*Corinne Deléchat*
*Camila Henao*
*Priscilla Muthoora*
*Svetlana Vtyurina*

# The Determinants of Banks' Liquidity Buffers in Central America

**Abstract**

Banks' liquidity holdings are comfortably above legal or prudential requirements in most Central American countries. While good for financial stability, high liquidity may nonetheless hinder financial market development and monetary policy transmission. Using a panel of 96 commercial banks from Central America, Panama and the Dominican Republic for 2006-2010, we find that the demand for precautionary liquidity buffers is associated with measures of bank's size, profitability, capitalization, and financial development. Higher liquidity is also associated with deposit dollarization, reinforcing the monetary policy and market development challenges in

The authors would like to thank Miguel Savastano for his guidance, and two anonymous referees for their insightful comments. Przemek Gajdeczka, Fernando Delgado, Mario Mansilla, Stephanie Medina Cas, Andy Swiston, Camilo Tovar and other colleagues at the International Monetary Fund, as well as staff from the Central Bank of Guatemala, Rudy Loo-Kung and Mario Cuevas at the Inter-American Development Bank and Miquel Dijkman at the World Bank also provided valuable comments. The views expressed herein are those of the authors and should not be attributed to the IMF, its Executive Board, or its management. All remaining errors are our own.

highly dollarized economies. This is one of the first empirical studies to investigate the relation between degrees of dollarization and bank liquidity holdings. Its findings suggest that improvements in supervision and measures to promote dedollarization, including developing local currency capital markets, would help enhance financial systems' efficiency and promote intermediation in the region.

JEL classification: E44, G21, O16.

Keywords: Central America, bank liquidity, credit, dollarization, foreign banks.

## 1. INTRODUCTION

This paper studies the determinants of banks' liquidity buffers in Central America,[1] Panama and the Dominican Republic (CAPDR) using a panel of 96 commercial banks over 2006-2010. In particular, the paper examines whether CAPDR banks' liquidity buffers, defined as the liquid assets-to-deposits ratio, can be explained by bank and country-level characteristics as predicted by theory and presented in some empirical studies. Of particular interest for the region is whether liquidity holdings are related to bank ownership (public vs. private, foreign vs. domestic) or the banking systems' degree of dollarization.

CAPDR banking systems are highly liquid. As seen in Figure 1, holdings of liquid assets as a share of total deposits averaged about 28% for the region in 2010 while reserve requirements were set at about 17% on average.[2] Liquidity ratios are also high compared to larger South-American countries; liquidity ratios averaged about 15% for Brazil, Chile and Colombia in

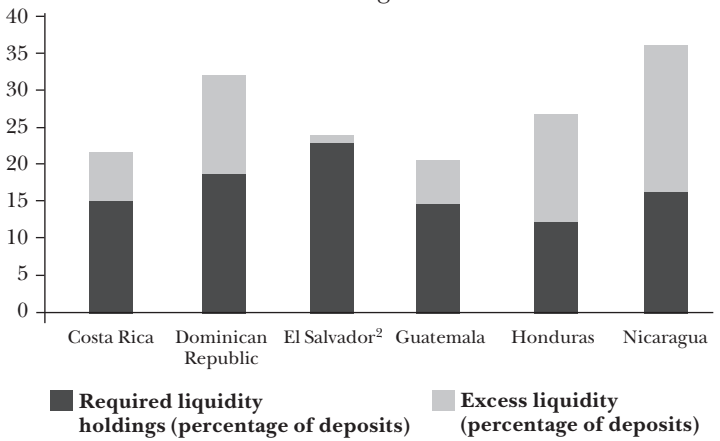
[1] Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua.

[2] The liquidity requirement for Panama is not strictly comparable to that of the other countries and is thus not included in Figure 1. It is defined as the ratio of liquid assets and securities and obligations payable to banks within 186 days, as a share of short-term deposits.

Figure 1

**CAPDR: LIQUID ASSETS-TO-DEPOSITS RATIO[1]**

Percentage, 2010




Sources: Central America, Panama and Dominican Republic central banks and superintendencies' websites, and authors' calculations.

[1] Liquid assets include cash central bank reserves and deposits abroad.

[2] Prudential liquidity requirement.

2010.[3] For monetary and supervisory authorities ensuring that banks hold adequate amounts of high-quality liquid assets is essential for financial stability, as highlighted during the recent global financial crisis. However, if liquidity holdings are much above legal requirements, this may be costly in terms of foregone financial intermediation. Excess liquidity also hinders the development of interbank and money markets and acts as *sand in the wheels* of the monetary transmission mechanism in countries with a monetary policy (Gray, 2011).

From individual banks' point of view, holding sufficient liquidity is necessary to insure against liquidity risk (Diamond and Dybvig, 1983; Diamond and Rajan, 2001 and 2005). Since loans are relatively illiquid, large and unexpected deposit

[3] These estimates are based on authors' calculations using data provided by IMF country teams and are available upon request.

withdrawals can lead to insolvency as it may be too costly or not possible to raise liquidity on short notice, especially if local capital markets are underdeveloped. Instead of self-insuring, banks could resort to other forms of financing, such as accessing interbank markets, central bank liquidity windows, or external credit lines. However, asymmetric information may lead to coordination failures on the interbank market and external credit lines may freeze, as seen during the recent financial crisis. Solvent but illiquid banks could still fail, absent a lender of last resort (LOLR; Rochet and Vives, 2004). Thus banks hold a buffer of liquid assets as self-insurance, equating the marginal benefit of holding liquid assets to the marginal cost of foregoing alternative investments.

A priori, one could expect the self-insurance motive to be especially important in CAPDR. Local capital markets are underdeveloped, interbank markets are thin, and LOLR arrangements remain limited or nonexistent. For the five partially-dollarized economies, the high share of foreign-currency assets and liabilities limits the ability of the central bank to act as LOLR. The two fully dollarized economies in the region, Panama and El Salvador, did not have a LOLR as of end-2010.[4] Furthermore, while the region's predominant reliance on customer deposits for funding is a likely reason for its resilience during the global financial crisis, it is also a vulnerability which calls for holding adequate liquidity buffers.

The remainder of the paper is structured as follows. Section 2 provides some background information on CAPDR banking systems. Section 3 briefly reviews the theoretical and empirical literature on the determinants of liquidity holdings. Section 4 describes the data and presents stylized facts on the distribution of banks' liquidity holdings. Section 5 presents the econometric methodology while Section 6 discusses the estimation results. Section 7 concludes.

[4] El Salvador formally approved the regulations to establish a liquidity facility in June 2012.

## 2. SOME BACKGROUND ON CENTRAL AMERICA, PANAMA & DOMINICAN REPUBLIC BANKING SYSTEMS

With the exception of Panama, the region's banking systems are relatively small, highly concentrated and dollarized to various degrees as seen in Tables 1 and 2. Panama's banking system stands out of the group in terms of its size, which is four times greater than the sample average measured by the ratio of total system's assets to GDP (Table 2).[5] In four countries (Honduras, Nicaragua, El Salvador and Panama) the share of foreign banks' assets in total assets is greater than 50%, suggesting higher potential vulnerabilities from cross-border linkages. While the presence of state banks is quite small in terms of number of banks and share of system's assets, state banks have a very strong presence in Costa Rica, where their assets account for 55% of total assets. Customer deposits are the main source of funding and show a high degree of dollarization, particularly in Nicaragua and Costa Rica. The share of short-term deposits is also relatively high in the region, with the exception of Panama. Table 2 shows that, compared with 2006, Panama's banking system has experienced significant consolidation as has Guatemala's, although to a more modest extent. Banking systems' size, measured by total assets as a share of GDP, expanded in Costa Rica, Guatemala, and Nicaragua but decreased in the other countries. During the period, private sector credit increased as a share of GDP in all countries but the Dominican Republic and El Salvador.

Reserve requirements are the amount of funds that a depository institution must hold as reserve at the central bank against specified deposit liabilities. The liquidity requirement obliges a bank to hold on its balance sheet sufficient high-quality liquid assets to cover short-term liabilities. Three different regimes

[5] This study does not include Panama's offshore banking sector. By law, Panama's offshore banks cannot take deposits from or lend to the domestic economy. Offshore banks' assets represented 50 percent of GDP at end-2010.

Table 1

CAPDR: BANKING SYSTEM INDICATORS, 2010

| | *Number of banks* | *Number of state banks* [3] | *State bank assests in total assets* | *Number of foreign banks* [4] | *Foreign bank assets in total assets* | *Percent of assets in 5 largest banks* | *Assets in foreign currency in total assets* | *Credit in foreign currency in total credit* | *Foreign currency in total deposits* | *Demand deposits in total deposits* |
|---|---|---|---|---|---|---|---|---|---|---|
| Costa Rica | 16 | 3 | 55 | 9 | 26 | 78 | 46 | 47 | 41 | 53 |
| Guatemala | 18 | 1 | 2 | 7 | 13 | 79 | 23 | 30 | 24 | 41 |
| Honduras | 17 | 1 | 1 | 9 | 50 | 75 | 24 | 28 | 30 | 22 |
| Nicaragua | 6 | 1 | 0.01 | 4 | 67 | 97 | 72 | 90 | 73 | 31 |
| Dominican Republic | 15 | 2 | 31 | 4 | 29 | 87 | 26 | 21 | 30 | 18 |
| El Salvador [1] | 12 | 2 | 6 | 10 | 83 | 85 | | | | 26 |
| Panama [1, 2] | 49 | 2 | 14 | 28 | 57 | 57 | | | | 15 |

Sources: Central American Monetary Council (SECMCA), International Financial Statistics, and authors' calculations.
[1] Officially dollarized economies. [2] Domestic banking system. [3] State share of more than 50%. [4] Banks with 50% of capital in foreign hands, excludes offshore.

Table 2

CAPDR: BANKING SYSTEM INDICATORS, 2006 AND 2010

| | *Number of banks* | | *Assets to GDP* | | *Credit to GDP* | |
|---|---|---|---|---|---|---|
| | *2006* | *2010* | *2006* | *2010* | *2006* | *2010* |
| Costa Rica | 17 | 16 | 57 | 60 | 39 | 46 |
| Guatemala | 23 | 18 | 39 | 44 | 27 | 30 |
| Honduras | 16 | 17 | 91 | 68 | 48 | 50 |
| Nicaragua | 7 | 6 | 57 | 62 | 33 | 34 |
| Dominican Republic | 13 | 15 | 33 | 32 | 19 | 18 |
| El Salvador [1] | 12 | 12 | 64 | 61 | 44 | 40 |
| Panama [1, 2] | 87 | 49 | 221 | 200 | 82 | 91 |

Sources: Central American Monetary Council (SECMCA), International Financial Statistics, and authors' calculations.
[1] Officially dolarized economies. [2] Domestic bank system.

for liquidity management are in place in CAPDR countries. Honduras and El Salvador apply both reserve requirements and prudential liquidity requirements. Costa Rica, Guatemala, Dominican Republic and Nicaragua only use reserve requirements, while Panama, in the absence of a central bank, uses exclusively prudential liquidity requirements, as presented in Table A1 of Appendix A.

Reserve requirements in CAPDR are in line with those in other Latin American countries, and average about 15% for local currency deposits and 15.5% for foreign currency deposits, as indicated in Figure 2. The two officially-dollarized economies rely on prudential liquidity requirements, held at the central bank in the case of El Salvador and held by individual banks in the case of Panama.[6] Although they are potentially useful policy instruments, reserve and liquidity requirements are not actively

[6] In addition to reserve requirements, Honduras also imposes liquidity requirements to avoid maturity mismatches.

jointly applied in most countries, with the exception of El Salvador and Honduras (see Appendix A, Table A1).[7]

Overall, banking sectors in the region are well capitalized, liquid and profitable. Figure 3 illustrates that financial systems remained resilient in the face of the 2009 global financial crisis, mostly due to their strong initial positions. Despite rapid credit growth, the region did not experience excessive credit booms and there was very limited exposure to toxic asset-backed securities or to wholesale funding. Stress tests of liquidity risk suggested that banks had adequate coverage of their liquid liabilities and could withstand deposit withdrawal shocks of 15%-20% during a 30 day period.[8] However, although banking supervision has improved over the past decade, compliance with Basel Core Principles remains uneven and below that of the six largest South American economies (Delgado and Meza, 2011). Financial safety nets remain incomplete and financial markets, including interbank markets, are underdeveloped.

## 3. DETERMINANTS OF BANKS' LIQUIDITY BUFFERS: LITERATURE REVIEW

The determinants of banks' liquidity buffers, as identified in the theoretical and empirical literature, can be classified into four broad categories. These are the opportunity costs of alternative investments and shocks to funding, bank characteristics, macroeconomic fundamentals, and moral hazard motives.

### 3.1 Opportunity Cost and Shocks to Funding

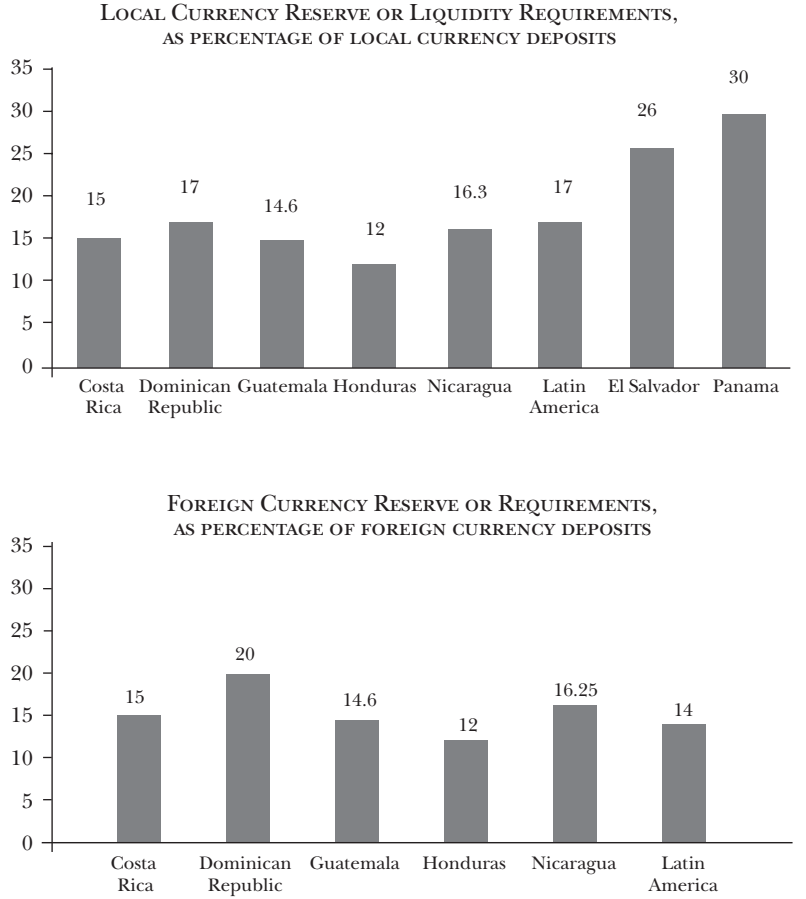
The early literature on bank liquidity uses the firm's theory of inventory decisions as a starting point. The cost of holding

[7] In this regard, excess liquidity is probably best analyzed in the context of single country time-series studies. In the panel context, our preferred definition of liquidity buffers for the empirical analysis in Section 4 is the liquid assets-to-deposits ratio.

[8] See *Financial System Stability Assessment* for the countries in the region, available at <www.imf.org>.

Figure 2

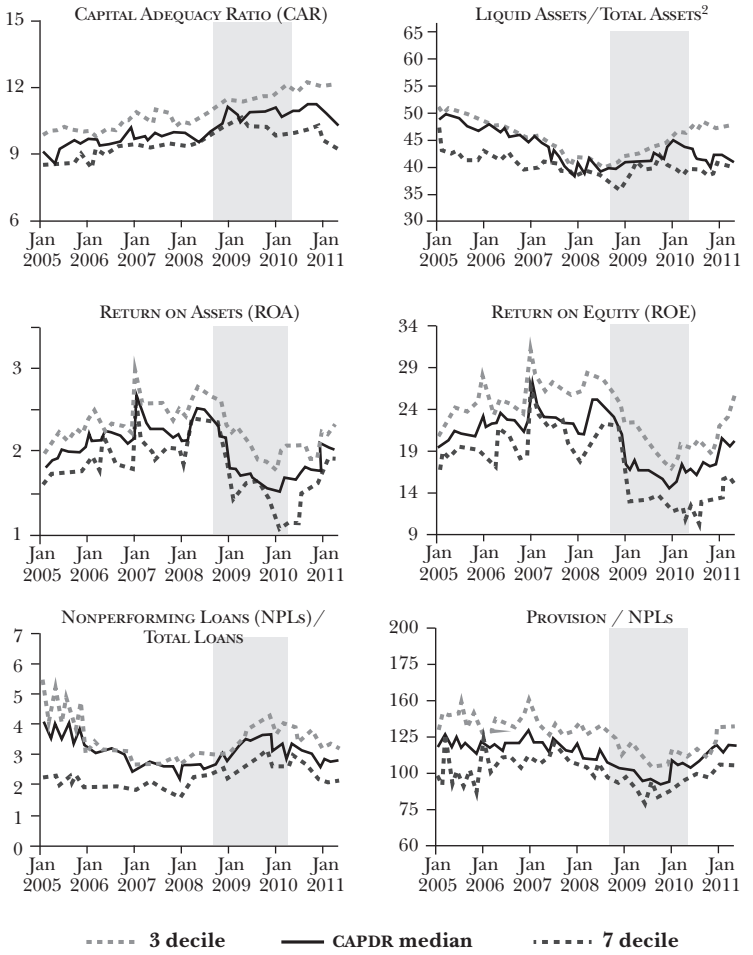
**CAPDR: Statutory Reserves and Liquidity Requirements by Currency, 2010**




Sources: Central banks and superintendencies.
Note: Reserve requirements for all countries excluding the fully dollarized economies, Panama and Salvador, which have prudential liquidity requirements. Liquidity requirement for Panama is defined as the ratio of liquid assets, including securities and obligations payable to banks within 186 days, as a share of short-term deposits.

Figure 3

**CAPDR: Financial Stability Indicators**




Source: Central American Monetary Council.

[1] Shaded area represents the 2008-2009 global financial crisis.

[2] Liquid assests include short-term investments.

liquid assets (with low returns compared with other types of investments) is compared to the benefits of reducing risks of *running out* (Baltensperger, 1980, and Santomero, 1984). Models testing these relations predict that the size of liquidity buffers should reflect the opportunity cost of holding liquid assets rather than loans. The size of liquidity buffers is also hypothesized to take into account the distribution of liquidity shocks that the bank may face. In particular, it should be positively related to the volatility of the funding base as well as to the cost of raising additional funds.

Using aggregate time-series data for banks in Thailand, Agénor et al. (2004) find that the demand for precautionary reserves (measured as the log of excess reserves over total deposits) is positively related to the penalty rate, proxied by either the discount or the money market rate, as well as to the volatility of the cash-to-deposit ratio. Dinger (2009) finds in a panel of Eastern European banks that liquidity buffers are negatively related to the real deposit rate, but positively related to the interbank rate.

### 3.2 Bank Characteristics

The newer generation of models explaining liquidity demand relies on some form of market imperfection to explain why firms (including banks) cannot raise unlimited amounts of liquidity instantaneously. The market imperfection is asymmetric information, either in the form of moral hazard (Holmstrom and Tirole, 1998) or adverse selection (Kiyotaki and Moore, 2008).[9]

[9] Holmstrom and Tirole (1998) and Kiyotaki and Moore (2008) make this argument for firms in general: liquidity constraints, together with liquidity shocks, result in entrepreneurs not being able to raise the entire cost of their desired investment externally, so that they have to hold enough liquid assets to make a down payment for each unit of investment (there are also limits on the amount of equity that can be resold). Therefore, although the rate of return on cash is very low, entrepreneurs will choose to hold some in their portfolio. Liquidity shocks reduce the price of equity and increase the desired holdings of liquid assets.

Financially-constrained banks would thus tend to hold more liquidity.[10]

These models highlight several characteristics affecting banks' ability to raise non-deposit forms of finance, and, thus, their precautionary demand for liquidity buffers. Among these are bank size (small banks have more difficulties in accessing capital markets), profitability (more profitable banks can more readily raise capital and thus are less liquidity-constrained), and ownership (both public banks and foreign banks should be less liquidity-constrained than private and domestic banks, respectively, because public banks may have an implicit guarantee while foreign banks would have access to support from headquarters).[11]

Aspachs et al. (2005) find that banks' liquidity buffers are negatively related to bank characteristics such as loan growth and net interest margins[12] and that the coefficients on size and profitability are not significant. Kashyap and Stein (1995, 2000) and Kashyap et al. (2002), using a large panel of US banks, find a strong effect of bank size on holdings of liquid assets, with smaller banks being more liquid as they face constraints in accessing capital markets. Dinger (2009) also finds that smaller Eastern European banks hold more liquidity, although this relation is non-linear, and that foreign banks hold less liquidity.

Bank ownership may not only exert a direct influence on liquidity holdings but may also interact with other explanatory variables. In particular, Aspachs et al. (2005) find that, for the United Kingdom, foreign banks' liquid asset holdings are not affected by the availability of a domestic LOLR while local banks are. Furthermore, in their sample, foreign banks'

---

[10] See for example Almeida et al. (2004), Kashyap et al. (2002), Kashyap and Stein (1995, 2000), Repullo (2005), and Rochet and Vives (2004).

[11] Freixas and Holthausen (2005).

[12] The negative relation between liquidity and net interest margins only holds for domestic banks. By contrast, foreign-owned banks' liquidity holdings are positively related, which may reflect remittances of liquidity from abroad when UK interest margins are high.

liquidity holdings tend to react less to changes in the domestic policy rate and GDP growth, suggesting that foreign banks are subject to a somewhat different set of constraints than their local counterparts.

### 3.3 Macroeconomic Fundamentals

The models mentioned above also have implications for the cyclical behavior of liquidity demand. If capital markets are imperfect, the demand for liquidity should be countercyclical, as banks would hoard liquid assets during recessions and offload them in good times given more opportunities to lend. Liquidity buffers would thus be negatively related to measures of the output gap or real GDP growth, the credit cycle, and policy interest rates. For example, Almeida et al. (2004) develop and estimate on a large sample of US manufacturing firms a model where financially-constrained firms have a higher propensity to accumulate cash holdings.

These findings have important policy implications. The countercyclicality of liquidity buffers limits the effectiveness of monetary policy: liquidity injections to stimulate the economy in a recession would be used by banks to rebuild their liquidity buffers instead of being on-lent, and aggregate credit would not necessarily pick up. Aspachs et al. (2005) find that banks' liquidity buffers in the United Kingdom are negatively related to real GDP growth and the policy rate. Agénor et al. (2000) and Saxegaard (2006) find that excess reserves are negatively related to the output gap and the policy rate in Thailand and in sub-Saharan Africa, respectively. Dinger (2009) finds, using a sample of Eastern European banks, that liquidity holdings are negatively related to real GDP growth and real per capita gross domestic product.

### 3.4 Moral Hazard and Safety Nets

In theory, the strength of the financial safety net and, in particular, the availability of a LOLR arrangement, should reduce

banks' incentives to hold liquidity buffers (Repullo, 2003). Empirical studies of banks in the United Kingdom and Argentina, where LOLR support is measured, respectively, as the Fitch support rating and the availability of external credit lines in the context of the currency board, support this prediction (Aspachs et al., 2005, and González-Eiras, 2003).

High credit or deposit dollarization reduces the effectiveness of the domestic LOLR. Partially-dollarized economies are subject to currency and liquidity risks given that the central bank cannot issue foreign currency (Gulde et al., 2004, and Levy-Yeyati and Broda, 2002). Liquidity coverage should then be positively associated with the degree of deposit dollarization. However, the incentives to hold such buffers would diminish in the presence of a large stock of central bank international reserves or central bank access to external credit lines, as these would be a ready source of US dollar liquidity in the case of a run on US dollar deposits (Ize et al., 2005). Using a sample of about 100 countries, De Nicoló et al. (2005) find that deposit dollarization is associated with higher solvency and liquidity risk measured by deposit volatility. However, to our knowledge, no empirical study has focused on the effects of deposit dollarization on banks' liquidity.

## 4. TESTING FOR THE DETERMINANTS OF BANKS' LIQUIDITY BUFFERS

### 4.1 Data and Variable Definitions

Our sample combines annual data for 96 CAPDR banks over 2006 to 2010 from the BankScope database[13] with country-level macroeconomic fundamentals and structural variables drawn from regional monetary and supervisory authorities' websites and other publicly-available databases.[14] The sample covers 72%

[13] A financial database supplied by Bureau van Dijk.

[14] Please see Section 4.3 and Tables 1 and 2 in Appendix B for further details on data definition and sources, description as well as an indication for expected signs for the relation between different variables.

of all commercial banks in the region and about 80% of total banking system assets, though admittedly the coverage is not homogeneous across all the countries, as shown in Figure 4.[15]

The choice of the sample is constrained by data availability. The period 2006-2010, although not necessarily representative, constitutes the interval for which data for most CAPDR banks were available. Starting at an earlier date would have severely limited coverage for some countries, in particular Nicaragua, and since BankScope data is based on published bank statements, final data becomes available with a lag that varies across countries and banks. Individual bank data were picked in order to take into account the importance of regional conglomerates in the region.[16]

### 4.2 Definition of Liquidity Buffers

Liquidity buffers are measured by the ratio of liquid assets to customer deposits and short-term funding. Liquid assets include cash and cash-like assets,[17] quoted or listed government bonds, and short-term claims on other banks. Although the breakdown of the numerator components is not available, there are relatively few listed government securities in the region (Shah et al., 2007). The denominator includes banks' customer deposits and short-term interbank deposits. Customer

[15] The information on coverage is averaged over banks/years. A caveat is that the pattern of missing institutions may not be random.

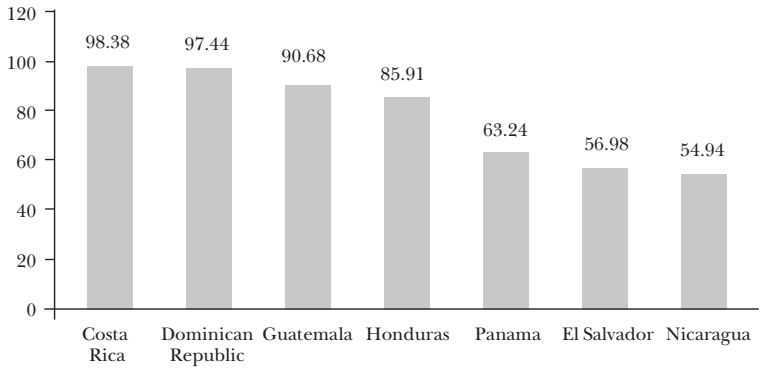
[16] We also selected banks that were active in 2010 to avoid bank attrition (due to acquisition or mergers) in the sample and we searched within the BankScope dataset for news of merger or acquisition deals for each bank. In a couple of cases, banks sold stakes in an existing bank, leading to changes in cross-ownership patterns, but not to the nature of ownership, hence we did not control for this in the econometric specification. However, we did check for large changes in asset ratios to make sure that there was no uncharacteristically large change from one year to another.

[17] These include cash in vault, liquid positions in foreign exchange held abroad, and reserves held at the central bank (except for Panama, as there is no central bank).

Figure 4

**CAPDR: BANKSCOPE SAMPLE COVERAGE OF TOTAL BANKING SYSTEM'S ASSETS**

2006-2010 average percent




Sources: BankScope database, CAPDR central banks and superintendencies' websites, and authors' calculations.

deposits are the main source of funding in the region; while the share of short-term funding is low (the share of customer deposits in the denominator is 93% for the whole sample). As seen in Figure 5, the ratio of liquid assets to customer deposits and short-term funding from the individual bank data is close to system-wide liquidity ratios, defined as liquid assets (cash and cash-like, excluding securities) to deposits. We use it as our main dependent variable and use the ratio of liquid assets to total assets for robustness checks.[18]

Our dependent variable captures highly liquid assets available on demand and, from a banking supervision's standpoint,

[18] Empirical studies use both ratios, see Aspachs et al. (2005) and Dinger (2009). The ratio of liquid assets to liabilities is the most consistent with the notion of CAPDR banks self-insuring against deposit shocks, though banking theory also emphasizes asset-side liquidity problems (Diamond and Rajan, 2005).

should ideally be measured at much more frequent intervals.[19] The two new minimum standards for liquidity defined by the Basel Committee on Banking Supervision explicitly take into account the time horizon dimension of adequate liquidity buffers. The *liquidity coverage ratio* aims at promoting short-term resilience of a bank's liquidity profile by ensuring that it has sufficient high-quality liquid assets (cash or cash-equivalent) to survive a significant stress scenario lasting for one month. The *net stable funding ratio* matches long-term assets with stable funding sources over a one-year horizon in order to promote resilience over a longer period (BIS, 2010).

## 4.3 Choice of Explanatory Variables

The choice of explanatory variables is guided by the theoretical and empirical literature reviewed in Section 3 and is summarized in Table B1, Appendix B.

### *4.3.1 Opportunity Cost, Liquidity Shocks and Bank Characteristics*

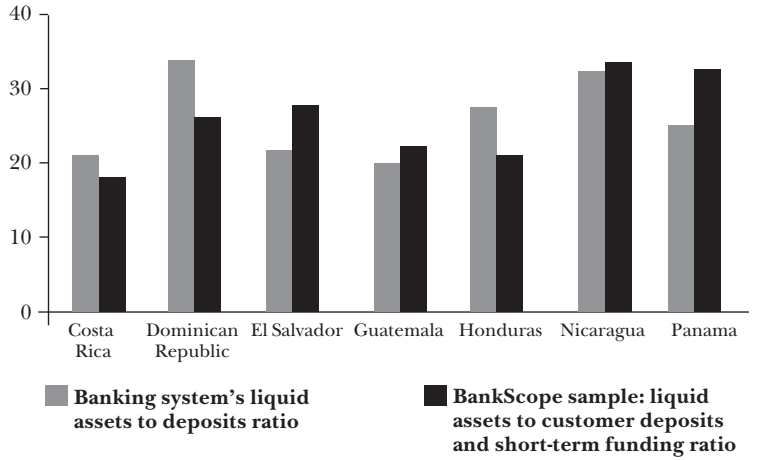
In line with the theory presented in Baltensperger (1980) and empirical results by Agénor et al. (2000) and Dinger (2009), we use the spread between the lending and the deposit rate as a measure of the opportunity cost of holding liquid assets. The probability of a liquidity shock can be proxied by a measure of the volatility of total deposits at the system level as in Agénor et al. (2000) –we can calculate a monthly coefficient of variation of total deposits for each country, but have only annual bank-level data– or by the volatility of inflation. Past liquidity shocks

[19] In particular, there could be large seasonal variations in banks' liquid assets holdings that could bias the regression estimates. Using monthly data at the country level collected by the monetary authorities and the Secretariat of the Central America Monetary Council, we were able to verify that, at the aggregate level at least, there is no evidence of systematic end-year seasonal bias (tabulations available on demand).

Figure 5

**CAPDR: LIQUIDITY RATIOS AT SYSTEM LEVEL AND IN BANKSCOPE SAMPLE**

2006-2010 average percent




Sources: BankScope database, CAPDR central banks and superintendencies' websites, and authors calculations.

may also matter: a history of banking crisis could lead banks to become more risk-averse and hold more liquidity.

Given the importance of public and foreign banks in Central America's banking systems, we are particularly interested in testing whether liquidity buffers vary systematically according to bank ownership (public/private and foreign/domestic). As noted before, Aspachs et al. (2005) find that foreign banks' preference for liquid assets differs from that of domestic banks in the case of the United Kingdom's banking system as they would have access to emergency liquidity from their headquarters. Public banks may similarly be less risk-averse than private banks because they may perceive that they have an implicit or explicit government guarantee. Indeed, in developing countries, the lending behavior of state-owned banks has been found to be less-procyclical than that of private banks (Micco and Panizza, 2006). Public banks also tend to be less efficient and less profitable than private banks (Micco et al., 2004).

We control for other bank characteristics such as size, measured by the log of total assets, as the work by Kashyap and Stein (1995, 2000) suggests that smaller banks may have less easy access to capital markets and thus be more liquidity constrained. The squared value of this variable captures possible non-linearities in the impact of bank size on liquid asset holdings (Dinger, 2009). Capitalization is expected to be positively related to liquidity demand as better capitalized banks may reflect more prudent business models (Dinger, 2009). Capitalization is measured by the ratio of equity to total assets. More profitable banks would be expected to hold less liquidity due to easier access to capital markets (Aspachs et al., 2005). Profitability is measured by the ratio of the net interest margin to interest-earning assets. The ratio of loan-loss reserves to gross loans should capture the banks' degree of risk aversion or the perceived riskiness of their loan portfolio.

### *4.3.2 Macroeconomic Fundamentals and Safety Nets*

As described in Section 3, models with financial frictions imply that macroeconomic conditions and fundamentals would also affect precautionary liquidity demand (Aspachs et al., 2005; Dinger, 2009; Opler et al., 1997). We use output growth in CAPDR to capture the economic cycle: faster growth is expected to be related to lower liquidity buffers as banks would expand lending, while they would hoard liquidity in a downturn. Financial development is captured by the ratio of private-sector credit to GDP, a traditional proxy for financial depth: the more lending opportunities, the lower the precautionary liquidity buffers. The availability of safety nets is captured by the extent of deposit dollarization (which reduces the effectiveness of the central bank as LOLR) and the net international reserves holdings of central banks, a measure of the capacity of the central bank to provide liquidity support in foreign currency in partially dollarized banking systems. Dollarization is measured by the share of dollar deposits in total system deposits (no currency breakdown is available

for bank-level data in BankScope), and we use the log of each country's net international reserves.

### 4.4 Data and Stylized Facts

Overall there is significant variation in liquidity holdings in the sample as shown in Table B2 of Appendix B. Liquidity holdings in terms of customer deposits and short-term funding are on average 25% in our sample and represent about 19% of total assets. Average capitalization is relatively high at about 13%, as noted in Basso et al. (2012). Foreign banks represent 45% of observations, and private banks about 90%. Deposit dollarization amounts to about 50% though there are wide variations across countries.

Simple correlations, detailed in Table B3 of Appendix B, show that the main explanatory variables are related to banks' liquidity holdings as predicted by the theory and in line with empirical evidence, with a few exceptions.[20] In particular, foreign ownership, real GDP growth and financial depth are positively associated with liquidity holdings, whereas a negative relation was expected. At the same time, deposit dollarization is negatively related to liquidity holdings, while theory predicts a positive association. In addition to the effect of small sample size and outlier observations on simple correlations, several explanations can be put forward to explain these somewhat counterintuitive results. On foreign ownership, in particular, the overwhelming majority of foreign banks in the sample are subsidiaries rather than branches. The implied operational and financial independence relative to foreign branches may explain why these banks choose

[20] Another way to explore the relation between explanatory variables and liquidity buffers is to divide banks into quartiles based on the size of liquidity buffers and test whether the characteristics of banks with high liquidity buffers are significantly and statistically different from banks with low buffers. Results from such an analysis, which are available from the authors upon request, show that most of the explanatory variables exhibit the predicted relation with liquidity buffers.

to hold higher liquidity. The results on real GDP growth and financial depth are in part explained by the lack of variation in these macroeconomic variables across all banks for a given country and year. But, additionally, the results may reflect the fact that growth for two of the fastest growing economies during the sample period (Panama and the Dominican Republic) was not primarily led by private credit but by government demand. Similarly, these two countries have the most financially integrated banking systems, but Panama's large presence of foreign subsidiaries and the Dominican Republic's banking crisis in 2003 may have had effects on the risk aversion of banks and their preference for liquidity. As for the result on dollarization, the correlation could be spurious as the most dollarized countries are also the ones with the largest number of foreign subsidiaries.

Given the short time dimension of the panel and its coverage of crisis years, we are also interested in testing whether the behavior of the main explanatory variables was different during the global financial crisis (2008-2009). Restricting the quartiles analysis described in footnote 19 for the crisis years reveals that the relations observed in the full sample continue to hold (see Appendix B, Table B4). However, the relation between deposit dollarization and liquidity buffers is now negative and significant. This possibly reflects the fact that the most financially-integrated economies in the region (e.g., Panama, Dominican Republic), experienced a temporary sharp drop in foreign capital inflows in late 2008 and early 2009.

## 5. EMPIRICAL ANALYSIS

### 5.1 Baseline Specification

In line with the discussion in the previous section, we specify the determinants of banks' liquidity buffers as a combination of bank characteristics, macroeconomic fundamentals and country-specific characteristics. The baseline specification can be represented by Equation 1:

$$L_{it} = \beta_0 + \beta_1 L_{i,t-1} + \beta_2\ bank_{ijt} + \beta_3 macro_{jt} + \beta_4 country_{jt} + \\ + \mu * j + \nu * t + \xi_{ijt}, \quad (1)$$

where the subscripts $i$, $j$ and $t$ refer to bank, country and time (year) respectively. $L$ represents bank-level liquidity buffers. We include a lagged dependent variable. If, as predicted by theory, banks target an optimum level of liquidity holdings then these holdings should be persistent over time as shown by Opler et al. (1997) for US firms. Bank denotes variables measuring bank fundamentals that are derived from banks' balance sheets. Macro represents the macroeconomic determinants of banks' liquidity buffers such as real GDP growth and interest rates, and country includes observable country-level characteristics, such as the moral hazard and safety net variables presented in the previous section and Table B1 of Appendix B. Unobservable country and time effects are captured by country ($j$) and time ($t$) dummy variables.

### 5.2 Hypotheses of Interest

Based on our review of the theoretical and empirical literature as well as stylized facts on liquidity data for CAPDR countries, we pay particular attention to the following:

*i) Ownership.* We test separately for the effect of private vs. public, and domestic vs. foreign ownership. As discussed in Sections 3 and 4, ownership may not only exert a direct influence on liquidity holdings but may also affect the regression slope through interactions with other explanatory variables. To test this hypothesis, we interact the relevant ownership dummy variable $(own_{ijt})$ with the other explanatory variables as shown in Equation 2:

$$L_{it} = \beta_0 + \beta_1 L_{i,t-1} + \beta_2\, bank_{ijt} + \beta_3 macro_{jt} + \beta_4 country_{jt} + \\ + (\beta_5 bank_{ijt} * own_{ijt}) + (\beta_6 macro_{jt} * own_{ijt}) + \\ + (\beta_7 country_{jt} * own_{it}) + \mu * j + \nu * t + \xi_{ijt}. \quad (2)$$

*ii) Dollarization*. We use the same framework to test whether liquidity buffers are higher in countries with more dollarized banking systems as measured by the share of foreign currency deposits in total deposits.

### 5.3 Estimation Methodology

Equations 1 and 2 are estimated using the *generalized methods of moments* (GMM) methodology developed by Blundell and Bond (2000) and Bond (2002). GMM estimators are particularly appropriate to address the dynamic panel bias that arises in the presence of lagged dependent variables in samples with a large number of groups ($N$) and a relatively small number of time periods ($T$). Given the persistence of liquidity ratios, Systems GMM is the preferred estimator as it helps overcome the weak instrument problem (past changes do contain information about current levels), and results in improvements in the efficiency of the estimates (Arellano and Bond, 1991; Roodman, 2006).[21]

To avoid instrument proliferation, the number of lags for the GMM instruments is restricted to two (Roodman, 2009).[22] Specification corrections are applied to the two-step covariance matrix (Windmeijer, 2005). In addition, tests for second-order serial correlation (first-order correlation is expected given the design of the method) and for independence between the residuals and the instruments are applied.[23]

---

[21] Blundell and Bond (2000) show that when the dependent variable is highly persistent, the first-differenced GMM estimator has been found to have poor finite sample properties (bias and imprecision), particularly as the time dimension gets shorter. The Systems GMM estimator relies on both lagged differences (as per Arellano and Bover, 1995) and levels of the endogenous variables as instruments. They show that this results in significant improvements in precision and allows overcoming the small sample bias.

[22] As a rule of thumb, it is desirable to keep the number of instruments to no more than the number of groups (Roodman, 2006).

[23] The tests for second-order correlation and independence of residuals and instruments are based on the Arellano-Bond (AB) and

For robustness, Equations 1 and 2 are also estimated using ordinary least squares (pooled OLS), and by robust fixed effects (FE). As shown in Rodman (2006) the OLS estimate of the lagged dependent variable coefficient is biased upward, while with robust FE the coefficient on the lagged dependent variable is biased downward. Therefore, the GMM coefficient on the lagged dependent variable is expected to lie between the two, as shown in Table C1 of Appendix C.

## 6. RESULTS

Table 4 presents GMM estimation results from a robust specification of Equations 1 and 2 above, using the ratio of liquid assets to customer and short-term funding as a dependent variable.[24]

### 6.1 Baseline Specification

Estimation results from the baseline specification (Table 3, columns 1 and 2) show that liquidity buffers in CAPDR are persistent: the coefficient on the lagged dependent variable is positive and significant. This result is consistent with the view that banks target an optimal or desired level of precautionary liquidity holdings, although it could also be attributed to the presence of structural obstacles to credit that lead banks to hold higher liquidity buffers.

---

Hansen statistics, respectively. The estimation was implemented in Stata using Roodman's (2006) xtabond2 routine. Bank size and the country and year dummy variables were treated as predetermined and the other variables as endogenous.

[24] The coefficients on the macroeconomic variables (real GDP growth, interest rate spread) were consistent with predictions but neither significant nor very robust. Given the limited time span of our panel, part of the effect of these variables on liquidity buffers was likely captured by the country and time dummies. GMM estimation of the full model also became difficult as the number of instruments was becoming too large relative to available observations.

Liquidity ratios are related to bank size, though with nonlinearities: liquidity holdings increase with bank size, but there is a point at which bank size begins exhibiting a marginal decreasing effect on liquidity. This result is the opposite of what is found by Dinger (2009) in Eastern Europe, and may be explained by differences in the distribution of bank size in both regions. In CAPDR, the distribution of banks is highly skewed with a high concentration of assets in a few large banks, as indicated in Table 1 in Section 2.[25]

Liquidity holdings are also negatively related to the loan-loss reserve ratio, indicating that banks with higher savings against potential losses or riskier loan portfolios tend to have lower liquidity buffers in CAPDR. Liquidity holdings are negatively associated with the net interest margin (as expected), though the relation is not as robust as for the previous two variables. The coefficient on capitalization is negative and significant in the baseline, so that better capitalized banks would tend to hold less liquidity (the coefficient remains negative but is no longer significant in the specifications with interaction terms). As mentioned in the previous section, this finding is counterintuitive, as the expectation would be that better capitalized banks would also hold more liquidity buffers if higher capitalization is indicative of a prudent business model. The credit-to-GDP ratio is negatively related to liquidity buffers, in line with predictions (though the coefficient is not significant).

### 6.2 Specifications with Interaction Terms: The Role of Bank Ownership

Results indicate that ownership has some effect on liquidity holdings, though mostly through the interaction terms. Our results do not show any significant evidence that private

[25] In estimations without the quadratic term the coefficient on bank size is negative and robust across specifications as expected from theory and as found in related empirical studies (results available upon request).

Table 3

**CAPDR: DETERMINANTS OF BANKS LIQUIDITY BUFFERS – GMM ESTIMATES**

| *Dependent variable is the ratio of total liquid assets to customer deposits and short-term funding* | *Baseline (1)* | *Private ownership (2)* | *Foreign ownership (3)* | *Dollarization (4)* |
|---|---|---|---|---|
| Liquid assets ratio (−1) | 0.189[c] | 0.218[a] | 0.231[b] | 0.223[b] |
| | (0.044) | (0.114) | (0.099) | (0.092) |
| Bank size | 7.994[c] | 8.545[c] | 10.381[b] | 5.639[b] |
| | (1.875) | (2.299) | (4.137) | (2.635) |
| Bank size squared | −0.371[c] | −0.392[c] | −0.483[b] | −0.244[a] |
| | (0.092) | (0.126) | (0.203) | (0.129) |
| Capitalization | −0.321[b] | −0.505 | −0.316 | −0.017 |
| | (0.123) | (0.336) | (0.305) | (0.542) |
| Net interest margin | −0.123 | −0.089 | −0.593 | 0.404 |
| | (0.076) | (1.067) | (1.199) | (0.331) |
| Loan-loss reserve ratio | −0.282 | −0.035 | −0.550 | −0.799 |
| | (0.252) | (0.588) | (0.506) | (0.624) |
| Credit to GDP ratio | −0.323 | 0.404 | −0.441 | −0.041 |
| | (0.292) | (0.664) | (0.344) | (0.679) |
| Variable | | 42.500 | −13.249 | *1.491*[c] |
| | | (36.406) | (18.512) | (0.470) |
| Capitalization * variable | | 0.077 | 0.161 | −0.001 |
| | | (0.616) | (0.647) | (0.014) |
| Net interest margin * variable | | 0.036 | 0.309 | −0.022 |
| | | (1.128) | (1.058) | (0.015) |
| Loan-loss reserve ratio * variable | | −0.077 | *2.858*[b] | 0.027 |
| | | (0.827) | (1.291) | (0.022) |
| Credit to GDP ratio * variable | | −1.283 | 0.169 | −0.012 |
| | | (0.880) | (0.282) | (0.009) |
| Observations | 321 | 321 | 321 | 321 |
| $R^2$ | | | | |
| No. of groups | 96 | 96 | 96 | 96 |
| No. of instruments | 64 | 54 | 54 | 64 |
| Hansen test *p*-value | 0.348 | 0.192 | 0.132 | 0.232 |

| | | | | |
|---|---|---|---|---|
| A-B AR(2) test | 1.283 | 1.027 | 1.040 | 1.562 |
| A-B AR(2) test *p*-value | 0.199 | 0.305 | 0.298 | 0.118 |

Source: Authors' calculations.
Notes: Robust standard errors in parentheses. [a] Coefficient significant at the 10% level; [b] at the 5% level; [c] at the 1% level. Dependent variable is the ratio of liquid assets to total assets. GMM is two-step system GMM estimator with Windmeijer standard error correction. Columns 2 through 4 test the hypotheses that ownership (foreign/domestic and public/private), and degree of dollarization affect banks' liquidity buffers. Ownership is captured by dummy (=1 if the bank is private, =1 if the bank is foreign), dollarization by the share of dollar deposits in total deposits at the country level. All regressions include time and country dummies. Constant estimated but not reported.

ownership does affect liquidity buffers, though the coefficient on private ownership is positive. Foreign banks tend to hold less liquidity, but the coefficient on ownership is not statistically significant either. Foreign banks with riskier loan portfolios or which are more conservative regarding expected loan losses do tend to have higher liquidity buffers (Table 3, column 3). This finding is consistent with results obtained by Detragiache et al. (2008), who show that foreign banks tend to be more prudent and lend to less risky customers.

### 6.3 Specifications with Interaction Terms: Deposit Dollarization

As indicated in Table 3, column 4, deposit dollarization is robustly and significantly associated with higher liquidity buffers. The individual effect is quite large: a one standard deviation (34%) increase in deposit dollarization leads to a 150% increase in the liquidity to deposit ratio.[26] The strong positive

[26] Given that reserve requirements are set at the same rate for local and foreign currency deposits in most countries and that actual liquidity holdings are held above requirements, it is unlikely that this result is driven mechanically by reserve requirements. However, the large standard deviation is in part due to the fact that the share of foreign deposits in total deposits is 100 percent in El Salvador and Panama.

association between deposit dollarization and liquidity buffers may not necessarily imply a direct causal relation. The same factors that cause households and firms to hold more dollar deposits could very well also lead banks to hold more precautionary liquidity.[27] Nonetheless, the positive relation between dollarization and high liquidity holdings would help explain why the monetary transmission mechanism is slower in more dollarized economies (as discussed in Medina Cas et al., 2011).

The interaction with the loan-loss reserve ratio also indicates that prudent banks or banks with risky loan portfolios in dollarized economies tend to hold more liquidity (though the coefficient is not significant in the GMM specification). More profitable banks in dollarized economies tend to hold less liquidity.

### 6.4 Robustness Checks

As a main robustness check, we estimate our model using the ratio of liquid assets to total assets as our dependent variable. The results, which are presented in Table 4, are broadly consistent with those in Table 3 in terms of signs of coefficients. The coefficient on the lagged dependent variable is about twice as large and the coefficient of the dollarization variable remains significant and close to unity.

Table C1 in Appendix C presents further robustness checks. These include showing both the results of the pooled OLS and the fixed effects regressions as discussed above (columns 1-3), and looking into the interactions of foreign ownership and dollarization only for the private banks of the sample (columns 4-5). One caveat is that limiting the number of observations increases the risk of over-fitting the model with too many instruments. Nonetheless, the Hansen statistic's *p*-value remains reasonable for all specifications.

---

[27] De Nicoló et al. (2005) find in a large cross-country sample that the credibility of macroeconomic policy and the quality of institutions are key determinants of deposit dollarization.

Table 4

**CAPDR: DETERMINANTS OF BANKS LIQUIDITY BUFFERS – GMM ESTIMATES**

| *Dependent variable is the ratio of liquid assets to total assets* | *Baseline (1)* | *Private ownership (2)* | *Foreign ownership (3)* | *Dollarization (4)* |
|---|---|---|---|---|
| Liquid assets ratio (−1) | 0.557[c] | 0.567[c] | 0.483[c] | 0.519[c] |
| | (0.098) | (0.089) | (0.101) | (0.093) |
| Bank size | 3.861[c] | 4.077[c] | 5.484[c] | 3.815[c] |
| | (0.866) | (1.048) | (1.908) | (1.257) |
| Bank size squared | −0.180[c] | −0.197[c] | −0.262[c] | −0.179[c] |
| | (0.044) | (0.056) | (0.085) | (0.061) |
| Capitalization | −0.211[c] | −0.192 | −0.175[a] | −0.063 |
| | (0.070) | (0.124) | (0.099) | (0.215) |
| Net interest margin | −0.037 | −0.799 | −0.593[a] | 0.216 |
| | (0.033) | (1.193) | (0.311) | (0.151) |
| Loan-loss reserve ratio | −0.036 | 0.277 | −0.292[a] | −0.178 |
| | (0.145) | (0.280) | (0.166) | (0.395) |
| Credit to GDP ratio | −0.181 | 0.117 | −0.295 | 0.249 |
| | (0.181) | (0.355) | (0.251) | (0.553) |
| Variable | | 16.285 | −5.554 | *1.336*[c] |
| | | (24.600) | (7.717) | (0.346) |
| Capitalization * variable | | −0.071 | −0.161 | −0.003 |
| | | (0.251) | (0.212) | (0.004) |
| Net interest margin * variable | | 0.756 | 0.487 | −0.012 |
| | | (1.186) | (0.328) | (0.008) |
| Loan-loss reserve ratio * variable | | −0.291 | 1.340 | 0.005 |
| | | (0.456) | (0.903) | (0.017) |
| Credit * variable | | −0.444 | 0.100 | −0.013 |
| | | (0.424) | (0.130) | (0.009) |
| Observations | 321 | 321 | 321 | 321 |
| $R^2$ | | | | |
| No. of groups | 96 | 96 | 96 | 96 |
| No. of instruments | 64 | 67 | 67 | 77 |

| | | | | |
|---|---|---|---|---|
| Hansen test *p*-value | 0.337 | 0.267 | 0.283 | 0.448 |
| A-B AR(2) test | 1.075 | 1.152 | 0.891 | 1.427 |
| A-B AR(2) test *p*-value | 0.282 | 0.249 | 0.373 | 0.154 |

Source: Authors' calculations.
Notes: Robust standard errors in parentheses. [a] Coefficient significant at the 10% level; [b] at the 5% level; [c] at the 1% level. Dependent variable is the ratio of liquid assets to total assets. GMM is two-step system GMM estimator with Windmeijer standard error correction. Columns 2 through 4 test the hypotheses that ownership (foreign/domestic and public/private), and degree of dollarization affect banks' liquidity buffers. Ownership is captured by dummy (=1 if the bank is private, =1 if the bank is foreign), dollarization by the share of dollar deposits in total deposits at the country level. All regressions include time and country dummies. Constant estimated but not reported.

These additional regressions support our main findings. The relative size of the coefficient on the lagged dependent variable in the pooled OLS, fixed effects and GMM is consistent with expectations: in OLS this coefficient is correlated with the error term and biased upward, while in the fixed effects specification it is the opposite. Good estimates of the true parameter should lie in between or near these values, which is the case here (see column 2 of Appendix C, Table C1). Previous results on ownership and dollarization hold in the sample of private banks.

## 7. CONCLUSIONS AND POLICY LESSONS

Our study finds that liquidity buffers in CAPDR are comfortably above legal and prudential requirements. With average liquidity at about 25% of deposits (during 2006-2010), banks in the region have handled and are able to handle historic deposit volatility outside of crisis episodes.

A closer look at the reasons for which banks would want to hold liquidity buffers above legal or prudential requirements indicates that CAPDR banks appear to be guided at least in part by rational precautionary motives. One of our main findings and contribution of this paper is that, in the sample, banks' precautionary demand for liquidity is positively related to the degree

of deposit dollarization. Other results are in line with previous studies and show that bank characteristics that influence their ability to raise additional funding on demand play an important role. Smaller, less efficient and less profitable banks tend to hold higher liquidity buffers. Foreign banks tend to hold less liquidity, although this result is not statistically significant. This possibly reflects the preponderance of foreign subsidiaries in the pool of foreign banks sampled. Surprisingly, banks with riskier loan portfolios also hold less liquidity overall, though this is not the case for foreign banks and banks in highly dollarized economies.

Our results still need to be considered against the caveat of data limitations. The uneven coverage of individual countries' banking systems, short estimation time frame and small cross-section dimension may affect the coefficient estimates from the regressions. Nevertheless, some useful policy lessons already emerge from our analysis.

A first policy lesson would be to continue with ongoing efforts to strengthen financial sector supervision and develop financial markets. Greater confidence in the system and more opportunities for investment and intermediation (through stronger credit institutions) could help lower banks' precautionary liquidity buffers without compromising financial stability.

Strengthened supervision would help address the issue of the negative relation between the loan-loss ratio and liquidity buffers, which may indicate that domestic banks may not fully internalize the costs of riskier lending practices. In contrast, foreign banks may be subject to stricter internal guidelines. As mentioned, further progress in risk-based supervision would be especially warranted: despite notable progress, CAPDR countries still do not meet minimum international standards and lag behind larger South American countries.

Another important lesson relates to the dollarization of CAPDR economies and banking systems and calls for strengthening the credibility of macroeconomic policy and institutions as well as the coverage of financial safety nets. Our findings show that, in the sample, banks' precautionary demand for liquidity is associated with the degree of deposit dollarization. Given the lack

of US dollar LOLR facilities in all countries, and in particular the absence of LOLR facilities in the two fully dollarized economies, our findings suggest that continuing with ongoing efforts to strengthen financial safety nets (as in El Salvador) would be necessary.

Furthermore, maintaining higher liquidity buffers because of dollarization also has negative implications for the development of financial markets, and for the adequate functioning of the monetary policy transmission mechanism. For the countries in the region that aim at transitioning to inflation targeting, tackling the root causes of deposit dollarization should be an important part of their strategy.

With causality likely running from policies to dollarization and back, measures that would help create a *virtuous cycle* of dedollarization and lower precautionary liquidity holdings could be informed by the experience of dedollarization in South America. In a study of financial dedollarization in Bolivia, Paraguay, Peru and Uruguay, Garcia-Escribano and Sosa (2011) find that successful, market-driven dedollarization was associated with *i)* stronger macroeconomic policies and institutions, credible and consistent implementation of policies over time, *ii)* active management of reserve requirement differentials and introduction of other prudential measures, and *iii)* development of domestic currency capital markets. As discussed in this paper, there is ample room for more active liquidity management on the part of CAPDR monetary and prudential authorities. In addition, measures to develop local currency capital markets, starting with domestic public debt markets, would enhance financial systems' efficiency and help diversify sources of funding and investment opportunities.

Finally, further research could usefully look into the relation between high or excessive liquidity and financial depth. If there are indications that liquidity holdings in excess of what would be demanded by banks for precautionary motives are associated with lower bank lending, measures to promote more active bank liquidity management and reduce macroeconomic volatility would be warranted.

# Appendix A

## Apéndice A

Cuadro A1

**ACPRD: REQUERIMIENTOS LEGALES DE RESERVAS Y DE LIQUIDEZ, 2010**

| *País* | *Requerimiento de reservas* | | *Remuneración (porcentaje)* | *Requwerimiento de líquidez (porcentaje)* | *Pasivos computables* | *Activos de cumplimiento* | *Promedio* | *Penalidad* | *Finalidad/ último cambio* |
|---|---|---|---|---|---|---|---|---|---|
| | *Moneda nacional (porcentaje)* | *Moneda extranjera (porcentaje)* | | | | | | | |
| Costa Rica | 15 | 15 | n.d. | | Demanda, moneda extranjera, tiempo, interbancarios, gobierno. Se excluyen los depósitos interbancarios. | Depósitos en el banco central (sólo aquellos en la cuenta de reservas) en la misma moneda que los depósitos. | Periodo de conservación de 15 días. | Tasa de interés de ventana de descuento sobre la deficiencia de reservas. | Política monetaria |
| Guatemala | 14.6 | 14.6 | 0.6 | n.d. | Todos los depósitos | Efectivo en bóveda y depósitos en el banco central en la misma moneda que los depósitos. | Mensual | n.d. | Política monetaria |
| Honduras | 6 (no remunerados), 12 (remunerados) | 12 (no remunerados), 10(remunerados) | Sólo inversiones obligatorias se remuneran a ½ de la tasa de interés. | Sí [1] | Depósitos, depósitos a plazo vencidos, contratos reducidos de capital y estampillas de ahorro y otros. | Efectivo en bóveda, depósitos en el banco central y bonos del gobierno en el caso de inversiones obligatorias en moneda nacional en la misma moneda que los depósitos. | Durante un periodo de dos semanas | Las penas dependerán de la moneda de denominación y del tipo de institución. | Política monetaria, 2008-2009 |
| República Dominicana | 17 | 20 | Las reservas en moneda extranjera son remuneradas a la tasa de un día al otro de la Reserva Federal– 200 bps | n.d. | Demanda, moneda extranjera, tiempo, interbancario, gobierno. Se excluyen los depósitos interbancarios. | Permitido 18% en depósitos con el banco central y 2% en efectivo en bóveda. | Semanal, el periodo de tenencia termina el viernes | n.d. | Política monetaria, 2009 |
| Nicaragua | 16.25 | 16.25 | n.d. | Sobre excesos de reserva (n.d.) | Todos los depósitos | Efectivo de títulos del BC. | n.d. | Interés cobrado con base en la tasa de interés interbancaria (mayor a 1%) | Política monetaria, 2005-2006 |
| El Salvador | 23 | n.d. | n.d. | 3 | Todos los depósitos | 25% para depósitos a la vista en el BC o en banco extranjero, 25% en depósitos o títulos del BC, 50% en títulos del BC emitidos con fines de liquidez. | Durante un periodo de dos semanas | n.d. | Prudencial |
| Panamá | n.d. | n.d. | n.d. | 30; 20 (se aplica para todos los bancos con licencia general en territorio y bancos propiedad del estado a 30.0 para los bancos con licencia general; 20.0 para bancos con licencia general que mantienen depósitos promedios interbancarios trimestrales que exceden el 80 por ciento del total de los depósitos) | Demanda, depósitos a plazo de hasta 186 días (salvo que la parte que garantiza los préstamos en el banco mismo), depósitos de ahorro. Están excluidos los depósitos recibidos de la casa matriz, sucursales, subsidiarias o afiliadas en el exterior. | Moneda de curso legal en Panamá, depósitos bancarios en Panamá, depósitos bancarios en el extranjero, obligaciones emitidas por gobiernos extranjeros, obligaciones emitidas por agencias privadas extranjeras y del gobierno, obligaciones bancarias pagaderas en Panamá hasta en 186 días, cuotas de obligaciones pagaderas hasta 186 días, otros activos líquidos. | n.d. | n.d. | Prudencial |

Fuentes: sitios web de los bancos centrales y superintendencias de ACPRD.
Nota: [1] Honduras también impone requerimientos de liquidez específicos, con base en bandas temporales por descalce de vencimientos. Para la primera banda, el descalce de vencimientos en flujos de caja para el próximo mes debe ser inferior a la cantidad de activos líquidos, mientras que para la segunda banda el descalce del vencimiento en flujos de caja para los próximos tres meses debe ser inferior a 1.5 veces los activos líquidos. n.d. indica que los datos no están disponibles.

## Appendix B

Table B1

CAPDR: VARIABLES USED IN EMPIRICAL ESTIMATION

| *Variable name (expected sign)* | *Concept* | *Measurement* | *Data source* |
|---|---|---|---|
| | **Dependent variable** | | |
| Liquidity ratio | Liquid assets to customer deposits and short-term funding. | Cash, short-term claims on other banks (including CDs) and where appropriate the trading portfolio/customer deposits and short-term funding | BankScope |
| | Liquid assets to total assets. | Cash, short-term claims on other banks (including CDs) and where appropriate the trading portfolio/total assets | BankScope |
| | **Explanatory variables** | | |
| | *Bank characteristics* | | |
| Lagged liquidity ratio (+) | Liquidity buffers should be persistent over time. | See above for definition | BankScope |
| Capitalization (+) | Better capitalized banks should have more prudent business models. | Ratio of equity to total assets | BankScope |

| | | | |
|---|---|---|---|
| Net interest income to average earning assets (−) | Profitability: more profitable banks should hold less liquidity. | (Interest income−interest paid)/ interest earning assets | BankScope |
| Loan−loss reserves ratio (+) | Perceived riskiness by banks of their loan portfolio: banks anticipating higher losses should hold higher liquidity buffers. | Ratio of loan−loss reserves to gross loans | BankScope |
| Size (−) | If small banks are financially constrained, then they should hold more liquidity. | Natural logarithm of total assets | BankScope |
| Private ownership (+) | Private banks are expected to be more prudent and hold more liquidity than public banks, which can rely on implicit or explicit state guarantees. | Dichotomous variable (1 for private; 0 for public) | BankScope |
| Foreign ownership (−) | Foreign banks should be less financially−constrained than domestic banks and thus hold lower levels of liquid assets. | Dichotomous variable (1 for foreign; 0 for domestic). A distinction is also made between foreign subsidiaries and branches | BankScope |
| | | *Macroeconomic fundamentals* | |
| Real GDP growth (−) | Imperfect capital markets imply that liquidity buffers should be countercyclical. | Annual growth rate of real GDP per capita | International Financial Statistics (IFS) |
| Interest rate spread (−) | Measure of the opportunity cost of holding liquid assets. | Difference between average lending and deposit rate | IFS |

| | | | |
|---|---|---|---|
| | | *Country characteristics* | |
| Deposit volatility (+) | Higher aggregate deposit volatility forces banks to hold more liquid assets to hedge against unanticipated deposit withdrawals. | Coefficient of variation of monthly system–wide deposits during one year | Executive Secretariat of the Centroamerican Monetary Council <www.secmca.org> |
| Inflation volatility (+) | High inflation volatility is a proxy for macroeconomic instability. | Coefficient of variation of monthly inflation during one year | IFS |
| Credit to GDP ratio (−) | Captures financial development. More developed economies should have less financial constraints. | Total credit to the private sector as percent of GDP | Executive Secretariat of the Centroamerican Monetary Council <www.secmca.org> |
| | | *Moral hazard and safety nets* | |
| Deposit dollarization (+) | The higher the dollarization, the lower the effectiveness of the domestic lender of last resort. | Share of foreign-exchange deposits in total deposits (system-wide) | Executive Secretariat of the Centroamerican Monetary Council <www.secmca.org> |
| Net international reserves (−) | In partially dollarized economies, NIR capture the capacity of the central bank to act as a lender of last resort in case of a foreign currency shock. | Natural logarithm of net international reserves | IFS |

Table B2

**CAPDR: DESCRIPTIVE STATISTICS**

| *Variable* | *No. observations* | *Mean* | *Std. dev.* | *Min.* | *Max.* |
|---|---|---|---|---|---|
| Liquid assets to customer deposits and short-term funding ratio | 448 | 25.3 | 18.3 | 2.0 | 191.0 |
| Liquid assets to total assets ratio | 448 | 18.9 | 10.4 | 0.9 | 75.6 |
| Capitalization (equity to asset ratio) | 448 | 13.2 | 9.3 | 2.6 | 83.0 |
| Loan loss reserves to gross loans | 417 | 3.2 | 3.1 | 0.0 | 25.0 |
| Net interest income to average earning assets | 428 | 8.8 | 10.5 | 1.0 | 87.0 |
| Loan to asset ratio | 448 | 58.9 | 17.1 | 3.3 | 90.6 |
| Loan growth (y/y, percent) | 350 | 24.0 | 55.6 | −66.2 | 594.5 |
| Bank size (log of total assets) | 448 | 12.8 | 1.7 | 4.1 | 16.5 |
| Foreign ownership dummy (=1 if foreign bank) | 480 | 0.4 | 0.5 | 0.0 | 1.0 |
| Private ownership dummy (=1 if private bank) | 480 | 0.9 | 0.3 | 0.0 | 1.0 |
| Interest rate spread | 480 | 8.3 | 2.9 | 3.1 | 16.8 |
| Real GPD growth | 384 | 3.9 | 5.7 | -7.9 | 15.3 |
| Net international reserves | 480 | 7.9 | 0.4 | 6.7 | 8.6 |
| Deposit dollarization | 480 | 50.2 | 34.2 | 13.5 | 100.0 |
| Credit to GPD (%) | 480 | 48.8 | 25.9 | 17.2 | 93.7 |

Sources: International Financial Statistics, World Economic Outlook Database, BankScope Database, CAPDR central banks and banking supervision websites; authors' calculations.

**Table B3**

**CAPDR: PAIRWISE CORRELATIONS**

| | *Liquid assets to customer deposits and short-term funding ratio* | *Capitalization* | *Loan-loss ratio* | *Net interest income* | *Bank size* | *Foreign ownership dummy* | *Private ownership dummy* | *Interest rate spread* | *Real GDP growth* | *Net international reserves* | *Deposit dollarization* | *Credit to GDP ratio* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Liquid assets to customer deposits and short-term funding ratio | 1 | | | | | | | | | | | |
| Capitalization | 0.426[c] | 1 | | | | | | | | | | |
| Loan-loss ratio | −0.011 | 0.027 | 1 | | | | | | | | | |
| Net interest income to average earning assets | −0.077 | 0.244[c] | 0.275[c] | 1 | | | | | | | | |
| Bank size | −0.186[c] | −0.372[c] | −0.189[c] | −0.286[c] | 1 | | | | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Foreign ownership dummy | 0.097[b] | 0.055 | −0.083[b] | 0.194[c] | 0.067 | 1 | | | | | | |
| Private ownership dummy | 0.124[c] | −0.116[b] | −0.137[b] | 0.0723 | −0.198 | 0.272[c] | 1 | | | | | |
| Interest rate spread | −0.194[c] | 0.120[b] | 0.155[b] | 0.195[c] | −0.123[b] | 0.044 | −0.068 | 1 | | | | |
| Real GDP growth | 0.052 | 0.029 | −0.158[b] | −0.129[a] | 0.032 | −0.0838 | 0.025 | −0.32[c] | 1 | | | |
| Log of net international reserves | −0.134[b] | −0.002 | −0.071 | 0.054 | 0.078[a] | −0.08[a] | −0.18[c] | 0.003 | −0.041 | 1 | | |
| Deposit dollarization | −0.151[b] | 0.098[a] | 0.059 | 0.111[a] | −0.041 | 0.119[b] | −0.189[c] | 0.808[c] | −0.323[c] | 0.035 | 1 | |
| Credit to GDP ratio | 0.157[c] | −0.0181 | −0.391[c] | −0.288[c] | 0.227[c] | 0.07 | 0.099[a] | −0.536[c] | 0.362[c] | −0.209[c] | −0.462 | 1 |

Sources: IMF staff calculations, International Financial Statistics, World Economic Outlook Database, BankScope Database, CAPDR central bank and banking supervision websites.

[a] Coefficient significant at the 10 percent level; [b] at the 5 percent level; [c] at the 1 percent level.

Table B4

**DEPENDENT VARIABLES' MEANS BY LIQUIDITY QUARTILES**
**(2008-2009)**

| | *1st quartile of liquidity ratio* | *2nd quartile of liquidity ratio* | *3rd quartile of liquidity ratio* | *4th quartile of liquidity ratio* | *p-value* |
|---|---|---|---|---|---|
| Mean of liquidity to customer and short-term funding ratio | *11.94* | *18.88* | *25.68* | *47.88* | |
| Loan loss reserves to gross loans | 3.50 | 3.44 | 3.12 | 2.38 | 0.03 |
| Net interest margin | 10.31 | 8.92 | 9.95 | 8.30 | 0.39 |
| Bank size (log of total assets) | 12.83 | 13.13 | 13.12 | 12.37 | 0.21 |
| Foreign ownership dummy (=1 if foreign bank) | 0.38 | 0.41 | 0.52 | 0.47 | 0.36 |
| Private ownership dummy (=1 if private bank) | 0.88 | 0.92 | 0.89 | 0.98 | 0.05 |
| Real GDP growth | −0.56 | −0.13 | 0.09 | 2.44 | 0.00 |
| Inflation volatility | 2.72 | 2.16 | 2.14 | 2.00 | 0.01 |
| Interest rate spread | 10.07 | 8.60 | 8.36 | 7.44 | 0.00 |
| Deposit volatility | 3.30 | 3.22 | 2.92 | 3.68 | 0.25 |
| Deposit dollarization | 27.20 | 20.49 | 19.50 | 18.29 | 0.03 |
| Credit to GDP ratio (%) | 42.49 | 44.48 | 50.83 | 59.49 | 0.00 |
| Number of observations | 48 | 41 | 47 | 52 | |

Source: authors' calculations.
Note: *p*–value from a test of statistical difference of the means of the 4th quartile versus the 1st quartile.

# Appendix C

Table C1

**CAPDR: ROBUSTNESS CHECKS, DETERMINANTS OF BANKS' LIQUIDITY**

| *Dependent variable is the ratio of liquid assets to customer deposits and short-term funding* | *Baseline*[1] | | | *Foreign ownership*[2] | *Dollarization*[2] |
|---|---|---|---|---|---|
| | *(1)* | *(2)* | *(3)* | *(4)* | *(5)* |
| | *Pooled OLS* | *GMM* | *Fixed effects* | | |
| Liquid assets ratio (−1) | 0.347[c] | 0.189[c] | 0.169[c] | 0.164[b] | 0.227[c] |
| | (0.064) | (0.044) | (0.025) | (0.069) | (0.072) |
| Bank size | 7.401[c] | 7.994[c] | 16.804 | 11.172[b] | 7.848[b] |
| | (1.448) | (1.875) | (10.703) | (5.221) | (3.038) |
| Bank size squared | −0.350[c] | −0.371[c] | −0.886[a] | −0.553[b] | −0.381[b] |
| | (0.064) | (0.092) | (0.476) | (0.218) | (0.152) |
| Capitalization | −0.355[c] | −0.321[b] | −0.502[c] | −0.453 | −0.424 |
| | (0.060) | (0.123) | (0.184) | (0.516) | (0.477) |
| Net interest margin | −0.156[b] | −0.123 | 0.011 | −1.169 | 0.332 |
| | (0.064) | (0.076) | (0.325) | (0.833) | (0.335) |
| Loan-loss reserve ratio | −0.224 | −0.282 | 0.221 | −0.984 | −1.032 |
| | (0.160) | (0.252) | (0.290) | (0.810) | (0.704) |
| Credit to GDP ratio | −0.213 | −0.323 | −0.337[a] | −0.904[b] | −0.860 |
| | (0.272) | (0.292) | (0.199) | (0.387) | (0.675) |
| Variable | | | | −18.363 | 1.201[c] |
| | | | | (15.445) | (0.412) |

| | | | | | |
|---|---|---|---|---|---|
| Capitalization * variable | | | | −0.070 | 0.000 |
| | | | | (0.711) | (0.008) |
| Net interest margin * variable | | | | 0.973 | −0.021 |
| | | | | (0.891) | (0.015) |
| Loan-loss reserve ratio * variable | | | | 3.021[a] | 0.036 |
| | | | | (1.552) | (0.022) |
| Credit to GDP ratio * variable | | | | 0.212 | −0.003 |
| | | | | (0.214) | (0.009) |
| Observations | 321 | 321 | 321 | 289 | 289 |
| $R^2$ | 0.55 | | 0.19 | | |
| No. of groups | | 96 | 96 | 88 | 88 |
| No. of instruments | . | 64 | | 67 | 77 |
| Hansen test *p*-value | | 0.348 | | 0.117 | 0.135 |
| A-B AR(2) test | | 1.283 | | 0.770 | 1.574 |
| A-B AR(2) test *p*−value | | 0.199 | | 0.442 | 0.116 |

Source: Authors' calculations.
Notes: Robust standard errors in parentheses. [a] Coefficient significant at the 10 percent level; [b] at the 5 percent level; [c] at the 1 percent level. Dependent variable is the ratio of liquid assets to customer deposits and short-term funding. Two-step system GMM estimator with Windmeijer standard error correction. Ownership is captured by dummy variables (=1 if the bank is private, =1 if the bank is foreign), dollarization by the share of dollar deposits in total deposits at the country level. All regressions include time and country dummies. Constant estimated but not reported. [1] Baseline specification as in column (1) of Table 4. [2] Columns 4-5 show GMM estimation results for the sample of private banks (excluding public banks).

## References


Agénor, P., J. Aizenmann, and A.W. Hoffmaister (2004), "The Credit Crunch in East Asia: What Can Bank Excess Liquid Assets Tell Us?," *Journal of International Money and Finance,* Vol. 23, pp. 27-49.

Almeida, H., M. Campello, and M. S. Weisbach (2004), "The Cash Flow Sensitivity of Cash," *The Journal of Finance,* Vol. 59, No. 4, pp. 1777-1804.

Arellano, M., and S. Bond (1991), "Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations," *Review of Economic Studies,* Vol. 58, pp. 277-297.

Aspachs, O., E. Nier and M. Thiesset (2005), *Liquidity, Banking Regulation and the Macroeconomy,* mimeo., London School of Economics, London.

Baltensperger, E. (1980), "Alternative Approaches to the Theory of the Banking Firm," *Journal of Monetary Economics,* Vol. 6, pp.1-37.

Barajas, A., R. Chami, R. A. Espinoza, and H. Hesse (2010), *Recent Credit Stagnation in the MENA Region: What to Expect? What Can Be Done?,* IMF Working Paper, No. 10/219, International Monetary Fund, Washington.

Bank for International Settlements (2010), *Basel III: International Framework for Liquidity Risk Measurement, Standards and Monitoring,* Basel, Switzerland.

Basso, O., F. L. Delgado and M. Meza (2012), *Strengthening Bank Capital and Liquidity in Central America: the Road to Basel III,* mimeo.

Blundell, R., and S. Bond (2000), "GMM Estimation with Persistent Panel Data: an Application to Production Functions," *Econometric Review,* Vol.19, No. 3, pp 321-340.

Bolzico, J., E. Gozzi, and F. Rossini (2010), *Redes de seguridad financiera, Fit & Proper,* mimeo., available via the Internet: <http://www.fitproper.com>.

Bond, S. (2002), *Dynamic Panel Data Models: A Guide to Micro Data Methods and Practice,* Working Paper, No. 09/02, Institute for Fiscal Studies, London.

Cárdenas, M., and C. Henao (2010), *Latin America and the Caribbean Economic Recovery,* The Brookings Institution, available via the Internet: <http://www.brookings.edu/~/media/research/files/articles/2010/7/latin%20america%20economy%20cardenas/07_latin_america_economy_cardenas>.

Clarke, R. G., R. Cull, and M. S. Martínez Pería (2006), "Foreign Bank Participation and Access to Credit Across Firms in Developing Countries," *Journal of Comparative Economics,* Vol. 34, pp. 774-795.

Delgado, F., and M. Meza (2011), *Developments in Financial Supervision and the Use of Macroprudential Measures in Central America,* IMF Working Paper, No. 11/299, International Monetary Fund, Washington.

Detragiache, E., T. Tressel and P. Gupta (2008), "Foreign Banks in Poor Countries: Theory and Evidence," *The Journal of Finance,* Vol. 63, No. 5, pp. 2123-2160.

Diamond, D. W., and R. G. Rajan (2001), "Liquidity Risk, Liquidity Creation and Financial Fragility: A Theory of Banking," *Journal of Political Economy,* Vol. 109, No. 2, pp. 287-327.

Diamond, D. W., and R. G. Rajan (2005), "Liquidity Shortages and Banking Crises," *Journal of Finance,* Vol. 30, No. 2, pp. 615-647.

Diamond, D. W., and P. H. Dybvig (1983), "Bank Runs, Deposit Insurance, and Liquidity," *Journal of Political Economy,* Vol. 91, No. 3, pp. 401-419.

De Nicoló, G., P. Honohan, and A. Ize (2005), "Dollarization of Bank Deposits: Causes and Consequences," *Journal of Banking & Finance,* Vol. 29, pp. 1697-1727.

Dinger, V. (2009), "Do Foreign-owned Banks Affect Banking System Liquidity Risk?," *Journal of Comparative Economics,* Vol. 37, pp. 647-657.

Douglas D. W., and R. G., Rajan (2001), "Liquidity Risk, Liquidity Creation, and Financial Fragility: A Theory of Banking," *Journal of Political Economy,* University of Chicago Press, Vol. 109, No. 2, pp. 287-327.

Freixas, X., and C. Holthasusen (2005), "Interbank Market Integration under Asymmetric Information," *The Review of Financial Studies,* Vol. 18, No. 2. pp. 459-490.

Galindo, A., and L. Leiderman (2005), *Living with Dollarization and the Route to Dedollarization,* IDB Working Paper, No. 526, Inter-American Development Bank, Washington.

Galindo, A. J., A. Izquierdo and L. Rojas-Suárez (2010), *Financial Integration and Foreign Banks in Latin America,* IDB Working Paper, No. 116, Inter-American Development Bank, Washington.

García-Escribano, M., and S. Sosa (2011), *What Is Driving Financial Dedollarization in Latin America?,* IMF Working Paper, No. 11/10, International Monetary Fund, Washington.

Gelos, G. R., and J. Roldós (2004), "Consolidation and Market Structure in Emerging Market Banking Systems," *Emerging Markets Review,* Elsevier, Vol. 5, No. 1, pp. 39-59.

Gonzalez-Eiras, M. (2003), *Banks' Liquidity Demand in the Presence of a Lender of Last Resort,* Documento de Trabajo, No. 61, Universidad de San Andrés, Buenos Aires.

Gray, S. (2011), *Central Bank Balances and Reserve Requirements,* IMF Working Paper, No. 11/36, International Monetary Fund, Washington.

Guerrero, R. M., K. Focke and F. Rossini (2010), *Redes de seguridad financiera,* IDB Working Paper, No. 121, Inter-American Development Bank, Washington.

Gulde, A., D. Hoelscher, A. Ize, D. Marston, and G. De Nicoló (2004), *Financial Stability in Dollarized Economies,* IMF Occasional Paper, No. 230, International Monetary Fund, Washington.

Holmström, B., and J. Tirole (1998), "Private and Public Supply of Liquidity," *Journal of Political Economy,* Vol. 106, No. 1, pp. 1-40.

Ize, A., M. A. Kiguel and E. Levy Yeyati (2005), *Managing Systemic Liquidity Risk in Financially Dollarized Economies,* IMF Working Paper, No. 05/188, International Monetary Fund, Washington.

Kashyap, A. K., and J. C. Stein (1995), "The Impact of Monetary Policy on Bank Balance Sheets," *Carnegie-Rochester Conference Series on Public Policy,* Vol. 42, pp. 151-195.

Kashyap, A. K., and J. C. Stein (2000), "What Do a Million Observations on Banks Say About the Transmission of Monetary Policy?," *American Economic Review,* Vol. 90, No. 3, pp. 406-428.

Kashyap, A. K., R. Rajan and J.C. Stein (2002), "Banks and Liquidity Providers: An Explanation for the Coexistence of Lending and Deposit-Taking," *The Journal of Finance,* Vol. 57, No. 1 (February), pp. 33-73.

Kiyotaki, N., and J. Moore (2008), *Liquidity, Business Cycles and Monetary Policy,* Technical Paper for Clarendon Lecture, No. 2.

Laeven, L., and F. Valencia (2012), *Systemic Banking Crises Database: An Update,* IMF Working Paper, No. 12/163, International Monetary Fund, Washington.

Levy-Yeyati, E., and C. Broda (2002), *Dollarization and the Lender of Last Resort,* Massachussetts Institute of Technology.

Medina Cas, S., A. Carrión-Menéndez, and F. Frantischek (2011), *The Policy Interest-rate Pass-through in Central America,* IMF Working Paper, No. 11/240, International Monetary Fund, Washington.

Medina Cas, S., A. Carrión-Menéndez, and F. Frantischek (2011), *Improving the Monetary Policy Frameworks in Central America,* IMF Working Paper, No. 11/245, International Monetary Fund, Washington.

Micco, A., U. Panizza and M. Yañez (2004), *Bank Ownership and Performance,* IDB Working Paper, No. 518, Inter-American Development Bank, Washington.

Micco, A., and U. Panizza (2006), "Bank Ownership and Lending Behavior," *Economic Letters,* Elsevier, Vol. 93, No. 2, pp. 248-254.

Opler, T., L. Pinkowitz, R. Stulz, and R. Williamson (1997), *The Determinants and Implications of Corporate Cash Holdings,* NBER Working Paper, No. 6234, Cambridge National Bureau of Economic Research.

Reinhart, C. M., K. S. Rogoff and M. Savastano (2003), *Addicted to Dollars,* NBER Working Paper, No. 10015, National Bureau of Economic Research, Cambridge.

Repullo, R. (2005), *Liquidity, Risk-taking and the Lender of Last Resort,* CEMFI Working Paper, No. 0504, Centro de Estudios Monetarios y Financieros, Madrid.

Rochet, J., and X. Vives (2004), "Coordination Failures and the Lender of Last Resort: Was Bagehot Right After All?," *Journal of the European Economic Association,* Vol. 2, No. 6, pp. 1116-1147.

Roodman, D. (2009), "Practitioner's Corner: A Note on the Theme of Too Many Instruments," *Oxford Bulletin of Economics and Statistics,* Vol. 71, No.1, pp. 135-158.

Roodman, D. (2006), *How to Do xtabond2: An Introduction to 'Difference' and 'System' GMM in Stata,* CGD Working Paper, No. 103, Center for Global Development, Washington.

Santomero, A. M. (1984), "Modeling the Banking Firm," *Journal of Money, Credit and Banking,* Part 2, Vol. 16, pp. 576-602.

Saxegaard, M. (2006), *Excess Liquidity and Effectiveness of Monetary Policy: Evidence from Sub-saharan Africa,* IMF Working Paper, No. 06/115, International Monetary Fund, Washington.

Shah, H., A. A. Jobst, L. Valderrama-Ferrando, and I. Guerra (2007), *Public Debt Markets in Central America, Panama, and the Dominican Republic,* IMF Working Paper, No. 07/147, International Monetary Fund, Washington.

Shah, H., A. Carvajal, G. Bannister, J. Chan-Lau and I. Guerra (2007), *Equity and Private Debt Markets in Central America, Panama, and the Dominican Republic,* IMF Working Paper, No. 07/288, International Monetary Fund, Washington.

Windmeijer, F. (2005), "A Finite Sample Correction for the Variance of Linear Efficient Two-step GMM Estimators," *Journal of Econometrics,* Vol. 126, No. 1, pp. 25-51.