IMF Working Paper

Financial Dollarization of Households and Firms: Does it Differ?

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INTERNATIONAL MONETARY FUND

IMF Working Paper

African Department

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Authorized for distribution by Gene Leon

January 2019

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Abstract Using a newly complied and extended database from International Financial Statistics, and applying different panel-regression techniques, this paper documents the evolution of households' and firms' dollarization over the past decade. We assess the macroeconomic determinants of dollarization for households and firms and explore differences between high and low-income countries. We find that households' and firms' dollarization in loans and deposits are weakly explained by the currency substitution model, except in low income countries, where inflation plays a significant role. Instead, market development variables such as financial deepening, access to external debt and FX finance as well as other market considerations are key to explain the dynamics of deposits and loans dollarization, regardless of the level of income.These factors can account for a significant fraction of the dollarization, but using a variance decomposition model, there is evidence that a non-negligible portion has yet to be explained. This suggests that there are key determinants for household and firm dollarization that are not fully captured by traditional macroeconomic explanatory variables.

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I.   Introduction

Dollarization—the use of foreign currency as a medium of exchange, store of value, or unit of account by residents—is a notable feature in low-income and emerging market countries of Latin America, Eastern Europe, and parts of Asia and sub-Saharan Africa (SSA) (see Corrales *et al.*, 2015, Neanidis and Savva, 2009).

The economic literature has made great strides in helping us better understand the *determinants* of dollarization, which is often a reflection of past episodes of severe economic and political disruption, with both borrowers and lenders finding security in transacting in a foreign currency (see Levy-Yeyati, 2006)[2]. The chronic macroeconomic instability that has troubled countries in the past has, however, receded in most cases. Conflicts and social turmoil, while not eradicated, are now circumscribed. Institutions—notably the state—have been strengthened, governance is improving, and budgetary and monetary policies are becoming more sustainable in most low and middle-income countries. Similarly, while the financial system remains underdeveloped in many dollarized countries, there are signs of financial deepening emerging. In other words, the macroeconomic foundations are strengthening, and policymakers have gained in credibility, reducing the attractiveness of dollarization in many cases (see Corrales *et al.,* 2015).

However, while the literature has focused on explaining the causes of overall dollarization, it has paid scant attention to the differences in the determinants between household and firm dollarization. Does household dollarization differ from firm dollarization? Do households and firms hold deposits and assets differently in foreign currencies, and if so, why? To gain new insights into the dollarization phenomenon, this study aims to delve more deeply into the impact of dollarization by circling in on dollarization at the household and firm level. This is an important question to answer, in the context of de-dollarization policies for instance (see Kokenyne et al., 2010). The literature has made it clear that dollarization is never easy to reverse, even if the underlying causes have been removed; having more information of the sectoral determinants of dollarization will therefore help better crystalize the policy implications. This is the first study to our knowledge to provide systematic empirical analysis

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[2] The macroeconomic and financial *consequences* of dollarization—notably the advantages but particularly the potential risks it poses to the economy—have been well documented in the economic literature (see Levy-Yeyati, 2006 for instance). Dollarization negatively impacts monetary policy effectiveness and weakens financial stability. It leads to a less effective monetary transmission mechanism, making it hard to use countercyclical monetary policy effectively. At the same time, the central bank's role as a lender of last resort is limited by the availability of currency reserves. Dollarization can induce lending in foreign currency to borrowers with little or no foreign exchange earnings, which potentially weakens balance sheets by creating a significant currency mismatch. By exposing the balance sheets of the public sector, private enterprises, and households, dollarization has historically been a major contributor to banking and exchange rate crises (see Cayazzo et al., 2006). Banks are exposed to losses in the event of a sharp real depreciation, which would drive up the costs of servicing foreign currency debt without necessarily raising the borrowers' income (see Gulde-Wolf *et al.,* 2004).

regarding differences between macroeconomic determinants for households and firms' dollarization across the world. This study therefore provides more targeted policies on how respectively household and firm dollarization can be addressed.

The main findings can be summarized as follows: Both household and firm deposit and loan dollarization tend to be largely driven by structural factors, rather than macroeconomic stability—though this could be because the period covered is one where across the world, inflation and exchange rate policies were largely kept in check in most countries. However, the impact of structural factors differs between households' and firms', and between deposit- and loan dollarization.

In the remainder of this paper, we briefly discuss the relevant literature on dollarization in section II, focusing on household and firms. Section III provides descriptive statistics on the development of dollarization in the last decade. The empirical approach for assessing the determinants of dollarization of households and firms and their contribution to the changes in dollarization levels in SSA over time are illustrated in section IV. Section V concludes.

II.   Literature Review

The literature on dollarization has typically focused only on aggregate (household plus firm) deposit and/or credit dollarization (e.g. Nicolo, Honohan, and Ize, 2005, Levy-Yeyati, 2006, Stix, 2013). This is surprising, as households and firms have in principle different reaction functions to dollarization. This limited research interest by the profession so far is largely a reflection of the lack of cross-sectional data that allows disaggregated analysis. But even the theoretical literature has been rather mute on the differences between household and firm dollarization, with the notable exception of Ize (2005).

The initial focus of the literature was the *currency substitution* angle of the phenomenon, motivated by the history of high inflation in Latin America.[3] While both households and corporations may want to save in FX in an unstable macroeconomic environment, to protect themselves from exchange rate depreciations or high inflation—and therefore the drivers of deposit dollarization may be similar—they may behave differently when it comes to borrowing—the drivers of loan dollarization may differ. Exporting firms for instance, which earn FX, have a natural hedge in FX borrowing and may therefore be more inclined to borrow in foreign currency. Households, on the other hand, typically earn in local currency and may

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[3] The key message from this initial literature was that the elasticity of substitution between domestic and foreign currency is likely to increase when the private sector perceives risks of changes in the value of the domestic currency, which is likely to be the case in episodes involving floating exchange rates (Miles, 1978; Brillenbourg and Schadler 1980; Girton and Roper, 1981; Ortiz, 1983). De Nicoló, Honohan and Ize (2003) also reported that in most cases, surges in dollarization have come in response to clearly identified episodes of monetary chaos that undermined the credibility of the local currency (see also Quispe-Agnoli and Whisler, 2006).

therefore be less willing, and would take more risk, if they borrow in foreign currency. Financial institutions may also be reluctant to lend to households in foreign currency, given the risks involved, creating further impediments to borrow in FX for households (and firms that don't export). Regulations may also impact the behavior of households and firms differently. This is because as a result of the differences in the composition of the balance sheet of households and corporations, regulators often impose different rules on borrowing, often prohibiting households to borrow in FX altogether, while allowing firms to borrow in FX as long as they export (see Cayazzo et al., 2006).[4]

The currency substitution view was, however, challenged by the persistence of dollarization in the 1990s, when inflation rates in dollarized economies declined significantly. Edwards and Magendzo (2003), analyzing the macroeconomic record of dollarized economies, report that inflation has been significantly lower in dollarized economies than non-dollarized ones. Although the currency substitution view attributes this persistence to long-lasting memories of past inflation that induce high inflation after years of price stability, the more recent literature that has emerged perceives dollarization more as an asset substitution phenomenon.

This emerging literature can be grouped into three main categories (Levy-Yeyati 2006):

(i)   *The portfolio view*. This explains dollarization as the optimal portfolio choice for a given distribution of real returns in each currency. Thus, if the domestic deposit yields higher returns than a corresponding dollar deposit, deposit dollarization should be lower. According to this view, households and firms should act in an analogous manner when it comes to loans or deposits in FX. If the differential between domestic deposit rates and foreign deposit rates is high, they will tend to save in domestic currency, while they will prefer to borrow in foreign exchange, all else being equal. This assumes of course no restrictions such as regulations imposed on banks in their capacity to lend on foreign exchange.

(ii)   *The market development view*. This looks at dollarization as the suboptimal response to a market imperfection. Restrictions on the use of foreign exchange reflected in limited current account openness, weak financial deepening (reflected in a low M2 to GDP ratio), with lack of investment opportunities in domestic currency—where economic agents prefer to hold

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[4] Ize (2005) is the only model we are aware of that provides a theoretical framework differentiating between the household and firms. The household sector decides on its deposits based on the minimum variance portfolio choice paradigm, while risk neutral firms choose the currency composition of their borrowing in the presence of default risk. His model highlights that first, depositors (households) choose foreign currency denominated assets motivated by the "safe heaven" portfolio (dollar denominated assets) while borrowers (firms) choose foreign currency denominated loans to maximize their objective function in the presence of default risk. For both types of agents, he finds that policy should concentrate on enhancing the credibility of monetary policy through institutional reform and capacity building to help reduce the risk emanating from dollarization.

currency in FX as the domestic financial sector is shallow and provides few saving options—are examples of market failures that can affect the dynamic of dollarization, with implications for the development of local currency markets. According to this view, households and firms should behave similarly—they will prefer to deposit savings in foreign currency for lack of domestic alternatives, and will be forced to borrow in foreign currency, given the limited options available in local currency. Even companies that have direct access to foreign capital markets—typically large firms—will act in the same manner. Only when domestic capital markets develop do households and firms start to borrow and save more in local currency.

(iii)   *The institutional view*. The idea is that institutional failures can foster dollarization either by generating new distortions or by strengthening the channels highlighted in the first two categories. For example, the quality of institutions affects the credibility of monetary policy and commitment to an exchange rate regime. Political instability resulting from weak institutions, through its large fiscal costs and implications for inflation affects economic agents' incentives to hold foreign currency denominated assets. Again, both households and firms will be impacted by the institutional view.

Not surprisingly, the empirical literature on dollarization of either households or firms has mostly focused on Latin America and more recently on Transition economies, given the availability of data. Most of the studies have also focused on the microeconomic determinants, rather than macroeconomic ones. This is because they often focus on a single country or a set of homogeneous countries for which data is available.

a. Households

While the phenomenon of corporate borrowing in FX could be explained by currency hedging of exporting firms, lending in FX currency to largely un-hedged households is harder to explain, as it poses a risk to financial stability. Only very few empirical studies have provided insights on the foreign currency lending behavior of households.

Pellényi and Bilek (2009) is one of the first studies that looked at the determinants of household loan dollarization, looking at household characteristics. By analyzing survey data of Hungarian households collected in 2008, they find that foreign currency borrowers are not statistically different from domestic currency borrowers with regards to income, age, and gender. In fact, FX borrowing is common in Hungary, and driven mostly by macroeconomic factors: high interest rate spreads, a relatively stable exchange rate and the competition by foreign owned banks. However, foreign currency borrowers tend to be more risk averse and more aware of currency risks. The study shows that being more sophisticated and aware of FX risks triggers risk mitigation tools such as insurance against the currency risk.

Beer, Ongena and Peter (2010), perform a similar analysis of the borrowing behavior of Austrian households. The authors, using multivariate multinomial logit models, on a survey of 2,556 Austrian households estimate the influence of household characteristics, which are split into subjective factors (e.g. risk perception, financial knowledge, and education) and objective factors (e.g. socio-demographics). According to their results, foreign currency borrowers are usually less risk averse, older, financially better educated, and wealthier. This confirms that individuals borrowing in FX are more sophisticated actors, knowing the risks and being able to better deal with them.

A more comprehensive study by Fidrmuc et al. (2013) looks at household survey data for 9 Central and Eastern European Countries (CEEC) over the 2007-2010 period. Using a two-stage Heckman selection approach allows them to relate the denomination of the currency loan to various socio-demographic and economic factors. Their results reveal that foreign currency loans are driven by households' lack of trust in the stability of the local currency and in domestic financial institutions. Moreover, hedging factors (e.g. remittances and household income in FX), as well as expectations of euro adoption increase the probability of foreign currency loans. This finding can be interpreted as supporting the portfolio behavior view of households.

The few studies that looked at household dollarization—while insightful—are largely microeconomic in nature and mostly focused on a single country, looking at household characteristics, and tend to pay less attention to macroeconomic and institutional factors, something that our paper aims to correct.

b. Firms

The empirical research on firm-level data confirms a significant role for currency matching in the choice of the currency denomination by borrowers (Kedia and Mozumdar, 2003). Brown, Kirschenmann and Ongena (2010) consider several micro level determinants of firm borrowing in Bulgaria, by employing firm level loan data between 2003 and 2007. Their model incorporates both supply (bank characteristics) and demand determinants (firm characteristics) of foreign currency loans. Their results show that comparably larger and older firms as well as firms with lower distress costs in case of default demand more foreign currency loans. This confirms again that more sophisticated actors tend to borrow more in FX.

In a separate study, Brown *et al.* (2011) examine the firm- and country-level determinants of foreign currency borrowing by small firms, using information on loans extended to 3,101 firms in 25 transition countries between 2002 and 2005. Their results suggest that foreign currency borrowing is more strongly related to firm-level foreign currency revenues than it is to country-level interest rate differentials. This supports the conclusion that carry-trade behavior is not the key driver of foreign currency borrowing. Overall, the findings endorse the view that firms that

take foreign currency loans are better equipped to bear the corresponding currency risks than is commonly thought.

Similarly, Mora *et al.* (2013), in one of the few studies outside of the CEEC region, investigate what induces small firms in an emerging market economy to borrow in dollars from domestic banks, by looking at Lebanon. The findings complement studies of large firms with foreign currency loans from foreign lenders. Exporters, naturally hedged against currency risk, are more likely to incur dollar debt. Firms also partly hedge themselves by passing currency risk to customers and suppliers. Firms reliant on formal financing (banks and supplier credit) are more likely to contract dollar debt than firms reliant on informal financing (family, friends and moneylenders). Bank relationships, however, do not increase the dollar debt likelihood. And finally, profitable firms are less likely to have dollar debt. Information frictions and limited collateral, therefore, constrain dollar credit even when it is intermediated domestically.

The only study that we are familiar with that looks at both household and firm dollarization is that of Basso *et al.* (2011). They use a newly compiled data set on 24 transition economies and, employing a standard panel as well as a panel-VAR methodology, find that increasing access to foreign funds leads to higher credit dollarization, while it decreases deposit dollarization. Their empirical results show that higher interest rate differentials on loans increases credit dollarization. On the other hand, deposit dollarization decreases when the interest rate differential on deposits increases. Hence interest rate differentials matter. They observe that household credit dollarization is lower compared to corporate dollarization, which might be comforting knowing that households usually have less hedging capabilities. An important distinction between households and firms is that a country's openness to the international economy is contributing to corporate but not to household financial dollarization. Note that the explanatory power of their model is generally lower for household vis-a-vis total and corporate dollarization. Hence, this framework does not seem to capture all the main determinants of household dollarization.

Overall, the findings on the determinants of dollarization of households and firms currently in the literature are mostly aligned with expected behavior. They show that most individuals and entities engaging in dollarization for credit or deposits, are sophisticated, and aware of the risks. However, for our purposes, the above studies may also contain some biases, given their focus on Transition economies. Foreign currency borrowing behavior of individuals and firms is determined not only by economic and monetary policies, but also by more general political developments in CEEC countries, where accession to the European Union and/or to EMU is an important subject in the political agenda of governments. Additionally, once lenders get used to foreign currency deposits, it may take a rather long time to change their behavior again, which, in turn, indirectly impacts borrowing in foreign currency. Hence, both path dependence and expectations matter for the determination of the credit currency structure. We therefore aim to extend the scope of these studies, by building on the model of Corrales *et al.* (2015) and

aim to offer a broad cross-country perspective on the drivers of dollarization by differentiating households from corporations.

III. Dynamics of Households and Firms' Dollarization

Using the International Financial Statistics (IFS) database of the International Monetary Fund, we calculated deposit and loan dollarization, for households and firms, as the share of FX deposits/loans of total households/firms' deposits/loans (e.g. firms' loans dollarization equals firms' loans in FX as percent of total firms' loans). Therefore, dollarization measures are calculated separately for each group (appendix A2 covers the data source for each variable). The database includes countries from different regions and levels of income (see appendix A for more details) and it covers the period from 2001 to 2016. One caveat to our study is that many countries do not have refined data on household and firm credit or deposits, meaning that not all countries were included in the regressions. Another word of caution is that in many countries, particularly developing ones, individuals and firms may not be properly captured, potentially biasing some of the findings. Many big firms in developing and emerging countries belong to only one individual and depending on how their loans and deposits are registered (under the name of the firm of the owner or the individual directly) and treated for statistical purposes, this may impact the results.

Households and firms can be considered, in most of the countries, as the most important agents for financial activity. Between 2001 and 2016, households and firms combined represented 87.1 percent of total deposits and 92.1 percent of total loans in the financial sector, excluding the Central Banks. Moreover, in terms of dollarization, they represented 57.5 percent of deposits and 68.7 percent of deposits and loans respectively (Table 1). The level of dollarization for both deposits and loans appear greater for firms than for households. This is not a surprise, and could reflect that (exporting) firms are included in the data. As already discussed in the literature, these firms are more likely to both have access to FX, and to earn FX. Also, it is clear from the data that households have on net more deposits than loans in dollars. While we do not have the breakdown by households, it is likely that households are more conservative, and hold dollars as a form of saving. Firms on the other hand, are net borrowers in dollars, with significantly higher loans in foreign exchange.

Table 1. Financial Sector: Loans and Deposits by Sector for all countries*.
Average 2001-2016

	% of Total		Dollarization (%)	
	Deposits	**Loans**	**Deposits**	**Loans**
Other Financial Corporations	5.2	2.0	19.2	16.3
State and Local Government	1.2	0.8	9.3	8.0
Public Non-Financial Corporations	6.5	5.2	23.7	20.9
Private Sector: Firms	*30.9*	*75.0*	*30.7*	*47.7*
Private Sector: Households	*56.2*	*17.1*	*26.8*	*21.0*

Source: International Financial Statistics – IMF, author's calculations
* Excludes observations for which dollarization is 0 across all five economic sectors

In terms of the evolution of dollarization and excluding countries with 0 and 100 percent level of dollarization[5], it seems that households have reduced their median level of deposits and loans denominated in FX between the first and second half of the period from 2001 to 2016 (see figure 1). A similar result is found for firm's deposit dollarization, but the opposite is true for firms' FX loans (Panel 1). Since the sample is divided both before and after the world financial crisis and calculating the ratios of deposit and loan dollarization imply converting FX values into domestic currency, it is possible that the depreciation of domestic currencies, experienced after the crisis by many developing and transition economies, could explain the expansion on firm's loan dollarization. Alternatively, the prevailing low interest rate environment following the global financial crisis—and the search for yield—may have encouraged local companies to borrow in foreign currency, at rates that are low by historic standards.

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[5] Countries with 0 or 100 percent dollarization do not provide information for the analysis of the determinants of financial dollarization since changes in economic variables will not affect these values. This excludes countries like Ecuador, which are fully dollarized, or in the context of SSA, the CFA countries, where deposit and credit dollarization are not permitted by law. The same applies to Lesotho and Swaziland, which have restrictions on holdings of FX deposits and credits. In these countries, banks are not allowed to take FX deposits or lend in FX, and capital controls ensure that FX does not find its way into the financial system. This fully explains why there is no deposit or loan dollarization in these countries.

Figure 1. Private Sector Financial Dollarization
(Foreign currency deposits/loans as % of total. Excludes 0 or 100 dollarization)

a. **Firms: Deposits**

b. **Firms: Loans**

c. **Households: Deposits**

d. **Households: Loans**
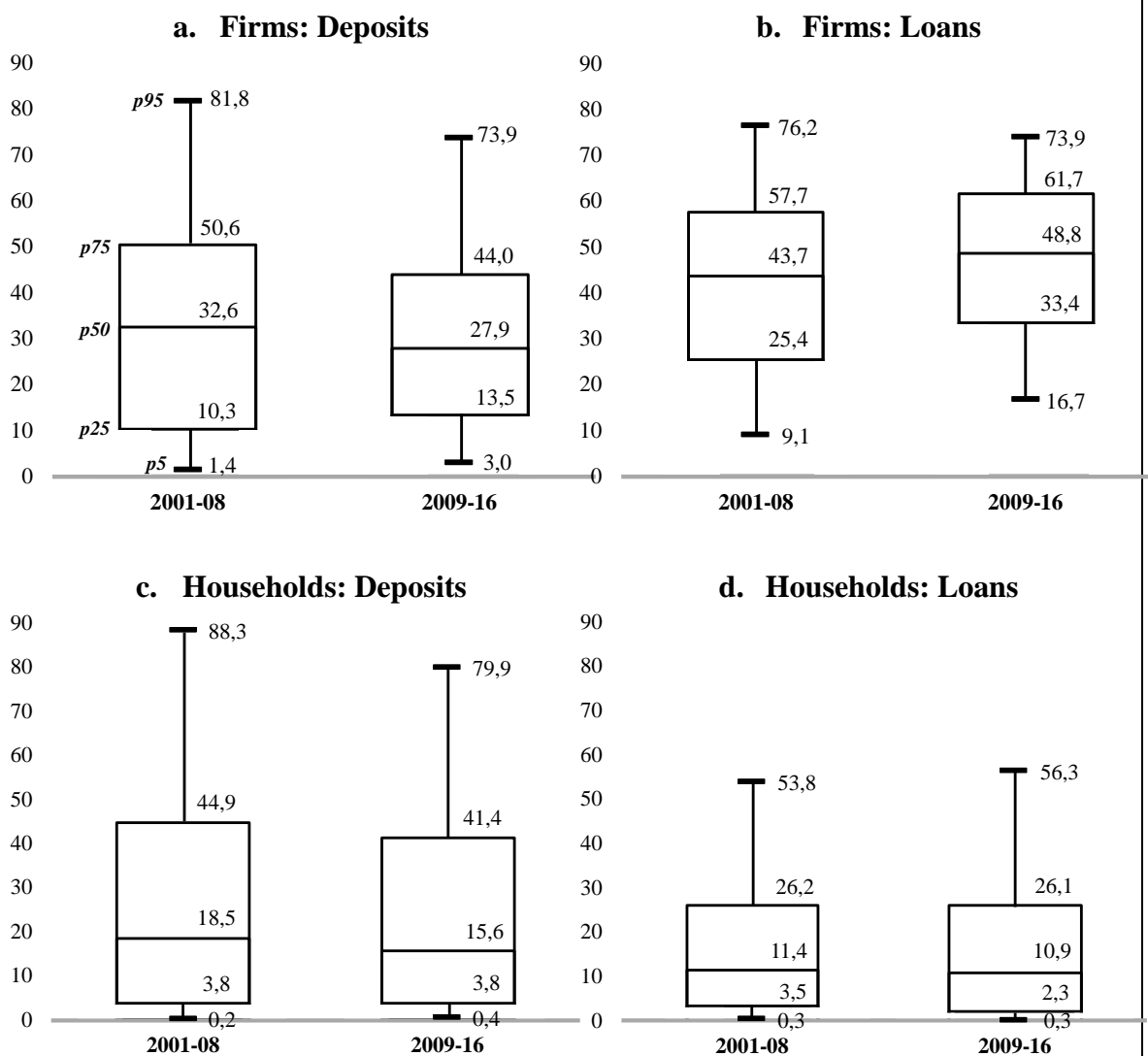
Source: International Financial Statistics Database – IMF, authors calculations

Differences of dollarization by level of income

Disaggregating the data by level of income seems to provide more insights into the drivers of dollarization, since both deposit and loan dollarization differ significantly between higher and

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lower income[6] countries (Table 2). Based on World Bank's classification of countries by level of income, on average, low income countries show a greater level of deposit dollarization for households and firms. Several lower income countries have experienced episodes of hyperinflation, in part owed to political instability. Hence, these larger levels of deposit dollarization seem to reflect households and firms' decision on hedging by using FX deposits as store of value. On the other hand, loan dollarization appears significantly higher in higher income countries. This may reflect the presence of large companies with better financial capabilities and revenues in FX currency that allow them to take FX loans.

			Higher Income	Lower Income	Diff
Deposits	Firms	Average	28,8	37,2	-8.4 ***
		S.D.	21,2	25,5	
		Obs.	774	552	
	Households	Average	23,1	31,6	-8.5 ***
		S.D.	26,0	27,6	
		Obs.	817	589	
Loans	Firms	Average	51,3	37,5	13.8 ***
		S.D.	17,0	20,5	
		Obs.	931	772	
	Households	Average	15,9	21,2	-5.3 ***
		S.D.	17,8	20,1	
		Obs.	623	350	

Table 2. Financial Dollarization by Level of Income*. 2001-2016

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Source: International Financial Statistics – IMF, author's calculations
* Excluding 0 or 100 percent levels of dollarization

Figure 2 shows loan dollarization on the x-axis and deposit dollarization in the y-axis. Most firms in both lower and higher income countries exhibit larger levels of loans dollarization relative to deposits dollarization. However, the vast majority is clustered around the 45-degree line, which suggests some precaution in terms of possible balance sheet effects. Nonetheless, there is a non-negligible share of countries where firms' loans in foreign currency largely exceed their deposits in foreign currency, exposing them to currency risks. Households in both types of countries are more inclined to have deposits in foreign currency rather than loans. This

[6] The World Bank classifies countries into four groups by level of income: high, upper-middle, lower-middle and low income. We combine the first two and the last two to create two groups: higher and lower income. The main objective of creating the two groups is to have a large enough sample size. When splitting the sample into the four income groups, the means of high and upper-middle income groups, as well as the means of low and lower-middle income, appear not to be significantly different, suggesting that it is fine to classify them accordingly. However, in the econometric analysis no high-income country enters the effective sample (see appendix A).

could be due to bank systems allowing to take foreign currency deposits but not extending loans in a currency different than the domestic one.

Figure 2. Correlation between Loans and Deposits Dollarization. Average 2001-2016
(Foreign currency deposits/loans as % of total. Excludes 0 or 100 dollarization)

a. Firms

b. Households

Source: International Financial Statistics – IMF, author's calculations
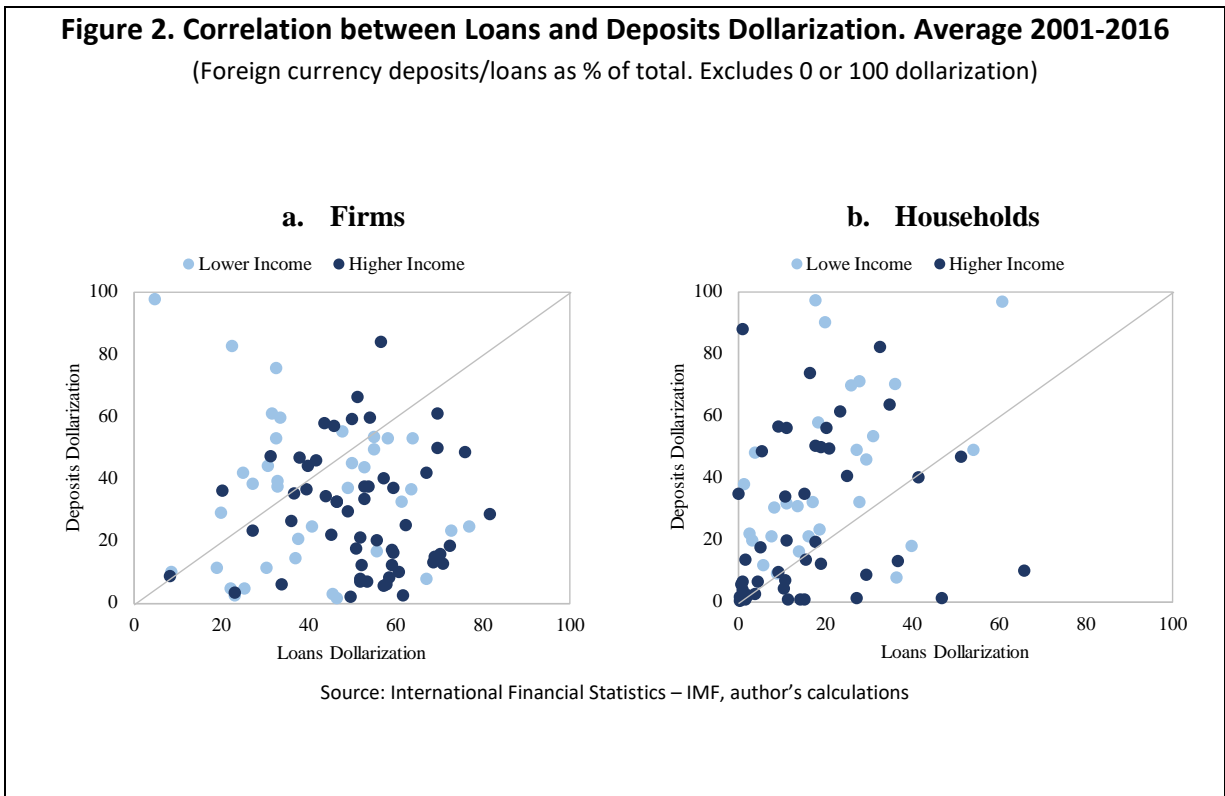
A correlation analysis of key macroeconomic variables (Figures 3 and 4) suggests that firms' dollarization of deposits and loans are mainly correlated with financial market development (proxied by M2 to GDP ratio) for both higher and lower income countries. Correlation between firms' loan dollarization and inflation is stronger for higher income countries, but the correlation of firms' deposits dollarization and inflation is stronger for lower income countries. In the case of household loan dollarization, lower income countries show larger correlations with macroeconomic variables than higher income countries. Household deposits dollarization appears strongly correlated with financial market development. The econometric section of this paper explores these results.

Figure 3. Correlations: Firms Dollarization and Macroeconomic Variables. Avg. 2001-16

a. Firms Loans
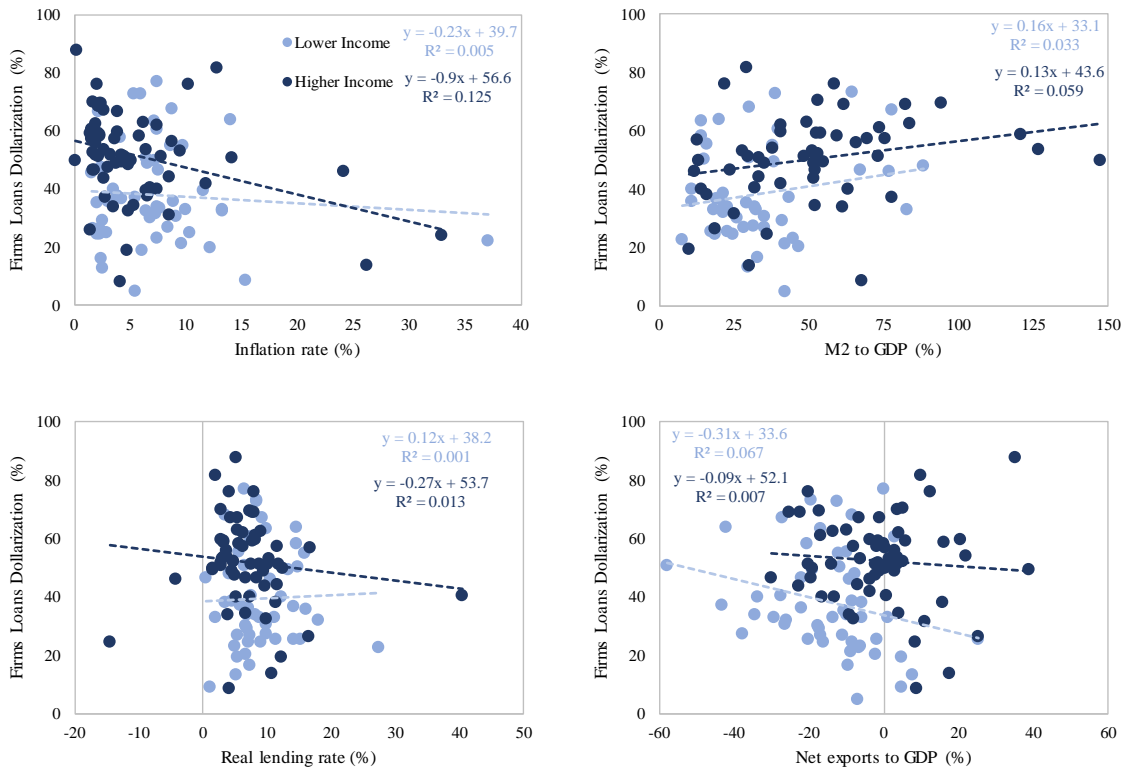
b. Firms Deposits
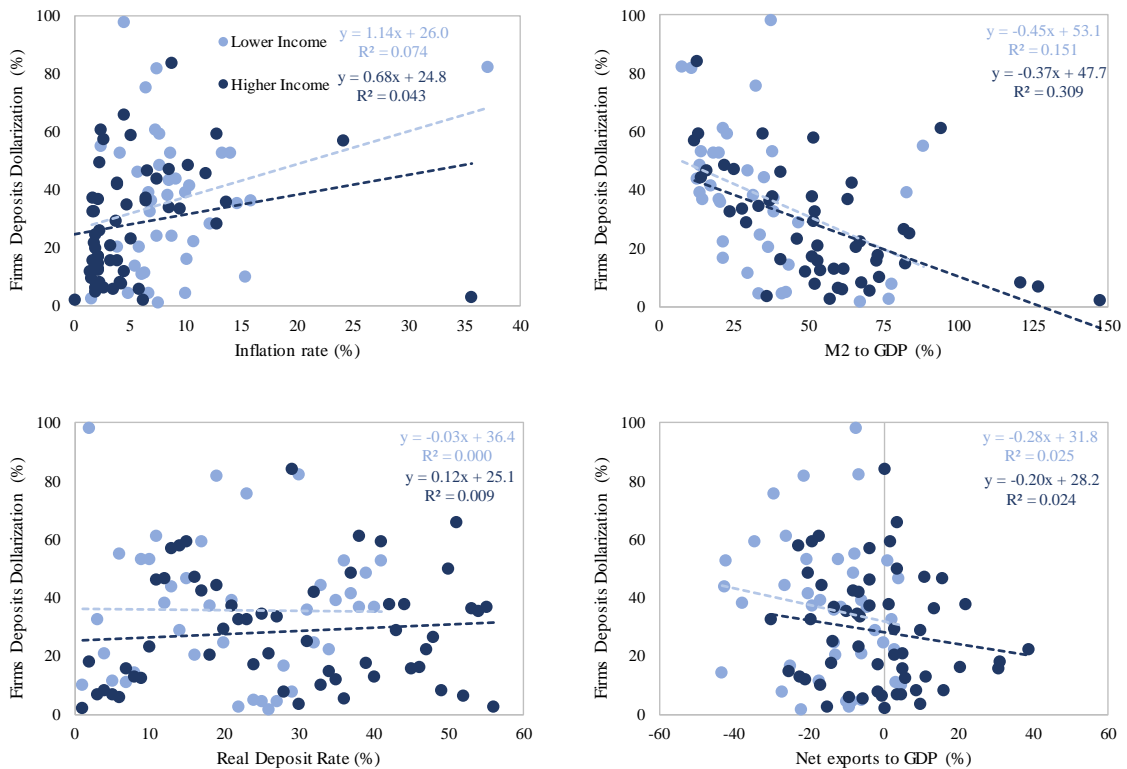
Source: International Financial Statistics – IMF, author's calculations

Figure 4. Correlations: Households Dollarization and Macroeconomic Variables. Avg. 2001-16

a. Households Loans

y = 0.19x + 17.4
R² = 0.006
y = 0.03x + 15.5
R² = 0.000

y = -0.22x + 27.7
R² = 0.164
y = -0.13x + 22.9
R² = 0.052

y = 0.84x + 11.8
R² = 0.104
y = 0.84x + 10.3
R² = 0.066

y = -0.36x + 14.5
R² = 0.124
y = -0.05x + 15.7
R² = 0.002

b. Households Deposits

y = 0.80x + 25.5
R² = 0.030
y = 1.08x + 15.9
R² = 0.087

y = -0.55x + 53.4
R² = 0.177
y = -0.54x + 51.6
R² = 0.390

y = 0.56x + 32.6
R² = 0.003
y = -0.12x + 21.9
R² = 0.000

y = -0.44x + 26.2
R² = 0.039
y = -0.30x + 21.9
R² = 0.031

Source: International Financial Statistics – IMF, author's calculations

16
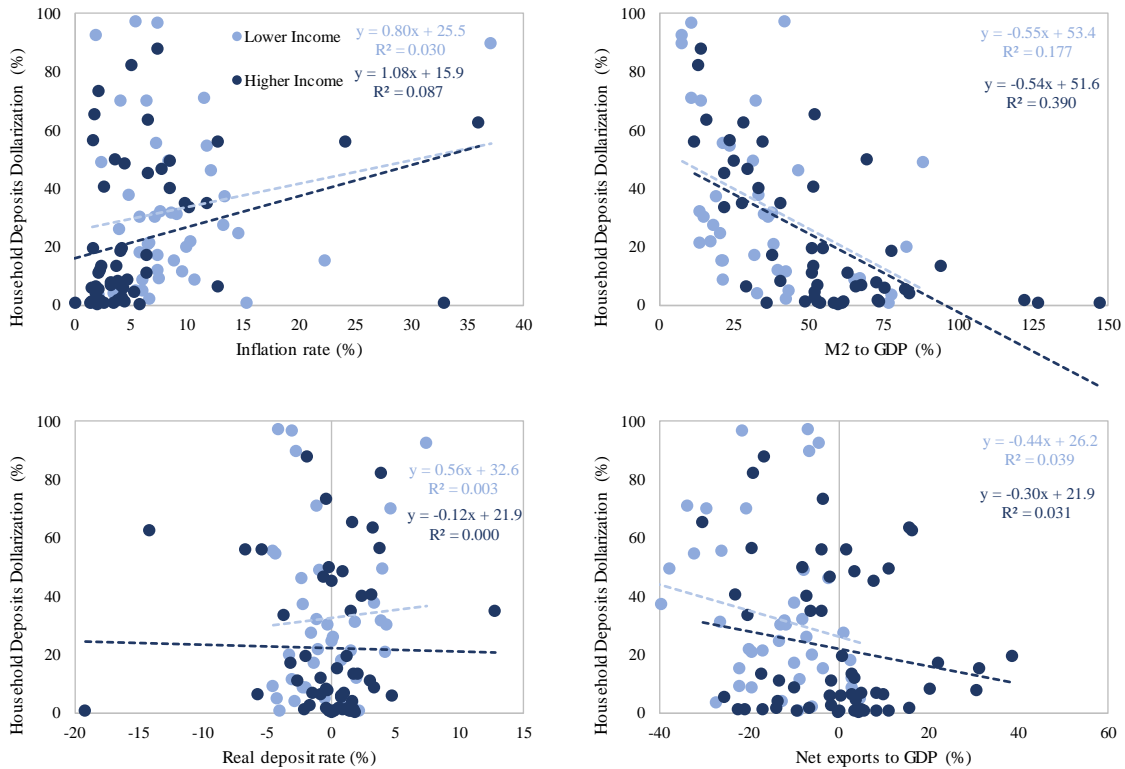
IV. Determinants of Households' and Firms' Dollarization

a. Data and Model

The effective dataset of econometric analysis is an unbalanced panel consisting of 52 (39) countries for households' deposit (loan) dollarization and 49 (63) countries for firms' deposit (loan) dollarization. While dollarization data are available for more countries, the effective sample is reduced because we exclude countries with zero values or full dollarization (as this may be driven by legal requirements for instance) and some countries that have missing control variables[7].

The baseline estimation model is given by:

$$Dollar_{i,t} = \alpha_i + \beta_1 \cdot CurrSubs_{i,t} + \beta_2 \cdot Portfolio_{i,t} + \beta_3 \cdot MktDev_{i,t} + \beta_4 \cdot Access_{i,t}$$
$$+ \beta_5 \cdot Inst_{i,t} + \beta_6 \cdot Controls_{i,t} + \varepsilon_{i,t}$$

where $Dollar_{i,t}$ is the measure of dollarization given by deposits or loans in foreign currency as percent of the corresponding total for both households and firms. $CurrSubs_{i,t}$ groups the variables capturing the currency substitution dimension—the negative relation between the demand for local currency and inflation—proxied by the inflation rate and nominal exchange rate depreciation against the US dollar. Overall, inflation and nominal exchange rate depreciation are expected to positively impact deposit dollarization, though the bearing on loan dollarization is ambiguous and context specific. Household's and firm's preference to take on local or FX loans will depend on the conditions (rates, duration) with the relative attractiveness depending on the local circumstances. $Portfolio_{i,t}$ represents the portfolio optimization considerations—expected return of holding foreign exchange—estimated by the deposit or loan interest rate spreads to the US dollar and relevant real interest rates. Per this model, if the domestic deposit yields higher returns than a corresponding dollar deposit, deposit dollarization is lower, while loan dollarization should be higher (and vice-versa).

Similarly, higher domestic real deposit rates should be associated with lower levels of deposit dollarization, and a higher level of loan dollarization. $MktDev_{i,t}$ proxies for market developments and externalities that lead to risk mispricing affecting dollarization. These are captured by the Chinn-Ito index of capital account restrictions, external debt to GDP and M2 to GDP ratios, as well as GDP per capita. Lower capital account openness should go along with restrictions on the use of FX and discourage both deposit and loan dollarization. Higher external debt to GDP is likely to lead to higher balances in foreign exchange by the respective

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[7] See appendix A Tables A1a – A1d for the complete list of countries included in the regressions, sources (Table A2) and descriptive statistics (Table A3) of included variables. Including countries with 0 and 100 dollarization do not affect the results significantly

entities which owe this debt[8]. $Access_{i,t}$ represents variables reflecting ease of access to foreign exchange—such as availability of export earning industries—and it is proxied by net exports to GDP. This variable has an ambiguous impact on deposit dollarization. While it could be expected that the ability to keep money overseas should reduce domestic deposit dollarization, the ability (of banks) to mobilize resources in foreign exchange may increase their appetite for passing on the exchange rate risk while making use of (potentially cheaper) foreign funding. $Inst_{i,t}$ stands for institutional characteristics that influence dollarization, including the exchange rate regime and the political freedom (Honig, 2009).

Fixed exchange rates—if credible—could lead to indifference between holding deposits in domestic currency or FX and thus likely lead to lower dollarization, given the often more cumbersome procedures and higher fees with FX holdings. The effect of a floating exchange rate is ambiguous: if purchasing power is largely determined by import prices and the domestic currency fluctuates significantly, then there is a higher risk of keeping domestic currency. The opposite also applies—if purchasing power is mostly a function of goods prices in local currency, FX holdings become riskier. $Controls_{i,t}$ are relevant control variables such as the population size. α_i are potential country fixed effects (controlling for time invariant cross-country differences), and $\varepsilon_{i,t}$ is an independent identically distributed (iid) error term. Variables are either measured in percent (inflation, exchange rate depreciation, real interest rates and interest rate spreads), percent of GDP (external debt, M2, and net exports), or reflect either an index (KA index, polity) or a dummy (income level). GDP per capita is measured in thousands of US dollars and population in millions of inhabitants. Therefore, coefficient estimates are interpretable as the change in the share of dollarization in response to a one unit change in the respective explanatory variable.

b. Model Selection

Previous studies on dollarization have discussed some potential issues on the econometric analysis of this topic. Generally, dollarization is affected by its persistence and endogeneity of some explanatory variables. In order to circumvent these problems, some authors have made use of cross-sectional OLS regressions and lagged variables (De Nicolo *et al.,* 2003 and Levy-Yeyati, 2006). Additionally, to account for possible autocorrelation in the error term, other authors have employed annual panel data regressions and standard errors, or have modeled it explicitly (Neanidis and Savva, 2009 and Basso *et al.,* 2011). With the purpose of deriving a baseline model that considers these potential concerns, we estimate various models with all regressors lagged by one period to minimize potential endogeneity.

Tables 3 to 6 show the results for of deposit and loan dollarization for household and firms, and for each we consider eight models to ensure the robustness of results. Models 1 through 5

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[8] These proxies for the market development view reflect the positive correlation between the probability of default and the real exchange rate, and imperfect information on the currency composition of the borrower such as implicit debtor guarantees that favor FX over national currencies.

are pooled OLS regressions with time dummy variables (model 2), a trend variable (model 3), a dummy for income level (model 4) and an interaction term between income level and trend (model 5). Model 6 performs an Arellano-Bond estimation and includes the lag of the specific case of dollarization as regressor, which, as expected, turns to be positive and significant, while most of the other variables are greatly reduced in their explanatory power. This implies that slow-moving factors that affect the long-run level of dollarization tend to be washed out, as they are captured by the lagged dependent variable. Given the heterogeneity across countries, and the results of Breusch-Pagan LM test strongly rejecting the poolability of the data, we also estimate random (model 7) and fixed effects models (model 8) correcting for the presence of heteroskedasticity and autocorrelation in the standard errors[9]. In addition, potential collinearity of the independent variables is a concern. To better understand whether this might have any repercussions for the coefficient estimates we make use of two test statistics. First, we compute variance inflation factors, a measure of multicollinearity commonly used. Variance inflation factors remain always below 2.5 for all variables. Second, the condition number test for the dollarization regression yields an index value of 5.30 for deposit dollarization and 5.98 for loan dollarization, suggesting that there is no support for multicollinearity (see Annex 4). We also assess the variation in the coefficient estimates by dropping one variable at a time from the baseline regression. While there are variations, the coefficients remain relatively stable and there is no instance of a swing from a positive significant to a negative significant coefficient value, or vice versa. This suggests that there are likely limited implications from collinearity.

Overall, the goodness of fit measures when available are relatively low. This means that while the factors in the econometric model can account for a significant fraction of the dollarization, there is still a non-negligible portion of dollarization yet to be explained, suggesting that there are some unique features which are not fully captured by traditional explanatory variables. As we saw from the literature review, micro-data variables such as an economic agents' financial sophistication, age, etc. which matters for deposit and loan dollarization are not captured in our model.

Deposit dollarization: Households vs. Firms[10]

The results on deposit dollarization show great similarities between households and firms and one interesting difference (Table 3 and 4). In general, across model specifications, market development variables appear to be the most crucial factors driving deposit dollarization for both households and firms. Financial deepening, measured by M2 to GDP ratio appears highly significant, suggesting that, on average, an increase of one standard deviation in this variable (i.e. 21.7 percent) is associated with a reduction on both households and firms' deposit

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[9] Wald tests strongly reject homoskedasticity. Hence, standard errors are clustered by country.

[10] For the discussion on differences between households and firms' dollarization, Wald tests were performed for the null hypothesis of the coefficient for variable X in firms' deposits/loans dollarization being equal to the coefficient of the same variable X in households' deposits/loans dollarization. Results are available upon request.

dollarization of about 13 percentage points (pps). This is also what was found in previous studies such as Corrales et al. (2015). As financial sector development takes hold and more financial products in domestic currency are offered, dollarization declines. Financial sector deepening not only captures the diversity of savings products available, but also provides a more stable environment requiring less dollarization. Capital account openness appears particularly important for firms across all specifications, implying that less restrictions are associated with larger levels of dollarization. As previously found in the literature (e.g. Levy-Yeyati, 2006), results show that larger levels of external debt as percent of GDP are related to greater levels of deposit dollarization. On average, an increase of one standard deviation in this variable (i.e. 31.8 percent) increases deposit dollarization for households and firms in about 3.2 pps. Net exports as percent of GDP, a proxy for access to foreign exchange, appears as an important factor reducing deposit dollarization for both households and firms. Increasing net exports as share of GDP by one standard deviation (i.e. 16.8 percent) reduces dollarization by 1.7 pps.

For the two groups, the spread between domestic and US deposit rates appears significant in the non-Pooled OLS models. The results suggest that a one standard deviation increase in the spread (i.e. 11.5 percent) decreases deposit dollarization by 1.4 pps, on average across the two groups, supporting the portfolio view described earlier. Currency substitution considerations also appear relevant in random and fixed effects models. Currency substitution model does not appear to be an import explanatory factor in explain deposit dollarization of households and firms. For firms, depreciation against the US dollar increase deposit dollarization significantly, while for households the relevant variable seems to be inflation, but results are not statistically strong. This could be due to the period covered which overall, including in developing countries, was a disinflationary period, with inflation as a result having less of an impact on deposit dollarization. Finally, another explanation is that individuals hedge themselves through other means than just depositing their money in FX, but by buying real assets such as houses, cars, etc.

There is one interesting difference between the two set of regressions (tables 3 and 5). For households, better institutions are consistently, across models, associated with lower levels of dollarization, while this variable seems irrelevant for firms'. This result suggests that for households, which are less sophisticated than firms and typically less resilient, stronger institutions, by reducing risks may discourage dollarization (see Honig, 2009 for similar findings). Firms, however, having both the sophistication and the necessary skill set to hedge themselves from certain risks, are less dependent on strong institutions. This result could suggest that financial market development variables also captures relevant institutional conditions for firms.

Table 3. Deposits Dollarization: Firms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			OLS			GMM		
	Pooled	Year Dum.				AB	RE-AR(1)	FE-AR(1)
Currency Substitution								
Inflation - Average	0.15	0.21	0.19	0.11	0.13	0.02	-0.04	0.03
	(0.13)	(0.24)	(0.20)	(0.20)	(0.20)	(0.04)	(0.03)	(0.04)
Depreciation agaisnt USD - average	0.04	-0.01	-0.01	0.03	0.02	0.01	0.06***	0.10***
	(0.08)	(0.09)	(0.08)	(0.06)	(0.07)	(0.03)	(0.02)	(0.03)
Portfolio Model								
Deposit rate spread to U.S	-0.16**	-0.17	-0.12	-0.14	-0.13	-0.16***	-0.09***	-0.11***
	(0.08)	(0.11)	(0.08)	(0.08)	(0.09)	(0.04)	(0.02)	(0.02)
Real deposit rate: $i(t) - infl(t+1)$	0.11	0.18	0.11	0.08	0.09	0.07	-0.05	-0.03
	(0.11)	(0.14)	(0.12)	(0.12)	(0.12)	(0.04)	(0.03)	(0.05)
Market Development								
Chinn-Ito index	3.27***	3.23*	3.24*	3.13**	3.14**	0.86**	1.86***	1.70*
	(0.54)	(1.65)	(1.61)	(1.55)	(1.56)	(0.44)	(0.39)	(0.93)
External Debt % of GDP	0.14***	0.16**	0.15**	0.13*	0.13*	0.02	0.09***	0.05***
	(0.03)	(0.07)	(0.06)	(0.06)	(0.06)	(0.01)	(0.02)	(0.01)
M2 % of GDP	-0.42***	-0.43***	-0.43***	-0.45***	-0.45***	-0.09*	-0.35***	-0.14
	(0.04)	(0.11)	(0.11)	(0.11)	(0.11)	(0.05)	(0.04)	(0.09)
GDP p.c.	-0.06	-0.15	-0.13	0.58	0.51	0.06	-0.17	-0.73
	(0.20)	(0.68)	(0.69)	(0.99)	(1.01)	(0.19)	(0.22)	(0.75)
Access to FX Finance								
Net Exports % of GDP	-0.03	0.01	0.01	-0.04	-0.04	-0.03	-0.09***	-0.15***
	(0.06)	(0.15)	(0.15)	(0.14)	(0.14)	(0.03)	(0.04)	(0.03)
Institutions								
Dummy: Defacto floating regime = 1	0.30	-0.19	-0.52	0.53	0.48	0.28	0.47	-0.75
	(1.92)	(3.41)	(3.17)	(3.22)	(3.16)	(0.78)	(0.67)	(0.71)
Polity Score	-0.19	-0.18	-0.18	-0.23	-0.22	-0.15	0.09	0.08
	(0.15)	(0.33)	(0.33)	(0.34)	(0.34)	(0.12)	(0.11)	(0.14)
Controls								
Population	-0.06***	-0.07	-0.07	-0.08*	-0.08*	-0.00	-0.11***	0.16***
	(0.02)	(0.04)	(0.04)	(0.04)	(0.04)	(0.02)	(0.02)	(0.04)
Trend			0.56*					
			(0.32)					
Dummy Income: High & upper middle = 1				-7.47	-10.30			
				(8.33)	(8.96)			
Dummy Income * Trend					0.41			
					(0.48)			
Firms Deposits Dollarization *(t-1)*						0.73***		
						(0.06)		
Constant	45.24***	47.89***	41.34***	46.06***	46.35***	11.51***	44.20***	35.03***
	(2.55)	(7.44)	(7.18)	(7.34)	(7.38)	(3.03)	(2.04)	(2.62)
Observations	621	621	621	621	621	582	621	621
R-squared	0.400	0.412	0.408	0.410	0.412			
Wald-test, p-value		0.0263						
Number of groups						49	49	49
R-sq. within								0.134
Heteroskedasticity, p-value							0	
Autocorrelation, p-value							0	
Arrelano-Bond AR(1), z-value						-4.380		
Arrelano-Bond AR(2), z-value						1.140		

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4. Deposit Dollarization: Households

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			OLS			GMM		
	Pooled	Year Dum.				AB	RE-AR(1)	FE-AR(1)
Currency Substitution								
Inflation - Average	-0.12	-0.14	-0.09	-0.15	-0.13	0.08**	-0.05*	0.12*
	(0.14)	(0.28)	(0.24)	(0.25)	(0.25)	(0.04)	(0.03)	(0.07)
Depreciation agaisnt USD - average	-0.07	-0.07	-0.11	-0.08	-0.09	-0.06***	-0.00	0.04
	(0.08)	(0.09)	(0.08)	(0.07)	(0.08)	(0.02)	(0.01)	(0.03)
Portfolio Model								
Deposit rate spread to U.S	-0.11	-0.08	-0.08	-0.10	-0.09	-0.14***	-0.07***	-0.13***
	(0.08)	(0.12)	(0.09)	(0.09)	(0.09)	(0.03)	(0.01)	(0.02)
Real deposit rate: $i(t) - infl(t+1)$	0.06	0.08	0.06	0.04	0.05	0.06*	-0.04	-0.01
	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.03)	(0.03)	(0.04)
Market Development								
Chinn-Ito index	2.63***	2.62	2.66	2.58	2.60	-0.23	0.98***	0.08
	(0.59)	(1.91)	(1.88)	(1.86)	(1.87)	(0.34)	(0.34)	(0.45)
External Debt % of GDP	0.19***	0.20**	0.19**	0.18**	0.18**	0.02***	0.06***	0.04***
	(0.03)	(0.08)	(0.07)	(0.07)	(0.07)	(0.01)	(0.01)	(0.01)
M2 % of GDP	-0.65***	-0.66***	-0.66***	-0.67***	-0.67***	-0.02	-0.51***	-0.20***
	(0.04)	(0.11)	(0.11)	(0.12)	(0.12)	(0.03)	(0.03)	(0.06)
GDP p.c.	0.99***	0.90	0.91	1.29	1.24	-0.01	0.95***	-0.78
	(0.21)	(0.73)	(0.72)	(1.08)	(1.14)	(0.12)	(0.13)	(0.47)
Access to FX Finance								
Net Exports % of GDP	-0.23***	-0.20	-0.21	-0.23	-0.22	-0.03	-0.10***	-0.20***
	(0.06)	(0.18)	(0.17)	(0.17)	(0.17)	(0.02)	(0.03)	(0.06)
Institutions								
Dummy: Defacto floating regime = 1	-4.62**	-4.76	-5.20	-4.55	-4.62	-0.54	-0.00	-1.75
	(2.05)	(4.44)	(4.24)	(4.22)	(4.17)	(0.55)	(0.56)	(1.17)
Polity Score	-0.89***	-0.90***	-0.89***	-0.90***	-0.89**	-0.15	-0.32***	-0.28***
	(0.16)	(0.33)	(0.33)	(0.34)	(0.34)	(0.11)	(0.09)	(0.09)
Controls								
Population	-0.08***	-0.09***	-0.09***	-0.09***	-0.09***	-0.03*	-0.08***	-0.05
	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.01)	(0.01)	(0.03)
Trend			0.45					
			(0.35)					
Dummy Income: High & upper middle = 1				-3.68	-5.51			
				(9.94)	(9.86)			
Dummy Income * Trend					0.26			
					(0.49)			
Households Deposits Dollarization *(t-1)*						0.85***		
						(0.04)		
Constant	48.14***	42.75***	45.12***	48.93***	49.13***	5.94**	42.01***	44.51***
	(2.79)	(8.66)	(7.78)	(8.67)	(8.78)	(2.40)	(1.81)	(1.55)
Observations	661	661	661	661	661	623	661	661
R-squared	0.473	0.479	0.477	0.475	0.475			
Wald-test, p-value		0.618						
Number of groups						52	52	52
R-sq, within								0.201
Heteroskedasticity, p-value							0	
Autocorrelation, p-value							0	
Arrelano-Bond AR(1), z-value						-2.766		
Arrelano-Bond AR(2), z-value						-0.927		

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Loan dollarization: Household vs. Firms

Contrary to deposit dollarization, the results for the determinants of households' and firms' loan dollarization show significant differences (Table 5 and 6). One limitation of our analysis is that borrowing is often constraint by banking regulations that is not directly captured in our regressions due to lack of data. In some countries, banking regulations for households differ from firms when it comes to FX borrowing (see Cayazzo et al., 2006). Variables capturing the currency substitution view are all statistically insignificant. This suggests that borrowing by households or firms in foreign currency is not directly determined by the inflationary environment, or (risks from) exchange rate depreciation. Regarding the portfolio view, the variables are largely insignificant. In other words, the relative cost of borrowing in foreign exchange cannot explain why households or firms borrow in FX (see also Mengesha and Holmes, 2013).

For households, M2 to GDP ratio is the only variable consistently significant and with a negative sign across almost all model specifications, suggesting that an increase in this ratio by one standard deviation (i.e. 21.7 percent) decreases households' loan dollarization by 3.4 pps. In other words, having access to a deep and diverse banking system tends to reduce FX loan dollarization, and encourages borrowing in local currency. In contrast, this variable seems to play no significant role as determinant of firms' loan dollarization. Within market development variables, only capital account openness exhibits some explanatory power for firms' loan dollarization, with an increase in one standard deviation (i.e. 1.4 units) representing, on average, an increase of 4.7 pps in firms' loan dollarization.

An open capital account encourages borrowing in FX for firms, though this impact is much weaker for households, where it is barely statistically significant. This could be explained by the ease with which firms can borrow abroad, which is not the case for households that face a higher hurdle rate. Similarly, net exports as percent of GDP does appear significant and with the expected negative sign, explaining firms' loan dollarization across models, while for households, this sign is mostly not significant. This suggest that for firms, the ability to earn FX reduces the incentives to borrow in FX, while for households, which presumably earn very little in FX (or even nothing), this is not a significant factor in explaining loan dollarization. The exchange rate policy of a country has no statistically significant impact on the borrowing in FX by firms, which may be a reflection of firms being sophisticated. For households, the floating exchange rate reduces, as expected, the borrowing in FX, as a floating exchange rate increases the risks of borrowing in FX (see Garcia Pascual et al., 2006 for micropudential measures of how to reduce the FX related-risks. In this context, the analysis of Cerutti, Claessens and Laeven (2015), looking at the period 2001-2013 study corroborates our findings. Their analysis that the usage of macroprudential policies, especially foreign exchange related macroprudential ones, are common among emerging and to a lesser extent lower income country corroborates our findings. In AE, where dollarization is less of a concern, borrower-

based macro-prudential policies are instead preferred. The quality of institutions, however, has neither an impact on the FX borrowing of firms or households.

Table 5. Loans Dollarization: Firms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			OLS			GMM		
	Pooled	Year Dum.				AB	RE-AR(1)	FE-AR(1)
Currency Substitution								
Inflation - Average	-0.08	-0.04	-0.06	-0.11	-0.12	-0.01	-0.03	0.08*
	(0.10)	(0.23)	(0.20)	(0.20)	(0.19)	(0.06)	(0.03)	(0.04)
Depreciation agaisnt USD - average	-0.00	-0.03	-0.03	-0.01	0.00	0.01	-0.01	0.03
	(0.06)	(0.06)	(0.05)	(0.04)	(0.04)	(0.02)	(0.01)	(0.04)
Portfolio Model								
Lending rate spread to U.S	0.03	0.03	0.05	0.05	0.05	0.03	0.04***	-0.02
	(0.06)	(0.06)	(0.05)	(0.04)	(0.04)	(0.02)	(0.01)	(0.05)
Real lending rate: $i(t) - infl(t+1)$	-0.10	-0.08	-0.10	-0.09	-0.09	-0.05	-0.01	-0.10*
	(0.08)	(0.13)	(0.12)	(0.10)	(0.10)	(0.05)	(0.03)	(0.05)
Market Development								
Chinn-Ito index	3.84***	3.85***	3.84***	3.85***	3.85***	0.26	0.73**	-1.18
	(0.46)	(1.17)	(1.16)	(1.20)	(1.20)	(0.32)	(0.31)	(0.76)
External Debt % of GDP	-0.04**	-0.04	-0.04	-0.06	-0.06	-0.01	-0.04***	-0.12**
	(0.02)	(0.04)	(0.04)	(0.04)	(0.04)	(0.01)	(0.01)	(0.05)
M2 % of GDP	0.03	0.02	0.02	0.00	0.01	-0.02	0.10***	0.07
	(0.03)	(0.09)	(0.09)	(0.08)	(0.08)	(0.03)	(0.03)	(0.05)
GDP p.c.	1.24***	1.22***	1.22***	1.95***	1.98***	0.29*	1.57***	1.33***
	(0.16)	(0.34)	(0.34)	(0.36)	(0.38)	(0.16)	(0.13)	(0.32)
Access to FX Finance								
Net Exports % of GDP	-0.34***	-0.33***	-0.33***	-0.35***	-0.35***	-0.03	-0.09***	-0.13**
	(0.04)	(0.09)	(0.09)	(0.08)	(0.09)	(0.04)	(0.03)	(0.05)
Institutions								
Dummy: Defacto floating regime = 1	-2.41	-3.06	-3.00	-2.15	-2.07	-0.49	-0.66	-1.93
	(1.71)	(3.76)	(3.66)	(3.85)	(3.84)	(0.74)	(0.69)	(1.59)
Polity Score	0.46***	0.47*	0.46*	0.47*	0.47*	0.13	0.27***	0.73***
	(0.12)	(0.28)	(0.27)	(0.27)	(0.27)	(0.11)	(0.06)	(0.21)
Controls								
Population	-0.00	-0.00	-0.00	-0.02	-0.02	0.01	-0.08***	-0.02
	(0.01)	(0.05)	(0.05)	(0.04)	(0.04)	(0.01)	(0.02)	(0.11)
Trend			0.37					
			(0.35)					
Dummy Income: High & upper middle = 1				-8.43*	-6.97			
				(4.24)	(4.33)			
Dummy Income * Trend					-0.21			
					(0.29)			
Firms Loans Dollarization *(t-1)*						0.78***		
						(0.02)		
Constant	32.90***	28.89***	29.89***	32.98***	32.82***	8.62***	30.24***	34.55***
	(2.12)	(5.48)	(5.06)	(4.76)	(4.82)	(1.55)	(1.56)	(4.78)
Observations	764	764	764	764	764	722	764	764
R-squared	0.286	0.293	0.291	0.304	0.304			
Wald-test, p-value		0.117						
Number of groups						63	63	63
R-sq, within								0.165
Heteroskedasticity, p-value								0
Autocorrelation, p-value								0
Arrelano-Bond AR(1), z-value						-4.010		
Arrelano-Bond AR(2), z-value						1.703		

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6. Loans Dollarization: Households

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			OLS			GMM		
	Pooled	Year Dum.				AB	RE-AR(1)	FE-AR(1)
Currency Substitution								
Inflation - Average	-0.09	-0.11	-0.07	-0.11	-0.08	0.05	0.01	0.00
	(0.14)	(0.21)	(0.19)	(0.20)	(0.19)	(0.05)	(0.04)	(0.10)
Depreciation agaisnt USD - average	0.02	0.03	-0.00	0.02	0.00	0.01	0.00	0.03
	(0.08)	(0.08)	(0.09)	(0.10)	(0.09)	(0.03)	(0.02)	(0.03)
Portfolio Model								
Lending rate spread to U.S	0.02	0.02	0.04	0.02	0.04	-0.01	0.03	0.07*
	(0.08)	(0.09)	(0.07)	(0.07)	(0.07)	(0.05)	(0.02)	(0.04)
Real lending rate: $i(t) - infl(t+1)$	0.03	0.06	0.01	0.02	0.00	0.12	0.01	0.07
	(0.13)	(0.23)	(0.21)	(0.21)	(0.21)	(0.08)	(0.04)	(0.07)
Market Development								
Chinn-Ito index	1.82***	1.76	1.79	1.73	1.72	0.57	0.88**	2.08*
	(0.59)	(1.45)	(1.41)	(1.46)	(1.46)	(0.42)	(0.36)	(1.05)
External Debt % of GDP	0.00	0.01	0.01	-0.00	-0.00	-0.02	0.01	-0.11***
	(0.03)	(0.08)	(0.08)	(0.08)	(0.08)	(0.03)	(0.02)	(0.02)
M2 % of GDP	-0.20***	-0.20**	-0.20**	-0.21**	-0.21**	-0.00	-0.11***	0.06
	(0.04)	(0.08)	(0.08)	(0.09)	(0.09)	(0.05)	(0.03)	(0.08)
GDP p.c.	-0.18	-0.21	-0.21	0.01	-0.10	-0.16	-0.23	0.23
	(0.24)	(0.62)	(0.60)	(0.63)	(0.63)	(0.16)	(0.18)	(0.29)
Access to FX Finance								
Net Exports % of GDP	0.10	0.12	0.11	0.09	0.10	-0.03	-0.11***	-0.22**
	(0.07)	(0.18)	(0.17)	(0.17)	(0.17)	(0.05)	(0.04)	(0.08)
Institutions								
Dummy: Defacto floating regime = 1	-9.39***	-9.42**	-9.67***	-9.27**	-9.28**	-1.26	-0.05	-1.12
	(2.06)	(3.66)	(3.47)	(3.44)	(3.44)	(0.85)	(0.72)	(0.93)
Polity Score	0.23	0.22	0.24	0.23	0.26	-0.01	0.34**	0.48
	(0.16)	(0.40)	(0.39)	(0.40)	(0.40)	(0.21)	(0.16)	(0.46)
Controls								
Population	-0.07***	-0.07***	-0.07***	-0.08**	-0.08**	-0.00	-0.06***	-0.02
	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.02)	(0.01)	(0.16)
Trend			0.21					
			(0.29)					
Dummy Income: High & upper middle = 1				-1.98	-4.68			
				(6.10)	(6.29)			
Dummy Income * Trend					0.40			
					(0.39)			
Households Loans Dollarization (t-1)						0.73***		
						(0.05)		
Constant	32.90***	28.06***	31.50***	33.15***	33.68***	6.15**	21.16***	15.96***
	(3.39)	(8.09)	(6.61)	(7.27)	(7.36)	(2.55)	(1.97)	(3.27)
Observations	426	426	426	426	426	389	426	426
R-squared	0.231	0.240	0.233	0.232	0.235			
Wald-test, p-value		0.557						
Number of groups						38	39	39
R-sq. within								0.0942
Heteroskedasticity, p-value							0	
Autocorrelation, p-value							5.42e-08	
Arrelano-Bond AR(1), z-value						-2.602		
Arrelano-Bond AR(2), z-value						0.809		

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Deposit dollarization: Comparing higher versus lower income countries

The regressions on deposit dollarization for households and firms do not show a significant coefficient for the income level dummy (Table 7 and 9). However, the sign is negative in both cases, reflecting the fact that deposit dollarization is lower in higher income countries. Does the level of development of the country—proxied by income per capita—impact the level of deposit dollarization for households or firms? To deepen the analysis, we explore differences in the determinants of deposit dollarization by further disaggregating regressions into higher and lower income countries for both households and firms. We document these differences using the results for pooled OLS regressions, and we also report results for random and fixed effects models (Tables 7 and 8).

Among currency substitution variables, inflation appears as a significant contributor to increasing deposit dollarization of firms in lower income countries, under most model specifications. This variable is statistically different in lower income countries compared to higher income ones, and suggests that firms in lower-income countries are more sensitive to inflation—perhaps because it is harder to hedge oneself for lack of other financial instruments and assets, than in higher income countries. Note that when it comes to deposit dollarization of households, the results are not statistically significant, and do not vary between households in richer and poorer countries (see also Olalekan, 2009). Regarding the portfolio view, the spread between deposits in domestic currency and FX tend to be negatively correlated for both households and firms in both higher and lower income countries, suggesting that their decisions to hold dollars are sensitive to nominal interest rate differences. However, the coefficients are much larger in higher income countries, which could suggest differences in the level of financial education of agents between the two income level groups.

Regarding market development proxies and access to FX finance, there are few significant differences between firms in higher and lower income countries, except for the size of some coefficients. Results for both higher income and lower income countries suggest that these factors are relevant explanatory power for deposit dollarization, as is to be expected. The results suggest that financial deepening, access to external debt and FX finance as well as other market considerations captured by GDP per capita are key factors of the dynamics of deposit dollarization regardless of the level of income. One difference though is the coefficient on the capital account openness: whereas in higher income countries, a more open capital account encourages higher dollarization of deposits of firms, in lower income countries, this reduces the incentive for firms to hold dollars. This could reflect better information access of firms in richer countries, or regulatory constraints, that make it easier for these firms compared to their counterparts in lower income countries to save in dollars. One major difference impacting deposit dollarization of households is the quality of institutions. In both rich and poor countries, households and firms reduce their deposit dollarization when the quality of institutions improves. Whereas for firms, the exchange rate variable has no impact on deposit

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dollarization for households or firms, there are clearer differences for households. In richer countries, a floating exchange rate marginally discourages deposit dollarization, whereas in poorer countries, it doesn't have an impact.

Table 7. Deposits Dollarization: Firms. High versus Low Income Countries

	(1)	(2)		(3)	(4)		(5)	(6)	
	RE-AR			FE-AR			Pooled OLS		
	High	Low	Diff	High	Low	Diff	High	Low	Diff
Currency Substitution									
Inflation - Average	-0.09**	0.12**	0.21***	-0.14*	0.14***	0.28***	0.19	0.03	-0.16
	(0.04)	(0.05)	(0.07)	(0.07)	(0.05)	(0.09)	(0.22)	(0.15)	(0.26)
Depreciation agaisnt USD - average	0.08**	0.03	-0.05	0.13***	0.10**	-0.03	0.09	-0.02	-0.10
	(0.03)	(0.02)	(0.04)	(0.04)	(0.03)	(0.05)	(0.09)	(0.11)	(0.15)
Portfolio Model									
Deposit rate spread to U.S	-0.18***	-0.06***	0.12***	-0.19***	-0.09***	0.10*	-0.30***	0.02	0.32**
	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)	(0.05)	(0.08)	(0.10)	(0.13)
Real deposit rate: $i(t) - infl(t+1)$	-0.05	0.06	0.11	0.10	0.01	-0.09	-0.17	0.30***	0.46**
	(0.04)	(0.06)	(0.07)	(0.09)	(0.04)	(0.11)	(0.20)	(0.10)	(0.22)
Market Development									
Chinn-Ito index	3.91***	-1.03*	-4.95***	4.52***	0.03	-4.49***	5.52***	-2.65***	-8.18***
	(0.52)	(0.54)	(0.75)	(1.47)	(0.71)	(1.48)	(0.74)	(0.88)	(1.15)
External Debt % of GDP	0.09***	0.17***	0.08**	0.05***	0.05	0.00	0.18***	0.15***	-0.03
	(0.02)	(0.03)	(0.04)	(0.01)	(0.03)	(0.03)	(0.03)	(0.05)	(0.06)
M2 % of GDP	-0.41***	-0.30***	0.11*	-0.29***	0.01	0.30***	-0.39***	-0.46***	-0.07
	(0.04)	(0.04)	(0.06)	(0.08)	(0.11)	(0.05)	(0.07)	(0.04)	(0.08)
GDP p.c.	-0.42	0.55*	0.97*	-0.95	-0.49	0.45	-0.75	1.85***	2.59***
	(0.49)	(0.30)	(0.58)	(0.57)	(0.99)	(1.16)	(0.61)	(0.41)	(0.74)
Access to FX Finance									
Net Exports % of GDP	-0.11**	-0.21***	-0.11	-0.05	-0.35***	-0.30***	0.07	-0.41***	-0.48***
	(0.04)	(0.06)	(0.08)	(0.06)	(0.04)	(0.09)	(0.07)	(0.09)	(0.12)
Institutions									
Dummy: Defacto floating regime = 1	1.09	-0.49	-1.58	-0.13	1.04	1.17	-1.53	-0.46	1.08
	(0.78)	(1.46)	(1.65)	(0.92)	(1.94)	(2.55)	(2.10)	(3.66)	(4.20)
Polity Score	0.24*	-0.34*	-0.58**	0.33	-0.05	-0.38	-0.10	-0.02	0.07
	(0.14)	(0.19)	(0.24)	(0.21)	(0.15)	(0.27)	(0.19)	(0.17)	(0.25)
Controls									
Population	-0.09***	-0.20***	-0.10**	0.19**	0.06	-0.13	-0.05***	-0.19***	-0.14***
	(0.02)	(0.04)	(0.04)	(0.07)	(0.18)	(0.23)	(0.02)	(0.05)	(0.05)
Observations	380	241	621	380	241	621	380	241	621
R-squared							0.459	0.509	0.489
Number of groups	31	18	49	31	18	49			
R-sq, overall	0.398	0.247		0.0921	0.107			0.107	
R-sq, within	0.196	0.256		0.203	0.259			0.259	
Heteroskedasticity, p-value	0	0		0	0			0	
Wald test		0			0				
Hausman test				0.220	0.321				
Autocorrelation, p-value				0.00901	7.87e-10				

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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Table 8. Deposits Dollarization: Households. High versus Low Income Countries

	(1) RE-AR High	(2) RE-AR Low	Diff	(3) FE-AR High	(4) FE-AR Low	Diff	(5) Pooled OLS High	(6) Pooled OLS Low	Diff
Currency Substitution									
Inflation - Average	-0.02	-0.11**	-0.09	0.12**	0.17*	0.05	0.21	-0.44**	-0.65**
	(0.04)	(0.05)	(0.06)	(0.05)	(0.09)	(0.07)	(0.25)	(0.21)	(0.33)
Depreciation agaisnt USD - average	0.04	-0.00	-0.04	-0.03*	0.08	0.10**	0.01	-0.13	-0.13
	(0.02)	(0.02)	(0.03)	(0.01)	(0.05)	(0.05)	(0.10)	(0.12)	(0.16)
Portfolio Model									
Deposit rate spread to U.S	-0.10***	-0.03	0.07**	-0.10***	-0.15***	-0.05	-0.24***	0.06	0.30**
	(0.02)	(0.02)	(0.03)	(0.03)	(0.04)	(0.05)	(0.09)	(0.12)	(0.15)
Real deposit rate: i(t) - infl(t+1)	-0.06	-0.02	0.04	0.01	-0.04	-0.05	-0.39*	0.22	0.61**
	(0.04)	(0.05)	(0.06)	(0.04)	(0.05)	(0.06)	(0.23)	(0.14)	(0.27)
Market Development									
Chinn-Ito index	2.73***	0.21	-2.52***	-0.83	-0.17	0.66	4.76***	-1.75*	-6.51***
	(0.51)	(0.42)	(0.66)	(0.48)	(0.60)	(0.59)	(0.82)	(1.04)	(1.32)
External Debt % of GDP	0.04**	0.10***	0.06*	0.03***	0.12***	0.08**	0.20***	0.24***	0.04
	(0.02)	(0.03)	(0.03)	(0.01)	(0.04)	(0.03)	(0.04)	(0.05)	(0.07)
M2 % of GDP	-0.55***	-0.40***	0.14**	0.05	-0.43***	-0.48***	-0.67***	-0.68***	-0.01
	(0.03)	(0.05)	(0.06)	(0.06)	(0.05)	(0.06)	(0.06)	(0.05)	(0.08)
GDP p.c.	1.08***	0.44	-0.64	-2.21***	-0.10	2.11***	1.35**	1.62***	0.27
	(0.22)	(0.33)	(0.39)	(0.53)	(0.54)	(0.54)	(0.56)	(0.47)	(0.73)
Access to FX Finance									
Net Exports % of GDP	-0.08**	-0.26***	-0.17***	-0.12	-0.33***	-0.21**	-0.36***	-0.18*	0.18
	(0.04)	(0.05)	(0.06)	(0.08)	(0.05)	(0.08)	(0.09)	(0.09)	(0.13)
Institutions									
Dummy: Defacto floating regime = 1	-0.24	1.63	1.87	-2.93**	1.19	4.12***	-10.06***	3.39	13.45***
	(0.75)	(1.35)	(1.54)	(1.22)	(1.57)	(1.25)	(2.30)	(3.02)	(3.80)
Polity Score	-0.31***	-0.82***	-0.52***	-0.36***	0.04	0.40*	-0.61***	-1.00***	-0.40*
	(0.09)	(0.17)	(0.19)	(0.05)	(0.23)	(0.20)	(0.17)	(0.18)	(0.24)
Controls									
Population	-0.08***	-0.29***	-0.21***	0.03	0.10	0.07	-0.06***	-0.28***	-0.22***
	(0.01)	(0.04)	(0.04)	(0.04)	(0.19)	(0.21)	(0.01)	(0.04)	(0.04)
Observations	386	275	661	386	275	661	386	275	661
R-squared							0.512	0.561	0.532
Number of groups	32	20	52	32	20	52			
R-sq, overall	0.111	0.411		0.000717	0.271			0.271	
R-sq, within	0.162	0.349		0.169	0.352			0.352	
Heteroskedasticity, p-value	0	0		0	0			0	
Wald test		0			0				
Hausman test				0.00406	0.0794				
Autocorrelation, p-value				2.23e-05	7.94e-06				

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Loan dollarization: Comparing higher versus lower income countries

Tables 9 and 10 display the results for loan dollarization disaggregating level of income for firms and households respectively. As in the case of deposits, regressions for household loan dollarization do not show a significant coefficient for the income level dummy, and for the case of firms it is weakly significant. However, firms borrowing in foreign exchange is statistically significantly and positively related to income per capita, in both richer and poorer countries. This suggests that as income rises, firms in general borrow more in foreign currency, in both rich and poor countries, while this is not the case for households.

Currency substitution variables are statistically insignificant for both households and firms at higher and lower income level. In other words, loan dollarization by households and firms is not visibly determined by higher inflation or exchange rate volatility. Similarly, portfolio view variables are largely insignificant statistically, and appear statistically significant only in particular cases. Only the real lending rate seems to play a role in explaining firms' loan dollarization in lower income countries when countries effects are considered.

Financial deepening, measured by M2 to GDP ratio, appears to be statistically significant only for the case of higher income countries' households' loan dollarization, though this is not the case under every specification. This means that broader access to finance encourages, ceteris paribus, borrowing in foreign currency for households. On the other hand, access to FX finance, measured by net exports as percent of GDP, consistently appear as significant determinant of firms' loan dollarization in both higher and lower income countries. This implies that the availability, and potential availability to earn FX—reducing the FX risk—may be a positive factor favoring loan dollarization of firms, as has been found in the previous literature (e.g. Corrales et al., 2015). Results suggests that an increase in one standard deviation of this variables (i.e. 16.8 percent) reduces dollarization of firms' loans by 3.2 pps in higher income countries and by 2.8 pps in lower income countries. A similar result is found for households but only on higher income countries.

The exchange rate regime doesn't appear to have an impact of loan dollarization for households or firms in lower income countries, though it does appear to have a negative impact on household borrowing in foreign currency in higher income countries. This implies that higher income households, perhaps because they are more sophisticated and knowledgeable, may be reluctant to borrow in foreign exchange when there is strong exchange rate volatility. On the quality of institutions has a strong negative impact on loan dollarization of firms, but a negligible impact on households, in both higher and lower income countries.

Table 9. Loans Dollarization: Firms. High versus Low Income Countries

	(1)	(2)		(3)	(4)		(5)	(6)	
	RE-AR			FE-AR			Pooled OLS		
	High	Low	Diff	High	Low	Diff	High	Low	Diff
Currency Substitution									
Inflation - Average	-0.06	0.01	0.06	0.10	0.06	-0.04	-0.07	0.02	0.09
	(0.04)	(0.05)	(0.06)	(0.06)	(0.08)	(0.09)	(0.17)	(0.15)	(0.22)
Depreciation agaisnt USD - average	-0.02	-0.02	-0.00	0.03	0.00	-0.03	0.01	-0.03	-0.03
	(0.02)	(0.02)	(0.03)	(0.07)	(0.02)	(0.08)	(0.08)	(0.08)	(0.11)
Portfolio Model									
Lending rate spread to U.S	0.07***	0.01	-0.07**	-0.02	-0.00	0.01	0.13	-0.02	-0.15
	(0.02)	(0.02)	(0.03)	(0.09)	(0.02)	(0.07)	(0.08)	(0.08)	(0.12)
Real lending rate: i(t) - infl(t+1)	-0.01	0.01	0.01	-0.20*	-0.04	0.16	-0.17	0.03	0.20
	(0.04)	(0.04)	(0.06)	(0.11)	(0.05)	(0.12)	(0.16)	(0.10)	(0.18)
Market Development									
Chinn-Ito index	1.22*	0.86**	-0.37	-1.28	-1.67***	-0.39	2.55***	3.80***	1.25
	(0.72)	(0.38)	(0.82)	(1.77)	(0.29)	(1.80)	(0.70)	(0.60)	(0.93)
Extemal Debt % of GDP	-0.06***	0.04	0.10***	-0.12*	-0.06***	0.07	-0.11***	0.06**	0.17***
	(0.02)	(0.02)	(0.03)	(0.06)	(0.02)	(0.06)	(0.02)	(0.03)	(0.04)
M2 % of GDP	0.22***	0.00	-0.22***	0.12	-0.04	-0.16	-0.03	0.00	0.03
	(0.05)	(0.03)	(0.06)	(0.07)	(0.08)	(0.10)	(0.07)	(0.03)	(0.07)
GDP p.c.	2.69***	1.30***	-1.39***	-0.41	1.83***	2.24*	3.23***	1.34***	-1.89***
	(0.34)	(0.22)	(0.40)	(1.12)	(0.32)	(1.20)	(0.43)	(0.23)	(0.48)
Access to FX Finance									
Net Exports % of GDP	-0.08**	-0.12***	-0.04	-0.17*	-0.11***	0.07	-0.32***	-0.27***	0.04
	(0.04)	(0.04)	(0.05)	(0.09)	(0.03)	(0.11)	(0.06)	(0.07)	(0.09)
Institutions									
Dummy: Defacto floating regime = 1	-1.51*	2.07	3.59**	-2.22	-0.19	2.03	-4.16*	7.84***	12.00***
	(0.84)	(1.32)	(1.57)	(1.56)	(1.13)	(1.46)	(2.34)	(2.55)	(3.45)
Polity Score	0.23***	0.72***	0.49***	0.81**	0.31**	-0.50	0.47**	0.51***	0.04
	(0.08)	(0.14)	(0.16)	(0.30)	(0.11)	(0.31)	(0.18)	(0.11)	(0.21)
Controls									
Population	-0.00	-0.08***	-0.08***	0.02	0.32**	0.30	-0.03	-0.08***	-0.05*
	(0.02)	(0.02)	(0.03)	(0.21)	(0.14)	(0.29)	(0.02)	(0.02)	(0.03)
Observations	467	297	764	467	297	764	467	297	764
R-squared							0.285	0.491	0.355
Number of groups	41	22	63	41	22	63			
R-sq, overall	0.193	0.0800		0.0299	0.00220			0.00220	
R-sq, within	0.144	0.337		0.153	0.367			0.367	
Heteroskedasticity, p-value	0	0		0	0			2.77e-09	
Wald test		0			0				
Hausman test				0.159	1.63e-06				
Autocorrelation, p-value				0	3.24e-05				

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 10. Loan Dollarization: Households. High versus Low Income Countries

	(1)	(2)		(3)	(4)		(5)	(6)	
	RE-AR			FE-AR			Pooled OLS		
	High	Low	Diff	High	Low	Diff	High	Low	Diff
Currency Substitution									
Inflation - Average	0.00	0.06	0.06	0.12	0.04	-0.08	0.31	-0.15	-0.46*
	(0.07)	(0.06)	(0.09)	(0.10)	(0.11)	(0.09)	(0.20)	(0.14)	(0.24)
Depreciation agaisnt USD - average	-0.03	0.02	0.05	-0.02	0.04	0.06	-0.08	0.14	0.22
	(0.04)	(0.03)	(0.05)	(0.05)	(0.06)	(0.09)	(0.11)	(0.12)	(0.16)
Portfolio Model									
Lending rate spread to U.S	0.07**	0.04	-0.03	0.14***	0.00	-0.14**	0.05	0.00	-0.05
	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)	(0.06)	(0.11)	(0.10)	(0.15)
Real lending rate: i(t) - infl(t+1)	-0.06	0.00	0.06	-0.14	0.26**	0.39*	-0.45**	0.25	0.70***
	(0.06)	(0.06)	(0.08)	(0.12)	(0.10)	(0.20)	(0.20)	(0.15)	(0.25)
Market Development									
Chinn-Ito index	0.83	0.99*	0.16	-0.55	3.44***	3.99***	1.34*	4.93***	3.59***
	(0.51)	(0.54)	(0.75)	(1.48)	(1.11)	(0.91)	(0.72)	(1.10)	(1.31)
External Debt % of GDP	0.03	-0.06	-0.08*	-0.09**	-0.10*	-0.01	0.08*	-0.32***	-0.40***
	(0.03)	(0.04)	(0.05)	(0.03)	(0.05)	(0.05)	(0.04)	(0.08)	(0.09)
M2 % of GDP	-0.20***	0.06	0.26***	-0.08	0.25**	0.33	-0.44***	0.02	0.46***
	(0.05)	(0.05)	(0.07)	(0.24)	(0.11)	(0.31)	(0.06)	(0.06)	(0.09)
GDP p.c.	0.08	-0.22	-0.30	0.44	-0.38	-0.82	0.06	-0.12	-0.18
	(0.38)	(0.28)	(0.48)	(0.69)	(0.62)	(0.83)	(0.47)	(0.33)	(0.58)
Access to FX Finance									
Net Exports % of GDP	-0.21***	-0.03	0.18**	-0.23**	-0.30	-0.07	0.07	-0.06	-0.13
	(0.06)	(0.05)	(0.08)	(0.09)	(0.18)	(0.23)	(0.12)	(0.12)	(0.17)
Institutions									
Dummy: Defacto floating regime = 1	-1.31	1.85	3.15*	-3.13*	2.77	5.90*	-14.66***	2.79	17.44***
	(1.07)	(1.27)	(1.67)	(1.51)	(1.76)	(2.87)	(2.00)	(3.06)	(3.66)
Polity Score	0.47**	-0.12	-0.59**	0.13	1.69	1.57	0.47*	-0.45**	-0.92***
	(0.20)	(0.22)	(0.30)	(0.40)	(1.05)	(0.91)	(0.25)	(0.21)	(0.33)
Controls									
Population	-0.05***	-0.16***	-0.12***	-0.09	-0.36	-0.27	-0.04*	-0.30***	-0.26***
	(0.02)	(0.03)	(0.04)	(0.09)	(0.37)	(0.35)	(0.03)	(0.04)	(0.04)
Observations	223	203	426	223	203	426	223	203	426
R-squared							0.387	0.345	0.371
Number of groups	22	17	39	22	17	39			
R-sq, overall	0.201	0.234		0.100	0.0322			0.0322	
R-sq, within	0.133	0.112		0.140	0.155			0.155	
Heteroskedasticity, p-value	0	0		0	0			0	
Wald test		2.06e-06			0				
Hausman test				0.000872	0.0311				
Autocorrelation, p-value				0.00318	1.07e-05				

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

V. Contributions to dollarization

We use the coefficient estimates of pooled OLS regressions and the observed variation in the countries' explanatory variables to assess the contribution of the respective dimensions to the change in the observed dollarization (see Figure 5 and 6). Across agents (firms and households) and type of dollarization (loans and deposits), market development factors appear as the greater contributor explaining the change in dollarization levels in the period analyzed (2001-2016).

Figure 5. Firms Dollarization. Pooled OLS. Contribution by Determinants
(Percent)
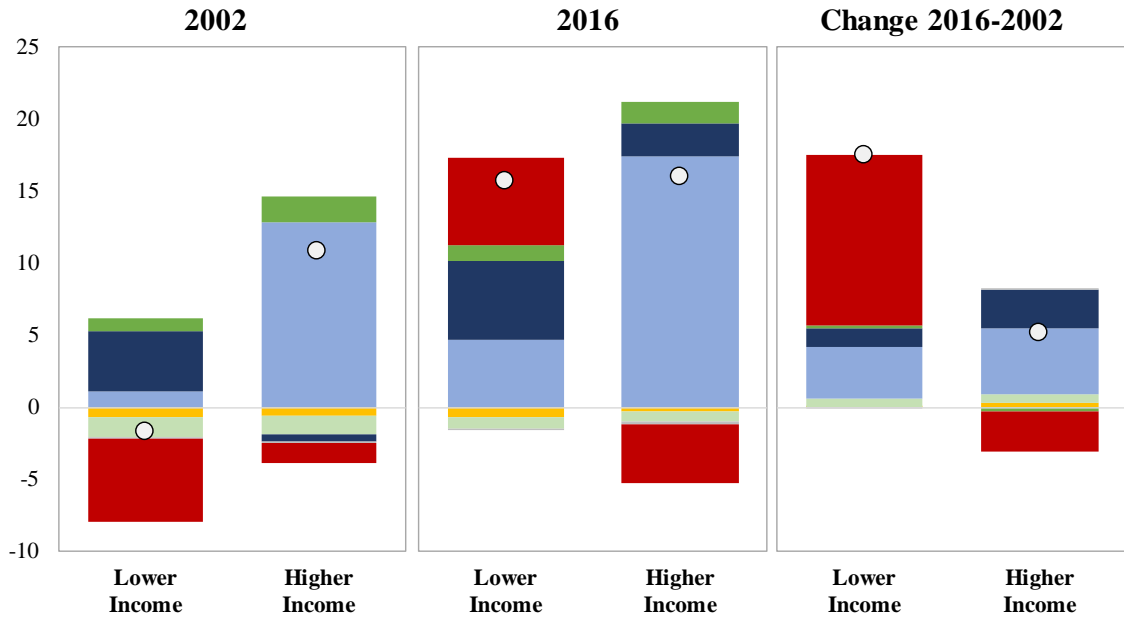
a. Loans

Source: Data from International Financial Statistics (IFS). Author's estimations

Legend: Currency Substitution · Portfolio Model · Market Development · Access to FX · Institutions · Controls · Residual · Observed less constant

b. Deposits

Figure 6. Households Dollarization. Pooled OLS. Contribution by Determinants
(Percent)
a. Loans

2002 **2016** **Change 2016-2002**

Lower Income Higher Income Lower Income Higher Income Lower Income Higher Income

b. Deposits

2002 **2016** **Change 2016-2002**

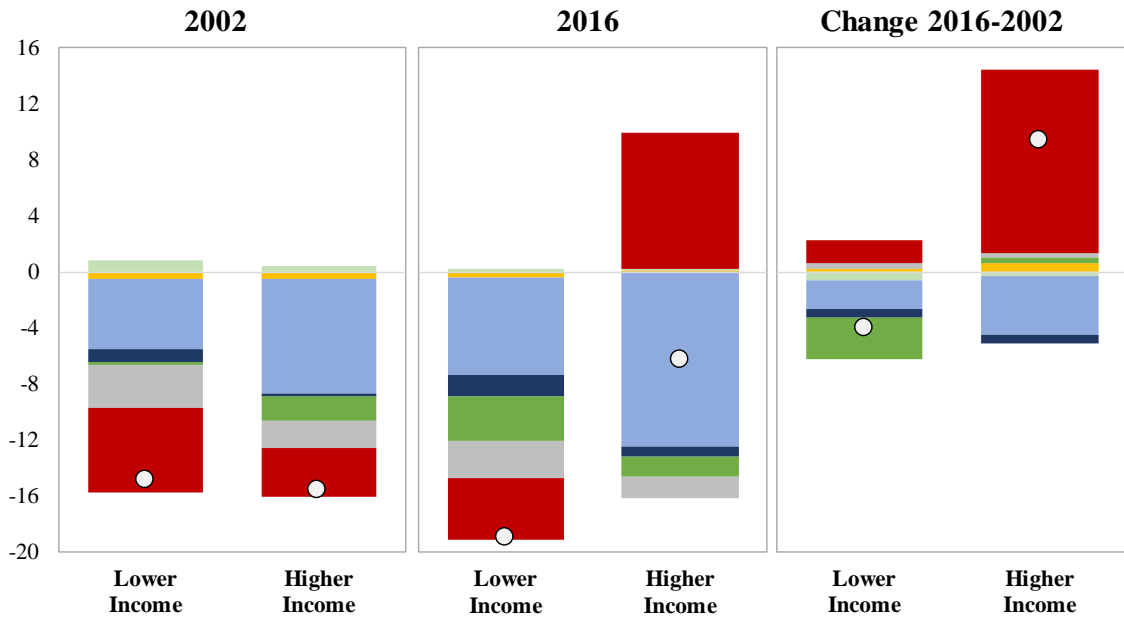Lower Income Higher Income Lower Income Higher Income Lower Income Higher Income

Source: Data from International Financial Statistics (IFS). Author's estimations

- Currency Substitution
- Portfolio Model
- Market Development
- Access to FX
- Institutions
- Controls
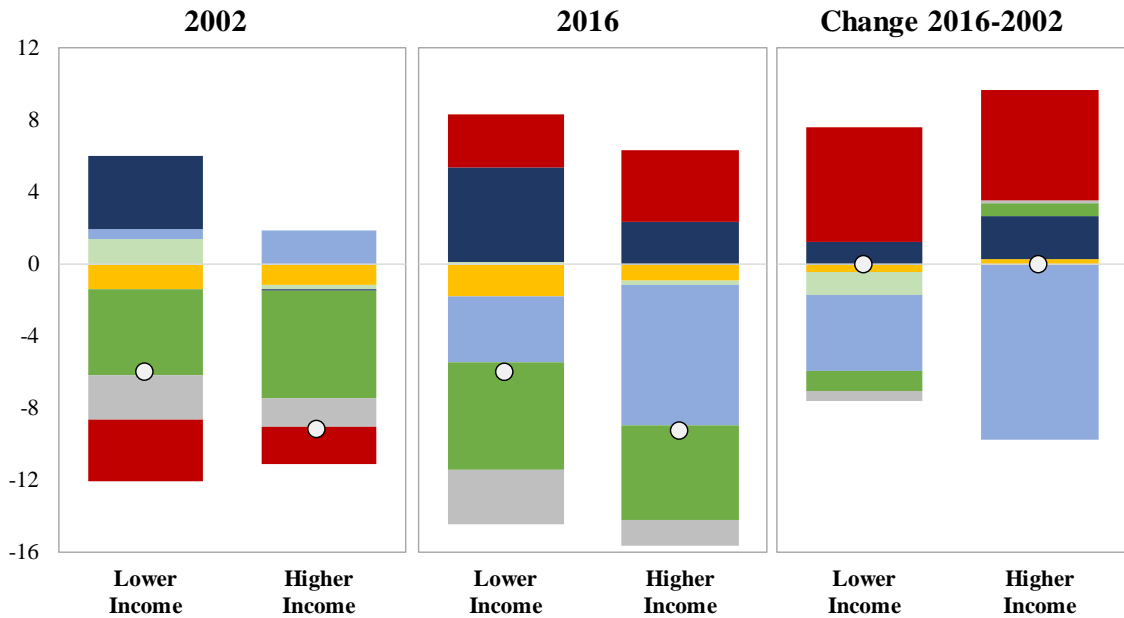- Residual
- Observed less constant

However, there are some notable differences between lower and higher income countries. After market development factors, firms' loans dollarization is explained by access to foreign currency on a greater scale for higher income countries, while firms' deposits dollarization is explained by currency substitution factors mainly in the case of lower income countries. On the other hand, institutions play a significant role explaining the change in households' loans dollarization in lower income countries, whereas in higher income countries, factors other than market development make a very small contribution. Households' deposit dollarization is also explained by access to foreign currency mainly in higher income countries, and in lower income countries portfolio model factors are also important drivers. Overall, factors considered here can account for a significant fraction of dollarization, but there is still a non-negligible portion yet to be explained, suggesting that there are some unique features which are not fully captured by traditional explanatory variables

VI. Conclusions and policy implications

Dollarization is a highly persistent phenomenon (see Kokenyne et al., 2010). The economic literature has paid scant attention to differences in the determinants of loan and deposit dollarization between households and firms. Typically, as exemplified by Levy-Yeyati (2006) or Corrales et al. (2015), studies looked at aggregate dollarization. This is largely due to the lack of sufficient granular data. Only over the last decade have statistical agencies across the world started to collect and publish data on deposit and loan dollarization that enable to differentiate between households and firms.

This study, is the first to our knowledge, to look at the determinants of dollarization, differentiating households from firms, across the world. To better understand the divergences of household and firm dollarization, this paper estimates the determinants of deposit and loan dollarization across countries, and carries out some sensitivity analysis. The results suggest that there are clear similarities, but also some differences, in the determinants of loan and deposit dollarization across households and firms. The main conclusions to emerge are:

(i)   The currency substitution model—which articulates that loan and deposit dollarization should rise with higher inflation and when the nominal exchange rate depreciates—is weak in explaining both household and firm dollarization. In other words, macro-stability doesn't seem to shed light, in our sample of countries, on the behavior of households and firms.

(ii)   Structural factors, as measured by the market development model is better at explaining the dollarization behavior of both households and firms, even though their impact differs. Capital account liberalization tends to encourage deposit dollarization by firms in particular, and to a lesser extent by households. This means that opening the capital account, by encouraging borrowing in FX, needs to be carefully monitored to ensure that only companies that earn FX can borrow in foreign currency.

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(iii)   Financial sector development, on the other hand, tends to have a negative impact on deposit dollarization of firms in particular, and to a lesser extent on household. Household borrowing in foreign currency is negatively impacted by financial sector development. When the financial sector can lend in local currency—households are happy to oblige.

(iv)   Access to foreign exchange negatively impact loan dollarization of firms, though it doesn't impact loan dollarization of households, as expected. This could also be due to regulatory factors, which were not captured in our model.

(v)   A floating exchange rate regime has not much impact on dollar deposits for both firms and households, it does though have a negative impact on loan dollarization for households, though not for firms. A floating exchange rate policy discouraging borrowing in foreign currency of households, though it doesn't for firms, probably because the latter, for instance by exporting, can potentially hedge themselves by earning FX, which the former cannot do as easily.

(vi)   The quality of institutions has no visible impact on the deposit dollarization of firms, but it significantly impacts in a negative way the dollarization of deposits of households. This could be a reflection that firms can hedge their risks by saving in a way that households cannot—they have more opportunities to hedge their risks. Inversely, better institutions encourage firms to borrow in foreign currency, perhaps by making it easier to borrow, but do not appear to have an impact on household borrowings in foreign currency of households.

The results suggest that household and firm dollarization have a lot in common. The findings also suggest that if a country wants to reduce dollarization of both deposits and loans, the focus should be more on structural factors—such as developing the financial sector—than on macro-economic stability, which has less of an impact on dollarization, and which is now more or less stable in most countries of the world. More research is needed to include regulatory variables to even better understand the motives behind household and firm dollarization.

Appendix A

Table A1.a. Effective Regression Sample for Households Deposits Dollarization

Country	Region	Income Level
Haiti	Latin America & Caribbean	Low income
Nepal	South Asia	Low income
Congo, Dem. Rep. of	Sub-Saharan Africa	Low income
Mozambique	Sub-Saharan Africa	Low income
Rwanda	Sub-Saharan Africa	Low income
Sierra Leone	Sub-Saharan Africa	Low income
Tanzania	Sub-Saharan Africa	Low income
Uganda	Sub-Saharan Africa	Low income
Cambodia	East Asia & Pacific	Lower middle income
Indonesia	East Asia & Pacific	Lower middle income
Mongolia	East Asia & Pacific	Lower middle income
Solomon Islands	East Asia & Pacific	Lower middle income
Armenia	Europe & Central Asia	Lower middle income
Kyrgyz Republic	Europe & Central Asia	Lower middle income
Moldova	Europe & Central Asia	Lower middle income
Tajikistan	Europe & Central Asia	Lower middle income
Ukraine	Europe & Central Asia	Lower middle income
Bolivia	Latin America & Caribbean	Lower middle income
Guatemala	Latin America & Caribbean	Lower middle income
Honduras	Latin America & Caribbean	Lower middle income
Nicaragua	Latin America & Caribbean	Lower middle income
Egypt	Middle East & North Africa	Lower middle income
Morocco	Middle East & North Africa	Lower middle income
Bangladesh	South Asia	Lower middle income
Bhutan	South Asia	Lower middle income
Pakistan	South Asia	Lower middle income
Sri Lanka	South Asia	Lower middle income
Cape Verde	Sub-Saharan Africa	Lower middle income
Ghana	Sub-Saharan Africa	Lower middle income
Kenya	Sub-Saharan Africa	Lower middle income
Nigeria	Sub-Saharan Africa	Lower middle income
Zambia	Sub-Saharan Africa	Lower middle income
Fiji	East Asia & Pacific	Upper middle income
Malaysia	East Asia & Pacific	Upper middle income
Albania	Europe & Central Asia	Upper middle income
Azerbaijan, Rep. of	Europe & Central Asia	Upper middle income
Belarus	Europe & Central Asia	Upper middle income
Bosnia & Herzegovina	Europe & Central Asia	Upper middle income
Bulgaria	Europe & Central Asia	Upper middle income
Georgia	Europe & Central Asia	Upper middle income
Macedonia, FYR	Europe & Central Asia	Upper middle income

Country	Region	Income Level
Turkey	Europe & Central Asia	Upper middle income
Costa Rica	Latin America & Caribbean	Upper middle income
Dominican Republic	Latin America & Caribbean	Upper middle income
Guyana	Latin America & Caribbean	Upper middle income
Jamaica	Latin America & Caribbean	Upper middle income
Mexico	Latin America & Caribbean	Upper middle income
Paraguay	Latin America & Caribbean	Upper middle income
Venezuela, Rep. Bol.	Latin America & Caribbean	Upper middle income
Algeria	Middle East & North Africa	Upper middle income
Angola	Sub-Saharan Africa	Upper middle income
South Africa	Sub-Saharan Africa	Upper middle income

Table A1.b. Effective Regression Sample for Households Loans Dollarization

Country	Region	Income Level
Haiti	Latin America & Caribbean	Low income
Nepal	South Asia	Low income
Congo, Dem. Rep. of	Sub-Saharan Africa	Low income
Mozambique	Sub-Saharan Africa	Low income
Rwanda	Sub-Saharan Africa	Low income
Tanzania	Sub-Saharan Africa	Low income
Uganda	Sub-Saharan Africa	Low income
Indonesia	East Asia & Pacific	Lower middle income
Mongolia	East Asia & Pacific	Lower middle income
Armenia	Europe & Central Asia	Lower middle income
Kyrgyz Republic	Europe & Central Asia	Lower middle income
Moldova	Europe & Central Asia	Lower middle income
Tajikistan	Europe & Central Asia	Lower middle income
Ukraine	Europe & Central Asia	Lower middle income
Bolivia	Latin America & Caribbean	Lower middle income
Guatemala	Latin America & Caribbean	Lower middle income
Honduras	Latin America & Caribbean	Lower middle income
Nicaragua	Latin America & Caribbean	Lower middle income
Egypt	Middle East & North Africa	Lower middle income
Morocco	Middle East & North Africa	Lower middle income
Sri Lanka	South Asia	Lower middle income
Zambia	Sub-Saharan Africa	Lower middle income
Malaysia	East Asia & Pacific	Upper middle income
Albania	Europe & Central Asia	Upper middle income
Azerbaijan, Rep. of	Europe & Central Asia	Upper middle income
Belarus	Europe & Central Asia	Upper middle income
Bosnia & Herzegovina	Europe & Central Asia	Upper middle income
Bulgaria	Europe & Central Asia	Upper middle income
Georgia	Europe & Central Asia	Upper middle income
Macedonia, FYR	Europe & Central Asia	Upper middle income
Colombia	Latin America & Caribbean	Upper middle income

Country	Region	Income Level
Costa Rica	Latin America & Caribbean	Upper middle income
Dominican Republic	Latin America & Caribbean	Upper middle income
Jamaica	Latin America & Caribbean	Upper middle income
Mexico	Latin America & Caribbean	Upper middle income
Venezuela, Rep. Bol.	Latin America & Caribbean	Upper middle income
Algeria	Middle East & North Africa	Upper middle income
Angola	Sub-Saharan Africa	Upper middle income
South Africa	Sub-Saharan Africa	Upper middle income

Table A1.c. Effective Regression Sample for Firms Deposits Dollarization

Country	Region	Income Level
Haiti	Latin America & Caribbean	Low income
Nepal	South Asia	Low income
Congo, Dem. Rep. of	Sub-Saharan Africa	Low income
Mozambique	Sub-Saharan Africa	Low income
Rwanda	Sub-Saharan Africa	Low income
Sierra Leone	Sub-Saharan Africa	Low income
Tanzania	Sub-Saharan Africa	Low income
Uganda	Sub-Saharan Africa	Low income
Cambodia	East Asia & Pacific	Lower middle income
Indonesia	East Asia & Pacific	Lower middle income
Mongolia	East Asia & Pacific	Lower middle income
Solomon Islands	East Asia & Pacific	Lower middle income
Armenia	Europe & Central Asia	Lower middle income
Kyrgyz Republic	Europe & Central Asia	Lower middle income
Moldova	Europe & Central Asia	Lower middle income
Tajikistan	Europe & Central Asia	Lower middle income
Ukraine	Europe & Central Asia	Lower middle income
Bolivia	Latin America & Caribbean	Lower middle income
Guatemala	Latin America & Caribbean	Lower middle income
Honduras	Latin America & Caribbean	Lower middle income
Nicaragua	Latin America & Caribbean	Lower middle income
Egypt	Middle East & North Africa	Lower middle income
Morocco	Middle East & North Africa	Lower middle income
Bangladesh	South Asia	Lower middle income
Pakistan	South Asia	Lower middle income
Sri Lanka	South Asia	Lower middle income
Cape Verde	Sub-Saharan Africa	Lower middle income
Ghana	Sub-Saharan Africa	Lower middle income
Kenya	Sub-Saharan Africa	Lower middle income
Nigeria	Sub-Saharan Africa	Lower middle income
Zambia	Sub-Saharan Africa	Lower middle income
Fiji	East Asia & Pacific	Upper middle income
Malaysia	East Asia & Pacific	Upper middle income

Albania	Europe & Central Asia	Upper middle income
Azerbaijan, Rep. of	Europe & Central Asia	Upper middle income
Belarus	Europe & Central Asia	Upper middle income
Bosnia & Herzegovina	Europe & Central Asia	Upper middle income
Bulgaria	Europe & Central Asia	Upper middle income
Georgia	Europe & Central Asia	Upper middle income
Macedonia, FYR	Europe & Central Asia	Upper middle income
Turkey	Europe & Central Asia	Upper middle income
Dominican Republic	Latin America & Caribbean	Upper middle income
Guyana	Latin America & Caribbean	Upper middle income
Jamaica	Latin America & Caribbean	Upper middle income
Mexico	Latin America & Caribbean	Upper middle income
Venezuela, Rep. Bol.	Latin America & Caribbean	Upper middle income
Algeria	Middle East & North Africa	Upper middle income
Angola	Sub-Saharan Africa	Upper middle income
South Africa	Sub-Saharan Africa	Upper middle income

Table A1.d. Effective Regression Sample for Firms Loans Dollarization

Country	Region	Income Level
Haiti	Latin America & Caribbean	Low income
Nepal	South Asia	Low income
Benin	Sub-Saharan Africa	Low income
Burkina Faso	Sub-Saharan Africa	Low income
Burundi	Sub-Saharan Africa	Low income
Comoros	Sub-Saharan Africa	Low income
Congo, Dem. Rep. of	Sub-Saharan Africa	Low income
Guinea-Bissau	Sub-Saharan Africa	Low income
Mali	Sub-Saharan Africa	Low income
Mozambique	Sub-Saharan Africa	Low income
Niger	Sub-Saharan Africa	Low income
Rwanda	Sub-Saharan Africa	Low income
Senegal	Sub-Saharan Africa	Low income
Sierra Leone	Sub-Saharan Africa	Low income
Tanzania	Sub-Saharan Africa	Low income
Togo	Sub-Saharan Africa	Low income
Uganda	Sub-Saharan Africa	Low income
Indonesia	East Asia & Pacific	Lower middle income
Mongolia	East Asia & Pacific	Lower middle income
Solomon Islands	East Asia & Pacific	Lower middle income
Armenia	Europe & Central Asia	Lower middle income
Kyrgyz Republic	Europe & Central Asia	Lower middle income
Moldova	Europe & Central Asia	Lower middle income
Tajikistan	Europe & Central Asia	Lower middle income
Ukraine	Europe & Central Asia	Lower middle income
Bolivia	Latin America & Caribbean	Lower middle income

Guatemala	Latin America & Caribbean	Lower middle income
Honduras	Latin America & Caribbean	Lower middle income
Egypt	Middle East & North Africa	Lower middle income
Morocco	Middle East & North Africa	Lower middle income
Bangladesh	South Asia	Lower middle income
Bhutan	South Asia	Lower middle income
Sri Lanka	South Asia	Lower middle income
Cameroon	Sub-Saharan Africa	Lower middle income
Cape Verde	Sub-Saharan Africa	Lower middle income
Congo, Republic of	Sub-Saharan Africa	Lower middle income
Cote d'Ivoire	Sub-Saharan Africa	Lower middle income
Kenya	Sub-Saharan Africa	Lower middle income
Lesotho	Sub-Saharan Africa	Lower middle income
Swaziland	Sub-Saharan Africa	Lower middle income
Zambia	Sub-Saharan Africa	Lower middle income
Fiji	East Asia & Pacific	Upper middle income
Malaysia	East Asia & Pacific	Upper middle income
Albania	Europe & Central Asia	Upper middle income
Azerbaijan, Rep. of	Europe & Central Asia	Upper middle income
Belarus	Europe & Central Asia	Upper middle income
Bosnia & Herzegovina	Europe & Central Asia	Upper middle income
Bulgaria	Europe & Central Asia	Upper middle income
Georgia	Europe & Central Asia	Upper middle income
Macedonia, FYR	Europe & Central Asia	Upper middle income
Brazil	Latin America & Caribbean	Upper middle income
Colombia	Latin America & Caribbean	Upper middle income
Costa Rica	Latin America & Caribbean	Upper middle income
Dominican Republic	Latin America & Caribbean	Upper middle income
Guyana	Latin America & Caribbean	Upper middle income
Jamaica	Latin America & Caribbean	Upper middle income
Mexico	Latin America & Caribbean	Upper middle income
Venezuela, Rep. Bol.	Latin America & Caribbean	Upper middle income
Algeria	Middle East & North Africa	Upper middle income
Angola	Sub-Saharan Africa	Upper middle income
Botswana	Sub-Saharan Africa	Upper middle income
Gabon	Sub-Saharan Africa	Upper middle income
South Africa	Sub-Saharan Africa	Upper middle income

Table A2. Sources of Variables

Variable	Source
Deposits/loans dollarisation (%)	International Financial Statistics (IFS)—IMF
Inflation (%)	World Economic Outlook Database—IMF
Nominal depreciation against USD (%)	International Financial Statistics (IFS)—IMF
Real deposit/lending rate (%)	International Financial Statistics (IFS)—IMF
Deposit/lending rate spread to USA (%)	International Financial Statistics (IFS)—IMF
Capital Account Openness Index—KA Index	Chinn-Ito Index—2015

External debt (% of GDP)	World Economic Outlook Database—IMF
M2 (% of GDP)	International Financial Statistics (IFS)—IMF
GDP per Capita (thousand USD)	World Economic Outlook Database—IMF
Net exports (% of GDP)	World Economic Outlook Database—IMF
Defacto Peg (dummy)	AREAER Database—IMF
Polity index	Polity IV database
Population (millions)	World Economic Outlook Database—IMF

Table A3. Summary Statistics of Variables

	N	Mean	SD overall	SD between	SD within	Minimum	Maximum
Firms deposits dollarization	621	34.54	23.28	22.9	7.2	0.0	99.3
Firms loans dollarization	764	43.56	18.98	17.6	9.5	0.3	100.0
Households deposits dollarization	661	33.49	27.53	27.9	6.6	0.0	98.5
Households loans dollarization	426	20.38	18.15	18.9	9.3	0.0	100.0
Inflation (avg)	764	7.06	6.84	4.8	5.1	-3.7	62.2
Depreciation against USD (% avg)	764	3.1	10.99	4.7	10.1	-28.2	83.8
Lending rate spread to U.S	764	7.42	13.82	7.5	11.7	-69.3	73.7
Real lending rate: i(t) - infl(t+1)	764	8.61	9.96	7.0	7.1	-104.5	60.5
Deposit rate spread to U.S	661	1.6	11.5	3.8	10.8	-71.8	47.3
Real deposit rate: i(t) - infl(t+1)	661	-0.33	7.84	4.5	6.5	-107.1	29.1
KA openness (Chinn-Ito Index)	764	-0.14	1.41	1.3	0.5	-1.9	2.4
External debt to GDP ratio	764	45.89	31.75	25.5	20.1	2.5	183.8
M2 to GDP ratio	764	35.91	21.66	20.6	6.4	6.1	141.8
GDP p.c (Thousand PPP USD of 2011)	764	6.7	5.04	4.9	1.3	0.6	25.3
Net exports to GDP ratio)	764	-11.13	16.79	15.3	7.4	-70.9	44.6
Defacto floating regime	764	0.19	0.39	0.3	0.3	0.0	1.0
Polity score	764	3.96	5.47	5.2	1.7	-10.0	10.0
Population (Million)	764	26.29	46.5	43.3	3.0	0.4	255.5

Table A4. Independent Variables Correlation Matrix

		A	B	C	D	E	F	G	H	I	J	K	L	M	N
A	Inflation - Average		0.4	0.1	-0.1	0.0	-0.4	0.0	0.0	-0.2	0.0	0.1	0.1	0.0	0.1
B	Depreciation against USD - average	0.4		-0.1	-0.1	-0.2	-0.2	0.0	0.1	0.0	0.1	0.0	0.2	0.0	0.0
C	Lending rate spread to U.S	0.1	-0.1		0.6	…	…	0.1	0.1	-0.2	-0.2	0.1	0.1	0.1	0.1
D	Real lending rate: i(t) - infl(t+1)	-0.1	-0.1	0.6		…	…	0.2	0.1	-0.2	-0.2	0.0	0.2	0.1	0.1
E	Deposit rate spread to U.S	0.0	-0.2	…	…		0.4	0.0	0.1	-0.1	-0.1	0.1	0.0	0.0	0.0
F	Real deposit rate: i(t) - infl(t+1)	-0.4	-0.2	…	…	0.4		0.1	0.0	-0.1	-0.1	0.0	0.1	0.0	0.0
G	Chinn-Ito index	0.0	0.0	0.1	0.2	0.0	0.1		0.2	-0.1	0.1	0.0	0.1	0.2	-0.1
H	External Debt % of GDP	0.0	0.1	0.1	0.1	0.1	0.0	0.2		-0.1	-0.1	-0.2	0.0	0.1	-0.3
I	M2 % of GDP	-0.2	0.0	-0.2	-0.2	-0.1	-0.1	-0.1	-0.1		0.5	0.1	0.0	0.1	0.1
J	GDP p.c.	0.0	0.1	-0.2	-0.2	-0.1	-0.1	0.1	-0.1	0.5		0.4	0.1	0.1	0.2
K	Net Exports % of GDP	0.1	0.0	0.1	0.0	0.1	0.0	0.0	-0.2	0.1	0.4		0.0	-0.1	0.3
L	Dummy: Defacto floating regime = 1	0.1	0.2	0.1	0.2	0.0	0.1	0.1	0.0	0.0	0.1	0.0		0.2	0.3
M	Polity Score	0.0	0.0	0.1	0.1	0.0	0.0	0.2	0.1	0.1	0.1	-0.1	0.2		0.1
N	Population	0.1	0.0	0.1	0.1	0.0	0.0	-0.1	-0.3	0.1	0.2	0.3	0.3	0.1	

Table A5. Collinearity Analysis: Variance Inflation Factors and Condition Number

	Loans	Deposits
Inflation - Average	1.46	1.53
Depreciation against USD - average	1.33	1.32
Lending rate spread to USD	1.88	
Real lending rate: i(t) - infl(t+1)	1.94	
Deposit rate spread to USD		1.30
Real deposit rate: i(t) - infl(t+1)		1.41
Chinn-Ito index	1.16	1.14
External Debt % of GDP	1.18	1.17
M2 % of GDP	1.52	1.45
GDP p.c.	1.86	1.75
Net Exports % of GDP	1.50	1.45
Dummy: Defacto floating regime = 1	1.26	1.26
Polity Score	1.15	1.16
Population	1.36	1.34
Mean VIF	1.47	1.36
Condition Number	5.98	5.30

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