

IS THERE A LINK BETWEEN DOLLARIZATION AND BANKING CRISES?

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Abstract

I estimate a multivariate probit model to identify key variables that are predictive of banking crises. To add to the literature on this subject, I focus on the role played by unofficial dollarization of domestic banking systems. Unofficial dollarization is a source of vulnerability for emerging markets as large depreciations render both domestic firms and banks unable to pay dollar-denominated debt. Surprisingly, I find only weak evidence that unofficial dollarization affects the probability of a banking crisis. This finding casts doubt on the widely held belief that liability dollarization is a significant source of risk for emerging markets and developing nations, although there are still reasons to believe that dollarization remains a significant source of risk.

Keyword(s): Unofficial dollarization, banking crises

1. INTRODUCTION

As a result of the severe banking crises in emerging markets during the 1980's and 1990's, a vast literature has developed attempting to identify key variables that might be useful in predicting future crises.¹ Identifying developing nations vulnerable to potential banking crises has become a major policy issue because of their devastating consequences. Because of the unique role that banks play in channeling funds to those with productive investment opportunities, a major disruption to the banking system can lead to sharp declines in credit, investment, consumption and output, leading to bankruptcy for otherwise viable firms. As described in Mishkin (1995), banks solve asymmetric information problems by becoming experts in assessing credit risk. When banks become insolvent, this information capital is lost. In fact, most banking crises are followed by major recessions as well as large budgetary costs required to recapitalize the banking system. Among the leading causes of banking crises

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¹ See for example, Demirgüç-Kunt and Detragiache (1998), Eichengreen and Rose (1997), Eichengreen and Arteta (2000) and Domaç and Peria (2000).

identified in this growing literature are external factors, rapid financial liberalization coupled with lending booms and inadequate prudential regulation and supervision.²

This paper follows Domaç and Peria (2003) in looking at the role played by currency mismatches and dollar borrowing in emerging markets. However, as opposed to focusing solely on the external dollar borrowing of domestic banks, this paper adds to the literature by considering the additional currency risk caused by the domestic unofficial dollarization of domestic banking systems in emerging markets. I use a database on unofficial dollarization in order to look at the effect of both foreign currency deposits of domestic residents in domestic banks and foreign currency loans made by domestic banks to domestic firms on the probability of a banking crisis.

When banks accept dollar deposits from domestic residents, they assume a source of foreign exchange risk. When banks make dollar loans to domestic firms who earn revenue in pesos, however, they do not hedge their foreign exchange exposure; they only replace currency risk with dollar loan default risk.³ In other words, dollar lending to domestic firms creates a source of non-performing loans as large depreciations might leave the firm unable to repay the dollar loan, thus increasing the potential for a banking crisis. Thus both dollar deposits and dollar credit can play a role in emerging market banking crises. Using dollarization data for 85 emerging markets for the years 1988-2000, I find, however, only limited evidence that liability dollarization of the domestic banking system increases the probability of a banking crisis. I discuss possible explanations for this result, although at the very least it calls into question the widely held belief that liability dollarization is a significant source of risk for emerging markets and developing nations.

The rest of the paper is organized as follows. Section 2 presents the empirical methodology. Section 3 discusses the results of the estimation. Section 4 summarizes the findings.

2. EMPIRICAL METHODOLOGY AND DATA

To estimate the effect of unofficial dollarization on the probability of a banking crisis, I estimate the following probit regression:

$$Crisis_{it} = \beta_1 UnofficialDollarization_{it-1} + \underline{\gamma} MacroControls_{it-1} + \varepsilon_{it} \quad (1)$$

Aggregate data on deposit dollarization are available for 91 emerging markets and developing nations while data on credit dollarization are available for 41. However, as discussed below, I eliminate crisis observations after the beginning of a crisis, reducing the sample size to 85 countries with data on deposit dollarization. Including additional regressors further limits the sample size to 52 countries (when only using data on deposit dollarization).

I confine the sample to emerging markets for two reasons. First developing nations are different than developed nations. As noted by Eichengreen and Rose (1998), banks account for a larger share of the total assets of financial institutions in developing than

² There is less consensus, however, on the relative importance of structural vs. macroeconomic factors as well as domestic vs. external factors.

³ For now, I will assume that all firms earn revenue in pesos. I will relax this assumption later.

advanced-industrial countries. In addition, the maturity of bank liabilities is usually shorter in developing nations. They have also weaker supervisory and regulatory institutions. Developing nations are also more vulnerable to changing external conditions. Second, in order to examine the effect of unofficial dollarization on banking crises, I must restrict attention to countries for which unofficial dollarization is an issue. Due to histories of high inflation and lack of confidence in the domestic currency, unofficial dollarization has progressed steadily in many emerging markets in the 1980's and 1990's. Of course, many of the countries in the sample did not experience banking crises during the sample period and therefore serve as controls.

The dependent variable is a dummy variable that assumes the value one when the country is experiencing a banking crisis. Since a crisis cannot be predicted with certainty, I estimate the probability using a probit model. Thus, the probability of a crisis is determined given a set of explanatory variables that indicate banking sector vulnerability.⁴ As is standard in the literature, I only code the first year of a crisis as a one while subsequent crisis years are excluded from the sample. This is necessary in order to avoid the endogeneity problem stemming from the feedback effect of the crisis on some of the macro variables and financial variables that serve as explanatory variables in the model. For example, as pointed out by Demirgüç-Kunt and Detragiache (1998), ratio of domestic credit to GDP is likely to fall after the crisis, and the decline in credit would most likely lead to lower GDP growth as well. In addition, real interest rates may fall and inflation may rise when the government adopts looser monetary policy to support the banking system. Finally, banking crises may force countries to abandon a fixed exchange rate in favor of a floating regime (Eichengreen and Arteta, 2000).⁵ To minimize simultaneity problems, I estimate the model lagging the regressors by one period. In addition, Eichengreen and Arteta (2000) note that crises tend to be recognized with a lag, implying an additional reason to lag the regressors by one period.

Of course it is crucial to construct the banking crisis dummy properly by accurately dating and identifying banking crises. Using the list from Caprio and Klingebiel (2003), the most comprehensive to date, I define a systemic banking crisis as an episode in which bank failures lead to the exhaustion of much of bank capital. Their classification is based on both official published data and the opinion of country experts. They also identify borderline or smaller (non-systemic) crisis episodes in which only a subset of banks are threatened by insolvency. For countries with data on deposit dollarization, there are 40 banking crises during the sample period (29 are systemic and 11 are non-systemic). In the base regression, I estimate systemic banking crises although results were similar when I include both types of crises. Including additional regressors reduces the number of crises in the estimation.

To estimate the effect of unofficial dollarization on the probability of a banking crisis, it is important to choose the measure of unofficial dollarization that most accurately reflects domestic banks' vulnerability to currency risk. One estimate of bank risk is dollar mismatch, defined as the difference between banks' dollar liabilities (dollar deposits) and their dollar-denominated loans to domestic firms (Arteta, 2002). However, since matching dollar deposits with dollar loans to firms who earn revenue in domestic currency only replaces currency risk with dollar loan default risk, banks' unhedged source of currency risk is given by their dollar

⁴ Results are similar using a multivariate logit model.

⁵ In addition, they point out that the data on exchange rate regimes used by most authors are for the end of the calendar year so lagging the explanatory variables is necessary to avoid drawing the conclusion that banking crises and floating regimes are contemporaneously correlated.

liabilities, not dollar mismatch. I therefore focus on deposit dollarization, scaled by either total deposits or total bank liabilities, to estimate bank risk.

If domestic firms, however, earn revenue in dollars, then dollar mismatch is the more appropriate measure of bank risk. This would be the case in a country with a large tradables sector where exporting firms typically earn revenue in dollars. Therefore, I create a weighted bank dollarization variable that is a linear combination of dollar mismatch and dollar deposits where the weight depends on the extent to which firms earn revenue in dollars.⁶ The more firms earn revenue in dollars, estimated by the share of exports in GDP, the more weight is placed on dollar mismatch. This variable is scaled by total bank liabilities in the estimation. One issue with weighted bank dollarization is that it requires data on both credit dollarization, which are available for only 41 countries and deposit dollarization which are available for 91. Thus, using weighted bank dollarization as a predictor of banking crises, while theoretically preferable to dollar deposits, significantly reduces the sample size relative to dollar deposits. I therefore focus on the effects of both variables.

Following Domaç and Peria (2003), I also attempt to capture domestic banks' exposure to external foreign exchange risk. I define external mismatch as foreign liabilities of domestic banks minus foreign assets, divided by total bank liabilities.⁷ As opposed to domestic borrowers, foreign borrowers earn revenue in dollars and thus pose no dollar loan default risk to domestic bank lenders. Therefore, external currency mismatch is a good measure of currency risk whereas currency mismatch in the domestic context is not.

Table 1 presents summary statistics for the dollarization variables. The median of dollar mismatch is close to zero, suggesting that it is common practice for domestic banks to match dollar deposits with dollar credit to domestic firms. One reason, as argued in Honig (2005), is that making dollar loans to domestic firms does reduce currency risk even if it does not necessarily hedge dollar deposits of residents. After all, not all depreciations of the domestic currency leave the firm unable to repay any of the dollar loan. In those cases, banks recover more of the value of the loan following a depreciation if the loan is denominated in dollars. Second, banks are often regulated to limit currency mismatches. The median of external dollar mismatch is also close to zero. Since weighted bank dollarization is a linear combination of dollar mismatch and dollar deposits, its median not surprisingly falls in between the medians of those two variables.

The other explanatory variables are standard in this literature (Demirgüç-Kunt and Detragiache 1998, Eichengreen and Rose, 1998, Eichengreen and Arteta, 2000 and Domaç and Peria, 2003). In the base regression, I include domestic macroeconomic variables, external variables and financial variables. Specifically, the list includes the real growth of GDP per capita, the inflation rate, the real interest rate, the budget surplus/deficit as a percentage of GDP, international reserves as a percentage of M1, the exchange rate regime, external debt relative to GNP, the current account relative to GDP, the ratio of domestic credit to GDP, the rate of domestic credit growth, the ratio of cash held by banks to assets, the ratio of gross capital flows to GDP and a weighted average of interest rates in the advanced-industrial countries.

⁶ In an earlier version of this paper (2003), I use a similar variable which estimates the combined exposure to currency risk of both domestic banks as well as domestic firms. Results were similar.

⁷ Unfortunately, the data provided by the IMF does not actually provide the currency of denomination for these foreign assets and liabilities. However, since the sample consists exclusively of emerging markets, I assume, following Domaç and Peria (2003), that these foreign assets and liabilities are denominated in dollars.

A poor economy hurts banks by increasing the share of non-performing loans in the banking system. Thus, I would expect higher growth rates in real growth GDP per capita to reduce the probability of a banking crisis. On the other hand, higher real interest rates should have a positive impact on the likelihood of a crisis. High short-term real interest rates affect bank balance sheets adversely if banks cannot increase their lending rates quickly enough. High inflation is associated with high nominal interest rates and may also be viewed as a sign of poor macroeconomic policy. The government surplus as a percentage of GDP captures the financing needs of the central government. In many developing countries, deficits are financed through loans from the banking system. Thus, when fiscal deficits are large, the banking system may come under increasing pressure and may be more vulnerable.

I also include a number of domestic financial variables. Demirgüç-Kunt and Detragiache (1998) argue that financial liberalization may weaken the condition of the banking sector because this process may result in excessive risk-taking and outright fraud. One measure of the extent of financial liberalization is the ratio of domestic credit to the private sector to GDP (Pill and Pradhan, 1995). The real interest rate also proxies for financial liberalization (Galbis, 1993). The growth rate of domestic credit accounts for the presence of lending booms, which are often associated with banking crises (Gavin and Hausmann, 1996). To test whether systemic banking sector problems are related to sudden capital outflows I use the ratio of foreign exchange reserves to M1 as an explanatory variable, which proxies for the exposure that banks face to potential runs associated with balance of payments crises. To capture the liquidity of the banking system and the ability of banks to deal with potential runs on their deposits, I use the ratio of bank cash and reserves to bank assets. More liquid banking system should be correlated with a lower incidence of banking crises as countries are better equipped to handle adverse macroeconomic shocks.

Eichengreen and Rose (1998) construct the “Northern” interest rate as the weighted average of short-term rates for the United States, Germany, Japan, France, the United Kingdom and Switzerland; the weights are proportional to the fractions of debt denominated in the relevant currencies.” Emerging markets are vulnerable to changes in capital flows, which are quite sensitive to changes in world interest rates (Calvo, et al., 1993). A reduction in industrial country interest rates pushes foreign investors to search for higher returns in emerging markets. Therefore, a rise in foreign interest rates can slow the inflow of foreign capital into developing nations, thus limiting a key source of funds for domestic banks. Moreover, domestic banks will be forced to offer even higher interest rates to attract foreign capital, only some of which will be passed on to domestic borrowers. Finally, higher rates can worsen asymmetric information problems, increasing the likelihood of a financial crisis (Mishkin 1995).

I also estimate the effect of the exchange rate regime on the probability of a banking crisis. I use the *de facto* classification developed by Reinhart and Rogoff (2003), breaking up their classification into a binary variable with a value of one indicating greater exchange rate flexibility. The effect of the regime is theoretically ambiguous. Fixed exchange rates may reduce the probability of a banking crisis by forcing policy makers into maintaining sound policies that are required to maintain the peg (Eichengreen and Rose, 1998). For example, to prevent depletion of the country’s international reserves and the subsequent end of the peg, policy makers are forced to rein in the growth of domestic credit and specifically the tendency to initiate lending booms. In addition, fixed exchange rate regimes impose constraints on lender-of-last-resort activities, which should alleviate moral hazard considerations. In

addition, Calvo (1999) argues that credible fixed exchange rate regimes may be less susceptible to random external shocks. Finally, unhedged foreign-currency-denominated liabilities are a major source of vulnerability for both firm and bank balance sheets because large depreciations can significantly increase the value of liabilities (Mishkin, 1996). This process can lead to sharp contractions in output and is one of the main reasons why many emerging markets exhibit a “fear of floating” (Calvo and Reinhart, 2002). Thus, fixed exchange rate regimes that prevent large depreciations should reduce the probability of a depreciation induced banking crisis.

However, there are a number of reasons why floating regimes should be correlated with a lower incidence of banking crises. First, the ability to use monetary policy allows emerging markets to stabilize output in response to real shocks facing the economy without the increase in interest rates that does harm to the banking system, although the presence of unhedged dollars liabilities requires that any depreciation be minimal. In addition, fixed exchange rates may provide implicit guarantees to domestic firms and banks considering borrowing in foreign currency. Both borrowers and lenders know that the government will feel responsible for any devaluation and thus fail to hedge their foreign exchange exposures (Eichengreen and Hausmann, 1999), whereas the exchange rate risk inherent in flexible regimes limits this moral hazard by promoting hedging of dollar liabilities (Goldstein 1999; Burnside, et al., 2001; Mishkin, 1999).⁸ Along this line of thought, floating exchange rates may discourage excessive capital inflows that pose problems for the banking system. Finally, fixed exchange rate regimes constrain the ability of the monetary authorities to engage in lender of last resort operations because domestic credit growth may threaten the peg and provoke a balance-of-payments crisis (Eichengreen and Rose, 1998). Thus central banks will be unable to support the banking system by injecting liquidity into the economy or by easing borrowing restrictions. This may encourage runs on the banks (Diamond and Dybvig, 1983).⁹ Furthermore, fixed exchange rates may encourage self-fulfilling bank runs in order to exchange peso deposits for dollar reserves before the stock is depleted (Chang and Velasco, 1998).

Due to potential multicollinearity, I performed factor analysis on the regressors (excluding the dollarization variables) prior to the regression. The estimated factors were then included as regressors in the probit estimation. As an alternative, I grouped the regressors into external, domestic and financial variables, performed factor analysis on the regressors in each group separately, and then included the estimated factors in the regression. Results were similar to the base probit regression.

3. EMPIRICAL RESULTS

Tables 2 and 3 report results for the effect of dollarization on the probability of a banking crisis. For each dollarization variable, the first column presents the probit coefficients. The second column presents dF/dx , the change in the probability of a crisis given a change in the

⁸ However, under credible fixed exchange rates, there is no expected depreciation so that the cost of hedging should be less than under a floating regime where there is expected depreciation. Thus fixed regimes might encourage hedging of dollar liabilities (Eichengreen and Hausman 1999).

⁹ However, it is also possible that the existence of lender of last resort ability encourages banks to take excessive risk, knowing that they will be bailed out, a fact which increases the probability of a banking crisis.

regressors, evaluated at the mean of the regressors. The standard errors are corrected for heteroskedasticity and within-country serial correlation. The dependent variable indicates the onset of systemic banking crises in emerging markets. In Table 2, none of the other regressors have been included in the estimation. The coefficients are positive for the deposit dollarization variables although not significant. The weighted bank dollarization variable is far less significant. In the final two columns, I look at the effect of external dollar borrowing of domestic banks as previously analyzed by Domaç and Peria (2003). The coefficient has the wrong sign although is insignificant. However, as this table only presents simple correlations, there is certainly the possibility of omitted variable bias.

Table 3 presents the results of the main estimation, which includes the standard regressors identified in the banking crisis literature as predictive of crises. All regressors are lagged except for the “northern” interest rate as there should be no feedback effect of a banking crisis in an emerging market on this variable. The coefficient of the ratio of dollar deposits to total deposits is insignificant at standard confidence levels, although the p-value is 0.19 suggesting that this variable still may impact the probability of a banking crisis. Similarly, the p-value of weighted bank dollarization is 0.22, again suggesting that dollarization plays a role in banking crises. The coefficient of external mismatch is now positive although insignificant.

While the results for the dollarization variables suggest some effect on the probability of a crisis, the coefficients are not significant at standard confidence levels. There are a number of possible explanations for these results. First, while adding additional regressors reduces possible omitted variable bias, it also reduces the sample size considerably, limiting the number of crises contained in the estimation. In fact, there are only 17 reported banking crises in the multivariate regression so that is possible that dollar liabilities did not play a role in this limited number of crises.

Second, even if there is a large depreciation, firms may still be able to repay dollar loans from domestic banks, in which case the banking system is able to withstand the depreciation despite the fact that domestic firms may see a significant deterioration of their balance sheets. Another possibility for the insignificance of the dollarization variables is that high levels of unofficial dollarization only contribute to banking crises when they are combined with significant depreciations. Therefore, I interact the dollarization variables with a dummy variable that assumes the value one when the exchange rate depreciation is greater than 100%. I find that the dollarization variables have a greater impact when there is a large depreciation, although the coefficients are still quite small.

Finally, higher levels of domestic unofficial dollarization do not always imply higher levels of currency risk. For example, consider the extreme case of a completely dollarized economy in which depositors deposit dollars in domestic banks, domestic banks lend in dollars to domestic firms, and domestic firms earn revenue in dollars. In this case, there is no currency risk stemming from dollarization because there exist no currency mismatches. For this reason, I add a quadratic term on the deposit dollarization variable so capture the possibility that for high levels of dollarization, increases in dollarization may actually reduce risk as perhaps more firms earn revenue in dollars. And for low levels of dollarization, increases in dollarization imply increases in currency risk as perhaps depositors have begun the process of depositing dollars in domestic banks, but domestic firms still do not earn revenue in dollars. In that case domestic banks either face currency risk in lending pesos to domestic firms or dollar loan default risk if they denominated loans in dollars. The quadratic

term increases the size and significance of the effect of deposit dollarization, but the results are still not economically significant.

Should we conclude therefore that dollarization is not a source of risk for domestic banks? I believe the answer is no. First, as described in the previous paragraph, the effect of dollarization depends on the extent to which dollarization has progressed. Secondly, there are examples in which liability dollarization played central roles in banking crises. For example, in Mexico in 1994, domestic banks had borrowed dollars from depositors in dollars and had lent to domestic firms in dollars to match their liabilities. But because these firms earned revenue in pesos, the large currency depreciation made many of those loans become non-performing. In a recent paper, de Nicoló, et al. (2003) find that dollarization is predictive of the share of non-performing loans.

Finally, it is not entirely surprising that unofficial dollarization is not significant in explaining the probability of a crisis in a particular country at a particular time. During the sample period (1988-2000), unofficial dollarization has not displayed significant year-to-year within country variation despite falling inflation and attempts to limit exchange rate movements. Therefore, it is unlikely for this variable, or any variable that displays limited variation over time to explain individual crisis episodes. At the very least, however, the results suggest that liability dollarization may not be as important in causing banking crises as previously claimed.

I also look at the effect of the macro environment. In column one, the ratio of reserves to M1, the ratio of bank cash to assets, the ratio of the current account surplus to GDP and the growth in real GDP per capita have the correct negative sign. The ratio of bank cash to assets is highly significant. The ratio of domestic credit to GDP, the growth in domestic credit have the correct positive sign. Surprisingly, the real interest rate, the ratio of capital flows to GDP, the northern interest rate and inflation have the wrong sign. Finally, floating regimes tend to increase the probability of a banking crisis, matching the results in Domaç and Peria (2003).

4. Conclusion

Using a multivariate probit model, this paper attempts to identify key variables that are predictive of banking crises. Since the 1980's emerging markets have been subject to severe banking sector problems, and thus the need to forecast future problems is great. I focus on dollarization of domestic banking systems. I find only limited evidence that unofficial dollarization is predictive of banking crises. This finding casts doubt on the widely held belief that liability dollarization is a source of risk for emerging markets and developing nations, although there is still reason to believe that liability dollarization is a risk factor for certain countries.

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Table 1
Summary statistics for bank dollarization variables

	No. Obs.	Median	Std. Dev.
Dollar Deposits/Total Bank Liabilities	738	16.0	18.6
Dollar Deposits/Total Bank Liabilities*	257	24.1	20.5
Dollar Mismatch/Total Bank Liabilities	257	2.5	20.9
Weighted Bank Dollarization	240	22.1	22.6
External Dollar Mismatch/Total Bank Liabilities	961	-2.0	20.9

Notes: All ratios expressed in percentage terms.

* Limited to countries with data on dollar mismatch.

Table 2
Effect of Dollarization on the Probability of a Banking Crisis - no control variables

Dependent variable: Crisis (binary variable indicating beginning of banking crisis)								
Dollar Deposits/Total Dep.	0.40	0.04						
	(1.27)	(1.27)						
Dollar Deposits/Total Liab.			0.45	0.05				
			(0.99)	(0.99)				
Weighted Bank Dollarization					0.07	0.01		
					(0.13)	(0.13)		
External Mismatch							-0.57	-0.06
							(1.23)	(1.23)
Observations	572	572	567	567	182	182	712	712
Countries	85	85	85	85	37	37	81	81
Pseudo R-squared	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.01

Notes: Probit Coefficients given in first column of each specification.

Marginal Effects evaluated at the mean of the regressors provided in second column.

All ratios expressed in percentage terms. Absolute value of z statistics in parentheses.

Standard errors robust to heteroskedasticity and within country clustering.

Coefficients multiplied by 100. Constant term not shown. All regressors lagged.

* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 3
Effect of Dollarization on the Probability of a Banking Crisis

Dependent variable: Crisis (binary variable indicating beginning of banking crisis)								
Dollar Deposits/Total Dep.	0.65 (1.29)	0.04 (1.29)						
Dollar Deposits/Total Liab.			0.36 (0.57)	0.02 (0.57)				
Weighted Bank Dollarization					2.34 (1.24)	0.02 (1.24)		
External Mismatch							1.12 (0.51)	0.06 (0.51)
Exchange Rate Regime	59.43 (1.84)*	4.60 (1.84)*	51.95 (1.66)*	4.31 (1.66)*	91.94 (0.78)	0.83 (0.78)	44.31 (1.56)	2.66 (1.56)
Reserves/M1	-0.07 (1.29)	0.00 (1.29)	-0.07 (1.29)	0.00 (1.29)	-0.07 (0.13)	0.00 (0.13)	-0.03 (0.54)	0.00 (0.54)
External Debt/GNP	-0.47 (0.99)	-0.03 (0.99)	-0.49 (1.04)	-0.03 (1.04)	0.22 (0.27)	0.00 (0.27)	-1.17 (2.17)**	-0.06 (2.17)**
Domestic Credit/GDP	0.06 (0.08)	0.00 (0.08)	0.08 (0.11)	0.01 (0.11)	-2.59 (1.18)	-0.02 (1.18)	-0.09 (0.14)	0.00 (0.14)
Real Interest Rate	-0.13 (0.42)	-0.01 (0.42)	-0.08 (0.30)	-0.01 (0.30)	-1.52 (1.34)	-0.01 (1.34)	0.09 (0.37)	0.00 (0.37)
Capital Flows/GDP	-6.68 (1.76)*	-0.42 (1.76)*	-6.86 (1.86)*	-0.48 (1.86)*	-7.71 (0.53)	-0.05 (0.53)	-10.31 (2.56)**	-0.54 (2.56)**
Cash/Bank Assets	-9.00 (2.53)**	-0.51 (2.53)**	-8.23 (2.51)**	-0.50 (2.51)**	-22.84 (1.97)**	-0.16 (1.97)**	-7.65 (2.65)***	-0.35 (2.65)***
Northern Interest Rate	-32.85 (3.52)***	-2.03 (3.52)***	-30.80 (3.34)***	-2.08 (3.34)***	-77.58 (1.87)*	-0.54 (1.87)*	-26.81 (3.03)***	-1.34 (3.03)***
Current Account/GDP	-3.45 (0.81)	-0.22 (0.81)	-3.81 (0.92)	-0.27 (0.92)	3.58 (0.29)	0.02 (0.29)	-10.15 (2.14)**	-0.48 (2.14)**
Government Surplus/GDP	5.36 (1.86)*	0.34 (1.86)*	5.10 (1.66)*	0.36 (1.66)*	-2.07 (0.23)	-0.01 (0.23)	1.57 (0.40)	0.08 (0.40)
Inflation	-0.25 (0.87)	-0.02 (0.87)	-0.19 (0.74)	-0.01 (0.74)	-2.04 (1.47)	-0.01 (1.47)	-0.22 (0.95)	-0.01 (0.95)
Growth Domestic Credit	0.13 (0.48)	0.01 (0.48)	0.15 (0.54)	0.01 (0.54)	1.02 (1.61)	0.01 (1.61)	0.36 (1.20)	0.02 (1.20)
Growth real GDP per capita	-5.53 (1.51)	-0.35 (1.51)	-5.38 (1.43)	-0.38 (1.43)	-10.12 (1.22)	-0.07 (1.22)	-8.28 (2.31)**	-0.43 (2.31)**
Observations	263	263	258	258	95	95	320	320
Countries	52	52	52	52	24	24	52	52
Pseudo R-squared	0.18	0.18	0.17	0.17	0.39	0.39	0.20	0.20

Notes: Probit Coefficients given in first column of each specification.

Marginal Effects evaluated at the mean of the regressors provided in second column.

All ratios and growth rates expressed in percentage terms. Absolute value of z statistics in parentheses.

Standard errors robust to heteroskedasticity and within country clustering.

Coefficients multiplied by 100. Constant term not shown. All regressors lagged except Northern Interest Rate.

* significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix A

Below I list the variables and sources used. The data is annual and it covers the period 1988–2000.

Table A1

Variable	Description and Source
Systemic and non-systemic banking crises	Source: Caprio and Klingebiel (2003)
<i>Dollarization Variables</i>	
Dollar Credit	Foreign currency credit issued by domestic banks to the resident private sector. Source: IMF Country Reports.
Dollar Deposits	Foreign currency deposits of residents held in domestic banks. Source: IMF Country Reports.
Total Credit	Total credit issued by domestic banks to the resident private sector. Source: IMF Country Reports.
Total Liabilities	Total liabilities of domestic banks. Source: IMF Country Reports.
Foreign Assets	Foreign assets of domestic deposit money banks. Source: IFS.
Foreign Liabilities	Foreign liabilities of domestic deposit money banks. Source: IFS.
<i>Exchange Rate Regime Variables</i>	
<i>de facto</i> regime	Source: Reinhart and Rogoff (2003)
<i>de jure</i> regime	Source: IMF's <i>Annual Report on Exchange Arrangements and Exchange Restrictions</i> .
<i>Macro Variables</i>	
Trade (% of GDP)	Exports plus Imports divided by GDP. Source: IFS and WDI.
Exports (% of GDP)	Exports divided by GDP. Source: IFS and WDI.
Money Market Interest Rate	Source: IFS.
Growth of Real GDP per capita (%)	Source: WDI.
Current Account (% of GDP)	Current Account Balance as % of GDP. Source: IFS and WDI.
Inflation %	Annual percentage change in Consumer price index. Source: IFS and WDI.
Cash/Assets (%)	Reserves of Deposit Money Banks (IFS line 20) / Assets of Deposit Money Banks (IFS line 20+21+22A-D,F)
Capital Flows (% of GDP)	Capital Account plus Financial Account + Net Errors and Omissions. Source: IFS (lines 78bcd + 78bjd + 78cad)
Government Deficit (% of GDP)	Source: IFS and WDI.
Real GDP	Source: IFS and WDI.
Foreign reserves/M1 (%)	Central bank foreign exchange reserves as percent of M1. Source: IFS.
Growth in Domestic Credit %	Annual percentage change in domestic credit. Source: IFS.
Northern Interest Rate (%)	Weighted average of short-term interest rates from the US, Germany, Japan, France, the UK, and Switzerland (IFS line 60b); the weights being proportional to the fraction of debt denominated in the relevant currencies (Global Development Finance) (Eichengreen and Rose 1998)
Total external debt (% of GNP)	Source: Global Development Finance, World Bank.

Table A2
Deposit and Credit Dollarization Data Availability

Country	Deposits	Credit	Country	Deposits	Credit
Albania	90-00	98-99	Macedonia	95-99	95-99
Angola	92-99		Madagascar	93-00	98
Antigua & Barbuda	90-98		Malawi	94-00	
Argentina	92-00		Mexico	92-00	92-00
Armenia	93-00		Moldova	93-00	
Azerbaijan	92-97	93-94	Mongolia	91-99	91-94
Bahamas	90-00	90-00	Mozambique	91-00	97-00
Belarus	93-99	93-95	Myanmar	89-99	
Belize	90-00		Nepal	93-99	
Bolivia	92-00	92-00	Nicaragua	90-99	
Bosnia & Herz.	94-00		Pakistan	90-99	
Botswana	93-98		Papua New Guinea	90-99	
Bulgaria	90-00	90-00	Paraguay	89-00	89-00
Cambodia	93-00		Peru	92-00	92-00
Cape Verde	88-98		Philippines	90-98	
Congo, Dem. Rpb.	96-99		Poland	93-00	
Costa Rica	91-97		Romania		93-00
Croatia	91-00	91-94	Russian Federation	92-00	92-00
Cyprus	89-94		Rwanda	91-99	
Czech Republic	92-00	92-00	Sao Tome & Principe	94-00	
Djibouti	92-98	92-97	Serbia	99-00	99-00
Dominica	89-00		Slovak Republic	92-00	92-00
Ecuador	92-98		Slovenia	91-99	
El Salvador	91-98		South Africa	94-99	94-99
Eritrea	97-99		St. Kitts & Nevis	89-99	
Estonia	92-00	94-00	St. Lucia	91-98	
Gambia		95-00	St. Vincent & Gren.	89-99	
Georgia	94-00	94-00	Sudan	89-00	
Ghana	93-00	94-00	Tajikistan	93-00	
Grenada	90-00		Tanzania	94-00	
Guinea	91-00		Thailand	90-00	
Guinea-Bissau	90-96		Trinidad & Tobago	93-00	
Haiti	94-99	94-99	Tunisia	91, 94-99	
Honduras	89-98		Turkey	89-98	90-98
Hungary	92-99	94-99	Turkmenistan	93-97	93-97
Indonesia	90-99	93-99	Uganda	92-98	
Israel	90-99	91-99	Ukraine	94-00	94-00
Jamaica	91-99	92-99	United Arab Emirates	93-97	
Jordan	90-96		Uruguay	89-98	89-98
Kazakhstan	94-99	95-99	Uzbekistan	92-99	97-99
Korea	94-98		Vanuatu	89-99	89-99
Kuwait	95-00		Venezuela	90-98	
Kyrgyz Republic	93-99	96-99	Vietnam	89-00	94-99
Lao P.D.R.	92-98		Yemen	94-99	94-99
Latvia	93-00	93-00	Zambia	94-98	
Lithuania	93-00		Zimbabwe	93-94, 97-00	