Taming Financial Dollarization: Determinants and Effective Policies

The Case of Uruguay

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ABSTRACT: With some of the most significant levels of financial dollarization in the Western Hemisphere, Uruguay is characterized by extensive dollarization in both deposits and loans. While traditional factors like high inflation and substantial devaluations have been associated with such outcome, the enduring nature of dollarization in Uruguay also underscores the importance of structural elements. In formulating a holistic strategy to reduce dollarization, not only should there be an enhancement of the monetary policy framework aimed at maintaining low, stable inflation, but it should also consider the calibration of prudential policies such as currency-differentiated reserve requirements and foreign-currency credit repos.

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WORKING PAPERS

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Contents

Introduction

1.   Dollarization has deeply entrenched within the Uruguayan economy, becoming a longstanding characteristic. [1] The origins of this widespread acceptance of the dollar can be traced back to the 1960s when dollar deposits were introduced as a more secure means of storing value.[2] Similar to other countries in the region, the surge in dollarization in Uruguay can be attributed to periods of pronounced inflation and currency depreciation, which eroded confidence and weakened demand for the local currency. Notably, financial dollarization reached its peak in Uruguay following the 2002 crisis, when the exchange rate peg system was abandoned, resulting in a significant depreciation of the Uruguayan peso. Despite the country's relative success in achieving comparatively lower and more stable inflation through the implementation of an inflation targeting regime since 2005, Uruguay continues to grapple with a significant degree of dollarization in both deposits and loans, making it one of the highest in Latin America. [3]

2.   Dollarized economies confront a range of significant risks stemming from their reliance on a foreign currency as medium of exchange. Foremost among these risks is the heightened vulnerability to exchange rate volatility. Dollarized economies may suffer from amplified financial fragility and increased susceptibility to external financial shocks, as dollarization exposes domestic banks and borrowers to exchange rate risks and potential liquidity shortages during global financial turmoil.

3.   Additionally, dollarization may lessen dollarized countries' control over monetary policy. Dollarization might strengthen the exchange rate transmission channel to domestic prices, particularly when price and cultural dollarization are present. The relationship between dollarization and inflation has been extensively documented for Uruguay (see more references in Zacheo and Guenaga, 2019; Cuitiño et al., 2021), as well as for other dollarized countries (Phiakeo, 2017; Levy Yeyati, 2021). In addition, countries with a floating exchange rate regime and significant dependence of their exports on international prices might tend to "fear" exchange rate movements more. The fear of floating is the conjecture that the presence of liability dollarization (i.e., private sector loans in foreign currency) might make countries less tolerant to large exchange rate changes because of the adverse effects those changes may have on sectoral balance sheets, financial stability, and, ultimately, on aggregate output (Reinhart, 2003). Also, since the high share of loans and deposits of the banking system in dollars are linked to international interest rates rather than domestic rates, this

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[1] The term "dollarization" has different dimensions. Some countries adopt full dollarization schemes, under which a country officially abandons its own currency and adopts a more stable currency of another country as its legal tender. On the other hand, some other countries have dual-currency economies or partial dollarization. Schemes of partial dollarization can also have different extents. For instance, *financial dollarization* is understood as the dollarization of financial contracts (usually loans and deposits, see Levy-Yeyati (2006)), while the term *real dollarization* is used to identify economies with dollar denomination of price and wage contracts (using the dollar as unit of account and medium of exchange). A comprehensive definition of dollarization can be found in Berg and Borensztein (2000).

[2] Between 1972 and 1982, despite a falling inflation differential (measured as domestic inflation minus the U.S.), financial dollarization increased steadily in Uruguay. Dollarization increased from near-zero levels in 1972 to over 70 percent in 1989 (Guidotti & Rodriguez, 1992).

[3] Throughout this document, the analysis is focused on the factors behind the high level of FX deposits, thus we frequently use deposit dollarization and financial dollarization interchangeably. Deposit dollarization is measured as the share of FX deposits in total deposits of the banking system. That said, our results include robustness tests that generalize our findings to dollarization of credit (Annex IV).

weakens the interest rate channel, and limits the ability of monetary policy to control domestic prices. This constrains, mechanically, the effect of the monetary policy rate on economic activity, creating a negative feedback loop whereby episodes of high and unstable inflation lead to high levels of dollarization, and at the same time, high levels of dollarization hinder the ability to control inflation. This lack of monetary sovereignty curtails the efficacy of domestic monetary policy in managing inflation, fostering growth, and stabilizing the economy during periods of crisis.

4.   Financial dollarization is influenced by several key determinants identified in the literature. These determinants encompass monetary factors, such as inflation and exchange rate stability, and institutional factors. Institutional factors, such as the credibility of monetary policy and financial development, significantly impact dollarization levels. Moreover, higher dollarization levels are associated to other structural factors as well (Garcia-Escribano and Sosa, 2011; IMF, 2021), namely: (i) lower economic development, (ii) lower governance quality indicators, (iii) higher financial and trade openness, and (iv) higher remittances inflows. Understanding these determinants is essential for designing targeted policy measures that can effectively address the challenges posed by financial dollarization and promote financial stability.

5.   Prudential policies can play a crucial role in supporting de-dollarization strategies for economies facing high levels of dollarization. Besides the role of structural factors and monetary policy variables, the results in this paper underscore that currency-differentiated reserve requirements could be an effective policy tool to de-dollarize the financial system. By implementing targeted prudential measures, policymakers can effectively mitigate the associated financial sector risks and encourage a gradual shift towards the use of local currency instruments. Currency-differentiated reserve requirements, for instance, can incentivize banks to reduce their exposure to foreign currency by imposing higher reserve ratios on foreign currency-denominated assets. Additionally, other prudential policy tools might contribute to similar objectives. Differentiated provisions for loan losses and risk weights for loans in local currency and foreign currency can discourage excessive borrowing and encourage the use of domestic currency for credit transactions. These prudential measures can help reduce the risks and vulnerabilities arising from dollarization, enhance financial stability, and provide a conducive environment for fostering confidence in the local currency.

6.   This paper sheds light on the drivers of dollarization in dollarized economies in the region. Our results are focused on Uruguay's dollarization levels and propose policy measures to mitigate its effects. Dollarization persists due to a combination of factors, but targeted prudential measures can play a vital role in reducing its prevalence. By implementing a comprehensive de-dollarization strategy that encompasses long-term structural policies, improvements to the monetary policy framework, and calibrated prudential measures, Uruguay can aim to reduce dollarization and enhance its monetary and financial stability.

7.   The organization of this paper is as follows: The second section provides a comprehensive literature review, discussing previous research on the factors driving dollarization and effective de-dollarization policies implemented in other countries. In the third section, an in-depth analysis of stylized facts related to the dollarization in Uruguay is conducted, examining key aspects of monetary policy, such as the relationship between inflation, exchange rate and dollarization, and the effects of interest rates on dollarization. Moving on to the fourth section, the empirical approach is formalized, presenting empirical evidence on the drivers of

dollarization and the effectiveness of prudential policies in de-dollarizing the financial system, both in Uruguay and other countries within the region. This section includes also a special focus on Peru's de-dollarization experience. Finally, the fifth section concludes by offering policy recommendations based on the findings and insights discussed throughout the paper.

Literature Review

8.   Several models have been developed in the literature to explain, theoretically, financial dollarization. The framework proposed by Guidotti and Rodriguez (1992) stresses the role of dollarization as the result of competition between different currencies, which provide about the same types of services. Their results suggest dollarization in Latin America might be the product of the financial liberalization processes implemented during the 1970s and 1980s, which would have allowed greater competition in monetary and financial services. Following an alternative approach, Ize and Levy Yeyati (1998) present a portfolio model of financial intermediation, suggesting that the choice of a partially dollarized economy is influenced by hedging decisions, where dollarization hysteresis could occur when the expected inflation rate volatility is high relative to the real exchange rate volatility. Their model also implies that countries seeking to limit asset substitution should target inflation rather than the real exchange rate. Expanding the scope of analysis, Ize & Parrado (2002) propose a general equilibrium model where real dollarization, financial dollarization and monetary policy co-exist. Following the same theoretical line, and building on existing literature, Basso et al. (2011) propose a framework to explain deposit and credit dollarization allowing for interest rate differentials and access to foreign funds to play a role in explaining the process of asset substitution.

9.   The determinants of financial dollarization have been empirically researched too, revealing the important role of inflation and exchange rates. Reinhart et al. (2003) argue that high inflation history, increased reliance on locally issued dollar-linked debt, access to global capital markets, and the advent of transition economies were crucial to the global increase in dollarization during the 1980–1990s. They noted a consistent high dollarization level in South America and the Middle East and an increase in emerging market economies from 2000-2010, contrasting with a downward trend in low-income countries (Mwase and Kumah, 2015). Thus, in economies with a history of inflationary instability, the use of a foreign currency, often the U.S. dollar, can serve as a reliable store of value and medium of exchange. Rennhack and Nozaki (2006) confirmed those results and found that in addition to inflation, depreciating trends in the exchange rate could encourage dollarization as it fosters anticipation of future currency weakening.

10.   However, monetary factors do not capture the full range of determinants. The role of institutional and structural factors is also important. Rennhack and Nozaki (2006) highlighted that countries with financial market imperfections, such as uncertain FX exposure of debtors, can find themselves locked into an equilibrium with high financial dollarization because of the very high economic costs of moving to a low dollarization equilibrium. In the same line, Della Valle et at. (2018) and IMF (2021) find evidence suggesting that financial sector development, remittances, trade openness and financial account restrictions might play a role explaining dollarization levels.

11.   Financial dollarization could have potential benefits for the economy, at least in the short term**.** On the one hand, dollarization is often seen as a tool for risk diversification, particularly in economies with high inflation or volatile monetary policies. By offering a more stable store of value, dollarization could encourage saving and investment and foster deeper financial integration with global markets. Baliño et al (1999) notes that the benefits of dollarization include closer integration with international markets, exposure to competition from these markets, and the availability of a more complete range of assets for domestic investors. At least temporarily, in countries in which inflationary experience has undermined confidence in the local currency, dollarization can sometimes help to remonetize the economy, restore local intermediation, and reverse capital flight. Similarly, De Nicolo et al. (2003) find that dollarization is likely to promote financial deepening in countries with a high inflation environment.

12.   However, the literature also emphasizes several costs associated with dollarization. A key issue is the increased vulnerability due to the dollarization of public and private debt, leading to a 'currency mismatch' problem where liabilities are denominated in a foreign currency while assets and incomes are in the local currency, making the financial health of households and firms more vulnerable to exchange rate fluctuations (Galindo & Leiderman, 2005). Expanding on the potential costs of dollarization, Levy-Yeyati (2006) provides a comprehensive analysis of the complex trade-offs that financial dollarization presents. Financial dollarization costs include the exacerbation of currency mismatch, constraints on monetary policy effectiveness, and increased financial vulnerability due to higher risks of banking crises. Some additional challenges that arise from dollarized environments are the higher vulnerability of the financial system to capital flows and depreciation risk, the weakening of the central bank's effectiveness as a lender of last resort, and the need to adjust monetary and exchange rate policies to include the presence of foreign currency deposits (Quispe-Agnoli, 2002).

13.   Dollarization impacts monetary policy effectiveness because it might increase the pass-through from the exchange rate to domestic prices. Honohan and Shi (2002) have shown that greater dollarization is associated with a higher pass-through coefficient from exchange rate changes to consumer prices, potentially increasing nominal risk in the economy. Reinhart et al. (2003) find evidence suggesting that dollarization appears to increase exchange rate pass-through, reinforcing the claim that "fear of floating" is a greater problem for highly dollarized economies. Acosta-Ormaechea & Coble (2011) report that in some dollarized countries the exchange rate channel is more relevant than the interest rate channel in the transmission of monetary policy. This result follows from the limited impact of the policy rate in curbing inflationary pressures, in combination with a relatively large and persistent exchange rate pass-through. In addition, Güenaga (2017), reporting results from a semi-structural neo-Keynesian model estimated for Uruguay, finds that partial dollarization in the context of contractive monetary policy would lead to a higher loss of product and lower effect on prices, thus increasing the sacrifice ratio comparing to a non-dollarized economy.

14.   Since dollarization has been a long-standing feature of the Uruguayan economy, the discussion of its causes and effects has benefited from country-specific extensive analysis. Licandro and Licandro (2001 and 2003) propose that the dollarization of assets in Uruguay started due to the lack of peso-denominated financial alternatives in a chronic-inflation country. They also identify devaluations on

unhedged borrowers as one of the main risks to financial stability derived from high dollarization levels. Licandro and Mello (2017) extend the characterization of the dollarization in Uruguay by using results from the 2013 Financial Survey of Households. They find that the level of dollarization of bank savings is positively explained by the size of savings and household wealth. Also, they introduce the concept of "cultural dollarization" and propose a proxy variable to measure it, finding that it is associated with wealth and home ownership. They note that the pricing system plays a key role in the dollarization culture. The latter was confirmed by Landaberry and Mello (2019), who, using information from 9 million announcements for consumer goods, found evidence of the persistence of US dollar pricing for high-value goods. They identified specific categories of goods that are mostly priced in dollars, such as vehicles, real estate, home appliances, and electronics. Their results suggest that US dollar pricing is positively associated with the products' value. Complementing the analysis of Uruguayan dollarization, the determinants of dollarization from corporates were analyzed in Mello (2016). Based on microeconomic and financial data from the annual Survey of Economic Activity (2012) and the BCU credit registry, it reports quantitative evidence to explain the liquidity and credit dollarization levels. The results show that liquidity in dollars is associated with the levels of debt in dollars, firm size, and the firms' sales tradable/non-tradable condition. Also, they find that debt in dollars is associated with the leverage of the firm, dollarization of assets, and the tradable/non-tradable condition of the firms' input purchases and goods sales.

15.   Prudential policies have shown to be effective in reducing financial dollarization when they are coordinated as part of a broader comprehensive de-dollarization strategy. Garcia-Escribano (2010) finds that increased reserved requirement differentials in Peru lowered commercial credit dollarization, while higher provisions for dollar-denominated loans decreased mortgage loan dollarization. At the regional level, they find evidence on the positive effect of increased reserve requirement spreads on de-dollarization, helping de-dollarize credit more broadly in Peru and Paraguay and de-dollarize deposits in Bolivia and Paraguay. Prudential measures aimed at internalizing the risks of financial dollarization, such as stricter capital requirements against open FX positions, higher provisions for foreign-currency-denominated loans, and the introduction of differentiated capital risk weights on dollar-denominated loans, have also lowered credit dollarization in Bolivia, Paraguay, and Uruguay. More broadly, outside of Latin America, Cakir et al. (2022) find additional evidence that such prudential measures have had a similar impact in other Emerging Markets, significantly reducing credit dollarization in Georgia, Kazakhstan, and Kyrgyz Republic. Their results also suggest that higher reserve requirement differentials assisted in de-dollarizing deposits in Armenia, Georgia, and Kyrgyz Republic and de-dollarizing loans in Georgia and Kyrgyz Republic. Catao and Terrones (2016) find evidence that prudential measures in Peru such as higher provisions for dollar-denominated loans are effective in reducing credit and deposit dollarization. It also identifies the introduction of local currency repos in 2015 as a new prudential policy tool to encourage financial de-dollarization, suggesting it merits later examination.

16.   A comprehensive policy approach is needed to effectively address financial dollarization. Macroeconomic structural policies, adequate monetary conditions and prudential measures, which are tightly intertwined in the pursuit of de-dollarization, should be coordinated (Garcia-Escribano and Sosa, 2011; Della Valle et al., 2018). The literature on the determinants of financial dollarization highlights a variety of factors ranging from inflation and exchange rate fluctuations to structural factors, with the effectiveness of prudential policies in mitigating dollarization risks a topic that needs further assessment. This paper primarily aims to

precisely measure the impact of prudential policies, among other monetary and structural determinants, on dollarization levels.

Stylized Facts

Dollarization Trends

17.   **Uruguay has reached one of the highest ratios of FX deposits to total deposits among Latin-America and Caribbean economies.** Dollarization has been a persistent characteristic of the Uruguayan economy for an extended period. A de-dollarization trend followed the 2002/2003 dollarization peak but that process lost momentum during the Global Financial Crisis. Since then, financial dollarization has stabilized.

Figure 1. Uruguay: Dollarization Trends

Financial Dollarization (in percent)

Source: BCU, authors' calculations

Regional Comparison of Dollarization (Share of FX liabilities to total liabilities, percent)

Source: Haver data and IMF staff calculations.
Average is the simple average of Bolivia, Paraguay, Peru, Costa Rica, Dominican Republic, Honduras, Guatemala, Chile and Argentina.

Domestic Treasury Notes and International Bonds by Currency and Residency

Source: National authorities and IMF staff calculations.

Implicit Foreign Exchange Risk

Source: Uruguayan authorities.
Measured as the ratio of FX loans granted to sectors with income in local currency to total loans.

18.   **About 75 percent of total deposits in the banking system are in dollars, predominantly held by households**. Households account for 72 percent of private sector foreign exchange deposits, while corporations account for the remaining 28 percent. Concentration is even more pronounced in the case of private FX loans, where 97% of the loan portfolio corresponds to corporate loans and only 3% to households. In addition, price dollarization is prevalent in the economy, with the housing market and durable goods being

primarily priced in dollars. The pricing of real estate, appliances, jewelry, livestock, and other high-value items displays a significant degree of dollarization (Landaberry and Mello, 2019.)

Figure 2. Uruguay: Distribution of Private Deposits
(in percent, 2021)

Households

FX, 57.7

LC, 10.0

Corporates

FX, 22.2

LC, 10.1

Source: BCU

Figure 3. Uruguay: Distribution of Private Credit
(in percent, 2021)

Corporates

FX, 47.9

LC, 14.4

Households

LC, 36.3

FX, 1.4

Source: BCU
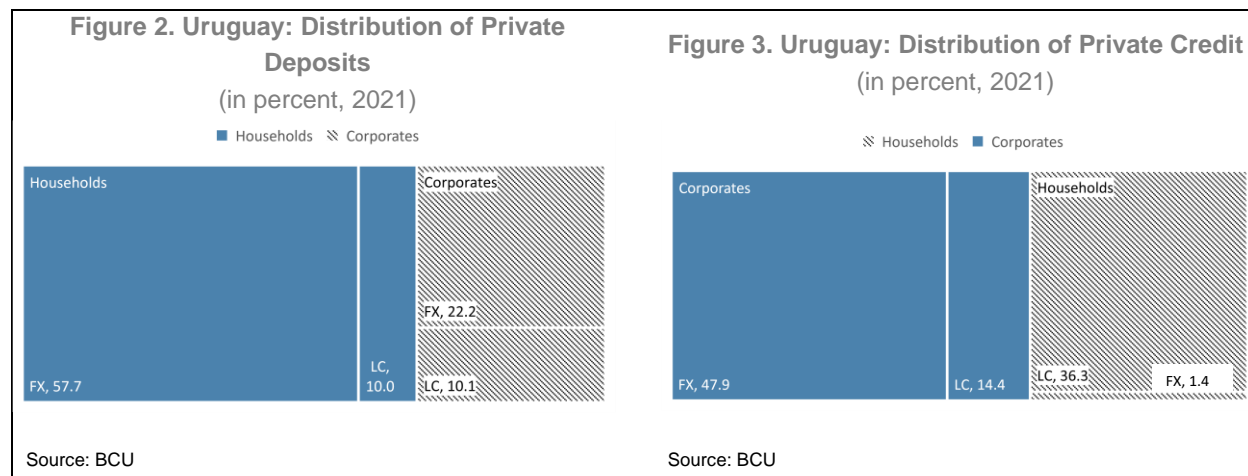
19.   The extensive dollarization in Uruguay, at multiple levels, leads to financial stability risks. The high levels of public debt denominated in dollars and a considerable share of unhedged borrowers amplify the risks associated with dollarization. As of end-2021, approximately 50 percent of the central government's market debt is denominated in foreign currency, and more than 75 percent of corporate debt is in dollars[4]. However, it is noteworthy that the public debt sourced from the local banking system is minimal. In addition, around 25 percent of FX loans are estimated to be unhedged (given the lack of data on currency composition of firms' income, these are estimated as the ratio of FX loans granted to firms in the non-tradable sector).

Uruguay's Macroeconomic and Structural Characteristics

20.   Uruguay has stable but high average inflation rate, and a history of significant fluctuations in its exchange rate relative to the US dollar. Even after the 2002/03 crisis, and despite implementing an inflation targeting regime since 2005, Uruguay's inflation rate has consistently remained elevated, with an average inflation of about 8 percent. Additionally, Uruguay's exchange rate volatility is among the highest among other Latin American dollarized economies.

21.   Uruguay has relatively high GDP per capita in the region, and minimal restrictions on its external financial account, but its trade openness is relatively low, and there is ample room to continue enhancing its financial development. The country outperforms all other dollarized economies in the region in terms of economic development and governance indicators. Uruguay also has a low level of restrictiveness on its financial account, as indicated by the IMF's Financial Account Restrictiveness Index (FARI). Financial openness and rapid growth have not been accompanied by higher trade or financial development. Uruguay's

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[4] Uruguay has seen a significant reduction in the proportion of public debt over the past two decades. In 2000, the foreign exchange public debt accounted for approximately 90% of the GDP. However, by 2022, it had decreased to about 45% of GDP.

trade openness is among the lowest compared to other dollarized economies, and its financial development is relatively low, and similar to that of less developed countries (see Figure A1 in the Annex I).[5]

| Table 1. Uruguay: Average CPI Inflation and ER Volatility: 2005-2022					
	CPI Inflation	Inflation Volatility 1/		ER Volatility 1/	
	(Percent, yoy)	12-month	3-month	12-month	3-month
Bolivia	4.6	1.3	0.6	0.3	0.1
Chile	3.8	1.0	0.5	4.9	2.5
Costa Rica	5.5	1.1	0.6	2.3	1.0
Dominican Republic	4.8	2.5	1.0	3.2	1.0
Guatemala	5.0	1.2	0.6	1.0	0.5
Honduras	5.7	0.9	0.4	0.8	0.3
Nicaragua	7.1	1.6	0.7	2.1	0.7
Paraguay	5.3	1.5	0.9	3.1	1.5
Peru	3.2	0.7	0.3	2.3	1.0
Uruguay	7.8	0.8	0.4	4.8	2.2

Source: IMF International Financial Statistics.

1/ Volatility is measured as the rolling standard deviation for the specified time window.

Dollarization, Inflation and Exchange Rate Fluctuations

Figure 4. Granger Causality Test Between Inflation and Depreciation
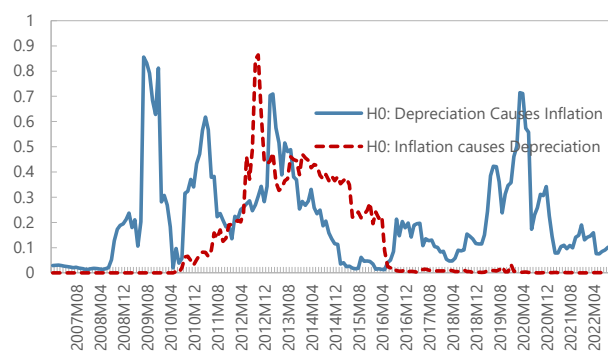
Source: Authors' calculations.
The chart report p-values for the two possible H0 tests of the Granger causality test run using 7-year rolling window of monthly data. The first observation in the chart correspond to the Granger test results between 2000M1 and 2007M1, while the last observation corresponds to the results corresponding to 2015M10-2022M10 period.

22.   The relationship between dollarization, inflation and exchange rate is intricate and has many dimensions. Inflation and exchange rate variations might cause higher dollarization levels and, simultaneously, higher dollarization levels might weaken monetary policy interest rate channel transmission and cause higher inflation.

23.   We found empirical evidence supporting that, exchange rate fluctuations affect domestic prices and not vice versa. As a first step, we disentangle the relationship between inflation and the exchange rate.

Endogeneity is a usual challenge between macroeconomic variables. In the case of the relationship between exchange rate and inflation, endogeneity cannot be ruled out. The causality mechanism from ER to prices is straightforward. ER transmit changes in international prices to domestic prices, which are an important factor in

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[5] Uruguay's trade openness is not that low when compared with the full set of Latin-American countries though, and has grown considerably over the past two decades, rising from 37 percent of GDP in 2000 to 58 percent of GDP in 2022.

open and small economies. But a reverse causality could hold as well. For instance, higher domestic prices could negatively affect exports' competitiveness and, in turn, lead to currency depreciation pressures. To characterize the relationship between exchange rate and prices in Uruguay, we ran *Granger* causality tests between both variables. Our results provide evidence of causality from ER depreciation to inflation (i.e., exchange rate fluctuations preceded price variations). It is interesting to note that this strong relationship has not been stable over the previous two decades. During the commodity boom period (2004-2014), the relationship between both variables has been weak. This could indicate that, during that period, prices fluctuated driven by other factors, such as the buoyant economic activity seen during those years. At the same time, this suggests that the relationship holds during depreciation periods but not that much when the currency is appreciating. The reverse causality, from inflation to exchange rate, cannot be supported by the data[6].

Figure 5. Uruguay: Pass-Through from ER to Domestic Prices

Source: IMF staff calculations.
Beta coefficients from regressions of: Spec. 1: the y-o-y inflation on the y-o-y depreciation of the ER; Specif. 2: the 3-month moving average of the y-o-y inflation on the 3 month moving average of the y-o-y depreciation of the ER; Spec. 3: the quarterly logarithmic difference in the price level on the quarterly logharitmic difference in the peso-dollar ER. All calculated over a 5-year window using monthly data. Reporting the R-squared coefficient from regressions of: the y-o-y inflation on the y-o-y depreciation of the ER.

24.   Uruguay's exchange rate pass-through to inflation has been relatively low in the previous 20 years. Quantitatively, the effect of exchange rate on inflation can be captured by the exchange rate pass-through measure. According to our own calculations and those from similar studies (Levy-Yeyati, 2021; Alvarez-Plata and Garcia-Herrero, 2008), the ER pass-through for Uruguay reached a peak in the early 2000s and declined to about zero or even negative (although not statistically significant) numbers between 2011-2013. Since then, it steadily increased to positive and statistically significant levels. A few caveats are worth

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[6] The results from the bivariate analysis do not rule out the possibility that a third factor, such as fiscal or monetary policy regimes, might determine both variables. We have not included a formal multivariate causality analysis in this document. Instead, we report long-term correlations, utilizing cointegration analysis and the estimation of reduced-form equations.

mentioning. The standard exchange rate pass-through measure, the elasticity of CPI to ER, does not capture all the components of the formation of prices process. As different countries show varying ER volatility (and different inflation levels), even a similar pass-through coefficient might imply different outcomes for each country. While Uruguay's pass-through has been estimated as one of the lowest among other dollarized countries in the region, with pass-through in some regional peers estimated as high as 0.6, the explanatory power of exchange rate on inflation is not negligible. As suggested by the goodness of fit between ER and prices, the relationship between both could be quite strong (see figure 5). Finally, to further enhance our analysis, we employed local projection estimates to assess the pass-through effect of the exchange rate on inflation and 12-month ahead inflation expectations at various horizons (12, 24, and 26 months). As depicted in Figure A4 in the Annex, the results indicate that the exchange rate has a statistically significant and long-term impact on inflation. In contrast, inflation expectations are only marginally influenced at the 12-month horizon and exhibit an insubstantial effect (not statistically significant) at extended horizons. These findings imply that inflation expectations remain relatively well-anchored and are largely unaffected by fluctuations in the exchange rate. Nevertheless, it is worth noting that these expectations are tightly anchored above the inflation target range in Uruguay (IMF, 2023).

25.   In general, it is widely accepted that inflation and exchange rates are two main drivers of dollarization. The importance of those two variables on dollarization levels has been underscored in many theoretical models. One widely accepted model to estimate the drivers of dollarization is the Minimum Variance Portfolio (MVP) model (Ize and Levy Yeyati, 2003). [7] Under certain assumptions, it proposes that dollarization increases with inflation volatility and decreases with the volatility of the real exchange rate depreciation.[8] While the MVP model is useful to frame the discussion about incentives and preferences of agents towards the use of an alternative currency, according to our own calculations, the MVP dollarization ratio explains only partially the observed dollarization levels (see Annex I, Figure A2).

The Role of Interest Rates

26.   The relationship between dollarization and interest rate differentials can be assessed from the dynamics of the uncovered interest rate parity (UIP) condition.[9] While the benchmark MVP model underscores the relevance of inflation and ER depreciation, it assumes, in its simplest version, that nominal interest rates are fixed[10]. In a framework where interest rates can change, a positive UIP premium would favor de-dollarization, because it implies higher returns in local currency, while the opposite holds for periods of negative UIP premium, although compensation for risk also needs to be taken into account.

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[7] Interestingly, the dollarization share implied by the MVP model is equivalent to the ER pass-through standard measure. See Annex II for a proof.

[8] It can be proved that the share of deposit dollarization implied by the MVP model is equivalent to the most standard measure of the pass-through from the nominal exchange rate and domestic prices. See more details of the MVP model and a proof of this equivalence in the Annex II .

[9] UIP condition is defined as $E_t(S_{t+h})(1 + i_t^{US}) = S_t(1 + i_t)$ where i_t and i_t^{US} t are the local currency and the dollar (12-month deposit) interest rates, respectively. E denotes expectations over the next year, and h is a 12-month horizon. S is the exchange rate in units of local currency per USD.

[10] Ize & Levy-Yeyati (2003) include an extended version of their model including the role of interest rate volatility, however, its suitability has not been tested for a broad set of countries empirically yet.

27.   In Uruguay, the volatility of the 12-month deposit UIP premium is primarily driven by changes in exchange rate expectations. Interest rate differentials were generally stable over the last two decades, making fluctuations in the exchange rate the main driver of UIP changes. Additionally, exchange rate expectations have consistently favored a depreciation of the local currency relative to the US dollar. Besides those factors, the implementation of prudential policies to minimize FX financial risks in the first half of the 2000s and a financial market that steadily became more developed in the previous two decades may have helped bring down UIP premia from high levels in the early 2000s. Our results found that, for 12-month deposits, the UIP condition holds (see details in Annex III), which indicates no systematic compensation for risk on average.

Figure 6. Uruguay: Uncovered Interest Rate Parity Premium
(12-month Deposits, in logs)

Source: IMF staff calculations based on BCU and Consesus data.
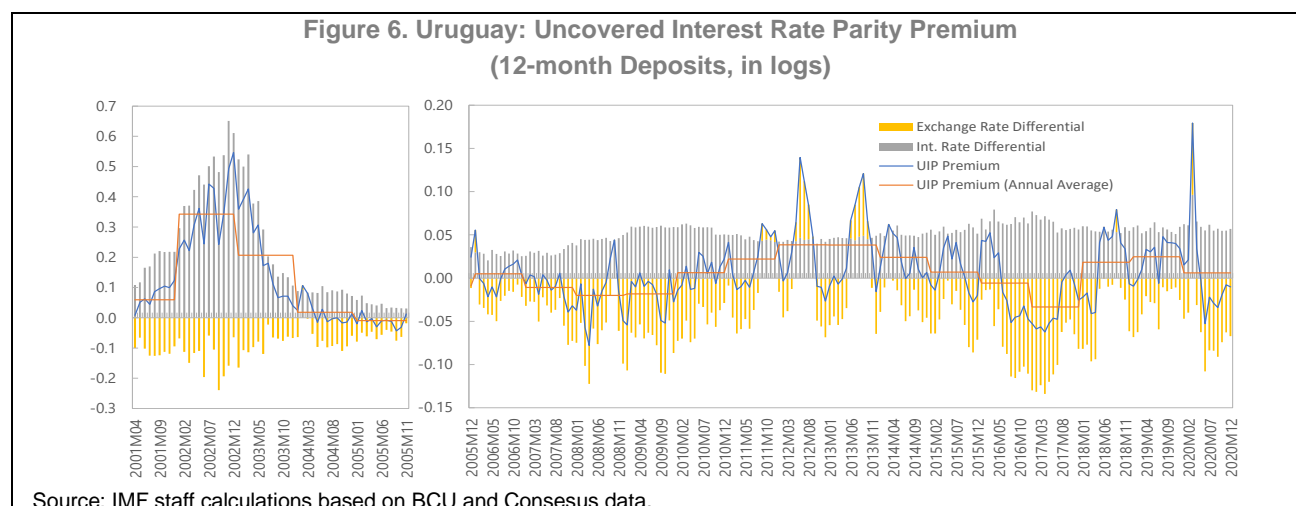
28.   The fluctuations of the UIP components can help explain financial dollarization. While the UIP condition holds in the long term, short-term fluctuations could contain information to explain dollarization. Empirical analysis supports the expected relationship between the UIP components and the degree of financial dollarization in the economy. Regression results indicate that the level of dollarization decreases as the interest rate differential between domestic currency and dollar deposits increases. Additionally, a higher spot exchange rate is associated with lower levels of dollarization, while expectations of a depreciating exchange rate tend to result in higher levels of dollarization (see Table 2).

Table 2. Uruguay: Financial Dollarization and Changes in the UIP Components

Cointegrating Equation (VEC model)

Log of Share of Deposit Dollarization	1.00
Deposit Interest Rate Differential (i-i*)	0.031***
	(0.00393)
Log of ER (eop)	1.97***
	(0.6090)
Log of ER 12-month expectations	-1.88***
	(0.57)
Error Correction Term	-0.009**
	(0.00515)

Standard errors in ( )
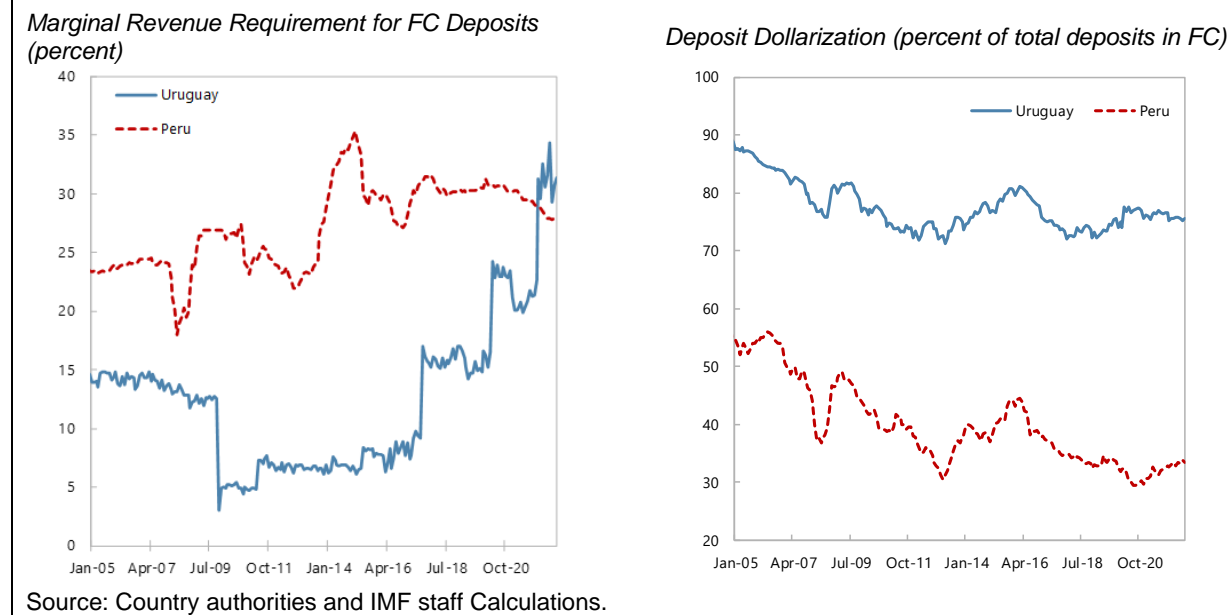*** p<0.01, ** p<0.05, * p<0.1
Source: Author's calculations. Results from a VEC model using
monthly data between 2003-2020. Johansen cointegration test
results indicate the existence of a cointegrating vector.

Reserve Requirement Differential as Prudential Tool

29.   Macroprudential policies such as marginal reserve requirement for foreign currency deposits can help reduce dollarization. Raising the cost of holding dollar-denominated deposits relative to local currency deposits for local banks is a strategy that policymakers have often pursued to discourage deposit dollarization. A useful tool consists in differentiating the reserve requirement for dollar and local currency deposits, specifically by raising the reserve requirement of dollar-denominated deposits above the one for local currency deposits. This imposes an additional cost to banks of holding dollar deposits. Among countries with a high degree of deposit dollarization in Latin America, Peru is a successful example of a country that has used this tool as a measure to encourage the de-dollarization of banking deposits. The combination of marginal reserve requirement, together with the introduction of additional prudential measures, such as higher provisions for foreign currency loans, have helped reduce financial dollarization in Peru (Catão and Terrones, 2016; and García-Escribano and Sosa, 2011). In contrast, Uruguay has had a relatively low level of marginal reserve requirement for foreign currency deposits, only reaching comparable levels in the last year (See Figure 7).

Figure 7. Uruguay: Marginal Reserve Requirement and Deposit Dollarization

Marginal Revenue Requirement for FC Deposits (percent)

Deposit Dollarization (percent of total deposits in FC)

Source: Country authorities and IMF staff Calculations.

The Determinants of Dollarization

Drivers of Dollarization in the Region

30.   Deposit dollarization can be influenced by macroeconomic and structural country characteristics other than inflation, depreciation and interest rate differentials. Adopting a methodology similar to Della Valle et al. (2018) and IMF (2021), a regression analysis was conducted to examine the drivers of deposit dollarization in a selected group of economies in the region.

31.   The baseline regression analysis is based on annual data between 1999 and 2019 and employs a panel regression approach to explain financial dollarization. The sample comprises 10 countries in the region: Bolivia, Chile, Costa Rica, Dominican Republic, Guatemala, Honduras, Nicaragua, Paraguay, Peru, and Uruguay. The selected determinants of dollarization are aligned with the existing literature on exchange rate arrangements and included variables such as economic size (measured by population and real GDP per capita), trade openness (as a percentage of GDP), capital account openness (proxied by the IMF's Financial Account Restrictiveness Index (FARI), remittances, and governance indicators.[11] The regression model also

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[11] Based on the capital controls reported in the Annual Report on Exchange Rate Arrangements and Exchange Restrictions.

incorporates variables related to monetary and external position performance, such as the MVP estimates[12], exchange rate, and inflation.

32.   In the preferred panel data estimates, most macroeconomic determinants are statistically significant and have the expected sign. The analysis reveals statistically significant and positive correlations between dollarization, the exchange rate, and the MVP term (Table 3, Column 1). The latter accounts for the relative impact of exchange rate and inflation variance, as well as their covariance. Higher levels of net remittances, which are often received in US dollars increase the availability of foreign currency (FX) in the economy, thereby boosting the size of FX deposits and exacerbating cultural and price dollarization. The effect of the exchange rate on dollarization is not surprising, as a continued depreciation of the local currency incentivizes to hold FX as a store of value. Finally, the positive relationship between the MVP variable and dollarization supports the MVP model's theoretical framework.
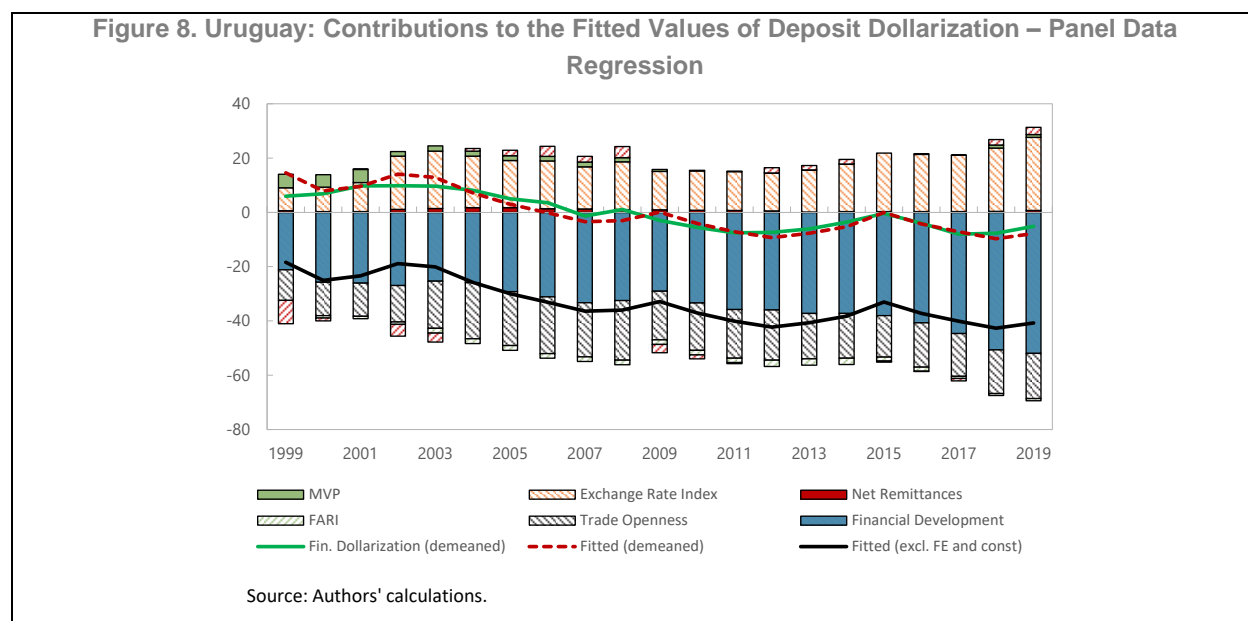
33.   The model also indicates an inverse relationship between dollarization and financial development, financial account restrictiveness, and trade openness. Higher financial development, as reflected by the financial development index, may lower the incentives to hold foreign currency deposits, given the increased opportunities to hedge currency risks and invest in local currency securities, and lower incentives for keeping dollars for precautionary reasons. Conversely, a negative relationship between dollarization and financial account restrictiveness may be driven by reduced access to FX resources, which could reduce the availability of FX deposits and loans.[13] The negative relationship between trade openness and dollarization contradicts previous evidence from Della Valle et al. (2018), who found a positive coefficient for a broader set of countries. However, the effect of this variables holds even when broken down by exports and imports, with imports having a slightly larger negative effect on dollarization than exports[14].

34.   When examining the impact of the explanatory variables on dollarization levels in Uruguay, the results show that exchange rate, financial development, and trade openness have the most significant contributions. The contribution of each variable to the model's predicted fitted value was estimated, after adjusting for the constant and fixed-effect terms. Continued exchange rate flexibility would contribute to the de-dollarization strategy as exchange rate appreciations are associated to lower dollarization levels. Also, the continued improvement of financial development has helped reduce financial dollarization. The analysis also highlights the sensitivity of dollarization levels to variations in trade openness. Variables such as FARI and net remittances had less of an impact in this case due to their low Uruguay-specific variance.

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[12] The MVP estimates are included as a regressor. This accounts for the effect of real exchange rate depreciation and inflation variances and covariance on dollarization levels.

[13] The Financial Development index is published by the IMF. It is a relative ranking of countries on the depth, access and efficiency of their financial institutions and financial markets.

[14] The effect of trade openness could be further assessed by introducing in the analysis the share of imports and exports invoiced in US dollars. Boz (et al. 2022) suggest that countries invoicing more in dollars tend to experience greater dollar exchange rate pass-through to their import prices and higher sensitivity of their trade volumes to fluctuations in these exchange rates. The trade invoicing currency might affect dollarization levels as well.

Figure 8. Uruguay: Contributions to the Fitted Values of Deposit Dollarization – Panel Data Regression

Source: Authors' calculations.

Uruguay's Country-Specific Dollarization Drivers and The Role of Prudential and Monetary Policies

35.   Country-specific regressions for Uruguay confirmed the previous findings. There were two potential factors that could affect the robustness of the previous results: first, the panel data regression may have captured the dynamics of economies other than Uruguay more strongly, as the estimated coefficients are a weighted average of the information observed in each country. Second due to data availability, the panel data specifications use annual frequency data and did not include interest rate series nor proxies for prudential policies, because of missing observations for other economies. To address these issues, an additional set of country-specific results using monthly data and incorporating interest rates of deposits in both local currency and FX as potential explanatory variables is reported. The analysis also includes a newly built variable to capture the effect of currency-differentiated deposit reserve requirements (Columns 10-12 of Table 3). The signs of the coefficients remain unchanged, although the magnitude and significance of some variables is affected. In addition to the three main drivers of dollarization mentioned above (¶34), there is an important contribution from two more variables, the fluctuations of net remittances and the reserve requirement differential. While statistically significant and with the expected sign, interest rates of peso and dollar deposits do not drive the results in a quantitatively important way.

Figure 9. Uruguay: Contributions to the Fitted Values of Deposit Dollarization – Uruguay's Country-Specific Regression

Source: Authors' calculations.
Contributions are defined as the regression coefficient estimate of a given variable times its value.
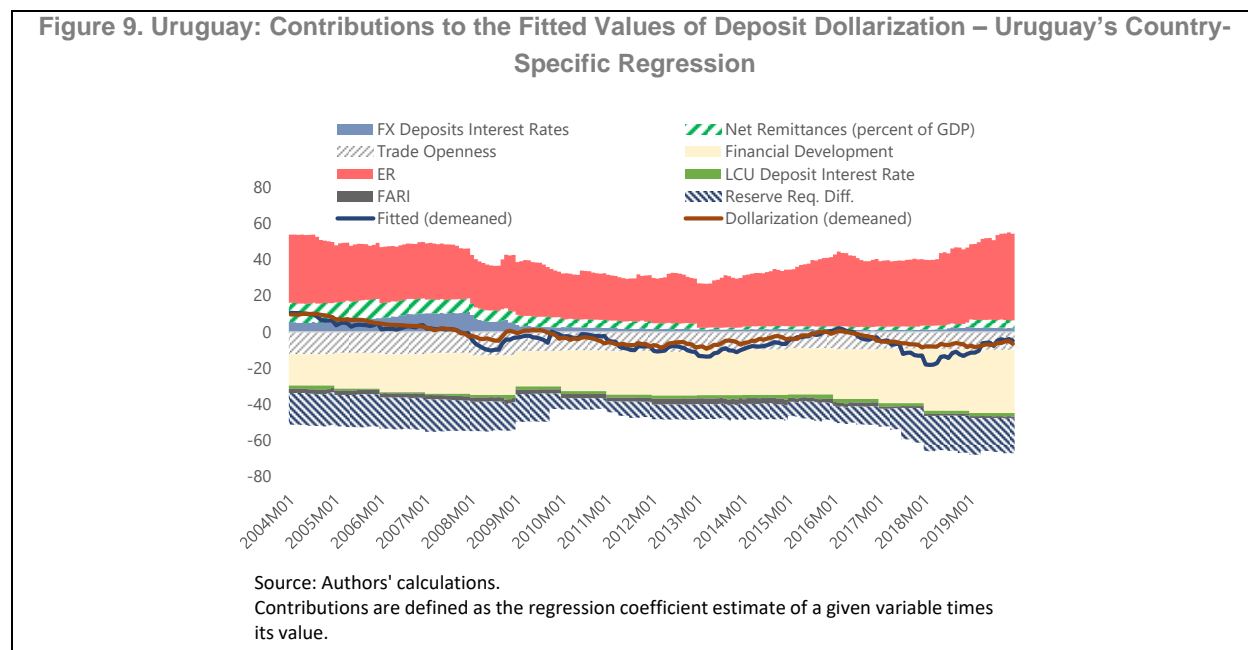
36.   The country-specific regression results also suggest that the role of prudential measures could be significant. The margin between reserve requirements for dollar and peso deposits affect financial dollarization levels. A one percent increase in the differential between reserves requirements in dollars and pesos would contribute to reducing financial dollarization levels by around 0.8 percentage points.

37.   The impact of prudential and monetary policies on the level of financial dollarization in the Uruguayan economy is also relevant using higher frequency data. In order to understand the drivers of dollarization at higher frequency, a model with monthly data is also estimated (i.e. excluding structural variables). Following Catão and Terrones (2016) a set of external and domestic variables affecting dollarization were identified. The model including high frequency monetary/financial external and domestic variables is based on monthly data from 2006 until 2021 and utilizes a time series regression for a set of domestic factors, which include some macro-prudential policies, and external factors. Domestic factors include the introduction of monetary policy rate as instrument, reserve requirement differential, exchange rate and domestic inflation. External factors are aligned with previous literature and consist of foreign interest rates (as represented by the interest rate spread between dollar and peso), volatility in global financial centers (as represented by the VIX index), and US inflation

38.   Regression results using high-frequency data confirm the role of marginal reserve requirements, as well as the role of monetary policy and inflation (Column 11 in Table 3). The empirical results suggest that a one percentage increase in the reserve requirement differential between dollar and peso deposits decreases deposit dollarization by 0.75 percentage points. Additionally, the results suggest that the implementation of inflation targeting with a short-term rate policy instrument between 2007 and 2013, and again

Table 3. Uruguay: Drivers of Dollarization

Share of Deposits in FX	(1)	(2)	(3)	(4) a/	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12) e/
	Panel Data FE b/	Panel Data FE b/	Panel Data FE b/	Panel Data FE b/	Panel Data FE b/	Panel Data FE b/	Panel Data FE b/	Panel Data FE b/	Time Series OLS	Time Series VEC c/	Time Series DOLS d/	Time Series DOLS d/
FD: Financial development index	-1.70**	-1.74**	-1.70**	-1.65**	-1.84**	-1.84**	-1.79**	-1.83**	-1.13***	-1.04***		
	(0.61)	(0.65)	(0.57)	(0.60)	(0.64)	(0.61)	(0.63)	(0.60)	(0.12)	(0.20)		
Trade Openness (perc. of GDP)	-0.33**			-0.38**	-0.31**	-0.31**	-0.31**	-0.31**	-0.34***	-0.13		
	(0.11)			(0.14)	(0.12)	(0.12)	(0.12)	(0.12)	(0.06)	(0.13)		
Exports of Goods and Services (perc. of GDP)		-0.51**										
		(0.16)										
Imports of Goods and Services (perc. of GDP)			-0.62**									
			(0.25)									
Financial Account Restrictiveness	-0.43**	-0.43**	-0.41*	-0.49**	-0.50**	-0.50**	-0.48**	-0.50**	-0.49	-0.28		
	(0.17)	(0.17)	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)	(0.32)	(0.55)		
Net Remittances (perc.of GDP)	2.31*	2.15*	2.45**	1.85*	2.31*	2.32*	2.30*	2.32*	9.26***	11.70***		
	(1.05)	(1.09)	(1.01)	(0.83)	(1.08)	(1.08)	(1.07)	(1.08)	(2.82)	(4.34)		
Log of Exchange Rate Index (eop, 2005=100)	16.72**	16.85**	15.19**	13.03*	14.49**	14.57**	15.01**	14.91**	11.33***	27.73***	10.20***	4.68*
	(5.77)	(5.89)	(4.85)	(6.03)	(5.01)	(5.42)	(5.09)	(5.55)	(2.24)	(2.96)	(0.88)	(2.43)
Variance of Inflation					-0.02	-0.02*						
					(0.04)	(0.01)						
Variance of Deprec. Real ER					0.00		-0.00					
					(0.00)		(0.00)					
Covariance Inflation-Deprec. Real ER					-0.00			-0.01*				
					(0.01)			(0.00)				
MVP (from monthly data)	0.13**	0.12*	0.14**	0.09								
	(0.05)	(0.05)	(0.05)	(0.05)								
FX Deposits Interest Rates									1.39***	3.19***		
									(0.43)	(0.87)		
LCU Deposits Interest Rates									-0.05**	-0.20**		
									(0.02)	(0.08)		
Lending interest rate spread (i-i*)												1.62***
												(0.05)
Deposit interest rate spread (i-i*)											-2.41***	
											(0.07)	
Reserve Requirement Differential (USD dep. req. minus peso dep. req.)										-0.81***	-0.75***	-0.52***
										(0.13)	(0.03)	(0.10)
Monetary Policy Rate as instrument (Dummy)											-0.50*	-3.47***
											(0.29)	(0.35)
Uruguay CPI inflation											3.51***	1.94***
											(0.09)	(0.27)
US CPI inflation											-0.61***	5.30***
											(0.12)	(0.31)
VIX											5.96***	-12.56***
											(0.34)	(0.87)
US Treasury Yield: 3-month											2.37***	
											(0.14)	
US Treasury Yield: 12-month												0.25
												(0.26)
Observations	197	197	197	187	197	197	197	197	240	208	216	216
R-squared	0.65	0.63	0.64	0.63	0.63	0.63	0.63	0.63		0.94		
Frequency	Annual	Annual	Annual	Annual	Annual	Annual	Annual	Annual	Monthly	Monthly	Monthly	Monthly
Number of countries	10	10	10	10	10	10	10	10	1	1	1	1

Source: Authors' calculations based on IMF and WB data.
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
a/ Instead of contemporaneous regressors, this specification includes lagged RHS explanatory variables as a simple way to control for endogeneity.
b/ FE stands for Fixed Effect model.
c/ VEC reports the cointegrating equation from a Vector Error Correction Model.
d/ DOLS reports the cointegrating equation from a Dynamic OLS model estimation.
e/ This model has credit dollarization as the dependent variable.

since late 2020 has contributed to reducing financial dollarization[15]. Furthermore, higher domestic inflation would be associated with higher dollarization levels: a reduction of inflation of 1 percentage point would lower dollarization by about 3.5 percentage points. Those results further reinforce the importance of monetary policy credibility and delivering low and stable inflation in supporting financial de-dollarization.

39. **External factors can also explain de-dollarization trends at a high frequency**. Higher interest rate spreads between peso and dollar deposits make holding deposits in pesos more attractive and reduce dollarization. Conversely, higher US interest rates also increase dollarization as it makes deposits in US dollars more attractive. Lower US inflation increases dollarization although the effect is quantitatively small. Increased global financial market volatility encourages deposit dollarization, suggesting that a flight-to-safety effect remains significant in Uruguay whenever risk-off events occur in global financial markets.

40. **Most of the previous findings hold when the determinants of credit dollarization are analyzed.** Importantly, the role of monetary policy and prudential policies is consistent (Table 3, Column 12). However, as expected, some variables exhibit the opposite signs, since the determinants of savings (deposits) and borrowing (credit) would be expected to operate in different ways. In particular, financial global volatility and interest rate differential variables capture well that credit dollarization would decline in scenarios of financial stress, and the positive (negative) effect of local currency (FX currency) interest rates on FX credit demand.[16]

Additional Prudential Measures for Consideration: The Case of Peru

41. **In addition to reserve requirements, other prudential tools, such as repos in local currency, should be considered as part of a comprehensive financial de-dollarization strategy.** Encouraging credit growth in local currency, particularly by substituting dollar-denominated loans, is a complementary goal to reducing financial dollarization. A helpful policy tool is injecting more liquidity into the local currency credit market through repos. Although Uruguay has yet to introduce these policy tools, Peru again presents a practical example from within the region where such policies have been used successfully as part of a comprehensive strategy to reduce credit and deposit dollarization. In the case of Peru, the central bank introduced three types of repos to do this. Foreign currency credit repos aimed at substituting dollar-denominated loans with local currency loans, foreign currency reserve repos directed at exchanging foreign currency reserves for local currency credit, and public deposits repos which auction fiscal surpluses deposited at the central bank.

42. **A country-specific regression for Peru is used to measure the effectiveness of repos in de-dollarizing deposits and credit in the financial system.** Using a similar specification to the country-specific model for Uruguay, the regression uses monthly frequency data to estimate the effect of three types of repos in Peru in reducing financial dollarization. The repos in question are grouped into two categories: repos aimed at substituting dollar-denominated loans with local currency loans and repos directed at expanding credit in local

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[15] This is represented in the model by a binary variable that takes the value of one for the periods when the BCU was using the short-term interest rate as the instrument to conduct monetary policy, and zero when the BCU was using monetary aggregates targeting as the policy instrument.

[16] See Annex A.4 for robustness analysis after controlling for the exchange rate valuation effect on the dollarization ratio.

currency. The latter category is comprised of foreign currency reserve repos and public deposit repos. The effect of reserve requirement differentials and interest rate spreads, deposit interest spreads, and credit expansion repos are examined separately, given a high degree of multicollinearity between these variables in the case of Peru.

43.   Regression results confirm the efficacy of repos as a tool to reduce financial dollarization in Peru. Empirical results indicate a one percentage point increase in the amount of outstanding foreign currency credit substitution repos decreases credit dollarization by approximately 1.6 percentage points, with an additional effect in reducing deposit dollarization between 0.7 and 1.1 percentage points. A larger effect can be observed for credit expansion repos, with a one percentage point increase in outstanding repos being associated with a 1.9 percentage point reduction in credit dollarization and a 2.5 percentage point decrease in deposit dollarization. Similar to Uruguay's case, we also find a significant effect from reserve requirement differentials, further reinforcing the need for a comprehensive set of prudential policies to achieve substantial reductions in financial dollarization.

Table 4. Peru: Repos as a Tool for De-Dollarization						
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Deposit Dollarization a/	Deposit Dollarization a/	Deposit Dollarization a/	Credit Dollarization a/	Credit Dollarization a/	Credit Dollarization a/
Log of Exchange Rate (eop)	81.86***	43.14***	96.81***	116.60***	42.61***	58.31***
	(5.90)	(7.58)	(5.48)	(6.37)	(7.47)	(7.36)
Reserve Requirement Differential (USD dep. req. minus PEN dep. req.)	-4.34***			-6.59***		
	(0.52)			(0.76)		
Deposit interest rate spread (i-i*)		-16.04***				
		(5.45)				
Lending interest rate spread (i-i*)					3.83***	2.62***
					(0.34)	(0.39)
Log of Outstanding FC Credit Substitution Repos	-0.77**	-1.11***		-1.64***	-1.56***	
	(0.34)	(0.40)		(0.45)	(0.32)	
Log of Outstanding LC Credit Expansion Repos			-2.50***			-1.93***
			(0.08)			(0.24)
Peru CPI inflation	-1.60*	2.03**	2.12***	-2.31	0.86	0.88
	(0.93)	(0.81)	(0.52)	(1.59)	(0.58)	(0.62)
US CPI inflation	-9.82***	-3.85***	-1.99***	-14.66***	0.71	2.57***
	(1.02)	(0.98)	(0.61)	(1.37)	(1.19)	(0.79)
VIX	-13.75***	-22.83***	-7.49***	-25.76***	-8.44***	-5.68***
	(2.64)	(3.73)	(0.99)	(3.03)	(2.56)	(1.56)
Observations	198	198	198	219	219	219
Frequency	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly

Source: Authors' calculations based on IMF and Peruvian authorities' data.
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
a/ DOLS reports the cointegrating equation from a Dynamic OLS model estimation.

Policy Recommendations

44.   The phenomenon of dollarization can be attributed to a convergence of structural elements, macroeconomic conditions, and prudential regulations. Staff analysis suggests that structural factors and macroeconomic indicators, such as exchange rate volatility and the level of financial development, have a substantial impact on the degree of dollarization. Also, the results support that a comprehensive de-dollarization strategy should incorporate policy tools aimed at improving the monetary policy framework, lowering inflation in a sustained manner, and adjusting prudential regulations. This strategy should be designed

to address the interplay of the contributing factors and work towards the common goal of reducing dollarization in the country.

45.   Re-calibrating prudential policies and strengthening the monetary policy framework would also contribute to de-dollarize Uruguay's economy. An increase of one percentage point in the reserve requirement differential between local currency and US dollar deposits could result in a reduction of approximately 0.8 percentage points. in the share of FX deposits and 0.5 percentage points in the share of FX credit. Furthermore, there is evidence supporting a positive impact from improvements in the monetary policy framework, specifically from the use of the short-term interest rate as the monetary policy instrument.

46.   A comprehensive approach to de-dollarization requires coordination between long-term and short-term policies. A de-dollarization plan should encompass policies aimed at improving structural factors, maintaining macroeconomic stability, and enhancing economic conditions, such as sustained exchange rate flexibility, especially in periods of exchange rate appreciation. A strengthened monetary policy framework and the implementation of prudential policies, such as the analyzed currency-differentiated reserve requirement and local currency repos, would also be crucial to the success of a de-dollarization plan.

47.   Future research should examine the role of additional prudential regulation instruments. The substantial influence of financial account restrictions on the degree of dollarization in other dollarized economies highlights the sensitivity of financial dollarization to prudential regulation. Further analysis regarding the effects of other prudential measures on the extent of price dollarization is beyond the scope of this paper. Nonetheless, prudential regulation designed to reduce the system's exposure to borrowers who have not hedged their risk or safeguard FX deposits should be aimed at achieving a common objective.

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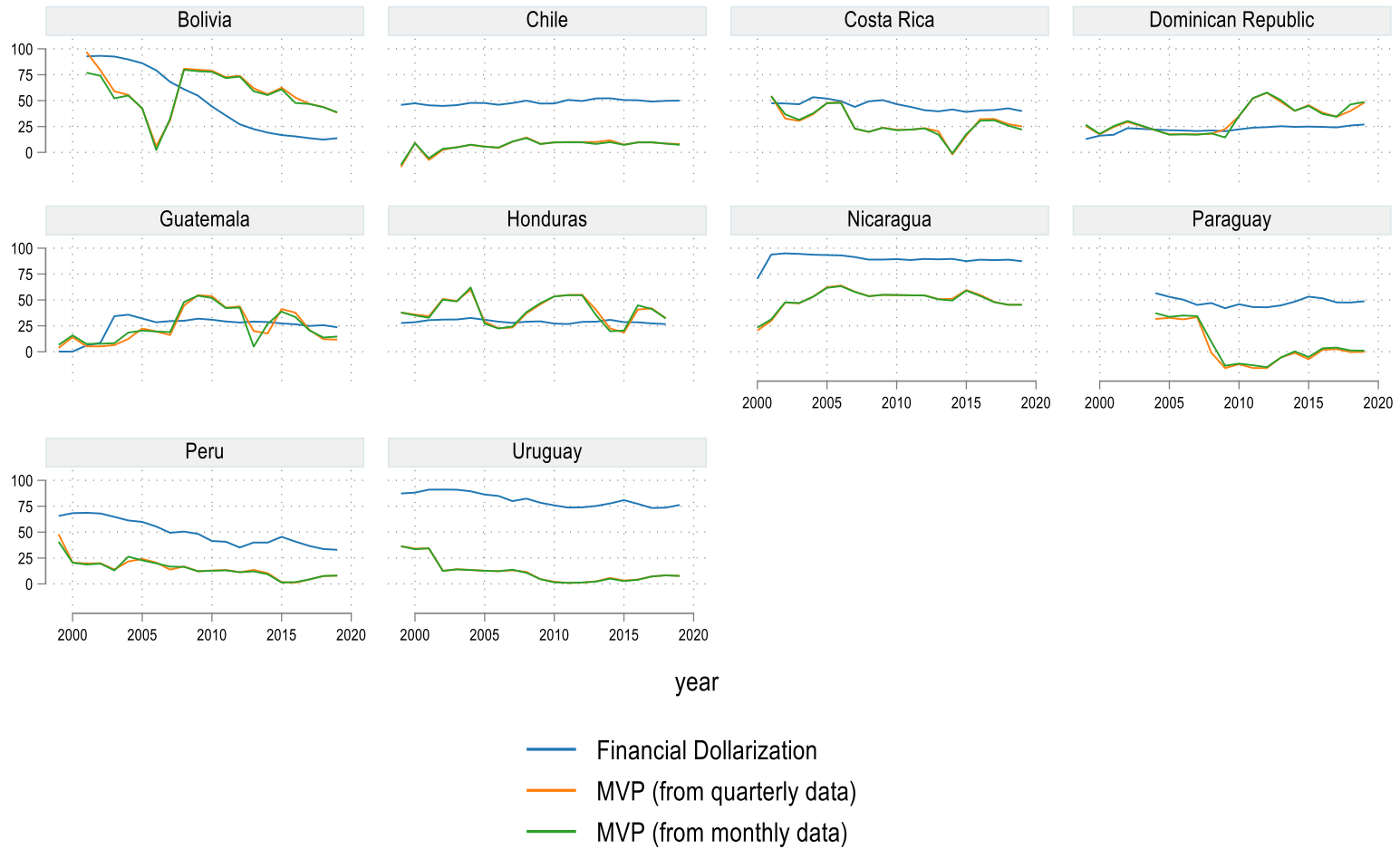
Annex I. Selected Charts and Tables

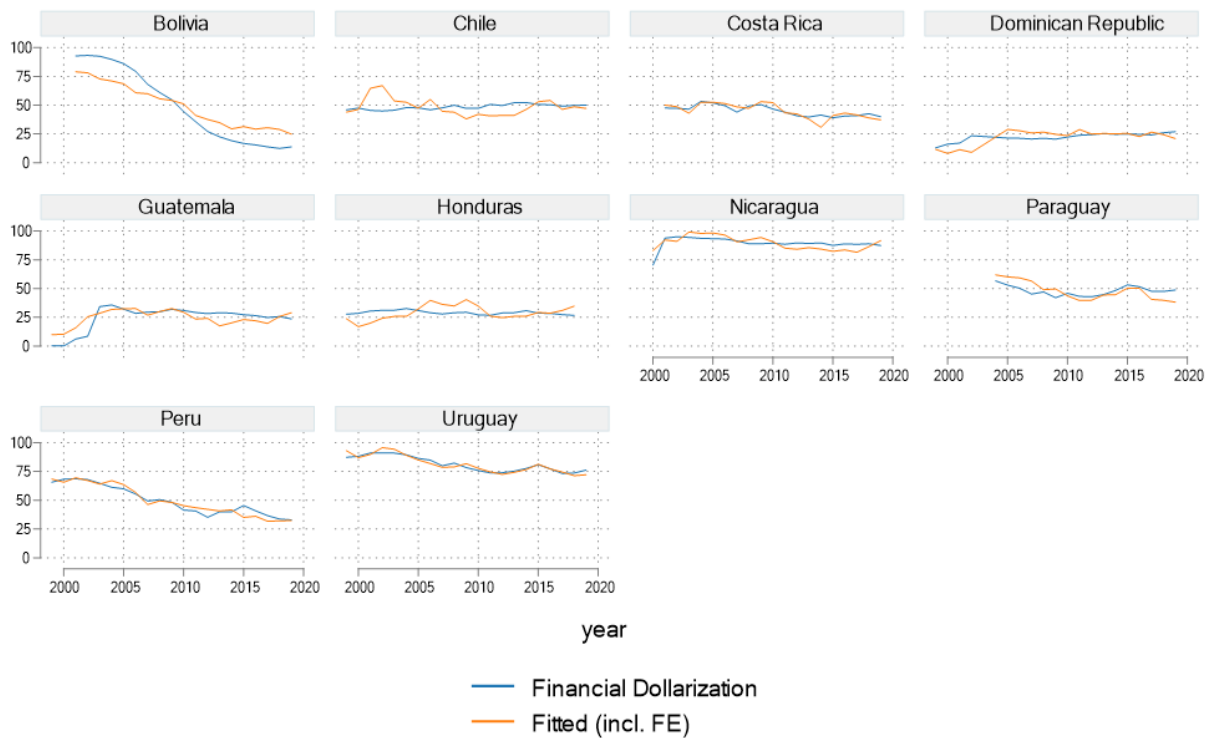**Figure A1. Uruguay's vs. Other Dollarized Countries – Select Economic Indicators**
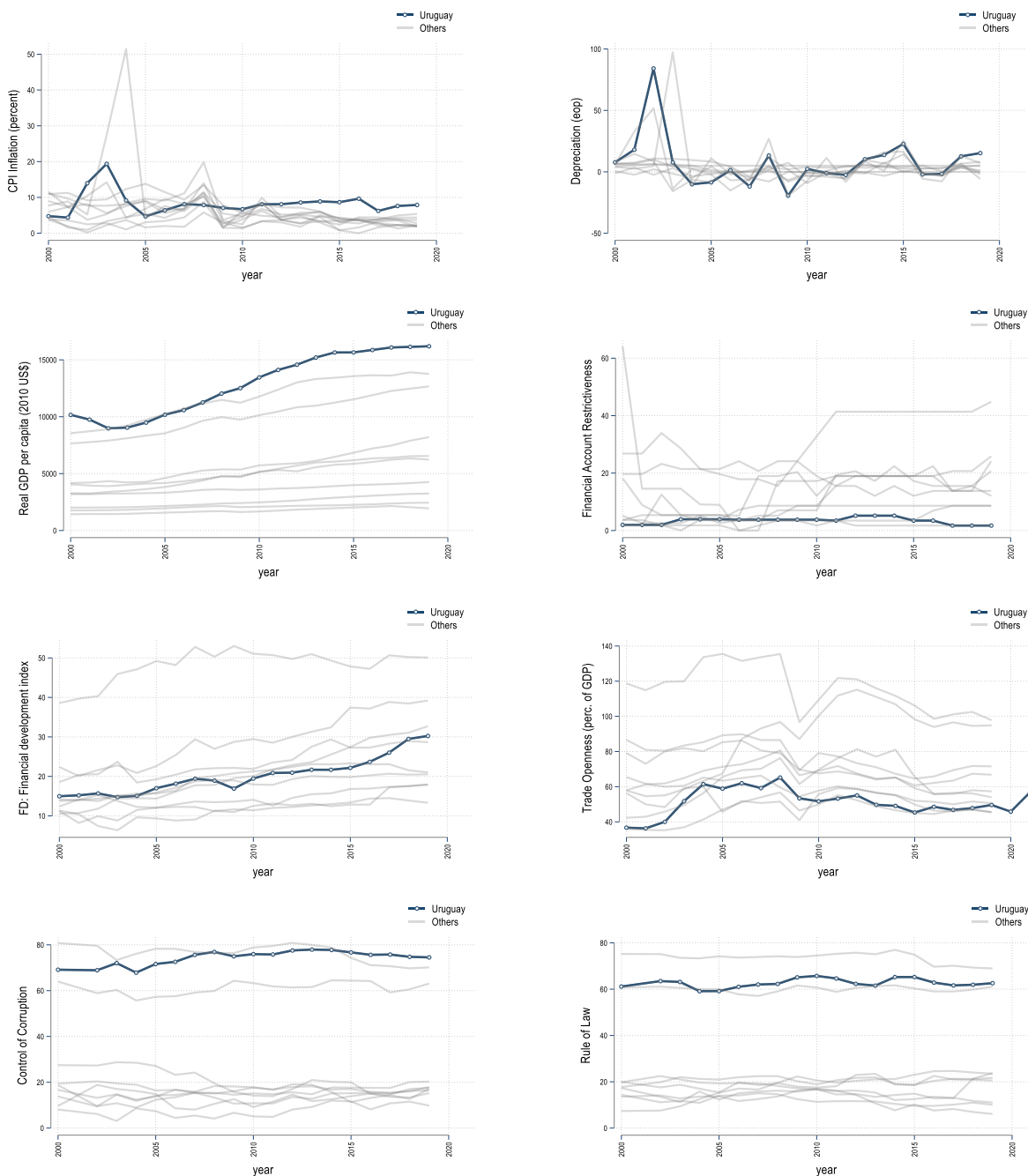
Source: IMF staff calculations based on IMF and WB data.

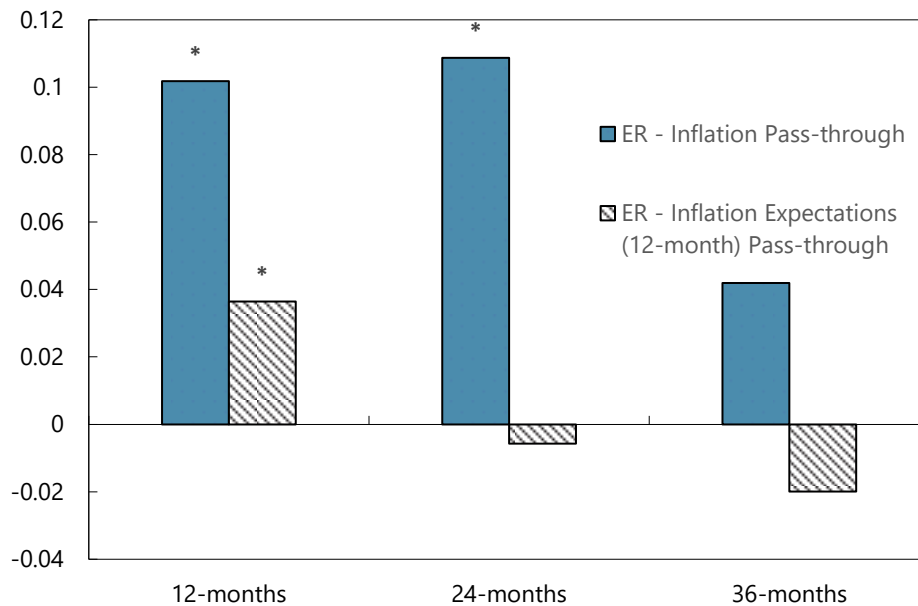Figure A2. Uruguay: Financial Dollarization and the MVP Model

Source: Authors' calculations.

Figure A3. Uruguay: Actual and Fitted Values of the Panel Data Specification (Table 3, Column 1)

Source: Authors' calculations.

Figure A4. Uruguay: Cumulative Pass-Through at Different Time Horizons

Source: Authors' calculations.
Estimated using local projection method. Control variables include current
and 2 lags of monthly change in the exchange rate, 2 lags of y-o-y inflation,
2 lags of the cyclical component of the industrial production index, 2 lags
of the monthly percentage change in the global oil price index, 2 lags of
the monthly percentage change in global food prices.
* Reflects a statistically significant effect at 10 percent level.

Source: Authors' calculations.

Table A1. Uruguay: Minimum Reserve Requirements for Banks on Deposits in Local Currency

	Demand Deposits	Term Deposits (30-90 days)	Term Deposits (91-180 days)	Term Deposits (181-364 days)
August 2002	30%	24%	24%	22%
November 2002	30%	24%	24%	5%
April 2003	27.5%	21.5%	21.5%	5%
June 2003	22.5%	16.5%	16.5%	5%
July 2003	20%	14%	14%	5%
August 2003	17.5%	11.5%	11.5%	5%
October 2003	17%	9%	6%	4%
March 2007	17%	9%	6%	4%
November 2007	17%	9%	6%	4%
December 2009	12%	9%	6%	4%
May 2011	15%	9%	6%	4%
August 2013	15%	9%	6%	4%
May 2015	23%	14%	9%	6%
March 2016	28%	14%	9%	6%
August 2017	22%	11%	7%	5%
April 2020	15%	6%	2%	2%
Jan 2021	22%	11%	7%	5%
Jan 2022	15%	3%	2%	1%

Source: BCU, Libro XIV, Régimen de Encajes and Circulares Instituciones Financieras.

Table A2. Uruguay: Minimum Reserve Requirements for Banks on Deposits in Foreign Currency

	Demand Deposits and Term Deposits (up to 180 days)	Term Deposits (more than 180 days)
August 2002	10%	4%
July 2003	10%	4%
September 2003	25%	19%
March 2007	25%	19%
November 2009	15%	9%
May 2011	18%	14%
August 2013	18%	14%
May 2015	26%	20%
March 2016	28%	20%

Source: BCU, Libro XIV, Régimen de Encajes and Circulares Instituciones Financieras.

Annex II. The MVP Model

In this model (Ize, A. & E. Levy Yeyati, 2003), currency choice is determined by hedging decisions on both sides of a bank's balance sheet. Domestic depositors' portfolios comprise three assets: domestically held home currency deposits (HCD), domestically held foreign currency deposits (FCD) and cross-border foreign currency deposits (CBD), with real returns in terms of the domestic price index. Due to foreign exchange rate risk, dollar deposits (at home or abroad) are imperfect substitutes for home currency deposits. In addition, deposits held locally are imperfect substitutes for deposits held abroad.

The MVP estimate for the levels of dollarization, in its simplest version depends on ER depreciation and inflation volatilities only. The share of deposits in dollars predicted by the MVP is defined in the following terms:

$$\lambda^* = \frac{\sigma_{\pi,\pi}^2 + \sigma_{\pi,s}^2}{\sigma_{\pi,\pi}^2 + \sigma_{s,s}^2 + 2\sigma_{\pi,s}^2}$$

In the above formula, $\sigma_{\pi,\pi}^2$ is the variance of inflation, $\sigma_{\pi,s}^2$ is the covariance between inflation and real exchange rate depreciation, and $\sigma_{s,s}^2$ is the variance of real exchange rate depreciation. The dollarization level implied by the MVP model is equivalent to the coefficient of the pass-through from nominal exchange rate to inflation.

Proof of the equivalence between the MVP and the pass-through coefficient To formally prove this, define the identity $S = E/P$, where S is the real exchange rate, E is the nominal exchange rate (local currency per dollar), and P is the level of domestic prices. Correspondingly, the ER identity could be expressed in percentage change as approximately[1] $s = e - \pi$, where s is the real depreciation rate, e is the nominal depreciation rate, and π is inflation. The most common measure of the pass-through is equal to the coefficient β from the specification below:

$$\pi = \alpha + \beta \cdot e + \varepsilon$$

$\hat{\beta}$ correspond to the estimate of β, which is calculated in terms of the variance of the nominal ER and the covariance between ER and inflation. As shown below, that definition is equivalent to the definition of the MVP estimate.

$$Pass-through = \hat{\beta} = \frac{\sigma_{\pi,e}^2}{\sigma_{e,e}^2} = \frac{\sigma_{\pi,(s+\pi)}^2}{\sigma_{(s+\pi),(s+\pi)}^2} = \frac{\sigma_{s,\pi}^2 + \sigma_{\pi,\pi}^2}{\sigma_{s,s}^2 + \sigma_{\pi,\pi}^2 + 2\sigma_{\pi,s}^2} = \lambda^*$$

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[1] This approximation assumes that the term $(s \cdot \pi)$ is small.

Annex III. UIP Premium

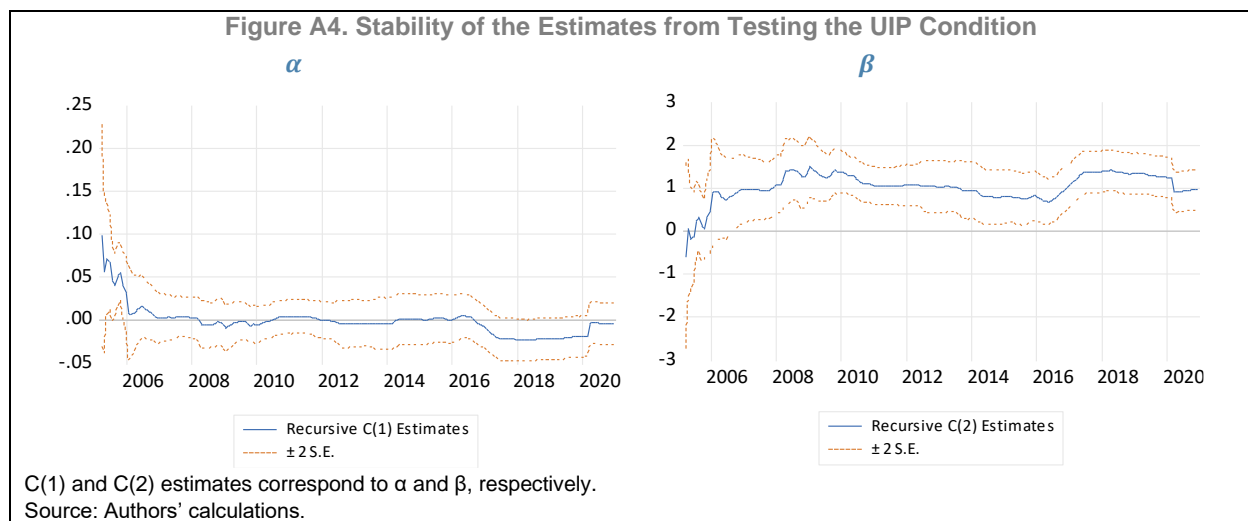Denoting logs with lower case letters, the UIP condition can be re-expressed as:

$$\delta_{t+h} = \left(\widetilde{\iota}_t - \widetilde{\iota_t^{US}}\right) + \widetilde{s}_t - \widetilde{s_{t+h}^e}$$

where $\widetilde{\iota}_t = log(1 + i_t)$, $\widetilde{\iota_t^{US}} = log(1 + i_t^{US})$, $\widetilde{s}_t = \log(S_t)$ and $\widetilde{s_{t+h}^e} = log\big(E_t(S_{t+h})\big)$. A value of $\delta = 0$ would indicate that the UIP holds at all times.

Over the long term, and isolating periods of large volatility such as the 2002 crisis, the UIP condition holds. The UIP premium has been zero on average over the last twenty years. In addition, the UIP premium does not show a consistently positive or negative bias. It is possible to check if the UIP condition holds estimating the below specification:

$$\widetilde{s_{t+1}^e} - \widetilde{s}_t = \alpha + \beta\left(\widetilde{\iota}_t - \widetilde{\iota_t^{US}}\right) + u$$

and testing the two null hypotheses that $\alpha = 0$, and $\beta = 1$. For Uruguay, the null hypotheses cannot be rejected at standard confidence intervals.

Figure A4. Stability of the Estimates from Testing the UIP Condition

C(1) and C(2) estimates correspond to α and β, respectively.
Source: Authors' calculations.

Annex IV. Robustness Analysis

Measures of financial dollarization could be distorted by a valuation effect from fluctuations in the exchange rate. Large exchange rate movements can affect the estimated dollarization ratio of deposits and credit even when demand for either currency in the banking system has not changed. This annex presents a series of robustness exercises to check whether the effect and significance of prudential policies holds when controlling for the valuation effect in the definition of financial dollarization. Two alternative measures that control for valuation effects are used: first, the deposits and credit dollarization ratio measured at a constant exchange rate (see Mwase and Kumah, 2015), and second, the level of deposits and loans in US dollars to see if there is a decline in absolute terms.

Results for prudential and monetary policies broadly hold for the measures of the dollarization ratio adjusted for valuation effects and for dollarization measured in absolute terms. The effect of reserve requirement differential increases marginally for deposits, while for credit the effect is four times larger for the level of dollar-denominated loans. Although for the credit dollarization ratio the effect of reserve requirements is not statistically significant, the coefficient remains negative. Monetary policy credibility remains an important factor as well, with results showing higher levels of domestic inflation being associated with higher levels of financial dollarization, and the introduction of a policy rate as instrument associated with significantly lower levels of dollarization in deposits and credit.[2]

	(1)	(2)	(3)	(4)
Table A3. Uruguay: Robustness Checks				
VARIABLES	Deposit Dollarization at Constant ER a/	Log of Deposits in FC a/	Credit Dollarization at Constant ER a/	Log of Credit in FC a/
Log of Exchange Rate (pa)	-7.37***	0.27***	-5.78***	-0.19***
	(1.13)	(0.07)	(0.40)	(0.04)
Reserve Requirement Differential (USD dep. req. minus UYU dep. req.)	-0.98***	-0.01***	-0.02	-0.02***
	(0.04)	(0.00)	(0.02)	(0.00)
Deposit interest rate spread (i-i*)	-2.72***	0.02**		
	(0.08)	(0.01)		
Lending interest rate spread (i-i*)			0.36***	0.01***
			(0.01)	(0.00)
Monetary Policy Rate as instrument (Dummy)	-0.46	-0.10***	-0.61***	-0.07***
	(0.35)	(0.01)	(0.10)	(0.01)
Uruguay CPI inflation	4.27***	-0.03*	0.12***	0.11***
	(0.10)	(0.01)	(0.05)	(0.00)
US CPI inflation	-0.54***	-0.00	1.27***	-0.00
	(0.15)	(0.01)	(0.06)	(0.01)
VIX	7.15***	-0.21***	-2.64***	-0.06***
	(0.47)	(0.04)	(0.17)	(0.02)
US Treasury Yield: 3-month	2.88***	-0.12***		
	(0.20)	(0.01)		
US Treasury Yield: 12-month			-0.28***	-0.03***
			(0.06)	(0.01)
Observations	216	216	216	216
Frequency	Monthly	Monthly	Monthly	Monthly

Source: Authors' calculations based on IMF and Uruguayan authorities' data.
Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
a/ DOLS reports the cointegrating equation from a Dynamic OLS model estimation.

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[2] This exercise should be interpreted with caution as adjusting the dollarization ratio for exchange rate valuation effects may alter the sign of the estimated coefficient in a regression of exchange rate on dollarization. This can result in an inaccurate conclusion of the direction of the effect. It can be shown that one special case where this could happen is when the true (unobserved) relationship between the exchange rate and dollarization ratio is non-linear.