Unintended Consequences of Foreign Exchange Reserve Movements? Financial Dollarization in Emerging Market Economies

Zhang, Zhongxia and Svirydzenka, Katsiaryna

International Monetary Fund, International Monetary Fund

1 November 2020

Unintended Consequences of Foreign Exchange Reserve Movements? Financial Dollarization in Emerging Market Economies *

Zhongxia Zhang

International Monetary Fund

Katsiaryna Svirydzenka

International Monetary Fund

November 1, 2020

Abstract

This paper investigates the determinants of financial dollarization in emerging market economies, a phenomenon where domestic residents hold large shares of their portfolios in foreign currencies. In addition to common explanatory variables, this paper places an emphasis on central banks' foreign exchange reserve movements. A dataset of 30 emerging market economies is compiled using monthly data from January 2004 to December 2014 on foreign currency loans and deposits. Foreign exchange interventions are quantified as the changes in central banks' foreign exchange reserves, adjusted by valuation effects such as exchange rate movements and asset returns. Results from panel regressions confirm a positive and statistically significant association between lagged foreign exchange interventions and the private sector's foreign currency positions. In addition, past changes in foreign exchange reserves are positively associated with increases in financial dollarization. Panel data instrumental variable regressions are applied to establish a causal relationship between foreign exchange reserve movement and the private sector's risk-taking behavior in financial dollarization. We find that a rise in foreign exchange reserve does not affect the share of foreign currency in the portfolios, but it increases the depth of financial dollarization in percent of GDP.

*We thank Jay Shambaugh, Graciela Kaminsky, Tara Sinclair, Miguel Savastano, Nathan Porter, Kenji Moriyama, and Xingwei Hu for their valuable comments. The views expressed in this paper are those of the authors only. All errors are our own.

JEL Classification: F31, G11, G21, E44, E58.

Keywords: Financial Dollarization, Foreign Exchange Reserves, Foreign Exchange Interventions.

1 Introduction

Financial dollarization is a common phenomenon in emerging market economies. Domestic residents, such as households, firms, and financial institutions, tend to hold large shares of their portfolios in foreign currencies. Households and firms choose to hold foreign currency denominated assets in order to protect the value of their wealth. The banking sector makes loans in foreign currency to hedge against inflation and risk of exchange rate fluctuations as well. This is because, historically, many emerging market economies have witnessed high inflation and large exchange rate depreciation episodes. In most cases, domestic residents in emerging market economies choose to carry global reserve currencies, such as U.S. dollars and euros, in their foreign currency portfolios.

Financial dollarization is a critical issue for policymakers, because private sector's multi-currency positions create new challenges for monetary policy, financial stability, and debt management. First, former research work suggests that monetary policy transmission channels, and the degree of exchange rate pass-through in financially dollarized economies, differ in comparison to economies dominated by national currencies. For example, central banks typically set policy rates to influence lending and borrowing costs of local currencies' denominated assets. In an economy with a large presence of foreign currencies' denominated assets, central banks' role in managing their respective economies is weakened because the interest rates of foreign currencies' denominated assets are largely determined by those currency issuing authorities abroad. Therefore, high levels of dollarization complicate central banks' decision-making and create challenges to conduct effective monetary policy. Second, exchange rate fluctuations not only have an impact on the economy via a trade channel, but also have a wealth effect via a financial channel. For instance, in a financially dollarized economy, an exchange rate depreciation can boost exports by making domestic goods cheaper. At the same time, foreign currency asset (liability) holders' wealth (obligation) increases in the unit of local currencies. Lastly, balance sheet currency mismatches pose a risk in emerging market economies. Typically, the private sector's assets are denominated in local currency, and part of the liabilities is denominated in foreign currency. In an event of large exchange rate depreciation, domestic debtors often encounter debt service distress because the debt obligations skyrocket in local currency terms. Higher default rates and a collapse in spending often lead to an economic recession (Verner and Gyongyosi 2020). Therefore, exchange rate devaluations may be contractionary instead of expansionary, and the adverse balance sheet effects make central banks more reluctant to let exchange rates fully depreciate to offset the negative shocks (Calvo and Reinhart 2002; Hausmann et al. 2001; Cespedes, et al. 2004).

This paper studies the determinants of financial dollarization in emerging market economies, and asks questions of the role of Foreign Exchange (FX) reserves. Foreign exchange reserve management is an important part of the central banks' policy toolkit. Traditionally, foreign exchange reserves provide a buffer in maintaining exchange

rate stability and mitigating balance of payment risks. Under disorderly market conditions, authorities will use foreign exchange reserves to prevent excess volatility. In addition, reserves are useful to meet needs from import payments, external debt obligations, and capital outflows. This paper aims to explore whether there is a link between reserve movement and the private sector's financial dollarization decisions. Does central banks' usage of foreign exchange reserves encourage risk-taking behavior from the private sector? The gross positions of the private sector loans and deposits are examined with respect to foreign exchange interventions and changes in foreign exchange reserves. This research question is important to understand the factors which affect financial dollarization, and provide crucial insight on whether foreign exchange reserve management can be included in the policy options to reduce financial dollarization. The findings in this paper suggest that, past foreign exchange reserve movements are positively associated with financial dollarization. However, a rise in foreign exchange reserve does not affect the share of foreign currencies in the portfolios, but it increases the depth of financial dollarization in percent of GDP.

The rest of this paper is organized as follows: Section 2 reviews the literature of financial dollarization, foreign exchange interventions, and central banks' foreign exchange reserve holdings; Section 3 presents the data and stylized facts; Section 4 discusses the empirical methodology; Section 5 shows the empirical regression results on financial dollarization; Section 6 performs several robustness checks; The last section discusses and concludes the paper.

2 Literature review

There are a number of explanations for high and persistent levels of dollarization in developing countries (Levy Yeyati 2006). The early literature was primarily focused on currency substitution, where agents preferred the foreign currency because they did not have faith in the local currency as a good store of value. Mostly recently, the theories develop on several fronts, including how risk-averse residents choose their portfolios to optimize risk-return profile; the presence of market imperfections and externalities; and the quality of institutions.

Measurement of financial dollarization is a non-trivial aspect of the research work. Researchers typically distinguish between loan dollarization and deposit dollarization. Reinhart, Rogoff and Savastano (2003), propose a composite index of financial dollarization instead. Their index is the normalized sum of foreign currency bank deposits as a share of broad money, total external debt as a share of GDP, foreign currency domestic government debt as a share of total domestic debt. Using this measure, they show that a high degree of financial dollarization appears to increase exchange rate pass-through but does not seem to hinder monetary policy control.

A portfolio model is devloped by Ize and Levy Yeyati (2003) to examine financial dollarization, where risk-averse agents choose the currency composition of their deposits and loans in a monetary economy. The authors show that minimum variance

portfolio (MVP) allocations provide a natural benchmark to estimate the scope of financial dollarization and its relation with macroeconomic policies.

Researchers have also applied panel data models to understand financial dollarization. Based on results from a standard panel data model and a panel vector autoregressive model using monthly dataset from 24 transition economies, Basso et al. (2011) find that access to foreign funds increases credit dollarization but decreases deposit dollarization. They also confirm that interest rate differentials matter for loan and deposit dollarization. Vieira et al. (2012) study financial dollarization in a group of 79 economies using the generalized method of moments (GMM) in a panel data model. The authors argue that a high level of domestic debt combined with default risk explains the persistence of financial dollarization, even after inflation declines. Their results demonstrate that inflation risks caused by increasing probability of default account for financial dollarization more than inflation itself.

Previous empirical work suggests that inflation, exchange rate depreciation, interest rate differentials, financial market depth, legal restrictions on onshore dollarization, currency-matching of assets and liabilities by banks, access to foreign financing, credibility of policy, and the quality of institutions are main determinants of financial dollarization. For example, by applying a number of propensity score matching methods to a large sample of 106 developing countries, Lin and Ye (2013) find strong evidence that inflation targeting lowers financial dollarization. By performing panel data regressions on 66 countries, Honig (2009) indicate that improved government quality reduces unofficial dollarization. Luca and Petrova (2008) and Neanidis and Savva (2009) provide evidence that financial dollarization is driven by banks' incentive for currency-matched portfolios.

Although this paper studies the role of foreign exchange reserves on financial dollarization, traditionally central banks mainly use foreign exchange reserves to stabilize exchange rates. Given its high cost and mixed effectiveness, foreign exchange intervention is a controversial policy option for central banks. However, many central banks do intervene on the foreign exchange market. Neely (2008) and Mohanty and Berger (2013) summarize central banks' views in foreign exchange intervention, including motives, methods, and tactics. There are many ways that central banks could affect exchange rates, both directly and indirectly. The International Monetary Fund's Annual Report on Exchange Arrangements and Exchange Restrictions provides detailed information on foreign exchange interventions, including: changes in foreign exchange markets, changes in currency and exchange rate structures, changes in exchange subsidies and exchange taxes, and exchange restrictions and multiple currency practices.

In theory, foreign exchange interventions may influence exchange rates through two distinct channels: the signaling channel (Mussa 1981) and the portfolio-balance channel (Dominguez and Frankel 1993). Intervention operations affect exchange rates through the signaling channel when they are used as a means of signaling to the market about the central banks' views of the appropriate exchange rates, future policy intentions, or future fundamentals (Mussa 1981). The signaling channel is likely

to be weak in emerging market economies since their central banks have a short history of institutions and policy credibility. The portfolio balance channel assumes foreign and domestic assets are imperfect substitutes for each other so that Uncovered Interest Parity (UIP) does not hold. Given that the degree of substitutability between emerging market currency securities and foreign currency debt securities is small, the portfolio balance channel is expected to be large in these countries.

Foreign exchange intervention appears to be more common in emerging market economies (Disyatat and Galati 2007; Ghosh, Ostry, and Chamon 2016; Chamon, Hofman, Magud, and Werner 2019). This is partly a reflection on the structural characteristics of emerging market economies such as predominant foreign currency borrowing, shallow financial and currency markets, and volatile capital flows. Fratzscher, Gloede, Menkhoff, Sarno, and Stohr (2019) find that FX intervention works mostly effective in smoothing the path of exchange rates, and in stabilizing the exchange rate in countries with narrow band regimes. However, Kuersteiner, Phillips and Villamizar-Villegas (2018) point out that while interventions had significant effects on the exchange rate, the effects are short-lived.

In the last two decades, emerging market economies have seen the rapid growth of foreign exchange reserves. Obstfeld, Shambaugh, and Taylor (2010) study this puzzle and argue that financial stability and financial openness contribute greatly in explaining reserve holdings in emerging markets. In addition to traditional determinants of reserve holdings such as openness to international trade, the authors show that a primary reason for a central bank to hold reserves is to protect the domestic banking sector, while limiting external currency depreciation. Bocola and Lorenzoni (2020) propose a theory in which liability dollarization arises from an insurance motive of domestic savers. Their results show that reserves can play a catalytic role by encouraging virtuous behavior of local borrowers and by promoting financial stability.

In this paper, we ask the following questions: when central banks use reserves to intervene in the foreign exchange market, does that action change the private sector's foreign currency positions relative to total positions? Do movements in central banks' foreign exchange reserves encourage private sector agents to take more foreign currency loans and deposits? These are important questions for policymakers due to the monetary, financial and debt management challenges created by financial dollarization and the fast-growing foreign exchange reserves. However, to the best of our knowledge, no academic study has been done to cast light on how central banks' foreign exchange reserve movements affect financial dollarization. This paper aims to fill the critical gap in the above topic. In addition to movements in foreign exchange reserves and exchange rate, this paper also considers capital account openness and monetary policy rate as potential determinants of financial dollarization. Therefore, the paper contributes to the flourishing literature on the integrated policy framework, where monetary policy, capital controls, foreign exchange interventions, and macroprudential policy are jointly configurated to achieve the optimal macroeconomic outcomes (IMF 2020; Adrian, Erceg, Linde, Zabczyk, and Zhou 2020; Basu, Boz, Gopinath, Roch, and Unsal 2020).

3 Data description and stylized facts

We compile a dataset that covers 30 emerging market economies using monthly data from January 2004 to December 2014 on foreign currency loans and deposits. These eleven years have witnessed the rapid growth of emerging market economies prior to 2008, the Global Financial Crisis, and the post-crisis economic recovery. Ideally, the study would extend the sample to earlier years. However, lack of data availability poses a hurdle to enlarge the sample.

Data on foreign currency loans and deposits are from the IMF's Monetary and Financial Statistics database. The database includes surveys on other depository corporations (e.g., commercial banks, merchant banks, savings and loan associations, credit unions, rural and agricultural banks) within a given country. The database contains loans to other financial corporations and other resident sectors (i.e., the private sector). In addition, the database contains series on residents' total amounts and foreign currency amounts of transferable deposits and other deposits.

The paper studies two sets of measures of financial dollarization by looking at households' deposit portfolios and banks' lending portfolios. The first set of measures is the currency composition of financial dollarization (i.e., ratio of foreign currency loans to total loans and ratio of foreign currency deposits to total deposits). We divide foreign currency loans by the total amount of loans to obtain the ratio of foreign currency share of loans. We sum up the residents' foreign currency deposits and divide them by the total amount of residents' deposits to get the ratio of foreign currency share of deposits. The second set of measures is the depth of financial dollarization (i.e., foreign currency loans in percent of GDP and foreign currency deposits in percent of GDP). Since the foreign currency loans and deposits are denominated in local currency, the second set of measures is calculated as foreign currency loans or deposits divided by GDP in local currency.

It is important to note that all the bank loans and deposits data are resident, which means that all transactions are within the country. Therefore cross-border financial dollarization behaviors are not examined in this paper. For example, if a foreign bank located in the United States provides loans to Brazilian residents, our financial dollarization measure does not capture this activity. Likewise, when residents in South Africa move money to a bank located in the United Kingdom, our financial dollarization measure does not cover that activity either. The fact that all the four financial dollarization measures are resident is fundamental to all of our results in this paper.

For other control variables, inflation measures in this paper are from the IMF's INS database.[1] Additionally, policy rate data is retrieved from Haver Analytics. The government quality index is a simple average of law and order, bureaucracy quality, and corruption ratings based on International Country Risk Guide (ICRG)'s data.

[1] Two high inflation episodes are dropped (Venezuela in December 2013; Belarus during September 2011 to June 2012), since these observations drive all the regression results.

All other variables are downloaded from the IMF's International Financial Statistics database, unless otherwise noted.

In this study, foreign exchange intervention refers only to the actions of selling or purchasing currencies by central banks (or ministries of finance) to affect the exchange rate. Other actions are considered exchange rate policies. Few emerging market economies publish official data on foreign exchange interventions. We quantify foreign exchange interventions as the changes in central banks' foreign reserves, adjusted by valuation effects.

$$\text{Change in FX Reserves} = \text{Foreign Exchange Intervention} + \text{Valuation Effects} \quad (1)$$

Specifically, the valuation effects are the sum of currency movements and portfolio returns. The international Monetary Fund tracks the currency composition of reserves for its member countries, however, the country-level data on currency composition of reserves is confidential and only the aggregate data by income group are published. Nevertheless, the country-level data have been used on a few occasions for research purpose. Eichengreen and Mathieson (2000) use the country-level data for developing countries to examine the determinants of currency composition of foreign exchange reserves. Their empirical results show that the demand for reserves denominated in different currencies is strikingly stable and the principal determinants are trade flows, financial flows and currency pegs. Since the information on the currency composition of reserves is crucial to estimate valuation effects and foreign exchange interventions precisely, we follow Lane and Shambaugh (2010)'s approach to exploit Eichengreen and Mathieson (2000)'s regression results to predict the currency composition of foreign exchange reserves for our sample countries. Eichengreen and Mathieson (2000)'s regression coefficients are used to predict the share for each of the global reserve currencies (the U.S. dollar, the euro, the Japanese yen, and the pound sterling). We impose a non-negativity constraint on the predicted values for the currency shares. We then normalize the currency shares so that all the currency shares add up to 100 percent for each country at any given point in time. Furthermore, we assume that foreign exchange reserves are invested in their corresponding currency's long-term sovereign bonds (e.g., the share of U.S. dollars assets is invested in U.S. Treasury securities).

From Equation (1), a positive value in foreign exchange intervention means that the central bank is selling domestic currency and buying foreign currencies, which lead to increases in foreign exchange reserves. On the other hand, a negative value in FX intervention means that the central bank is buying domestic currency and selling foreign currencies, which lead to declines in foreign exchange reserves.

Table 1 presents the summary statistics for key variables in this study. On average, about one quarter of emerging markets' loans and deposits are denominated in foreign currencies. However, the sample averages mask the heterogeneity among countries. For example, the highest share of FX loans to total loans is about 80% and the largest

Table 1: Summary statistics

Variable	Observation	Mean	Std. dev.	Min	Max
FX loans to total loans (percent)	3,644	27.1	22.4	0	79.5
FX deposits to total deposits (percent)	3,143	26.8	23.0	0.05	88.2
FX loans to GDP (percent)	3,632	12.1	11.8	0	68.9
FX deposits to GDP (percent)	3,791	13.9	14.3	0.02	70.3
FX reserves to GDP (percent)	3,948	16.9	9.9	1.2	55.5
FX intervention to GDP (percent)	3,918	0.10	0.8	-13.5	8.0
Exchange rate depreciation	3,588	2.5	15.0	-43.2	183.6
Inflation	3,573	6.4	5.6	-4.4	49.0
Bank credit to the private sector to GDP (percent)	3,654	50.2	30.8	7.0	162.8
Chinn-Ito index of financial openness	3,960	0.54	0.33	0	1
Policy rate differential	3,785	5.6	4.9	-2.6	49.0
Government quality index	3,960	0.48	0.11	0.19	0.78

share of FX deposits to total deposits is around 88%. When the foreign currency loans and deposits are expressed in percent of GDP, the sample averages are 12.1% and 13.9%, respectively. The ratio of foreign exchange reserves to GDP has a mean of 16.9%, with a minimum of 1.2% and a maximum of 55.5%. On average, central banks hold FX reserves equivalent to 16.9% of GDP, and foreign exchange interventions are about 0.10% of GDP on a monthly basis. However, its lowest value of -13.5% and the highest value of 8.0% suggest that there are massive interventions in the currency markets. The mean values for inflation and exchange rate depreciation are 6.4% and 2.5%. The high maximum values suggest high inflation and large exchange rate depreciation. Commercial banks' credit to the private sector has an average of 50.2% to GDP. The Chinn-Ito index is a measure of financial openness. The larger the value is, the more financially open the economy is. The index is normalized between 0 and 1 and it has a mean of 0.54. The policy rate differential is the difference between the domestic policy rate and the effective Federal Funds rate in the United States. Its mean of 5.6 indicates that, on average, emerging markets' central banks set their policy rates higher than that in the United States. Finally, the government quality index has an average of 0.48. A higher index suggests better government quality.

Figure 1 suggests that on average, the foreign currency shares of loans and deposits in our sample emerging markets have gradually declined since 2004. However, the Global Financial Crisis has reversed this trend. As of December 2014, the currency compositions of loans and deposits are approximately the same as those in the beginning of 2004. In addition, Figure 2 shows that foreign currency loans and deposits in percent of GDP have increased steadily in emerging markets. This suggests that financial deepening, measured by total loans (or deposits) to GDP, has also played an important role in financial dollarization. In addition, the narrowing gap between FX loans and deposits is noticeable. However, the gap in financial dollarization is not the focus of this study, because it is private sector risk not central banks' use of reserves that mainly accounts for the gap. Figure 3 plots sample average FX reserve changes and FX interventions. Before 2008, central banks in emerging markets on

Figure 1: Financial Dollarization by Currency Composition

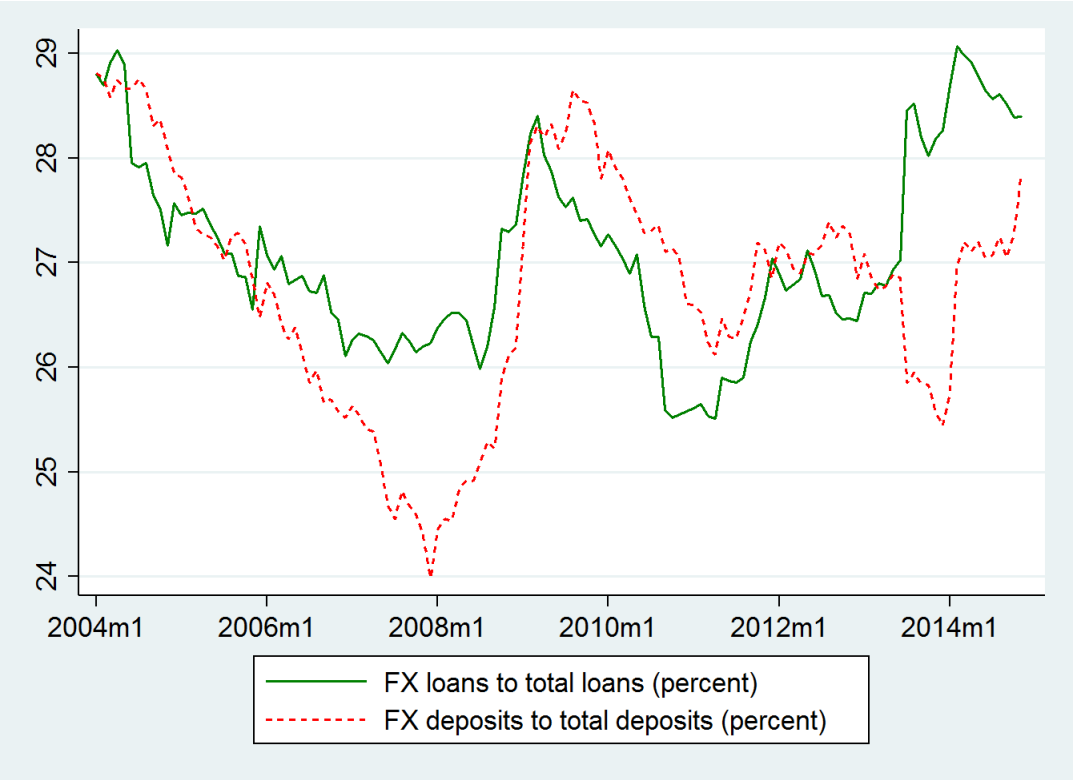


Figure 2: Financial Dollarization in Percent of GDP

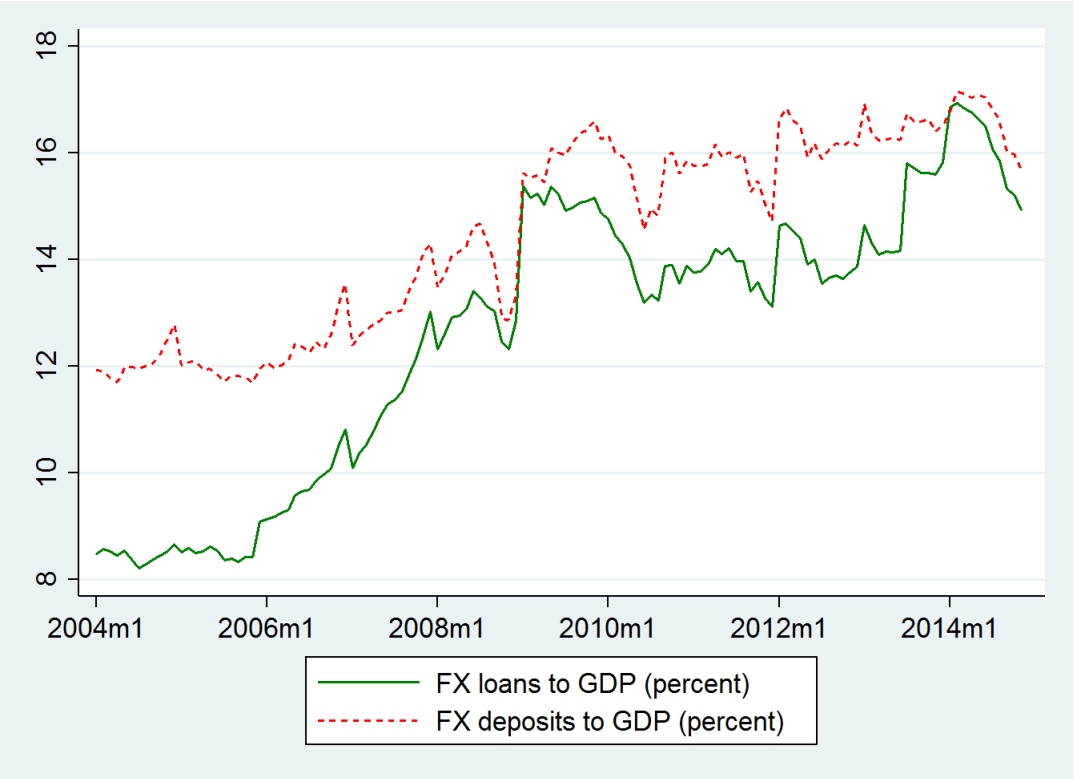
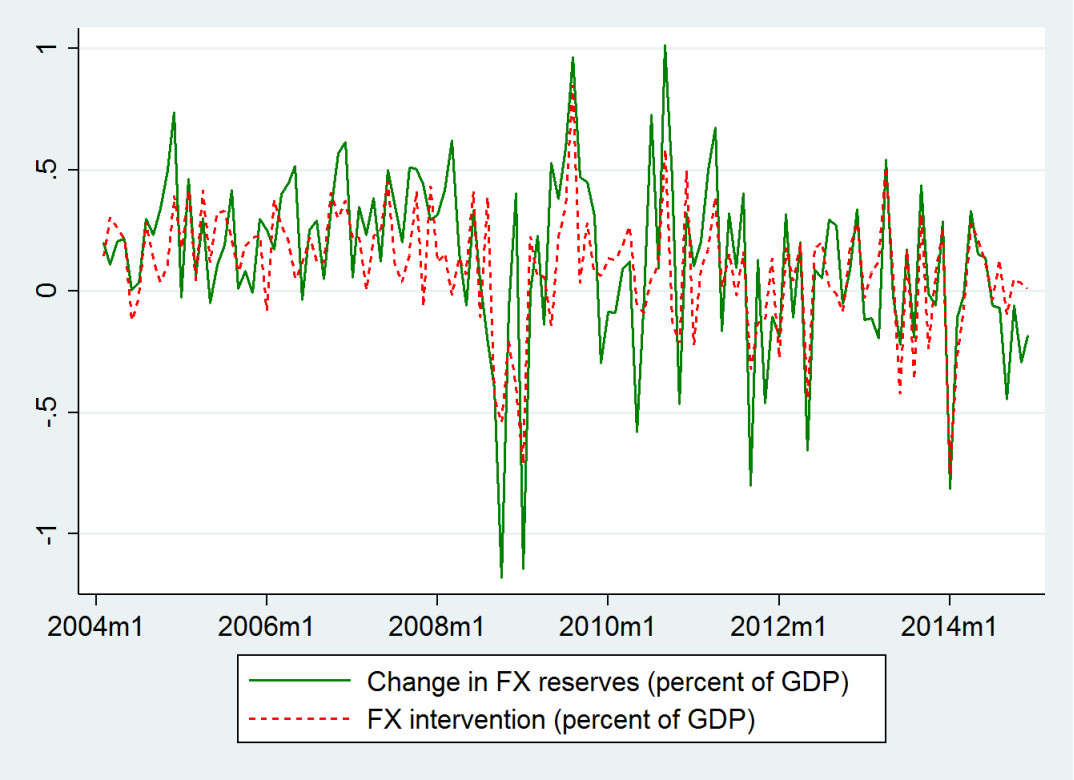


Figure 3: Foreign Exchange Reserve Movements



average boosted reserve accumulation by buying foreign currency assets. The Global Financial Crisis has triggered a time of turmoil, with more volatilities seen in the currency markets. As a result, central banks have intervened more heavily in the FX market by using reserves.

Not surprisingly, the data shows that all the four measures of financial dollarization are positively correlated (Table 2). The high correlations indicate that loans dollarization and deposits dollarization go hand-in-hand with each other. This is true either measured in currency compositions or in percent of GDP. Furthermore, banks' credit to GDP ratio is negatively associated with foreign currency shares of loans and deposits.[2] The Chinn-Ito index is another variable that is highly correlated with dollarization. This means increases in financial openness are positively associated with more foreign currency loans and deposits. In addition, de facto exchange rate peg is positively associated with foreign currency loans and deposits in percent of GDP.

On the other hand, the unconditional correlations between inflation and dollarization are mixed and they do not provide any meaningful information. Similarly, the signs of unconditional correlations between exchange rate depreciation and dollarization switch between positive and negative values among the four dollarization measures and do not convey useful information. Finally, foreign exchange interven-

[2]However, once proper control variables are included in the regression analysis, results show that the credit to GDP ratio is positively associated with financial dollarization.

Table 2: Pairwise correlations

	FX loans/ total loans	FX deposits/ total deposits	FX loans/ GDP	FX deposits/ GDP	ER dep.	Inf.	Credit/ GDP	Chinn-Ito index	PR diff.	Govt. index	FX inter.	Change in res./ GDP	Shambaugh ER peg
FX loans/ total loans	1												
FX deposits/ total deposits	0.841	1											
FX loans/ GDP	0.775	0.655	1										
FX deposits/ GDP	0.644	0.791	0.728	1									
ER depreciation	0.022	0.046	0.060	-0.016	1								
Inflation	-0.037	0.009	-0.098	-0.147	0.284	1							
Credit/ GDP	-0.236	-0.347	0.132	-0.023	-0.024	-0.235	1						
Chinn-Ito index	0.372	0.451	0.303	0.472	-0.179	-0.238	-0.129	1					
Policy rate differential	0.025	0.215	-0.088	-0.045	0.469	0.605	-0.295	-0.261	1				
Government quality index	-0.065	0.008	0.140	0.218	-0.117	-0.392	0.298	0.263	-0.316	1			
FX intervention	0.025	0.020	-0.008	0.009	-0.070	-0.042	0.003	0.022	-0.050	0.010	1		
Change in reserve/ GDP	0.021	0.016	-0.004	0.015	-0.092	-0.039	0.009	0.025	-0.064	0.017	0.921	1	
Shambaugh ER peg	0.008	-0.026	0.141	0.172	-0.024	-0.032	0.007	-0.056	-0.169	-0.052	-0.014	-0.019	1

tion, the key variable of interest, does not exhibit a strong correlation with any of the dollarization measures.

4 Empirical methodology

Previously, financial dollarization has been studied within the scope of the private sector. Foreign currency loans and deposits are determined by both supply and demand factors. The volumes of loans and deposits are jointly decided by banks, firms, and households. In this paper, we introduce the public sector to the research work on financial dollarization. Studying the effect of central banks' foreign exchange reserve movements on financial dollarization is meaningful: first, central banks may be able to influence exchange rates, which is a powerful factor on the private sector's dollarization decisions. Table 1 indicates that, on average, annual FX intervention is equivalent to 1.16% of GDP. This nontrivial amount of intervention suggests that the central banks' role in stabilizing the exchange rate cannot be ignored. Second, emerging markets central banks' massive holdings of reserves can be a valuable resource to rescue the domestic banking system. As shown in Table 1, the average reserves-to-GDP ratio is 16.9%, which is roughly a third of the banks' credit to the private sector (50.2% of GDP). This can allow the private sector take bold steps in foreign exchange businesses.

Before discussing the role of foreign exchange reserves, it is useful to examine what factors drive our financial dollarization measures. Changes in the measures of deposit dollarization either reflect valuation effects or portfolio rebalance operations. Fluctuations in interest rates and exchange rates lead to valuation effects that affect the foreign currency shares of portfolios. Households can also actively adjust the currency compositions of their deposits based on economic considerations. When economic considerations are taken into account, the optimal decision is to maximize return, to minimize risk, and to stay within the limit of any capital controls imposed by the authorities. Similarly, changes in the measures of loan dollarization are the results of valuation effects or portfolio rebalance operations. Swings in asset prices, interest rates and exchange rates generate valuation effects and shift the ratio of foreign currency loans to total loans. However, the portfolio rebalance considerations are more complicated. Because commercial banks' balance sheets include liabilities (e.g., deposits) and assets (e.g., loans), banks may hedge against additional risks from balance sheet currency mismatches and net open positions. Therefore, return maximization, risk minimization and capital controls all attribute to portfolio rebalance decisions.

If foreign exchange interventions are successful, they can prevent excessive exchange rate movements. This will, in turn, have an impact on households, firms, and banks by encouraging them to take more risks. Since emerging market economies' exchange rate excessive volatilities often occur during bad times (i.e., when exchange rates overshoot), we expect that successful foreign exchange interventions would re-

store domestic residents' confidence in local currencies. Therefore, central banks' actions in supporting local currencies and selling foreign exchange reserves will effectively reduce financial dollarization. If foreign exchange interventions are ineffective, they will move neither the level nor the volatility of the exchange rates, and therefore will not drive financial dollarization via the exchange rate channel. Ghosh, Ostry, and Chamon (2016) survey sterilized intervention in emerging market economies and find that the effectiveness of such interventions is mixed: not all the central banks in emerging markets can effectively influence the exchange rates.

From a slightly different perspective than the one provided above, movements in foreign exchange reserves can influence financial dollarization by changing the private sector's perceptions: commercial banks may view foreign exchange reserves as a gauge of central banks' capacity to bail out banks during a banking crisis. Increases in foreign exchange reserves are expected to raise both loan and deposit dollarization. This is a second channel in addition to the channel on exchange rate stabilization.

However, a concern arises with a potential endogeneity problem. Intuitively, this raises the question of whether the central bank or the private sector should act first in foreign exchange transactions. The central banks' interventions may be due to the private sector's foreign exchange buying or selling actions. Central banks' foreign exchange interventions are strongly correlated with private sector's worry about exchange rate risk. When central banks spend reserves to intervene in the currency market, foreign exchange reserves decline. Such a scenario typically coincides with a high intensity of worries from the private sector and depreciation pressure on emerging markets' currencies. On the other hand, when central banks accumulate reserves by selling domestic currency and buying global reserve currencies, usually the private sector does not worry too much about exchange rate risk, and emerging markets' currencies appreciate in value. Another reason to worry about the endogeneity problem is the usage of reserve requirements on foreign currency positions. In some countries, when financial dollarization increases, foreign exchange reserve also rises due to regulatory requirements to place a certain proportion of foreign currency reserves at the central bank. Unfortunately, the standard exchange rate market pressure indices that measure investors' fear all rely on movements in foreign exchange reserves and exchange rates. These indices are not immune to the endogeneity concern. Controlling for the lagged level of dollarization or lagged central banks' foreign exchange interventions may address the issue of endogeneity and reverse causality.

A key approach to settle the endogeneity problem is the method of Instrumental Variable (IV), but unfortunately most commonly used instrumental variables for FX interventions in the literature are either weakly correlated with FX interventions or correlated with the error term. Common instrumental variables for FX interventions, such as international capital flows, the M2-to-GDP ratio, central bank foreign assets to imports, recent balance of payments crisis, and sovereign wealth fund flows, either weakly correlate with FX interventions or fail to meet the exogeneity requirement. We decide not to apply the instrumental variables for FX interventions due to the lack of satisfactory IVs.

We then switch our analysis by focusing on changes in foreign exchange reserves. However, the issue of endogeneity is not fully resolved without an instrumental variable approach. An ideal instrument to implement this strategy is strongly correlated with foreign exchange reserve movements but not the error term. This paper utilizes two instrumental variables for changes in foreign exchange reserves to perform panel data instrumental variable regressions.

The first instrumental variable is constructed as changes in foreign exchange reserves in the same geographic region, excluding the country itself.[3] There are good reasons to believe that this constructed variable is a valid instrument: on the one hand, countries in the same geographic region usually face common shocks; therefore the tendency of conducting foreign exchange interventions is likely to be correlated. On the other hand, countries in the same geographic region often have similar currency composition of foreign exchange reserves; therefore the valuation effects in their foreign exchange reserves are highly correlated. Eichengreen and Mathieson (2000)'s study reveals that the principal determinants of the currency composition of foreign exchange reserves are trade flows, financial flows, and currency pegs. Countries in the region share the main drivers for trade flows, such as distance, common borders, colonization history, and free trade agreements. Furthermore, countries in the region share the main drivers for financial flows, such as trade linkages, cross-border lending from common parent banks in advanced countries, monetary policy in the United States, and the global risk appetite. Lastly, countries in the region also share the main drivers for currency pegs, including international trade, financial flows, and currency denomination of debt service.

This paper utilizes the valuation effects on reserves as a second instrument for movements in foreign exchange reserves. The impact of valuation effects is one of the reasons for changes in foreign exchange reserves, therefore there is a strong correlation between the valuation effects and changes in foreign exchange reserves. Furthermore, the valuation effects can be considered as exogenous, since, to a large extent, private agents and central banks in emerging markets cannot affect the exchange rates among global reserve currencies and asset returns. Emerging markets' central banks usually diversify their foreign exchange reserves by investing the majority of their reserves in global reserves currencies' safe assets, and the reserves are denominated in U.S. dollars. The first source of valuation effects comes from fluctuations in exchange rates among global reserve currencies (e.g., EUR to USD, GBP to USD, JPY to USD). It is important to note that the valuation effects here are about the relative values of the global reserve currencies, not the same as the depreciation valuation shock (i.e., depreciation of the bilateral exchange rate of domestic currency against the U.S. dollar).

[3]Another potential instrumental variable for a country's foreign exchange intervention is the amount of foreign exchange interventions in the region excluding the country itself. This would be an ideal instrumental variable if we have a neat measure of foreign exchange intervention. However, since countries typically do not publish data on the currency composition of their foreign exchange reserves and we estimate the currency compositions of reserves for all sample countries, our foreign exchange intervention variable is not perfect due to measurement noise. Therefore, we decide not to use this potential instrument.

Therefore, the valuation effects are exogenous and we do not need to concern about the valuation effects we use as an instrument having a direct effect on the dependent variables. In addition, the second source of valuation effects originates in variations in asset returns (e.g., the yield on long-term U.S. Treasury securities). Specifically, the returns on long-term sovereign bonds in developed countries are mainly influenced by their domestic monetary and fiscal policies at home.[4]

We use panel data regressions to analyze the determinants of financial dollarization. Following the dollarization literature (Luca and Petrova 2008; Neanidis and Savva 2009; Honig 2009; Levy Yeyati 2006; Barajas and Morales 2003), the approach is a reduced form equation to capture both supply and demand factors. We include the conventional control variables, in addition to variables on foreign exchange reserves. The baseline regression takes the following form:

$$Y_{i,t} = XB + \alpha_i + \gamma_t + \epsilon_{i,t}, \tag{2}$$

where the dependent variable $Y_{i,t}$ is one of the proxy measures for financial dollarization (loan dollarization or deposit dollarization) for country i at time t. The key variables of interest are central banks' foreign exchange interventions or changes in foreign exchange reserves in the past (two lags for quarterly data and one lag for annual data are used). For regressions on the depth of financial dollarization, we normalize the changes in reserves (or foreign exchange interventions) by nominal GDP. The control variables include: the lagged level of dollarization; exchange rate depreciation; inflation level; credit-to-GDP ratio (as a proxy for financial development); the Chinn-Ito index of financial openness; the policy rate differential (the difference between the domestic policy rate and the effective Federal funds rate); and a composite government quality indicator to represent institutional quality (following Honig 2009). Country and time fixed effects are incorporated. Since the dollarization measures are generally slow-moving and several key macroeconomic variables are quarterly series, we conduct the analysis at quarterly and annual frequencies. In addition, the regression analysis clusters observations by country and reports robust standard errors.

Next, we utilize the above two instrumental variables to address the endogeneity problem. As discussed above, changes in foreign exchange reserves in the same geographic region excluding the country itself and reserves' valuation effects are considered exogenous. We employ the panel data instrumental variable regressions to test whether changes in reserves have any impact on financial dollarization.

To address the issue that the estimator may be biased in a dynamic panel data model, in the robustness check section we utilize the Arellano and Bond Generalized Method of Moments (GMM) estimator and report the results. In addition, we also

[4]The 30 emerging market economies in this study are mostly medium-sized countries. China, India and Russia are not included in the sample due to data availability. Hence the argument on the global shortage of safe assets and lower safe assets' yields because of emerging markets' reserve accumulation is weak for this research.

run regressions on the first-difference transformations.

5 Empirical results

The main estimation results are reported in Tables 3, 4, 5 and 6. Both foreign currency loans and deposits exhibit strong inertia: the level of dollarization has a strong persistence and the previous dollarization level is a good predictor of the current dollarization level, as indicated by the highly significant and positive coefficients on the lagged financial dollarization measure. The estimated coefficients are robust across a range of estimation specifications (panel regressions or panel instrumental variable regression) in all of the four tables. Furthermore, the estimated coefficients are much larger under quarterly frequency (around 0.9) than those under annual frequency (between 0.49 and 0.75). This result means that, as the time horizon becomes longer, the current dollarization level depends less on the past dollarization level.

Exchange rate depreciations significantly contribute to increases in financial dollarization. They reflect valuation effects on portfolios by changing the relative value of foreign currency assets (or liabilities) in domestic currency denomination. They may also reflect active portfolio rebalance operations induced by exchange rate movements. As expected, exchange rate depreciations lead to increases in foreign currency shares of loans and deposits. The results are highly significant and larger under the annual frequency. For example, a one percentage point exchange rate depreciation increases the share of FX loans to total loans (or the share of FX deposits to total deposits) by about 0.09 percentage point. However, when looking at financial dollarization measures in relation to GDP, exchange rate depreciations do not seem to have an impact.

Results show that inflation, a key macroeconomic target that central banks closely monitor, is not a determinant of financial dollarization. High inflation can put pressure on exchange rate stability and cause loss of confidence in local currencies' denominated assets. However, when exchange rate depreciation and other variables are controlled in the regression analysis, the estimated coefficient of inflation on financial dollarization loses significance. The results imply that inflation does not drive financial dollarization as long as the exchange rate remains stable.

The ratio of banks' credit to the private sector in percent of GDP, a measure of domestic financial market depth, is positively associated with financial dollarization. This suggests that, as the economy experiences financial deepening, foreign currency loans and deposits increase their presence in portfolios' currency compositions and in percent of GDP. For example, a one percentage point increase in the private sector credit to GDP ratio expands the shares of foreign currency loans in total loans by about 0.02 percentage point quarterly and about 0.08 percentage point annually. Similarly, such an increase boosts foreign currency loans in percent of GDP by about 0.04 percentage point quarterly and about 0.16 percentage point annually. Developments of domestic financial markets seem to promote financial dollarization more in

Table 3: Regression results on FX loans to total loans

Dependent variable: FX loans/ total loans	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FX loans/ total loans in t-1	0.927***	0.927***	0.939***	0.927***	0.745***	0.746***	0.741***	0.748***
	(0.0132)	(0.0131)	(0.0180)	(0.0107)	(0.0559)	(0.0555)	(0.0452)	(0.0425)
Exchange rate depreciation	0.0168***	0.0168***	0.00150	0.0170***	0.0947***	0.0959***	0.0832**	0.0996***
	(0.00588)	(0.00585)	(0.0126)	(0.00492)	(0.0216)	(0.0222)	(0.0365)	(0.0210)
Inflation	0.00774	0.00737	0.0387	0.00770	-0.0174	-0.0125	-0.00586	-0.0144
	(0.0223)	(0.0223)	(0.0312)	(0.0172)	(0.126)	(0.126)	(0.0834)	(0.0797)
Credit/ GDP	0.0212**	0.0216**	0.0110	0.0213***	0.0770*	0.0819*	0.0758**	0.0836***
	(0.00984)	(0.00994)	(0.0108)	(0.00601)	(0.0423)	(0.0411)	(0.0306)	(0.0265)
Chinn-Ito measure of financial openness	1.091	1.085	1.039	1.099**	4.892	4.837	4.630**	4.897***
	(0.761)	(0.760)	(0.633)	(0.444)	(2.956)	(2.897)	(1.910)	(1.798)
Policy rate differential	0.0480	0.0481	0.0219	0.0484*	0.290	0.293	0.263**	0.301***
	(0.0505)	(0.0506)	(0.0390)	(0.0251)	(0.192)	(0.187)	(0.125)	(0.102)
Government quality index	-2.572	-2.628	-0.749	-2.742	-11.47	-11.29	-10.68	-11.47
	(1.986)	(1.949)	(3.064)	(1.762)	(8.435)	(8.367)	(7.547)	(7.208)
FX intervention/ GDP in t-1	0.0765**				0.165**			
	(0.0366)				(0.0725)			
FX intervention/ GDP in t-2	0.0114							
	(0.0362)							
Change in FX reserves/ GDP in t-1		0.0361	-0.892	0.0156		0.187***	-0.0542	0.257*
		(0.0304)	(0.611)	(0.0588)		(0.0584)	(0.574)	(0.137)
Change in FX reserves/ GDP in t-2		0.0520	0.0628	0.109*				
		(0.0350)	(0.592)	(0.0598)				
Constant	1.133	1.136	0.979	1.136	3.502	3.282	4.118	3.039
	(1.198)	(1.155)	(1.413)	(1.019)	(4.593)	(4.594)	(4.609)	(4.070)
Estimation method	Panel	Panel	Panel IV1	Panel IV2	Panel	Panel	Panel IV1	Panel IV2
Frequency	Quarterly	Quarterly	Quarterly	Quarterly	Annual	Annual	Annual	Annual
Observations	1,044	1,044	1,044	1,044	257	257	257	257
R-squared	0.899	0.899			0.646	0.652		
Number of countries	29	29	29	29	29	29	29	29

Note: Robust standard errors in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$. Panel IV1: instrumental variable panel regressions using changes in foreign exchange reserves in the region excluding the country itself. Panel IV2: instrumental variable panel regressions using valuation effects of foreign exchange reserves for the country itself. Since the R-squared has no statistical meaning in the context of instrumental variable regressions, we do not report its values.

Table 4: Regression results on FX deposits to total deposits

Dependent variable: FX deposits/ total deposits	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FX deposits/ total deposits in t-1	0.842***	0.843***	0.918***	0.837***	0.509***	0.506***	0.560***	0.497***
	(0.0205)	(0.0202)	(0.0475)	(0.0183)	(0.0484)	(0.0489)	(0.0880)	(0.0619)
Exchange rate depreciation	0.0291***	0.0290***	0.000786	0.0316***	0.0870***	0.0891***	0.0527	0.0952***
	(0.00828)	(0.00791)	(0.0160)	(0.00574)	(0.0195)	(0.0191)	(0.0350)	(0.0207)
Inflation	-0.0124	-0.0111	0.0478	-0.0161	-0.125**	-0.125**	-0.132	-0.124
	(0.0189)	(0.0189)	(0.0441)	(0.0200)	(0.0527)	(0.0506)	(0.107)	(0.0808)
Credit/ GDP	0.0212*	0.0201	-0.00305	0.0220***	0.0533	0.0546	0.0283	0.0589**
	(0.0114)	(0.0117)	(0.0175)	(0.00762)	(0.0386)	(0.0374)	(0.0399)	(0.0277)
Chinn-Ito measure of financial openness	1.080**	1.106**	0.813	1.137**	4.352**	4.386**	3.918*	4.464**
	(0.479)	(0.487)	(0.876)	(0.489)	(1.748)	(1.720)	(2.334)	(1.749)
Policy rate differential	0.0992**	0.0986**	0.000728	0.107***	0.430***	0.438***	0.301*	0.461***
	(0.0393)	(0.0396)	(0.0686)	(0.0305)	(0.104)	(0.104)	(0.165)	(0.108)
Government quality index	-1.468	-1.515	0.735	-1.770	-6.087	-6.089	-6.380	-6.041
	(2.132)	(2.155)	(3.952)	(2.003)	(6.505)	(6.437)	(9.775)	(7.377)
FX intervention/ GDP in t-1	-0.107				-0.00888			
	(0.0683)				(0.0751)			
FX intervention/ GDP in t-2	-0.00892							
	(0.0800)							
Change in FX reserves/ GDP in t-1		-0.0962	-1.655*	0.0238		0.0404	-0.778	0.176
		(0.0702)	(0.878)	(0.0685)		(0.0651)	(0.517)	(0.132)
Change in FX reserves/ GDP in t-2		0.00816	-0.113	0.0553				
		(0.0537)	(1.038)	(0.0680)				
Constant	2.440*	2.410	2.046	2.422**	8.274**	8.127**	10.72**	7.698*
	(1.407)	(1.429)	(2.038)	(1.114)	(3.848)	(3.832)	(5.435)	(3.934)
Estimation method	Panel	Panel	Panel IV1	Panel IV2	Panel	Panel	Panel IV1	Panel IV2
Frequency	Quarterly	Quarterly	Quarterly	Quarterly	Annual	Annual	Annual	Annual
Observations	895	895	895	895	219	219	219	219
R-squared	0.807	0.807			0.516	0.517		
Number of countries	24	24	24	24	24	24	24	24

Note: Robust standard errors in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$. Panel IV1: instrumental variable panel regressions using changes in foreign exchange reserves in the region excluding the country itself. Panel IV2: instrumental variable panel regressions using valuation effects of foreign exchange reserves for the country itself. Since the R-squared has no statistical meaning in the context of instrumental variable regressions, we do not report its values.

Table 5: Regression results on FX loans to GDP

Dependent variable: FX loans/ GDP	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FX loans/ GDP in t-1	0.893***	0.893***	0.900***	0.892***	0.614***	0.620***	0.649***	0.626***
	(0.0172)	(0.0172)	(0.0231)	(0.0116)	(0.0302)	(0.0317)	(0.0583)	(0.0381)
Exchange rate depreciation	-0.000343	0.000587	-0.00948	0.00157	0.00507	0.00644	0.0286	0.0110
	(0.00410)	(0.00411)	(0.0161)	(0.00464)	(0.0149)	(0.0139)	(0.0350)	(0.0162)
Inflation	-0.000643	-0.00291	0.00130	-0.00507	0.104	0.110	0.106	0.109*
	(0.0209)	(0.0205)	(0.0413)	(0.0163)	(0.0707)	(0.0698)	(0.0719)	(0.0624)
Credit/ GDP	0.0445***	0.0454***	0.0474***	0.0462***	0.158***	0.161***	0.166***	0.162***
	(0.0160)	(0.0160)	(0.0156)	(0.00639)	(0.0410)	(0.0407)	(0.0263)	(0.0222)
Chinn-Ito measure of financial openness	-0.128	-0.130	-0.526	-0.126	0.809	0.734	0.918	0.771
	(0.459)	(0.449)	(0.831)	(0.421)	(1.580)	(1.556)	(1.650)	(1.418)
Policy rate differential	0.0426	0.0442	0.0277	0.0460*	0.196*	0.198**	0.239**	0.206**
	(0.0424)	(0.0416)	(0.0519)	(0.0241)	(0.103)	(0.0966)	(0.108)	(0.0807)
Government quality index	0.0678	-0.0563	3.096	-0.160	3.208	3.280	1.822	2.983
	(1.616)	(1.622)	(3.769)	(1.640)	(5.932)	(5.846)	(6.769)	(5.635)
FX intervention/ GDP in t-1	0.0516				0.145**			
	(0.0433)				(0.0668)			
FX intervention/ GDP in t-2	0.0106							
	(0.0340)							
Change in FX reserves/ GDP in t-1		0.0835**	0.313	0.143***		0.173***	0.611	0.263**
		(0.0389)	(0.772)	(0.0552)		(0.0479)	(0.597)	(0.108)
Change in FX reserves/ GDP in t-2		0.0305	-1.417*	0.0293				
		(0.0308)	(0.773)	(0.0563)				
Constant	-2.027**	-2.042**	-1.495	-2.060**	-6.786*	-6.930*	-7.937**	-7.135**
	(0.982)	(0.992)	(1.763)	(0.906)	(3.422)	(3.445)	(3.746)	(3.039)
Estimation method	Panel	Panel	Panel IV1	Panel IV2	Panel	Panel	Panel IV1	Panel IV2
Frequency	Quarterly	Quarterly	Quarterly	Quarterly	Annual	Annual	Annual	Annual
Observations	1,044	1,044	1,044	1,044	257	257	257	257
R-squared	0.920	0.921			0.750	0.756		
Number of countries	29	29	29	29	29	29	29	29

Note: Robust standard errors in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$. Panel IV1: instrumental variable panel regressions using changes in foreign exchange reserves in the region excluding the country itself. Panel IV2: instrumental variable panel regressions using valuation effects of foreign exchange reserves for the country itself. Since the R-squared has no statistical meaning in the context of instrumental variable regressions, we do not report its values.

Table 6: Regression results on FX deposits to GDP

Dependent variable: FX deposits/ GDP	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FX deposits/ GDP in t-1	0.892***	0.891***	0.911***	0.889***	0.591***	0.589***	0.586***	0.591***
	(0.0183)	(0.0180)	(0.0318)	(0.0128)	(0.0438)	(0.0435)	(0.0481)	(0.0469)
Exchange rate depreciation	0.00269	0.00400	-0.00659	0.00547	-0.00138	0.000947	-0.00373	0.00545
	(0.00431)	(0.00407)	(0.0183)	(0.00456)	(0.0175)	(0.0168)	(0.0280)	(0.0169)
Inflation	-0.0176	-0.0193	-0.0217	-0.0209	-0.0726	-0.0582	-0.0600	-0.0564
	(0.0160)	(0.0151)	(0.0415)	(0.0155)	(0.0719)	(0.0734)	(0.0646)	(0.0640)
Credit/ GDP	0.0279**	0.0293**	0.0307*	0.0301***	0.106***	0.111***	0.110***	0.113***
	(0.0109)	(0.0110)	(0.0174)	(0.00593)	(0.0317)	(0.0314)	(0.0240)	(0.0228)
Chinn-Ito measure of financial openness	0.668*	0.665*	0.0746	0.665*	3.250**	3.291**	3.357**	3.227**
	(0.380)	(0.371)	(1.004)	(0.403)	(1.250)	(1.243)	(1.479)	(1.444)
Policy rate differential	0.0561**	0.0578**	0.0375	0.0596**	0.325***	0.325***	0.319***	0.330***
	(0.0237)	(0.0234)	(0.0580)	(0.0240)	(0.0811)	(0.0799)	(0.0902)	(0.0856)
Government quality index	-0.978	-1.066	2.410	-1.222	-4.512	-3.619	-3.717	-3.524
	(1.229)	(1.201)	(4.113)	(1.590)	(4.316)	(4.052)	(5.772)	(5.751)
FX intervention/ GDP in t-1	0.0998				0.171*			
	(0.0632)				(0.0839)			
FX intervention/ GDP in t-2	-0.00541							
	(0.0309)							
Change in FX reserves/ GDP in t-1		0.120**	0.514	0.184***		0.194***	0.102	0.283**
		(0.0529)	(0.957)	(0.0551)		(0.0701)	(0.451)	(0.110)
Change in FX reserves/ GDP in t-2		0.0406	-1.804*	0.0918				
		(0.0436)	(0.963)	(0.0570)				
Constant	-1.394	-1.425*	-0.241	-1.488*	-0.963	-1.562	-1.234	-1.879
	(0.834)	(0.824)	(2.161)	(0.891)	(2.753)	(2.669)	(3.529)	(3.163)
Estimation method	Panel	Panel	Panel IV1	Panel IV2	Panel	Panel	Panel IV1	Panel IV2
Frequency	Quarterly	Quarterly	Quarterly	Quarterly	Annual	Annual	Annual	Annual
Observations	1,089	1,088	1,088	1,088	269	268	268	268
R-squared	0.894	0.896			0.661	0.671		
Number of countries	30	30	30	30	30	30	30	30

Note: Robust standard errors in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$. Panel IV1: instrumental variable panel regressions using changes in foreign exchange reserves in the region excluding the country itself. Panel IV2: instrumental variable panel regressions using valuation effects of foreign exchange reserves for the country itself. Since the R-squared has no statistical meaning in the context of instrumental variable regressions, we do not report its values.

the long run (on an annual basis) than in the short run (on a quarterly basis).

These findings do not support Caballero and Krishnamurthy (2003)'s theory, which proposes that the limited financial development of emerging markets is a significant factor behind the large share of dollar-denominated external debt. In other words, domestic agents take foreign currency debt due to a low level of domestic financial development. Their theory points to a negative coefficient for financial development on dollarization. However, in this study the estimated coefficient on private sector credit to GDP ratio is positive and statistically significant.

The Chinn-Ito Index (2006), a de jure measure of financial openness, is important in documenting capital flow restrictions and examine financial dollarization.[5] All financial dollarization measures except the FX loans to GDP ratio are positively associated with the Chinn-Ito Index. The findings give evidence to suggest that as an economy becomes more financially open, households and firms tend to diversify their portfolios by taking more deposits and loans in foreign currencies.

The policy rate differential is the gap between domestic and foreign (the U.S.) policy rates. It is a proxy for firms' borrowing costs (at home or abroad) or households' deposit returns (at home or abroad) under normal economic conditions. One would expect depositors and banks to treat policy rate differentials differently. When the domestic rate is higher than the foreign rate, local depositors prefer to put money in local currencies and banks prefer to lend in foreign currencies. When the domestic rate is lower than the foreign rate, cost-benefit analysis would indicate that depositors prefer to place savings in foreign currencies and banks prefer to make loans in domestic currencies. Both loans and deposits determine banks' activities.

We find that both bank loans and deposits are positively associated with policy rate differentials. However, as shown in Table 2, the policy rate differential is strongly associated with exchange rate depreciation and inflation. The positive coefficients of the policy rate differential may come from these high correlations and may reflect the effects of exchange rate depreciation and inflation. Moreover, central banks use policy rates to respond to macroeconomic conditions such as inflation and exchange rate movements. Before the Global Financial Crisis, most central banks were in a tightening cycle to set their policy rates on an upward trend. However, when the crisis started, many central banks cut policy rates aggressively to provide monetary accommodation and stimulate their economies. When the Global Financial Crisis period is excluded from the analysis, the policy rate differential is no longer statistically significant.[6]

The government quality index measures the quality of governance and institutions. Scholars often argue that better government quality is helpful in reducing financial dollarization. For instance, De Nicoló, Honohan, and Ize (2005) demonstrate that the credibility of macroeconomic policy and the quality of institutions are both key

[5]We have also tried the capital control measures coded by Fernandez et. al (2016). The regression results look similar.

[6]Detailed results are reported in the robustness check section.

determinants of cross-country variations in dollarization. However, we find that, although the estimated coefficients on this index are negative for all the financial dollarization variables, they are not statistically significant.

Results from panel regressions illustrate a positive relation between foreign exchange interventions and financial dollarization. The estimated coefficients on lagged foreign exchange interventions are statistically significant in Tables 3, 5, and 6. Past foreign exchange interventions seem to positively associate with financial dollarization. For instance, if in the previous period the central bank intervenes in the currency market by selling domestic currency and buying foreign currencies, in the next period there will be increases in the share of FX loans to total loans, FX loans to GDP, and FX deposits to GDP. However, due to the presence of the endogeneity issue, we cannot confirm that the private sector's risk-taking behavior is induced by foreign exchange interventions.

Next, we look at the effect of changes in foreign exchange reserves. Similar to the findings on foreign exchange interventions, the estimated coefficients on lagged changes in foreign exchange reserves are statistically significant under panel regressions in Tables 3, 5, and 6. This suggests that past changes in foreign exchange reserves are positively associated with increases in the share of FX loans to total loans, FX loans to GDP, and FX deposits to GDP.

Results from the first-stage panel data instrumental variable regressions show that the first instrument (changes in reserves in the region excluding the country itself) is weakly significant and the second instrument (valuation effects) is strongly significant.[7] For changes in foreign exchange reserves in the region excluding the country itself, in all but one cases it is marginally significant at the 10% level. For the valuation effects of foreign exchange reserves, the instrument is always highly significant at the 1% level. Such strong association is not surprising, because by definition, the valuation effects are one of two factors that cause changes in a country's foreign exchange reserves. The results indicate that only the second instrumental variable is a strong instrument, and we can draw an inference as to whether changes in foreign exchange reserves affect financial dollarization from the second-stage regressions when the valuation effects are used as an in instrumental variable. To save space, the first-stage results are omitted in the regressions tables.

Results are significant under panel data instrumental variable regressions for the depth of financial dollarization but not for the currency composition of financial dollarization. When the valuation effects of foreign exchange reserves for the country itself are used in panel data instrumental variable regressions, the estimated coefficients on past changes in foreign exchange reserves are only statistically significant in Tables 5 and 6. The estimated coefficients are positive in both the quarterly and

[7]When both instruments are included, first-stage regression results show that the first instrument is insignificant and the second instrument is still statistically significant at the 1% level. When running regressions using changes in reserves in the region excluding the country itself as an instrumental variable, the standard errors are much larger. This is another sign to indicate that changes in reserves in the region excluding the country itself is a weak instrument.

annual regression results. They suggest that, past changes in foreign exchange reserves can increase contemporaneous FX loans to GDP and FX deposits to GDP. This boost effect on FX positions in percent of GDP exists both in the short run and in the long run. A one percentage point increase in the FX reserves change to GDP ratio expands the FX loans to GDP ratio by about 0.14 percentage point quarterly and 0.26 percentage point annually. Similarly, such an increase causes the FX deposits to GDP ratio to rise by about 0.18 percentage point quarterly and 0.28 percentage point annually. At the same time, past reserve changes do not seem to alter the contemporaneous currency composition of financial dollarization.

These results imply that, only under certain cases, past reserve changes are positively associated with financial dollarization. There is empirical evidence to establish causality between the above two variables when FX positions in percent of GDP are examined. We do not find a causal relation between the above two variables when FX positions in percent of total portfolios are studied. Past reserve changes can encourage the private sector to increase the depth of financial dollarization, and the long run effect under the annual frequency is stronger than the short run effect under the quarterly frequency. We can only confirm that movements in foreign exchange reserves generate risk-taking behavior from the private sector to adjust foreign currency positions relative to nominal GDP. Increases in foreign exchange reserves encourage risk-taking actions from the private sector to hold additional loans and deposits both in local currency and foreign currencies in a proportional manner so that the currency composition of the portfolios does not change.

6 Robustness check

We examine the role of the exchange rate regime and the number of years since the peg. Does the de facto exchange rate regime increase financial dollarization? Do countries with long-lived pegs and countries with new pegs differ in dollarization behaviors? We include an exchange rate regime dummy variable from Shambaugh (2004). In addition, we consider the duration of the peg by controlling for the inverse of the peg spell. This particular functional form is chosen because the survival rate of exchange rate pegs is approximately an inverse function of the number of years since the peg (Klein and Shambaugh 2008).[8] However, these two added control variables are not statistically significant in the regression results. The nonlinear effect of the de facto fixed exchange rate on financial dollarization may explain the above results. When the trust in local currency is high, private agents feel safe to use local currencies and this leads to a decline in financial dollarization (e.g., the initial years of the Argentine Currency Board). However, when the trust in local currency is low, fear of future devaluation does not go away. Private agents can take advantage of the

[8]Ilzetzki, Reinhart, Rogoff (2017)'s exchange rate regime classification and the number of years since the last currency crisis (Reinhart and Rogoff 2009) are also tested. However, Ilzetzki, Reinhart, Rogoff (2017)'s classification shows very few exchange rate regime changes, which make the estimation results less reliable.

de facto peg to convert more assets into foreign currencies and this causes financial dollarization to rise.

We also include a broad dollar index as an additional control variable. Avdjiev, Du, Koch and Shin (2016) and Avdjiev, Bruno, Koch and Shin (2018) highlight the strength of the U.S. dollar in determining cross-border bank lending in emerging markets. Drawing empirical evidence on macro and micro data, the authors demonstrate that a stronger dollar goes hand-in-hand with contractions of cross-border bank lending in dollars. However, in this paper, we do not find a similar effect in resident bank lending. The strength of the dollar explains neither the currency composition nor the depth of loan dollarization within a given emerging market.

We then replace the effective federal funds rate with the Wu-Xia (2016) shadow rate to calculate the policy rate differential. By the end of 2008, the effective federal funds rate in the United States was close to zero. The Federal Reserve did not raise its target funds rate until December 2015. This means that about half of the sample periods fall in a period when the Federal Reserve was constrained by the Zero Lower Bound. To account for the effect of unconventional monetary policy in the United States, we reconstruct the policy rate differential using the Wu-Xia (2016) shadow rate. Results look similar when the new policy rate differential is applied.

Admittedly, the relatively short sample length can make the results sensitive to the given sample period. In particular, the results may be affected by the Global Financial Crisis. Around the crisis, there were large swings in exchange rates and inflation in emerging markets. As a result of these, there were substantial fluctuations in foreign exchange reserves and the valuation effects of reserves. When the regressions exclude the Global Financial Crisis, the results remain broadly consistent. Furthermore, the policy rate differential does not affect financial dollarization anymore.

In this paper, we employ a dynamic panel data model to study the determinants and dynamics of adjustments in financial dollarization. A well-known econometric issue is that, for the fixed effect estimator, the within transformation leaves the transformed regressors correlated with the transformed error terms. This introduces a bias to the estimator and the bias does not vanish when the number of groups increases. Therefore, the within estimator is inconsistent for large N (number of groups) and small T (number of periods). However, as T gets large, the fixed effect estimator becomes consistent (Baltagi 2013). Arellano and Bond (1991) argue that additional instruments can be used in a dynamic panel data model if one utilizes the orthogonal conditions between the lagged dependent variables and the disturbance terms. This can yield a consistent estimator, known as the Arellano and Bond Generalized Method of Moments (GMM) estimator. For our macro panel, the data cover a decent number of countries (N=30) over a moderate size of time dimension (T=44 for quarterly data). Hence, we may still favor the within estimator, given the fact that the bias may not be large. Nevertheless, we perform the Arellano and Bond GMM estimator on our dynamic panel data model.[9] We first utilize the lagged dependent

[9]An alternative approach is the first-difference transformation. We omit the results from such regressions since the results look similar.

variables as instruments and then include the two previous instrumental variables on changes in reserves to the estimation. The results, which have passed the autocorrelation test and the Sargan test of over-identification restrictions, are reported in the robustness check. They are broadly consistent with the results reported in the main tables. At the quarterly frequency, increases in foreign exchange reserves seem to encourage the private sector to take more foreign currency loans and deposits relative to GDP, although they do not seem to affect the currency compositions of financial dollarization.

7 Discussion and conclusion

In this paper, we explore two potential channels in which central banks' usage of foreign exchange reserves may affect financial dollarization. The first channel stabilizes exchange rates through foreign exchange interventions. We find that past interventions are positively associated with financial dollarization. However, due to the endogeneity concern, one should use caution to draw an inference between central banks' interventions in the currency market and the private sector's dollarization decisions. Furthermore, this channel crucially depends on the effectiveness of foreign exchange interventions since this channel only works when the central banks are able to manage the exchange rate. In general, emerging market economies have experienced mixed intervention outcomes and most prior studies use high-frequency data to avoid the endogeneity bias. Although research may find that intervention works in the short-term, if the effect lacks persistence it can raise doubts and weaken the exchange rate channel on financial dollarization. To sum up, whether foreign exchange interventions can affect financial dollarization remains an open question.

The second channel that we examine is the effect of changes in reserves on financial dollarization. In this channel, movements in foreign exchange reserves can alter the private sector's perception on the central banks' ability to bail out the banking sector. We find that past changes in foreign exchange reserves are positively associated with financial dollarization. To address the endogeneity concern, we use two instrumental variables: changes in foreign exchange reserves in the region excluding the country itself and the valuation effects of foreign exchange reserves for the country itself. Changes in reserves in other countries in the region turns out to be a weak instrument, although both foreign exchange interventions and the valuation effects are expected to be highly correlated for countries in the region due to common shocks and similar currency composition of foreign exchange reserves. The other instrument, the valuation effects, account for part of the changes in reserves, and it is a strong instrument to examine the causal effect of changes in reserves on financial dollarization. The valuation effects can be considered as exogenous because reserves are denominated in U.S. dollars and most of the valuation effects are exchange rate fluctuations among reserve currencies (e.g., EUR to USD, GBP to USD, JPY to USD). The results from panel regressions with instrumental variables indicate that a rise in

foreign exchange reserve does not affect the share of foreign currency in the portfolios, but it increases the depth of financial dollarization in percent of GDP.

This paper does not study the usage of financial derivatives in foreign exchange intervention. Our foreign exchange intervention measure only captures transactions on the spot market. Although the United States tends to intervene exclusively in the spot market, many emerging market economies intervene in the derivative markets (Domanski, Kohlscheen and Moreno 2016; Schrimpf and Sushko 2019). Our foreign exchange intervention measure can hardly capture central banks' financial derivative transactions. We leave this caveat for future research.

References

Adrian, Tobias, Erceg, Christopher J., Linde, Jesper, Zabczyk, Pawel, Zhou, Jianping, 2020, "A Quantitative Model for the Integrated Policy Framework", IMF Working Paper 20/122.

Arellano, Manuel and Bond, Stephen, 1991, "Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations", The Review of Economic Studies, Vol. 58, pp. 277-97.

Avdjiev, Stefan, Du, Wenxin, Koch, Catherine and Shin, Hyun Song, 2016, "The dollar, bank leverage and the deviation from covered interest parity", BIS Working Papers No 592.

Avdjiev, Stefan, Bruno, Valentina, Koch, Catherine and Shin, Hyun Song, 2018, "The dollar exchange rate as a global risk factor: evidence from investment", BIS Working Papers No 695.

Baltagi, Badi H., 2013, "Econometric Analysis of Panel Data", fifth edition, Wiley.

Barajas, Adolfo and Morales, R. Armando, 2003, "Dollarization of Liabilities: Beyond the Usual Suspects", IMF working paper WP/03/11.

Barry Eichengreen and Donald Mathieson, 2000, "The Currency Composition of Foreign Exchange Reserves; Retrospect and Prospect", International Monetary Fund working paper, WP/00/131.

Basso, Henrique S., Oscar Calvo-Gonzalez, Marius Jurgilas, 2011, "Financial dollarization: The role of foreign-owned banks and interest rates", Journal of Banking & Finance, Volume 35, Issue 4, Pages 794-806.

Basu, Suman, Boz, Emine, Gopinath, Gita, Roch, Francisco, and Unsal, Filiz, 2020, "A Conceptual Model for the Integrated Policy Framework", IMF Working Paper 20/121.

Bocola, Luigi, and Lorenzoni, Guido, 2020, "Financial Crises, Dollarization, and Lending of Last Resort in Open Economies." American Economic Review, 110 (8): 2524-57.

Caballero, Ricardo J. and Krishnamurthy, Arvind, 2003, "Excessive Dollar Debt: Financial Development and Underinsurance", Journal of Finance, Vol. 58, pp. 867-894.

Calvo, Guillermo and Reinhart, Carmen, 2002, "Fear of Floating." Quarterly Journal of Economics, 117(2), pp. 379–408.

Cespedes, Luis Felipe, Roberto Chang and Andres Velasco, 2004, "Balance Sheets And Exchange Rate Policy," American Economic Review, v94, 1183-1193.

Chamon, Marcos, Hofman, David, Magud, Nicolás E., and Werner, Alejandro, eds., 2019, "Foreign Exchange Intervention in Inflation Targeters in Latin America.", Washington, DC: International Monetary Fund.

Chinn, Menzie D. and Hiro Ito, 2006, "What Matters for Financial Development? Capital Controls, Institutions, and Interactions", Journal of Development Economics, Volume 81, Issue 1, Pages 163-192.

De Nicoló, Gianni, Honohan, Patrick and Ize, Alain, 2005, "Dollarization of bank deposits: Causes and consequences", Journal of Banking & Finance, Volume 29, Issue 7, Pages 1697-1727.

Disyatat, Piti, and Galati, Gabriele., 2007, "The Effectiveness of Foreign Exchange Intervention in Emerging Market Countries: Evidence from the Czech Koruna." Journal of International Money and Finance, 26, 383–402.

Domanski, Dietrich, Kohlscheen, Emanuel, and Moreno, Ramon, 2016, "Foreign exchange market intervention in EMEs: what has changed?", BIS Quarterly Review, September 2016.

Dominguez, Kathryn M.E. and Frankel, Jeffrey, 1993, "Does Foreign Exchange Intervention Matter? The Portfolio Effect", American Economic Review, Vol. 83, No. 5, 1356-1369.

Eichengreen, Barry, and Mathieson, Donald J., 2000, "The Currency Composition of Foreign Exchange Reserves: Retrospect and Prospect", International Monetary Fund working paper WP/00/131.

Fernandez, Andres, Michael Klein, Alessandro Rebucci, Martin Schindler, Martín Uribe, 2016, "Capital Control Measures: A New Dataset," IMF Economic Review, Palgrave Macmillan; International Monetary Fund, vol. 64(3), pages 548-574.

Fratzscher, Marcel, Gloede, Oliver, Menkhoff, Lukas, Sarno, Lucio, and Stohr, Tobias, 2019, "When Is Foreign Exchange Intervention Effective? Evidence from 33 Countries." American Economic Journal: Macroeconomics, 11 (1): 132-56.

Ghosh, Atish, Ostry, Jonathan, Chamon, Marcos, 2016, "Two targets, two instruments: Monetary and exchange rate policies in emerging market economies", Journal of International Money and Finance, Volume 60, Pages 172-196.

Hausmann, Ricardo, Panizza, Ugo and Stein, Ernesto, 2001, "Why Do Countries Float the Way they Float?" Journal of Development Economics, 66(2), pp. 387–414.

Honig, Adam, 2009, "Dollarization, Exchange Rate Regimes and Government Quality", Journal of International Money and Finance, vol. 28, issue 2, 198-214.

Ilzetzki, Ethan, Carmen M. Reinhart, Kenneth S. Rogoff, 2017, "Exchange Arrangements Entering the 21st Century: Which Anchor Will Hold?", NBER Working Paper No. 23134.

International Monetary Fund, 2020, "Toward an Integrated Policy Framework", Board Paper, October 2020.

Ize, Alain, and Levy Yeyati, Eduardo, 2003, "Financial dollarization", Journal of International Economics, Volume 59, Issue 2, Pages 323-347.

Klein, Michael, Shambaugh, Jay, 2008, "The dynamics of exchange rate regimes:

Fixes, floats, and flips", Journal of International Economics, Volume 75, Issue 1, May 2008, Pages 70-92.

Kuersteiner, Guido M., Phillips, David C., Villamizar-Villegas, Mauricio, 2018, "Effective sterilized foreign exchange intervention? Evidence from a rule-based policy", Journal of International Economics, Volume 113, July 2018, Pages 118-138.

Lane, Philip R. and Shambaugh, Jay C., 2010, "Financial Exchange Rates and International Currency Exposures", American Economic Review, 100 (1): 518-40.

Levy Yeyati, Eduardo, 2006, "Financial Dollarization: Evaluating the Consequences", Economic Policy, Vol.21, No.45, pp. 61-118.

Lin, Shu, Ye, Haichun, 2013, "Does Inflation Targeting Help Reduce Financial Dollarization?", Journal of Money, Credit and Banking, Volume45, Issue 7, Pages 1253-1274.

Luca, Alina, Petrova, Iva, 2008, "What drives credit dollarization in transition economies?", Journal of Banking & Finance 32, 858–869.

Mohanty, M S and Berger, Bat-el, 2013, "Central Bank Views on Foreign Exchange Intervention", BIS Paper No 73, 55-74.

Mussa, M. 1981, "The Role of Official Intervention." Group of Thirty Occasional Papers, No.6, Group of Thirty, New York.

Neanidis, Kyriakos C., Christos S. Savva, 2009, "Financial dollarization: Short-run determinants in transition economies", Journal of Banking & Finance, 33, 1860–1873.

Neely, Christopher, 2008, "Central Bank Authorities' Beliefs about Foreign Exchange Intervention", Journal of International Money and Finance, 27.

Obstfeld, Maurice, Shambaugh, Jay and Taylor, Alan, 2010. "Financial Stability, the Trilemma, and International Reserves," American Economic Journal: Macroeconomics, American Economic Association, vol.2(2), pages 57-94, April.

Reinhart, Carmen M., Kenneth S. Rogoff, 2009, "This Time Is Different: Eight Centuries of Financial Folly", Princeton University Press.

Reinhart, Carmen M., Rogoff, Kenneth S. and Savastano, Miguel A., 2003, "Addicted to Dollars", NBER Working Paper No. 10015.

Schrimpf, Andreas and Sushko, Vladyslav, 2019, "Sizing up global foreign exchange markets", BIS Quarterly Review, December 2019.

Shambaugh, Jay C., 2004, "The Effect of Fixed Exchange Rates on Monetary Policy", Quarterly Journal of Economics vol. 119 no.1, February 2004, p. 301-352.

Verner, Emil, and Gyozo, Gyongyosi, 2020, "Household Debt Revaluation and the Real Economy: Evidence from a Foreign Currency Debt Crisis." American Economic Review, 110 (9): 2667-2702.

Vieira, Fabrício A.C., Márcio Holland, Marco F.Resende, 2012, "Financial dollarization and systemic risks: New empirical evidence", Journal of International Money

and Finance, Volume 31, Issue 6, Pages 1695-1714.

Wu, Jing Cynthia and Xia, Fan Dora, 2016, "Measuring the Macroeconomic Impact of Monetary Policy at the Zero Lower Bound", Journal of Money, Credit, and Banking, 48 (2-3), 253-291.

Appendix

Data and variable description

The dataset is monthly from January 2004 to December 2014 on 30 emerging market economies.

Countries included in the study: Albania, Armenia, Belarus, Brazil, Bulgaria, Chile, Colombia, Costa Rica, Croatia, Dominican Republic, Egypt, Hungary, Indonesia, Kazakhstan, Latvia, Lithuania, Malaysia, Mexico, Morocco, Pakistan, Philippines, Poland, Romania, South Africa, Sri Lanka, Thailand, Turkey, Ukraine, Uruguay, Venezuela.

Note on instrumental variables

Instrumental variable #1: changes in foreign exchange reserves in the region excluding the country itself

Instrumental variable #2: the valuation effects of foreign exchange reserves for the country itself

Although only 30 emerging market economies have adequate data to conduct econometric analysis on financial dollarization, foreign exchange reserve data is available for 44 emerging market economies. Therefore, all 44 countries' data is used to construct the first instrumental variable.

Our geographic classification is based on the World Bank's country group by region. Middle East and North Africa is combined with Sub-Saharan Africa to ensure at least three countries in each group. In sum, there are five regions. This approach allows the instrumental variable to have enough variations both by country and by time.

East Asia and Pacific: 5 countries

Indonesia, Malaysia, Philippines, Thailand, Vietnam;

South Asia: 3 countries

India, Pakistan, Sri Lanka;

Europe and Central Asia: 18 countries

Albania, Armenia, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Georgia, Hungary, Kazakhstan, Latvia, Lithuania, Macedonia, Poland, Romania, Russia, Serbia, Turkey, Ukraine;

Latin America and the Caribbean: 12 countries

Argentina, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Guatemala, Jamaica, Mexico, Peru, Uruguay, Venezuela;

Middle East and Africa: 7 countries

Algeria, Egypt, Jordan, Lebanon, Morocco, South Africa, Tunisia.

Total: 44 countries

Table 7: variable description

Symbol	Definition	Data source/ Transformation
FC_loan_LCU	FX loans	Monetary and Financial Statistics database, IMF
FX_deposit_LCU	FX deposits	Monetary and Financial Statistics database, IMF
loan_LCU	Total loans	Monetary and Financial Statistics database, IMF
deposit_LCU	Total deposits	Monetary and Financial Statistics database, IMF
NGDP	Nominal GDP	International Financial Statistics database, IMF
credit	Bank credit to private sector	International Financial Statistics database, IMF
inflation_INS	Inflation	INS database, IMF
ER_depreciation	Exchange rate	International Financial Statistics database, IMF
policyrate	Policy rate	Haver Analytics
IR_differential	Policy rate differential	Domestic policy rate minus effective Federal Funds rate
GovtQuality	Government quality index	A simple average of law and order, bureaucracy quality, and corruption ratings based on International Country Risk Guide (ICRG)'s data.
reserves	Foreign exchange reserves	International Financial Statistics database, IMF
intervention	Foreign exchange intervention	Changes in central banks' foreign reserves, adjusted by valuation effects.
ka_open	Chinn-Ito index of financial openness	Chinn and Ito (2006)
ka, kai, kao, cc, mm	FKRSU index of capital control	Fernandez et al. (2016)
Shambaugh_peg	Shambaugh fixed exchange rate dummy variable	Shambaugh (2004)
IRR_peg	Ilzetzki, Reinhart and Rogoff fixed exchange rate dummy variable	Ilzetzki, Reinhart and Rogoff (2017)
Reinhart_currency_crises	Reinhart and Rogoff currency crisis dummy	Reinhart and Rogoff (2009)

Table 8: Robustness Check 1. Control for exchange rate regime and the number of years since the peg

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable	FX loans/ total loans				FX deposits/ total deposits			
FX loans/ total loans in t-1	0.925***	0.925***	0.936***	0.925***				
	(0.0150)	(0.0148)	(0.0179)	(0.0107)				
FX deposits/ total deposits in t-1					0.842***	0.843***	0.915***	0.837***
					(0.0206)	(0.0205)	(0.0457)	(0.0182)
Exchange rate depreciation	0.0159***	0.0159***	0.00108	0.0160***	0.0278***	0.0277***	0.000367	0.0301***
	(0.00566)	(0.00564)	(0.0125)	(0.00492)	(0.00820)	(0.00787)	(0.0156)	(0.00574)
Inflation	0.00172	0.00140	0.0316	0.00180	-0.0196	-0.0183	0.0371	-0.0230
	(0.0213)	(0.0212)	(0.0310)	(0.0173)	(0.0199)	(0.0196)	(0.0424)	(0.0201)
Credit/ GDP	0.0218**	0.0221**	0.0116	0.0218***	0.0214*	0.0202	-0.00203	0.0220***
	(0.0102)	(0.0103)	(0.0108)	(0.00603)	(0.0121)	(0.0124)	(0.0170)	(0.00759)
Chinn-Ito measure of financial openness	1.354	1.346	1.310**	1.364***	1.390**	1.424**	1.200	1.451***
	(0.812)	(0.814)	(0.651)	(0.455)	(0.526)	(0.536)	(0.889)	(0.500)
Policy rate differential	0.0426	0.0426	0.0169	0.0427*	0.0919**	0.0911**	-0.00390	0.0994***
	(0.0481)	(0.0484)	(0.0386)	(0.0251)	(0.0365)	(0.0367)	(0.0670)	(0.0305)
Government quality index	-2.772	-2.808	-1.144	-2.909	-1.742	-1.806	0.166	-2.035
	(1.777)	(1.742)	(3.032)	(1.779)	(2.081)	(2.094)	(3.923)	(2.016)
Exchange rate peg dummy (Shambaugh 2004)	0.0117	-0.0122	0.325	-0.00657	0.0386	0.0853	0.430	0.0621
	(0.734)	(0.721)	(0.817)	(0.576)	(0.913)	(0.916)	(1.157)	(0.662)
Inverse of peg spell (Shambaugh 2004)	0.637	0.601	1.106	0.620	0.780	0.865	1.494	0.827
	(1.288)	(1.268)	(1.259)	(0.887)	(1.144)	(1.144)	(1.815)	(1.011)
FX intervention/ GDP in t-1	0.0773**				-0.107			
	(0.0361)				(0.0709)			
FX intervention/ GDP in t-2	0.0147				-0.00507			
	(0.0364)				(0.0817)			
Change in FX reserves/ GDP in t-1		0.0359	-0.863	0.0112		-0.0978	-1.594*	0.0167
		(0.0309)	(0.604)	(0.0586)		(0.0718)	(0.844)	(0.0682)
Change in FX reserves/ GDP in t-2		0.0539	0.0628	0.107*		0.0104	-0.106	0.0540
		(0.0351)	(0.584)	(0.0597)		(0.0564)	(1.005)	(0.0677)
Constant	0.647	0.673	0.119	0.657	1.809	1.702	0.826	1.746
	(1.217)	(1.198)	(1.728)	(1.238)	(1.959)	(1.994)	(2.605)	(1.397)
Estimation method	Panel	Panel	Panel IV1	Panel IV2	Panel	Panel	Panel IV1	Panel IV2
Frequency	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly
Observations	1,044	1,044	1,044	1,044	895	895	895	895
R-squared	0.899	0.899			0.808	0.808		
Number of countries	29	29	29	29	24	24	24	24

Note: Robust standard errors in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$. Panel IV1: instrumental variable panel regressions using changes in foreign exchange reserves in the region excluding the country itself. Panel IV2: instrumental variable panel regressions using valuation effects of foreign exchange reserves for the country itself. Since the R-squared has no statistical meaning in the context of instrumental variable regressions, we do not report its values. Annual regression results are omitted to save space.

Dependent variable	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	FX loans/ GDP				FX deposits/ GDP			
FX loans/ GDP in t-1	0.893***	0.893***	0.900***	0.892***				
	(0.0180)	(0.0180)	(0.0232)	(0.0115)				
FX deposits/ GDP in t-1					0.893***	0.891***	0.912***	0.890***
					(0.0176)	(0.0174)	(0.0330)	(0.0131)
Exchange rate depreciation	-0.00162	-0.000725	-0.00973	0.000136	0.00289	0.00418	-0.00688	0.00565
	(0.00437)	(0.00437)	(0.0161)	(0.00463)	(0.00447)	(0.00427)	(0.0187)	(0.00458)
Inflation	-0.00864	-0.0108	-0.00546	-0.0127	-0.0160	-0.0179	-0.0150	-0.0197
	(0.0182)	(0.0178)	(0.0415)	(0.0163)	(0.0159)	(0.0151)	(0.0422)	(0.0156)
Credit/ GDP	0.0449**	0.0458**	0.0481***	0.0466***	0.0274**	0.0289**	0.0293	0.0298***
	(0.0167)	(0.0167)	(0.0159)	(0.00640)	(0.0110)	(0.0111)	(0.0181)	(0.00598)
Chinn-Ito measure of financial openness	0.210	0.204	-0.288	0.206	0.649	0.642	-0.0585	0.642
	(0.541)	(0.535)	(0.862)	(0.429)	(0.404)	(0.391)	(1.058)	(0.411)
Policy rate differential	0.0348	0.0364	0.0233	0.0380	0.0566**	0.0585**	0.0411	0.0603**
	(0.0391)	(0.0385)	(0.0521)	(0.0241)	(0.0256)	(0.0253)	(0.0594)	(0.0242)
Government quality index	-0.173	-0.270	2.826	-0.343	-1.179	-1.229	2.234	-1.365
	(1.279)	(1.321)	(3.760)	(1.648)	(1.229)	(1.202)	(4.174)	(1.612)
Exchange rate peg dummy (Shambaugh 2004)	0.0999	0.0585	0.127	0.0356	0.472	0.384	0.815	0.339
	(0.568)	(0.571)	(1.079)	(0.539)	(0.512)	(0.498)	(1.314)	(0.529)
Inverse of peg spell (Shambaugh 2004)	0.954	0.889	0.744	0.852	0.580	0.455	0.697	0.395
	(0.717)	(0.723)	(1.660)	(0.828)	(0.648)	(0.642)	(2.035)	(0.826)
FX intervention/ GDP in t-1	0.0523				0.0995			
	(0.0442)				(0.0630)			
FX intervention/ GDP in t-2	0.0145				-0.00616			
	(0.0312)				(0.0299)			
Change in FX reserves/ GDP in t-1		0.0829**	0.346	0.138**		0.119**	0.458	0.183***
		(0.0399)	(0.771)	(0.0549)		(0.0528)	(0.962)	(0.0551)
Change in FX reserves/ GDP in t-2		0.0327	-1.405*	0.0274		0.0398	-1.840*	0.0916
		(0.0285)	(0.775)	(0.0559)		(0.0427)	(0.986)	(0.0570)
Constant	-2.848**	-2.815**	-2.149	-2.799**	-1.887*	-1.809*	-0.786	-1.822
	(1.064)	(1.063)	(2.190)	(1.128)	(0.949)	(0.936)	(2.690)	(1.129)
Estimation method	Panel	Panel	Panel IV1	Panel IV2	Panel	Panel	Panel IV1	Panel IV2
Frequency	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly
Observations	1,044	1,044	1,044	1,044	1,089	1,088	1,088	1,088
R-squared	0.921	0.922			0.895	0.896		
Number of countries	29	29	29	29	30	30	30	30

Table 9: Robustness Check 2. Examine the role of US dollar by including a broad dollar index

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable	FX loans/ total loans				FX deposits/ total deposits			
FX loans/ total loans in t-1	0.927***	0.927***	0.939***	0.927***				
	(0.0132)	(0.0131)	(0.0180)	(0.0107)				
FX deposits/ total deposits in t-1					0.842***	0.843***	0.918***	0.837***
					(0.0205)	(0.0202)	(0.0475)	(0.0183)
Exchange rate depreciation	0.0168***	0.0168***	0.00150	0.0170***	0.0291***	0.0290***	0.000786	0.0316***
	(0.00588)	(0.00585)	(0.0126)	(0.00492)	(0.00828)	(0.00791)	(0.0160)	(0.00574)
Inflation	0.00774	0.00737	0.0387	0.00770	-0.0124	-0.0111	0.0478	-0.0161
	(0.0223)	(0.0223)	(0.0312)	(0.0172)	(0.0189)	(0.0189)	(0.0441)	(0.0200)
Credit/ GDP	0.0212**	0.0216**	0.0110	0.0213***	0.0212*	0.0201	-0.00305	0.0220***
	(0.00984)	(0.00994)	(0.0108)	(0.00601)	(0.0114)	(0.0117)	(0.0175)	(0.00762)
Chinn-Ito measure of financial openness	1.091	1.085	1.039	1.099**	1.080**	1.106**	0.813	1.137**
	(0.761)	(0.760)	(0.633)	(0.444)	(0.479)	(0.487)	(0.876)	(0.489)
Policy rate differential	0.0480	0.0481	0.0219	0.0484*	0.0992**	0.0986**	0.000728	0.107***
	(0.0505)	(0.0506)	(0.0390)	(0.0251)	(0.0393)	(0.0396)	(0.0686)	(0.0305)
Government quality index	-2.572	-2.628	-0.749	-2.742	-1.468	-1.515	0.735	-1.770
	(1.986)	(1.949)	(3.064)	(1.762)	(2.132)	(2.155)	(3.952)	(2.003)
US dollar NEER broad index	0.126	0.169	-0.413	0.230	0.511	0.527	-0.870	0.685
	(0.412)	(0.414)	(0.929)	(0.347)	(0.812)	(0.786)	(1.346)	(0.417)
FX intervention/ GDP in t-1	0.0765**				-0.107			
	(0.0366)				(0.0683)			
FX intervention/ GDP in t-2	0.0114				-0.00892			
	(0.0362)				(0.0800)			
Change in FX reserves/ GDP in t-1		0.0361	-0.892	0.0156		-0.0962	-1.655*	0.0238
		(0.0304)	(0.611)	(0.0588)		(0.0702)	(0.878)	(0.0685)
Change in FX reserves/ GDP in t-2		0.0520	0.0628	0.109*		0.00816	-0.113	0.0553
		(0.0350)	(0.592)	(0.0598)		(0.0537)	(1.038)	(0.0680)
Constant	-12.31	-16.97	45.24	-23.50	-52.24	-54.02	95.20	-70.92
	(43.85)	(44.11)	(99.55)	(37.26)	(87.20)	(84.30)	(144.6)	(44.91)
Estimation method	Panel	Panel	Panel IV1	Panel IV2	Panel	Panel	Panel IV1	Panel IV2
Frequency	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly
Observations	1,044	1,044	1,044	1,044	895	895	895	895
R-squared	0.899	0.899			0.807	0.807		
Number of countries	29	29	29	29	24	24	24	24

Note: Robust standard errors in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$. Panel IV1: instrumental variable panel regressions using changes in foreign exchange reserves in the region excluding the country itself. Panel IV2: instrumental variable panel regressions using valuation effects of foreign exchange reserves for the country itself. Since the R-squared has no statistical meaning in the context of instrumental variable regressions, we do not report its values. Annual regression results are omitted to save space.

	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Dependent variable	FX loans/ GDP				FX deposits/ GDP			
FX loans/ GDP in t-1	0.893***	0.893***	0.900***	0.892***				
	(0.0172)	(0.0172)	(0.0231)	(0.0116)				
FX deposits/ GDP in t-1					0.892***	0.891***	0.911***	0.889***
					(0.0183)	(0.0180)	(0.0318)	(0.0128)
Exchange rate depreciation	-0.000343	0.000587	-0.00948	0.00157	0.00269	0.00400	-0.00659	0.00547
	(0.00410)	(0.00411)	(0.0161)	(0.00464)	(0.00431)	(0.00407)	(0.0183)	(0.00456)
Inflation	-0.000643	-0.00291	0.00130	-0.00507	-0.0176	-0.0193	-0.0217	-0.0209
	(0.0209)	(0.0205)	(0.0413)	(0.0163)	(0.0160)	(0.0151)	(0.0415)	(0.0155)
Credit/ GDP	0.0445***	0.0454***	0.0474***	0.0462***	0.0279**	0.0293**	0.0307*	0.0301***
	(0.0160)	(0.0160)	(0.0156)	(0.00639)	(0.0109)	(0.0110)	(0.0174)	(0.00593)
Chinn-Ito measure of financial openness	-0.128	-0.130	-0.526	-0.126	0.668*	0.665*	0.0746	0.665*
	(0.459)	(0.449)	(0.831)	(0.421)	(0.380)	(0.371)	(1.004)	(0.403)
Policy rate differential	0.0426	0.0442	0.0277	0.0460*	0.0561**	0.0578**	0.0375	0.0596**
	(0.0424)	(0.0416)	(0.0519)	(0.0241)	(0.0237)	(0.0234)	(0.0580)	(0.0240)
Government quality index	0.0678	-0.0563	3.096	-0.160	-0.978	-1.066	2.410	-1.222
	(1.616)	(1.622)	(3.769)	(1.640)	(1.229)	(1.201)	(4.113)	(1.590)
US dollar NEER broad index	0.399	0.461	-1.293	0.499	0.775**	0.806**	-1.745	0.922***
	(0.320)	(0.309)	(1.209)	(0.326)	(0.345)	(0.331)	(1.571)	(0.320)
FX intervention/ GDP in t-1	0.0516				0.0998			
	(0.0433)				(0.0632)			
FX intervention/ GDP in t-2	0.0106				-0.00541			
	(0.0340)				(0.0309)			
Change in FX reserves/ GDP in t-1		0.0835**	0.313	0.143***		0.120**	0.514	0.184***
		(0.0389)	(0.772)	(0.0552)		(0.0529)	(0.957)	(0.0551)
Change in FX reserves/ GDP in t-2		0.0305	-1.417*	0.0293		0.0406	-1.804*	0.0918
		(0.0308)	(0.773)	(0.0563)		(0.0436)	(0.963)	(0.0570)
Constant	-44.74	-51.44	136.9	-55.47	-84.40**	-87.70**	186.5	-100.2***
	(34.06)	(32.91)	(129.9)	(35.01)	(36.98)	(35.52)	(169.0)	(34.42)
Estimation method	Panel	Panel	Panel IV1	Panel IV2	Panel	Panel	Panel IV1	Panel IV2
Frequency	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly
Observations	1,044	1,044	1,044	1,044	1,089	1,088	1,088	1,088
R-squared	0.920	0.921			0.894	0.896		
Number of countries	29	29	29	29	30	30	30	30

Table 10: Robustness Check 3. Use Wu-Xia (2016) shadow rate to calculate the policy rate differential

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable	FX loans/ total loans				FX deposits/ total deposits			
FX loans/ total loans in t-1	0.927***	0.927***	0.939***	0.927***				
	(0.0132)	(0.0131)	(0.0180)	(0.0107)				
FX deposits/ total deposits in t-1					0.842***	0.843***	0.918***	0.837***
					(0.0205)	(0.0202)	(0.0475)	(0.0183)
Exchange rate depreciation	0.0168***	0.0168***	0.00150	0.0170***	0.0291***	0.0290***	0.000786	0.0316***
	(0.00588)	(0.00585)	(0.0126)	(0.00492)	(0.00828)	(0.00791)	(0.0160)	(0.00574)
Inflation	0.00774	0.00737	0.0387	0.00770	-0.0124	-0.0111	0.0478	-0.0161
	(0.0223)	(0.0223)	(0.0312)	(0.0172)	(0.0189)	(0.0189)	(0.0441)	(0.0200)
Credit/ GDP	0.0212**	0.0216**	0.0110	0.0213***	0.0212*	0.0201	-0.00305	0.0220***
	(0.00984)	(0.00994)	(0.0108)	(0.00601)	(0.0114)	(0.0117)	(0.0175)	(0.00762)
Chinn-Ito measure of financial openness	1.091	1.085	1.039	1.099**	1.080**	1.106**	0.813	1.137**
	(0.761)	(0.760)	(0.633)	(0.444)	(0.479)	(0.487)	(0.876)	(0.489)
Policy rate differential (Wu-Xia shadow rate)	0.0480	0.0481	0.0219	0.0484*	0.0992**	0.0986**	0.000728	0.107***
	(0.0505)	(0.0506)	(0.0390)	(0.0251)	(0.0393)	(0.0396)	(0.0686)	(0.0305)
Government quality index	-2.572	-2.628	-0.749	-2.742	-1.468	-1.515	0.735	-1.770
	(1.986)	(1.949)	(3.064)	(1.762)	(2.132)	(2.155)	(3.952)	(2.003)
FX intervention/ GDP in t-1	0.0765**				-0.107			
	(0.0366)				(0.0683)			
FX intervention/ GDP in t-2	0.0114				-0.00892			
	(0.0362)				(0.0800)			
Change in FX reserves/ GDP in t-1		0.0361	-0.892	0.0156		-0.0962	-1.655*	0.0238
		(0.0304)	(0.611)	(0.0588)		(0.0702)	(0.878)	(0.0685)
Change in FX reserves/ GDP in t-2		0.0520	0.0628	0.109*		0.00816	-0.113	0.0553
		(0.0350)	(0.592)	(0.0598)		(0.0537)	(1.038)	(0.0680)
Constant	1.133	1.136	0.979	1.136	2.440*	2.410	2.046	2.422**
	(1.198)	(1.155)	(1.413)	(1.019)	(1.407)	(1.429)	(2.038)	(1.114)
Estimation method	Panel	Panel	Panel IV1	Panel IV2	Panel	Panel	Panel IV1	Panel IV2
Frequency	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly
Observations	1,044	1,044	1,044	1,044	895	895	895	895
R-squared	0.899	0.899			0.807	0.807		
Number of countries	29	29	29	29	24	24	24	24

Note: Robust standard errors in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$. Panel IV1: instrumental variable panel regressions using changes in foreign exchange reserves in the region excluding the country itself. Panel IV2: instrumental variable panel regressions using valuation effects of foreign exchange reserves for the country itself. Since the R-squared has no statistical meaning in the context of instrumental variable regressions, we do not report its values. Annual regression results are omitted to save space.

	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Dependent variable	FX loans/ GDP				FX deposits/ GDP			
FX loans/ GDP in t-1	0.893***	0.893***	0.900***	0.892***				
	(0.0172)	(0.0172)	(0.0231)	(0.0116)				
FX deposits/ GDP in t-1					0.892***	0.891***	0.911***	0.889***
					(0.0183)	(0.0180)	(0.0318)	(0.0128)
Exchange rate depreciation	-0.000343	0.000587	-0.00948	0.00157	0.00269	0.00400	-0.00659	0.00547
	(0.00410)	(0.00411)	(0.0161)	(0.00464)	(0.00431)	(0.00407)	(0.0183)	(0.00456)
Inflation	-0.000643	-0.00291	0.00130	-0.00507	-0.0176	-0.0193	-0.0217	-0.0209
	(0.0209)	(0.0205)	(0.0413)	(0.0163)	(0.0160)	(0.0151)	(0.0415)	(0.0155)
Credit/ GDP	0.0445***	0.0454***	0.0474***	0.0462***	0.0279**	0.0293**	0.0307*	0.0301***
	(0.0160)	(0.0160)	(0.0156)	(0.00639)	(0.0109)	(0.0110)	(0.0174)	(0.00593)
Chinn-Ito measure of financial openness	-0.128	-0.130	-0.526	-0.126	0.668*	0.665*	0.0746	0.665*
	(0.459)	(0.449)	(0.831)	(0.421)	(0.380)	(0.371)	(1.004)	(0.403)
Policy rate differential (Wu-Xia shadow rate)	0.0426	0.0442	0.0277	0.0460*	0.0561**	0.0578**	0.0375	0.0596**
	(0.0424)	(0.0416)	(0.0519)	(0.0241)	(0.0237)	(0.0234)	(0.0580)	(0.0240)
Government quality index	0.0678	-0.0563	3.096	-0.160	-0.978	-1.066	2.410	-1.222
	(1.616)	(1.622)	(3.769)	(1.640)	(1.229)	(1.201)	(4.113)	(1.590)
FX intervention/ GDP in t-1	0.0516				0.0998			
	(0.0433)				(0.0632)			
FX intervention/ GDP in t-2	0.0106				-0.00541			
	(0.0340)				(0.0309)			
Change in FX reserves/ GDP in t-1		0.0835**	0.313	0.143***		0.120**	0.514	0.184***
		(0.0389)	(0.772)	(0.0552)		(0.0529)	(0.957)	(0.0551)
Change in FX reserves/ GDP in t-2		0.0305	-1.417*	0.0293		0.0406	-1.804*	0.0918
		(0.0308)	(0.773)	(0.0563)		(0.0436)	(0.963)	(0.0570)
Constant	-2.027**	-2.042**	-1.495	-2.060**	-1.394	-1.425*	-0.241	-1.488*
	(0.982)	(0.992)	(1.763)	(0.906)	(0.834)	(0.824)	(2.161)	(0.891)
Estimation method	Panel	Panel	Panel IV1	Panel IV2	Panel	Panel	Panel IV1	Panel IV2
Frequency	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly
Observations	1,044	1,044	1,044	1,044	1,089	1,088	1,088	1,088
R-squared	0.920	0.921			0.894	0.896		
Number of countries	29	29	29	29	30	30	30	30

Table 11: Robustness Check 4. Exclude the Global Financial Crisis (2008-2010)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable	FX loans/ total loans				FX deposits/ total deposits			
FX loans/ total loans in t-1	0.927***	0.927***	0.929***	0.926***				
	(0.0136)	(0.0132)	(0.0336)	(0.0132)				
FX deposits/ total deposits in t-1					0.879***	0.881***	0.851***	0.873***
					(0.0254)	(0.0255)	(0.150)	(0.0218)
Exchange rate depreciation	0.0174**	0.0174**	0.0104	0.0186**	0.0258***	0.0256***	0.0310	0.0314***
	(0.00747)	(0.00742)	(0.0202)	(0.00731)	(0.00828)	(0.00817)	(0.0603)	(0.00798)
Inflation	0.00527	0.00531	0.0220	0.00286	0.00119	0.00358	-0.0328	-0.0126
	(0.0210)	(0.0210)	(0.0931)	(0.0242)	(0.0274)	(0.0285)	(0.225)	(0.0263)
Credit/ GDP	0.0205*	0.0206*	0.0191	0.0206**	0.00816	0.00631	0.0311	0.00914
	(0.0108)	(0.0109)	(0.0284)	(0.00804)	(0.0175)	(0.0183)	(0.0924)	(0.00916)
Chinn-Ito measure of financial openness	1.171	1.174	1.164	1.186**	1.668**	1.723**	0.927	1.702***
	(0.773)	(0.772)	(1.226)	(0.557)	(0.601)	(0.617)	(2.938)	(0.581)
Policy rate differential	0.0353	0.0352	0.0200	0.0373	0.0588	0.0555	0.127	0.0759**
	(0.0434)	(0.0437)	(0.103)	(0.0321)	(0.0455)	(0.0452)	(0.354)	(0.0372)
Government quality index	-1.984	-2.108	-0.943	-2.379	-0.510	-0.683	4.626	-1.233
	(2.214)	(2.181)	(4.823)	(2.036)	(1.910)	(1.937)	(13.57)	(2.192)
FX intervention/ GDP in t-1	0.0672				-0.107			
	(0.0464)				(0.0707)			
FX intervention/ GDP in t-2	-0.00512				-0.0941			
	(0.0476)				(0.0824)			
Change in FX reserves/ GDP in t-1		0.0200	-0.0439	0.0115		-0.113	1.499	0.0447
		(0.0416)	(2.148)	(0.0885)		(0.0664)	(5.589)	(0.0987)
Change in FX reserves/ GDP in t-2		0.0485	-0.315	0.145*		-0.0486	-2.624	0.0925
		(0.0482)	(2.528)	(0.0823)		(0.0558)	(6.503)	(0.0900)
Constant	0.936	0.985	0.967	0.999	1.429	1.546	1.597	1.573
	(1.255)	(1.207)	(1.696)	(1.197)	(1.474)	(1.511)	(3.584)	(1.217)
Estimation method	Panel	Panel	Panel IV1	Panel IV2	Panel	Panel	Panel IV1	Panel IV2
Frequency	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly
Observations	701	701	701	701	596	596	596	596
R-squared	0.894	0.894			0.830	0.829		
Number of countries	29	29	29	29	24	24	24	24

Note: Robust standard errors in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$. Panel IV1: instrumental variable panel regressions using changes in foreign exchange reserves in the region excluding the country itself. Panel IV2: instrumental variable panel regressions using valuation effects of foreign exchange reserves for the country itself. Since the R-squared has no statistical meaning in the context of instrumental variable regressions, we do not report its values. Annual regression results are omitted to save space.

	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Dependent variable		FX loans/ GDP				FX deposits/ GDP		
FX loans/ GDP in t-1	0.902***	0.903***	0.824***	0.904***				
	(0.0174)	(0.0178)	(0.258)	(0.0138)				
FX deposits/ GDP in t-1					0.894***	0.894***	0.824***	0.893***
					(0.0221)	(0.0221)	(0.142)	(0.0150)
Exchange rate depreciation	-0.00929**	-0.00827*	-0.0321	-0.00649	-0.00978*	-0.00837*	-0.0365	-0.00660
	(0.00452)	(0.00453)	(0.118)	(0.00595)	(0.00499)	(0.00463)	(0.0656)	(0.00612)
Inflation	0.00931	0.00610	0.129	0.00157	0.0117	0.00887	0.130	0.00499
	(0.0195)	(0.0192)	(0.457)	(0.0199)	(0.0273)	(0.0267)	(0.239)	(0.0200)
Credit/ GDP	0.0467**	0.0472**	0.0189	0.0476***	0.0294**	0.0306**	0.000416	0.0313***
	(0.0181)	(0.0180)	(0.0968)	(0.00725)	(0.0122)	(0.0122)	(0.0635)	(0.00711)
Chinn-Ito measure of financial openness	-0.213	-0.239	2.090	-0.258	0.678	0.653	3.732	0.629
	(0.669)	(0.664)	(7.395)	(0.462)	(0.432)	(0.424)	(5.709)	(0.456)
Policy rate differential	0.0306	0.0333	-0.0912	0.0372	0.0327	0.0362	-0.0660	0.0400
	(0.0459)	(0.0452)	(0.463)	(0.0269)	(0.0318)	(0.0314)	(0.233)	(0.0279)
Government quality index	0.00936	-0.152	-6.308	-0.371	-1.081	-1.145	-6.464	-1.291
	(1.645)	(1.660)	(18.53)	(1.643)	(1.288)	(1.263)	(12.70)	(1.641)
FX intervention/ GDP in t-1	0.0725**				0.0810			
	(0.0348)				(0.0567)			
FX intervention/ GDP in t-2	0.00742				-0.00443			
	(0.0462)				(0.0430)			
Change in FX reserves/ GDP in t-1		0.0719**	-3.605	0.112		0.0884**	-2.972	0.121*
		(0.0312)	(10.79)	(0.0728)		(0.0421)	(5.216)	(0.0734)
Change in FX reserves/ GDP in t-2		0.0499	4.453	0.105		0.0345	3.220	0.0942
		(0.0472)	(11.21)	(0.0673)		(0.0670)	(5.606)	(0.0699)
Constant	-2.173*	-2.151*	-2.459	-2.160**	-1.541	-1.568	-2.258	-1.610*
	(1.121)	(1.131)	(6.172)	(0.907)	(0.967)	(0.952)	(4.872)	(0.920)
Estimation method	Panel	Panel	Panel IV1	Panel IV2	Panel	Panel	Panel IV1	Panel IV2
Frequency	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly
Observations	701	701	701	701	733	732	732	732
R-squared	0.932	0.932			0.915	0.915		
Number of countries	29	29	29	29	30	30	30	30

Table 12: Robustness Check 5. Dynamic panel data model using the Arellano-Bond estimators

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable	FX loans/ total loans				FX deposits/ total deposits			
FX loans/ total loans in t-1	0.895***	0.895***	0.915***	0.916***				
	(0.0113)	(0.0137)	(0.0149)					
FX deposits/ total deposits in t-1					0.814***	0.814***	0.820***	0.823***
					(0.0191)	(0.0191)	(0.0302)	(0.0274)
Exchange rate depreciation	0.0227***	0.0232***	0.0187***	0.0179***	0.0370***	0.0373***	0.0316***	0.0325***
	(0.00477)	(0.00478)	(0.00658)	(0.00639)	(0.00538)	(0.00540)	(0.00907)	(0.00896)
Inflation	0.0231	0.0214	0.0201	0.0160	-0.0138	-0.0122	-0.00489	-0.0244*
	(0.0173)	(0.0173)	(0.0215)	(0.0214)	(0.0202)	(0.0203)	(0.0173)	(0.0147)
Credit/ GDP	0.0307***	0.0318***	0.0255***	0.0287***	0.0279***	0.0266***	0.0245**	0.0271**
	(0.00639)	(0.00639)	(0.00985)	(0.00996)	(0.00845)	(0.00847)	(0.0120)	(0.0124)
Chinn-Ito measure of financial openness	1.005**	0.991**	0.643	0.755	0.791	0.851*	0.862*	1.053**
	(0.486)	(0.485)	(0.681)	(0.734)	(0.511)	(0.509)	(0.487)	(0.469)
Policy rate differential	-0.0351	-0.0360	-0.0311	-0.0161	0.0949***	0.0955***	0.0743***	0.0882***
	(0.0334)	(0.0334)	(0.0370)	(0.0371)	(0.0363)	(0.0363)	(0.0270)	(0.0286)
Government quality index	-1.005	-0.789	-1.696	-3.524**	-1.758	-2.004	-2.325	-1.423
	(2.274)	(2.271)	(1.883)	(1.759)	(2.490)	(2.479)	(2.414)	(2.349)
FX intervention/ GDP in t-1	0.0983***				-0.0998**			
	(0.0349)				(0.0455)			
FX intervention/ GDP in t-2	0.0325				-0.0113			
	(0.0345)				(0.0445)			
Change in FX reserves/ GDP in t-1		0.0589*	0.0535	0.0453		-0.0817**	-0.0919	-0.0959
		(0.0324)	(0.0341)	(0.0316)		(0.0398)	(0.0706)	(0.0698)
Change in FX reserves/ GDP in t-2		0.0767**	0.0625*	0.0567*		0.0112	-0.00760	0.0115
		(0.0321)	(0.0359)	(0.0341)		(0.0383)	(0.0566)	(0.0603)
Constant	1.022	0.917	1.485	1.917	3.269**	3.334**	3.628**	2.870
	(1.225)	(1.223)	(1.323)	(1.203)	(1.327)	(1.321)	(1.718)	(1.762)
Estimation method	GMM	GMM	GMM IV1	GMM IV2	GMM	GMM	GMM IV1	GMM IV2
Frequency	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly
Observations	1,044	1,044	1,044	1,044	895	895	895	895
Number of countries	29	29	29	29	24	24	24	24

Note: Standard errors in parentheses for GMM regressions; Robust standard errors in parentheses for GMM IV1 and GMM IV2 regressions. *** p < 0.01; ** p < 0.05; * p < 0.1. GMM: Dynamic panel data model using the Arellano-Bond estimator (difference GMM). GMM IV1: Dynamic panel data model using the Arellano-Bond estimator (difference GMM). Changes in foreign exchange reserves in the region excluding the country itself are included as additional instrumental variables. GMM IV2: Dynamic panel data model using the Arellano-Bond estimator (difference GMM). Valuation effects of foreign exchange reserves for the country itself are included as additional instrumental variables. Annual regression results are omitted to save space.

	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Dependent variable		FX loans/ GDP				FX deposits/ GDP		
FX loans/ GDP in t-1	0.871***	0.870***	0.879***	0.880***				
(0.0137)	(0.0137)	(0.0193)	(0.0204)					
FX deposits/ GDP in t-1					0.881***	0.881***	0.884***	0.882***
					(0.0152)	(0.0152)	(0.0187)	(0.0199)
Exchange rate depreciation	0.000292	0.00209	0.00277	0.00235	-0.00109	0.0114**	0.00685*	0.00835*
	(0.00518)	(0.00521)	(0.00392)	(0.00406)	(0.00504)	(0.00524)	(0.00406)	(0.00438)
Inflation	-0.0101	-0.0140	-0.00426	-0.00428	-0.00129	-0.0409**	-0.0237	-0.0318*
	(0.0189)	(0.0189)	(0.0218)	(0.0218)	(0.0174)	(0.0186)	(0.0162)	(0.0170)
Credit/ GDP	0.0630***	0.0666***	0.0558***	0.0581***	0.0313***	0.0430***	0.0347***	0.0379***
	(0.00848)	(0.00854)	(0.0176)	(0.0193)	(0.00776)	(0.00757)	(0.0122)	(0.0132)
Chinn-Ito measure of financial openness	-0.592	-0.565	-0.383	-0.478	0.984**	0.696	0.583	0.502
	(0.516)	(0.515)	(0.443)	(0.437)	(0.481)	(0.483)	(0.405)	(0.425)
Policy rate differential	0.0232	0.0182	-0.00757	0.00463	0.0486	0.0457	0.0511*	0.0499*
	(0.0381)	(0.0381)	(0.0416)	(0.0409)	(0.0356)	(0.0356)	(0.0280)	(0.0279)
Government quality index	1.620	1.836	1.191	0.302	-1.574	-1.158	-1.942	-1.595
	(2.343)	(2.341)	(2.216)	(1.708)	(2.411)	(2.409)	(1.899)	(2.037)
FX intervention/ GDP in t-1	0.0770**				0.137***			
	(0.0348)				(0.0367)			
FX intervention/ GDP in t-2	0.0366				0.0148			
	(0.0346)				(0.0360)			
Change in FX reserves/ GDP in t-1		0.123***	0.0912**	0.0962***		0.150***	0.129**	0.125**
		(0.0324)	(0.0374)	(0.0370)		(0.0344)	(0.0568)	(0.0556)
Change in FX reserves/ GDP in t-2		0.0399	0.0282	0.0346		0.0498	0.0271	0.0353
		(0.0318)	(0.0329)	(0.0332)		(0.0336)	(0.0438)	(0.0447)
Constant	-3.017**	-3.231***	-2.397*	-2.110*	0.233	-1.567	-0.680	-0.959
	(1.239)	(1.240)	(1.386)	(1.201)	(1.314)	(1.293)	(0.974)	(1.161)
Estimation method	GMM	GMM	GMM IV1	GMM IV2	GMM	GMM	GMM IV1	GMM IV2
Frequency	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly	Quarterly
Observations	1,044	1,044	1,044	1,044	1,089	1,088	1,088	1,088
Number of countries	29	29	29	29	30	30	30	30