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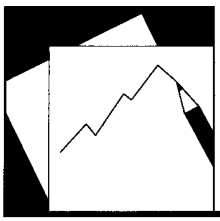

IMF Working Paper

Peru: Drivers of De-dollarization

Mercedes García-Escribano

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IMF Working Paper

Western Hemisphere Department

Peru: Drivers of De-dollarization

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Authorized for distribution by Martín Kaufman

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Abstract

Peru has successfully pursued a market-driven financial de-dollarization during the last decade. Dollarization of credit and deposit of commercial banks—across all sectors and maturities—has declined, with larger declines for commercial credit and time and saving deposits. The analysis presented in this paper confirms that de-dollarization has been driven by macroeconomic stability, introduction of prudential policies to better reflect currency risk (such as the management of reserve requirements), and the development of the capital market in soles. Further de-dollarization efforts could focus on these three fronts. Given the now consolidated macroeconomic stability, greater exchange rate flexibility could foster de-dollarization; additional prudential measures could further discourage banks' lending and funding in foreign currency; while further capital market development in domestic currency would help overall financial de-dollarization.

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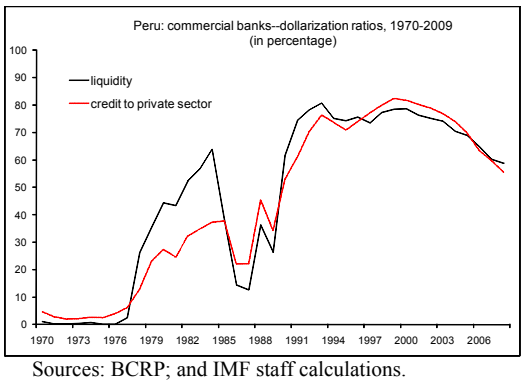
I. INTRODUCTION

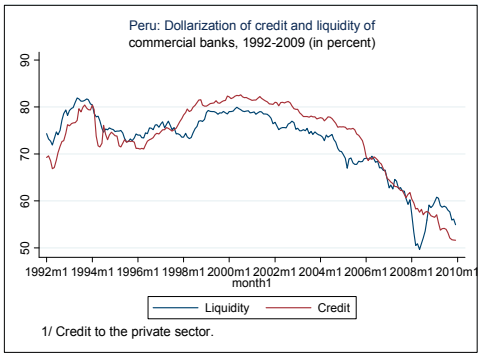
Dollarization in Peru started with the inflationary process of the mid-70s and peaked during the hyperinflation of 1988−90, despite efforts to de-dollarize in 1985. With high inflation, the U.S. dollar started to be the preferred means of payments and store of value. Lending institutions also saw that dollars minimize the risk of capital losses. Consequently, financial dollarization rose significantly (Figure 1).[2] In 1985, while inflation was high, the government forced the conversion of foreign currency deposits to local currency, resulting in capital flight and financial disintermediation. When the restriction on foreign currency deposits was lifted, re-dollarization was quick, and by the end-1990s, about 80 percent of deposits (and credit) were denominated in foreign currency.

Since the introduction of the inflation targeting (IT) regime in early 2000s, Peru has experienced a gradual and sustained market-driven financial de-dollarization.[3] Dollarization of credit has declined by nearly 25 percentage points during 2001−2009 to below 55 percent by end-2009 (Figure 1). Dollarization of deposits has also declined by a similar amount to about 52 percent.[4] Transaction dollarization has also declined and is now minimal (see Table 1).

Figure 1. Peru: Evolution of Dollarization for Commercial Banks



Sources: BCRP; and IMF staff calculations.



Sources: BCRP; and IMF staff calculations.

[2] Financial dollarization occurs when a large share of residents' assets and liabilities are denominated in foreign currency. Dollarization ratios in the paper refer to commercial banks, unless noted otherwise.

[3] Other countries in Latin America with widespread dollarization have also experienced a process of market-driven de-dollarization during the last decade, including Bolivia, Uruguay and Paraguay.

[4] Transaction dollarization has also declined and is now minimal.

Table 1. Peru: Transaction dollarization
(percentage of check and cash payments operations made in dollars)1/

	2003	2004	2005	2006	2007	2008	2009
Checks 2/	26.2	26.3	25.1	24.8	24.4	19.4	18.1
Cash withdraw							
Debit cards	21.6	17.6	13.6	12.4	8.7	4.6	5.4
Credit cards	11.1	9.3	6.3	5.5	4.7	3.6	3.4
ATM	13.4	10.7	7.8	7.9	7.0	5.3	5.3

Source: BCRP.
1/ Percentage in value terms.
1/ Includes cashed checks at the bank, deposited at the bank, and processed at the electronic clearing house.

While a great deal of work exists on the financial consequences of dollarization, the empirical literature on the process of de-dollarization is scant. While it is widely accepted that hyperinflation is one of the driving factors in financial dollarization when indexed instruments are not readily available, the persistence of high ratios of dollarized deposits and loans after periods in which inflation has fallen substantially is still a puzzle. Ize and Levy-Yeyati (2003) develop a model of optimal portfolio choice of risk-averse borrowers and lenders where the equilibrium level of deposit dollarization depends on the relative price and real exchange rate volatility. Specifically, their minimum variance portfolio (MVP) model implies that if real exchange depreciation is less volatile than inflation, then, consumers would prefer the dollar deposit as it is less risky. The authors test the model using cross-section data on deposit dollarization for 23 countries. De Nicolo et al. (2005) and Rennack and Nozaki (2006) confirm the MVP hypothesis. Another strand of literature highlights the role of currency-blind regulatory frameworks—for example, Broda and Levy-Yeyati (2003) argue that an explicit deposit insurance that applies uniformly across all deposits exacerbates deposit dollarization. Kokenyne and Veyrune (2008) and Erasmus et al. (2009) review international experience with dedollarization and conclude that dollarization is not easily reversed, even after the underlying causes have been removed. The authors highlight that successful attempts to dedollarize have been market-based and combined a track record of macroeconomic stability with other policies to enhance the attractiveness of the local currency.

This paper explores the factors that explain bank de-dollarization in Peru. The contributing role of three groups of factors—macroeconomic stability, prudential regulations and development of the capital market in soles—to the process of banks' de-dollarization is examined. In contrast with the literature that focuses exclusively on dollarization of overall deposits, this paper examines simultaneously the dollarization of deposits and credits. By estimating deposits and credits simultaneously, banks' response to the different factors that may impact dollarization is taken into consideration. The paper also examines the drivers of de-dollarization across categories of deposits and credits.

The findings confirm that Peru bank de-dollarization has been the result of a three-prong approach. Macroeconomic stability, proxied by inflation, different measures of exchange rate changes, and sovereign credit risk (EMBI), had a significant impact on de-dollarization. Prudential measures, such as the introduction of asymmetric reserve requirements and provisions for currency-induced credit risk, had an impact on banks' incentives to borrow and lend in soles. Last, the development of the local capital market in soles had a mixed impact on bank de-dollarization. The issuance of long-term treasuries in soles lowered dollarization of credit, probably by facilitating bank funding and pricing of long-term loans in soles. However, other sol market instruments led to higher bank dollarization—these may have competed with bank loans in soles, having an impact on the pool of bank borrowers.

The rest of the paper is organized as follows. Section II describes the de-dollarization trend of credit and deposits, and explores in detail the de-dollarization of credit by sectors and of deposits by maturity structure. This section decomposes the changes in credit (deposit) dollarization into a within and between component. Section III describes the three groups of factors—specifically, macro-economic conditions, regulatory and prudential policy measures, and development of a capital market in soles—that could have affected banks and agents preferences for borrowing and lending in domestic currency. Section IV models the de-dollarization dynamics using a vector autoregression approach, and identifies the factors that have boosted de-dollarization in recent years. Based on the empirical findings, section V outlines measures that could help further deepen and consolidate de-dollarization. Section VI concludes.

II. DE-DOLLARIZATION—STYLIZED FACTS

A. De-dollarization trend by type of credit and deposits[5]

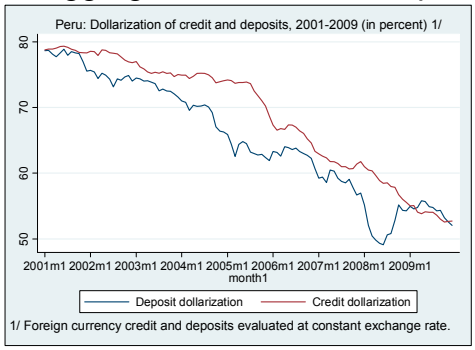
De-dollarization has been gradual. Peru has experienced a gradual financial de-dollarization since early 2000s. A sharp deposit de-dollarization took place in late-2007 and that was quickly reversed following the collapse of Lehman Brothers (Figure 2.a.). The return to trend de-dollarization during 2008 resulted from an increase in foreign currency deposits while domestic currency deposits remained stable.

Dollarization varies across types of loans and deposits. Dollarization of loans with longer maturities (mortgages and commercial) is higher than loans with shorter maturities (consumer and small businesses) (Figure 2.b.). Dollarization of demand and savings deposits, which are more liquid, is lower than time-deposits (Figure 2.c.).

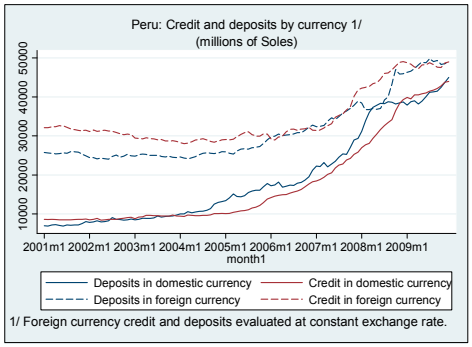
[5] To avoid the impact of valuation changes, deposits and credits in foreign currency are evaluated at a constant exchange.

Figure 2. Peru: De-dollarization of Credit by Sectors and of Deposits by Maturity

a. Aggregated credits and deposits

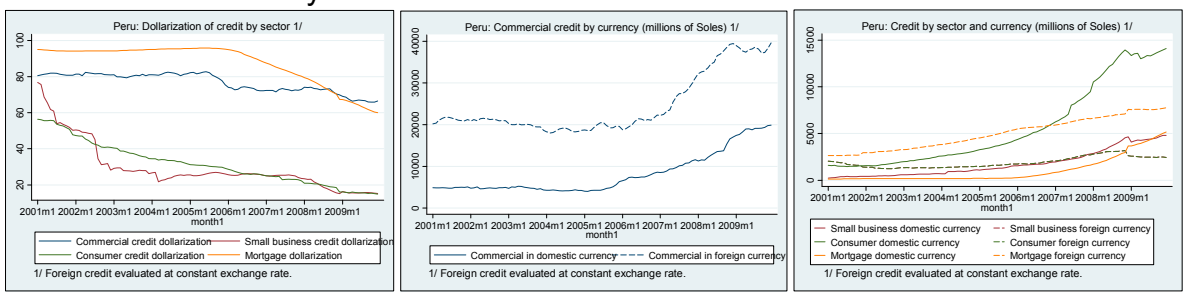


Sources: BCRP; and IMF staff calculations.



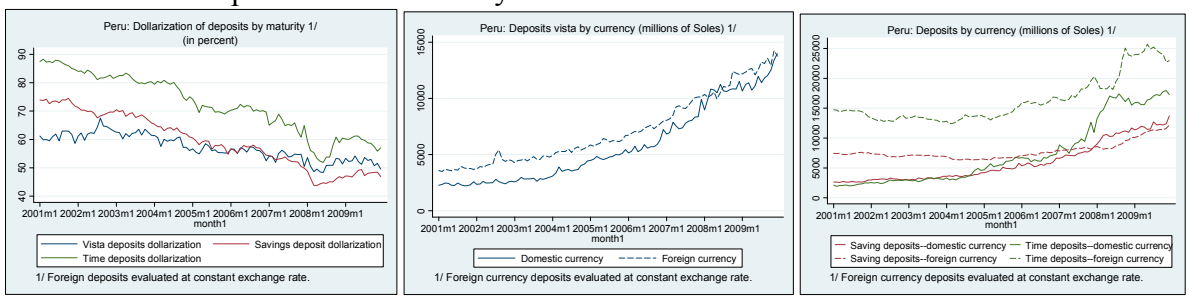
Sources: BCRP; and IMF staff calculations.

b. Credit by sectors



Sources: SBS; and IMF staff calculations.

c. Deposits across maturity loans



Sources: SBS; and IMF staff calculations.

B. Between and within de-dollarization

This section decomposes de-dollarization of credit and deposits into a within and between component. Time-series data on aggregate credit dollarization captures not only de-dollarization within sectors, but also compositional changes of credit among sectors. Similarly, data on aggregated deposit dollarization is influenced by compositional changes among deposits of difference maturity structure. Changes in credit dollarization through time can be decomposed as

$$d_t - d_\tau = \sum_{i=1}^{I} d_{it}\frac{c_{it}}{c_t} - \sum_{i=1}^{I} d_{i\tau}\frac{c_{i\tau}}{c_\tau} = \sum_{i=1}^{I}\left(d_{it} - d_{i\tau}\right)\frac{c_{it}}{c_t} + \sum_{i=1}^{I} d_{i\tau}\left(\frac{c_{it}}{c_t} - \frac{c_{i\tau}}{c_\tau}\right)$$

where d_{it} is dollarization of credit in sector i in year t, and c_{it} is the total credit extended to sector i in year t. The first term captures the time-series changes in dollarization within sectors. The second term captures the effect of changes in credit composition. A similar decomposition can be done for deposits

De-dollarization has been driven mainly by changes within each type of credit and deposits. The decomposition of credit de-dollarization through time into within and between components shows that credit de-dollarization has mostly been driven by within sector de-dollarization (Table 2.a.). The analysis also indicates that commercial sector de-dollarization explains the bulk of total de-dollarization. All commercial sectors—with the exception of fishing, mining, and electricity/water/gas—contributed to the commercial credit de-dollarization process (Appendix). The within and between decomposition for deposit de-dollarization reveals that de-dollarization within maturity explains almost all the decline in deposit dollarization (Table 2.b.).

Table 2. Peru: Decomposition of de-dollarization into a within and between components

a. Credit 1/

	Dollarization		Share in total credit (in percent)		2001-2009		
Sectors	2001	2009	2001	2009	between effect	within effect	total effect
commercial	80.8	66.5	79.0	62.8	-10.7	-11.3	-22.0
small business	50.3	15.3	2.6	6.0	0.5	-0.9	-0.4
consumer	47.8	14.9	9.0	17.5	1.3	-3.0	-1.7
mortgage	94.1	59.9	9.4	13.7	2.5	-3.2	-0.7
total	**78.3**	**53.5**	**100**	**100**	**-6.4**	**-18.4**	**-24.8**

b. Deposits 1/

	Dollarization		Share in total deposits (in percent)		2001-2009		
Maturities	2001	2009	2001	2009	between effect	within effect	total effect
sight	58.7	49.6	19.1	29.5	5.2	-1.7	3.5
saving	71.7	46.9	32.1	27.6	-2.1	-8.0	-10.1
time	84.6	57.1	48.9	42.9	-3.4	-13.4	-16.8
total	**75.5**	**52.1**	**100**	**100**	**-0.3**	**-23.1**	**-23.5**

Sources: BCRP; SBS; and IMF staff calculation.
1/ Credit and deposits in foreign currency are evaluated at a constant nominal exchange rate.

III. Contributing Factors and Measures

A. Macro pre-conditions—successful implementation of stabilization policies

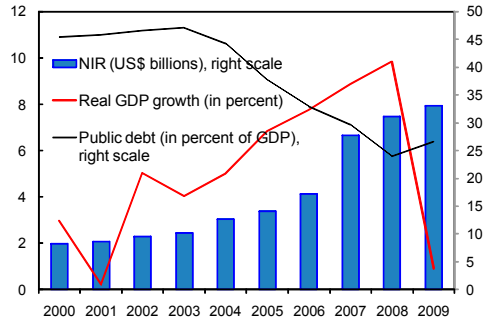
Dedollarization has followed the successful implementation of macroeconomic stabilization policies. Taking advantage of buoyant economic conditions in recent years, the Peruvian government has pursued large fiscal surpluses (of about 2.0-3.3 percent of GDP per year) during 2006-08. As a result, public debt has been reduced below 30

percent of GDP, one of the lowest levels in the region (Figure 3). The central bank, under the IT framework introduced in 2002 (initially with a target of 2.5 percent with a band of ± 1 percent and since 2007 lowered to 2 percent with a band of ± 1 percent), has successfully contained inflation within the inflation target band and anchored expectations. Moreover, the central bank has built a significant buffer of international reserves, providing a credible assurance of its ability to provide support in case of stress.[6] Last, thanks to stringent prudential regulations, Peru's financial sector is sound, as shown by its resilience during the recent global financial crisis.

Markets have acknowledged Peru's outstanding performance. Peru was granted investment grade by Fitch, Standard & Poor's in April and July 2008, respectively, and by Moody's in December 2009, consolidating its standing among major emerging market economies. Peru EMBI stands at about 210 bps compared to 410 bps for Latin America as a whole in late-May 2010.

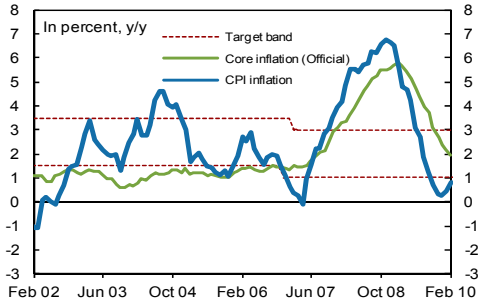
Figure 3. Peru: Macroeconomic performance, 2000−09

a. GDP growth, NIR and public debt



Sources: BCRP; and IMF staff calculations.

b. Inflation



Sources: BCRP; and IMF staff calculations.

B. Prudential measures

Several prudential measures introduced during the last decade have helped the de-dollarization process by lowering banks' incentives to borrow and lend in foreign currency. These measures include:[7]

- Reserve requirements (RR). The difference between the RR on foreign currency deposits and domestic currency deposits has changed during the period of analysis

[6] Net international reserves increased from US$ 9.6 billion in 2002 to US$ 33.1 billion in 2009.

[7] In addition to the financial prudential measures listed below, the following regulatory measure may have an impact on the demand for local currency. In particular, the Consumer Protection Law was amended in 2004 forcing retailers and wholesalers to list prices in domestic currency. However, the law leaves agents free to list prices also in dollars.

(Figure 4). The remuneration that the central bank pays on reserves has changed too. Figure 4 illustrates the evolution of the remuneration rate for deposits in either currency above the 6 percent level (which is the current level of non-remunerated reserve requirement applied to all deposits).

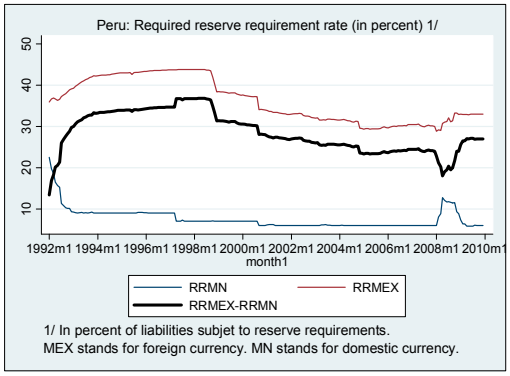
- Provisioning requirements. Since mid-2006, banks have to carry out a routine evaluation of currency risks, or alternatively, set up a reserve ranging from 0.25 percent to 1 percent of the credit in foreign currency that has not been evaluated.[8] As of 2009, additional provisions for foreign currency risk as a percent of total provisions are marginal.

Additional prudential measures linked to currency exposures are in place, but these have not been modified during the period of analysis. These measures are:

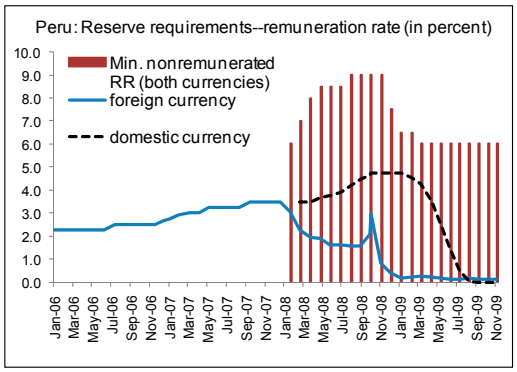
- Liquidity requirements. Banks are required to hold liquid assets equivalent to at least 8 percent in domestic currency and 20 percent in foreign currency of all their liabilities maturing during the next 12 months.

- Banks' net open position. In addition to limiting banks' foreign currency exposure, there are in Peru capital requirements on open foreign exchange positions. The limit to banks' long (short) open position was changed to 75 (15) percent of capital in February 2010, from a previous limit of 100 (10) percent of capital.[9]

Figure 4. Peru: Reserve requirements



Sources: BCRP; and IMF staff calculations.



Sources: BCRP; and IMF staff calculations.

[8] Cayazzo et al. (2006) indicate that only Peru among 17 surveyed countries that are partially dollarized reports requiring higher provisions for foreign currency loans relative to domestic currency ones.

[9] Cayazzo et al (2006) indicate that Poland, Singapore and Sweden have capital charges on foreign exchange exposures. Argentina, Bolivia, Chile, Costa Rica, Honduras and Uruguay have only limits on these exposures. The remaining of the 17 countries surveyed, including Peru, have both capital charges and limits on foreign currency exposures.

C. Development of a capital financial market in soles

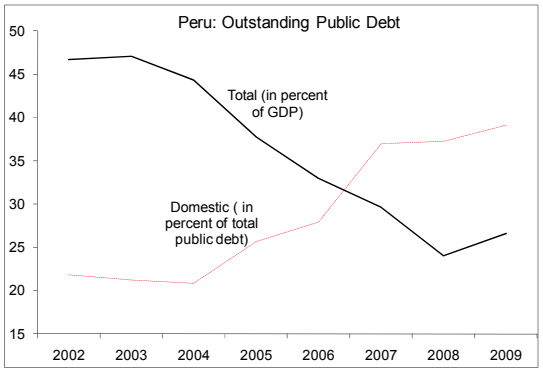
Peru has been actively developing its public and private debt market in domestic currency in recent years.

- Domestic public debt market. In 2003, Peru launched a market-making program with the objective of developing a market for domestic public debt, consisting mainly of fixed-rate instruments in domestic currency.[10,11] In line with this objective, Peru's public debt management strategy has been focused on developing a yield curve of government bonds in soles and reducing the share of public debt denominated in foreign currency (Figure 5.a.). As a result, government bonds in soles have gained liquidity and the yield curve has been extended considerably.[12,13]

- Private debt market. Private bond issuances in local currency have also increased substantially in recent years (Figure 5.b.).

Figure 5. Peru: Development of debt market in domestic currency

a. Public debt



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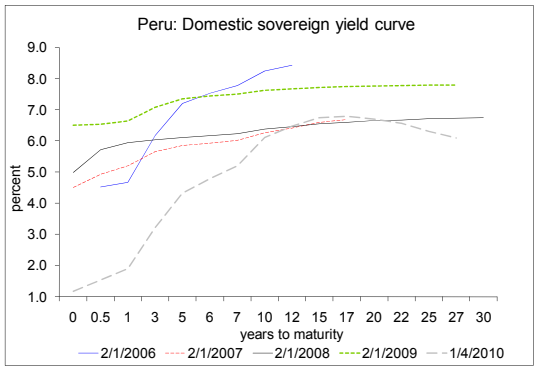


Sources: SBS; and IMF staff calculations.

[10] Ministerial Resolution 106-2003; Supreme Decree 189-2004; and Supreme Decree 137-2005.

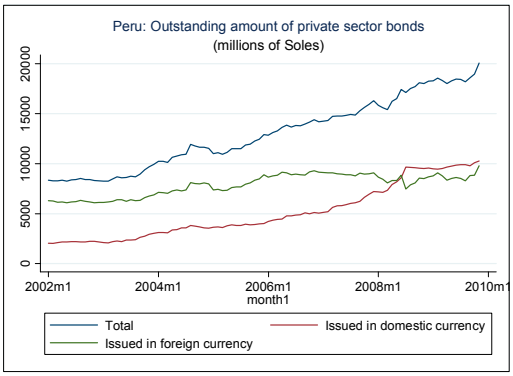
[11] The two types of domestic public bonds (known as Soberanos) are the fixed-coupon "Tasa Fija" bonds and the inflation adjusted, "VAC" bonds. The Tasa Fija bonds are the most liquid instruments and represent nearly 90 percent of Soberanos.

[12] The longest maturity of fixed-rate government paper in domestic currency is 32 years, as of February 2010. It was 5 years in 2003. The VAC curve extends up to 39-year tenors, but has limited liquidity, as the total outstanding amount is US$700 million.

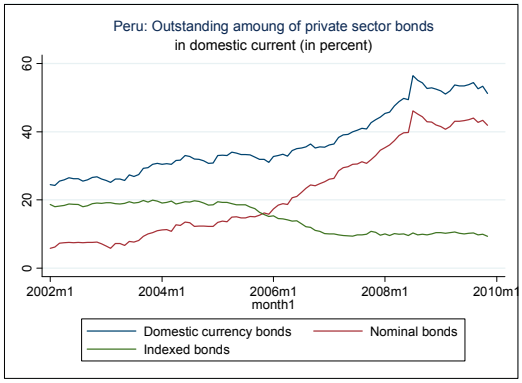
[13] Reflecting the availability of domestic debt instruments in soles, the portfolio of local pension funds (AFPs) denominated in dollars declined to 32 percent in November 2008 from 50 percent in 2000, and has recently increased to 41 percent in December 2009 as the limits on AFP foreign investments have been raised. AFPs hold more than 50 percent of the stock of Soberanos, followed by foreign investors (21 percent), local banks (15 percent), and insurance companies (4 percent).

Figure 5. Peru: Development of debt market in domestic currency (cont.)

b. Private sector debt



Sources: BCRP; and IMF staff calculations.



Sources: BCRP; and IMF staff calculations.

IV. UNDERSTANDING DE-DOLLARIZATION

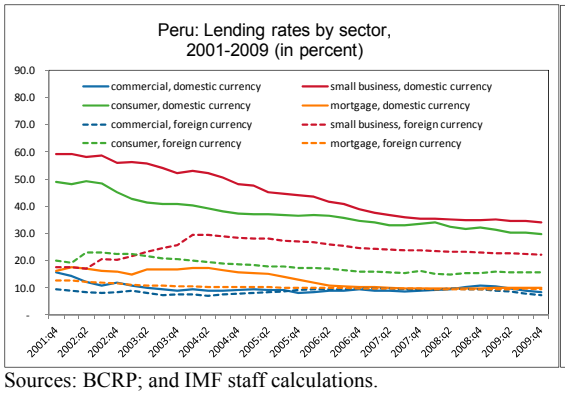
Dollarization reflects the choice of currency by depositors, borrowers and banks. Dollarization of credits and deposits reflect the equilibrium in the credit and deposit markets: banks supply loanable funds and demand deposits, and the private sector demands credit and provides funding. Banks, in turn, are active intermediaries between creditors and depositors. Data on quantities of credit and deposits and on lending and deposit rates correspond to the equilibrium in these markets. Figure 6 depicts in the vertical axis the ratio of lending (active) rates in foreign to domestic currency.

Peru's de-dollarization process is consistent with a shift of both demand of credit and supply of deposits toward soles. The null hypothesis of stable demand would imply that dollarization of credit (deposits) and the ratio of lending (active) rates in foreign to domestic currency negatively covary.[14] Shaded areas in Figure 6 appear to be consistent with rejecting the null, thereby with a shift in the demand of credit toward soles particularly for commercial loans since 2006. Other patterns, such as those highlighted in the deposits market, would be consistent with supply shifts.

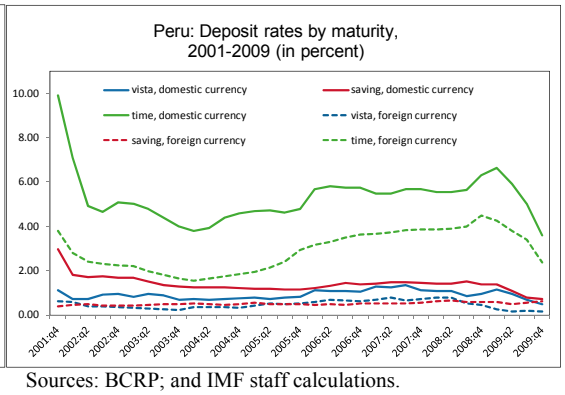
[14] The hypothesis of stable demand for credit in dollars implies that $(d_{it} - d_{i\tau})(r_{it} - r_{i\tau}) < 0$, where $d_{it} = \frac{c_{it}^{foreign}}{c_{it}}, r_{it} = \frac{i_{it}^{foreign}}{i_{it}^{domestic}}$

where i_{it} is the lending rate to sector i in year t.

Figure 6. Peru: Credit and deposit markets: quantities and prices



Sources: BCRP; and IMF staff calculations.



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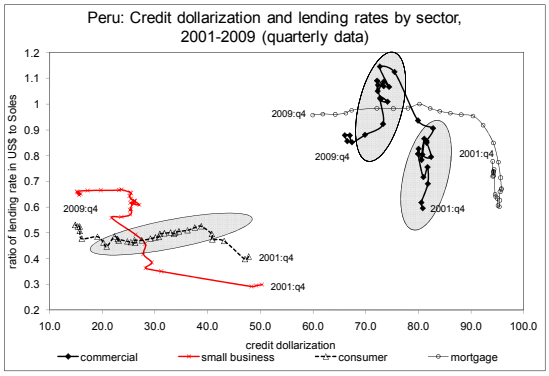
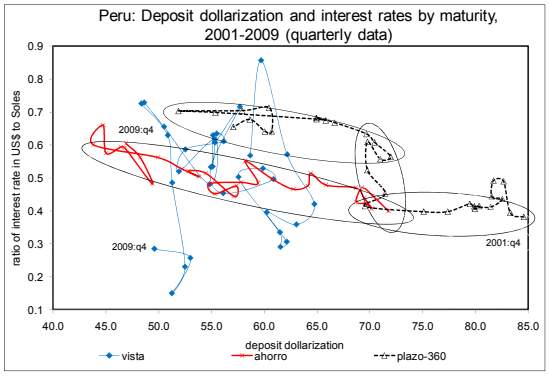


Sources: BCRP; and IMF staff calculations.



Sources: BCRP; and IMF staff calculations.

A VAR approach allows modeling the dynamics between dollarization of credits and deposits. Such an approach avoids imposing a particular structure to credit and deposit dollarization. It permits to capture (i) the simultaneous determination of credit and deposit dollarization, (ii) the response to exogenous factors that are demand or supply shifters, and (iii) the dynamics of credit and deposit dollarization.[15]

Two VAR specifications are estimated using monthly data for the period 2001−2009. The first specification includes dollarization of total credit and total deposits, both in first differences, as endogenous variables. The second includes six endogenous variables, in first differences: dollarization of commercial credit, consumer credit, mortgages, demand deposits, savings deposit, and time deposits.[16] Both specifications include a set of

[15] Granger causality was verified from deposit to credit dollarization.

[16] All series are valued at constant nominal exchange rate. The series of total credit and deposit dollarization used for the analysis in this section are constructed using December 2008 weights to avoid composition changes among types of credit and among types of deposits. Cointegration tests were performed in both specifications but rejected. Cointegration tests allowing for structural breaks were not performed as the period under analysis is characterized by macroeconomic stability and coincides with the introduction of the IT framework. Dollarization series in first-differences are I(0) processes.

exogenous variables to proxy macro-stability, changes to prudential measures, and development of the capital market in soles. Table 3 presents the definition of the exogenous variables, and Figure 7 depicts the endogenous and exogenous data series.[17] Further work could model some of the exogenous variables as endogenous.

The VAR estimation results of the aggregate model are presented in Table 4. Figure 8 depicts, for several of the exogenous variables, the impact of a unit increase to the exogenous variables on credit and deposit dollarization over time. The findings are:

- Macroeconomic variables. Inflation is not significant suggesting that it is not an important driver of dollarization once inflation and expectations are well-contained—as it has been the case in Peru for the estimation period. Appreciation spikes are important for explaining de-dollarization of credits and deposits. An appreciation spike equivalent to appreciations greater than 1 percent for two consecutive months results in a decline of the dollarization rate of 0.5 percentage points over time (Figure 8). After controlling for sharp exchange rate movements, the remaining exchange rate variability further helps to lower dollarization of credit. Under historical variability of the exchange rate over the last two years, the decline in credit dollarization will be 2.5 percentage points per year. The inclusion of EMBI changes in the regression measures the impact of macroeconomic stability not reflected in exchange rate movements.

- Market development. The issuance of long-term treasury bonds in soles fosters de-dollarization as the development of a sol yield curve helps bank funding and pricing of long-term credit in soles. Results indicate that as the share of private sector bonds issued in domestic currency increases, dollarization of credit increases too. This could be due to the fact that this variable is capturing instruments competing with bank lending in soles, and as a consequence dollarization of banking credit rises. However, overall credit in soles in the economy increases.

The VAR specification with disaggregated credit and deposits confirms the findings of the aggregate model and provides further insights on the drivers of de-dollarization. Results are presented in Table 5 and a selection of dynamic multipliers is included in Figure 9.

- Macroeconomic variables. Consistent with the aggregate model, exchange rate spikes matter for de-dollarization. Appreciation spikes foster de-dollarization of commercial credit, while depreciation spikes are associated with higher dollarization of mortgages. Once we control for sharp exchange rate movements, volatility of the

[17] A dummy variable for the 2004 legal change forcing retailers to list prices in domestic currency was tested as an explanatory variable but it was not significant; thus, this variable was not included in the set of exogenous variables used in the paper.

exchange rate lowers dollarization of commercial credit. Inflation seems to promote dollarization of time-deposits.

- Prudential variables. Higher RR spreads lower dollarization, specifically, for commercial credit. The introduction of higher provisions for foreign currency loans helped lower dollarization of mortgages, but this result merits further analysis as the dummy variable could be capturing other events that took place around the time this measure was introduced, such as the reduction in the IT band since 2007.[18]

- Market development. The issuance of long-term treasury bonds in soles, promotes de-dollarization of credit. The coefficients on treasury bonds with terms of 10−15 years and 15−20 years are significant for commercial credit. As found in the aggregate model, the increase in the share of bonds issued in soles raises dollarization of credit, in particular, of credit extended to the commercial sector, which supports the explanation that some of the private debt instruments issued in soles compete with banks loans in soles.

V. NEXT STEPS

To consolidate and deepen the de-dollarization process in Peru, a range of measures could play a role.

- Macro-economic related. The IT framework and consolidated policy credibility, reflecting strengthened institutions and a track record of prudent policies, have been key to keep inflation expectations well anchored, which are essential to the de-dollarization process. Moreover, the successful policy response during the global financial crisis has further increased currency credibility. In this context, some further exchange rate flexibility, while avoiding extreme depreciations, could foster the de-dollarization process.

- Prudential measures. Regulatory measures can also promote funding and lending in domestic currency. Provisions and capital requirements for foreign currency lending to un-hedged domestic borrowers could be periodically reassessed to ensure that the foreign exchange credit risk remains well internalized. The development of mortgage covered bonds in soles, which is being promoted by the Peruvian authorities, will help banks to finance mortgages in soles.[19]

- Development of a capital market in soles. Deepening long-term funding and pricing in soles will enhance de-dollarization, which would be supported by improving

[18] The discontinuation of the provision of credit risk guarantees by *MiVivienda* (a government-sponsored housing program) for new mortgages denominated in foreign currency extended by financial institutions took place in January 2008. Therefore, this change in *MiVivienda* is not driving the results.

[19] Currently, the interest rate on mortgages in soles is fixed for the first five years and then converts to a variable rate that changes with the Limabor.

further the Soberanos yield curve, and developing the repo market and the fixed-floating swap curve. The development of long-term sol instruments indexed to the CPI could promote de-dollarization through the solarization of pensions.[20]

VI. CONCLUSION

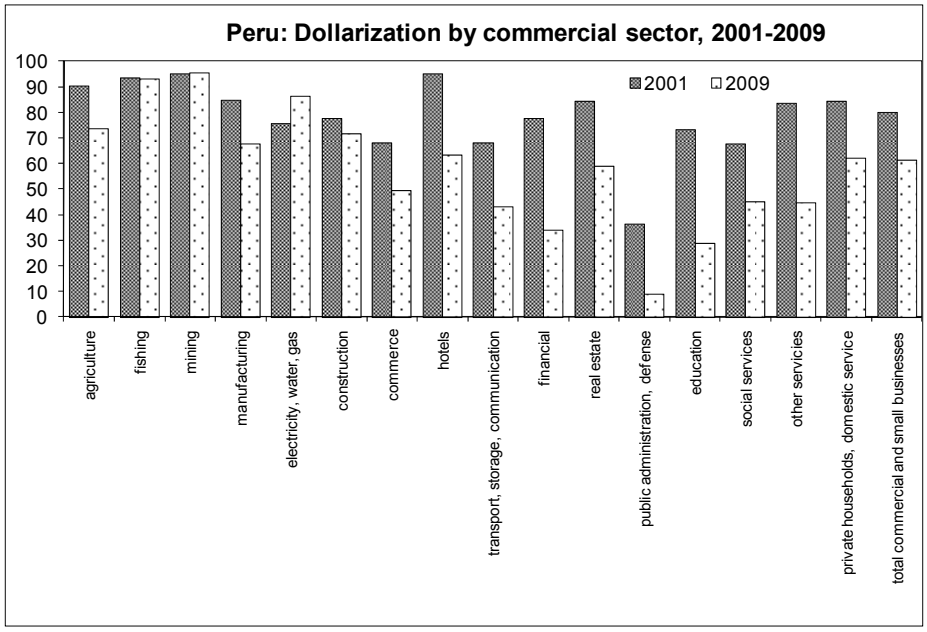
Peru has successfully pursued a market-driven financial de-dollarization during the last decade, which has been based on a three-prong approach. The lines of action have included ensuring macroeconomic stability, effective management of reserve requirements and introduction of other prudential policies to better reflect currency risk, and the development of a capital market in soles. As a result, dollarization ratios of credit and deposit—across all sectors and maturities—have declined, with larger decline for commercial credit and time and saving deposits.

Based on the results, the road ahead to further deepen de-dollarization could focus on the three fronts. Greater exchange rate variability, while maintaining macroeconomic stability and institutional credibility, can induce further credit de-dollarization. Additional prudential measures could further discourage lending and funding in foreign currency. Last, the capital market in domestic currency is still narrow—and although its development could compete with bank loans, all in all, it will help financial de-dollarization.

[20] Currently, regulation allows insurance companies to offer pensions in either dollars or soles VAC, but in practice, all pensions (about 95 percent) are denominated in dollars since availability of sol VAC instruments in the market is very limited. An alternative approach to promote de-dollarization of pensions would entail changing the legislation to permit pensions in nominal soles, and then, insurance companies would be able to offer pensions in soles adjusted with a fixed-factor, while hedging themselves with bonds in nominal soles.

Appendix. Decomposition of Commercial and Small Business Sector De-dollarization

During the period 2001−2009, all commercial and small business sectors, with the exception of fishing, mining and electricity/water/gas, de-dollarized.



Source: SBS; and IMF staff calculations.

The decomposition of de-dollarization between and within components shows that half of the de-dollarization experienced by the commercial and business sectors is explained by the decline in dollarization within sectors, with manufacturing, commerce and real estate being the sectors contributing the most.

Peru: Decomposition of de-dollarization across commercial sectors

	Dollarization		Share in total credit (in percent)		2001-2009		
Sector	2001	2009	2001	2009	between effect	within effect	total effect
agriculture	90.1	73.8	3.2	2.7	-0.4	-0.4	-0.9
fishing	93.4	93.1	2.7	1.3	-1.4	0.0	-1.4
mining	94.9	95.5	6.3	3.9	-2.3	0.0	-2.3
manufacturing	84.6	67.5	22.7	18.3	-3.7	-3.1	-6.8
electricity, water, gas	75.8	86.4	3.4	4.4	0.8	0.5	1.3
construction	77.7	71.8	2.9	1.9	-0.8	-0.1	-0.9
commerce	68.1	49.3	18.4	14.0	-3.0	-2.6	-5.6
hotels	95.0	63.3	1.5	1.5	0.0	-0.5	-0.5
transport, storage, communication	68.1	43.1	4.4	6.1	1.2	-1.5	-0.4
financial	77.6	33.9	3.2	2.7	-0.4	-1.2	-1.6
real estate	84.5	58.7	6.1	5.4	-0.6	-1.4	-2.0
public administration, defense	36.3	8.8	0.9	0.3	-0.2	-0.1	-0.3
education	73.4	28.9	0.5	0.9	0.3	-0.4	-0.1
social services	67.5	44.9	0.4	0.3	-0.1	-0.1	-0.2
other servicies	83.7	44.7	2.1	1.9	-0.1	-0.7	-0.9
private households, domestic service	84.4	62.0	2.8	2.9	0.1	-0.7	-0.6
total commercial and small businesses	**79.8**	**61.4**	**81.6**	**68.6**	**-10.4**	**-12.7**	**-23.0**

Source: SBS; and IMF staff calculations.

1/ Credits in foreign currency are evaluated at a constant nominal exchange rate.

Table 3. Definition of Exogenous Variables

Macro-stability variables	
$inflation_t$	Sum over *t* and *t-1* of the monthly percentage change of the CPI.
$d_t^{depreciation}$	Dummy equal to 1 if depreciation in *t* and *t-1* exceeds 1 percent; zero, otherwise. 1/
$d_t^{appreciation}$	Dummy equal to 1 if appreciation in *t*, and *t-1* exceeds 1 percent; zero, otherwise. 1/
e_t	Sum over *t* and *t-1* of the monthly percentage change of the nominal exchange rate.
s_t	Standard deviation of daily percentage change of the nominal exchange rate over 90-days
$\Delta embi_t$	First-difference of the EMBI Peru, divided by 100.
Prudential variables	
ΔRR_t	Difference over *t* and *t-2* of the spread between the required RR rate in foreign currency to the rate in domestic currency (in percent).
d_t^{2006}	Dummy equal to 1 starting in mid-2006 till mid-2007 to reflect the introduction of higher provisions for foreign currency loans; zero, otherwise.
Soles capital market variables	
Δ *share bonds in soles*	First difference of the percentage of the stock of private sector bonds denominated in local currency.
d_t^{10-15}	Dummy equal to 1 if during that month a treasury bond maturing in 10 up to 15 years was issued; zero, otherwise.
d_t^{15-20}	Dummy equal to 1 if during that month a treasury bond maturing in 15 up to 20 years was issued; zero, otherwise.
d_t^{20}	Dummy equal to 1 if during that month a treasury bond maturing in 20 or more years; zero, otherwise.

The exogenous variables are I(0) processes.
1/ According to the definition for the depreciation and appreciation dummies, there are 7 episodes of depreciation and 10 episodes of appreciation in the estimation sample consisting of 94 observations.

Table 4. Results of Aggregate VAR Model

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Δdol^{credit}_{t}	$\Delta dol^{deposit}_{t}$	Δdol^{credit}_{t}	$\Delta dol^{deposit}_{t}$	Δdol^{credit}_{t}	$\Delta dol^{deposit}_{t}$	Δdol^{credit}_{t}	$\Delta dol^{deposit}_{t}$
$\Delta dol^{credit}_{t-1}$	0.16*	-0.42**	0.12	-0.34	0.08	-0.34	0.02	-0.42*
	(0.10)	(0.20)	(0.10)	(0.21)	(0.10)	(0.22)	(0.10)	(0.23)
$\Delta dol^{credit}_{t-2}$	0.14	0.10	0.13	0.12	0.12	0.09	0.09	0.08
	(0.10)	(0.20)	(0.10)	(0.20)	(0.10)	(0.21)	(0.10)	(0.22)
$\Delta dol^{deposit}_{t-1}$	0.05	0.03	0.06	-0.02	0.08	-0.01	0.09*	0.01
	(0.05)	(0.09)	(0.05)	(0.10)	(0.05)	(0.11)	(0.05)	(0.11)
$\Delta dol^{deposit}_{t-2}$	-0.08**	-0.07	-0.07	-0.12	-0.02	-0.13	-0.03	-0.13
	(0.04)	(0.09)	(0.05)	(0.10)	(0.05)	(0.10)	(0.05)	(0.11)
macrostability								
inflationt	-0.01	0.13	-0.04	0.17	-0.09	0.20	-0.09	0.22
	(0.07)	(0.14)	(0.07)	(0.14)	(0.08)	(0.17)	(0.08)	(0.17)
$d_t^{appreciation}$	-0.41**	-0.59*	-0.43***	-0.59*	-0.45***	-0.57	-0.45***	-0.72*
	(0.16)	(0.34)	(0.16)	(0.34)	(0.17)	(0.36)	(0.17)	(0.38)
$d_t^{depreciation}$	0.27	0.49	0.25	0.56	0.32	0.51	0.27	0.41
	(0.19)	(0.40)	(0.19)	(0.40)	(0.21)	(0.44)	(0.21)	(0.46)
e_t	-0.09***	0.05	-0.08**	0.02	-0.09**	0.01	-0.08**	0.01
	(0.03)	(0.06)	(0.03)	(0.07)	(0.03)	(0.07)	(0.04)	(0.08)
s_t	-0.43	0.47	-0.47*	0.45	-0.54*	0.36	-0.49*	0.34
	(0.27)	(0.56)	(0.27)	(0.56)	(0.28)	(0.60)	(0.28)	(0.62)
Δembi	0.00	0.07	0.01	0.07	-0.01	0.10	0.00	0.15
	(0.09)	(0.18)	(0.09)	(0.18)	(0.09)	(0.20)	(0.09)	(0.20)
prudential								
ΔRR_t			-0.06	0.17	-0.10	0.17	-0.10	0.14
			(0.07)	(0.14)	(0.07)	(0.14)	(0.07)	(0.15)
d^{2006}			-0.20	0.05	-0.23*	0.07	-0.24	0.21
			(0.13)	(0.26)	(0.13)	(0.28)	(0.17)	(0.37)
capital market development								
Δ share bonds in soles					0.07*	-0.01	0.06	-0.03
					(0.04)	(0.09)	(0.04)	(0.09)
$d^{10\text{-}15}$							-0.31**	-0.25
							(0.13)	(0.28)
$d^{15\text{-}20}$							-0.01	-0.17
							(0.15)	(0.33)
d^{20}							-0.13	0.18
							(0.15)	(0.34)
Constant	-0.07	-0.42***	-0.02	-0.45***	0.00	-0.46***	0.03	-0.43**
	(0.07)	(0.15)	(0.07)	(0.15)	(0.08)	(0.17)	(0.08)	(0.18)
Observations	105	105	105	105	94	94	94	94
R-squared	0.27	0.21	0.39	0.83	0.40	0.85	0.39	0.86

Sources: IMF staff calculations.

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

Table 5. Results of Six Variable VAR Specification

	(1) $\Delta dol^{commercial}_{t}$	(2) $\Delta dol^{consumption}_{t}$	(3) $\Delta dol^{mortgage}_{t}$	(4) Δdol^{vista}_{t}	(5) Δdol^{saving}_{t}	(6) Δdol^{time}_{t}
$\Delta dol^{commercial}_{t-1}$	-0.03	0.02	-0.04	-0.07	-0.2	-0.43
	(0.10)	(0.08)	(0.05)	(0.26)	(0.16)	(0.27)
$\Delta dol^{commercial}_{t-2}$	0.07	0.19***	0.07	-0.09	-0.01	0.12
	(0.09)	(0.07)	(0.05)	(0.23)	(0.14)	(0.24)
$\Delta dol^{consumption}_{t-1}$	0.35**	-0.1	-0.1	-0.2	0.19	0.03
	(0.14)	(0.11)	(0.07)	(0.35)	(0.22)	(0.37)
$\Delta dol^{consumption}_{t-2}$	-0.19	0.14	-0.04	-0.19	0.21	-0.02
	(0.12)	(0.09)	(0.06)	(0.29)	(0.18)	(0.30)
$\Delta dol^{mortgage}_{t-1}$	-0.34*	-0.12	0.16*	-0.84*	-0.28	0.01
	(0.18)	(0.13)	(0.09)	(0.45)	(0.28)	(0.47)
$\Delta dol^{mortgage}_{t-2}$	-0.12	0.17	0.41***	0.76*	0.34	0.67
	(0.18)	(0.14)	(0.09)	(0.46)	(0.28)	(0.48)
Δdol^{vista}_{t-1}	-0.03	-0.02	-0.01	-0.53***	0.13**	0.07
	(0.04)	(0.03)	(0.02)	(0.10)	(0.06)	(0.10)
Δdol^{vista}_{t-2}	-0.02	-0.13***	-0.04**	-0.28***	0.03	-0.05
	(0.04)	(0.03)	(0.02)	(0.10)	(0.06)	(0.10)
$\Delta dol^{saving}_{t-1}$	0.28***	0.04	0.03	0.09	-0.32***	0.31
	(0.07)	(0.06)	(0.04)	(0.18)	(0.11)	(0.19)
$\Delta dol^{saving}_{t-2}$	-0.04	0.02	0	-0.27*	-0.17*	0.26
	(0.06)	(0.05)	(0.03)	(0.16)	(0.10)	(0.16)
Δdol^{time}_{t-1}	0.05	0	0.03	0.30***	0.21***	-0.25**
	(0.04)	(0.03)	(0.02)	(0.10)	(0.06)	(0.10)
Δdol^{time}_{t-2}	0.01	-0.04	-0.03	0.23**	0.08	-0.23**
	(0.04)	(0.03)	(0.02)	(0.11)	(0.06)	(0.11)
macrostability						
inflationt	-0.10	-0.07	-0.07	-0.40	-0.17	0.93***
	(0.11)	(0.08)	(0.06)	(0.28)	(0.17)	(0.29)
$d_t^{appreciation}$	-0.62**	0.20	0.02	-0.22	-0.31	-1.04
	(0.25)	(0.18)	(0.12)	(0.62)	(0.38)	(0.64)
$d_t^{depreciation}$	0.23	0.31	0.37**	0.65	0.64	0.95
	(0.31)	(0.23)	(0.16)	(0.78)	(0.47)	(0.80)
et	-0.11**	-0.01	0.02	0.08	-0.01	-0.01
	(0.05)	(0.04)	(0.03)	(0.13)	(0.08)	(0.13)
st	-1.24***	-0.12	-1.03***	-1.66	0.92	0.64
	(0.45)	(0.33)	(0.23)	(1.13)	(0.69)	(1.17)
Δembi	0.23*	-0.16*	-0.18***	0.79**	-0.39**	0.16
	(0.13)	(0.10)	(0.06)	(0.32)	(0.20)	(0.33)
prudential						
ΔRRt	-0.28***	0.1	0	-0.01	0.14	0.28
	(0.10)	(0.07)	(0.05)	(0.25)	(0.15)	(0.26)
d2006t	-0.31	-0.1	-0.23*	-0.71	-0.27	1.10*
	(0.25)	(0.18)	(0.13)	(0.62)	(0.38)	(0.65)
capital market development						
Δ share bonds in soles	0.15***	-0.05	0	0.13	-0.02	-0.08
	(0.06)	(0.04)	(0.03)	(0.15)	(0.09)	(0.15)
d^{10-15}	-0.53***	0.2	0.04	-0.21	-0.61**	-0.1
	(0.18)	(0.13)	(0.09)	(0.44)	(0.27)	(0.46)
d^{15-20}	-0.38*	0.37**	-0.11	0.53	0.22	-0.42
	(0.23)	(0.17)	(0.11)	(0.57)	(0.35)	(0.59)
d^{20}	-0.36	0.19	-0.08	0.79	0.11	0.4
	(0.23)	(0.17)	(0.11)	(0.56)	(0.34)	(0.59)
Constant	0.31**	-0.36***	0.08	0.22	-0.25	-0.69*
	(0.15)	(0.11)	(0.07)	(0.37)	(0.23)	(0.39)
Observations	94	94	94	94	94	94
R-squared	0.48	0.37	0.75	0.42	0.41	0.31

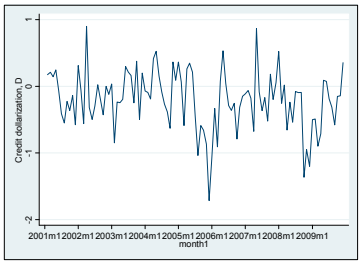
Sources: IMF staff calculations.

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

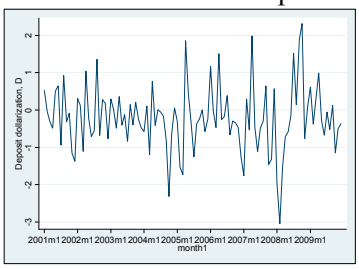
Figure 7. Data for the Empirical Analysis

Endogenous variables

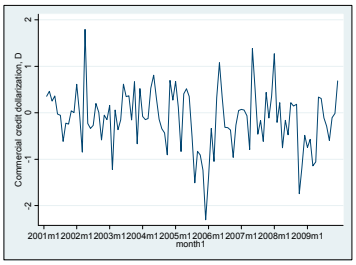
Δ dollarization of credit



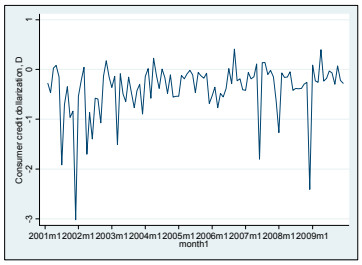
Δ dollarization of deposits



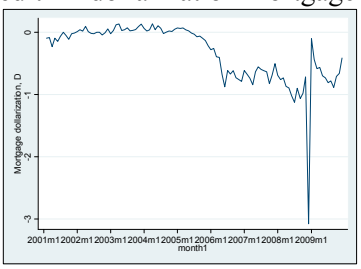
Δ dollarization commercial credit



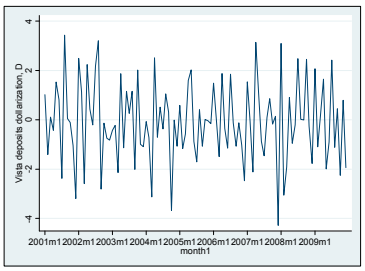
Δ dollarization consumer credit



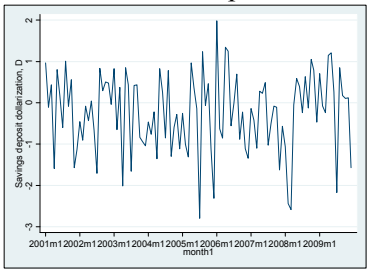
Δ dollarization mortgage



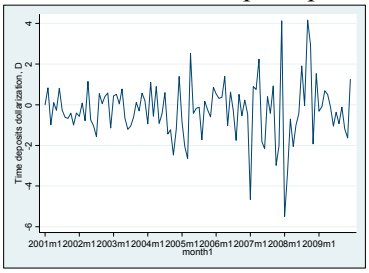
Δ dollarization deposit vista



Δ dollarization deposit ahorro



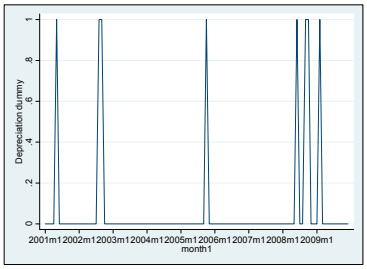
Δ dollarization deposit plazo



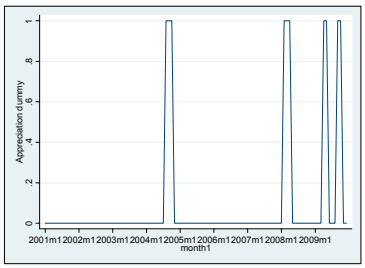
Source: IMF staff calculations.

Exogenous variables

$d_t^{depreciation}$



$d_t^{appreciation}$



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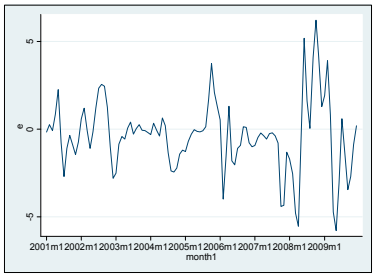
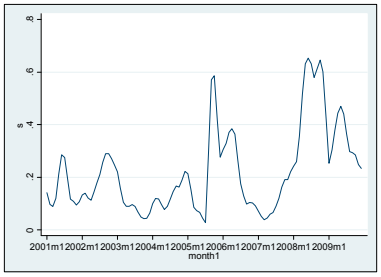
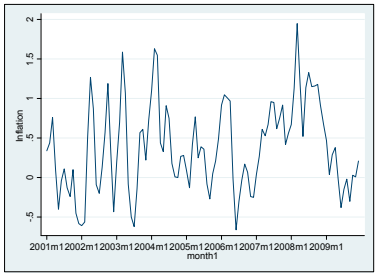


Figure 7. Data for the Empirical Analysis. (cont.)

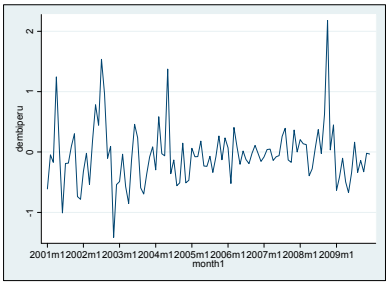
s



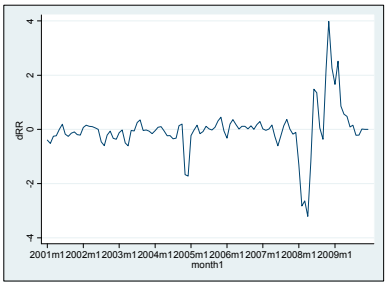
inflation



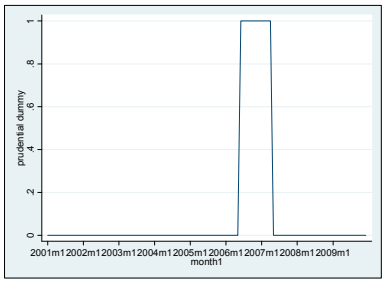
Δembi



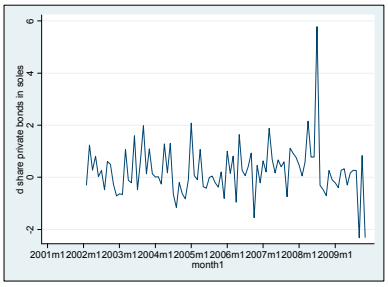
Δ RR



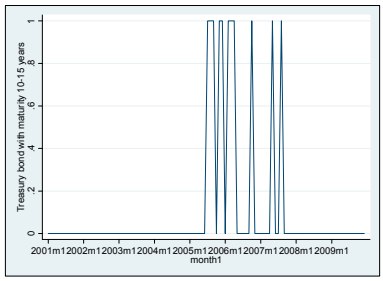
d_t^{pruden}



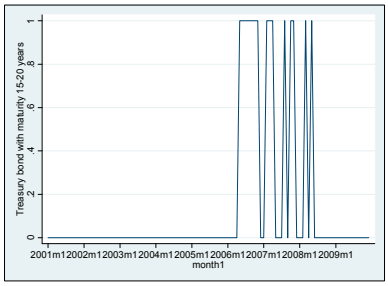
Δ share bonds in soles



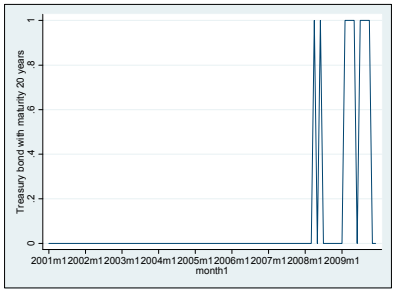
d_t^{10-15}



d_t^{15-20}



d_t^{20}

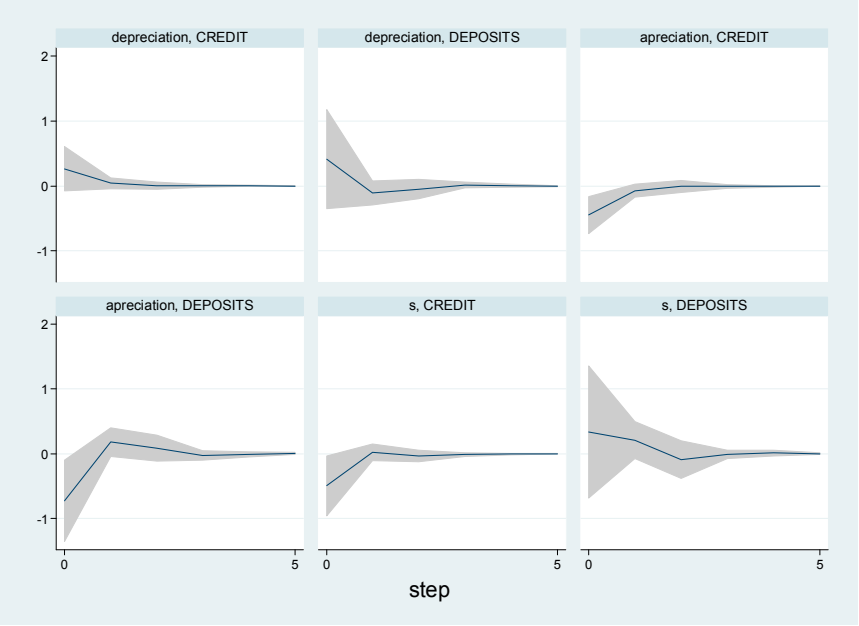


Source: IMF staff calculations.

Figure 8. Aggregate Model: Dynamic Impact of Selective Exogenous Variables

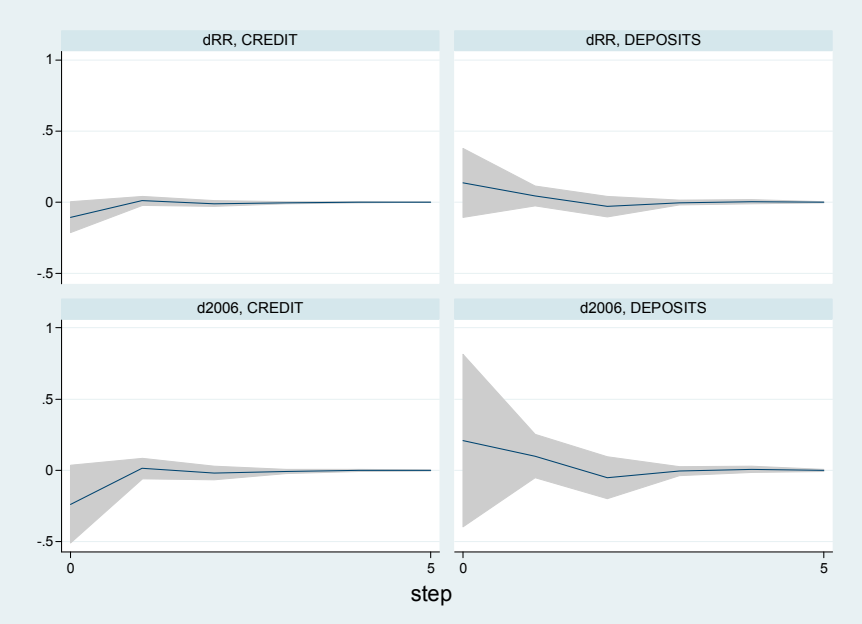
a. Dynamic multipliers

Exchange rate variables



Source: IMF staff calculations.

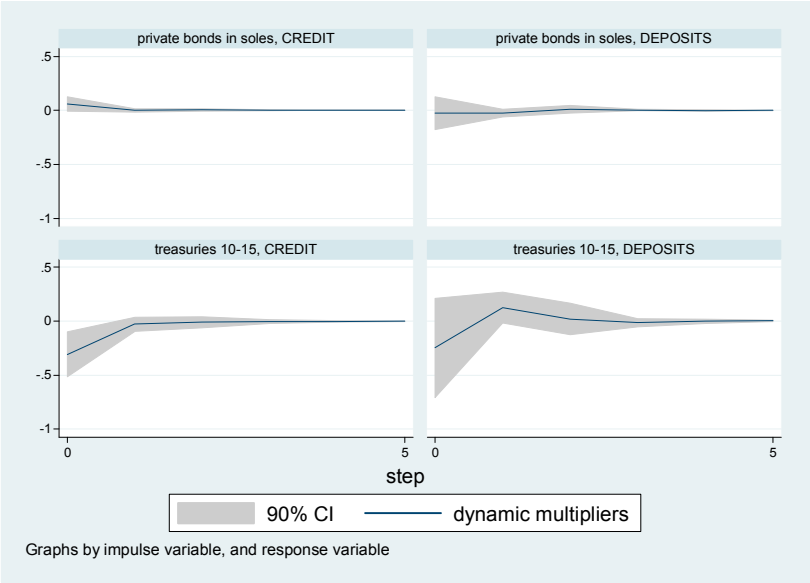
Prudential variables



Source: IMF staff calculations.

Figure 8. Aggregate Model: Dynamic Impact of Selective Exogenous Variables (cont.)

Capital market development variables



Source: IMF staff calculations.

b. Cumulative dynamic multipliers

Cumulative dynamic multipliers							
		Δdolcredit t			Δdoldeposit t		
		confidence intervals			confidence intervals		
	steps	cdm	Lower	Upper	cdm	Lower	Upper
inflation	0	-0.09	-0.22	0.03	0.22	-0.06	0.49
	5	-0.09	-0.23	0.05	0.22	-0.02	0.46
$d_t^{appreciation}$	0	-0.45	-0.73	-0.16	-0.72	-1.35	-0.09
	5	-0.54	-0.88	-0.19	-0.49	-1.08	0.11
$d_t^{depreciation}$	0	0.27	-0.08	0.61	0.41	-0.35	1.17
	5	0.32	-0.08	0.71	0.28	-0.40	0.96
s	0	-0.49	-0.96	-0.03	0.34	-0.68	1.36
	5	-0.52	-1.00	-0.04	0.46	-0.37	1.28
e	0	-0.08	-0.14	-0.03	0.01	-0.12	0.14
	5	-0.09	-0.16	-0.02	0.04	-0.09	0.16
Δembi	0	0.00	-0.15	0.15	0.15	-0.18	0.48
	5	0.01	-0.16	0.18	0.13	-0.16	0.43
	5	0.06	-0.01	0.14	-0.04	-0.17	0.09
d10-15	0	-0.31	-0.52	-0.10	-0.25	-0.71	0.21
	5	-0.35	-0.58	-0.13	-0.12	-0.50	0.27
d15-20	0	-0.01	-0.26	0.24	-0.17	-0.71	0.38
	5	-0.02	-0.30	0.25	-0.14	-0.62	0.33
d20	0	-0.13	-0.38	0.12	0.18	-0.37	0.74
	5	-0.13	-0.43	0.16	0.20	-0.30	0.70

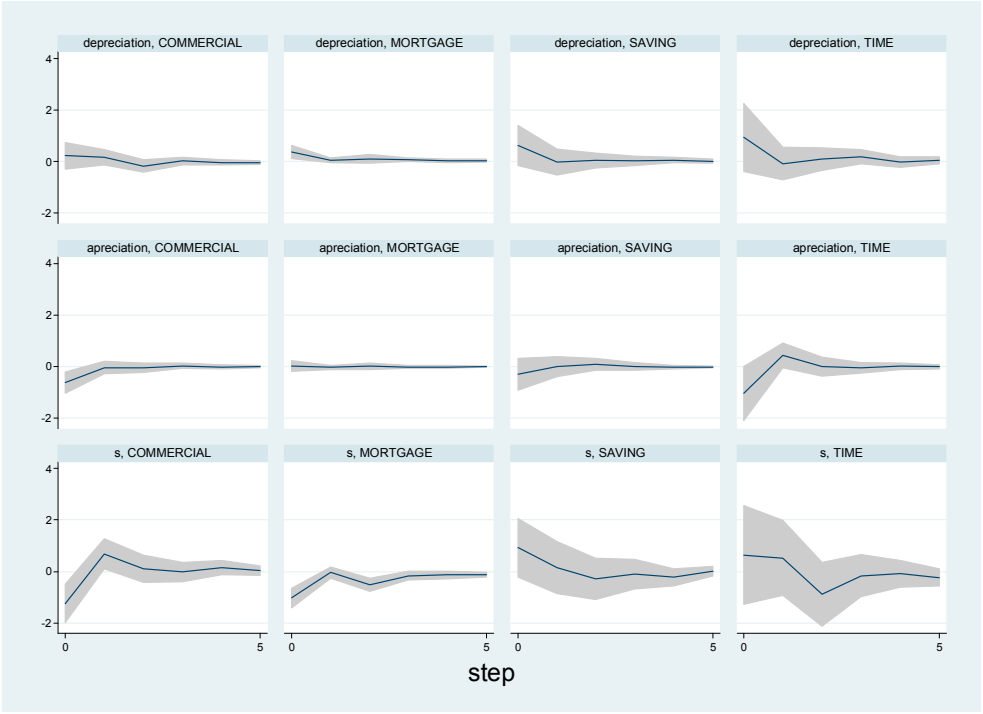
1/ 90 percent confidence interval. Highlighted if statistically significant different from zero.

Source: IMF staff calculations.

Figure 9. Six-Variable Model: Dynamic Impact of Selective Exogenous Variables

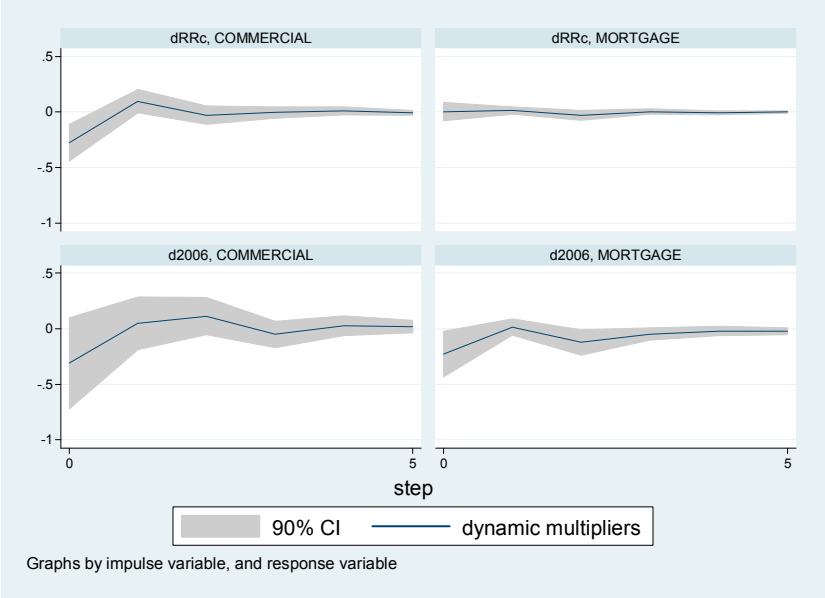
a. Dynamic multipliers

Exchange rate variables



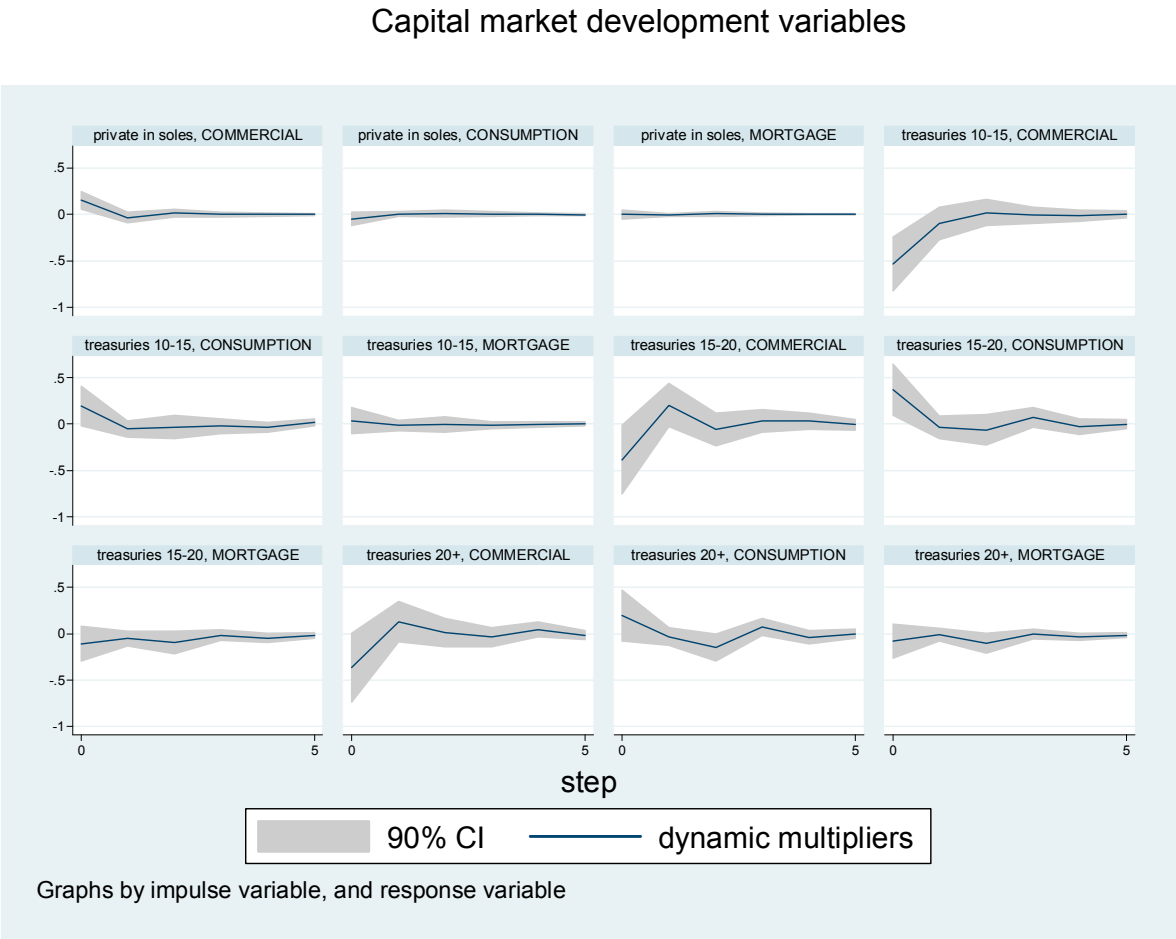
Source: IMF staff calculations.

Prudential variables



Source: IMF staff calculations.

Figure 9. Six-Variable Model: Dynamic Impact of Selective Exogenous Variables (cont.)



Source: IMF staff calculations.

Figure 9. Six-Variable Model: Dynamic Impact of Selective Exogenous Variables (cont.)

b. Cumulative dynamic multipliers

Cumulative dynamic multipliers

		$\Delta dol^{commercial}_t$			$\Delta dol^{consumption}_t$			$\Delta dol^{mortgage}_t$		
		confidence intervals			confidence intervals			confidence intervals		
exogenous variables	steps	cdm	Lower	Upper	cdm	Lower	Upper	cdm	Lower	Upper
inflation	0	-0.10	-0.29	0.08	-0.07	-0.20	0.07	-0.07	-0.16	0.02
	5	-0.05	-0.27	0.17	-0.11	-0.26	0.05	-0.11	-0.29	0.07
$d_t^{appreciation}$	0	-0.62	-1.03	-0.22	0.20	-0.10	0.50	0.02	-0.18	0.23
	5	-0.71	-1.22	-0.19	0.12	-0.25	0.48	-0.02	-0.44	0.40
$d_t^{depreciation}$	0	0.23	-0.28	0.74	0.31	-0.06	0.69	0.37	0.12	0.63
	5	0.21	-0.46	0.88	0.34	-0.13	0.82	0.70	0.16	1.24
s	0	-1.24	-1.99	-0.50	-0.12	-0.67	0.43	-1.03	-1.40	-0.66
	5	-0.28	-1.07	0.50	-0.19	-0.75	0.36	-2.00	-2.63	-1.38
e	0	-0.11	-0.19	-0.02	-0.01	-0.07	0.05	0.02	-0.03	0.06
	5	-0.13	-0.24	-0.03	-0.05	-0.12	0.03	0.03	-0.06	0.12
Δembi	0	0.23	0.01	0.44	-0.16	-0.31	0.00	-0.18	-0.29	-0.08
	5	0.24	-0.03	0.52	-0.22	-0.42	-0.03	-0.38	-0.60	-0.16
ΔRRt	0	-0.28	-0.44	-0.11	0.10	-0.02	0.23	0.00	-0.08	0.08
	5	-0.21	-0.36	-0.06	0.05	-0.06	0.16	-0.02	-0.15	0.11
d2006t	0	-0.31	-0.72	0.10	-0.10	-0.40	0.20	-0.23	-0.43	-0.02
	5	-0.15	-0.62	0.33	-0.17	-0.51	0.17	-0.43	-0.82	-0.03
Δ share bonds in soles	0	0.15	0.06	0.25	-0.05	-0.12	0.02	0.00	-0.05	0.05
	5	0.13	0.02	0.24	-0.03	-0.11	0.05	0.01	-0.08	0.10
d10-15	0	-0.53	-0.82	-0.24	0.20	-0.02	0.41	0.04	-0.11	0.18
	5	-0.63	-0.95	-0.30	0.08	-0.15	0.31	0.00	-0.26	0.27
d15-20	0	-0.38	-0.76	-0.01	0.37	0.10	0.65	-0.11	-0.30	0.08
	5	-0.18	-0.62	0.27	0.32	0.01	0.64	-0.33	-0.70	0.04
d20	0	-0.36	-0.74	0.01	0.19	-0.08	0.47	-0.08	-0.27	0.11
	5	-0.22	-0.67	0.23	0.05	-0.27	0.38	-0.24	-0.62	0.13

		Δdol^{vista}_t			Δdol^{saving}_t			Δdol^{time}_t		
		confidence intervals			confidence intervals			confidence intervals		
exogenous variables	steps	cdm	Lower	Upper	cdm	Lower	Upper	cdm	Lower	Upper
inflation	0	-0.40	-0.85	0.06	-0.17	-0.44	0.11	0.93	0.46	1.39
	5	0.03	-0.28	0.33	-0.02	-0.26	0.21	0.57	0.20	0.94
$d_t^{appreciation}$	0	-0.22	-1.23	0.79	-0.31	-0.92	0.31	-1.04	-2.09	0.01
	5	-0.25	-0.95	0.45	-0.23	-0.77	0.31	-0.65	-1.51	0.22
$d_t^{depreciation}$	0	0.65	-0.63	1.92	0.64	-0.14	1.42	0.95	-0.37	2.27
	5	0.52	-0.42	1.45	0.79	0.08	1.50	1.20	0.05	2.34
s	0	-1.66	-3.51	0.19	0.92	-0.21	2.05	0.64	-1.28	2.56
	5	-0.82	-1.93	0.30	0.47	-0.38	1.31	-0.21	-1.57	1.15
e	0	0.08	-0.13	0.29	-0.01	-0.14	0.12	-0.01	-0.23	0.20
	5	0.08	-0.07	0.23	0.02	-0.10	0.13	0.03	-0.15	0.22
Δembi	0	0.79	0.26	1.31	-0.39	-0.71	-0.07	0.16	-0.39	0.70
	5	0.47	0.09	0.85	-0.35	-0.65	-0.06	-0.26	-0.74	0.21
ΔRRt	0	-0.01	-0.42	0.40	0.14	-0.11	0.39	0.28	-0.14	0.71
	5	0.09	-0.12	0.31	0.21	0.04	0.37	0.30	0.04	0.55
d2006t	0	-0.71	-1.74	0.31	-0.27	-0.89	0.36	1.10	0.04	2.16
	5	-0.09	-0.74	0.56	-0.12	-0.62	0.38	0.53	-0.27	1.32
Δ share bonds in soles	0	0.13	-0.11	0.37	-0.02	-0.16	0.13	-0.08	-0.33	0.17
	5	0.04	-0.12	0.19	-0.05	-0.17	0.07	-0.10	-0.29	0.09
d10-15	0	-0.21	-0.93	0.52	-0.61	-1.05	-0.17	-0.10	-0.85	0.65
	5	-0.01	-0.45	0.44	-0.31	-0.66	0.03	-0.06	-0.61	0.49
d15-20	0	0.53	-0.40	1.46	0.22	-0.35	0.79	-0.42	-1.38	0.55
	5	0.17	-0.44	0.78	0.23	-0.24	0.70	-0.31	-1.06	0.45
d20	0	0.79	-0.14	1.72	0.11	-0.46	0.68	0.40	-0.56	1.36
	5	0.57	-0.04	1.19	0.25	-0.22	0.72	0.28	-0.47	1.04

1/ 90 percent confidence interval. Highlighted if statistically significant different from zero.

Source: IMF staff calculations.

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