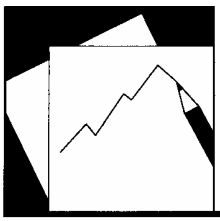
WP/06/7



IMF Working Paper

Financial Dollarization in Latin America

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INTERNATIONAL MONETARY FUND

 WP/06/7

IMF Working Paper

Western Hemisphere Department

Financial Dollarization in Latin America[1]

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January 2006

Abstract

This paper tests several explanations for financial dollarization (FD), with an emphasis on Latin America. The results provide evidence that FD is a rational response to inflation uncertainty. The paper builds on previous research by finding that an exchange rate policy biased towards currency depreciation and currency mismatches tends to contribute to high FD and that FD is highly persistent. These results suggest that countries with significant FD should encourage the use of domestic currency by maintaining macroeconomic stability; allowing more exchange rate flexibility and less bias towards currency depreciation; and adapting prudential regulations to ensure that costs associated with FD are fully internalized in financial contracts. At the same time, restoring confidence in the domestic currency may take many years of sound policies.

JEL Classification Numbers: E50, G11, G20

Keywords: Dollarization, monetary policy, credit risk

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[1] An earlier version of this paper was presented at the conference "The Policy Implications of Dollarization" held in Lima, Peru in April 2005. The authors would like to thank Roberto Garcia-Saltos, Alain Ize, Eduardo Levy-Yeyati, Roberto Steiner, Chris Towe, and the participants in a seminar at the IMF for comments and Kevin Cowan for comments on the presentation at the conference. They would also like to thank Genevieve Mendiola for superb research assistance.

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I. INTRODUCTION

In the past 15–20 years, many developing countries have experienced a process known as financial dollarization (FD), in which residents hold deposits denominated in foreign currency—the U.S. dollar in many cases.[2] In several countries, this has been accompanied by dollarization of the real sector, with a large share of purchases of goods and services and payment of wages taking place in foreign currency, or by currency substitution, where foreign currency also serves as a means of payment. The process of FD has usually occurred in the aftermath of a severe economic crisis involving high inflation that has undermined confidence in the local currency. Moreover, in many of these countries, dollarization remains very high, even though economic performance has improved and inflation has subsided.

Over the past decade, concerns about the effects of FD have increased. FD can help an economy by discouraging capital flight and encouraging residents to keep their savings in the domestic financial system. Yet it also carries potentially significant drawbacks, especially by narrowing the room for policy maneuver during a crisis.[3] If residents maintain significant cash balances in foreign currency, monetary policy may be less effective in managing domestic liquidity to control inflation or to dampen the effects of banking difficulties through lender-of-last-resort financing. More importantly, banks in highly dollarized countries tend to lend in foreign currency to borrowers with little or no foreign exchange earnings. This could weaken balance sheets by creating a significant currency mismatch. Banks could suffer severe losses in the event of a sharp real depreciation, which would drive up the costs of servicing foreign currency debt without necessarily raising the borrowers' income. Governments in highly dollarized countries also face this risk, as they tend to collect revenues in local currency while servicing debts in foreign currency. In this situation, high FD can deepen an economic crisis, such as in the case of Argentina in 2001 and Uruguay in 2002.

For this reason, the policy debate has focused on the causes of FD and the best policies to promote a recovery in the use of local currency for financial transactions and savings. This paper tests several explanations for FD, with an emphasis on Latin America—a region that encompasses countries that have avoided FD as well as those with persistently high FD. And in the past few years several countries in the region—most notably Paraguay and Perú—have been able to reduce the extent of FD. Section II reviews the empirical trends in FD.

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[2] This differs from official, full dollarization, which entails the legal adoption of a foreign currency as the sole monetary unit of a country. Currently, Ecuador, El Salvador, and Panamá are the only three Latin American countries with this monetary regime.

[3] The costs and benefits of financial dollarization are discussed fully in Balino, Bennet, and Borenstein (1999). Rogoff, Reinhardt, and Savastano (2004) challenge the notion that dollarization limits the scope for an independent monetary policy.

Section III assesses whether FD has been a rational response to inflation uncertainty. Section IV looks at the role of exchange rate policy and currency mismatches in encouraging and perpetuating FD. Section V reviews the policy implications of the results.

II. TRENDS IN FINANCIAL DOLLARIZATION

FD increased in most developing country regions between the mid-1990s and early this decade (Table 1). The use of foreign currency rose most rapidly in the transition economies, with almost half of all bank deposits denominated in foreign currency by 2001. FD rose in Latin America and Africa, while holding steady in Asia during this period. This trend occurred despite a significant decline in inflation after 1995 in most regions.

Average Inflation by Region
(In percent per year)

	1990-94	1995-99	2000-03
Africa	469.8	127.0	37.6
Asia	7.3	11.2	4.4
Industrialized	4.6	2.1	2.2
Latin America	365.6	14.8	9.3
Transition	873.0	44.1	10.4

Source: IMF, *International Financial Statistics.*

In the early 1990s, Latin America, Africa and the transition economies experienced high inflation on average. Asia experienced a moderate rise in inflation around the time of the Asian crisis in 1997–98. However, by the late 1990s, all of these regions had rates of inflation close to industrial country levels.

Looking more closely at Latin America, FD picked up sharply between 1990 and 2001 (Table 2). Foreign currency deposits as a share of total deposits rose significantly in countries that were already highly dollarized, such as Bolivia and Uruguay. Dollarization also picked up in countries with lower levels of dollarization in 1990, such as Costa Rica, the Dominican Republic, Honduras, Nicaragua, and Paraguay. Early this decade, Ecuador and El Salvador opted for full, official dollarization, each under very different circumstances. Five countries in Latin America—Brazil, Chile, Colombia, Mexico, and Venezuela—have avoided significant dollarization, even though they also have experienced severe macroeconomic problems since 1980. These countries preserved demand for their currencies through a combination of sound economic policies, indexed financial instruments, and legal restrictions on dollarized transactions. Except for Venezuela, residents of these countries placed their foreign currency assets abroad, but even in these cases, total foreign exchange deposits

(including offshore deposits) were less than in the highly dollarized countries.[4] Moreover, by shifting the foreign currency deposits abroad, these countries insulated their domestic banking systems from the risks associated with FD.

Since 2001, FD has declined in some Latin American countries. Argentina forced its residents to convert into pesos, reducing that country's dollarization sharply. Bolivia, Peru, and Uruguay have experienced moderate declines in foreign currency deposits as a share of total deposits, while FD fell sharply in Paraguay in 2004. Nonetheless, the extent of FD still remains high in many of these countries.

This persistence of FD seems puzzling because most of Latin America made significant gains in macroeconomic stability in this period. Both the rate and volatility of inflation declined significantly since the mid-1990s. Also the real exchange rate became more volatile, compared with the previous 15 years, which would tend to discourage FD (Table 3). The rise in the volatility of the real exchange rate probably results from the adoption of flexible exchange rate regimes in the late 1990s by many Latin American countries. The central government deficit declined as well, while financial systems appear to have deepened. Real economic growth has remained steady at 2½ percent a year on average, while real lending interest rates have become positive in real terms.

The persistence of dollarization through 2001 could reflect a historical legacy. Inflation in many Latin American countries during the period 1980–95 was extremely high by historical standards and compared with other developing country regions. In the period 1980–2003, there were a total of 56 so-called free-fall events—defined as years when broad money or consumer prices rose or the currency depreciated by over 1,000 percent or when deposit or lending interest rates exceeded 100 percent (Table 4). Three fourths of these events occurred in six Latin American countries (Argentina, Bolivia, Brazil, Nicaragua, Peru, and Uruguay).

III. Financial Dollarization As a Rational Response to Inflation Uncertainty

A. Theoretical Overview[5]

Even though inflation may have declined in countries with high FD, doubts may linger about the credibility of monetary policy, and residents resort to foreign currency deposits to protect their purchasing power measured in local currency from the risk of a surge in inflation. The yield curves in the six highly dollarized countries at end-2004 suggest that markets still wonder about the future stance of monetary policy (Figure 1). In Bolivia, Paraguay, Peru, and

[4] Singh et al. (2005), p. 82.

[5] Ize (2005) and Ize and Levy-Yeyati (2005) more thoroughly review the theoretical explanations of FD.

Uruguay, the gap between the yield curve for domestic currency deposits and for foreign currency deposits widens over time to well in excess of the inflation differential in most of these countries. In Costa Rica, the difference between the yield curves is closer to the inflation differential, yet the differential still widens gradually at longer maturities, suggesting concerns about the future stance of monetary policy.

Ize and Levy-Yeyati (2003) emphasize the importance of the relative volatility of inflation for determining the degree of FD. They argue that residents will prefer to hold foreign currency deposits if the risk of unexpected inflation is high. Specifically, residents look at the volatility of inflation relative to that of the change in the real exchange rate and hold a larger share of their portfolio in foreign currency assets as inflation becomes relatively more volatile and as the real exchange rate becomes more stable. In this situation, the real value of foreign currency assets—measured in terms of domestic purchasing power—is more stable. Similarly, stable domestic inflation and a volatile real exchange rate will make domestic currency assets a better store of value. This approach assumes that arbitrage tends to equalize the rates of return on domestic and foreign currency assets, which implies that shifts in inflation or interest rates will not affect the decision to hold foreign currency assets. Ize and Levy-Yeyati develop a variable that measures the portfolio share allocated to foreign currency assets that minimizes the variance of a portfolio with local currency and foreign currency interest bearing assets. They show that this share—known as the minimum variance portfolio (MVP)—rises as domestic inflation becomes more variable relative to the real exchange rate. They present empirical support for their view that a larger MVP contributes to more financial dollarization.

Weak institutions undermine the credibility of policies, as residents may fear that governments will erode the value of financial assets by generating unexpected inflation. De la Torre and Schmulker (2004) add that weak institutions can also raise doubts about the enforceability of contracts and encourage residents to shorten the duration of contracts or undertake transactions offshore in countries with more secure legal frameworks. Indicators of the quality of institutions have been developed by the World Bank, with a database starting in 1996 that includes measures of political stability, government effectiveness, regulatory quality, rule of law and control of corruption, and voice and accountability. Other agencies have compiled longer time series on institutional variables, such as political stability, bureaucratic effectiveness, and ethnic tensions.

The current macroeconomic situation can also influence the degree of dollarization. Guidotti and Rodríguez (1992) and Uribe (1997) develop models of currency substitution to explain how high inflation lowers demand for domestic currency as a means of payment and unit of account, contributing to dollarization. Their models also show that currency substitution can remain high even when inflation declines. Guidotti and Rodríguez point to costs associated with re-denominating transactions back into domestic currency, while Uribe attributes persistent dollarization to network effects—the cost of using foreign currency declines as more residents rely on this means of payment. In both models the demand for domestic currency will recover if inflation falls by enough to justify incurring the costs of the transition. While these models were developed to explain currency substitution, the results

can also apply to financial dollarization, especially in economies where financial innovations allow broader forms of money to also serve as a means of payment. The fiscal deficit can also affect the degree of dollarization. In many dollarized countries, the surge in inflation that cut confidence in the domestic currency arose from a wide fiscal deficit that had to be financed with money creation. For this reason, fiscal discipline might help reduce dollarization by strengthening confidence.

B. Empirical Results

We estimated equations that sought to explain FD in terms of the MVP, inflation, the central government deficit, indices of institutional quality and political stability, and legal restrictions on dollarization. The dependent variable is the ratio of foreign currency deposits to total deposits, which—while imperfect —provides the most widely available measure of dollarization. We first estimate a cross-section model for a sample of over 62 countries with broad regional coverage that includes OECD countries, transition economies, Asia and Africa as well as Latin America for the period 1990–2001.

The results of the cross section equations confirm the results of de Nicolo, Honohan and Ize (2003) and Ize and Levy Yeyati (2003) (Table 5). Equation 1 shows that the minimum variance portfolio explains an important part of dollarization, with a 10 percent increase in the MPV raising deposit dollarization by 6 percent. Inflation plays an important role as well. In addition, legal restrictions on foreign currency deposits appear to be effective in reducing deposit dollarization. The coefficient on the central government deficit—both as a share of GDP and of broad money—is not statistically significant. While surprising, this result could reflect a measurement problem—the central government deficit is the most widely available measure but may not be sufficiently comprehensive. Possibly, the current fiscal position may not reflect lingering uncertainty about the future stance of fiscal policy, or institutional changes—such as eliminating central bank financing to the government—may have eased concerns about the risk of monetizing large fiscal imbalances.

In Equations 2 through 5, the coefficients on the indicators of institutional quality are statistically significant and have the correct sign in the full sample, which includes OECD countries.[6] Looking at indicators of institutional quality developed by the World Bank, there is no significant difference between the quality of institutions in Latin America and Asia, Africa, or the transition economies. However, OECD countries clearly have much stronger institutions than developing countries. When OECD countries are excluded from the sample, the coefficients on the institutional variables are no longer statistically significant (Equations 6–9). This result might suggest that significant gains in institutional quality are required to bolster confidence and discourage dollarization.

[6] When all of the indicators of institutional quality are included in one equation, none of the coefficients is statistically significant, suggesting the presence of multi-colinearity.

We tested whether FD was higher in countries that experienced so-called freefall events during the 1980s. Equation 10 includes a dummy variable for those countries, and the results suggest that this factor does not explain differences in FD across countries.

We tried to assess how quickly these factors affect the level of dollarization by estimating these equations using a panel data set with a lagged dependent variable (Table 6). These equations were estimated using the two-step system GMM method developed by Blundell and Bond (1998).[7] Equation 11 suggests a high degree of persistence to dollarization, as the coefficient on the lagged dollarization ratio is quite high at 0.94. The MVP has a statistically significant effect on dollarization, although relatively small in the near term, as a 10 percent decline in the MVP would lead to just a 0.3 percent decline in financial dollarization after one year. The longer term effect is much larger—and similar to the elasticity estimated in the cross country regressions—with a 10 percent decline in the MVP leading to a 6 percent decline in deposit dollarization. Inflation and the nominal rate of depreciation have a statistically significant but small impact on dollarization, while the central government deficit has no significant impact on dollarization (Equations 11–13).[8] Equations 14 through 18 suggest that none of the measures of institutional quality or political stability—apart from the quality of the bureaucracy—have a significant effect on deposit dollarization, possibly reflecting the fact that there is insufficient variation in these variables over time.

There is some evidence that the persistence of FD is higher in Latin America and in highly dollarized countries (with dollarization ratios above 40 percent). Equation 19 includes an interactive dummy variable for Latin America on the coefficient for the lagged dependent variable and for the MVP. The results indicate that persistence is much lower outside of Latin America, as the coefficient on the lagged dependent variable declines to 0.72 for these countries. The coefficient on the MVP is considerably higher for countries outside Latin America. Equation 20 includes a similar interactive dummy variable for the lagged dependent variable and the MVP but this time for highly dollarized countries, and the results show that persistence is higher, and the effect of the MVP is lower, in these countries.

IV. The Role of Credit Risk

Ize and Powell (2004) and Ize (2005) broaden the explanation of FD to include credit risk arising from shift in interest rates or exchange rates. They emphasize the role of expected bankruptcy costs—which are often high in many developing countries because of non-transparent accounting and lengthy and at times unreliable judicial proceedings. From the creditors' perspective, the value of claims and collateral in local currency can also be diluted by surprise inflation. These authors show that economies settle into equilibria using the

[7] The estimation methodology is described in more detail in Appendix 2.

[8] When both inflation and nominal exchange rate depreciation are included in the same equation, both coefficients are statistically insignificant.

currency or mix of currencies that limit expected bankruptcy costs. Ize (2005) shows that equilibria with high FD are possible with an inflexible and asymmetric exchange rate policy, prudential regulations that encourage moral hazard and strong concerns about financial stress arising from a currency mismatch.[9] In such equilibria, these variables are interdependent, and causality is difficult to identify. For example, limited exchange rate flexibility can both perpetuate as well as result from high FD.

The exchange rate policy of central banks in many developing countries may encourage dollarization by limiting exchange rate flexibility, which reduces the risk of holding foreign currency assets and of lending in foreign currency to all sectors, including non-tradable. For this group of countries and time period, we calculated the Calvo-Reinhardt index of fear of floating, which measures the variability of the rate of depreciation in the nominal exchange rate relative to the sum of the variability of net international reserves and the variability of short-term interest rates. (Table 7). This index ranges from zero in the case of an exchange rate peg to infinity in the case of full exchange rate flexibility. According to this index, the dollarized Latin American countries tended to have significantly less exchange rate flexibility in the period 1990–2004 than the countries in the region that have avoided significant dollarization. However, there is considerable variation among these countries, with Bolivia and Honduras showing similar degrees of flexibility as Guatemala and Mexico over this period.

An asymmetric exchange rate policy—one that allows for some nominal currency depreciation but tends to resist nominal currency appreciation—can provide a one-way bet for holding foreign currency deposits and encourage dollarization, especially if combined with limited exchange rate flexibility. With this type of exchange rate policy, residents would preserve their purchasing power in local currency by holding foreign currency assets, which would benefit from higher average returns as well as lower risk.

We looked at several measures of the asymmetry of exchange rate policy. First we constructed an index of bias in exchange rate policy for the period 1990–2004 by assigning a value of -1 in months of currency appreciation and 1 in months of currency depreciation, and then finding the average for the year.[10] Values of this index close to 1 indicate a bias towards currency depreciation, while a value close to -1 suggests a bias in the other direction. The results indicate that the highly dollarized Latin American countries, especially Bolivia, Nicaragua, and Costa Rica, have had a stronger bias towards nominal currency depreciations than the other countries in the region.

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[9] The model makes the crucial assumption that projects returns rise with a real exchange rate depreciation. This means that borrowers in foreign currency would perceive that they would benefit as well from a real depreciation.

[10] Periods of no change in the exchange rate were assigned a value of 0.

Asymmetry of exchange rate policy could also refer to infrequent but sizable currency depreciations. For this reason, we also estimated the skewness of the distribution of monthly currency depreciations for two periods—1990–2001 and 1980–89. According to this measure, the more positive the degree of skewness, the greater the bias towards currency depreciations; more negative degrees of skewness indicate a bias towards currency appreciation. For the period 1990–2001, we found that there were no noticeable differences in this measure of asymmetry between highly and less dollarized countries, as both groups of countries had the same average degree of skewness over this time period. However, these averages mask considerable variation over time and across countries.

Prudential guidelines, such as capital adequacy requirements or deposit insurance, can encourage banks to engage in excessive foreign currency lending. These guidelines may not force creditors and borrowers to internalize the true costs of loans in foreign currency, which should include a premium for currency risk. The highly dollarized countries in Latin America tend to have prudential requirements that are largely neutral with respect to currency denomination (Table 8). Honduras is the only country that limits lending in foreign currency—both overall and to non-exporting clients. Bolivia, Honduras, Peru, and Paraguay apply higher reserve or liquid asset requirements on foreign currency deposits. All the highly dollarized countries in the region apply the same capital adequacy requirement to foreign and local currency assets and extend the same deposit insurance coverage to all deposits, regardless of currency denomination. These countries limit banks' net position in foreign exchange, and restrictions on the net long positions in foreign currency might create an incentive to onlend foreign currency deposits.

Countries with high FD face the potential for financial stress arising from sizable currency mismatches—liabilities in foreign currency that are not fully backed by assets or income streams also in foreign currency. This mismatch can make unwinding dollarization more risky and costly, especially if this happens in the context of a real exchange rate depreciation that could impose large losses on banks. Banks in highly dollarized countries often lend in foreign currency to many different sectors, including construction, wholesale and retail, trade and mortgages (Figure 2). In Costa Rica—where foreign currency loans accounted for about two-thirds of total loans in 2004—loans to these sectors account for well over half of total loans in foreign currency. This most likely reflects confidence in the stability of Costa Rica's real exchange rate. Moreover, lending in foreign currency for mortgages adds a political economy dimension to exchange rate policy, as governments would come under strong pressure for a bail out if homeowners ran into difficulties in paying their mortgages after a sharp real depreciation. A similar pattern of lending occurs in Honduras and Peru.

The balance sheets of nonfinancial corporations also show a similar pattern. In 2001, a large share of the total liabilities of the corporate sector in Argentina, Bolivia, Costa Rica, Peru, and Uruguay were in foreign currency, ranging from 52 percent in Bolivia to 78 percent in Uruguay (Table 9). These corporations appear to have been reacting in part to the high variability of domestic inflation. In addition, the Latin American countries that impose legal restrictions on dollarization, such as Colombia and Brazil, as well has having relatively stable

domestic inflation, had relatively low levels of dollarization of corporate liabilities. The nonexporting sector in the highly dollarized countries also tended to have a relatively high share of dollarized liabilities to total liabilities. In Uruguay, for example, nonexporting firms had on average 78 percent of their loans denominated in foreign currency. Moreover, the corporations with higher liability dollarization tended to have large net short positions in foreign currency.

As a rough measure of the extent of currency mismatches, we looked at the share of a country's foreign currency deposits in relation to its exports.[11] This measure tries to capture the extent of the banking system's vulnerability to losses from foreign exchange risk through its loan portfolio. In many dollarized countries, the level of foreign currency deposits in banks is similar to the level of foreign currency loans made by banks, because most countries impose limits on banks' net foreign exchange positions. At the same time, foreign exchange earnings of bank clients should ultimately come from the country's exports of goods and services. This measure is only moderately correlated with the foreign currency deposit ratio, with a correlation coefficient of 0.48. The countries with relatively high FD are fairly open to international trade, with exports of goods and services of about a third of GDP in the period 2000–04 (Table 10). However, foreign currency deposits in these countries averaged about 60 percent of GDP, or about twice export earnings. The less dollarized countries in the region had lower exports shares (about one-fourth of GDP) but also had much less FD, resulting in foreign currency deposits equivalent to about 10 percent of exports.

A. Empirical Results

We estimated cross section and panel data regressions that include the variables for the degree of exchange rate flexibility, bias of exchange rate policy and for the extent of currency mismatch, as well as the MVP and the rate of inflation (Table 11).[12] In equation 20, the coefficients on the MVP, inflation, restrictions on FD, the bias towards currency depreciation and currency mismatches are statistically significant. The degree of exchange rate flexibility is no longer statistically significant, possibly because its effects are captured by the MVP. Equation 21 looks at the evolution of FD over time, and uses the lagged values of these variables to minimize the endogeneity problem. This equation shows that FD is associated with the bias towards currency depreciation, the currency mismatch as well as inflation and the MVP, but the degree of exchange rate flexibility is not statistically significant. Interestingly, the central government balance now becomes statistically significant, with larger surpluses contributing to lower FD. The measures of the degree of skewness of the distribution of currency depreciations for 1990–2001 and 1980–89 were not statistically significant in either equation, probably because of the significant variation in the

[11] Goldstein and Turner (2004) propose a broader, more aggregated measure of the currency mismatch for an economy.

[12] Including a lagged dependent variable in Equation 21 led to counterintuitive results.

skewness measure across countries and over time. We must caution that—given the interdependency among these variables—these results point to a statistically significant association without necessarily establishing a causal relationship.

There appear to be two equations that provide good explanations of FD—equation 11 with a lagged dependent variable, the MVP and inflation and Equation 21 with the MVP, inflation, exchange rate flexibility, central government balance, asymmetry and the currency mismatch. The out-of-sample forecasts for the period 2002–04 suggests that both models capture the main trends in FD in some of the highly dollarized countries in the region (Figure 3). Both models correctly point to declines in FD in Bolivia, Nicaragua, Peru, and Uruguay and to broadly stable FD in the Dominican Republic and Honduras. However, the models miss the rise in FD in Costa Rica and the sharp drop in FD in Paraguay in 2004.

V. CONCLUDING REMARKS

These results provide evidence that financial dollarization (FD) is a rational response to uncertainty about inflation. FD tends to remain high in countries with unstable and high domestic inflation and with institutions that undermine confidence in the outlook for inflation. The evidence on the role of the central government balance is mixed, although equation (21) supports the view that larger fiscal surpluses do help reduce FD. Legal restrictions may have been effective in preventing FD, most likely in countries with low inflation or effective indexation mechanisms to preserve purchasing power in local currency. In countries that already have high FD, imposing such restrictions could create strong incentives to place financial savings offshore, leading to a costly economic adjustment. The study also finds that an exchange rate policy that is biased towards depreciation is associated with high FD, although the skewness measure of asymmetry is not statistically significant. The degree of exchange rate flexibility probably also matters, but these effects appears to be captured by the minimum variance portfolio (MVP). This exchange rate policy cuts the risk of lending and saving in foreign currency and tends to enhance the rate of return on foreign currency assets. Countries with high FD also have significant currency mismatches, which are encouraged by exchange rate policy as well as prudential regulations that are largely currency neutral.

The results also point to strong persistence in FD, with a high and statistically significant coefficient on the lagged dependent variable. However, this persistence does not appear to reflect the legacy of high inflation in the 1980s, as the freefall indicator and the skewness of exchange rate policy during the 1980s do not appear to have a significant effect on FD. The persistence could reflect the effect of currency mismatches and policies—such as exchange rate policy and prudential regulations—that create incentives for residents to continue holding foreign currency deposits. At the same time, the extent of FD probably also explains currency mismatches and imposes limits on exchange rate policy, and the causality implied by the econometric results needs to be interpreted with caution. But this is precisely the point of the explanation of dollarization in Ize (2005)—economies with highly variable inflation and financial market imperfections can find themselves locked into an equilibrium with high FD because of the very high economic costs of moving to a low dollarization equilibrium.

These results suggest that countries with significant FD should strive to encourage the use of domestic currency by maintaining macroeconomic stability, with low and stable inflation; allowing for more exchange rate flexibility and less bias towards depreciation; and strengthening institutions to improve confidence in the sustainability of economic policies. Highly dollarized countries should adapt their prudential regulations to ensure that creditors and debtors internalize the costs associated with FD. At the same time, restoring confidence in the domestic currency may take many years of sound policies and may require a careful approach to limit the transition costs of returning to a low dollarization equilibrium.

Table 1. Dollarization by Region, 1995 and 2001

	1995	2001
Transition Economies	34.4	47.8
Of which : Bosnia & Herzegovina	...	62.5
Bulgaria	29.5	57.2
Hungary	30.5	20.5
Poland	27.6	18.9
Russia	28.5	34.3
Slovenia	42.1	36.1
Ukraine	36.8	32.4
Asia	31.0	30.3
Of which: Indonesia	19.7	20.1
Korea, Republic of	0.5	3.5
Lao People's Dem. Rep.	57.3	82.7
Philippines	24.7	30.7
Thailand	0.3	1.3
Vietnam	34.6	43.4
Africa	23.2	31.9
Of which : Angola	25.4	81.0
Ghana	25.6	...
Nigeria	4.1	5.0
South Africa	0.7	6.2
Zambia	20.1	42.7
Latin America	39.8	44.3

Source: De Nicolo, Honohan and Ize (2005).

Table 2. Selected Latin American Countries: Deposit and Loan Dollarization

	Foreign Currency Denominated Deposits (In percent of total deposits)					Foreign Currency Denominated Loans (In percent of total loans)			
	1990	2001	2002	2003	2004	2001	2002	2003	2004
Argentina	47.2	71.5	4.2	6.7	10.7	80.0	7.2	7.1	14.1
Bolivia	80.7	91.5	90.8	90.0	85.3	97.0	97.3	97.7	97.7
Brazil	0.0	6.1	6.5	...	6.5	18.0	19.4	...	12.0
Chile	16.3	14.0	12.8	13.2	11.9	13.8	13.0	10.3	10.3
Colombia	0.3	0.5	0.4	0.0	2.0	11.0	11.6	8.8	6.1
Costa Rica	26.8	49.1	50.0	50.2	56.6	67.2	53.0	55.5	53.3
Dominican Republic 1/	2.2	23.9	26.1	27.5	25.1	27.6	30.9	37.0	27.3
Ecuador	13.3	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
El Salvador	4.1	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Guatemala	0.0	5.1	8.8	12.4	14.9	...	15.3	16.7	17.7
Honduras	1.8	33.4	34.2	35.1	35.7	22.2	22.8	26.4	30.9
Mexico	10.1	8.1	4.6	4.5	5.4	20.5	12.9	12.3	9.8
Nicaragua	40.3	70.6	72.1	69.6	68.7	83.6	83.1	84.3	85.0
Paraguay 1/	33.9	66.6	68.7	63.0	47.0	52.8	58.2	55.7	51.7
Peru	62.5	74.3	73.2	70.6	64.1	80.3	78.9	76.8	73.9
Uruguay 2/	88.6	83.0	90.0	93.0	83.0	66.0	81.0	76.0	70.0
Venezuela	...	0.2	0.2	0.2	0.1	0.7	0.8	0.7	0.6

Sources: Central banks; and IMF staff estimates.

1/ For the Dominican Republic and Paraguay, 1990 column refers to 1996 data.

2/ Loan ratio for Uruguay includes only lending to residents.

Table 3. Indicators of Macroeconomic Stabilty, 1980-2003

(In annual percent change, unless specified otherwise)

	1980-1995				1996-2003			
	Latin America 1/		Outside Latin America		Latin America		Outside Latin America	
	Mean	Volatility 2/	Mean	Volatility 1/	Mean	Volatility 1/	Mean	Volatility 1/
Nominal stability								
M2	216.3	4.0	75.5	4.4	15.4	1.0	30.2	5.0
CPI	244.8	4.4	89.6	9.4	11.2	1.3	21.0	8.1
Nominal exchange rate	234.7	4.8	84.2	17.2	14.2	1.9	43.1	10.9
Lending interest rate	81.1	4.7	27.4	3.1	29.2	0.6	20.4	1.1
Government deficit (in percent of GDP)	-3.9	1.2	-4.7	1.9	-3.0	0.9	-3.3	1.7
M2 (in percent of GDP)	29.6	0.5	52.8	0.9	33.9	0.4	51.2	0.9
Real stability								
Real GDP	2.5	1.8	2.1	3.5	2.5	1.4	3.8	1.2
Real exchange rate	5.3	10.4	-0.2	85.0	-0.3	36.3	1.1	11.5
Real lending interest rate	-147.0	8.2	-4.8	38.1	19.7	1.1	8.2	4.3
Exports (in percent of GDP)	22.2	0.4	43.2	1.3	27.5	0.4	43.4	0.6

Sources: IFS and WEO.

1/ Excludes Argentina in 1989 and Nicaragua in 1988.
2 / Coefficient of variation.

Table 4. Summary of Free-Fall Events, 1980-2003 1/

Country	Year	M2 (% chg)	CPI (% chg)	Exchange rate[2] (% chg)	Deposit interest r. (%)	Loan interest rate (%)
Angola	1993	657.2	1379.4	958.1	.	.
Angola	1994	3304.9	948.8	2137.3	.	.
Angola	1995	475.9	2671.8	4521.1	125.9	206.3
Angola	1996	3804.6	4145.1	4555.2	147.1	217.9
Angola	2000	303.7	325.0	372.7	39.6	103.2
Argentina	1981	118.3	104.5	139.6	157.1	...
Argentina	1982	131.5	164.8	488.8	126.2	...
Argentina	1983	403.0	343.8	306.2	281.3	...
Argentina	1984	603.7	626.7	542.4	396.8	...
Argentina	1985	435.0	672.2	789.6	630.0	...
Argentina	1987	163.7	131.3	127.4	175.9	...
Argentina	1988	441.5	343.0	308.2	371.8	...
Argentina	1989	2283.2	3079.8	4736.7	17235.8	...
Argentina	1990	1059.4	2314.0	1051.8	1517.9	...
Bolivia	1984	1421.1	1281.4	1253.8	108.3	120.7
Bolivia	1985	7035.3	11749.6	13943.2	68.8	172.2
Brazil	1980	.	.	.	115.0	...
Brazil	1981	88.1	101.7	76.7	108.0	...
Brazil	1982	84.0	100.5	92.8	156.1	...
Brazil	1983	135.8	135.0	221.4	154.6	...
Brazil	1984	270.1	192.1	220.3	267.6	...
Brazil	1985	322.5	226.0	235.5	295.4	...
Brazil	1986	289.2	147.1	120.2	109.5	...
Brazil	1987	213.7	228.3	187.3	401.0	...
Brazil	1988	1511.9	629.1	568.9	859.4	...
Brazil	1989	1461.9	1430.7	980.5	5845.0	...
Brazil	1990	1147.5	2947.7	2310.1	9394.3	...
Brazil	1991	705.3	432.8	495.3	913.5	...
Brazil	1992	1651.7	951.6	1009.9	1560.2	...
Brazil	1993	2979.8	1928.0	1859.9	3293.5	...
Brazil	1994	1035.7	2075.9	1887.7	5175.2	...
Bulgaria	1996	124.5	.	164.8	74.7	123.5
Israel	1980	.	131.0	.	.	176.9
Israel	1981	829.3	116.8	123.1	.	170.6
Israel	1982	141.8	120.4	112.3	.	140.2
Israel	1983	206.9	145.6	131.6	132.9	186.2
Israel	1984	510.2	373.8	421.6	438.4	823.0
Israel	1985	168.5	304.7	302.1	178.8	503.4
Nicaragua	1988	12360.0	10205.0	262676.7	107379.1	121906.0
Nicaragua	1989	2746.8	4770.2	5703.7	1585.9	558.0
Nicaragua	1990	8603.8	7485.5	4401.0	9.5	22.0
Nicaragua	1991	1428.4	2945.1	2930.6	11.6	17.9
Peru	1988	624.7	667.0	665.2	161.8	174.3
Peru	1989	2015.0	3398.7	1969.5	1135.6	1515.9
Peru	1990	6311.5	7481.7	6947.0	2439.6	4774.5
Peru	1991	236.1	409.5	311.2	170.5	751.5
Peru	1992	55.5	73.5	61.3	59.7	173.8
Poland	1989	236.0	244.6	234.3	100.0	64.0
Poland	1990	121.9	555.4	560.1	41.7	504.2
Uruguay	1988	87.2	62.2	59.0	67.8	101.5
Uruguay	1989	118.7	80.4	73.3	84.7	127.6
Uruguay	1990	123.0	112.5	88.3	97.8	174.5
Uruguay	1991	78.8	102.0	72.5	75.2	152.9
Uruguay	1992	45.4	68.5	49.9	54.5	117.8
Uruguay	2002	15.8	14.0	59.6	...	126.1
Zambia	1993	101.5	183.3	162.9	...	113.3

Sources: WEO and IFS.

1/ Free-fall events are defined as years when either one of the following occurred:
- Annual percentage change of M2 exceeds 1,000 percent.
- Annual percentage change of CPI exceeds 1,000 percent.
- Annual percentage change of exchange rate exceeds 1,000 percent.
- Deposit interest rate exceeds 100 percent per annum.
- Loan interest rate exceeds 100 percent per annum.

2/ National currency units per U.S. dollar.

Table 5. Deposit Dollarization--Results of Cross Country Regressions 1/

Equation	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Including OECD Countries					Excluding OECD Countries				Freefall
MVP	0.5	0.46	0.46	0.45	0.44	0.42	0.42	0.41	0.42	0.48
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Inflation	0.034	0.037	0.036	0.037	0.037	0.038	0.037	0.04	0.038	0.035
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)
Restriction	-5.2	-5.9	-5.3	-5.4	-5.8	-5.8	-5.7	-5.8	-5.7	-4.4
	(0.06)	(0.03)	(0.07)	(0.04)	(0.03)	(0.07)	(0.07)	(0.07)	(0.07)	(0.09)
Government balance	-0.87									
	(0.11)									
Voice and accountability		-4.6				-0.19				
		(0.04)				(0.96)				
Regulatory quality			-5.6				-1.58			
			(0.04)				(0.72)			
Rule of law				-3.7				1.67		
				(0.07)				(0.64)		
Control of corruption					-4.1				0.10	
					(0.03)				(0.98)	
Freefall (80s)										0.1
										(0.13)
Constant	9.1	14.3	15.2	14.0	14.2	17.0	17.2	17.3	17.0	10.6
	(0.00)	(0.00)	(0.000)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
No. of obs.	62	63	63	63	63	44	44	44	44	63
R-squared	0.66	0.67	0.67	0.62	0.67	0.60	0.60	0.61	0.60	0.66

Sources: Data sources, variable definitions and estimation methodology are presented in Appendices 1 and 2.

1/ P values are presented in parentheses.

Table 6. Deposit Dollarization--Results of Panel Data Regressions 1/

Equation	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
	Macro			Institutional				Latin America	Highly Dollarized
D_{t-1}	0.95	0.94	0.96	0.94	0.94	0.94	0.95	0.72	0.77
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
MVP_t	0.033	0.035	0.026	0.036	0.027	0.035	0.028	0.078	0.036
	(0.07)	(0.06)	(.105)	(0.1)	(0.06)	(0.06)	(0.07)	(0.01)	(0.02)
Inflation $_t$	0.001								
	(0.08)								
Depreciation $_t$		0.001							
		(0.10)							
Government balance $_{ma(3)}$			0.063						
			(0.56)						
Democratic process				0.388					
				(0.3)					
Bureaucracy					-0.643				
					(0.09)				
Control of corruption						-0.02			
						(0.95)			
Internal Conflict							-0.09		
							(0.62)		
Law & Order									
D_{t-1} Latin America								0.25	
								(0.00)	
MVP_t Latin America								-0.09	
								(0.01)	
D_{t-1} Highly Dollarized									0.21
									(0.03)
MVP_t Highly Dollarized									-0.04
									(0.03)
Constant	1.47	1.5	1.36	-0.12	3.09	1.59	2.19	3.37	3.3
	(0.01)	(0.01)	(.016)	(0.932)	(0.03)	(0.07)	(0.23)	(0.00)	(0.00)
No. of countries	47	47	47	47	47	47	47	47	47
No. of obs.	338	338	338	338	338	338	338	338	338
F-Statistic	604.6	807.6	1282.9	836.4	1161.1	781.9	1025.4	1300.2	3224.1

Sources: Data sources, variable definitions and estimation methodology are presented in Appendices I and II.

1/ P values are presented in parantheses.

Table 7. Latin America: Indicators of Exchange Rate Policy

	De Facto Flexibility 1/	Asymmetry 2/		Dollarization 3/
		Bias	Skewness	
Highly dollarized				
Bolivia	0.11	0.92	0.09	85.3
Costa Rica	0.01	0.32	0.14	56.6
Dominican Republic	0.65	0.92	0.65	25.0
Honduras	0.23	0.81	0.94	35.7
Nicaragua	0.00	1.00	-0.18	68.7
Paraguay	0.14	0.54	1.40	47.1
Peru	0.11	0.38	0.60	64.1
Uruguay	0.05	0.77	-0.32	83.0
Average	0.16	0.71	0.42	58.2
Low dollarization				
Brazil	0.34	0.54	0.57	0.0
Chile	0.93	0.26	-0.05	11.9
Colombia	0.79	0.41	0.45	2.0
Guatemala	0.12	0.09	0.33	14.9
Mexico	0.25	0.19	0.32	5.4
Venezuela	1.30	0.67	1.08	0.0
Average	0.62	0.36	0.45	5.70

Sources: Authors' estimates.

1/ Average of Calvo-Reinhart index for 1990-2004.
2/ Average for 1990-2004.
3/ Foreign currency deposits as share of total deposits for 2004.

Table 8. Risk Management Arrangements in Selected Highly Dollarized Economies, 2004

	Bolivia	Costa Rica	Dominican Republic	Honduras	Nicaragua	Paraguay	Peru	Uruguay
Credit risk	No specific limits	No specific limits	No specific limits	Yes a/	No specific limits	No specific limits	No specific limits b/	No specific limits
Liquidity risk								
Differential liquidity/ Reserve requirements	Yes	No	No	Yes	No	Yes	Yes	No
If yes, the requirements (in percent of eligible deposits)	14 percent + marginal on foreign currency 12 percent - marginal on local currency			12 percent reserve requirement and 2 percent forced investment for all currencies 38 percent liquidity only for foreign currency		26.5 percent on foreign currency 15 percent on local currency	30 percent on foreign currency 6 percent on local currency	
Capital adequacy requirements	No			No b/				
Different for foreign currency?			No				No	
If yes, what are the different requirements?								
Deposit insurance	No							
Limited coverage			Yes	Yes		Yes	Yes	
What is the limit?			US$17,000	US$10,000		75 times minimum	S/72,540	
Does the limit differ by currency?			No	No		monthly wage	No	
Lender of last resort								
Operations in foreign currency	Yes	No	No	No	No	No	Yes	Yes
Limits on banks' FX position (in percent of capital)								
Long position	80 percent		100 percent	No		4 percent[1]	100 percent	150 percent
Short position	20 percent		None	15 percent		4 percent[1]	10 percent	150 percent
Indexed domestic currency Instruments	UFV introduced in 2002	No	Limited use	No	No	No	Limited use.	

Sources: Singh et. al. (2005); and Fund staff.

1/ As percent of total risk-weighted assets, with some adjustments.
a/ Banks can lend only 48 percent of foreign currency deposits (33 percent to exporters and 15 percent to other clients).
b/ The authorities plan to issue a regulation setting a higher capital requirement for foreign currency loans.

Table 9. Corporate Sector Dollar-Denominated Liabilities, 2001

(In percent of total liabilities)

	All firms	Nonexporting
Argentina	60.1	53.8
Bolivia	52.9	47.9
Brazil	20.4	21.5
Chile	20.5	13.8
Colombia	6.4	5.1
Costa Rica	64.3	n.a.
Mexico	33.3	14.5
Peru	63.5	61.3
Uruguay	77.6	77.5
Venezuela	34.3	n.a.

Source: Inter-American Development Bank.

Table 10. Latin America: Indicators of Currency Mismatch, 2000-2004

(In percent)

	Exports 1/	FCD 2/	FCD/Exports 3/
Highly dollarized			
Bolivia	20.7	90.0	149.0
Costa Rica	44.9	48.3	37.0
Dominican Republic	45.4	25.7	19.0
Honduras	39.1	33.4	35.0
Nicaragua	23.4	70.3	145.0
Paraguay	39.7	61.5	34.0
Peru	17.4	70.1	102.0
Uruguay	23.6	86.1	202.0
Average	31.8	60.7	90.4
Less dollarized			
Brazil	14.8	6.4	10.0
Chile	34.9	11.5	13.0
Colombia	18.8	0.7	1.0
Guatemala	17.8	8.3	11.0
Mexico	18.9	7.1	8.0
Venezuela	30.6	0.2	0.0
Average	22.7	5.7	7.2

1/ Average for 2000-2004 of exports of goods and services in relation to GDP.
2/ Foreign currency deposits as share of total deposits . Average for 2000-04.
3/ Foreign currency deposits as share of exports of goods and services.

Table 11. Deposit Dollarization--Effect of Exchange Rate Policy 1/

Equation	(20) Cross Country	(21) Panel Data
MVP_t	0.35	0.04
	(0.00)	(0.03)
Inflation $_t$	0.04	0.002
	(0.00)	(0.15)
Float $_{t-1}$	-0.91	0.00
	(0.22)	(0.85)
Restriction	-2.7	...
	(0.19)	
Government balance $_{ma(3)}$	-0.05	-.40
	(0.91)	(0.01)
Asymmetry $_{t-1}$	13.4	1.83
	(0.02)	(0.07)
Currency Mismatch $_{t-1}$	22	14.33
	(0.00)	(0.00)
Constant	5.8	17.9
	(0.03)	(0.00)
No. of obs.	61	331
No. of countries	61	46
F-Statistic		
R-Squared	0.80	...

Sources: Data sources, variable definitions and estimation methodology are presented in Appendices I and II.

1/ P values are presented in parentheses.

Figure 1. Yield Curve for Deposit Interest Rates, 2004

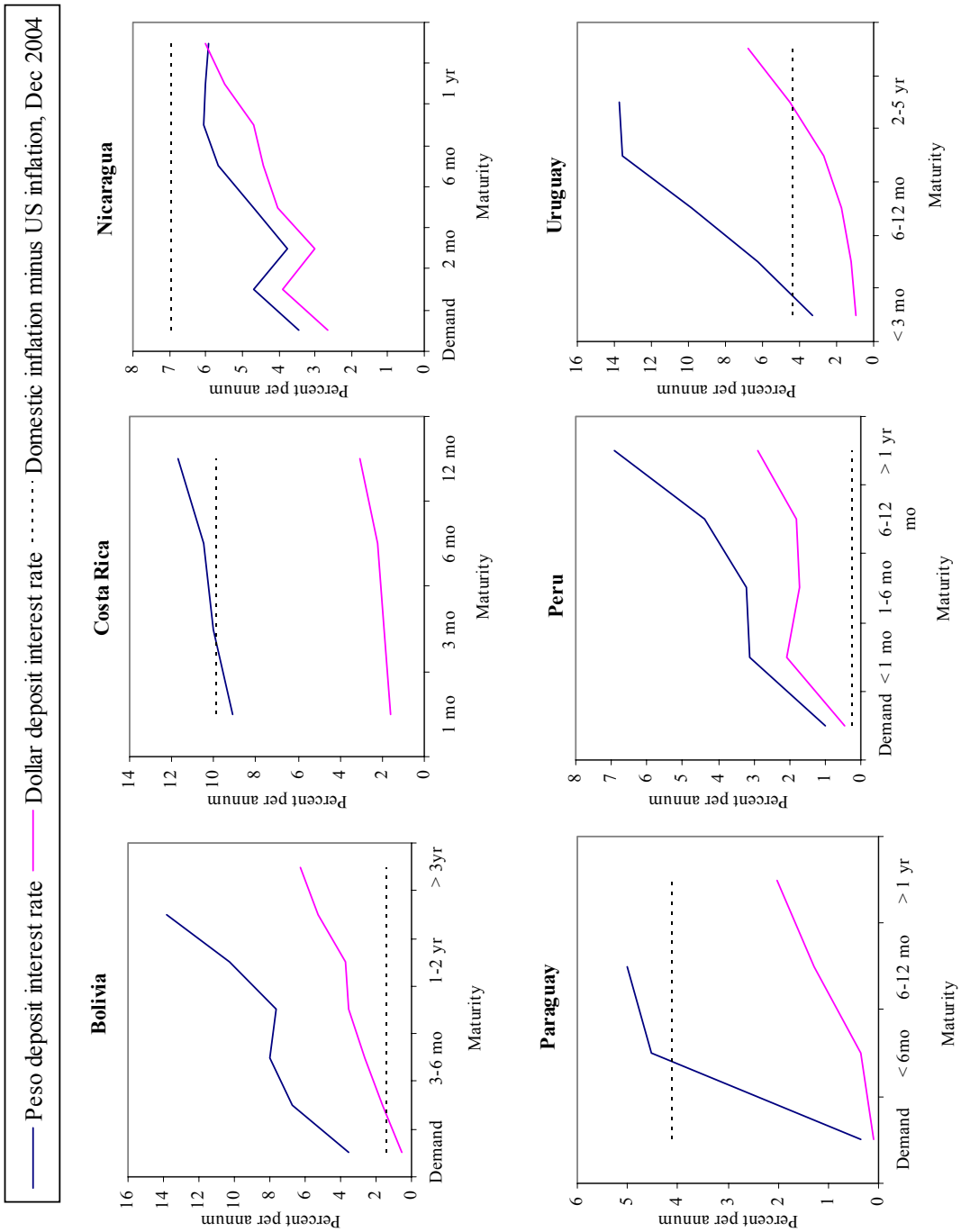


Figure 2. Sectoral Composition of Commercial Bank Loans
(In percent)

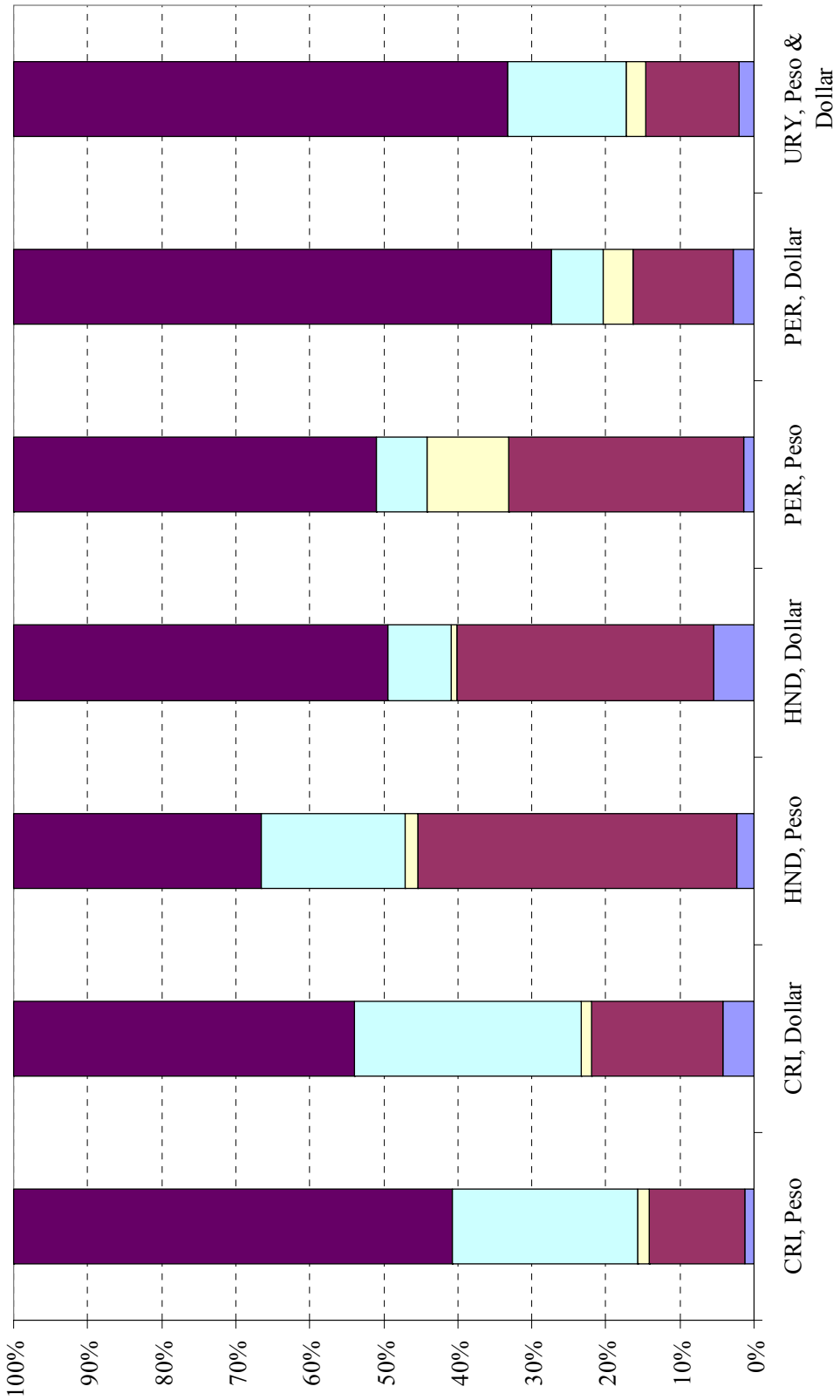
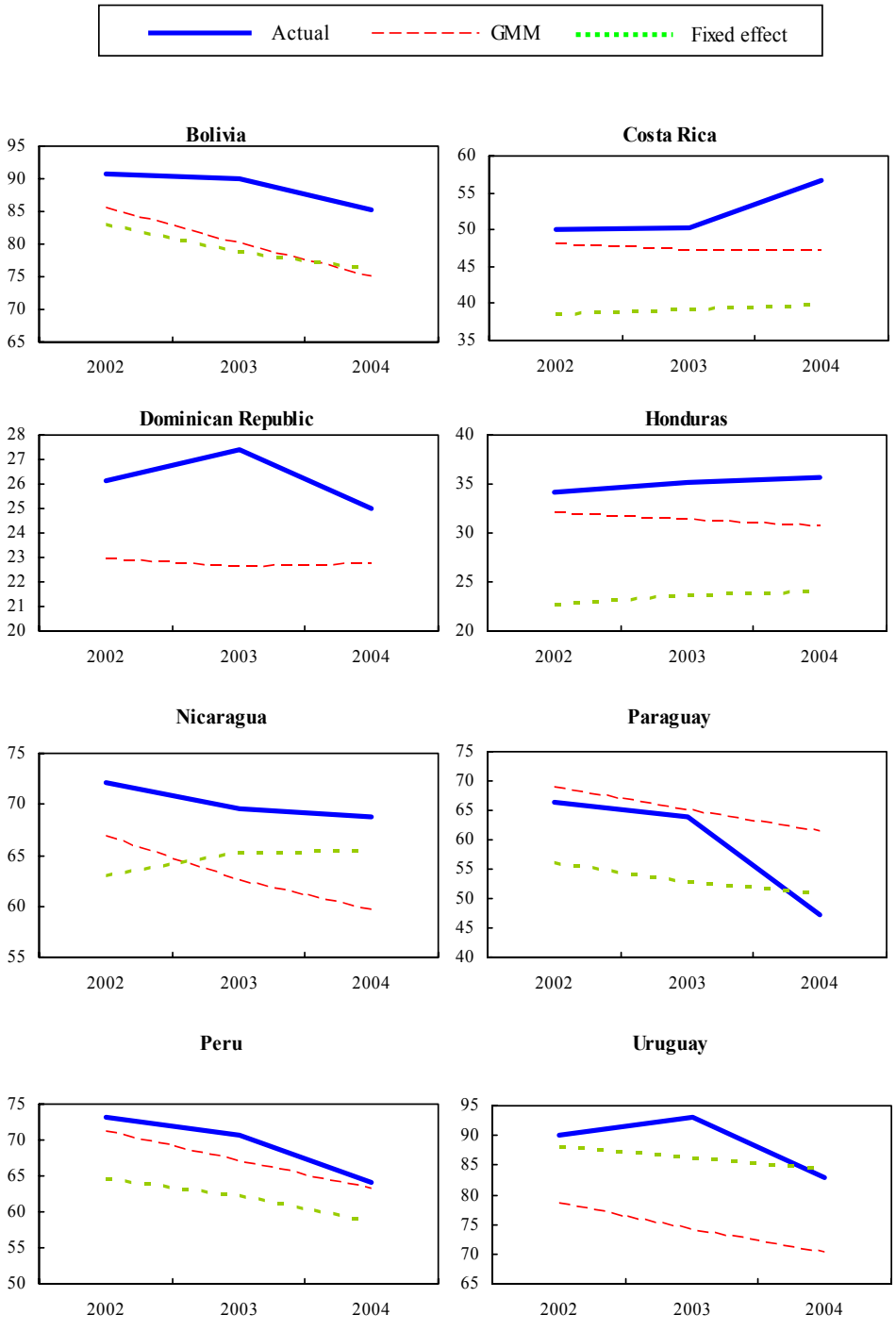


Figure 3. Deposit Dollarization: Out of Sample Forecast



Source: Authors' calculation.

Data Description

Variable description

Variable name	Variable description	Source
Dependent variable		
Deposit dollarization ratio	Foreign currency deposits in percent of total bank deposits.	DNHI
Independent variables: Macro indicators		
D_{t-1}	Lagged deposit dollarization ratio.	DNHI
D_{t-1} Latin America	Lagged deposit dollarization ratio interacted with a dummy variable for Latin America (1 for Latin American countries and 0 otherwise).	...
MVP	Minimum variance portfolio as constructed by Ize and Levy Yeyati (2003). The unit is in percentage, not in decimal fraction. See below for details of computation.	IFS
MVP Lat.Am.	MVP interacted with a dummy variable for Latin America.	...
Restriction	Index for restriction on foreign currency deposits. "0" represents no restriction and higher scores represent heavier restriction.	DNHI
Inflation	3-year backward-looking average inflation rate calculated as a percentage change in CPI.	IFS
Government balance	3-year backward-looking average of the government balance in percent of GDP. Negative figures imply deficits.	WEO
Depreciation	3-year backward-looking average of nominal depreciation, i.e., percentage change of the exchange rate measured by national currency unit per U.S. dollar.	IFS
Float	Calvo and Reinhart index of exchange rate flexibility.	IFS
Asymmetry	Index of asymmetry of exchange rate movements. Constructed by assigning a value of -1 in months of currency appreciation and 1 in months of currency depreciation, and then averaging for the year.	IFS
FCD/Export	Foreign currency deposits divided by exports. The unit is not in percent, but in decimal fraction.	DNHI, WEO, IFS

Variable name	Variable description	Source
Governance variables [1]		
Voice & accountability	Index of voice and accountability by Kaufmann, Kraay and Mastruzzi. Average for the years 1996, 1998, 2000, and 2002.	WBGOV
Regulatory quality	Index of regulatory quality by Kaufmann, Kraay and Mastruzzi. Average for the years 1996, 1998, 2000, and 2002.	WBGOV
Rule of law	Index of rule of law by Kaufmann, Kraay and Mastruzzi.Average for the years 1996, 1998, 2000, and 2002.	WBGOV
Control of corruption (WB) used in Table 5.	Index of control of corruption by Kaufmann, Kraay and Mastruzzi. Average for the years 1996, 1998, 2000, and 2002.	WBGOV
Democratic process	Political risk rating on democratic accountability.	PRS
Bureaucracy	Political risk rating on bureaucracy quality.	PRS
Control of corruption (PRS) used in Table 6.	Political risk rating on corruption.	PRS
Internal conflict	Political risk rating on internal conflict.	PRS
Law & order	Political risk rating on law and order.	PRS

[1] For all governance indicators, higher scores imply better governance and lower risk.

Computation of MVP

MVP for year t was computed using a formula

$$MVP_t = \frac{Corr(\pi_t, n_t) \cdot \sigma(\pi_t)}{\sigma(n_t)}$$

where π_t and n_t represent inflation and depreciation of the nominal exchange rate, respectively.[13] The correlation coefficient and standard deviations were estimated using quarterly data over a 10-year horizon; that is, to estimate MVP for year t, we used quarterly data of inflation and depreciation from year $t-9$ to year t.

MVP represents domestic agents' optimal portfolio of foreign currency deposits over total deposits, and the agents cannot usually have a short position. To incorporate this, we assigned MVP a value of 0 if the estimate of $Corr(n_t, p_t)$ was negative and a value of 100 if the estimate of MVP exceeded 100.

[13] Under an assumption that agents regard the U.S. inflation as fixed, our formula is equivalent to the original definition from Ize and Levy-Yeyati (2003).

Data sources

DNHI: De Nicolo, Gianni; Honohan, Patrick; Ize, Alain, Forthcoming, "Dollarization of Bank Deposits: Causes and Consequences," Journal of Banking and Finance.

IFS: *International Financial Statistics*, International Monetary Fund.

PRS: Political risk rating by The Political Risk Services Group (www.prsgroup.com).

WBGOV: Kaufmann, Daniel, Kraay, Aart and Mastruzzi, Massimo, "Governance Matters III: Governance Indicators for 1996-2002" (June 30, 2003). World Bank Policy Research Working Paper No. 3106.

WEO: *World Economic Outlook*, International Monetary Fund, 2004.

Estimation Methodology

1. Cross country regressions (Tables 5 and 11)

For cross country regressions, we converted our panel dataset into a cross-country dataset by averaging variables over years for each country. Then, we ran OLS regressions of deposit dollarization ratio on the independent variables specified in the tables.

2. Panel data regressions (Tables 6 and 11)

We used an unbalanced panel dataset with 47 countries and the period 1990–2001 and estimated two models:

- Model 1 (without the lagged dollarization ratio): $D_{it} = c + \beta * MVP_{it} + \gamma X_{it} + u_i + v_{it}$
- Model 2 (with the lagged dollarization ratio): $D_{it} = c + \alpha D_{it-1} + \beta * MVP_{it} + \gamma X_{it} + u_i + v_{it}$

where D_{it} represents the deposit dollarization ratio, MVP_{it} the minimum variance portfolio, X_{it} other independent variables, and u_i country specific effects. We make standard assumptions for the disturbance term v_{it}:

$$E(v_{it}) = 0,\ E(v_{it}u_i) = 0\ \ \forall t;\ E(v_{it}v_{is}) = 0\ \forall t \neq s.$$

Model 1 was estimated with standard fixed and random effect models without instrumental variables.

Model 2 was estimated with the two-step system GMM method developed by Blundell and Bond (1998).[14] We chose this estimator over a standard fixed or random effect estimator because the latter generates biased coefficient estimates under the presence of the lagged dependent variable in the right hand side. We chose the system GMM method over the so-called difference GMM method because the difference GMM method is known to suffer from weak IV problems when the coefficient on the lagged dependent variable is close to one, and the system GMM method can circumvent this problem.[15] To address small-sample downward biases on standard errors in two-step estimations, we used a corrective method invented by Windmeijer (2005).

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[14] This method requires additional assumptions that $E(D_{i1}v_{it}) = 0 \forall t$ and $E((u_i + v_{i3})\Delta D_{i2}) = 0$ for each i.

[15] In fact, the difference GMM method produces a coefficient estimate on the lagged dependent variable of around 0.36, much smaller than the estimate by the system GMM method.

Our result for the baseline regression (eq. 11 in Table 6) passes standard diagnostic tests. The Sagan test does not reject the hypothesis of no over-identifying restrictions. The second-order serial correlation in the first differences of residuals is not detected, thereby validating the foundation of the GMM moment conditions. In addition, the coefficient estimates do not change significantly when a smaller number of moment conditions are used or when the constant term is excluded from the right hand side.

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