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**DE-DOLLARIZING BOLIVIAN ECONOMY:
AN EMPIRICAL MODEL APPROACH**

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Abstract

Bolivia is experiencing financial de-dollarization as a consequence of exchange rate appreciation as the main driver. Capital inflows have impelled monetary authorities to appreciate exchange rate in order to fight against inflation having an impact over the de-dollarization process. The empirical results based in a VAR estimated model suggest that exchange rate volatility has been traduced in a de-dollarization process supported by another policies such as the issuance of bonds with longer maturity. Dollarization can be a source of stabilization and, in this way, has several pros and cons. It happens the same with the existing exchange rate regimes that have costs and benefits of their own.

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I. Introduction

Economic crisis always reopen the debate about the most appropriate exchange rate regime for an economy without considerations about its size and because exchange rate affects the economy's ability to adjust to negative real shocks, specially persistent ones besides the structural characteristics of the economy, i.e. degree of openness, structure of production, financial development, fiscal environment, degree of wage and price downward rigidity, and export and import composition. In general, a more flexible exchange rate regime facilitates adjustments in the real exchange rate implying lower costs in terms of unemployment especially for countries whose revenues are based on natural resources exploitation which largely expose the economy to negative real shocks and under rigid downward adjustment in nominal prices.

These shocks can be of external nature (movements in terms of trade following changes in the demand for raw materials, a rise in foreign interest rates for a net debtor country, a sudden reduction in capital inflows), or have a domestic cause (a drought, an earthquake or a political change with a negative impact on expectations and aggregate demand). When the economy faces these types of shocks and it is recommended a depreciation of the real exchange rate, having a flexible exchange rate can be an important instrument mostly in presence of real downward rigidities. Besides this feature, the exchange rate system is crucial for the effectiveness of monetary policy on aggregate demand, in the stabilization of the level of output and controlling the size of the current account deficit or, in the extreme cases, the exchange rate can be used to minimize volatility in nominal and real variables of the economy such as inflation, unemployment and output.

The paper is organized as follows. Section II revises pros and cons of the different types of exchange rates; Section III the dollarization process and Section IV takes a look to the dollarization process of the Bolivian economy. In Section V, it is analyzed the de-dollarization in a general manner, in Section VI the paper considers the relationship between dollarization and exchange rate appreciation; Section VII analyses the dollarization empirically, and Section VIII concludes.

II. Costs and Benefits of Alternative Exchange Rate Regimes

Corbo (2002) established that exchange rate regimes can be grouped into three broad categories: hard-peg regimes (dollarization, currency unions and currency boards), intermediate regimes (fixed-but-adjustable pegs, flexible pegs, crawling pegs, target zones), and floating regimes (managed floats with occasional interventions and free floats). The three categories offer benefits and costs that are related to the economic fundamentals present in the economies.

The benefits of hard-peg regimes can be summarized as follow. First, they eliminate (and intermediate regimes reduce) volatility in the nominal and real exchange rate and, when accompanied by supporting macro-policies, are less prone to generate misalignments that are unrelated to changes in fundamentals. Second, hard-pegs as well as fixed-but-adjustable exchange rate regimes (FBAR in the Corden's [2002] classification) also provide a nominal anchor for the evolution of the price level and allow for more efficient adjustments when shocks are of a nominal nature. Third, an additional advantage for countries with a poor track record on the use of monetary policy is that it also reduces the scope for an independent monetary policy.

In the same way, costs of hard-peg regimes take the following forms. First, real movements in the exchange rate are difficult to achieve when a change in fundamentals requires one because of

expectations; when such a movement is needed costs, in terms of output and unemployment, arises in presence of nominal downward price and wage rigidities. Thus, adjustments to real shocks under fixed exchange rate regimes are costlier than under more flexible regimes. Second, misperceptions about changes in the exchange rate conduces to over/expansion of foreign indebtedness exposing agents to high costs when an adjustment really takes place; additionally, hard-peg regimes are prone to speculative attacks through trade, direct foreign investment and capital flows, generating multidimensional issues that take the form of central bank losses associated to the exchange rate intervention, the effects related to the higher interest rates needed to defend the peg, movements in relative prices that affect expectations related to investment, and political and economic costs usually related to the abandonment of a peg. The mismatch present in economies where assets and liabilities are expressed in foreign currency while payments are expressed in the domestic one, is exacerbated leading to drastic adjustments to avoid crisis and bankruptcies. Third, a fixed exchange rate regime leads to a lost on monetary policy ability to help control demand to stabilize output; in contrast, a flexible exchange rate monetary policy is the most effective stabilization tool in presence of nominal price rigidities.

Even if floating regimes reduce most of the costs of the fixed ones, they also have costs that one must evaluate against their benefits. First, they usually are accompanied by higher inflation rates. To avoid this issue, any flexible exchange rate regime must be supported by an explicit nominal anchor in the form of inflation targeting regime. Second, flexible exchange rate regimes show more volatility in nominal and real exchange rates and sometimes lasting misalignments in the real exchange rate. This could be an important cost of flexible regimes as volatility and misalignments have real costs in terms of reduced trade and capital flows, and on growth and welfare. However, a currency mismatch could be avoided through appropriate regulation and supervision of the financial system and the development of instruments and markets for covering these risks as well as the development of modern capital markets expressed in domestic currency. To summarize, a flexible exchange rate system must be supported by appropriate supervision and regulation of banks and by the promotion of instruments to hedge exchange rate risks, and promoting the domestic currency denominated debt.

It is sometimes argued that countries have a fear of floating in the sense that even they know that having a flexible exchange rate is beneficial, they do not use this instrument in a broader sense because they assume the existence of a pass-through effect of devaluation to inflation or when it exists the possibility of real appreciation and its influence over competitiveness. However, analytical and empirical research have found that pass-through effects from depreciation to inflation is not as strong as it was thought. This is so for countries with a credible inflation targeting monetary policy and where agents believe that monetary policy makers are looking for inflation and exchange rate as separate objectives.

III. Dollarization

Dollarization refers to the use by the residents of one country of assets (or liabilities) denominated in another country's currency and can take many forms. Dollarization significantly differs according to: i) the type of assets (or liabilities) dollarized; ii) whether the foreign currency has the status of legal tender (official dollarization) or whether there is de-facto dollarization; and iii) the extent of dollarization (full or partial). More than one type of dollarization can exist in a country and measures for de-dollarization have to reflect the prevailing type of dollarization. Following Armas et.al. (2006), financial dollarization involves the indexation of domestic transactions to the

exchange rate; transaction dollarization or currency substitution means the foreign currency is used as a mean of payment in domestic transaction market.

Dollarization may be a natural consequence of opening the economy when economies participate into the world economy at the cost of more exposition to shocks which may require some level of dollarization what conduces to the development of domestic financial markets. Dollarization can minimize exchange rate risks for investors in general, increasing their confidence and boosting investment and economic growth. Portfolio diversification may develop financial markets and enhance savings providing funds for investment using financial intermediation and reversing capital flight that follows episodes of unstable macroeconomic conditions. Thus, lending in foreign currency may have a positive impact on domestic consumption and investment and, therefore, on economic growth avoiding instability and volatility of such variables in the long-run. Consumption, inflation and investment may become more stable depending on the level of dollarization that depends mainly on structural factors such as the economy's size, openness, the degree of financial integration and market development.

On the other hand, dollarization disadvantages can be summarized as follow. 1) Ize and Levy Yeyati (2005) say that dollarization limits the effectiveness of monetary policy. 2) Dollarized economies lose part or all of their seigniorage vis-à-vis the level of dollarization and its forms. Chang (2000), affirms that dollarization means that the dollarized economy pays seigniorage to the issuer of the foreign currency and, even if it is impossible to evaluate the exactly amount, the dollarized country should engage in negotiations to recover some of the revenue involved but, it is fair to say, there is little reasons to be optimistic about prospects for such negotiations in the short-run. 3) Dollarization reduces the efficiency of payments. Foreign bank notes are not always adapted to domestic transaction needs and monetary authorities of dollarized countries cannot control the quality of the banknotes in circulation (Kokenyne et.al. [2010]); but it is good to know that the later point of view has little importance because the adoption of a foreign currency should take into account such a problem in anticipation to a dollarizing process. 4) Partial dollarization increases balance sheet risks. A devaluation may offset the interest rate benefit from foreign currency borrowing limiting borrowers' ability to repay dollar debts, aggravating banking and macroeconomic crisis. 5) Dollarization increases the likelihood of a liquidity crisis. While central banks can provide funding in domestic currency in the event of bank runs, they usually cannot do the same in foreign currency rendering foreign currency holders more prone to panic.

IV. Bolivian Dollarization

Following Galindo and Leiderman (2005), high levels of inflation, low credibility about domestic macroeconomic policies and chronic volatility associated with monetary financing of budget deficits induced a switch to dollar-denominated assets. Even if dollarization was present in Bolivia since very long time, the shocking point about this issue exploded in the aftermath of 1981 re-dollarization process. In Bolivia during the 1970s and 1980s, fiscal policy was based on the premise that state enterprises (particularly in the mining and gas industries) and large public investments financed mainly by through foreign credit, were growth-promoting vehicles. At the beginning of the 1980s, terms of trade deteriorated significantly (because of the fall in the prices of minerals) during a time when international interest rates were increasing. The combination of both factors (falling prices and interest rate rises) produced a severe debt sustainability problem that obliged authorities to reschedule foreign debt payments in 1981, two years before debt problems spread thorough the region.

Between April 1984 and August (1985), Bolivia experienced hyperinflation and prices increased by a factor of 625 over the period (Morales [1988]). Bolivian hyperinflation was ranked as the seventh highest inflation in the world in the twentieth century and the only one not following a world war or a civil war. In August 1985, authorities adopted a stabilization package to control fiscal deficit and increasing monetary policy independence. Galindo and Leiderman (2005) adds that privatizations, elimination of subsidies, a freeze on public sector wages, tax reform and liberalization of certain markets, in addition to a law of central bank independence, were the major components of the package. Inflation and the fiscal deficit were reduced but the dollarization of deposits continued growing rapidly even when inflation become very low.

It is fair to recognize that the regain of agents' confidence in the economy, the economic stability obtained after the package of August 1985 and the reconstitution of the financial sector would have been impossible without the dollarization of the economy. Morales (2003) affirms that the cohabitation of two monies was accepted by the public and no major problem seemed to be posed by dollarization, except the loss of seigniorage, that after a hyperinflation was going to be small anyway or very slow to reconstruct.

V. De-dollarization

The measures for de-dollarization range from market-based ones that provide incentives to reverse currency substitution to measures that limit the use of foreign currency. such measures need the adoption of macro- and micro-economic policies to enhance the attractiveness of the local currency versus the foreign currency. In general terms, credibility must be reestablished and, as it takes long time, de-dollarization must be a day to day construction instead of a momentary decision. Moreover, measures to force de-dollarization can also be taken in parallel with stabilization policies and confidence ones, both of them taking into account the risks, capital flights, disintermediation, banking sector instability, exchange rate variability, public debt management and prudential monetary policy.

V.a). Macroeconomic Stability

This is the first step toward de-dollarization and it means reduction and stabilization of inflation. The policies include fiscal discipline and tight monetary policy. The adoption of a flexible exchange rate regime can be seen as a signal for restoring monetary policy autonomy; this behavior with others related to inflation targeting supports the goal of achieving stability in inflation which can be interpreted as an incentive to foster consumption, investment and exports consolidating the pros of the macroeconomic stability. Credibility on the peg is a very important under less flexible exchange rate regimes. Expectations become an important issue because agents need the certainty about the payment of their foreign exchange debt. Linkages to dollarization impede the achievement of a fully autonomous monetary policy but the economy recovers seigniorage adopting a bigger control over the financial sector of the economy.

V.b). Market-based de-dollarization

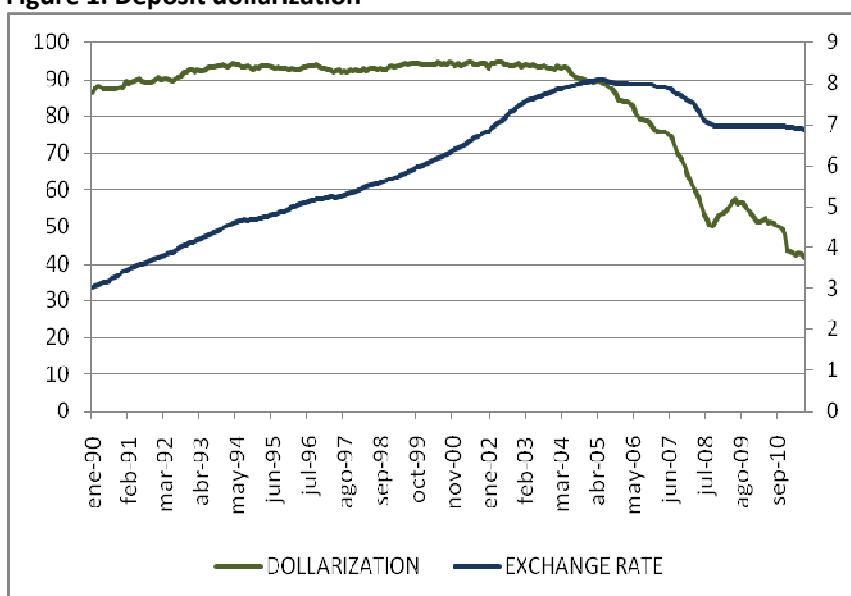
When exchange rate can move towards depreciation or appreciation, it introduces disincentives to dollarization in presence of controlled inflation, even more when targeting inflation is in place. Two-way exchange rate flexibility discourages lending and borrowing expressed in foreign currency assets. However, trends in the exchange rate could foster dollarization because agents form their expectations following these trends. Thus, depreciation trends could encourage

dollarization, while appreciation trends could encourage de-dollarization. The issuing of bonds expressed in domestic currency can put in place a bench-mark for the interest rate improving, in this way, monetary policy. The development of a foreign exchange market and an adequate level of official reserves, diminishes the need to hold foreign currency for precautionary reasons. Taxation is another source of de-dollarization, so transactions expressed in foreign currency must be taxed at least at the same level of domestic currency transactions.

VI. De-dollarization and exchange rate appreciation. Analyzing some trends

Even if there is no consensus about how to measure dollarization, the main point of view relates this issue to financial dollarization, i.e. the process in which a large share of residents' assets and liabilities are denominated in foreign currency. Financial dollarization is mostly a consequence of a lack of agents' confidence on domestic currency following periods of time when economic crisis and high levels of inflation were present in the economy. Typically, domestic currency loses its properties partial or totally and becomes risky for residents; henceforth, domestic currency demand lowers and foreign currency demand rises. When economy reestablishes credibility as a result of stabilization, dollarization usually remains in place mainly because of expectations about economic fundamentals. Ize and Levy Yeyati (2003), with a help of a model of their own about optimal portfolio choice, conclude that price instability is not enough to foster dollarization and the upside-down reasoning is not true either. Thus, low and stable inflation is not enough to reverse dollarization; however, credible inflation targeting seems to be important for achieving de-dollarization.

Figure 1. Deposit dollarization



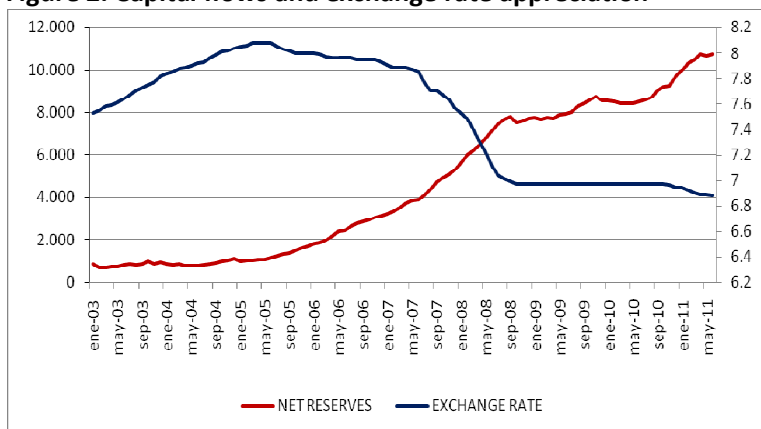
Source: BCB

The ratio of foreign currency deposits to total bank deposits is considered one very common measure of dollarization and is widely used for comparison purposes. Available statistics show that dollarization was very high when devaluation was very common and this trend was reversed mainly when appreciation changes expectations about the development of the exchange rate. Dollarization passed from a peak of 94,49% on April 2003 to 41,45% on June 2011 calculated with

available statistics. Taking into account that an economy is considered as highly dollarized when the ratio of foreign currency deposits to total bank deposits surpasses 30%, Bolivia continues of being a dollarized economy. If capital inflow continues its climbing, de-dollarization might become a common place, better if this environment is supported by other policies that enhance fundamentals stability and de-dollarization by themselves.

The 2000s was a period marked for de-dollarization in Bolivia and other countries of the region, being the pass-through the exchange rate appreciation as a consequence of large capital inflows. The mechanism seems to be simple: capital flows conduces to rises in monetary emission and a rise in inflation; in a context of FBAR regime, to lower inflation central bank has to appreciate exchange rate with the ultimate goal of maintaining inflation stable.

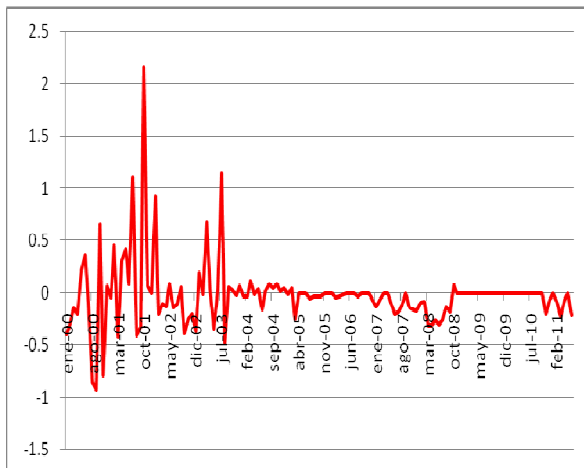
Figure 2. Capital flows and exchange rate appreciation



Source: BCB

Elasticity between exchange rate and capital flow was calculated and it is shown in Figure 3. Negative elasticity means that exchange rate appreciates when reserves rises. Reinhart and Reinhart (2008), express that, at least theoretically, an elasticity closer to zero means that sterilization is having positive effects over the economy. Calculated elasticities from January 2000 to mid 2003 show that exchange rate fluctuated (having greater volatility) more vividly than after such a period when elasticity shows that exchange regime becomes more rigid.

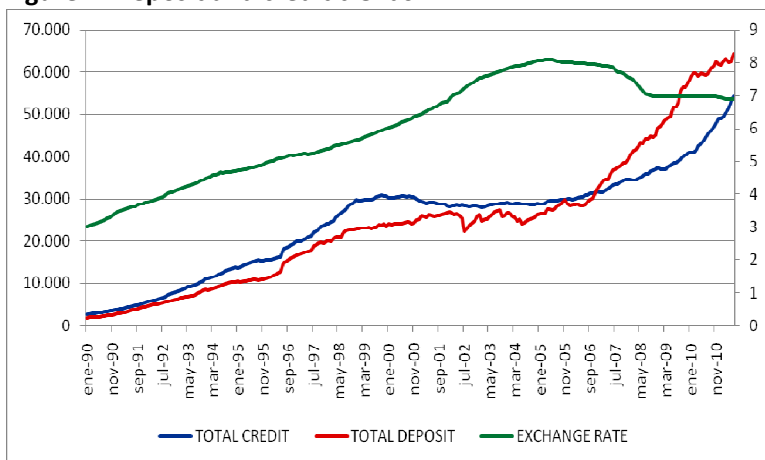
Figure 3. Elasticity exchange rate - reserves



Source: Own calculation with BCB statistics

Financial dollarization continues in the economy although at lower levels and Bolivia is still considered a highly dollarized economy. Galindo and Leiderman (2005) have found that dollarization persists even after periods of macroeconomic stability and decline of inflation, it seems that agents become less prone to put apart foreign currency in substitution of what it is yet considered a risky asset and behave as risk adverse agents.

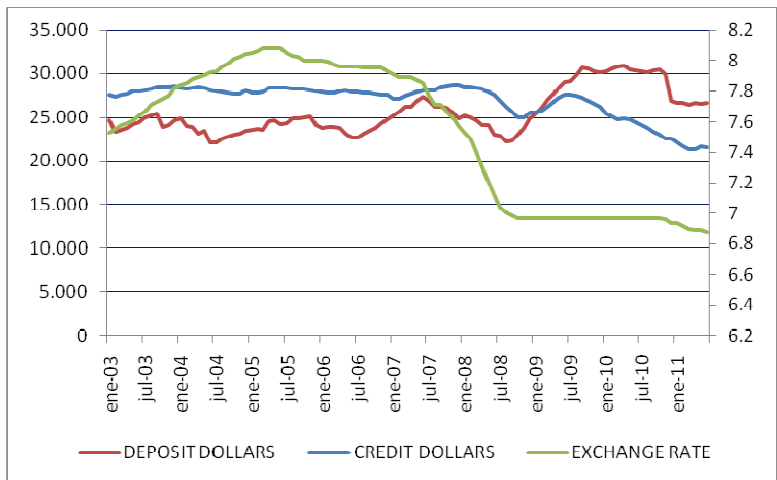
Figure 4. Deposit and credit trends



Source: BCB and ASFI

One source of misperception can be set off when analyzing deposit and credit growth as it is shown in Figure 4. The direct explanation for these types of trends is capital inflow as a consequence of rises in raw materials prices and remittances from abroad as the legal part of the whole story.

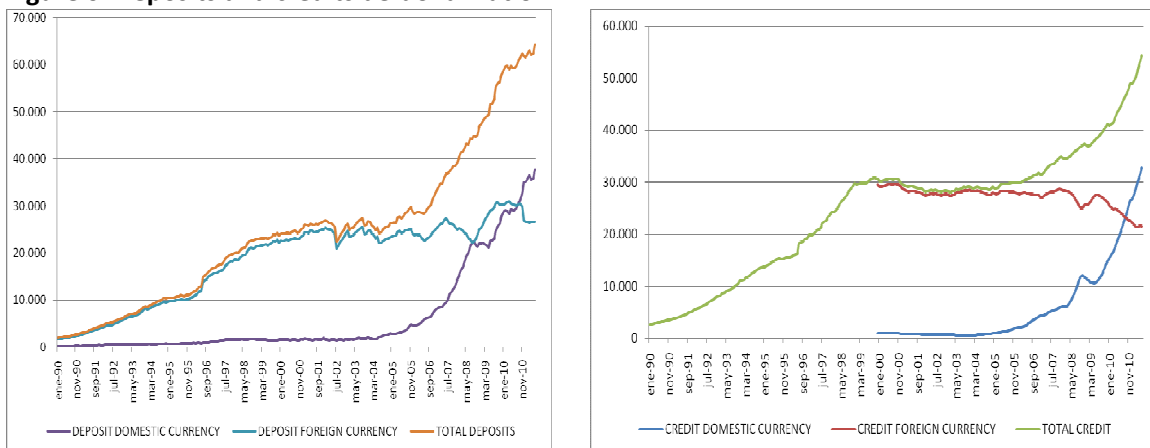
Figure 5. Deposit and credit denominated in foreign currency



Source: BCB and ASFI

As it was noted, in Figure 5 it seems that deposits are growing even in a de-dollarization environment that could be misleading; the explanation is direct again, the source is capital inflows to the economy that generates pressures traduced on exchange rate appreciations. Reinhart and Reinhart (2008) stress that there are two aspects to control appreciation. First, monetary authorities have several tools for limiting domestic currency appreciation, these tools face movements on agents' willingness to not hold assets that are losing market value, generating, in this way, pressures for a domestic currency appreciation. Second, monetary authorities rarely consider few instruments to control exchange rates and they usually react with several monetary mechanisms such as open market operations and exchange market interventions as the main ones. By using parity condition It is possible to explain exchange rate appreciation pressures and to determine instruments for controlling and limiting those pressures.

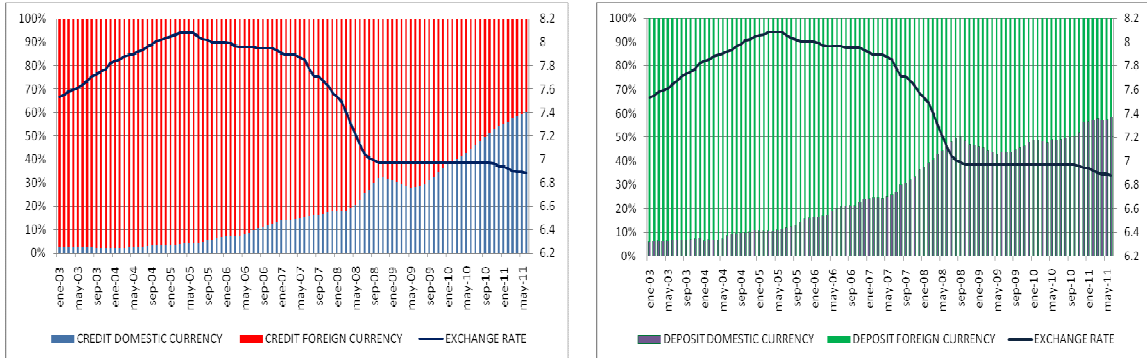
Figure 6. Deposits and credits de-dollarization



Source: ASFI and BCB

Figure 6. shows that deposits expressed in domestic currency have started to growth when appreciation was a major concern about exchange rate policy. On Figure 7. it is possible to visualize the change in the percentage composition of deposits and credits in domestic and foreign currency. It is well shown that deposit and credit react differently and economic theory pays more attention to deposits in foreign currency to measure dollarization.

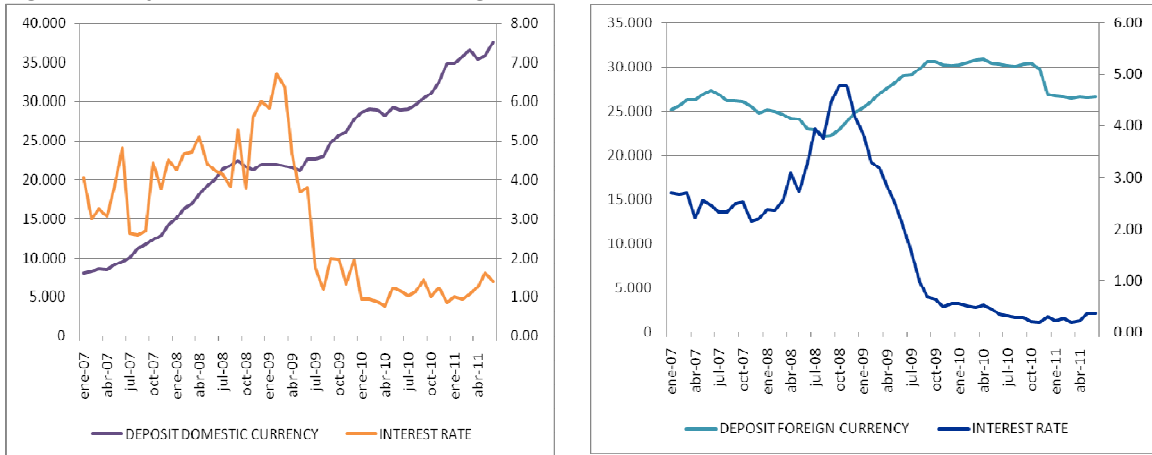
Figure 7. Deposits and credits percentage decomposition



Source: Own calculation with BCB and ASFI statistics

Figure 8. below shows that interest rates for domestic currency continues of being more volatile than the one related foreign currency. The explanation could be direct, domestic interest rates are prone to include domestic risk and inflation. In both cases, interest rates become lower because of an excess supply of deposits expressed in the two currencies. If there is a risk of liquidity trap is not an issue studied in the present paper.

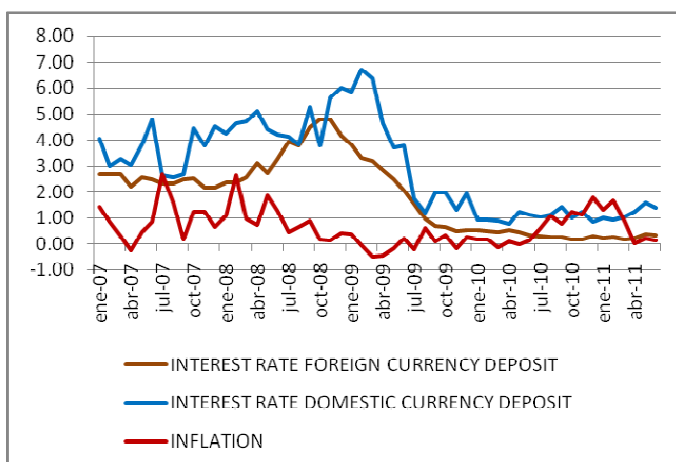
Figure 8. Deposits in domestic and foreign currencies and interest rates



Source: BCB and ASFI

As it was stressed in previous sections, to achieve de-dollarization it is important that at least assets expressed in the two currencies must be treated as equals and being taxed at same levels. Interest rates differ for deposits in the two currencies being higher for those expressed in domestic currency. At a first glance, it seemed that there were incentives to de-dollarize the economy, but it is clear too, that bankers' expectations about currency include inflation and risk and they behave as agents in an imperfect competition environment.

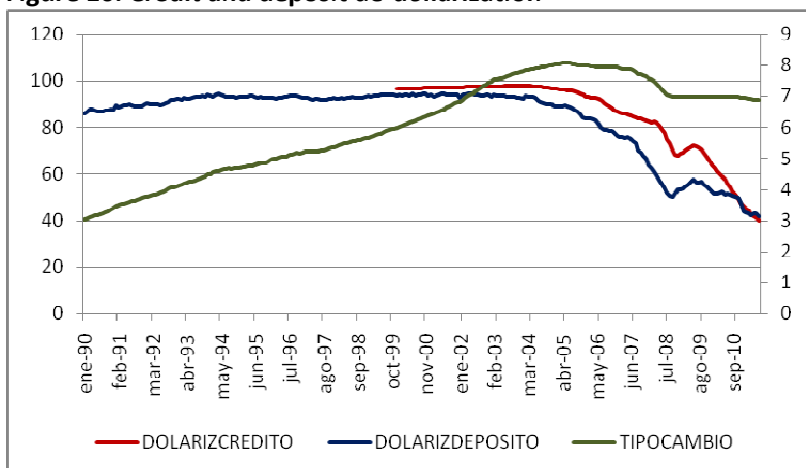
Figure 9. Interest rate comparison



Source: BCB and ASFI

From the peak to the lower level, dollarization was reduced in 53 percentage points and the main driver is exchange rate appreciation. Even if another instruments have been used to achieve de-dollarization -such as reserve requirements differential for both currencies and taxes on financial transactions expressed in foreign currency-, these measures cannot be well included in the model -a standard unrestricted VAR one-. Galindo and Leiderman (2005) have conducted a survey asking central bankers about de-dollarization policies put in place. The Bolivian respondent have stressed that there were some initiatives to de-dollarize the economy. These initiatives include the reduction of inflation, the macroeconomic stabilization, the introduction of fiscal debt indexation - a policy that has failed since 2003-, and reserve requirements to favor the use of domestic currency.

Figure 10. Credit and deposit de-dollarization



Source: BCB and ASFI

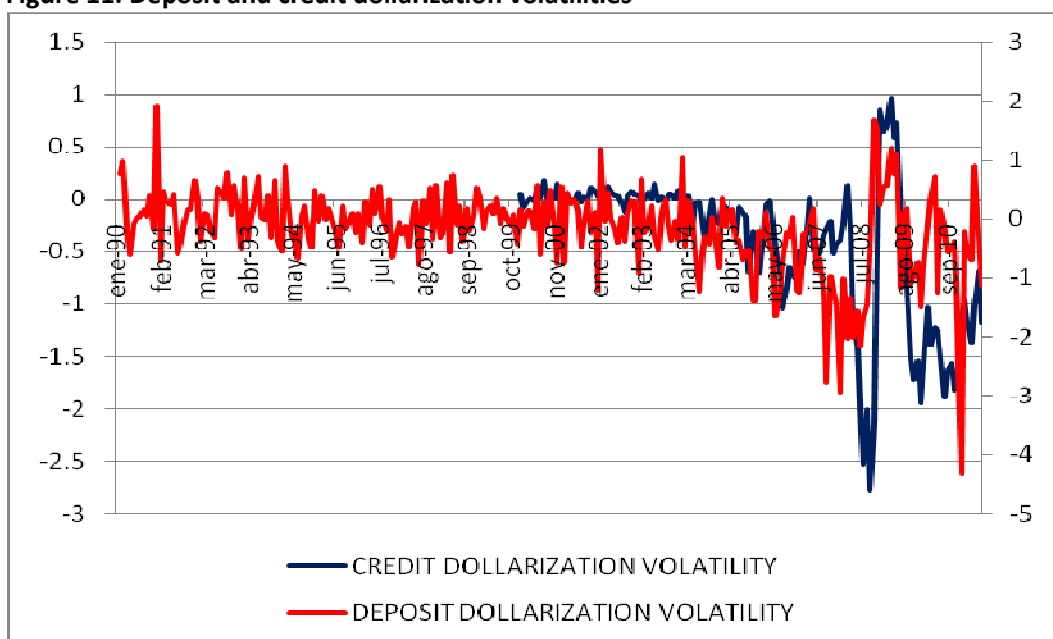
Credit and deposit de-dollarization follow the same trend being the deposit the leading variable. There are in the measures of deposit and credit de-dollarization an interesting point, a little resurgence in dollarization in the second half of 2008. It seems that agents reacted to the world financial crisis preferring foreign currency maybe supposing that the exchange rate had become more rigid and a "fear of floating" reaction from the monetary authorities.

VII. Measuring de-dollarization empirically

Garcia and Sosa (2011) conducted an empirical approach using three groups of factors ranked from macroeconomic conditions, prudential policy measures, and development of a capital market in domestic currency. The present analysis only takes into account macroeconomic variables and financial de-dollarization. It was used an unrestricted VAR model estimation using a standard Cholesky and variance decomposition beginning with the introduction of macroeconomic variables (inflation, nominal exchange rate and capital inflows) followed by the introduction of the change in deposit dollarization and ending with the introduction of credit dollarization. The available data is expressed monthly and starts on January 1990 and ends on June 2011 for deposits, inflation, exchange rate and capital inflows, and begins on January 2000 for credit dollarization. Garcia and Sosa (2011) have excluded 2003 for the Bolivian case because the existence of a crisis period explained by the same authors. Such a period was included in the present case without any consideration.

Preceding figures from 1. to 10. have shown the behavior of core macroeconomic variables and financial indicators considered in the present model. As dollarization rates declined and macroeconomic stability is well recognized, Bolivian authorities react as "fear of floaters" putting in place a more rigid exchange rate while other economies of the region have considered free floating systems (mainly managed floating with interventions). To fight inflation, open market operation is used as a main instrument but at the cost of making inflation more volatile because it is not supported by fiscal policy. The evidence on the trade-off between exchange rate and dollarization is mixed. Garcia and Sosa (2011) summarize some consulted research papers with no conclusion about this subject matter. Anyway, even if the trade-off between exchange rate and dollarization is not conclusive, it seems that in the Bolivian case the main driver of de-dollarization is the exchange rate appreciation.

Figure 11. Deposit and credit dollarization volatilities



Source: Own calculation with BCB and ASFI statistics

Volatility has augmented for the two variables (credit and deposit dollarization) in presence of exchange rate appreciation being credit dollarization volatility more acute than deposit dollarization volatility. Uncertainty and risk aversion (measured by the errors in the estimated models) seem to be the leading indicators that explain the volatility augmentation in the studied period. The possibility of a "de-dollarization crisis" is latent and decisions must be taken to expel dollarization and have an active domestic monetary policy if this is the goal of the exchange rate appreciation.

Some prudential measures were taken into place by monetary authorities and governments during the period and, as noted by Galindo and Leiderman (2005), these measures have had relative impact on agents' behavior about dollarization or have posed another problems like devaluation (because indexation to CPI was adopted in a period of exchange rate depreciation favoring the use of dollars) or little information available for agents to react in face of such measures.

Following Garcia and Sosa (2011), during the past decade, Bolivia has introduced different prudential measures to lower banks' incentives to borrow and lend in foreign currency, as well as to diminish agents' preferences for using foreign currency as a means of payments. In this line, Bolivia has raised provisions for foreign currency loans, have tightened capital requirements against open foreign exchange position, and has introduced tax on foreign currency transactions while expecting taxation over domestic currency transactions. It is fair to say that the main goal to tax foreign transactions was to collect revenue from the public and nor to de-dollarize the economy in a period of crisis and falling tax revenues.

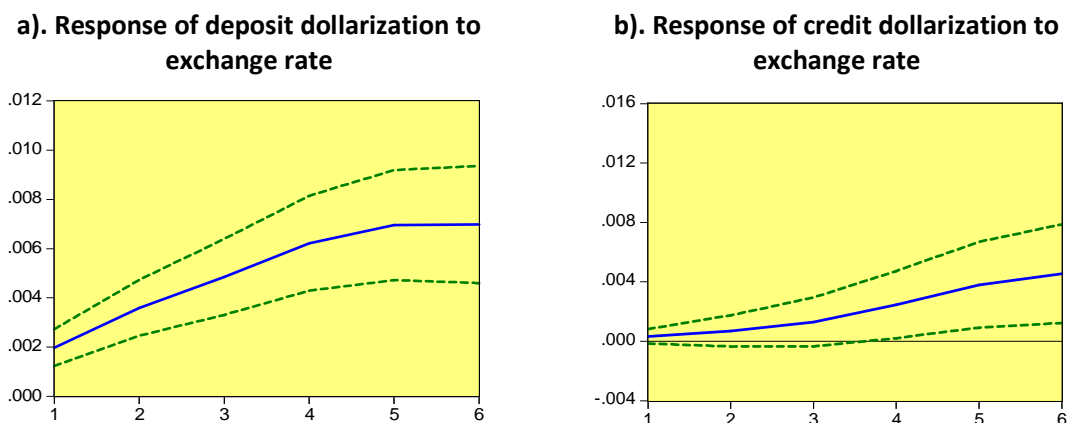
In particular, increases in the spread between the required reserve requirement ratios on foreign currency deposits and domestic currency deposits seem to have fostered de-dollarization of deposits and credits. Further to the changes in reserve requirements ratios, the remuneration rates have been modified. Credit de-dollarization seems to have been facilitated by the development of the capital market in local currency, in particular through the issuance of short-term public bonds in domestic currency. However, it seems that fighting inflation was the final goal of the issuance of public bonds as an instrument of open market operations. Interest rate on bonds is higher than interest on deposits and it exists the possibility of a crowding-out effect over investment, even if diminishing rates of investment in the economy do not have the spread of interest rates in the financial market as the main source of poor development but risk and uncertainty.

VII.a). Empirical results

Impulse-responses constitute a practical way to identify the dynamic responses of changes in deposit and credit dollarization to shocks presented over the rest of variables in the model, taking into account not only the direct effects of disturbances, but also the indirect effects through reactions of other variables in the model. Presentation of impulse responses shows the effects at each month, and not the cumulative effects over time. . Variance decomposition provides a quantification of the relative importance of each of the shocks as sources of variations in dollarization levels.

The driver of de-dollarization seems to be exchange rate appreciation as a result of capital inflows because of augmentations in commodity prices and remittances from abroad as it was cited in the preceding sections.

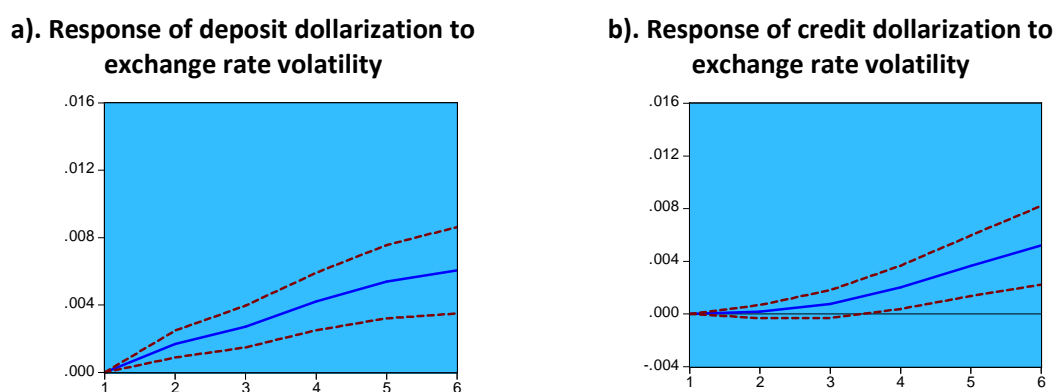
Fig 11. Response of dollarization to exchange rate appreciation



The effect of exchange rate over dollarization is quite rapid as one can see on Figure 11. Deposit dollarization responds in a more acute way than credit dollarization being the impact very significant one month after the shock. Credit dollarization response is not as faster as deposit dollarization but it is remarkable. A simple reasoning suggests that dollarization begins with deposits and then it happens a contagion effect over credit dollarization.

In line with the effect of exchange rate over dollarization, the impact of exchange rate volatility over deposit and credit dollarization is direct. Again, the leading variable seems to be deposit dollarization followed by credit dollarization. Expectations on further appreciation have created a shift to domestic currency deposits and credits. In an environment of exchange rate depreciation, agents prefer foreign currency even if the interest rate for domestic currency is higher, In contrast, higher interest rates for domestic currency in an exchange rate appreciation context result in a de-dollarization process.

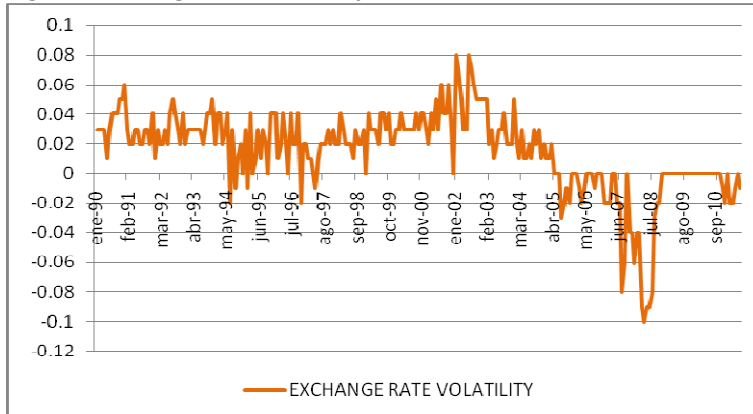
Fig 12. Response of dollarization to exchange rate volatility



Garcia and Sosa (2011) have found inconclusive results about response of deposit and credit dollarization to exchange rate volatility. By contrast, this paper shows that the response is clear and direct. Many reasons can be found when trying to explain the differences between the two

models, one is Garcia and Sosa's model does not take into account the three first years of the 2000s, another reason is that the present models takes into consideration a longer period of time including depreciation and appreciation sub-periods, being the later (i.e. appreciation of the exchange rate) more acute at the end of 2010 and in the first semester of 2011 as it is shown in Figure 13. Finally, being Bolivia's exchange rate regime a crawling peg to the U.S. dollar, with smooth exchange rate movements, the de facto pegged from October 2008 till November 2010 has influenced significantly the de-dollarization process.

Fig 13. Exchange rate volatility



Source: Own calculation with BCB statistics

From their part, the response of dollarization to changes in inflation means that dollarization increases when inflation rises.

Fig 14. Response of dollarization to inflation

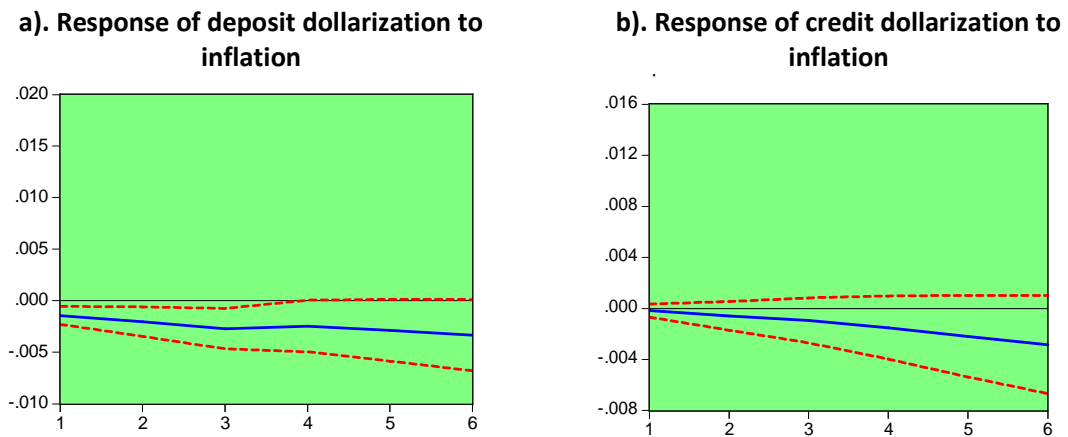


Fig 15. Response of dollarization to capital inflow

- a). Response of deposit dollarization to capital inflow b). Response of credit dollarization to capital inflow

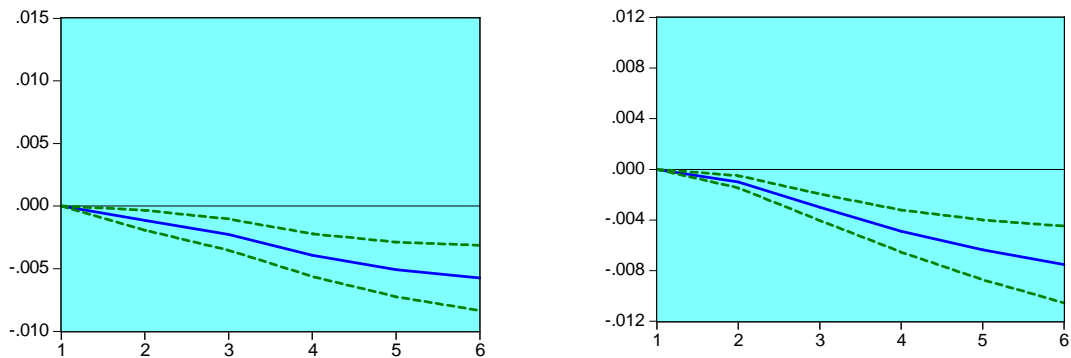
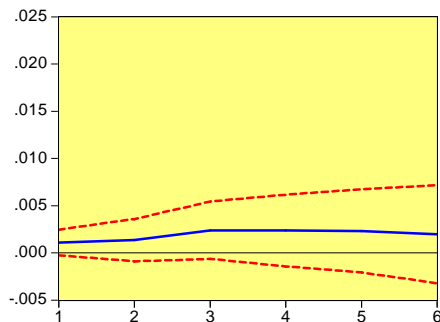
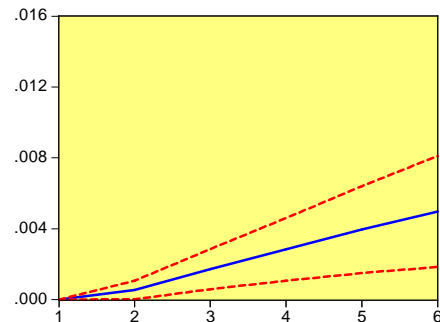


Fig 16. Response of dollarization to dollarization following changes in deposits and credits

a). Response of deposit dollarization to credit dollarization



b). Response of credit dollarization to deposit dollarization



The model presented here shows that causation goes from changes in deposit to changes in credit dollarization as it is shown in Figure 16. Thus, the declining trend in deposit dollarization has also played a role in fostering de-dollarization of credit during this period.

Finally, as Garcia and Sosa have done, the present model has been tested for several tests including extending the number of lags included in the model to 6 months, estimation using alternative Cholesky orderings of the variables, and modifying the definition of deposit (and credit) dollarization, by using the ratio of foreign currency deposits (credit) to total deposits (credit) at current exchange rates instead of measuring at constant exchange rates.

VIII. Conclusion

With no doubt it is remarkable the decline in financial dollarization observed in Bolivia in recent years, however dollarization remains very high, 41,45% on June 2011 calculated with available statistics, compared with other economies that successfully have achieved smaller levels of de-dollarization. Bolivian de-dollarization is remarkable because it was one of the most dollarized economies of the region. However, it rests a lot of work to do in the process of de-dollarization.

The main results can be summarized as follow:

- It is very important to maintain stability as strong as possible, keeping inflation at very low levels, and fostering investment.
- An active prudential framework must be taken into account to foster de-dollarization to support movements in the appreciation of the exchange rate.
- Productivity gains (not included here) must be another source de de-dollarize the economy being this one a very source of de-dollarization in the long-run.
- Issuing bonds with longer maturity must be seen as a source of de-dollarization instead of a simple way to fight against inflation.
- Finally, it is not recommended to adopt forced de-dollarization policies given the bad experiences lived in the Bolivian economic history.

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