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# DOLLARIZATION DYNAMICS: A COMMENT

Emilio Ocampo and Nicolás Cachanosky[1]

## Abstract

We analyze a recent paper that claims that dollarizing an economy in the presence of a "dollar shortage" will provoke an immediate sharp reduction in real output and welfare. We find many problems with the model that supports this conclusion: confusion about the nature of a dollar shortage and its practical implications, invalid assumptions, invariant calibration in the presence of a regime change and lack of empirical testing. In our opinion, the paper does not make a valuable contribution to the dollarization debate nor provide useful guidance to policymakers. The proposed model is based on unrealistic assumptions and its predictions are contradicted by the available evidence. A more promising and useful line of research would have been to investigate what happens to a dollarized economy in a scenario of exchange rate overshooting and how it compares in relation to other stabilization plans.

JEL Codes: E10, E42, E50, F30, F33.

Keywords: Dollarization, Dynamics, Dollar shortage

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# Dollarization Dynamics: A Comment

> *The "shortage of dollars" seems unfortunately to mean all things to all men; hence we must try first to come to a precise definition of the problem.*
>
> Howard S. Ellis, The Dollar Shortage in Theory and Fact (1948)

## 1. Introduction

In a recent paper, Caravello, Martinez Bruera and Werning (CMBW, 2023) set out to analyze a supposedly overlooked cost of dollarization: the recession induced by dollarizing an economy that faces a "dollar shortage."[2] Based on a simple two-sector model with a representative agent and fixed and flexible prices, to which they later add agent heterogeneity and financial frictions, the authors claim that under such scenario, a dollarization would resemble an immediate sudden-stop and generate an initial non-trivial reduction in output and welfare. Their model predicts that convergence to equilibrium could take more than five years.

We think there are several issues with this paper. The first concerns the nature and implications of a dollar shortage, the key underlying assumption of CMBW's model.[3] CMBW provide an imprecise definition of what is a "dollar shortage." Moreover, they assume it is not only an initial condition but also a permanent one. However, the empirical evidence suggests that dollar shortages, even under CMBW's definition, are transitory and engendered by policy distortions. The implications in one case or the other are very different. Secondly, the results of CMBW's model are based on another key assumption: with a dollar shortage it is only possible to dollarize at a "unfavorable rate." In other words,

[2] The following comments apply to the version dated June 2, 2023. A slightly different version was later published by the NBER.

[3] The concept of dollar shortage was used extensively in the post-war international economics literature (see for example Ellis, 1948, Graham, 1949, and Kindleberger, 1950).

they assume that in a scenario of free capital mobility and no foreign exchange restrictions, the dollarization exchange rate must be significantly higher than the prevailing market exchange rate. However, if the dollar shortage is permanent (as assumed by CMBW), this necessarily implies that market participants behave irrationally. Third, the empirical evidence suggests that there is no univocal relationship between a "dollar shortage" (as defined) and an "unfavorable" nominal exchange rate (which they authors do no define but we assume means implying a real exchange rate significantly than its long-term equilibrium value). The latter could exist without the former, and the former, if transitory in nature, cannot lead to the latter.[4] Therefore, the benchmark case of CMBW's model –dollarization *cum* dollar shortage– is empirically irrelevant and theoretically questionably. It would have been more useful to analyze what would happen in a scenario of dollarization with prior overshooting and low money balances and under such scenario to evaluate how dollarization compares to alternative stabilization plans.

Fourth, CMBW built a model to suggest the likelihood of potentially "dire consequences" of dollarizing an economy facing a "dollar shortage" but nowhere in their 52-page paper there is a discussion of whether the model's predictions fit the facts.[5] Also, the model is calibrated with parameters that do not consider that dollarization is a regime change in the sense given by Sargent (1982).[6] Therefore, model parameters cannot be assumed to remain invariant (Lucas, 1976). CMBW implicitly assume that the only structural change brought about by dollarization is that the nominal exchange rate remains inalterably fixed. On a minor note, CMBW only mention five papers on dollarization and omit many valuable works in a vast literature produced on the subject since 1993 (see for example some of the works cited in Ocampo, 2023).[7]

[4] If, as we argue here, the dollar shortage is transitory (i.e., the borrowing constraint is not permanent), then the market exchange rate cannot be "unfavorable" unless there is overshooting (Dornbusch, 1976).
[5] In a footnote CMBW incorrectly assert that "Ecuador dollarized in 2000-01." Dollarization was announced on January 10, 2000, officially closed by June 8. By the end of September approximately 97% of all existing *sucres* had been taken out of circulation. In other words, the Ecuadorean economy was fully dollarized by the end of 2000.
[6] From a policy standpoint, dollarization must be accompanied by other structural reforms. It wouldn't make sense without them. This was the case in Ecuador and in Argentina with the Convertibility Plan.
[7] Also, CMBW incorrectly cite the paper by Goldfajn and Olivares (2000) by adding two commenters as authors. It suggests they did not even read the paper.

Finally, although CMBW's model supposedly has universal applicability, it was built with Argentina in mind (the authors are Argentine) and is specifically calibrated for Argentina. CMBW note that "recent proposals for dollarization, previously rejected, have resurfaced and gained traction in Argentina in the midst of the presidential race and escalating inflation." The objective of CMBW's paper is to discredit such proposals and warn about the potentially "dire consequences" of dollarization.

For all the above reasons and others that we will explain in more detail below, we believe CMBW's paper does not make a meaningful contribution to the dollarization debate nor offers valuable guidance to policymakers. Their mathematical model is based on a definition of a dollar shortage that is conceptually unsound and empirically irrelevant. Even though, according to most estimates, private sector dollar holdings amount to more than 40% of GDP, CMBW claim that the country faces a dollar shortage that they estimate at 2.5% of GDP imposes a permanent binding constraint on the economy. Only with a set of unrealistic initial conditions and questionable micro-foundations the model built by CMBW can yield its apocalyptic predictions. A more promising and useful line of research would have been to investigate which monetary policy framework and foreign exchange regime can deliver superior results in a scenario in which, to stabilize the economy and establish a solid foundation for sustainable growth, policymakers must exit an unsustainable regime in a relatively short period of time due to the electoral calendar, but a) have no credibility and no effective commitment device other than dollarization to reduce time inconsistency (see Ocampo, 2023), and b) face heightened inflationary expectations.

## 2. Nature and Practical Implications of a Dollar Shortage

The most important prediction of CMBW's model –that dollarization will inevitably lead to a sharp and lasting contraction in output– assumes the existence of a "dollar shortage" that constrains the economy for an indefinite period. In fact, CMBW assert that the "most important" parameter of their "simple" model is "is the size of the shortfall in initial dollars relative to its steady state value (p.4)." Therefore, it is critical to understand the nature and practical implications of a "dollar shortage."

The closest CMBW get to a definition of the term is when they argue that "due to a shortage of foreign reserves or a lack of foreign credit, the conversion of domestic currency to dollars at an unfavorable rate [sic]… leaving the initial balance of foreign currency below its long-run steady-state value." But what is an "unfavorable rate"? The authors don't provide an answer either. Presumably, it is a rate that implies an historically high real exchange rate and/or a rate that is not warranted by macroeconomic fundamentals (i.e., a non-market exchange rate.) Later CMBW clarify that "dollars are scarce in the precise sense that money balances are below their steady state (p.11)." In the calibration section, they add that "at the pre-dollarization exchange rate, there are not enough dollars to convert all existing pesos (p.22)." They omit to clarify whether the pre-dollarization exchange rate is the one artificially set by the central bank below its market clearing level or some other rate. [8]

CMBW's model predicts that in the presence of such "dollar shortage", a dollarization would be immediately followed by a sharp and lasting recession.

> "In our model, if initial balances are large enough the economy reaches a steady-state equilibrium immediately, seamlessly switch from domestic to foreign currency. However, this is no longer the case when dollars are initially scarce, due to limited reserves, limited credit and low pre-existing dollar holdings. In this scarcity situation, the economy undergoes a non-trivial transition towards its steady state (p.3)."

In summary, according to CMBW, a "dollar shortage" occurs if: a) international reserves are close to zero, or significantly below the monetary base when converted at a "favorable" (prevailing? official? market?) exchange rate, and b) there is no access to external financing ("$b_t = 0$ for all $t \geq 0$", p.8). Although not a necessary condition for a dollar shortage, CMBW also assume that aggregate money balances pre-dollarization, as measured by $M_0$, are below their steady state level (and even lower after dollarization).[9]

[8] Things get more complicated when the foreign exchange market is tightly controlled by the authorities, as is currently the case in Argentina. It is hard to define what the "prevailing" exchange rate is today, as in effect, there are multiple exchange rates.

[9] In fact, in CMBW's model pre-dollarization money balances significantly below their steady state level would seem to be more important that the exchange rate at which they are dollarized.

Two consequences are derived from this set of initial conditions. First, a dollarization must necessarily be implemented at an "unfavorable" exchange rate. Second, post-dollarization money balances, as measured by $M_0$/GDP, will be significantly below their steady state. Third, only an adjustment of money balances, which requires a sharp drop in the consumption of tradables and recurrent trade surpluses, can bring back the economy back to equilibrium. As CMBW explain, "individuals cut their consumption to build up their money balances (p.14)." In the benchmark case, this brings about "potentially dire consequences": an immediate and lasting contraction in output and welfare. Convergence to equilibrium takes a long time. Under all scenarios CMBW's model predicts that it will take more than four years for consumption and output to return to their steady state equilibrium.

## 3. Model Assumptions, Calibration. Empirical Testing and Extensions

*Assumptions*

A key assumption underlying CMBW's model is that the effects of an initial "dollar shortage" are lasting, even after dollarization, due to a permanent borrowing constraint. This is a strong assumption. Under this scenario, CMBW claim that the exchange rate for dollarization will be "unfavorable" and significantly higher than the market exchange rate prevailing immediately before dollarization. Given that they also assume free capital mobility (p.6), this proposition implies that participants in the foreign exchange market behave irrationally. Otherwise, the market exchange rate pre-dollarization could not be significantly below the level implied by full convertibility. Second, there could be reasons other than a dollar shortage (as defined by CMBW) for a country to dollarize at an "unfavorable" exchange rate (e.g., pre-dollarization overshooting a la Dornbusch, 1976). Finally, under a dollar shortage scenario, any stabilization plan that uses the nominal exchange rate as an anchor would face similar dynamics to dollarization.[10] Third, in CMBW's model the dollar shortage can only correct itself through an adjustment in money balances which requires a trade surplus and a reduction in aggregate consumption (see pp.8-9, 11, 14).

[10] CMBW seem to be taking a Nirvana approach to the problem of an "unfavorable rate". In this context, a nirvana fallacy consists in comparing the results of a realistic policy framework with those of an idealized one instead of those of a realistic alternative (see Demsetz, 1969).

CMBW assert that Argentina currently faces "a dollar shortage" (p.2). However, the lack of foreign reserves at the central bank is the direct consequence of an unsustainable foreign exchange policy.[11] It is therefore a transitory phenomenon, unlike the chronic dollar shortage that Europe faced in the immediate postwar period under the Bretton Woods system.[12] No structural limitation prevents Argentina's central bank from accumulating foreign reserves, but a wrong-headed policy that can be reversed. Basic microeconomics teaches us that if the government artificially sets the price of a good below its equilibrium level (i.e., where demand and supply meet) this will inevitably create a shortage. It is very easy to correct this problem: remove price controls and let the market reach its equilibrium. More importantly, even if net foreign reserves are low immediately after the liberalization of the foreign exchange market, the exchange rate will not necessarily overshoot.[13] Market participants do not look at the current level of foreign reserves but at the level achievable with sustainable policies.[14] The empirical evidence suggests that this is the case. With respect to the borrowing constraint, it is evident that Argentina has limited access to voluntary sources of financing. However, if Argentina's long history of defaults teaches us anything, is that borrowing constraints do not last forever.

On December 7, 2015, net international reserves at the Argentine Central Bank (BCRA, 2016, p.35) amounted to US$6.8MM, while the monetary base converted at the free-market exchange rate amounted to US$44 billion. At the time, the sovereign had no access to the international capital markets due to the refusal of Cristina Kirchner's government to accept the rulings of a New York judge. According to CMBW's definition, Argentina faced a dollar shortage. However, ten days later, after a new government took office, the BCRA relaxed controls on foreign exchange transactions and let the peso float. The official exchange rate moved from 9 AR$/US$ on December 7 to 13 AR$/US$ pesos on December 31, 2015 (BCRA, 2015). By the 31st of January 2016, net foreign reserves had increased to US$ 8.5 billion. By April, the government reached a settlement with holdout creditors which reopened the capital

[11] For refutation of the hypothesis that there are not enough dollars to effect a dollarization at a "favorable" exchange rate see the report by Anker (2023).
[12] In both cases however, the shortage is created by the monetary authority. "The 'shortage' of dollars in the foreign world is therefore solely and simply explicable in the fact that the dollar is made available to residents of foreign countries, in necessarily rationed amounts, at lower prices in their respective currencies than in a free market they would be prepared to pay for the given supply." (Graham, 1949, pp.3-4).
[13] Overshooting is possible and perfectly rational under certain circumstances (see Dornbusch, 1976).
[14] This is particularly true when the market expects a regime change, which is the case in Argentina today.

markets for the sovereign. In other words, the much feared "dollar shortage" quickly disappeared. Argentina was able to tap the markets again within two quarters and to issue a 100-year bond at a fixed annual coupon of 7.125% within six quarters. It is important to keep these facts in mind given the slow convergence (more than four years) predicted by CMBW's model.

To conclude, a "dollar shortage" as (defined by CMBW) is not a useful concept to analyze the potential impact of dollarization. First, it is not permanent. Second, a "dollar shortage" may or may not lead to an "unfavorable exchange rate", and an "unfavorable exchange rate" may or may not be caused by a "dollar shortage." In our view, it would have been more productive for CMBW to consider building a model that predicts: a) what would happen to an economy that, for whatever reason, dollarized in a scenario of overshooting, and b) under such circumstances, in which way the results of a dollarization would differ from alternative stabilization plans (with fixed or flexible exchange rates.)[15] Regarding the first question there is a precedent that CMBW chose to ignore even though they mention it as "a country that famously went down this extreme path": Ecuador.

At the time of dollarization, January 2000, Ecuador was in default of its Brady bonds, its banking system was mostly bankrupt, and the inflation rate was running at an annualized rate close to 400% per annum. On December 31, 1999, the prevailing market exchange rate was 20,000 sucres per dollar.[16] Although at such rate the Ecuadorean central bank had more than enough foreign reserves to "buy" the entire monetary base, it was insolvent on a mark-to-market basis (i.e., it had a negative net worth).[17] On January 10, 2000, President Mahuad announced the dollarization of the economy at a conversion rate of 25,000 sucres per dollar. This implied a 20% depreciation of the domestic currency in only 10 days. At this nominal rate, the implicit real exchange rate was twice the average level for the period 1994-

[15] In one of the extensions to their model, CMBW claim that if the price of the non-tradable good is too high at the outset, the transitional dynamics of the model would be similar under a fixed exchange regime or a currency board (p.4).
[16] The *sucre* had been floating since February 1999.
[17] According to official figures, as of December 31, 1999, Ecuador's net foreign reserves amounted to US$ 808 billion, and the monetary base converted into dollars at the market exchange rate to US$ 770 billion. Technical insolvency is not necessarily a problem for a central bank, particularly if a large portion of its liabilities is long term or owed to multilaterals. The problem in Ecuador in January 2000 was that half of the assets in central bank's balance sheet were government debt.

1998. However, approximately 25% of the exchange rate overshooting took place during 1999, before dollarization.[18]

Several points worth mentioning. First, by May 2000, i.e., less than two quarters of dollarization, Ecuador had reached an agreement with the IMF and the Paris Club and by August it had completed a restructuring of its outstanding debt. Second, within four quarters of dollarization, net foreign reserves had increased by 23%. Third, monetization increased rapidly without pushing the economy into a recession. Fourth, the banking system was able to perform its intermediation role more efficiently after dollarization. Total credit to the private sector almost doubled in US$ between December 1999 and December 2004. More importantly, the percentage of low-income households with access to credit increased from 24.4% in 1999 to 27,3% in 2005/6. The dollar amount of loans to this group almost tripled in real terms and doubled as a percentage of household income (see Bebczuk, 2008).

Even if we consider that the exchange rate at which Ecuador dollarized meets the definition of "unfavorable," the overshooting reflected an unprecedented economic, financial and political crisis that unfolded during 1999 and reached its climax in January 2000 more than a scarcity of dollars at the central bank in January 2000 (whatever was left of the banking system was highly dollarized).[19]

Argentina's Convertibility offers two interesting episodes to test CMBW's theory. The most obvious one is its establishment on March 31, 1991. Despite what the Convertibility Law required, the central bank did not at the time have enough liquid dollar foreign reserves to "buy" the entire monetary base.[20] Also, the sovereign was in default of its external bank debt and did not have access to the international capital markets (in February 1991 the country risk premium was 1600 basis points). Finally, following several bouts of hyperinflation in 1989 and 1990, money balances were at an historically low level ($M_0$/GDP was at 2,8%). However, it is hard to argue that Convertibility was effected at an "unfavorably" high exchange rate (in real terms it was significantly below the historical average).[21] According to

[18] At the closing exchange rate on 31 December 1999, the real exchange rate index (1994=100) was at 173.37. At the end of January 2000, at 25,000 sucres per dollar, the index was at 206.51. In comparison, the index average for 1994-1998 was 99.57.
[19] See Jacome (2004) for a discussion of the factors that contributed to exchange rate overshooting in Ecuador in 1999.
[20] The available data does not allow us to estimate a mark-to-market balance sheet for Argentina's central bank as of March 31, 1991, but technical insolvency cannot be discarded. The monetary authorities were much less transparent than currently.
[21] According to some estimates, the real exchange rate in 1991 diverged as much from its long-term equilibrium value –almost 25%– as in 1980. See Espert and Maino (2000).

CMBW's model, the adjustment of money balances should have led to a sharp contraction in consumption and a surplus in the trade balance. Instead, consumption grew 12,6% in 1991 and 10,8% in 1992 (GDP at 8,9% and 8,7% respectively), while the trade balance surplus fell slightly in 1991 and turned negative in 1992. Net reserves doubled in the first four quarters following Convertibility and Argentina had regained full access to the international capital markets eleven quarter later.[22]

The second and less obvious precedent is the traumatic exit of Convertibility between December 2001 and January 2002. The Argentine government managed to engineer the set of initial conditions imagined by CMBW: a sovereign debt default that imposed a lasting borrowing constraint, a devaluation that led to an overshooting of the exchange rate to "unfavorable" levels (the nominal exchange rate remained practically unchanged at 3 pesos per dollar from January 2003 until December 2006), a sharp reduction of money balances below their steady state equilibrium through a partial confiscation of dollar denominated deposits, and an asymmetric "*pesification*" of bank liabilities that crippled the banking system and rendered it unable to fulfill its basic intermediation function. The outcome of this policy mix matches the predictions of CMBW's model: real wages and consumption dropped, an unprecedent string of trade and current account surpluses followed and it took real GDP more than four years to return to its previous peak despite a significant increase in the terms of trade. The exit from Convertibility was a non-virtuous regime change that entailed not only breaking a hard peg but also the rule of law. It generated results that are the opposite of those that would result from implementing a dollarization with structural reforms.

Argentina's current situation in some respects is worse than in 1991 –according to some estimates, net foreign reserves at the central bank are negative– but it is also easier to reverse. History shows, that if the incoming government announces a credible regime change (such as dollarization accompanied by a program of structural reforms), Argentina could regain access to the international capital markets in a relatively short time.[23]

[22] Ministerio de Economía (1993).
[23] It is worth noting that the face value of Argentina's total foreign bond debt currently amounts to approximately US$70 billion, which, adjusted by inflation, is half the amounts issued at the peak in the 1990s and in 2017.

As we have already explained, the concept of a permanent "dollar shortage" does not seem to have much relevance theoretically or empirically. Therefore, the base case scenario for which the model yields its predictions –dollarization *cum* dollar shortage– is unrealistic.[24] Also, CMBW take a very simplistic view of how dollarization is implemented. There is no "one size fits all" dollarization. Each country dollarizes its own way given a set of economic, financial, political, legal and institutional constraints. For the purposes of CMBW's model, implementation details cannot be assumed away. For example, in Ecuador, the US dollar replaced the *sucre* as legal tender by a law approved by Congress. Ecuadoreans had a fixed period to exchange their sucres for dollars. Initially, the rate of dollarization was relatively slow: after four months only 30% of the total sucres in circulation had been exchanged. As a result, over a period of nine months the economy had a bi-monetary system in which dollar and sucre bills co-existed (however, the banking system was fully dollarized).[25] El Salvador implemented dollarization differently. Instead of replacing the domestic currency –the *colón*– it simply made the dollar legal tender. In essence, the law created a two-currency economy (the banking system was fully dollarized). In this case, the dollarization curve was flatter than in Ecuador but, after four months, only 30% of the *colones* in circulation had been swapped for dollars. It took two years for the dollarization rate to reach 90%. This means that a main assumption of CMBW's model –instantaneous dollarization– is not only unlikely irrespective of the format chosen but also inconsistent with the empirical evidence.

Dollarization must be implemented at a market exchange rate, i.e., the rate determined by the interaction of supply and demand once all restrictions on foreign exchange transactions and capital movements have been lifted. This must necessarily be the most "favorable" exchange rate, even if there is overshooting. In the case of Argentina, current economic policy, which in the last two years has led to a strong appreciation of the peso in real terms, is unsustainably and must necessarily be corrected, with or without dollarization. Otherwise, it will be impossible to stabilize the economy. To put the onus of liberalizing foreign exchange markets on dollarization is to fall into a Nirvana fallacy.[26]

[24] This is not an assumption about agent behavior within the model but about the scenario for which the model yield predictions.
[25] Ecuador also minted fractional coins (less than one dollar) of an uncertain legal status.
[26] See note 9 above.

CMBW assume the terms of trade remain unchanged but ignore the fact that the initial mega devaluation generates a significant one time increase in the domestic price of the tradable good. Presumably this would also lead to an increase in output, which would in turn increase the trade balance and lead to higher inflows of dollars. However, for the benchmark case the model's dynamics "are solved without reference to the non-tradable sector" (p.3). The reason is that CMWB assume that the "output of the tradable good is given by a constant endowment" (p.7). In other words, the production of the tradable good does not require labor nor technology and has zero price elasticities. The model parameters remain invariant even though in the real-world producers of the tradable good would have an incentive to increase production. This is a very strong assumption that not only seems to defy basic microeconomics but also magnifies the predictions of their model.

Also, in an economy with a high degree of *de facto* dollarization (like Argentina today or Ecuador in January 2000) it would be highly unlikely for the private sector to have a dollar shortage even under the conditions spelled out by CMBW. In other words, the shortage of dollars affects mostly the central bank. However, in CMBW's model, it is the private sector that must adjust money balances to corrects the dollar shortage. See for example the following statement.

> "Proposition 1 shows that dollarizing when dollars are scarce effectively induces a "sudden stop" that lowers consumption of tradables throughout, creating a surplus in the current account to accumulate dollars… Intuitively, individuals cut their consumption to build up their money balances. Put differently, the shortage of money increases the shadow interest rate, inducing individuals to save. Collectively, these efforts create a current account and trade surplus that increases dollar money balances (p.14)."

There is a contradiction in CMBW's argument. A dollar shortage as defined supposedly requires an increase in money balances (which reduces consumption). But the private sector, which accounts for 80% of money balances, doesn't really have a dollar shortage (at least in Argentina). For the argument to work in the base case, requires two other strong assumptions: a) pre-dollarization dollar holdings are

highly concentrated (significantly more than peso holdings), and b) the banking system will never be able to intermediate those holdings (i.e., private agents with a dollar surplus cannot lend them to private agents with a dollar deficit). CMBW explicitly make this assumption when extending their model to include heterogenous agents and incomplete markets (pp.4-5).

Finally, as we have made it clear in several articles (Ocampo and Cachanosky, 2023), in the case of Argentina, it would not be advisable to move from the current highly regulated and controlled FX regime to a new hard currency regime (dollarization or other) without a transition period, which as a first step would involve the liberalization of the foreign exchange market and the lifting of price controls. With the current relative price structure, the economy will not reach its full potential. Therefore, imposing a monetary straitjacket on this structure would make it more difficult to achieve such goal.

To conclude, CMBW's model predicts that a deep and lasting recession (up to five years or more) would follow if a country dollarized at an "unfavorable" exchange rate in the presence of: a) a permanent borrowing constraint (i.e., no foreign borrowing or investment), b) historically low levels of monetization, c) inflexible prices, d) a highly concentrated tradable sector with zero supply elasticities, e) a banking system that cannot intermediate savings. In this imaginary world, the only mechanism that allows the economy to return to steady state equilibrium is a lasting reduction in the consumption of tradables. It would seem CMBW chose their assumptions about the initial conditions so that the model could yield a pre-specified set of predictions.

We agree that unrealistic assumptions are not problematic if a model yields verifiably accurate predictions. In this case, not only some of the model's assumptions about agent behavior are unrealistic (e.g., no use technology and zero elasticities in the production of tradables) but, more importantly, also about initial conditions. In other words, the model's predictions are only valid in an imaginary world that has little connection with reality. And even though CMBW did not empirically test their model, the available evidence seems to contradict its apocalyptic predictions. When reading CMBW's paper we are reminded of Caballero's warning about "quantitative mathematical formalizations of a precise but

largely irrelevant world" that are "useless as a tool for understanding significant events and dangerous for policy guidance (Caballero, 2010, p.92, 100)."

*Calibration*

CMBW calibrate their model for Argentina and claim that "that the transitional dynamics" (i.e., costs) of dollarization "may be significant." They recognize that given the "large uncertainty regarding the implementation of a dollarization policy, any calibration is admittedly speculative (p.22)."[27] We fully agree with this last statement and would add that the speculative calibration of their model puts into question the validity and relevance of its predictions.

CMBW do not explicitly quantify the dollar shortfall in terms of the difference in the exchange rate before and after dollarization but indirectly through dollarized money balances. For Argentina, CMBW estimate the steady state money balances ($M_0$/GDP) at 5%. They then compare this figure with the levels immediately before and immediately after dollarization, which they estimate at 4% and 2,5% respectively. The "dollarization *cum* dollar shortage" scenario is calibrated using the latter figure, which CMBW consider "a reasonable starting point" (p.22). This would imply a devaluation of the peso of approximately 50%. In other words, they imply dollarization would be effected at the current "informal" (blue) market exchange rate (without having previously eliminated all restrictions). As mentioned in the previous sub-section, dollarization must be effected at the market exchange rate once all restrictions are lifted which does not necessarily have to equal the "informal" exchange rate pre-dollarization.[28]

CMBW claim that the large amount of dollars currently held by the private sector is an irrelevant factor and that the sharp and immediate reduction in the dollar value of $M_0$ at the "unfavorable" rate would negatively affect the public sector, as it would have "to pay the private sector dollars in exchange for pesos that are useless (p.22)." Even if we accepted the validity of the dollar shortage concept, there are

[27] When all the local currency is exchanged for dollars, the central bank no longer has a monetary liability (see Beckerman, 2001, p.25). In such circumstances, monetary circulation is hard to estimate because the inflow of physical dollars is not directly measurable (see Vera, 2007).
[28] As of April,2023, the IMF estimated a real exchange rate overvaluation of between 10% and 25% (IMF, 2023, pp.6,53).

two strong assumptions implicit in this statement that are questionable. First, that dollarization occurs instantaneously. Second, that existing private sector US dollar holdings are irrelevant.

As mentioned in the previous sub-section, even if the dollar were to be imposed as exclusive legal tender (as was the case in Ecuador), dollarization would only occur gradually (how fast would depend on several factors, the most important of which is the conversion exchange rate.) It took nine months in Ecuador to complete dollarization and almost two years in El Salvador.

With respect to the second assumption, CMBW explicitly dismiss the argument that Argentines are already heavily dollarized (p.24). According to the latest official statistics, as of December 31, 2022, total liquidity denominated in US$ or other foreign currencies outside of Argentina or the Argentine banking system amounted to US$ 243 billion (see INDEC, 2023, p.6). This figure does not include undeclared assets. According to some estimates, Argentines hold approximately US$200 billion –some of which are undeclared for tax purposes– in dollar bills within the borders of Argentina (Gorodisch, 2021). CMBW claim that these "aggregate dollar holdings is [sic] not the correct measure of liquidity." Why would aggregate peso holdings be the correct measure for money balances but not aggregate dollar holdings? Supposedly because the distribution of the latter is concentrated among "affluent" individuals. However, the same can be said about peso holdings.[29] Contrary to CMBW's assertion, dollarized money balance in Argentina would not have to adjust upwards following dollarization because Argentines do not have a shortage of dollars. History proves that with a credible regime change, a portion of this liquidity (that portion already declared to the tax authorities) would be repatriated and/or deposited in domestic banks which would lead to a monetary and credit expansion. However, this is impossible in CMBW's world, in which the banking system is never able to fulfill its normal functions, i.e., it cannot intermediate savings. But both the theory and the evidence suggest that after dollarization the level of financial development increases significantly. For example, whereas in 2002 the ratio of bank credit to the private sector to GDP in Argentina and Ecuador were similar, in 2022 it was twice as large in the

[29] For example, according to official statistics, as of March 31, 2023, 22% of the holders of peso denominated time deposits in the Argentine banking system accounted for 86% of total peso denominated time deposits (Information available at https://www.bcra.gob.ar/PublicacionesEstadisticas/Cuadros_estandarizados_series_estadisticas.asp ).

latter. The assumption that financial frictions and markets are invariant to dollarization does not make sense.

Contrary to CMBW's assertion, instead of a sudden stop, dollarization would most likely provoke a massive inflow of dollars and a second monetary expansion through the banking system (this is what happened in Argentina under Convertibility and in Ecuador after dollarization). Also, the private sector currently accounts for 80% of total bank deposits in Argentina. Therefore, any pre-dollarization monetary imbalance, must be corrected by decisions taken by private agents. Finally, following dollarization, base money ($M_0$) will cease to have the meaning and significance usually accorded to it. In fact, it will become increasingly difficult to estimate it with precision.[30] Therefore, whether $M_0$ rises after dollarization, rapidly or gradually, or not at all to a steady state level would be irrelevant. A broader monetary aggregate such as M1 or M2 would be a more appropriate input for the model.

It is worth mentioning that when calibrating their model CMBW do not consider the "*cepo*" (current restrictions on foreign exchange transactions and capital movements) to characterize the initial conditions. They implicitly assume that foreign exchange market is completely liberalized at t=0 or that the prevailing exchange rate is a market rate. The fact that is not the case, raises one of the most complex issues that the incoming government will have to resolve to stabilize the economy.

*Empirical Testing*

According to CMBW, the dynamics of a dollarization in which the domestic currency is converted at an "unfavorable" rate are similar to those of a sudden stop: "a temporary drop in the consumption of tradable goods to accumulate of [sic] foreign currency."[31] An inflation rate significantly above the US compensates for the initial overshooting of the exchange rate.

> "When prices are not fully flexible a recession initially ensues—even when prices are fully adjusted upon announcement of dollarization—because the exchange rate is

[30] "It is not comparable with the monetary base before dollarization, since currency in circulation after dollarization consists of dollar currency not issued by the Central Bank" (Beckerman, 2001, p.25) and Vera (2007).
[31] An economy facing a CMBW's dollar shortage is an economy that that is still suffering the consequence of a sudden stop.

> overvalued, relative to the flexible price equilibrium. This recession eventually gives way to a boom as the economy accumulates dollars and the exchange rate falls behind and becomes undervalued, relative to the flexible price equilibrium (p.3)."

Earlier in the paper, CMBW explain their logic: "tradable consumption falls as agents seek to save to build up their stock of foreign currency. Put differently, the low real money balances raise the domestic interest rate (or shadow rate), and this lowers spending (p.3)." Following this logic, CMBW argue that "given that quantity of money starts below steady state and since the economy does not have access to capital markets, a drop in tradable consumption is required to rebuild money balances." According to CMBW's model convergence to equilibrium is very slow:

> "The price of non-traded goods falls and gradually recovers back to steady state, as money balances are gradually rebuilt… convergence takes a long time: even after 16 quarters (4 years), the stock of money is around 15 percentage points below steady state (p.23)."

Neither of the above statements squares with the facts. Ecuador implemented dollarization at what could be described as an "unfavorable rate" (but not due to a CMBW "dollar shortage", as net foreign reserves were enough to buy the monetary base at the market rate.) Therefore, the logical thing for CMBW to do would have been to test their model against the empirical evidence. As the table below in the Appendix shows, in the case of Ecuador, the key macroeconomic variables moved in a direction that is the opposite of what CMBW's model predicts (see the Appendix).

*Extensions*

CMBW extend their model in two ways. First, they assume that prices are not flexible and the initial price of the non-tradable good is not reset with dollarization (i.e., it is too high). Second, they add agent heterogeneity. With the first extension, the initial recession is deeper and longer lasting. No surprises here. With respect to the second extension, they assume the economy is made up of two groups of agents: "the first group are rentiers specialized in the tradable sector, living off their endowment of the export good (e.g., commodities); the other group of agents is specialized the non-tradable sector,

providing labor to produce non-tradable goods." Another critical assumption is that financial markets are imperfect and incomplete, "so these groups cannot borrow from one another, or insure each other."

Although according to CMBW their model supposedly has universal applicability, it was built with Argentina in mind (the authors in fact are Argentine). Modeling the tradable sector in this manner is questionable on empirical and theoretical grounds.[32] It implicitly assumes that capital and technology are irrelevant and a regime change such as dollarization would have no positive impact on incentives and output.[33] Basically, in the world imagined by CMBW the production of tradables has zero supply elasticity. A similar view has inspired the misguided economic policies that have led to Argentina's economic decline.

Be it as it may, this extension of the CMBW model leads to a strong conclusion: "heterogeneity has non-trivial implications for the aggregate dynamics, but most even more noteworthy is the breakdown across groups. In particular, dollarization may disproportionally hurt the group specialized in the non-tradable sector." In other words, according to CMBW "dollarization *cum* dollar shortage" does not only lead to a sharp and lasting output reduction but also greater inequality, benefiting the "landed oligarchy" at the expense of the masses of urban workers. Ecuador may not serve as a proper empirical test of this hypothesis since its tradable sector is mostly controlled by the State. However, it may be worth pointing out that inequality fell after dollarization.

## 4. Conclusion

In summary, we find that CMBW's contribution to the dollarization debate is limited. Their mathematical model is based on a definition of a dollar shortage that is conceptually unsound and empirically irrelevant. It predicts what would happen in an imaginary world that differs from reality in very fundamental ways. Unrealistic assumptions are not a problem if a model's predictions are

[32] See for example Mundlak, Cavallo and Domenech (1989) for an alternative view.

[33] CMBW assume no change in the terms of trade but ignore the fact that the initial mega devaluation generates a significant one time increase in the domestic price of the tradable good, and presumably, would also lead to an increase in output, which would in turn increase the trade balance and lead to higher inflows of dollars. However, for the benchmark case the model's dynamics "are solved without reference to the non-tradable sector" (p.3). In fact, CMWB assume that "output of the tradable good is given by a constant endowment" (p.7). The model parameters remain invariant even though producers of the tradable good would have an incentive to increase production. This assumption defies basic microeconomics.

verifiably accurate. This is not the case with CMBW's model. Its predictions are contradicted by the available evidence. CMBW's apocalyptic warning of potentially "dire consequences" of dollarizing the Argentine economy is groundless and offers no valuable guidance to policymakers. A more promising and useful line of research would have been to investigate which monetary policy framework and foreign exchange regime can deliver superior results in a scenario in which, to stabilize the economy and establish a solid foundation for sustainable growth, policymakers must exit an unsustainable repressed regime but lack credibility and limited ability to build it in the short time afforded by the electoral calendar. This is the challenge the next government of Argentina will face. The probability of failure is high. There are no easy solutions.

## 5. References


Anker Latin America (2023). "Special Report. Is dollarization viable?", 24 May. Buenos Aires.

Bebczuk, R.N. (2008). "Dolarización y Pobreza en Ecuador," CEDLAS, Working Papers 0066, CEDLAS, Universidad Nacional de La Plata.

Beckerman, P. (2001). "Dollarization and Semi-Dollarization in Ecuador," *World Bank Working Paper 2643* (July).

BCRA (2016). *Informe de Política Monetaria*, Mayo 2016. Buenos Aires: BCRA. Available at https://www.bcra.gob.ar/Pdfs/PoliticaMonetaria/IPM_Mayo_2016.pdf

Caballero, R. (2010). "Macroeconomics after the Crisis: Time to Deal with the Pretense-of-Knowledge Syndrome.", *Journal of Economic Perspectives*, Vol. 24, No. 4, (Fall), pp. 85-102.

Caravello, T. E., Martinez Bruera, P. and Werning, I. (2023). *Dollarization Dynamics*. NBER Working Paper 31296 (June).

Demsetz, H. (1969). "Information and Efficiency: Another Viewpoint," *The Journal of Law & Economics*, Vol. 12, No. 1 (April), pp. 1- 22.

Dornbusch, R. (1976). “Expectations and Exchange Rate Dynamics,” Journal of Political Economy, Vol. 84:6 (December), pp.1161-1176.

Gorodisch, M. (2021). “Cuántos dólares tienen los argentinos: los mayores tenedores fuera de EE.UU.”, Cronista, September 26. Available at https://www.cronista.com/finanzas-mercados/cuantos-dolares-tienen-los-argentinos-en-el-colchon-estiman-que-10-de-los-billetes-en-circulacion/

Ellis, H. S. (1948). “The Dollar Shortage in Theory and Fact,” *The Canadian Journal of Economics and Political Science / Revue canadienne d'Economique et de Science politique*, Vol. 14, No. 3 (August), pp. 358-372.

Espert, J.L. and Maino, R. (2000). “On the relationship between real exchange rate and public spending: The case of Argentina,” mimeo.

Goldfajn, I. and Olivares, G. (2000). “Full Dollarization: The Case of Panama,” *Economía Journal*, Vol.1-No.2 (Spring), pp. 101-156.

Graham, F.D. (1949). *The cause and cure of the dollar shortage*. Princeton, New Jersey: Princeton University Press.

INDEC (2023). “Balanza de pagos, posición de inversión internacional y deuda externa. Cuarto trimestre de 2022,” *Informes Técnicos*, Vol. 7, no 60. Buenos Aires: Ministerio de Economía.

Jacome H., L.I. (2004). “The Late 1990s Financial Crisis in Ecuador: Institutional Weaknesses, Fiscal Rigidities, and Financial Dollarization at Work,” *IMF Working Paper WP/04/12* (January).

Kindleberger, C. (1950). *The Dollar Shortage*. Cambridge, Massachusetts: MIT Press.

Lucas, R. E. (1976). “Econometric Policy Evaluation: A Critique”, pp. 19-46, in Brunner, K. and Meltzer, A.H. (Eds.) *Carnegie-Rochester Conference Series on Public Policy*.

Ministerio de Economía (1993). *Informe Económico. Primer Trimestre de 1993*. Buenos Aires: Ministerio de Economía.

Mundlak, Y., Cavallo, D. and Domenech, R. (1986). *Agriculture and Economic Growth in Argentina, 1913-1984*. Washington, D.C.: International Food Policy Research Institute.

Ocampo, E. (2023). "Dollarization as an Effective Commitment Device: The Case of Argentina", CEMA Serie Documentos de Trabajo, N. 848 (April).

Ocampo, E. and Cachanosky, N. (2022). *Dolarización: Una solución para la Argentina*. Buenos Aires: Editorial Claridad.

Ocampo, E. and Cachanosky, N. (2023). *Dolarización: Una solución para la Argentina.* Available online at https://dolarizacionargentina.substack.com

Sargent, T. J. (1982). "The End of Four Big Inflations," pp. 41–98, in Hall, R.E. (Ed.) *Inflation: Causes and Effects*. Chicago: University of Chicago Press/NBER.

Solt, F. (2020). "Measuring Income Inequality Across Countries and Over Time: The Standardized World Income Inequality Database," *Social Science Quarterly* 101(3):1183-1199. SWIID Version 9.3, June 2022.

Vera L., W. (2007). "Medición del Circulante en Dolarización: Ecuador 2000-2007," *Cuestiones Económicas*, Vol.23, No.2:2-3.

## 6. Appendix: Macroeconomic Data for Ecuador

*Table 1. CMBW model prediction versus Ecuador's dollarization*

| Variable | CMBW model prediction | Dollarized Ecuador |
|---|---|---|
| Output | Decreases | Increased |
| Money balances | Increase rapidly | Increased gradually |
| Real Wages | Decreases | Increased |
| Non-tradable output | Decreases | Increased sharply |
| Trade balance | Increases | Decreased |
| Real exchange rate | Immediate drop | Appreciated rapidly |

*Figure 1. Monthly Index of economic activity*

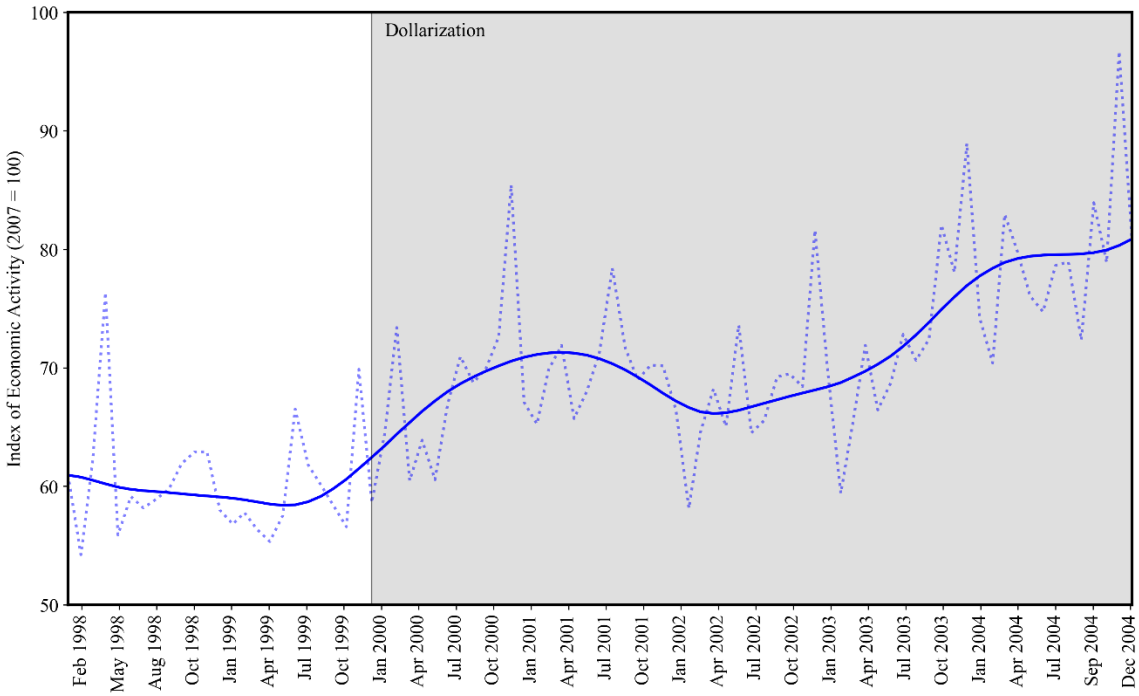


*Figure 2. Tradable and non-Tradable output*

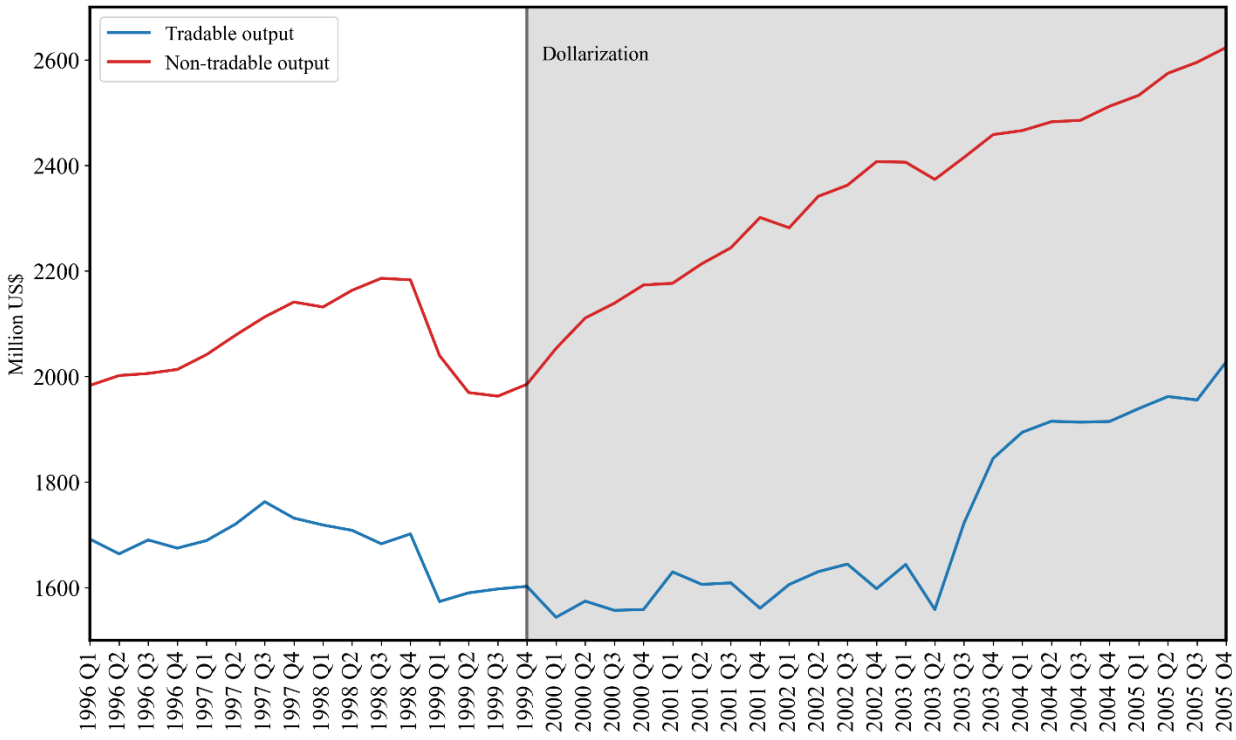



*Figure 3. Money balances (% of GDP)*

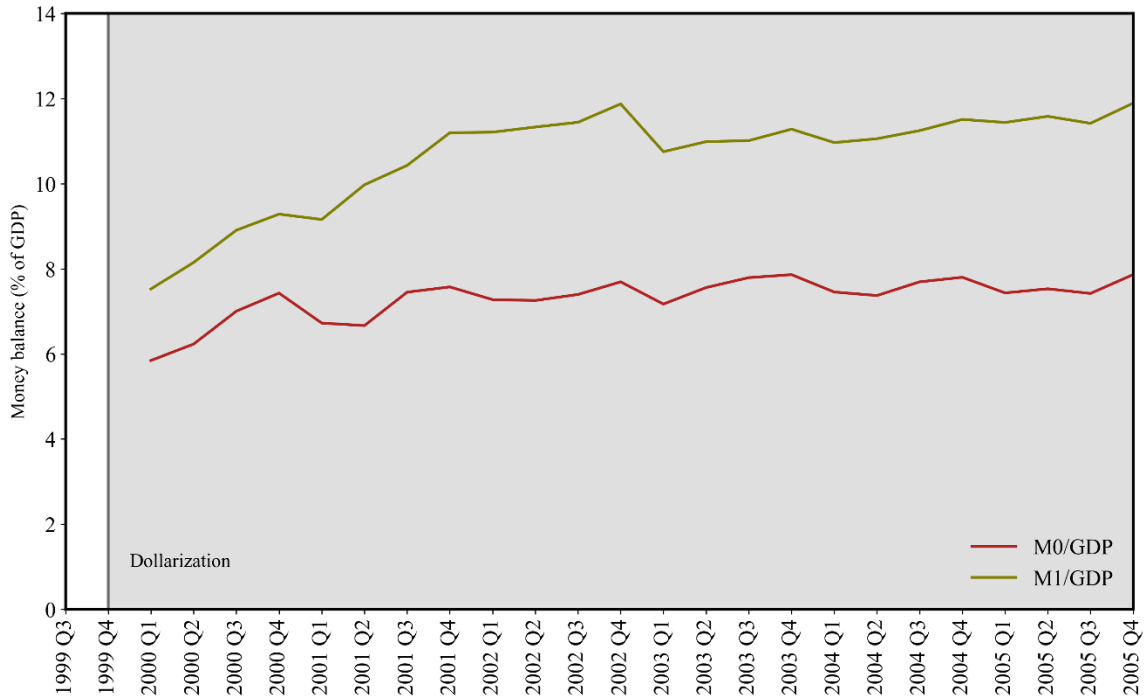


*Figure 4. Current account (millions of current US$), 1990 - 2005*

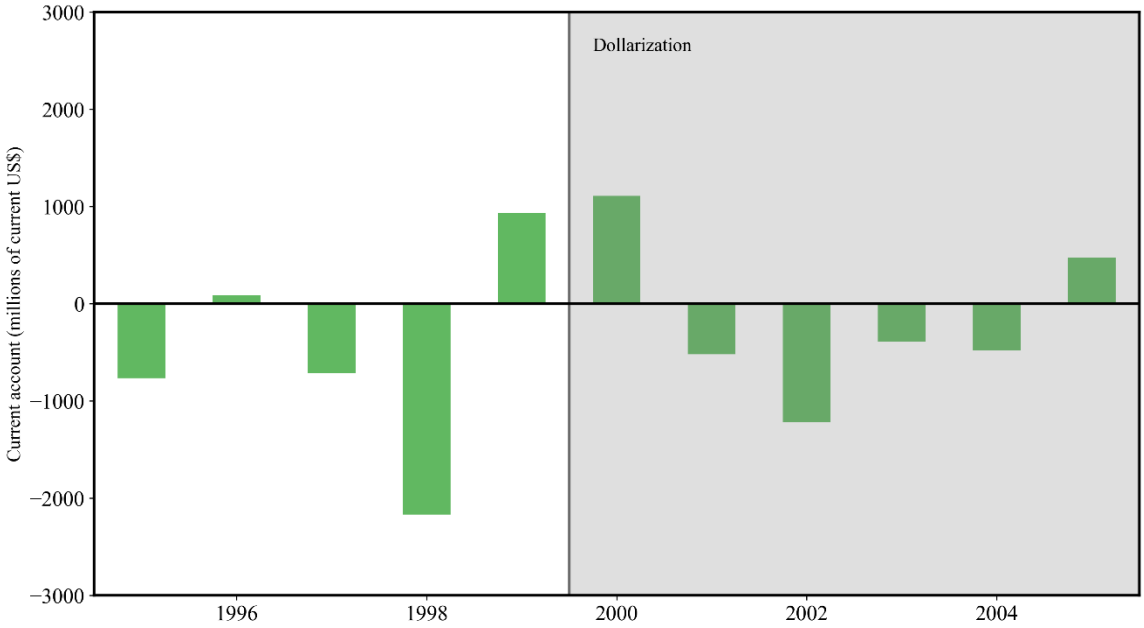



*Figure 5. Real exchange rate*

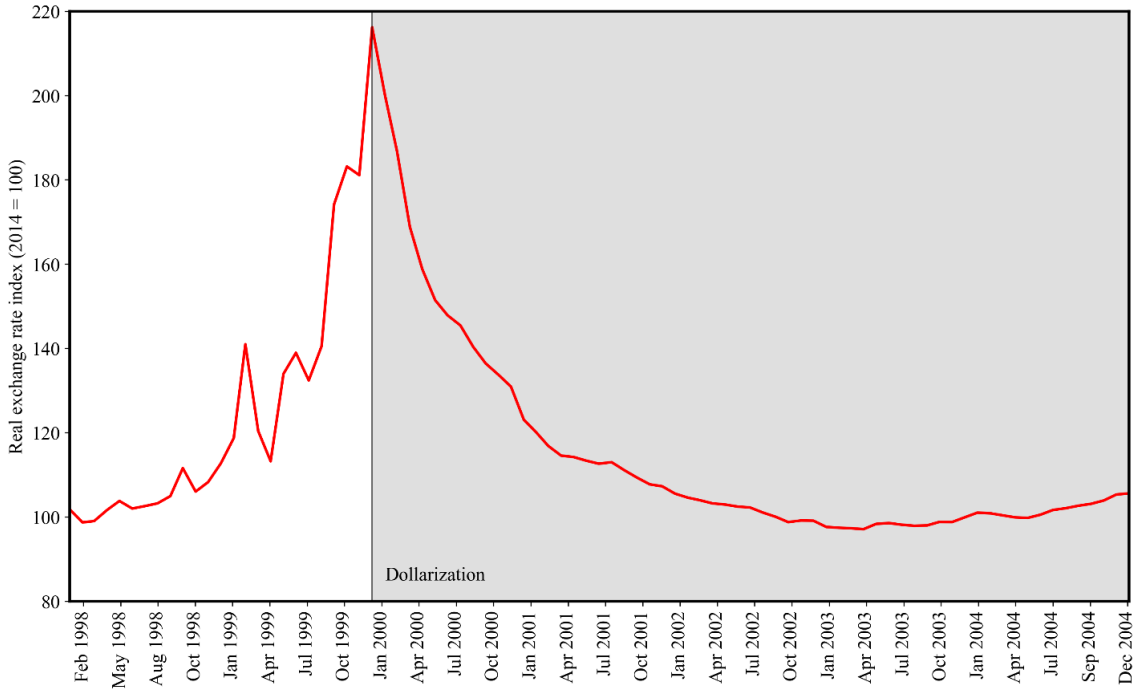


*Figure 6. Real wages*

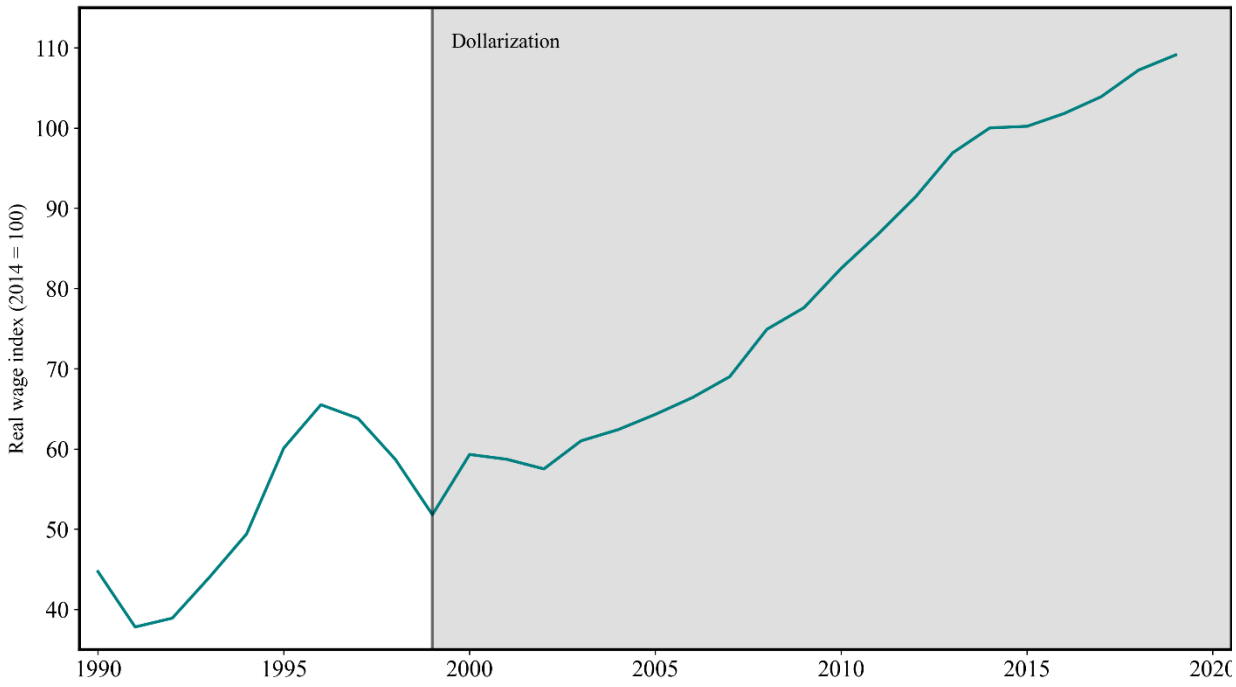
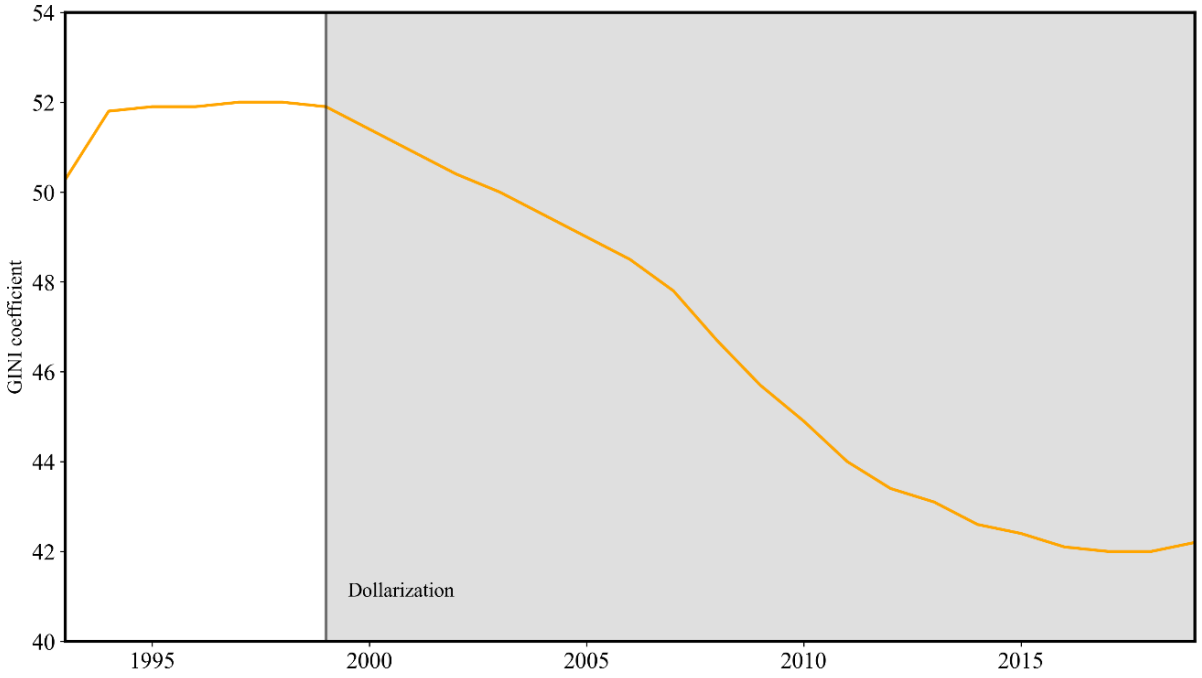



*Figure 7. GINI coefficient*




Source: The source for Figure 7 is Solt (2020). For the rest is Banco Central del Ecuador (BCE