Why do countries dollarize? A model of optimal dollarization decision*

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Abstract

Dollarization is typically adopted by countries affected by large episodes of inflation and currency devaluation as a last resort tool. However, dollarization is often seen to be costly for at least two main reasons: first, the (potential) immediate cost associated with large devaluations, and second, the future costs related to the inability to freely adjust money supply and generate seigniorage flows for the public authority. Considering these costs, is dollarization an optimal strategy? In this paper, we provide a framework for understanding whether dollarization can be rationalized as an equilibrium optimal decision. We construct an open economy model with (domestic) money and international reserves, which can be adopted as legal tender; given the state of the economy, the public authority has the option to dollarize or maintain the domestic currency. We then compare the dollarization option with other institutional designs to assess the (eventual) existence of welfare improving monetary arrangements.

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1 Introduction

Recent episodes of financial crisis and high inflation have brought attention to dollarization as a remedy to combat economic instability. More precisely, cases such as Argentina and Lebanon revived the discussion and consideration of dollarization as a last resort tool to tame inflation. We refer to dollarization as abandoning the domestic currency in favor of a foreign currency (typically the US dollar). Adopting a foreign currency (from now on dollarization) is deemed costly for two main reasons: first, there may bean immediate devaluation of the domestic currency through the swap of currencies, and second, the loss of seigniorage revenues for the central bank. However, there are benefits of dollarizing associated with lowering inflation and disciplining policymakers. Considering the costs and benefits of such a regime change, is dollarization an optimal strategy?

In this paper, we propose a theoretical model to study whether dollarization is an equilibrium optimal monetary regime. We characterize an open economy with money denominated in domestic currency and international reserves in foreign currency, which can be adopted as legal tender. Given the state of the economy, the public authority has the option to dollarize at any point in time or maintain the domestic currency. We then compare the dollarization option with other institutional designs to assess the (eventual) existence of welfare improving monetary arrangements.

The model is characterized by households and a public authority. Households maximize the present discounted value of the expected utility over the consumption of a tradable good and (real) money. The public authority is benevolent and maximizes a linear combination of the private (consumption and money) and public utility (transfers).

The public authority supplies the currency to households and engages in the market for international reserves, transferring back to households the (net) profits from these operations. In every period, it can choose whether to keep the domestic currency or dollarize the economy. Once dollarization is chosen, the public authority commits to it. After dollarization is instated, the money supplied will be determined by the amount of international reserves, and from that moment on, inflation will be zero.

We calibrate the model to Ecuador for the period 2000-2022, a country that experienced high inflation and dollarized its economy in 2000. The quantitative results associated with the post-dollarization period shows that the model replicates the ratio of reserves-to-GDP and M1-to-GDP, as well as the sign of the correlations between these two variables. However, by the construction of the model, there is a theoretical one-to-

one relation between reserves and M1. Given the current characterization, the model is not able to disentangle inflation and nominal exchange rate, due to the presence of a single good. The reminder of the paper is organized as follows: Section II reviews the state of the literature, Section III reports anecdotal evidence of countries that dollarized their economies; in Section IV we characterize the model and its quantitative results; Section V discussed the model limitations and plans for future work.

2 Literature Review

This paper is related to three bodies of literature. Firstly, we relate to the vast literature that addresses the loss of monetary policy independence arising after joining a currency union (Optimal Currency Area), implementing a strict fixed exchange regime, or adopting a currency board, which resembles the optimal decision to dollarize an economy discussed in our paper. From the seminal work of Mundell (1961) on currency areas, several papers have addressed this topic. Alesina and Barro (2002) and Alesina et al. (2002) theoretically and empirically investigated the determinants of optimal currency areas.

Secondly, our work relates to the literature that discusses the costs and benefits of dollarization, led by Fischer (1982), which finds that the costs of dollarizing are sizeable due to the loss of seignorage and that this regime is dominated by a commitement to establish a fixed exchange regime. Alesina and Barro (2001) and Rose (2000) emphasize the benefits of dollarization (or similarly, a currency area) related to the reduction of trading costs. Calvo (2001) and Calvo (2002) highlight that the attractiveness of dollarization becomes more prominent once (low) credibility, the domestic use of dollars, the weak financial systems, and the contagion from foreign shocks in emerging economies are accounted for in the analysis of an optimal currency area. Schmitt-Grohe and Uribe (2001) and Almirante and Neumeyer (2024) discuss the welfare implications of dollarization. Schmitt-Grohe and Uribe (2001) compare the welfare losses across multiple regimes and find that dollarizing minimizes welfare while the use of a foreign currency limits the behavior of policymakers. In Almirante and Neumeyer (2024), the authors compare a dollarized and a non-dollarized economy and its effects on default decisions. In our paper, we also take into consideration the costs and benefits of dollarization; however, the main focus is to determine whether this decision is chosen optimally rather than the consequences of this regime.

Finally, this paper relates to the literature on endogenous international reserves ac-

cumulation. In Tomas E. Caravello and Werning (2023b) and Tomas E. Caravello and Werning (2023a), the amount of international reserves available before dollarization is given and in shortage. Similarly, Almirante and Neumeyer (2024) compares a dollarized and non-dollarized economy in which the amount of international reserves is already given. By contrast, in our paper, we endogenize the international reserves accumulation decision since the public authority can choose the reserves position at every point in time. Many papers have addressed the optimal decision of holding reserves through different dimensions[1]. Firstly, international reserves as a tool to smooth consumption in a sovereign default model were studied initially by Alfaro and Kanczuk (2009) and later in Bianchi et al. (2018) was extended to long-term debt. Secondly, a strain of the literature analyzes international reserves accumulation as a buffer against sudden stops (Aizenman and Lee (2007),Hur and Kondo (2016)).

3 Anecdotal Evidence

Currently, there are a number of countries that use the US dollar as legal tender. In this section, we will provide a brief description of the events leading to dollarization and the aftermath of the implementation for the cases of Panama in 1904, Ecuador in 2000, El Salvador in 2001, and more recently Zimbabwe in 2009.

3.1 Panama

The case of Panama is a salient one since it dollarized its economy over 100 years ago. Although the decision to make the US dollar the *de factor* legal tender [2] after the independence from Colombia in 1904 was rooted in political and historical, rather than economic factors, the case of Panama still provides insight into the aftermath of a dollarized economy [3]. If we consider the benefits associated with a dollarized economy, Panama showed stability regarding growth and inflation: in fact, during the period 1960-2022, annual inflation averaged 2.6% per year while GDP growth was 5.3% per year. Additionally, in the absence of a central bank and with free entry of foreign banks into the country, the latter acted as lender of last resort [4].

[1] For a more detailed overview of the literature see Corsetti and Maeng (2023).
[2] The Balboa, Panama's currency co-exists with the US dollar and it is used for small transactions.
[3] Goldfajn and Olivares (2001) provides a historical overview of the process.
[4] See Quispe-Agnoli (2002).

3.2 Ecuador

The sustained decline in oil prices, external shocks such as the 1997-1998 El Niño phenomenon[5], and the economic instability in other emerging economies, along with domestic imbalances in the form of fiscal deficits and expansionary monetary policies, led to a severe economic crisis that culminated in 1999. After a crisis characterized by a recession, high inflation, and the devaluation of the sucre, the dollarization of Ecuador's economy was announced in January 2000 to bring soundness to government policies. At a conversion rate of 25,000 sucres per US dollar to guarantee the central bank had enough international reserves, the domestic currency was dropped and the US dollar became the new legal tender. After the dollarization, several fiscal responsibility laws were passed and oil stabilization funds were established. The dollarization proved to be effective in reducing inflation and by 2003, it declined to single-digits.

3.3 El Salvador

Before dollarizing, El Salvador had sound fundamentals, with low inflation and a growing economy: in the five years before the dollarization, inflation, and GDP growth averaged 4% and 2%, respectively while external debt as a percentage of Gross National Income was 33%. Unlike Ecuador or Zimbabwe, in which dollarization was precipitated by economic instability and high inflation, it was the desire to tighten the ties with the United States, and promote growth and trade, that led El Salvador to drop its domestic currency in favor of the US dollar [6]. Between 1993 and 2000, El Salvador had a currency peg of 8.75 colón per US dollar. Beginning January 1st of 2001, the US dollar became the new legal tender, and the colón was phased out in the following years.

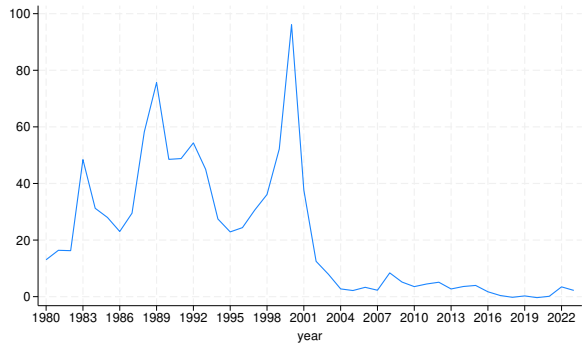
3.4 Zimbabwe

After almost a decade of macroeconomic imbalances (2000-2008) that require the assistance of the Central Bank of Zimbabwe, inflation sore, leading to a period of hyperinflation. In January 2009, the Government of National Unity (GNU) adopted a multicurrency system with the US dollar being the official currency. The incapacity to generate dollars (due to the high demand of imports relative to exports) created a liquidity crisis. After years of a shortage of dollars and the continued struggle to keep the peg

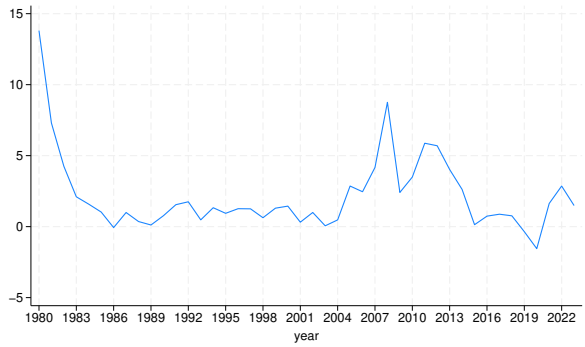
[5]This phenomenon destroyed the agricultural production and part of the country's infrastructure.
[6]See Swiston (2011).

with the dollar, in the hope of leaving the multi-currency system, the Central Bank of Zimbabwe announced in February 2019 the introduction of a new Zimbabwean dollar initially called the Real Time Gross Settlement dollar (RTGS dollar), and later renamed Zimbabwean dollar. This currency was the only legally permitted currency until March of 2020, when the Covid-19 pandemic forced to reinstall the multi-currency system and foreign currencies were legalized again. To leave the constraints imposed by a dollarized economy, the reserve Bank of Zimbabwe introduced a new currency called Zimbabwe Gold, aimed to replace the Zimbabwean dollar.

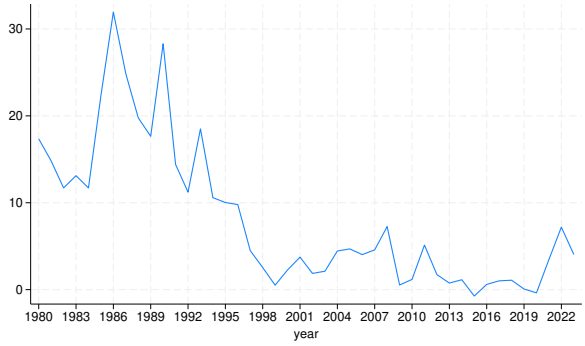
Figure 1: Average Annual Inflation 1980-2023 - p.p. -



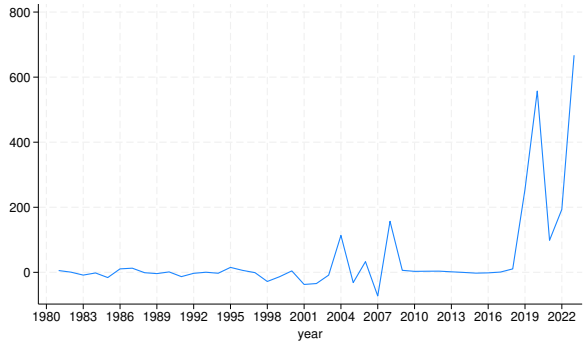
(a) Ecuador



(c) Panama



(b) El Salvador



(d) Zimbabwe

4 Model

In this section, we characterize a small open economy model to study the optimal choice of dollarization. Time is discrete and infinite and the economy is comprised of three types of agents: households, a public authority and international investors. In the model, households derive utility from consumption of a single tradable good and from real money holdings. The government transfers seignorage and tax revenues to households, in addition to the (net) profits obtained by engaging in the market for international reserves with the rest of the world.

In the model, there are two types of monetary regimes: one in which agents use local currency and other in which they use dollars. We assume that, at the beginning of the world, local currency (LC) is the only money circulating among households. In every period, the government can decide to either keep the local currency, or dollarize the economy. Dollarization is implemented by converting the current amount of international reserves into money, which is then transferred to households. Once implemented, we assume that dollarization requires the effective implementation of reserve requirements.[7] In addition, we assume that, once implemented, the government cannot switch back to having a local currency, i.e. dollarization is permanent.

We now begin by describing each agent.

4.1 Households

In each period, households receive an endowment of tradable goods (y_t), which is exogenous and follows the stochastic AR(1) process:

$$\log(y_t) = \rho_y \log(y_{t-1}) + \sigma_{\epsilon_y} \epsilon_t \tag{1}$$

where $\rho_y \in [0, 1]$ represents the degree of persistence of the AR(1), $\epsilon_t \sim N(0, 1)$ is a i.i.d random error and $\sigma_{\epsilon_y} > 0$ is the variance of the random term.

Households receive transfers T_t from the government in the form of lump-sum taxes, and pay a proportional tax τ to the government on the endowment of tradable goods received. Finally, households can save in the form of money M_{t+1} which is carried over

[7] This condition guarantees the existence of a unique, non-explosive steady state level of reserves. See Appendix XX for further details.

to the following period. The nominal budget constraint of households is:

$$P_t c_t + M_{t+1} = M_t + P_t(1-\tau)y_t + P_t T_t \tag{2}$$

where P_t is the price level at time t, c_t is the per-period level of consumption, and M_t is the (initial) stock of nominal money holdings at time t that are carried over from the previous period.

Households derive utility from consumption and real monetary holdings (money-in-the-utility-function model). Specifically, we assume that the private instantaneous utility is $u(c_t, \frac{M_t}{P_t})$.[8] We assume that $u'_{c_t}, u'_{M_t/P_t} \geq 0$. The budget constraint, expressed in real terms, is defined as:

$$c_t + m_{t+1} = \frac{m_t}{\pi_t} + (1-\tau)y_t + T_t \tag{3}$$

where $m_{t+1} \equiv \frac{M_{t+1}}{P_t}$ is the (real) stock of money carried over to the following period, and π_t is the (gross) inflation rate[9]. Consequently, the private instantaneous utility is represented as $u(c_t, \frac{m_t}{\pi_t})$. Notice that, in our model, higher inflation rates reduce the initial households's (real) money balances, inducing utility losses.

Taking transfers, tradable endowment, inflation, and the tax rate as given, households' problem can be represented as:

$$\max_{c_t>0, m_{t+1}>0} \quad \mathbb{E}_t \sum_{t=0}^{\infty} \left((1-\theta) u\left(c_t, \frac{m_t}{\pi_t}\right) + \theta v(T_t) \right) \tag{4}$$

subject to (3). Notice that $\theta \in [0,1]$ is a weight on public authority's transfers, while $v(T_t)$ is the instantaneous utility derived from transfers, which we assume is increasing and concave in its argument. The solution to the households' problem yields a demand for (real) money balances, which we can express as:

$$\beta \mathbb{E}_t \left(\frac{u'_{m_{t+1}/\pi_{t+1}}}{\pi_{t+1}} \right) + \beta \mathbb{E}_t \left(\frac{u'_{c_{t+1}}}{\pi_{t+1}} \right) = u'_{c_t} \tag{5}$$

The left-hand side of the money demand function represents the expected marginal benefit of one extra unit of money, while the right-hand side represents its associated marginal cost. The marginal benefit of money is comprised of the expected utility of

[8] This functional specification is equivalent to a cash-in-advance model in which monetary markets open before product markets, hence households' consumption levels are bound by the (real) stock of money carried over from the previous period.

[9] We define $\pi_t \equiv \frac{P_t}{P_{t-1}}$ as the gross inflation rate at time t.

money and the expected utility of consumption, while the marginal cost is given by the utility loss of extra saving in the current period. Notice that, other things equal, higher expected inflation reduces the marginal benefit of carrying money to the following period, as households internalize the lower expected purchasing power in terms of units of consumption.

4.2 Public Authority

The public authority supplies the currency to households and engages in the market for international reserves, transferring back to households the (net) profits from these operations. Hence, the transfer function is given by:

$$T_t = \tau y_t + m_{t+1} - \frac{m_t}{\pi_t} + a_t - q_a a_{t+1} \tag{6}$$

where a_t and a_{t+1} are, respectively, the beginning and the end-of-the-period stock of reserves demanded by the public authority. Reserves supply is perfectly elastic with price q_a, constant and exogenously set by international investors. Notice that, other things equal, higher current period inflation increases the *seigniorage* transfers to households.

In every period, before dollarization is implemented, the public authority has the option to either keep the local currency (L) or dollarize the economy (D). We assume that, once dollarization has been implemented, this process is irreversible and the local currency cannot be reinstated. If the public authority dollarizes, the economy will enter the state of the world of post-dollarization (PD), in which money supply is bound by reserves rules and (net) inflation is zero forever. Hence, the value function following dollarization,i.e. for any $t > D$, is given by:

$$V^{PD}(y, m, a) = \max_{a' \geq 0, m' \geq 0} \; (1-\theta)u\,(c, m) + \theta v(T) + \beta \mathbb{E}\left[V^{PD}(y', m', a')\right] \tag{7}$$

subject to:

$$\begin{cases} c = y + a - q_a a' \\ T = \tau y + m' - m + a - q_a a' \\ m' \leq \kappa a' \\ m' = \widehat{m}(y, a, a') \end{cases}$$

where $\kappa \in [0, 1]$ is the parameter governing the reserve requirement and $\widehat{m}(y, a, a')$ is the

money demand function.[10] The solution to the above problem yields optimality conditions for reserves and money in an economy that has already completed the dollarization process.

The first step of the dollarization process requires the conversion of the current stock of local currency with dollars. At time $t = D$, it holds that:

$$\frac{m_t}{\pi_t} \leq a_t \tag{8}$$

In the transition process, the inflation rate allows to convert local currency with foreign currency (reserves).

Therefore, the value function at time $t = D$ is given by:

$$V^D(y, m, a) = \max_{a' \geq 0, m' \geq 0, \pi} \; (1-\theta) u\left(c, \frac{m}{\pi}\right) + \theta v(T) + \beta \mathbb{E}\left[V^{PD}(y', m', a')\right] \tag{9}$$

subject to:

$$\begin{cases} c = y + a - q_a a' \\ T = \tau y + m' - \frac{m}{\pi} + a - q_a a' \\ \frac{m}{\pi} \leq a \\ m' \leq \kappa a' \\ m' = \widehat{m}(y, a, a') \end{cases}$$

and the solution to above optimization problems yields optimality conditions for reserves, money holding and inflation at the time that dollarization is implemented. The optimal inflation rate at time $t = D$ can be represented as:

$$(1-\theta) u'\left(\frac{m}{\pi}\right) \geq \theta v'(T) \tag{10}$$

The left-hand-side of the optimal inflation rate represents the marginal cost associated with one extra unit of inflation, which reduces the current stock of money in real terms, while the right-hand-side depicts its associated marginal benefit, which increases transfers to households. At time D, the marginal cost of inflation is no smaller than its marginal benefit, indicating that dollarizing the economy produces suboptimal inflation rates.

Before the dollarization process starts, either the local currency or the dollar can be

[10] The public authority internalizes the money demand function from the households' problem. Such function depends only on (y, a, a'), as the authority optimally chooses the level of reserves.

chosen as legal tender in this economy. Thus, for any $t < D$, the value function of the public authority is given by:

$$V(y, m, a) = \max_{D \in \{0,1\}} \quad (1 - D) \cdot V^{LC}(y, m, a) + D \cdot V^{D}(y, m, a) \tag{11}$$

where the value function of choosing the local currency regime, i.e. for any $t < D$, is given by:

$$V^{LC}(y, m, a) = \max_{a' \geq 0, m' \geq 0, \pi} \quad (1 - \theta) u\left(c, \frac{m}{\pi}\right) + \theta v(T) + \beta \mathbb{E}\left[V(y', m', a')\right] \tag{12}$$

subject to:

$$\begin{cases} c = y + a - q_a a' \\ T = \tau y + m' - \frac{m}{\pi} + a - q_a a' \\ m' = \widehat{m}(y, a, a') \end{cases}$$

Notice that, before dollarization, money supply and inflation are not constrained by reserve holdings. Similarly to the case when $t = D$, when $t < D$ the optimality condition for the inflation rate is:

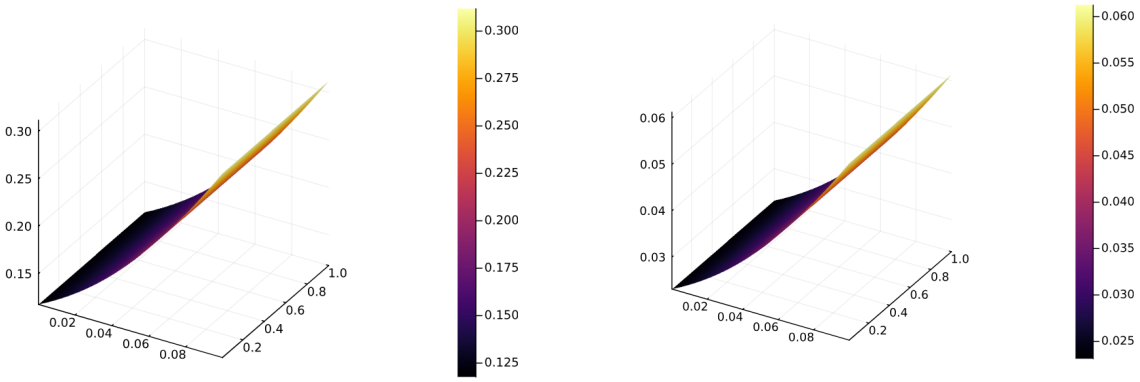
$$(1 - \theta) u'\left(\frac{m}{\pi}\right) = \theta v'(T) \tag{13}$$

with the difference being that, when the public authority chooses the local currency as legal tender, inflation is not downwardly constrained by reserves.

4.3 Policy functions

We show the policy functions of reserves and money for the post-dollarization phase and the policy function for inflation at time $t = D$. Following dollarization, the policy functions of reserves and money are defined, respectively, as $\widehat{a}^{PD}(y, m, a)$ and $\widehat{m}^{PD}(y, m, a)$. Figure 2 displays the policy functions for money holding and reserves accumulation following the dollarization process, while Figure 3 illustrates the policy function for inflation at the time that the dollarization process is implemented. On the x-axis we have money holding, on the y-axis reserves, and both policy functions are evaluated at the median realization of the tradable endowment.

Figure 2: Policy functions for money and reserves $t > D$

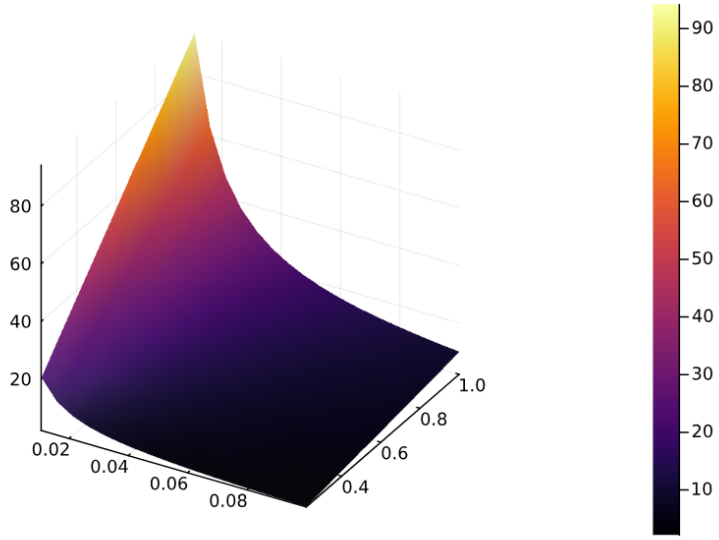


(a) Money

(b) Reserves

Note: On the x-axis we have money holding, on the y-axis reserves, and both policy functions are evaluated at the median realization of the tradable endowment.

Figure 3: Policy functions for inflation at $t = D$



Note: On the x-axis we have money holding, on the y-axis reserves, and both policy functions are evaluated at the median realization of the tradable endowment.

As we can observe, the policy functions of money and reserves post-dollarization display similar patterns, since we have assumed that $m' \geq \kappa a'$. Both functions depend on reserves only, since beginning-of-the-period levels of money holding do not affect current consumption and money demand. Therefore, both reserves and money are strictly

increasing in the beginning-of-the-period level of reserves. Conversely, the policy function of inflation at $t = D$ is affected by both money holding and reserves. The optimal inflation rate is increasing in the initial stock of money and decreasing in the initial stock of reserves. Intuitively, starting the dollarization process with low reserves implies an initially high level of inflation, as the public authority needs to convert the reserves into currency. Hence, the cost of dollarization can be particularly high for countries with initially low levels of reserves (or initially high stock of money to be converted).

4.4 Quantitative Results

In this section we present the quantitative results associated with the post-dollarization segment of the model for Ecuador. The model is calibrated to Ecuador for the period 2000-2022 using publicly available data at annual frequency. For a full description of the data sources, see Appendix I.

4.4.1 Functional forms

Households value consumption and money holding with the instantaneous utility function:

$$u\left(c, \frac{m}{\pi}\right) = \bar{u}(c) + \bar{u}\left(\frac{m}{\pi}\right) = \frac{c^{1-\sigma} - 1}{1-\sigma} + \omega \frac{\left(\frac{m}{\pi}\right)^{1-\gamma} - 1}{1-\gamma}$$

where $\sigma \in \mathbb{R}^{++} \setminus \{1\}$ with $\bar{u}(c) = \log(c)$ if $\sigma = 1$, and $\gamma \in \mathbb{R}^{++} \setminus \{1\}$ with $\bar{u}\left(\frac{m}{\pi}\right) = \log\left(\frac{m}{\pi}\right)$ if $\gamma = 1$. Then, households value transfers from the public authority with the instantaneous utility function:

$$v(T) = \frac{T^{1-\sigma} - 1}{1-\sigma}$$

where $\sigma \in \mathbb{R}^{++} \setminus \{1\}$ with $v(T) = \log(T)$ if $\sigma = 1$.

4.4.2 Parameters

We solve the model numerically using value function iteration in order to evaluate some of its quantitative predictions concerning the level of reserves and money holding. The model is calibrated using Ecuador's data, a country that dollarized the economy in 2000 after a period of high inflation.

Calibrated Parameters - The consumption risk aversion parameter σ takes the value of

3 and it is standard in the international macroeconomics literature. In a similar fashion, real money demand risk aversion parameter γ takes the value of 2. The volatility and persistence of the exogenous stochastic process y are calibrated to replicate the stochastic process of the cyclical component of Ecuador's GDP. From our estimation we obtain $\rho_y = 0.64$ and $\sigma_{\epsilon_y} = 0.02$. The international price of reserves q_a is set at 0.98, implying a real rate on risk-free bonds close to 2 percent, as it is common in the literature. The sharing parameter θ is calibrated following Bianchi (2011) and takes the value of 0.02. The parameter τ takes the value of 0.2, and it is calibrated to match the tax-revenues-to-GDP ratio of Ecuador. The discount factor β takes the value of 0.95, a standard value in the literature.

Parameters set by simulation - Two parameters are calibrated by simulations: the money-holding share ω, and the reserve requirement parameter κ. These two parameters are chosen to match two targets in the data: (i) the average reserves/GDP; (ii) the average M1/GDP.

Table 1 summarizes the parameter values.

Table 1: Parametrization

Description		Value	Target
Parameters from literature and data			
Risk aversion: consumption	σ	2	Standard value
Risk aversion: money holding	γ	2	Standard value
Persistence of y	ρ_y	0.64	Cyclical component GDP
Variance of the error term ϵ_y	σ_{ϵ_y}	0.02	Cyclical component GDP
Investors' reserves price	q_a	0.98	Average return US T-Bills
Sharing parameter	θ	0.02	Bianchi (2011)
Tax rate	τ	0.2	Average tax revenue/GDP ratio
Discount factor	β	0.95	Standard value
Parameters from simulations			
Households' money holding share	ω	0.0013	3.2% average reserves/GDP ratio
Reserves requirement	κ	5.09	16% average M1/GDP ratio

4.4.3 Model vs Data

We report the main statistics from the data and the simulations in Table 2. The model's statistics are computed by simulating the model for 100,000 periods, starting from the

lowest grid points of reserves and money and with a median endowment realization. We drop the first 250 periods in order to get rid of the influence of the initial conditions.

Table 2: Model statistics

Moment	**Data**	**Model**
Targeted moments		
Mean reserves/GDP (%)	3.2	3.2
Mean M1/GDP (%)	16.3	16.5
Untargeted moments		
St. deviation reserves/GDP	1.4	0.5
St. deviation M1/GDP	4.2	2.4
Reserves/GDP, M1/GDP correlation	0.10	1.0
Output, Consumption correlation	0.88	0.99

Note: The benchmark model corresponds to the solution of the calibration described in section 4.4.2. The model's statistics are computed by simulating the model for 100,000 periods, starting from the lowest grid points of reserves and money and with a median endowment realization. We drop the first 250 periods in order to get rid of the influence of the initial conditions.

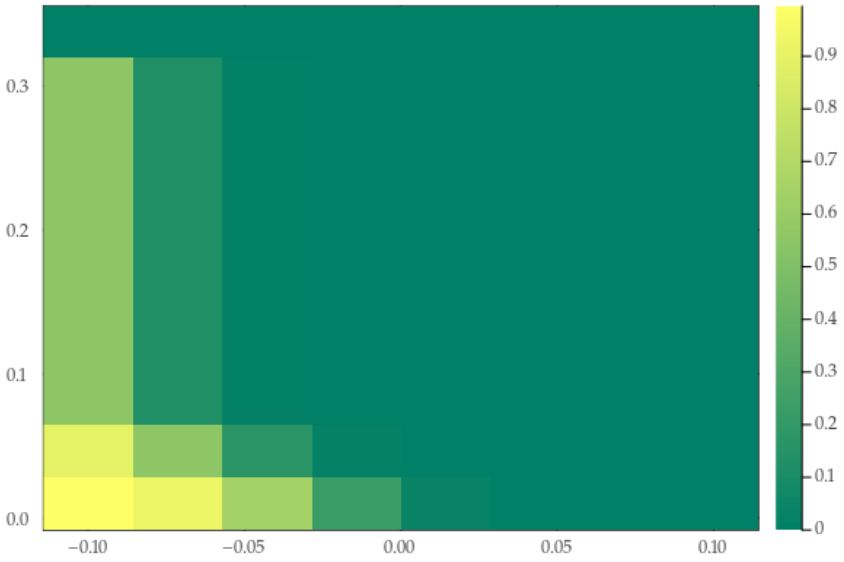
As already mentioned, the first set of moments matches its data counterpart. The model seems to be matching quite well the targeted moments. On the one hand, the model seems to be good at matching the standard deviations of money and reserves of the data, as well as the sign of the correlations. On the other hand, however, by construction the model generates a one-to-one correspondence between reserves and money, thus we overestimate this correlation, which is weaker in the data. The model also generates a strong consumption-output correlation, as observed in the literature.

4.4.4 Dollatization Decision

Once the model is solved numerically, we analyze the dollarization decision by computing the probability of dollarizing the next period, as shown in Figure 4. For a given level of debt, at low income realizations, the public authority is more likely to choose dollarization, but less so when the stock of domestic currency increases (it is more costly to dollarize by replacing the local currency). Meanwhile, for a lower stock of money holding, the dollarization probability is higher when the income is low since the cost of replacing the currency is smaller. As the income improves, the incentives to dollarize

reduce.

Figure 4: Dollarization Probability

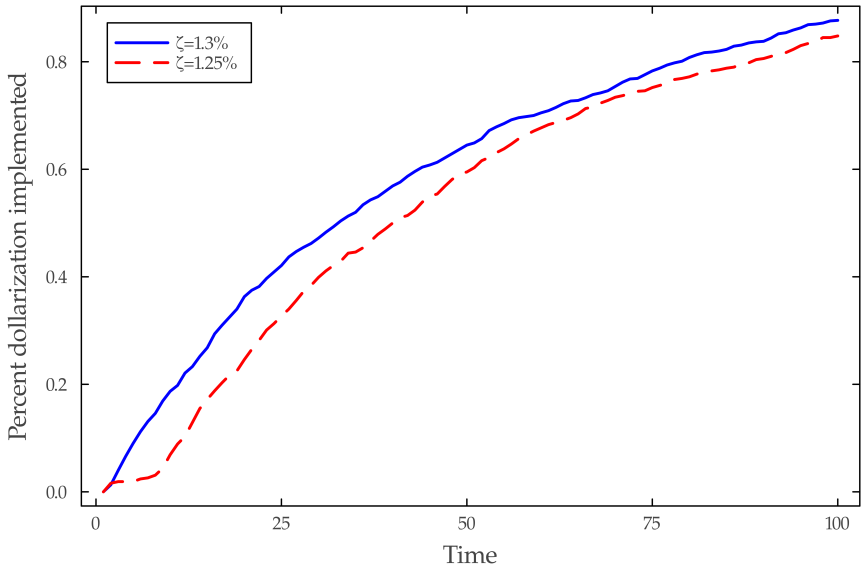


Note: XX

To further investigate the dollarization decision, we conduct an exercise to analyze how the incentives of dollarization change once the public authority is given the option to dollarize the economy. Firstly, we begin with an economy that does not have the alternative to dollarize and at time zero we allow for the option to do so for two different levels of trade gains derived from dollarization (one lower and one higher). We simulate the model for 1,000 realization paths and 1,000 periods and compute the cumulative percentage of dollarized economies over time. Figure 5 depicts the results.

When the public authority is given the option to dollarize, the number of dollarized economies increases over time for both the low and high trade gains. However, at every point in time, there are more dollarized economies when the trade gains derived from dollarization are higher. This result aims to highlight the notion that, despite dollarization being a costly option, for certain levels of trade gains, the benefits outweigh the cost of implementation.

Figure 5: Cumulative dollarized economies



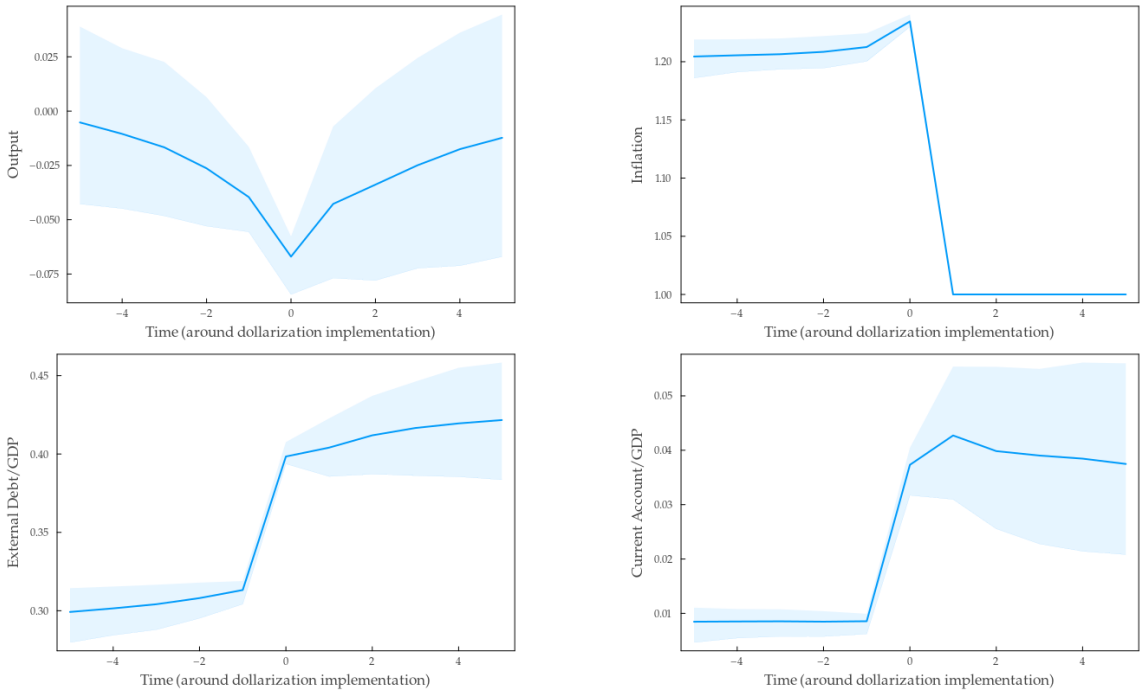
Note: XX

4.4.5 Dollarizatrion Dynamics

This section analyzes the dynamics of the model's main variables in an average dollarization episode. We simulate the model for 1,000 realization paths and 1,000 periods and compute the mean of each variable around a dollarization implementation at time zero, discarding trajectories in which dollarization decisions were made in the previous and posterior five periods. Figures 6 and 7 show the results.

From Figure 6, before dollarization is implemented, output falls after a sequence of bad income shocks, triggering the dollarization decision. At the moment of dollarization, debt increases to substitute the loss of seigniorage while inflation rises to reduce the real value of domestic currency at the moment of the currency exchange. The current account improves after the dollarization, which is a result driven by the model calibration. In this case, households observe that the real value of money holding has decreased due to the rise in inflation, and, since they expect future inflation to be zero, they begin demanding money from the rest of the world.

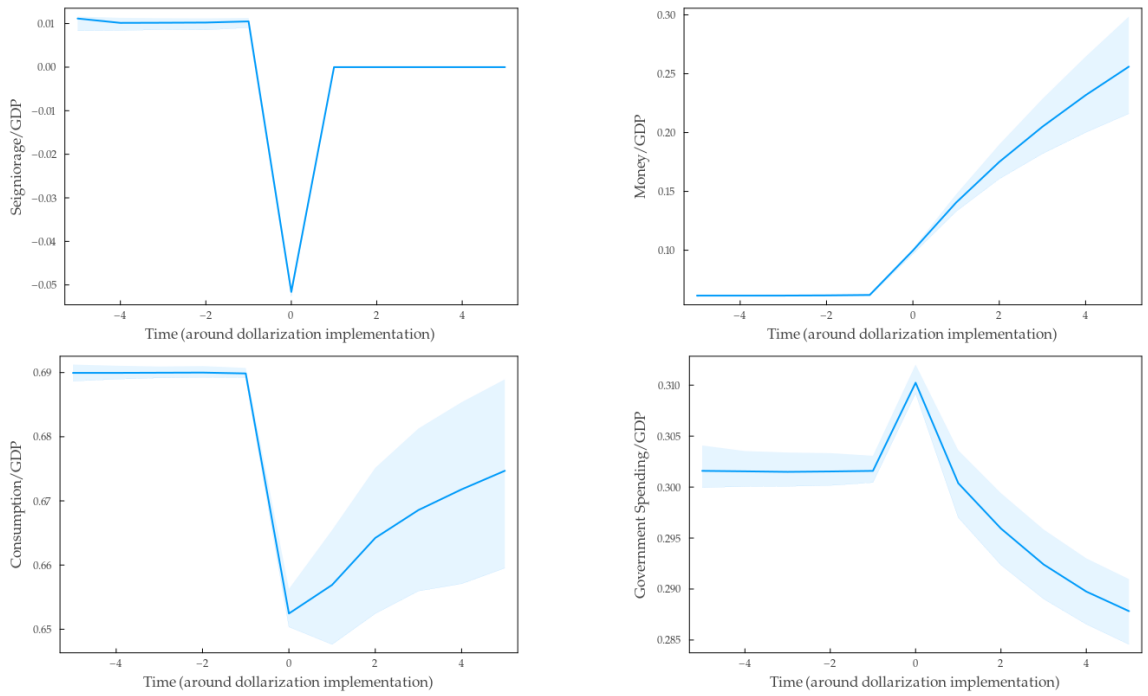
Figure 6: Average Dollarization Episode



Note: XX

As a result of the dollarization implementation, which involves the exchange of the domestic currency for a foreign currency (dollars), the public authority loses the seigniorage, hence it initially falls and becomes zero thereafter. The household's demand for money increases after dollarization gathering the resources from the rest of the world. Meanwhile, consumption falls as a consequence of the decrease in real money holdings and the need to save to demand money stocks from the rest of the world. Lastly, government spending increases for two reasons: first, debt increases after the loss of seigniorage which provides funds to increase spending; second, the rise in inflation reduces the cost of the exchange of currency, which frees resources.

Figure 7: Average Dollarization Episode



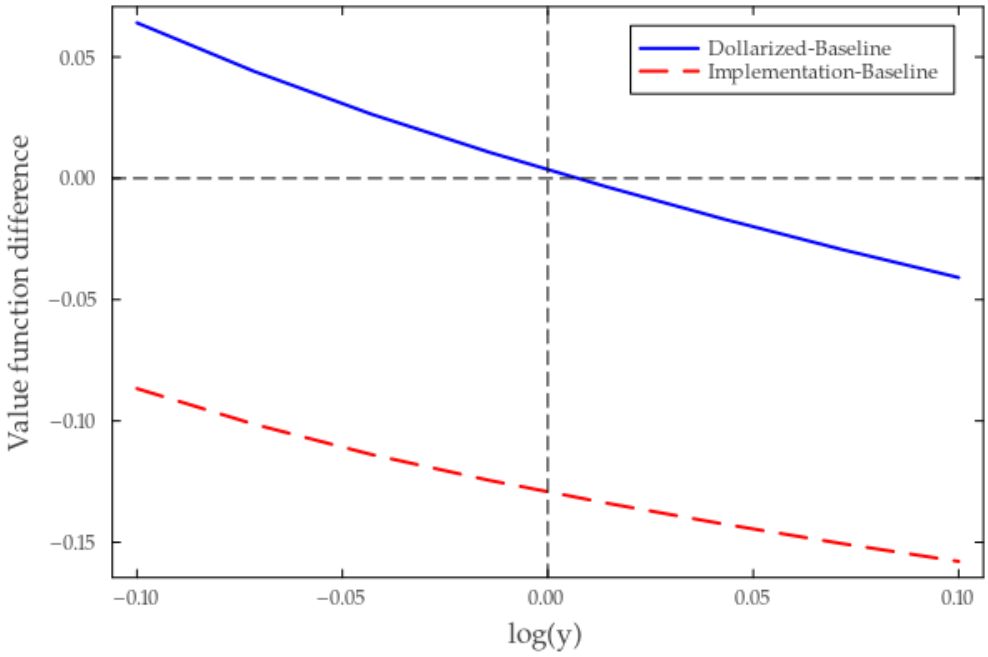
Note: XX

4.4.6 Experiment: Is dollarization beneficial?

In this section, we evaluate the benefits of dollarizing considering the costs associated with the implementation. We compare both the value of dollarization and the value of the implementation relative to the baseline to assess whether there are conditions under which, in the long run, dollarization is beneficial compared to the baseline yet not optimally chosen. Figure 8 shows the difference between the value of dollarization and the baseline and the difference between the value of implementing the dollarization and the baseline as a function of the income process. The initial conditions for money holdings and debt were set to XX.

For small income realizations, there is a region where the value of dollarization exceeds the value of the baseline economy while the baseline is preferred to the implementation. Under such income realization, dollarization provides a higher value relative to the baseline economy in the long run, yet this scenario is not chosen due to the costly implementation of dollarization (sub-optimum path).

Figure 8: Value function difference, given (m, b)



Note: XX

5 Limitations and Future Work

We acknowledge the current weakness of our model, such as the incapacity to disentangle inflation and nominal exchange rate, due to the presence of a single good, and the narrow definition of reserves we have in the model (i.e. official reserves as opposed to dollars' holding), which precludes from having already dollars in circulation in the country before dollarization takes place. Addressing these features will allow us to better match the moments of the data following in the post-dollarization phase.

As future work, we plan to complete the calibration and the solution of the model to study the dollarization dynamics, as well as the pre-dollarization phase. Consequently, we will determine the optimality vs non-optimality of the change to a dollarized monetary regime, by conducting two counterfactual exercise. First, we will study what would have happened to Ecuador without dollarization, and assess the welfare gains (or losses) associated with the regime change. Second, we will analyze the current economic and monetary position of other countries, such as Argentina, to determine whether dollarization would be optimal or not. Finally, we will study whether the dollarization regime is optimal in comparison to other monetary arrangements, such as pegs or currency

boards.

6 Conclusion

TBD

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Appendix I: Data Sources

- **Gross Domestic Product:**
  Gross domestic product in constant local currency from World Bank.GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.

- **Reserves as a % GDP:**
  Total Reserves in current US dollars (Indicator FI.RES.TOTL.CD) divided by Gross Domestic Product in current uS$ (Indicator NY.GDP.MKTP.CD) in World Development Indicators from World Bank. Total reserves comprise holdings of monetary gold, special drawing rights, reserves of IMF members held by the IMF, and holdings of foreign exchange under the control of monetary authorities. The gold component of these reserves is valued at year-end (December 31) London prices. Data are in current U.S. dollars.

- **Consumption:**
  Final consumption expenditure (formerly total consumption) is the sum of household final consumption expenditure (formerly private consumption) and general government final consumption expenditure (formerly general government consumption). Data are in constant local currency from World Bank.

- **Inflation:**
  Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used. Data source if from World Bank.

- **Money (M1):**
  The money supply is defined as the amount of money immediately available to agents to carry out transactions; In accounting terms, money in the strict sense is the sum of the monetary species in circulation and the deposits in current accounts obtained from the Central Bank of Ecuador.