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Emilio Ocampo y Nicolás Cachanosky

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Monetary Dynamics under Dollarization: Explaining Ecuador's Puzzle

Emilio Ocampo* Universidad del CEMA eo@ucema.edu.ar

Nicolás Cachanosky Center for Free Enterprise The University of Texas at El Paso 500 W. University Ave. El Paso, TX 79968 ncachanosky@utep.edu

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Abstract

This paper investigates a puzzle in the behavior of the money supply in Ecuador after it formally adopted the US dollar as its currency in January 2000. Modern open economy macroeconomics (MOEM) predicts that in a small open economy under an official dollarization regime, the money supply is endogenous to movements in the balance of payments. However, Ecuador's monetary and balance of payment statistics suggest otherwise. This incongruity has led some authors to claim that MOEM does not hold in Ecuador. We challenge this claim and argue that three factors can explain the apparent puzzle: a) monetary data misspecification, b) measurement errors in foreign trade flows, and c) an exogenous expansion of its balance sheet of the Central Bank of Ecuador's (CBE) during the period 2009-2014 to finance government deficits. We conclude that Ecuador's experience under dollarization is consistent with a key prediction of MOEM: inflation convergence. However, it also shows that the constraints that in theory an official dollarization places on fiscal profligacy and monetary activism can be overcome by creative spendthrift politicians. Finally, we highlight the challenge of measuring cash in economies that are dollarized or are part of a currency union and the need to consider the institutional and regulatory framework adopted for the central bank after dollarization to understand the monetary dynamics of an officially dollarized economy.

JEL Codes: E42, E59, O54 Keywords: money supply; dollarization

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1. Introduction

The macroeconomic performance of Ecuador, El Salvador and Panama during the first quarter of the 21st century provides an excellent opportunity to examine certain puzzles that, apparently, contradict standard open economy macroeconomics.¹ Ecuador is a case in point. Beckerman and Cortés Douglas (2002, p. 81) note that Ecuador implemented dollarization "more smoothly than many observers had anticipated." The reason behind many economists' skepticism was that starting conditions were far from auspicious. As noted by Solimano (2002, pp. 6–7), "adequate fiscal, financial conditions, and accounting practices were not present when Ecuador announced dollarization... the fiscal budget was in a sizable deficit during the year preceding dollarization and the state intervened in a large part of the banking system, with several important banks having negative net worth."

The resilience of Ecuador's dollarization has surprised many economists who would have predicted (in fact, some did) its demise in the face of a *coup d'état*, ten years of a left-wing populist regime under Rafael Correa (2007-2017) with rising deficits and debt, two sovereign debt defaults (2008 and 2020), a devastating earthquake in 2016, the 2008 Financial Crisis, COVID-19, and a political crisis in 2023 that led to the resignation of the sitting president. Yet, after a quarter of a century, the dollar continues to be Ecuador's sole legal tender, and dollarization has proven to be the most durable and credible institution in the country's history.² This speaks to its robustness as

¹ As presented, for example, in Mundell (1968, 2002), Dornbusch (1984), and Acharyya (2023).

 $^{^{2}}$ Since 1830, Ecuador has promulgated twenty constitutions of which the longest one (1929) lasted for 23 years. Dollarization has already lasted a quarter of a century.

a monetary regime, a valuable feature for countries with troubled currencies. And as such, it deserves scrutiny.

In this paper, we address an apparent puzzle related to the behavior of the money supply under an official dollarization regime. According to modern open economy macroeconomics (MOEM), in a small open economy operating under a fixed exchange regime, the money supply is endogenous to the net inflows of capital. Put it differently, when "a country opts for fixed exchange rates, it sacrifices monetary policy autonomy in favor of a mechanism of adjustment for correcting the balance of payments." (Mundell, 2002, p. 125). One of the main predictions of MOEM is that a fixed exchange rate system "leads eventually to the same rate of inflation as that country whose currency is the partner in the fix." (ibid., p.138). An official dollarization in these respects can be considered an extreme version of a fixed exchange regime so both propositions should hold

Several economists, such as De la Torre Muñoz (2015), Naranjo Chiriboga (2016, 2018), Guncay and Pérez (2019), and Villalba (2019), have argued that, in Ecuador, the causal relationship between the balance of payments and the money supply does not exist. In other words, the equilibrium in the money market is, supposedly, divorced from the balance of payments. To explain this apparent puzzle requires understanding how, in theory, monetary aggregates should behave under an official dollarization regime and then contrast this with what is observed once implemented.

2. Semantics

Since the term "dollarization" can be used with different meanings, before proceeding further, some conceptual clarifications are in order. The first is between *de facto* and *de jure* dollarization.

The former is a spontaneous response of economic agents to high, persistent, and volatile inflation. As Calvo and Vegh (1993, p. 34) observe, "few national currencies survive the destructive power of high inflation." In countries with high, persistent, and volatile inflation, the dollar serves as protection, even becoming essential for survival. *De facto* dollarization can take many forms depending on which function of domestic money is replaced by the dollar. *Real dollarization* refers to the proclivity of economic agents to price their products and services in dollars. *Transactional dollarization* describes a situation in which the dollar is used as a medium of exchange (despite not having legal tender status). *Financial dollarization* occurs when a large portion of an economy's financial assets and liabilities are denominated in dollars. Liability dollarization refers to a situation where a large portion of an economy's liabilities are denominated in dollars. This is typical of countries that are original sinners, i.e., countries that cannot borrow long term in their own currency (Eichengreen et al., 2023; Eichengreen & Hausmann, 1999). **Table 1** summarizes the different types of *de facto* dollarization and their effects.

Table 1. De facto dollarization and its effects				
Туре	The dollar replaces domestic currency as	Effect		
Real	Unit of account (<i>numeraire</i>)	Dollar indexation		
Transactional	Medium of exchange	Currency substitution		
Financial	Store of value	Asset/liability substitution		

These dimensions of *de facto* dollarization can manifest themselves in different degrees and independently of each other, e.g., a country can have high levels of liability dollarization and negligible levels of transactional dollarization. In general, countries with a longer history of high and volatile inflation, macroeconomic instability, and institutional weakness tend to exhibit higher levels of dollarization along all dimensions (e.g., Argentina). *De facto* dollarization imposes high transaction costs on the economy (particularly when capital or exchange rate controls exist) and limits the effectiveness of typical stabilization policies. In contrast, *de jure* or official dollarization refers to a government's decision to confer legal tender status to the dollar.³ Some countries have adopted other currencies, such as the euro (e.g., Kosovo and Montenegro). The IMF (2023a, p. 62) classifies this type of currency, foreign exchange, or monetary regime as one with "no separate legal tender" in which "the currency of another country circulates as the sole legal tender (official dollarization)." In reality, more than one foreign currency can have legal tender status. An example of this situation is Panama, a country that adopted the dollar as legal tender in 1904 and never had a central bank despite nominally having a national currency (the *balboa*). *De jure* dollarization can be unilateral (e.g., Ecuador, Kosovo, and Montenegro), i.e., no authorization is sought or required from the country that issues the chosen currency. Alternatively, the adoption of a foreign currency could be affected through a bilateral or multilateral treaty (e.g., the eurozone and the Maastricht Treaties).

It is important to note that official dollarization (or euroization) is not a "one size fits all" regime. Its implementation is country-specific and admits variations.⁴ For example, in Ecuador, the domestic currency (the *sucre*) was abolished, in El Salvador, it was preserved (the *colones*), while in Zimbabwe the legal tender status of the domestic currency was "temporarily" suspended and the use of dollars and the South African rand for all transactions was allowed. According to the IMF, as of December 31, 2022, fourteen countries had a "no separate legal tender" regime, of which seven had adopted the dollar, four the euro, and the remaining three, the Australian dollar. Using the term "dollarization" generically without specifying its practical implementation details can cloud the debate about its pros and cons.

³ Although the dollar is the most common currency adopted.

⁴ Recently, Ocampo and Cachanosky (2022) presented a proposal specific for the case of Argentina.

The IMF's definition of hard pegs includes "no separate legal tender" and currency board regimes. It is common to equate dollarization with "a pegged exchange rate, only with less room to maneuver" (Sachs & Larrain, 1999, p. 86). As the experience of several dollarized economies shows, this is a misleading simplification, one that maybe better describes a currency board arrangement. Without denying some similarities, official dollarization differs in important respects from other fixed exchange rate regimes. The most important difference is related to its significantly greater costs of reversibility and, therefore, its greater credibility. This is a particularly important issue in countries that suffer from "time-inconsistency disease" (Kydland, 2004) and/or institutional anomie (Nino, 1992).

3. Theoretical Framework

In an officially dollarized economy, the aggregate money supply expands, or contracts, based on the net inflow (or outflow) of foreign currency and/or due to changes in bank reserve requirements or the money multiplier.⁵ If we abstract from the latter, the following set of equations (a simplified version of a balance of payments approach) must hold. The first describes the most acid test of a currency's "convertibility", which can be traced back to the so called "currency principle" as defined in the debates that led to Peel's Act of 1844:

$$R = MB \tag{1}$$

⁵ A change in the public's preference to hold currency (instead of deposits) can be another source of changes in aggregate supply. The public preference of currency over deposits can be important in countries in which the credibility of the banking sector can be negatively affected by domestic and external shocks, such as Ecuador (or vice versa).

Where *R* is international reserves held at the central bank and *MB* is the monetary base. We can call this identity the "convertibility condition," which posits that to dollarize or set up a currency board, the central bank must be able to buy back 100% of its monetary liabilities at the established exchange rate (Bennett, 1994, p. 188). The supposed validity of this restriction continues to generate confusion among economists. Part of it has to do with semantics. It is unclear whether *R* includes gross reserves, liquid reserves, or net reserves, as currently defined by the IMF. But there are more fundamental reasons why this restriction is not binding. In fact, not even under the Peel Act, the convertibility condition held. More recently, Argentina's convertibility regime launched in March 1991, was based on a legal requirement that *MB* had to be 100% backed by *R*. However, at the time of the announcement, "the net reserve position was negative" (Bennett, 1994, p. 188). As we shall see below, the same occurred in Ecuador at the time dollarization was announced.

In theory, under an extreme form of official dollarization, the *MB* disappears when the local currency in circulation is replaced by dollars. If the central bank is closed, *R* also disappear. Instead of gross reserves at the central bank, the consolidated banking system accumulates net foreign assets (NFA). After dollarization, the following equation should hold:

$$\Delta M C_{US} + \Delta B R = \Delta N F A = T B + N F I + \Delta N F L \tag{2}$$

Where MC_{US} are dollars in circulation, *BR* bank reserves, *TB* the trade balance, *NFI* net factor income from abroad, and *NFL* net foreign liabilities.⁶ Equation (2) states that changes in

⁶ "Liquid funds at depository institutions" could be interpreted as bank reserves or demand deposits. If the former, then M is base money, whereas if the latter, then M is M1.

base money are accounted for by ΔNFA , which, *if there are no errors and omissions*, should be equal to the balance in the current account CA. For the banking system, assets must equal liabilities:

$$\Delta NFA + \Delta DC = \Delta M_S \tag{3}$$

Where *DC* is domestic credit to the private and public sectors and M_S is the aggregate nominal money supply (M2 in the case of Ecuador). In equilibrium,

$$M_S = M_D \tag{4}$$

When coupled with other key assumptions –such as free capital mobility, flexible labor markets, a stable demand for money function with real income and the nominal interest rate as independent variables, purchasing power parity and the law of one price– this set of equations linking the balance of payments, the banking system and monetary aggregates provides the conceptual skeleton of MOEM. Given these assumptions, under a fixed exchange rate system the domestic price level and the nominal interest rate for a small open economy are determined exogenously and the nominal money supply becomes endogenous to movements in the balance of payments. The adjustment in the money market is accomplished by changes in international reserves.

Apparently, in Ecuador, equations (1) to (3) do not hold. Some authors point to this alleged incongruity as proof that the MOEM is invalid. For example, Naranjo Chiriboga (2016) concluded that "under dollarization, money is endogenous and depends fundamentally on economic activity. It is economic activity, the growth of production, that determines the increase in the money supply, not the balance of payments." But this conclusion does not follow from the data. Accounting

identities do not reflect causal relationships but are the result of double-entry bookkeeping. The fact that measured savings did not equal investments would not be sufficient grounds to refute modern macro theory. Therefore, the fact that an accounting identity does not hold is indicative of measurement or misspecification problems.

In the context of MOEM, and as it relates to the money supply and the price level, official dollarization can be viewed as an extreme form of a fixed exchange rate system. However, as we already mentioned, the analogy has limitations and can lead to confusion. To start with, if the central bank is eliminated after dollarization, reserves and base money cease to exist (as is the case in Panama). Even if the central bank survives, as was the case in Ecuador and El Salvador, both terms cease to have the meaning usually ascribed to them. Measurement errors in the balance of payments or monetary statistics can complicate the analysis further.

The unobservability of a key component of the money supply in a dollarized economy makes it impossible to directly test the predictions of MOEM (or any other monetary theory) regarding the behavior of monetary aggregates. However, other key predictions of this theory, such as the convergence of the domestic inflation rate in an officially dollarized economy to US levels, are testable.⁷

Official dollarization regime can pose an analytical challenge not only for economists unfamiliar with its specific mechanics, but also for the IMF's staff, who rely on both metrics (among other key variables) to assess external sustainability (IMF, 2013b, 2015). Defining reserves in "a

⁷ Although beyond the scope of this paper, we conducted unit root and cointegration tests on the time series of monthly inflation rate differentials between Ecuador and the U.S. from January 2002 to December 2024 and the results are consistent with the predictions of the MOEM.

fully dollarized economy without a central bank is challenging" (IMF, 2023b, p. 41).⁸ If the central bank survives, "reserve accumulation by the central bank is constrained in dollarized economies, because money cannot be printed to exchange for foreign currency" (IMF, 2019, p. 32). Secondly, following official dollarization, all assets and liabilities of the central banks are instantly denominated in dollars. However, according to the IMF, the definition of reserves only corresponds "to those [US] dollars that represent claims on foreign sources, i.e., [US] dollar claims on domestic agents (including the government) are not part of reserves" (IMF, 2019, p. 32). In other words, in an officially dollarized economy, neither currency denomination nor residency are the key factors that define reserves, but free availability (IMF, 2013a, p. 22).

To avoid confusion *R* and *MB* must be reformulated. For example, the IMF recognizes that "without a central bank, Panama cannot accumulate reserves by issuing base money in exchange for FX assets [...] Instead, the country may accumulate reserves in order to smooth the exchange rate fluctuations or prevent currency mismatches in the balance sheets. As such, reserves act more as a buffer in the financial system and the public finances" (IMF, 2023b, p. 41). In this case, the IMF defines reserves as the net foreign assets held by the Banco Nacional de Panama (BNP), a state-owned commercial bank. However, this metric reflects the financial and credit policy of the BNP, and not necessarily (or precisely) reserves as conventionally defined, as it excludes net foreign assets held by the banking system, which could be substantially larger.

In the case of Kosovo, an example of unilateral official euroization, the position taken by the IMF (2013b, p. 22) is that "all central bank assets are in FX, hence free availability is the only identifying criterion. The Central Bank of Kosovo (CBK) considers assets *not* freely available if

⁸ Kosovo and Montenegro unilaterally adopted the Euro as legal tender in 2002. See IMF (2013a, 2013b, 2015).

they correspond to funds on which non-government entities have a claim, such as commercial banks' reserves or deposits of the Kosovo privatization fund." In theory, what should matter for equation (1) is that the central bank's net working capital with assets marked-to-market is positive.

4. The Case of Ecuador

The first step to solving Ecuador's puzzle is to define *R* properly, which is not as easy as it sounds. The Central Bank of Ecuador (CBE) survived dollarization and continued accumulating reserves from foreign currency flows, as in a non-dollarized economy (see Dávila Castillo, 2017, p. 23; IMF, 2001, p. 301).⁹ However, in official reports, the "Reserves" account was replaced by what was defined, first *ad-hoc* and later by law, as freely available international reserves (FAIR). FAIR included net foreign assets that could be quickly converted into dollars without incurring any penalty (Dávila Castillo, 2017, p. 23).¹⁰ It is important to note that since no liabilities were subtracted from it, FAIR are not equivalent to what the IMF (2021) currently defines as net international reserves (NIR).

Shortly before dollarization was announced, several economists in Ecuador argued that dollarization was not viable because the CBE had insufficient reserves to buy the *MB*. In other words, the "convertibility condition", supposedly, did not hold. Most notably, on December 27, 1999, a former general manager of the CBE publicly warned that "to dollarize we need to raise

⁹ Since PetroEcuador, the state owned oil company, accounts for a substantial share of the country's exports, FAIR continue to represent a substantial portion of total flows between residents and non-residents (see IMF, 2001, p. 301). ¹⁰ The "Trole" Law approved in March 2000 defined FAIR as the CBE's net foreign currency position including gold, SDR, the liquid reserve position at international monetary organizations held by the CBE, the position with the ALADI, and, investments in financial instruments denominated in foreign currency and issued by non-residents that, in accordance with internationally accepted accounting standards, are considered liquid and low risk.

600 million dollars in dollar bills to exchange them for the *sucres* that we, Ecuadoreans, have in our pockets [...] Who is going to give us those 600 million dollars? [...] I do not see dollarization as something logical, feasible, or advisable" (quoted in Naranjo, 2019, p. 153, translation is ours). Twelve days later, President Jamil Mahuad announced official dollarization, a regime that has lasted over a quarter of a century.¹¹

As understood today, the convertibility condition states that, at the fixed exchange rate, "unencumbered" R must be no less than the broad monetary base, which includes the monetary base plus any short-term debt issued by the central bank (in domestic or foreign currency). In January 2000, the Ecuadorean government fixed the exchange rate at 25.000 sucres per dollar, in line with the market on the last trading day before the announcement. At this exchange rate, the FAIR covered the monetary base as well as 100% of bank reserves, but not all the outstanding monetary stabilization bonds issued by the CBE and held by the banking system.¹² If on-demand public sector deposits were added, the break-even exchange rate was 32.411 sucres per dollar (see Dávila Castillo, 2017, p. 23).¹³

The CBE got around this problem by assigning a low probability to the scenario in which public sector deposits would be immediately converted into dollars. It also designed a novel accounting scheme that broke down CBE's balance sheet into four separate "systems" of accounts. This scheme established a *de facto* seniority structure with respect to the uses of FAIR. Its declared

¹¹ Argentine economists are prone to make the same mistake when analyzing the viability of dollarization in Argentina. ¹² According to a former CBE official, as of January 10, 2000, the break-even exchange rate was 24,423.14 (Naranjo Chiriboga, 2003, p.233).

¹³ According to De La Torre Muñoz (2011), the ratio of M2 to conventionally defined reserves yielded an exchange rate of 57.545 and the ratio of the "liquid components" of such reserves to the total amount of sucres in circulation an exchange rate of 32.840 (p.198).

objective was to introduce full transparency and give the public the ability to evaluate the financial integrity of dollarization on a weekly basis. This accounting methodology was later enshrined by a law approved by Congress on 13 March 2000, two months after the announcement of dollarization.

Under the new accounting scheme, System 1, which comprised all sucres in circulation, had the most senior claim to FAIR, followed by System 2, which included bank reserves and stabilization bonds. Together, these two systems would be analogous to the balance sheet of a currency board. Other remaining FX assets, holdings of government bonds, repos, and other external liabilities (including those with the IMF), as well as deposits held by public sector entities, were included in System 3. The last system included residual assets, liabilities, and net worth. According to official statistics, as of January 31, 1999, systems 1, 2, and 3 were fully covered by the FAIR. However, government bonds held by the CBE were accounted for in System 3 at par value instead of market value. If a marked-to-market methodology had been applied, the first three systems would have shown a deficit of more than US\$400 million. If the current definition of NIR had been used instead of FAIR, Systems 1 and 2 would have shown a shortfall of close to US\$400 million.

But dollarization, or convertibility, is not a *liquidation* event, but a *going-concern* process that critically depends on credibility.¹⁴ It does not require "buying" the monetary base instantaneously but standing ready to exchange the local currency in circulation on demand, over a period of time that can last several months with or without a deadline. In some respects, following the

¹⁴ A *going-concern* firm is assumed to remain in business for a long time (at least 12 months). Liquidating a firm that loses its *going-concern* status, or shutting down a *going-concern* firm, are two very different processes.

announcement of an official dollarization, a Central Bank faces the same problem any bank faces under a fractional reserve system. Notably, in Ecuador, even though the law established that after June 30, 2000, the sucre would no longer have legal tender status (i.e., they would lose 100% of their value), as of this deadline, one-third of the sucres in circulation had not been exchanged for dollars. A three-month extension was needed to retire them. In other words, although in January 2000 it was debatable among experts whether the CBE had "enough dollars" to implement dollar-ization, it took nine months to buy back all sucres in circulation. During this period, FAIR grew by US\$161 million.

What made it possible to dollarize Ecuador was not the FAIR held by the CBE, but the dollars held by the private sector.¹⁵ Larger remittances from abroad, which experienced an increase of 30% during 2000, contributed to an increase in bank deposits that, in turn, made it possible for the currency exchange to proceed smoothly. Between December 31, 1999, and December 31, 2000, total bank deposits increased 17% (or approximately US\$545 million). The success of dollarization in the face of seemingly insurmountable obstacles –a political crisis, sovereign debt default, rampant inflation, lack of external support, limited reserves, frozen deposits, etc. – took many experts by surprise.

Plenty of historical precedents, such as England's return to convertibility in 1821 (see Cannan, 1919, p. 14), and, more recently, Argentina's 1991 currency board, show that 100% backing of monetary circulation (or the monetary base) with specie or FX reserves is not a necessary condition for convertibility or dollarization. In other words, Equation (1) as conventionally defined is not a binding restriction. Credibility is the only binding restriction, and in this context, it depends

¹⁵ Money is fungible so it is impossible to identify which dollars were actually exchanged for *sucres*.

on certain key factors: 1) at the fixed exchange rate the local currency is not overvalued (i.e., there is no excess demand for dollars), 2) the banking system is not bankrupt or liquidity constrained, 3) the probability that the new regime will be reversed is negligible, and 4) the government is perceived to have enough fiscal resources to retire all of its monetary liabilities over a reasonable period of time. On 9 January 2000, when president Jamil Mahuad announced dollarization over a TV broadcast the Ecuadorean people perceived that a) at 25,000 sucres per dollar the local currency was not overvalued, b) politicians would no longer be able to resort to the inflation tax, and, c) despite the fact that the country was in default of its sovereign debt, it had enough resources on an ongoing basis to retire the equivalent of \$600 million (or 3% of GDP) of sucres in circulation over the period determined by law.

5. Explaining the Puzzle

5.1. Errors in Measuring Cash

Let's now address the issue of monetary expansion after dollarization using equations (2) and (3). "How is it possible that with more dollars leaving than entering the country, the total monetary supply has multiplied by ten?" wrote an Ecuadorean economist in early 2016, noting that the cumulative current account balances since 2000 were negative (Naranjo Chiriboga, 2016). As the table below shows, if we update the calculation as of December 31, 2023, although the cumulative current account turned positive, the money supply expanded more than 20 times:

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Table 2. Ecuador: Selected Monetary and Balance of Payments Statistics						
In millions of current dollars	31-Dec-99	31-Dec-23	Increase			
Dollars in circulation	577.9	19,818.4	19,240.5			
Bank Reserves	192.3	5,484.4	5,292.1			
International Reserves (FAIR)	872.7	4,454.4	3,581.7			
Cumulative Current Account (CA)			7,652.2			

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Source: Authors based on CBE data.

The significant divergence between the reported cumulative current account balances and the reported amount of dollars in circulation reported by the CBE, led several local economists to propose a series of explanations that challenge conventional open economy macroeconomics. For example, Naranjo Chiriboga (2018, p. 113) concluded that "official dollarization implies the endogenous money paradigm, i.e., the amount of money is a function of economic activity and not the balance of payments.". According to De la Torre Muñoz (2015, p. 21), the monetary approach to the balance of payments (MAB), which underlies MOEM, is not "applicable to the monetary reality of the dollarized Ecuadorian economy, particularly from the order of causality of determining the balance of payments equilibrium from the monetary equilibrium [sic]." Guncay and Pérez (2019, p. 75) find "a positive unidirectional effect from credit to total liquidity and from credit to deposits." These results led them to posit a post-Keynesian interpretation in which higher demand for credit engenders, "a la Munchhausen", the extra liquidity it needs to support it. Another study claims that the banking system was able to create money "out of nothing" and that dollarization "is viable and sustainable thanks to the fact that sufficient secondary monetary and liquidity expansion from the financial system allows for the adequate performance of the real economy" (Villalba, 2019, pp. 22–38).

In some important respects, at the theoretical level, some of the issues raised in this discussion are reminiscent of the old Banking versus Currency school debate that preceded the Peel Act of 1844: the different nature and dynamics of outside and inside money, the real bills doctrine, and the law of reflux. What was present in Ecuador during dollarization but absent in early 19th-century England was a left-leaning populist fiscal regime that financed significantly large excess government expenditures through the banking system. Also, convertibility under fixed exchange rates under the gold standard or a currency board is essentially different from dollarization.

Beyond any theoretical arguments, the main problem is the data. If an accounting identity does not hold, it is probably because of some error of measurement or reporting. As mentioned earlier, in the case of Ecuador, two factors cloud the analysis: a) the imprecise measurement and likely (and significant) overestimation of the amount of dollars in circulation by the CBE (Cabezas et al., 2023; Erráez, 2016; IMF, 2019), and b) inaccuracies in foreign trade statistics (IMF, 2019, pp. 39, 47–48).

Regarding the first point, after dollarization, the amount of dollars circulating in a dollarized economy is unknown. When an Ecuadorean withdraws \$1,000 from his bank account, the CBE reports a decrease of \$1,000 in deposits and an equivalent increase in dollars in circulation. However, if such withdrawal relates to outbound tourism, it can lead to an immediate overestimation of the latter (Erráez, 2016; IMF, 2019). For example, if an Ecuadorean traveling abroad withdraws \$1,000 from his local bank to buy a smartphone in Miami, those dollars would continue to be shown as currency in CBE's official statistics. This is not a minor issue. Since 2000, the annual outbound tourism flow has averaged 700,000 persons per year. A back-of-the-envelope calculation can put the magnitude of the potential measurement error in perspective. If we assume each tourist carried an amount of cash equivalent to 10% of GNP (\$750 in 2023), the total amount of cash withdrawn from circulation since 2000 would be US\$10 billion, which is 50% of the amount of dollars in circulation reported by the CBE at the end of 2023.¹⁶

The problem of accurately measuring precisely the amount of cash in circulation is common to other dollarized economies and for those that belong to a monetary union such as the Eurozone. The problem is less acute in countries that adopt a currency board. In the case of Panama, there is no central bank and no official measure of monetary circulation. In El Salvador, although the central bank survived after dollarization, it does not publish statistics of dollars in circulation. Soto (2014) proposed several methodologies to estimate cash withdrawals from the banking system in El Salvador. For the European case, Dias (2018) proposes a methodology to estimate the effective value of euros in circulation in twelve member countries.

The situation in Ecuador is different from that of El Salvador and Panama because the central bank publishes an estimate of the amount of dollars in circulation. The CBE has relied on two methods to estimate such variable: 1) as a fraction of total bank deposits based on the bank multiplier, and 2) as a function of the amount of dollars that the CBE requires from abroad to meet the liquidity needs of the Ecuadorean economy and the cash dollar holdings of the banking system (Vera Lasso, 2007). According to a recent study, this methodology led the CBE to overestimate by one-third the amount of dollars in circulation (and, consequently, also MB, M1, and M2), particularly after 2014 (Cabezas et al., 2023, p. 16).

This conclusion seems to be supported by the data. **Figure 1** shows the dollars in circulation per capita since 2000. As can be seen, growth between 2013 and 2017 is out of line with the

¹⁶ Since 2007, Ecuadoreans have a strong incentive to use cash when travelling abroad to avoid a 5% tax on capital exports that has been levied on credit card transactions.

historical trend. This was the period during which the expansion of domestic bank credit to the

public sector was greater.





5.2. Exogenous Expansion of CBE's Balance Sheet

There is another important factor that complicates the analysis: the exogenous expansion of the balance sheet of the CBE and state-owned banks engineered by Rafael Correa's government to finance persistent fiscal deficits. Erráez and Reynaud (2022, p. 22) have shown that between 2009 and 2014, "some accounting practices and subsequent changes in legislation were adopted that ultimately aimed to allow the CBE to finance the central government's deficit, challenging standard monetary economic thinking that fiscal dominance are disallowed in a full officially dollarized economy." Such balance sheet expansion, which at its peak represented approximately 10% of GDP, generated "large liabilities to the CBE that translated into low reserve coverage, putting the

public and private financial systems and ultimately the dollarization regime at risk" (Erráez & Reynaud, 2022, p. 1).

CBE's balance sheet expansion was effected through the purchase of bonds directly from the Treasury and, indirectly, by the extension of credit to state-owned banks, which in turn, used the funds mostly to buy bonds from the Treasury or fund specific spending programs (see Erráez & Reynaud, 2022). This led to an increase in aggregate bank deposits, which, under the multiplier methodology employed by the CBE, contributed to the overestimation of the currency in circulation, M1, and M2 (see Cabezas et al., 2023, p. 19).

Despite the limitations imposed by the quality of official statistics, there is no doubt that dollarization contributed to higher monetization levels in Ecuador. In contrast to the amount of dollars in circulation, the CBE can measure precisely the total amount of bank deposits, which, as a percentage of GDP increased from 17% at the end of 1999 to almost 50% at the end of 2023, a ratio that is in line with other non-dollarized stable economies in Latin America (see **Figure 2**).



Figure 2. Bank deposits as a percentage of GDP, Ecuador and selected countries

Source: World Bank. Global Financial Development (GFD).

For instance, in 2000, Ecuador's bank deposits in terms of GDP were slightly below countries such as Colombia, Mexico, and Peru. Ecuador's deposits grew as did those in these other countries, surpassing Mexico and Colombia by 2007. Also, there was an increase in the public's preference for cash starting in 2014 (see **Figure 3**).





2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 202 Source: Authors based on data from the CBE.

To conclude, the apparent divergence between the growth of net foreign assets and monetary aggregates and the reason why equation (2) does not hold is very simple: accounting identities only hold when Luca Pacioli's double-entry accounting method is used. This was not the case in Ecuador.¹⁷ The CBE estimated the amount of dollars in circulation without any reference to the balance of payments. Only by chance could equation (2) hold. Interestingly, the observed

¹⁷ The apparente divergence between Δ NFA and conventionally defined base money could not exist under a currency board system such as the one Argentina had between 1991 and 2001.

divergence significantly disappears when the amount of dollars in circulation is estimated using an adequate money demand function as done by Cabezas et al. (2023).

Table 3. Ecuador: Adjusted and unadjusted dollars in circulation					
In millions of current dollars	31-Dec-1999	31-Dec-2023	Increase		
Net Foreign Assets of CBE plus Banking System	256.2	11,926.1	11,669.9		
Dollars in circulation (adjusted)	577.9	12,568.8	11,990.9		

Source: Authors based on data by CBE and IMF. The amount of dollars in circulation is adjusted by the percentage estimated by Cabezas et al. (2023).

As to the validity of the MABP in Ecuador, as Johnson (1972, p. 1596) explained, "domestic monetary policy does not determine the domestic money supply but instead determines only the division of the backing of the money supply the public demands, between international reserves and domestic credit." What happened in Ecuador, and this is the puzzle, is that the demand for money increased even though the backing of aggregate monetary liabilities issued by the banking system had an increasing domestic component of dubious credit quality. This can be seen in **Figure 4** below.

MONEY SUPPLY UNDER OFFICIAL DOLLARIZATION Emilio Ocampo and Nicolas Cachanosky Figure 4. Ratio of NFA to Total Bank deposits and CBE liabilities to NFS



Note: NTA stands for Net Foreign Assets. Source: Authors based on data from the CBE.

The decline in the ratio of NFA to total bank deposits is a cause for concern. Since 2015 the backing of all monetary liabilities with NFRA has fallen below the "Palmer Rule", and at the end of 2023, it was at the lowest level since 2000.¹⁸ This is one of the legacies of ten years of fiscal irresponsibility under the government of Rafael Correa.¹⁹

Finally, as long as the law of one price is valid, a fixed exchange rate to the dollar, a convergence of domestic and US inflation independently of the growth in the money supply. This convergence took place in Ecuador despite it having a much faster growth in monetary aggregates than the United States. The answer to the apparent puzzle is that price stability, lower inflationary expectations, and higher GDP growth led to a significant increase in the demand for real cash

¹⁸ The Palmer rule states that a well-managed bank should keep one-third of its liabilities as cash and two-thirds in securities.

¹⁹ The participation of the public sector in the credit statistics shown in the graph is probably not fully captured by the statistics in the graph.

balances that was satisfied mostly through the banking system and faster growth in domestic credit. Far from refuting MOEM, the Ecuadorean experience seems to support it.

6. Conclusions

A quarter of a century of official dollarization regimes in Ecuador, El Salvador, and Panama, provides us with valuable evidence to understand the behavior of a small, open economy operating under official dollarization and test established macroeconomic theory. One of the main predictions of such a theory is that under such a regime, the money supply is endogenous to movements in the balance of payments and certain basic accounting identities linking the current account and monetary aggregates must hold. Yet, in the case of Ecuador, a cursory look at official statistics seems to contradict the latter statement. There are three main explanations of this apparent puzzle. First, accounting identities can only hold when a double entry bookkeeping is applied. This is not the case in most dollarized economies, as the monetary base and currency in circulation are not directly observable. Official statistics are based on estimates that do not accurately reflect reality. This problem is compounded when foreign trade statistics are not reliable. Also, and particularly important in the case of Ecuador, was an exogenous expansion of the central bank balance sheet under the government of Rafael Correa to finance recurring fiscal deficits. The first of these factors distorted basic accounting identities that underlie MOEM, creating the impression of an inconsistency where none exists, while the second eliminated a fundamental constraint that, in theory, all dollarized economies face. Neither factor was present in El Salvador or Panama, although in both cases fiscal discipline was also lacking (another dollarization "puzzle").

Instead of refuting MOEM, the experience of Ecuador under an official dollarization regime validates one of its main predictions: domestic inflation will converge to US inflation. It also yields valuable lessons for countries considering official dollarization as a way of eliminating high, persistent and volatile inflation. In our view, the most important of such lessons is that if the central bank survives intact, in countries without strong institutional safeguards, spendthrift politicians are likely to eventually resort to creative monetary activism which will compromise the integrity of the banking system and increase the probability of a sovereign default and/or a financial crisis.

7. References

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