities of inflation and real exchange rate.

Figure 4. Bolivia and Peru: Financial Dollarization

(Percent of total deposits)




Sources: Central Bank of Bolivia and Central Reserve Bank of Peru.

## IV. Monetary Policy Transmission

The recent declining trend of inflation in most of the less developed economies is closely related to the secular appreciation of their currencies. While this is likely to be also the case for Chile and Peru, there are clear differences in how inflation has become more stable in the two countries. There are many other open questions that still remain in this regard. How has the exchange rate pass-through evolved in these countries? To what extent is dollarization associated with lower monetary control and higher financial vulnerability? Has inflation targeting allowed greater control over inflation?

To address these questions, we use vector autoregression (VAR) models to characterize monetary policy and analyze the impact of the exchange rate on inflation in both countries. We find that Peru registers a much higher pass-through on average than Chile. However, the pass-through in Peru has diminished together with the implementation of FFIT. Second, we find that while exchange rate shocks had a significant impact on the rate of inflation under the FFCT regime, interest rate shocks have tended to dominate exchange rate disturbances under FFIT. Finally, we find evidence of Granger causality from the real bilateral exchange rate to NPLs in Peru, but not in Chile.

**Exchange rate pass-through**

Using a baseline VAR, which considers 7 variables,[9] we estimate the effect of the nominal exchange rate in both countries considering our complete monthly sample, from 1993:01 to 2005:07 that covers both the FFIT and IIT periods. Figures 5a. and 5b. show the impulse-response functions for Chile and Peru, respectively. There is clear evidence that Chile has a much lower pass-through than Peru. In particular, the Chilean pass-through is low and very short-lived (around 6 quarters), while Peru registers a much higher pass-through that takes more than two years to die out. The maximum impact of a 1 percent shock of the exchange rate to inflation is approximately 0.075 for Chile and 0.2 for Peru.

Figure 5a. Chile: Response of Inflation to One S.D. Nominal Exchange Rate Innovation 1993:01 – 2005:07

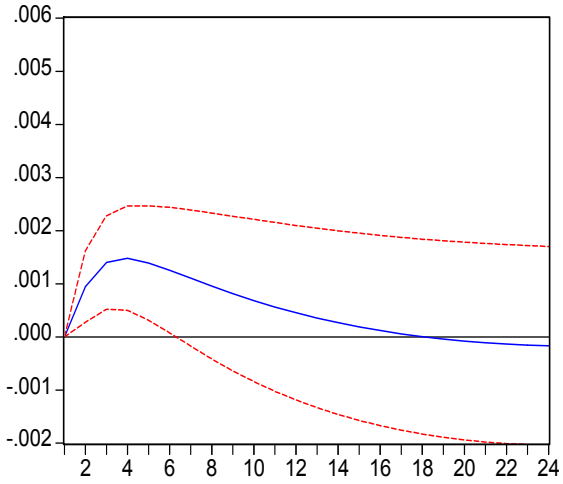
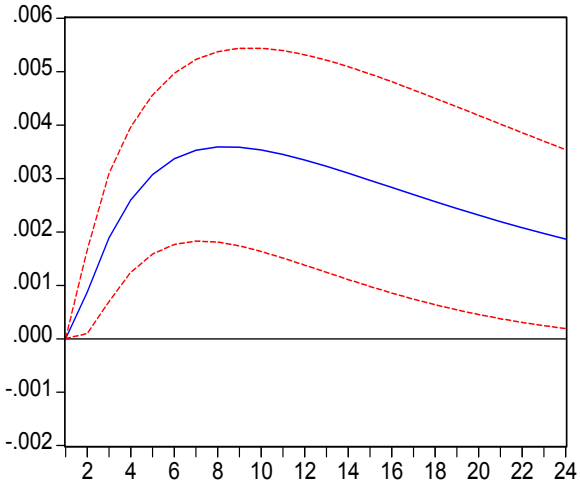



Figure 5b. Peru: Response of Inflation to One S.D. Nominal Exchange Rate Innovation 1993:01 – 2005:07




Source: Authors' calculations.

However, the pass-through declined as Peru switched from IIT to FFIT. Using the same baseline VAR model from the previous section, we compare the transmission mechanism before and after implementation of the FFIT framework. We run two VAR models: one from 1993:01 to 1998:12 and a second from 1999:01 to 2005:07. The 1999 threshold is taken to match differences in the behavior of the real exchange rate. We did not split the data from 2002—the year that IT was implemented—because there are not enough observations to run sensible regressions. However, the second sample is clearly influenced by the FFIT regime.

Figures 6a and 6b show the two samples' impulse-response functions of inflation for three types of shocks: interest rate, money, and the nominal exchange rate. The results are

[9] The variables considered in the baseline model are (in the same order in the VAR): world oil price, foreign interest rate, seasonally adjusted GDP, inflation, domestic (policy) interest rate, money, and the nominal exchange rate.

consistent with what one would expect. In particular, in the first sample, exchange rate and monetary shocks have a significant impact on inflation, whereas interest rate shocks do not. The reverse is true during the second period. This clearly suggests that the monetary transmission is endogenous to the policy regime. Unsurprisingly, the variable that is chosen as the key policy target becomes less volatile and becomes more relevant in terms of transmitting monetary signals.

**Interest rate pass-through**

As a complementary exercise, we focus our attention on the transmission from policy rates to banking rates for Peru, using the previous samples. We find that in the first sample, the interbank rate Granger causes the policy rate. However, the one-way causality is missing between these rates in the second sample (Table 3). This suggests that the central bank has gained credibility in influencing market rates.

**Financial stress**

Reflecting balance sheet effects, higher dollarization should trigger a closer association between exchange rate fluctuations and nonperforming loans. Figures 7a and 7b display the evolution of the real exchange rate and NPLs in Chile and Peru, respectively.

From the figures we can observe that there is some relationship between the two series in both countries. However, it is not possible to tell whether there is a causal relationship. Using a bivariate VAR model and two different subsamples (1994:03–2004:12 and 1999:01–2004:12), we find evidence of Granger causality from the real bilateral exchange rate to NPLs in Peru, but not in Chile (see Figures 8a–d). This is consistent with the former country being more dollarized than the latter. In Peru, real exchange rate shocks have a significant impact on NPLs from the fifth month and persist for around one semester, with no significant differences between the two subsamples.

Figure 6a. Peru: Response to One S.D. Innovation ±2 S.E. 1993:01– 1998:12

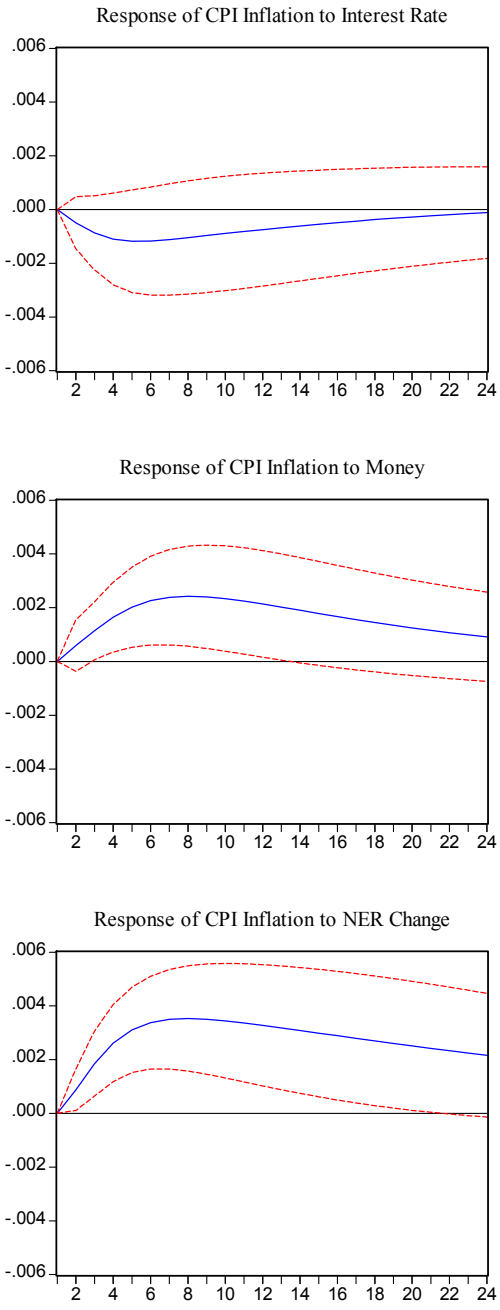
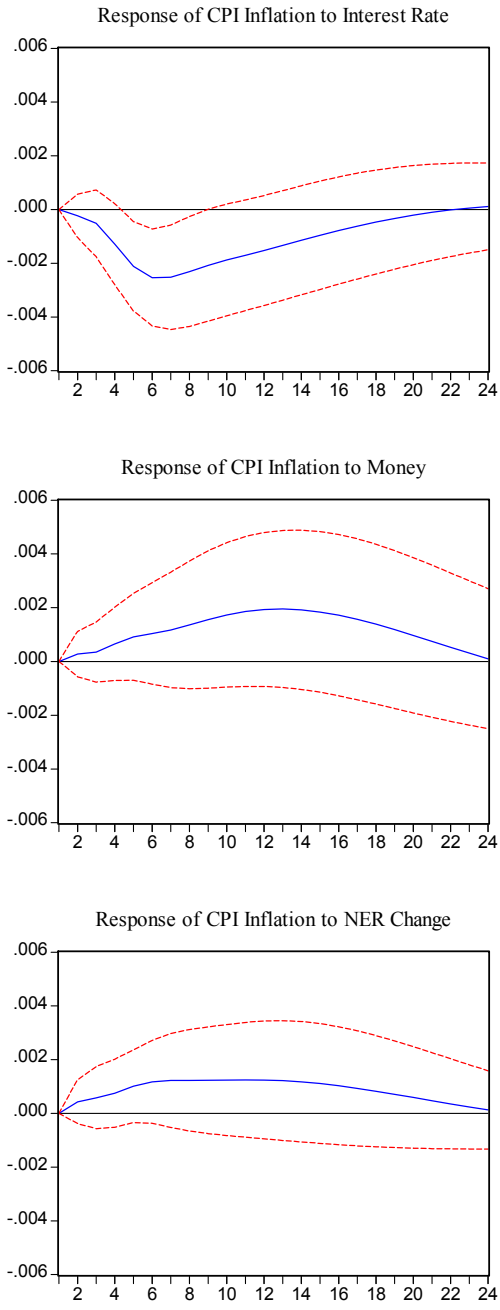



Figure 6b. Peru: Response to One S.D. Innovation ±2 S.E. 1999:01– 2005:07



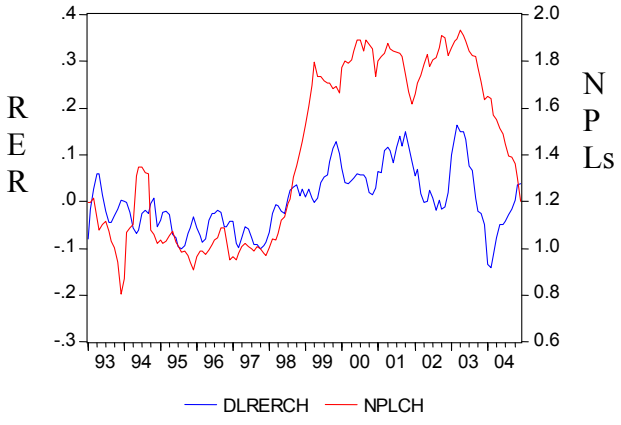

Source: Authors' calculations.

Table 3. Peru: Granger Causality: BCRP Rate vs. Banking Interest Rates

| Period: 1993:01–2004:12<br>Null Hypothesis | Obs. | F-Statistic | Probability |
|---|---|---|---|
| Interbank rate does not Granger cause BCRP rate | 100 | 7.94 | 0.00 |
| BCRP rate does not Granger cause interbank rate | | 1.68 | 0.19 |
| Lending rate does not Granger cause BCRP rate | 142 | 0.80 | 0.45 |
| BCRP rate does not Granger cause lending rate | | 9.00 | 0.00 |
| Deposit rate does not Granger cause BCRP rate | 142 | 5.27 | 0.01 |
| BCRP rate does not Granger cause deposit rate | | 7.34 | 0.00 |
| Deposit rate does not Granger cause lending rate | 142 | 3.45 | 0.03 |
| Lending rate does not Granger cause deposit rate | | 1.02 | 0.36 |
| | | | |
| Period: 1999:01–2004:12 | | | |
| Interbank rate does not Granger cause BCRP rate | 63 | 8.43 | 0.00 |
| BCRP rate does not Granger cause interbank rate | | 2.91 | 0.06 |
| Lending rate does not Granger cause BCRP rate | 72 | 4.58 | 0.01 |
| BCRP rate does not Granger cause lending rate | | 2.99 | 0.06 |
| Deposit rate does not Granger cause BCRP rate | 72 | 11.17 | 0.00 |
| BCRP rate does not Granger cause deposit rate | | 8.20 | 0.00 |
| Deposit rate does not Granger cause lending rate | 72 | 7.26 | 0.00 |
| Lending rate does not Granger cause deposit rate | | 2.05 | 0.14 |

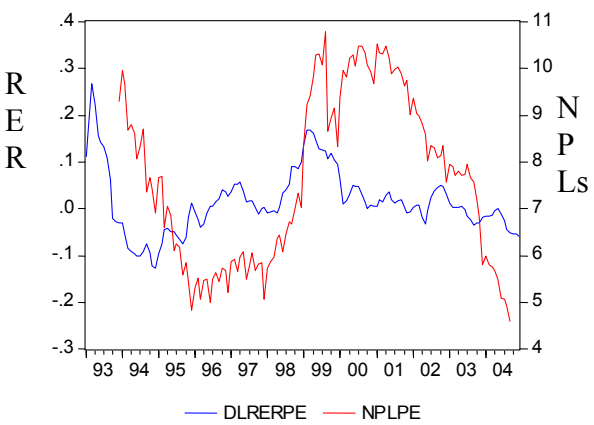
Source: Authors' calculations.

Figure 7a Chile: Real Exchange Rate (yoy) and NPLs, 1993–2004




Source: Central Reserve Bank of Peru and authors' calculations.

Figure 7b Peru: Real Exchange Rate (yoy) and NPLs, 1993–2004




Source: Central Reserve Bank of Peru and authors' calculations.

Figure 8a. Chile: Response of NPLs to One S.D. DLRERCH Innovation 1994:03–2004:12

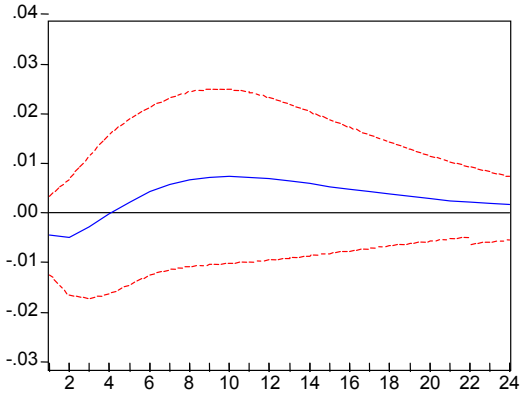



Figure 8b. Peru: Response of NPLs to One S.D. DLRERCH Innovation 1994:03–2004:12

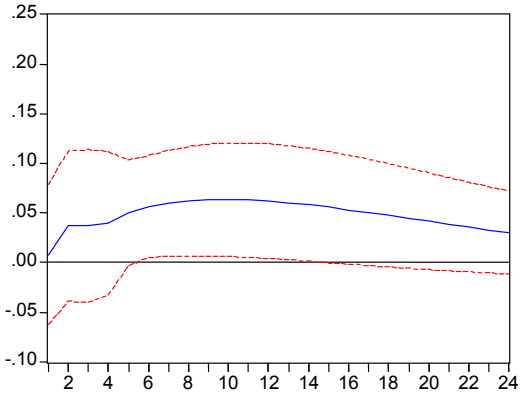



Figure 8c. Chile: Response of NPLs to One S.D. DLRERCH Innovation 1999:01–2004:12

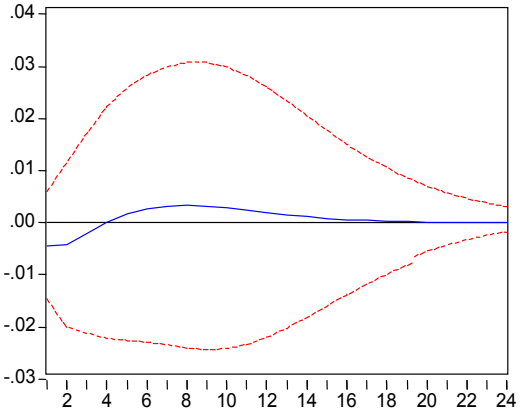
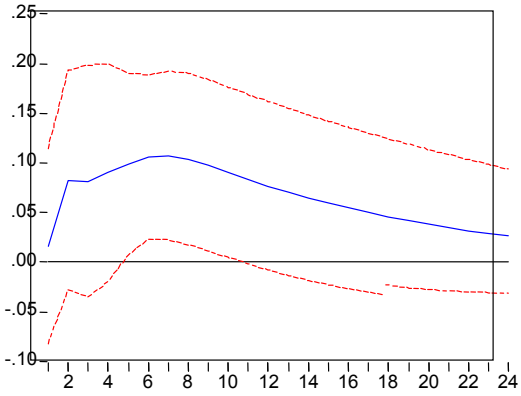



Figure 8d. Peru: Response of NPLs to One S.D. DLRERCH Innovation 1999:01–2004:12




Source: Authors' calculations.

## V. REACTION FUNCTIONS

We now turn to examine in more detail to what extent dollarization has affected in recent years the formulation of monetary policy in the four Latin American countries in our sample. The baseline reaction functions comprised those typically used for open economies. The short-term nominal interest rate (*i*) reacts to: (i) the actual inflation rate gap ( $\pi$ ); (ii) the output gap (*y*); (iii) the U.S. federal funds rate (*FF*), to account for interest rate parity; (iv) net international reserves (NIR), to gauge the reaction to reserve losses; and (v) the real effective exchange rate (*REER*), to take into consideration competitiveness targeting. Thus, the specification, used under different monetary policy frameworks, is the following:

$$i_t = \alpha + \beta\pi_t + \delta y_t + \phi\Delta REER_t + \eta\Delta NIR_t + \kappa FF + \gamma i_{t-1} + \varepsilon_t, \quad (1)$$

where $\Delta$ is the first difference operator. In the case of Bolivia, the dependent variable is the rate of crawl (*Crawl*), rather than the interest rate, reflecting the fact that the exchange rate is not allowed to float. The results (Table 4) are based on the Generalized Method of Moments (GMM) technique which provides better results when simultaneity and endogeneity become a problem.[10, 11]

Table 4. Reaction Functions (Based on GMM), 1993–2005

Using the interest rate as operational instrument

| Country | α | $\pi_t$ | $y_t$ | $\Delta REER_t$ | $\Delta NIR_t$ | $FF_t$ | $i_{t-1}$ | $R^2$ | J Statistic |
|---|---|---|---|---|---|---|---|---|---|
| Chile | 0.52<br>(0.67) | 0.75<br>(2.10) | 0.00<br>(0.09) | 0.00<br>(1.87) | 0.04<br>(0.90) | 0.08<br>(2.17) | 0.46<br>(2.02) | 0.78 | 0.30 |
| Colombia | -0.96<br>(-0.91) | 0.82<br>(3.23) | 0.01<br>(1.67) | -0.31<br>(-3.24) | 0.62<br>(1.54) | 0.01<br>(1.88) | 0.51<br>(1.04) | 0.88 | 0.05 |
| Peru | -0.88<br>(-0.05) | 0.53<br>(3.08) | -0.38<br>(-1.55) | -0.00<br>(-1.17) | -0.32<br>(1.96) | -0.09<br>(-0.99) | 0.77<br>(4.06) | 0.97 | 0.20 |

Using the rate of crawl as operational instrument

| Country | α | $\pi_t$ | $y_t$ | $\Delta REER_t$ | $\Delta NIR_t$ | $FF_t$ | $Crawl_{t-1}$ | $R^2$ | J Statistic |
|---|---|---|---|---|---|---|---|---|---|
| Bolivia | 0.03<br>(1.87) | -0.51<br>(-5.90) | -0.41<br>(-4.00) | -0.20<br>-(1.99) | -0.27<br>(-1.74) | -0.02<br>(-1.70) | 0.72<br>(5.04) | 0.83 | 0.01 |

Note: T-statistics appear in parentheses. Optimal weighting matrix obtained from first step two-stage least squares parameter estimates. Instruments: lagged values of inflation, estimates of output gap, and changes in real exchange rates.

[10] In symbols, $i_t = \sigma_0 + \sigma_1(\pi_t - \bar{\pi}) + \sigma_2(y_t - \bar{y}) + \sigma_3\Delta(REER_t) + \sigma_4\Delta NIR_t + \sigma_5 FF + \sigma_6 i_{t-1} + \xi_t$ where the gaps are calculated using a Hodrick-Prescott filter measuring trend.

[11] Following the methodology suggested by Clarida et al. (1998), policy reaction functions were first estimated using ordinary least squares on quarterly data from 1990 to 2004. We found that simple rules help explain central banks' behavior concerning interest rate settings reasonably well. Also a Chow Breakpoint Test (not reported here) suggested the existence of a monetary regime change in the period 1998–1999.

This exercise provides an opportunity to characterize monetary policy implementation in the economies under study. Several interesting results emerge.[12] First, the strong significance and signs of the contemporaneous inflation coefficient indicates that all central banks, even the Cental Bank of Bolivia, try to control it. While an increase in inflation leads to higher interest rates in Chile, Colombia, and Peru, in Bolivia it leads to a *slowing down* of the rate of crawl.

Second, the coefficients associated with the output gap are weakly significant for Colombia and Peru. However, in the latter case it is wrongly signed, possibly reflecting the dominance of confidence shocks that simultaneously raise the risk premium and depress output through a decline in aggregate demand. Interestingly enough, the output coefficient is strongly significant in the case of Bolivia, confirming that the monetary authorities have used monetary policy for countercyclical purposes, as indeed has been the case during the last few years.

Third, the coefficients associated with changes in the real exchange rate are significant for Bolivia and Colombia. In view of its expansionary impact, an exchange rate depreciation leads to a decline in interest rates in Colombia and a slowing down of the rate of crawl in Bolivia.

Fourth, both the Peruvian and the Bolivian monetary authorities react to changes in their international reserves. A reserve loss leads to counteracting increases in the policy interest rate in Peru and the rate of crawl in Bolivia. This suggests that both countries use their international reserves as front line buffers against shocks and adjust their monetary policy to replenish their reserves once they have been used.

All in all, the evidence therefore supports classifying Chile as an FFIT country, where inflation control is the only key target for monetary policy. While inflation control is also the main policy target in Colombia, concerns about the real exchange rate also appear to be relevant, suggesting that there might exist some element of competitiveness targeting as well. In the case of Peru and Bolivia, the fact that they mold in part their monetary policy around a more active use of their international reserves is consistent with a concern for limiting the potentially damaging impact of large exchange rate fluctuations in a highly dollarized environment. In the case of Peru, which does allow its exchange rate to float, this would suggest classifying it as an IIT country. In the case of Bolivia, the importance of international reserves and the real exchange rate in monetary policy, together with the fact that it operates through a crawl, make it a natural FFCT candidate. It is important to note, however, that inflation also appears to have been an important concern for the Bolivian monetary authorities. It is also rather remarkable that Bolivia appears to be the country with the most countercyclical monetary policy.

[12] The tests show that there are no problems of autocorrelation and that the equation set up explains around 90 percent of actual movements of interest rates.

## VI. CONCLUDING REMARKS

Since our main conclusions from this research were summarized in the Introduction, we now turn to some avenues for future work and some policy implications.

As far as the analytical framework is concerned, the challenge for future work is to develop simple models of IT that fully incorporate some of the special features that arise under financial dollarization, such as contractionary devaluations due to balance-sheet effects and the wide use of direct foreign exchange market intervention. From a policy perspective, one would need to consider models in which the monetary authority has two instruments to respond to various fluctuations: the policy interest rate and direct foreign exchange market intervention. Accordingly, when facing, for example, a sudden stop, the authorities may spread the burden of the monetary adjustment between interest rate hikes and selling foreign currencies. As far as we know, these trade-offs have not been discussed in previous IT work.

We believe there are important ways for improving the transparency of monetary policy in dollarized IT economies. Given the key role of financial system fragility in these economies, and the wide use of foreign exchange market intervention as a policy instrument, it would seem reasonable to expect central banks to communicate to the public their assessments, evidence, and policy strategy in these areas. A quick look at existing inflation reports indicates that there is scope for improvement here.

Another policy theme has to do with dedollarization as a means of improving the efficacy of monetary policy. In most emerging market economies, dedollarization typically occurs as an endogenous phenomenon, along with a marked reduction in the rate of inflation and not as a result of active and direct policies with that objective. Yet, the experience of countries such as Chile and Israel suggests that policymakers can also have a direct role in this process by contributing to the development and deepening of domestic financial markets. For example, the growing presence of medium- and long-term bonds denominated in domestic currency is a remarkable phenomenon. Other useful policy (institution building) steps have to do with helping develop markets in financial instruments to hedge foreign exchange risk. These can be expected to attenuate the “fear of floating” phenomenon. These are key policy issues that need to be addressed in future work.

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