How does being a dollarized economy affect a country in times of a crisis?

Authors:
Carine Bergevin-Chammah, Maria del Mar Domenech, Marta Guasch, Ricard Murillo and Rosa Ripoll

Directors:
Fernando Broner
Antonio Ciccone
Jaume Ventura

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ABSTRACT IN ENGLISH:

This paper analyses how a dollarized country is affected by a financial crisis, since a different response is expected due to the lack of independent monetary policy. The study focuses on the case of the dollarized economy of Ecuador during the 2008 U.S. dollar appreciation amid the financial crisis. In order to assess whether Ecuador had a different response to the crisis compared to its non-dollarized counter-factual, a Synthetic Control Method is implemented. Furthermore, a Structural Vector Autoregression (SVAR) method is used to study the response of the main macroeconomic variables to a nominal appreciation through a Structural Impulse-response Function (SIRF), comparing it to the response to a nominal depreciation in the case of Colombia. The results show that the behavior of Ecuador during the crisis diverges substantially from the response of similar economies. The results in the case of Colombia are in accordance with the IS-LM model, whilst for the case of Ecuador the nominal rigidities prevent prices to adjust immediately, provoking short term fluctuations in real variables. Finally, some policy recommendations are proposed.

ABSTRACT IN CATALAN:

Aquest article analitza com un país dolaritzat està condicionat per una crisi financera, ja que es preveu una resposta diferent a causa de la manca de política monetària independent. L'estudi se centra en el cas de l'economia dolaritzada de l'Equador durant l'apreciació dels EUA dels EUA en el marc de la crisi financera. Per tal de determinar si l'Equador tenia una resposta diferent a la crisi en comparació amb la seva no-dolarització contrafactual, s'implementa un mètode de control sintètic. El mètode d'Autoregresió vectorial estructural (SVAR) de Fur-Thermore s'utilitza per estudiar la resposta de les principals variables macroeconòmiques a una valoració nominal a través d'una Funció d'impuls-resposta estructural (SIRF), comparant-la amb la resposta a una depreciació nominal del cas de Colòmbia. Els resultats mostren que el comportament de l'Equador durant la crisi difereix substancialment de la resposta d'economies similars. Els resultats en el cas de Colòmbia estan d'acord amb el model IS-LM, mentre que per al cas de l'Equador, les rigideses nominals impedeixen que els preus s'ajustin immediatament, provocant fluctuacions a curt termini en variables reals. Finalment, es proposen algunes recomanacions de política.
How does being a dollarized economy affect a country in times of a crisis? Evidence from Ecuador.

Carine Bergevin-Chammah, Maria del Mar Domenech
Marta Guasch, Ricard Murillo and Rosa Ripoll

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Abstract

This paper analyses how a dollarized country is affected by a financial crisis, since a different response is expected due to the lack of independent monetary policy. The study focuses on the case of the dollarized economy of Ecuador during the 2008 U.S. dollar appreciation amid the financial crisis. In order to assess whether Ecuador had a different response to the crisis compared to its non-dollarized counter-factual, a Synthetic Control Method is implemented. Furthermore, a Structural Vector Autoregression (SVAR) method is used to study the response of the main macroeconomic variables to a nominal appreciation through a Structural Impulse-response Function (SIRF), comparing it to the response to a nominal depreciation in the case of Colombia. The results show that the behavior of Ecuador during the crisis diverges substantially from the response of similar economies. The results in the case of Colombia are in accordance with the IS-LM model, whilst for the case of Ecuador the nominal rigidities prevent prices to adjust immediately, provoking short term fluctuations in real variables. Finally, some policy recommendations are proposed.
List of Figures

1. Broad effective exchange rate .............................................. 10
2. Real effective exchange rate ............................................... 10
3. Annual inflation rate ........................................................ 10
4. Inflation response to a NER shock ...................................... 11
5. Trade balance as % of GDP .................................................. 12
6. Imports and exports as % of GDP ....................................... 13
7. Trade balance as a % of GDP .............................................. 14
8. Gap in trade balance over GDP .......................................... 15
9. Trade Balance response to a RER shock ............................. 16
10. Exports and Imports response to a RER shock .................... 17
11. Real GDP growth ............................................................ 18
12. Unemployment rate .......................................................... 19
13. GDP per capita growth % of GDP .................................... 19
14. GDP and unemployment response to a RER shock ................ 20
15. Consumption and consumption change as % of GDP ............. 21
16. Consumption response to a RER Shock .............................. 22
17. Public debt as a % of GDP .................................................. 22
18. Government spending % of GDP ........................................ 22
19. RER response to a NER shock ............................................ 32
20. Exports over GDP .............................................................. 37
21. Gap of exports over GDP ................................................... 38
22. Imports over GDP ............................................................. 39
23. Gap of imports over GDP ................................................... 40
24. Gap of GDP per capita growth ........................................... 41
25. Unemployment growth ...................................................... 42
26. Gap of unemployment growth .......................................... 43
27. Placebo test for trade balance over GDP ............................ 44
28. Placebo test for exports over GDP .................................. 45
29. Placebo test for imports over GDP .................................. 46
30. Placebo test for GDP growth ............................................ 47
31. Placebo test for unemployment growth ............................ 48
1 Introduction

The current crisis in Venezuela has made dollarization resurface as a possible solution to tame its hyperinflation and soaring GDP growth. Currency substitution was seen as the remedy for Latin American countries struggling with currency and fiscal crisis from the end of the 1990’s to the beginning of the 2000’s. At that time, Argentina adopted a currency board that later had to be abandoned, while Ecuador and El Salvador officially adopted the U.S. dollar as their currency and still use it to this date.

The costly reversal feature of the dollarization is attractive for the credibility signaling it gives to international markets, but it is also a monetary policy burden as the country loses the ability of stabilizing the economy through the interest and exchange rates. This is even truer during times of recessions as monetary policy is usually used to stimulate domestic demand. Combined with the fact that the U.S. dollar has a tendency to appreciate during global crises due to its feature of safe asset, dollarization could have important implications for a country during these episodes. The latest episode of a global meltdown in 2008 can help evaluate the impact of being a dollarized economy compared to a country with a floating exchange rate, since the U.S. dollar did appreciate against its main trading partners at the time. This paper will focus on the case of Ecuador and its close neighbor Colombia to evaluate the different impact of the crisis on their main macroeconomic variables in order to help a dollarized economy formulate short and long-term policy to better respond to negative external shocks.

We find that the prediction of the IS-LM model in Colombia holds, hence that the adjustment to the real shock is mainly done through prices as the exchange rate absorbs the shock by depreciating while Ecuador suffers real consequences and has to adjust through fiscal means. Overall during the crisis, Ecuador’s real variables seem to have reacted more than comparable countries to the negative demand shock of 2008 leading to higher increases in government spending. Ecuador’s reserves accumulated throughout the oil price boom have allowed the country to increase its spending without increasing too much its debt. However, we argue that this situation was only possible due to a period of high oil prices and derive some implications for fiscal policy.

The rest of this paper is structured in the following way: section 2 surveys the relevant policies implemented in Ecuador and Colombia during the financial crisis; section 3 reviews the current literature and explains the theoretical framework on which the analysis is based on; section 4 gives a qualitative and quantitative description of the main macroeconomic variables; section 5 recommends policies; and finally section 6 concludes on the main findings and policy recommendations.

2 Description of Ecuador and Colombia’s Economic Context

Apart from geographical location, Colombia was chosen as a comparison country for Ecuador for different reasons. To start with, contrary to Ecuador, it has its own autonomous monetary policy, which is necessary to compare the effect of the dollarization. Concretely, the country follows an inflation targeting regime. Furthermore, both countries export and import the same kind of goods, making them competitors in the international market, therefore they face the same foreign price. Their most important
exports are first crude oil and second, primary products, such as coffee, bananas and cut flowers. On the imports side, the two countries import mainly electronics, vehicles and chemical products, although Ecuador imports more refined petroleum than Colombia. Also, they both rely heavily on the United States as it is their major trading partner. Hence, their trade balance follows a similar path (see Appendix A). Moreover, inflation, unemployment and GDP appear to generally behave similarly for both economies, which allows us to infer that the differences we observe at the time of the crisis is attributable to the different exchange rate regimes.

2.1 Survey of Policies Implemented amid the Crisis

As the effects of the 2008 global financial crisis were being felt in Ecuador and Colombia, they both implemented countercyclical policies to weather through the economic slump. However, given their different exchange rate regimes, they had very different tools available.

Colombia had let its currency float in 2000 and implemented an inflation target band with the objective of regulating inflation and promoting GDP growth. Hence, when the 2008 crisis hit the country, the central bank lowered its interest rate target by 650 basis points to 3.5% (IMF, 2010, p.6). Moreover, following weak exports, the Colombian peso depreciated by 14% in one year, which allowed to cushion the shock on foreign demand. Additionally, the Colombian government increased expenditure on infrastructures and social programs in order help households cope with the crisis (OECD, 2015, p.16).

On the other hand, Ecuador did not have any monetary tool at hand when the country was hit by the crisis, since in 2000 it decided to adopt the U.S. dollar as its official currency. The decision to abandon its past currency, the sucre, was made in the midst of its worst economic crisis, which started in the late 1990s, triggered by a combination of a rapid depreciation of the sucre, an acceleration of inflation, and in particular, the collapse of the banking system (IMF, 2004, p.5). Although Ecuador defaulted on its Brady Bond in 1999, the dollarization of 2000 helped it regain international confidence and lowered significantly the inflation rate. However, the main cost of this solution was the complete loss of monetary independence and seigniorage privilege. Hence, when the 2008 crisis hit, the central bank could only impose a minimum reserve of 45% on banks in Ecuador in order to keep interest rates low and liquidity high (Ray & Kozameh, 2012, p.1). As far as the fiscal policy is concerned, in order to protect domestic firms from cheaper imports brought on by the appreciation of the U.S. dollar, the government imposed a tariff of 8.7% on 23% of its imports of consumer goods in 2008. However, to limit the impact of the crisis and protectionist measures, it also extended social programs such as the housing assistance and conditional cash transfer programs (Ray & Kozameh, 2012, p.14-17). To put this stimulus into numbers, the amount of financing extended to household nearly doubled, while the conditional cash transfer program was expanded by one fourth by outreaching eligible families. This translated into an increase of social welfare spending from 0.7 to 1.8% of GDP between 2006 and 2009 (Ray & Kozameh, 2012, p.12).

On the exchange rate debate in Ecuador, some dissatisfaction was already being expressed in the early 2000’s. Apart from the worries on limited monetary policy autonomy, policy makers had concerns on export diversification since adopting the dollar made Ecuador unable to provide export incentives through exchange rate depreciations and kept the economy dependent on primary products (Drake & Hershberg, 2006,
The large subsidies on oil derivative products (such as regular gasoline, diesel and liquefied petroleum gas) also finances the growth of the industry in the country which makes it harder for Ecuador’s economy to distance itself from commodity shocks (Cueva, 2008, p.8).

In fact, the higher dependency on primary product of Ecuador is shown by the higher export diversification index, where a higher index indicates lower diversification (see Appendix B). For this reason, Colombia is expected to have a higher share of industrial production than Ecuador. However, since 2008, both countries’ industrial production have been decreasing as a share of GDP (see Appendix B). This could be due to the fact that even though Colombia’s exports are more diversified, the country still depends heavily on oil like Ecuador. The global economic slowdown and the subsequent fall in oil prices could explain why industrial production decreased in both countries.

Another debate brought on by the dollarization was the increase in the real exchange rate, which made domestic producers worse off. Although the inflation rate was drastically decreased since the adoption of the dollar, it still remained high and dependent on commodity prices (see figure 3). However, leaving the dollarization would only be an option if there was the option for Ecuador to have a central bank that could credibly manage the currency, which based on past experience can be put into question.

For Colombia, the main monetary issue relates the impact of commodity exports on the peso. The concern is that as Colombia’s commodity exports increase, their currency would appreciate and hurt domestic industries (The Economist, 2009b). Meanwhile, the central bank is trying to keep inflation low and stable which is at odds with the policy needed to keep the currency low, meaning increasing money supply.

3 Theoretical framework and literature review

3.1 The IS-LM model

The model used to analyze the effects of the 2008 crisis and the dollar appreciation is a basic IS-LM model \(^1\). Under this scenario, the equilibrium is defined by the following two equations (respectively, IS and LM):

\[
Y = C(Y, \bar{T}) + I(Y, \bar{r}) + G - IM(Y, \bar{e}) + X(Y^*, \bar{\epsilon}) \tag{1}
\]

\[
\frac{M}{P} = L(\bar{r}, Y^*) \tag{2}
\]

Where \(Y\) is the total domestic income, \(Y^*\) is the foreign income, \(C\) represents consumption, \(T\) stands for income tax, \(I\) represents investment, \(r\) stands for interest rate, \(G\) represents government spending, \(IM\) represents imports, \(X\) stands for exports and, finally, \(\epsilon\) is the real exchange rate, defined as the nominal exchange rate \(E\) \(^2\) multiplied by the foreign price level \(P\) and divided by the domestic price level \(P^*\), and \(\frac{M}{P}\) is the

\(^1\)Similar to the one used in Kandil and Mirzaie (2003).

\(^2\)An increase in \(E\) is an appreciation in the domestic currency.
real money balances, where $P$ is the price level and $M$ is the amount of money in circulation.

The situation analyzed in this paper focuses on the dollar appreciation that followed the 2008 crisis. In the case of an unanticipated real appreciation, the model predicts three main results (Kandil and Mirzaie, 2003). First, in the goods market, an appreciation will make exports more expensive and imports cheaper. This will make domestic products less competitive, compared to foreign products, causing a decrease in domestic output and prices. Additionally, the fall in the price of imports implies also a shift in domestic consumption. Foreign goods are now cheaper for domestic consumers, reducing the demand for home products. This could imply higher unemployment as the reduced demand also reduces domestic output. Second, in the money market, the appreciation of the domestic currency implies a higher interest rate which will decrease the demand for domestic currency. This decreases the interest rate and moderates the contraction of aggregate demand and therefore the reduction in output and prices. Third, regarding the supply side, the shock will decrease the cost of intermediate goods, which decreases the cost of production (and therefore also the aggregate price level), and increases output.

Next, some theories and findings in the literature regarding the impact of fluctuations in the real exchange rate on some macroeconomic variables of interest will be presented. Additionally, a review of the literature regarding the advantages and disadvantages of the dollarization will also be presented.

**Impact of real exchange rate fluctuations on inflation**

The theory of exchange rates identifies two different channels through which they can affect inflation, depending on the source of the shock (Riksbank, 2016, p. 31). First, a change in terms of trade driven by a depreciation makes imports more expensive impacting both consumer good prices and intermediate good prices, increasing production costs and again increasing the price of consumer goods. Neokeynesian theory suggests that this makes the country’s goods cheaper for the rest of the world, positively affecting foreign demand and thus increasing the domestic economic activity, which leads to inflationary pressures. Therefore, according to this channel, the real exchange rate and inflation rate are negatively correlated. Second, a negative shock in world demand can lead to a depreciation of the domestic currency, which could decrease the price level due to the slowdown of the economic activity (Riskbank, 2016, p.31-32).

Moreover, the effect also depends on the persistence of the change of the exchange rate and the expectations of economic agents. When changes are persistent, firms are more likely to change their prices, while temporary fluctuations are more likely to have no effect on price changes (Riksbank, 2016, p.32). Additionally, inflation expectation impacts price changes through the behavior of agents in the economy. Higher expected inflation will be reflected in contracts with firms and lead to an increase in production costs, hence in consumer price.

**Impact of real exchange rate changes on trade balance**

One of the salient issues in economic policy, especially in developing countries, is the task of setting the exchange rate since it reflects a country’s trade competitiveness...
(Gómez and Alvarez-Ude, 2009). When defining it, one of the most important effects to take into account is the responsiveness of the trade balance.

Previous literature has extensively analyzed the impact of the real exchange rate on trade balance with the so-called J-curve framework and the Marshall-Lerner condition. According to the latter, a devaluation of a currency will improve the country’s trade balance only if the sum of the price-elasticities of exports and imports exceeds unity, hence if exports and imports react strongly to price changes. If it does not, a devaluation can worsen the trade balance. On the other hand, the J-Curve reflects how a devaluation of a country’s exchange rate affects the trade balance taking into consideration a dynamic view, that is, it analyses how trade balance is affected over time. This curve shows that immediately after the currency devaluation the trade balance worsens because the volume of imports and exports do not adjust immediately due to the short-run inelasticity of demands. Afterwards, however, the demand starts reacting: domestic demand shifts from foreign to domestic production due to the higher price of imports, and in the same way, foreign demand of domestic exports also starts increasing because of lower export prices. In conclusion, the J-Curve reflects how there will be first a deterioration of the trade balance, followed by a recovery, which will improve the trade balance to a higher level compared to the one before the devaluation (Abbas, Johari and Haji, 2014).

There is an important number of papers that have tested the Marshall-Lerner condition and the J-Curve. However, these show no clear empirical results on the effect of exchange rates on the trade balance (Baharumshah, 2001). This might happen because previous studies have used different methodologies and different time of periods for identical countries to address this analysis (Stučka, 2004).

Impact of real exchange rate changes on output, consumption and unemployment

According to Keynesian models, a real exchange rate depreciation has been seen as a tool for improving output in the short run. As it has already been exposed, when a country has a cheap currency, imported goods are more expensive for it, which in turn fosters domestic and foreign demand for home products and can increase total production and employment. As it has been proved by previous literature, consumption is highly procyclical, and therefore it is expected to follow a path similar to output fluctuations: an appreciation is expected to decrease consumption, whereas a depreciation leads to a temporal increase of this variable. Nevertheless, much literature has found contradictory evidence regarding the predictions of the model.

Krugman and Taylor (1978) found, within a Keynesian model, that a decrease in the real exchange rate can have contractionary effects for output, given a certain set of conditions. Also, Ozturk et al. (2008) found that in the long run a depreciation of the real exchange rate only affects 9 out of 23 OECD countries. Among the countries affected, in six of them the effect was contractionary and in the other three the effect was expansionary. In the same line, Sheelay (1986) uses a cross-country time series data for different Latin American countries to determine the relation between inflation and real exchange rate on output. He finds out that for these countries, a devaluation has, on average, a contractionary effect.
3.2 Dollarization

The literature on dollarization emerged in the beginning of the 2000’s when a wave of countries experienced both full and partial dollarization. Full dollarization is the case of interest of this paper, and hence will be the focus of the following discussion. Dollarization is defined as the official adoption of a foreign currency and more precisely, the adoption of the U.S. dollar. This exchange rate regime is a solution for countries suffering from hyperinflation and deep recession simultaneously.

To start with, the enhanced credibility and management given by adopting the U.S. monetary policy lowers the interest rates and restores international confidence, which in turn reduces inflation and fosters growth (Dornbusch, 2000, p.5). With respect to inflation, agents expect lower inflation in the country that abandoned control of their monetary policy to adopt the U.S. dollar, since the Federal Reserves has credibility in having low stable inflation rate. This lower expectation translates into low inflation as well. This channel is especially strong for countries with a history of hyperinflation (Quispe-Agnoli, 2002, p.7). In fact, Edwards and Magendzo (2001, p.15) find that the average difference in the inflation rate between dollarized and non-dollarized countries ranged from 3.4% to 5.7% per year, while the mean and median GDP growth was 1% lower in dollarized economies. This fact may be explained by the impossibility of dollarized countries to accommodate to external disturbances. The author suggests that this correlation is not conclusive, since it is based on historical data of few dollarized countries and that there were difficulties finding a comparison control group.

On the other hand, there exists a vast literature on the effects of dollarisation on trade. First, an important indicator to take into account is the exchange rate volatility. When exporting and importing with another country, firms look for stability in prices. If changes in the exchange rate between two currencies is unstable, it creates uncertainty in the final price at which firms sell their products, and hence, the profits to be made. Moreover, hedging against this risk is costly and not accessible to all traders. Overall, a larger number of studies seem to conclude that exchange rate volatility reduced the level of trade (Ozturk, 2006). In this sense, Obstfeld and Rogoff (2000) maintain that the exchange rate volatility can be interpreted as a market imperfection.

Third, the adoption of the US dollar should increase international trade vis-à-vis the United States and the rest of the world, although findings are still inconclusive. It is possible that a currency union would make trade between two or more countries more stable compared to trading with countries with another currency and therefore, sharing the same currency could foster trade between two different countries. In this respect, Rose (2000) uses a cross-country panel data comparison to find that countries with the same currency tend to trade three times as much as they would with different currencies, while Klein (2002, p.17) examined the case of dollarization in particular and did not find significant evidence that it increases bilateral trade between the dollarized country and the United States. Beside, Alessina, Barro and Tenreyro (2002) discusses the optimality of currency unions. In accordance to the previous research, they find that sharing a common currency increases the trade between these countries. Also, they point out that a currency union between two countries will be beneficial if before sharing the currency, countries already trade substantially.

Finally, the high cost of reversing full dollarization makes this regime more credible than a simple peg in the long-run and eliminates the risk of currency attack. However, the loss of seigniorage implies that the government must turn to other sources of fiscal
revenue. On the other hand, the decrease in interest rates will reduce the debt servicing burden compensating for the loss of in seigniorage (Dornbusch, 2000, p.2).

4 Analysis of Important Economic Indicators

This section is aimed at offering an overview of the main economic variables affected by the exchange rate regime during a global crisis like the one in 2008. As explained previously, in the second half of 2008 an important dollar appreciation took place and Ecuador suffered a significant change in its real exchange rate. Therefore, this provides an excellent opportunity to analyze whether a dollarized country is impacted differently by a global crisis, compared to a non-dollarized country.

In order to undertake the analysis, data has been collected from different sources and a database has been constructed containing different monthly time series covering the period of January 2000 to October 2016. The database used is from the following sources: International Monetary Fund (IMF); the World Bank; OECD; Eurostat; and some Central Banks’ websites, among which are the Banco Central de Ecuador and the Banco de la República de Colombia. More details on the data sources and the variables used to do the analysis can be found in Appendix D.

So as to assess whether the response to the crisis of some macroeconomic variables in Ecuador is different from non-dollarized countries, we first present a qualitative analysis of the main variables around the crisis and follow with a synthetic control method, which constructs a counter-factual Ecuador to illustrate the evolution of the variables as if it had not been dollarized. In order to construct the synthetic control method, developed countries and countries that do not have a floating exchange rate have been excluded. Moreover, four approaches have been implemented: first, using data on developing countries, second, restricting it to Latin American economies, and for the two remaining we repeat the same analysis controlling also for quality of institutions and corruption.

Finally, we complement the case study with a SVAR approach modeling the responses to the shock in the real exchange rate during the crisis, meaning an appreciation in Ecuador and a depreciation in Colombia. This method contrasts with the synthetic control method by offering a description of the evolution of each variable as a response to the specific shock to exchange rates.

4.1 Nominal effective exchange rate, real effective exchange rate and inflation

As our theoretical framework indicates, under a flexible exchange rate regime, a negative shock to world demand like the one in the 2008 meltdown decreases the demand for the country’s currency and makes it depreciate.

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3 The vertical dashed line in the following graphs indicates the start of the U.S. dollar appreciation in July 2008.
4 Different SVARs and their corresponding IRF were computed for Ecuador and Colombia.
5 See appendix E and F for a more detailed explanation of the methodology.
Figure 1 illustrates exactly this effect for Colombia, yet the opposite effect happened to the U.S. dollar due to its status of safe asset, meaning Ecuador faced a nominal appreciation⁶. As for the real effective exchange rate, it can be seen in figure 2 that this indicator follows the same trend as the nominal effective exchange rate, which is in line with the theory and indicates that Colombia’s exports must have been much more competitive than Ecuador’s, while Ecuador’s foreign purchasing power should have increased during that period. However, it seems that inflation reacts opposite to theory for Ecuador, as the appreciation should have been linked with lower inflation, and as we can observe in figure 3, in 2008 there was an increase in price levels in both countries.

Nevertheless, one cannot conclude that the fluctuations in the price level in Ecuador and Colombia were due to the movements in their nominal exchange rates. In fact, a closer look to figure 3 shows that movements in inflation in Ecuador and Colombia seem to follow movements in the West Texas Intermediate oil prices. This suggests that the worried of both economies regarding their heavy reliance on primary commodities might be justified. Hence, even though Colombia had the power to incentivize its exports through the exchange rate and managed to diversify them more than Ecuador, it is still as prone to variations in commodity markets.

In order to analyze the real direction of the effect of the nominal exchange rate fluctuations on price level, a SVAR analysis is conducted⁷. It estimated the effect of a

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⁶The exchange rates used are broad effective rates calculated as weighted averages of bilateral exchange rates. This measure is used because it allows to assess the competitiveness and trade capability of a country.

⁷In order to construct the Cholesky decomposition required for the SVAR and its IRF, some
1% nominal appreciation and depreciation to inflation rate in Ecuador and Colombia, respectively. The reasoning underlying this estimation is that Ecuador suffered an appreciation in 2008, whereas Colombia underwent a depreciation.

Results in figure 4 show that a nominal depreciation only has a significant effect in the case of Colombia, where it leads to an increase in the inflation rate of approximately 0.05% as theory predicts. The response is however not immediate since the increase in inflation rate is significant only after approximately two months, pointing at the presence nominal rigidities, and lasts for a minimum of two more months. Therefore, prices adjust more in Colombia that in Ecuador as a response to nominal exchange rate fluctuations. Apart from the fact that, contrary to Colombia, Ecuador has no control on its price level and might not be able to adjust to price shocks, another potential explanation for this phenomenon is the higher degree of competition that exists among Colombian firms. In fact, the market concentration index, the Herfindahl-Hirschman Index (HHI), is in average higher in Ecuador than in Colombia. As a consequence, one can expect prices to be stickier in Ecuador since firms have higher market power.

![Figure 4: Inflation response to a Nominal Exchange Rate shock](image)

Inflation response to a 1% increase (decrease) in the NER of Ecuador (Colombia). Data taken from Banco Central de Ecuador and Banco de la República Colombia

As it has been exposed, prices adjust faster in Colombia than in Ecuador which could be explained by the inability of Ecuador to adjust prices and by its lower degree of competition. This might imply that it is especially important for Ecuador to incentivize market competition among firms, as this would improve the extent to which firms adjust prices to nominal exchange rate fluctuations. Moreover, the high correlation between inflation and commodity prices brings more uncertainty and diminishes the stability given by the U.S. dollar. A higher diversification of its export could help reduce the link with commodities and bring more stability in the inflation rate. Although the channel of devaluation is not available for Ecuador, it could replace at minimum remove its oil subsidy which incentivizes the growth of this industry.

short run restrictions have been imposed. In concrete, the inflation and the real exchange rate are assumed not to influence the nominal exchange rate, and the real exchange rate not to have an effect on inflation.

8We focus more on the trend of the variables rather than the actual numbers as the relationship with exchange rates might not be linear, making the conversion of the results into actual number more complex.
4.2 Analysis of real variables

In order to verify the consequences of exchange rate fluctuations on real macroeconomic variables, the response of the real exchange rate to a change of the nominal exchange rate must be identified. Therefore, a first analysis has been made to show that a nominal appreciation (depreciation) leads to a real appreciation (depreciation) in both countries. Indeed, results demonstrate that this link exists and can be consulted in Appendix E.1. Hence we can now conduct our analysis on our variable of interest using the real exchange rate.

Trade Balance, Exports and Imports

The first question to be answered is how the trade balance reacts to fluctuations in the real exchange rates of both economies. From figure 5, it can be seen that the trade balance as a percentage of GDP was smoother for Colombia than for Ecuador between 2007-2010. In the middle of the crisis, when the U.S. dollar started appreciating, Ecuador’s trade balance over GDP decreased by about 18 percentage points, while in Colombia it decreased by less than 5 percentage points. This finding seems to point to the shock absorbing function of a free floating exchange rate regime. This effect on the trade balance is relevant since this large negative shock implies loss of revenues for exporting firms and a dampening of the national income.

However, it could be that this decrease in the trade balance reflects not only a decrease in exports but also an increase in imports. This would indicate an increase in consumption due to a greater purchasing power of Ecuadorians given by the appreciation of the US dollar and an increase in welfare.
Yet, figure 6 shows that the ratio of imports over GDP also decreased drastically for Ecuador, almost twice as the decrease in Colombia. Hence, exports had to decrease by much more than imports to have its trade balance decrease in total. This drop is hard to explain only on the basis of the inelasticity of imports found in the literature (Kandil, 2009, p.162). It could be that the imposition of import tariffs on consumer goods in 2008 had a greater effect on import demand than the appreciation (USTR, 2010 p.1), and as a result, imports decreased due to the higher price faced by Ecuadorians. This also helps explain the worsening of Ecuador’s terms of trade amid the appreciating U.S. dollar (see Appendix C). Therefore, it seems as if Ecuador was not able to counteract the impact of the crisis on its trade sector as well as Colombia did since its currency could not absorb part of the negative demand shock through the depreciation.

In order to analyze how the trade balance of Ecuador could have reacted to this shock in 2008 if it had not been dollarized, we use a synthetic control method analysis. As explained in the Appendix F, four different counter-factuals have been built. Figure 7 allows us to see that the reduction in the trade balance of Ecuador would have worsened if it had not been dollarized. The results for the four counter-factuals look very similar, meaning that the countries with positive weights are similar in the four different specifications. Also, we have computed the difference between the trade balance of Ecuador and its counter-factual before and after the appreciation (see figure 8). When plotting it, ideally, before July 2008 the graph should be around zero, and after this period, we should observe a negative gap between the line and the x-axis, which would mean that the decline in the trade balance suffered by Ecuador is larger than for its counter-factual. As it can be observed in the graph, before July 2008 the graph is around zero in the four different specifications, meaning that it is properly matched, and after the appreciation, for all the counter-factuals a difference of more than -10% is observed. This results matches our preliminary analysis. To check the robustness of this results, we have conducted robustness tests for every variable (see Appendix F figures 27-31).
The intuition for this result is that the synthetic control group includes countries whose currency can depreciate in times of crisis, which fosters exports and smooth the decrease in the trade balance over GDP. This is why the control group can be interpreted as the reaction Ecuador would have had if it fully controlled its monetary policy.

Notes: The explanatory variables used for graphs a) and b) were real exchange rate, inflation, terms of trade and different pre-treatment periods. Graphs c) and d) include also the Gini index as a corruption indicator.
Next, we attempt to focus on whether this decrease in the trade balance is driven by a decrease in the exports, given that Ecuador’s exports are now more expensive, or an increase in the imports, as the appreciated currency can foster imports.

In figure 20 (see Appendix F) it can be observed that exports of Ecuador decrease more than the counter-factual created by this method. In the same line, figure 21 shows that the difference between Ecuador and the synthetic group since is close to zero before the 2008 appreciation, but right after July 2008, the gap between Ecuador and its counter-factual increases, meaning that Ecuador would have been able to export more if it had not been dollarized.

Finally, when imports over GDP are analysed, it appears in figure 22 that as expected by the theory, during the appreciation of the currency Ecuador’s imports over its GDP were higher than its counter-factual. It is remarkable that this difference is persistent over time. Nevertheless, when the indicators of inequality and corruption are included in the matching, the difference between Ecuador and its counter-factual becomes smaller.

\footnote{When matching this extra variables, we are imposing that an alternative Ecuador with its own currency would have similar Gini and corruption index over time, so that it is possible to capture}
Nevertheless, one cannot still assess whether the decline in the Ecuador’s trade balance is due solely to the appreciation occurred in 2008 or to the crisis itself. Hence to verify that we turn to our SVAR analysis.

As seen in figure 9, the trade balance of the two economies react very differently to the shocks. With regards to Ecuador, a J-curve is observed: first, the trade balance reacts positively to a real appreciation, due to the fact that prices are relatively higher, which increases revenues from exports. In a second step, foreigners adjust the quantity they purchase due to the increase in prices, which deteriorates significantly the trade balance for at least 20 months.

For the case of Colombia, the trade balance appears, first, to decrease, following the common J-curve, and then to increase, although non-significantly. This means that, if a nominal depreciation was implemented with the objective to depreciate the real exchange rate and therefore to improve the competitiveness of the exporters during the period studied (2000-2016), the policy was not effective in the sense that it does not appear to have lead to an improvement in the trade balance. This might be explained by the fact that Colombian competitors might also have depreciated with the same objective, which offsets the increase in the competitiveness of Colombian firms.

Another reason one can think of to explain this effect is the lack of compliance with the Marshall-Lerner condition. This theory requires the sum of the price elasticities of the demand for imports and exports to be greater than one in order to observe an improvement of the Trade Balance as a response to a real depreciation. As a consequence, one can expect the demand for exports or imports to be very inelastic in Colombia.

Overall, although the trade balance of Colombia does not improve following a depreciation, its reaction is in general more desirable for the economy than for the case of Ecuador, since in the latter we observe a worsening in the trade balance due to the appreciation of the currency.

Figure 9: Trade Balance response to a RER shock

![Figure 9: Trade Balance response to a RER shock](image)

Trade Balance response to a 1% increase (decrease) in the RER of Ecuador (Colombia).

Data taken from Banco Central de Ecuador and Banco de la República Colombia.
Figure 10: Exports and Imports response to a RER shock

![Graphs showing exports and imports response](image)

Figure 10 presents the results for the SVAR separating for exports and imports. As it can be observed, in the dollarized economy exports experience a high volatility and a slight decrease after experiencing the appreciation. Then, after 6 months, they stabilize to the previous growth level. During the first phase, the expected increase in exports revenues is not observed. This might be due to the fact that US is the major trading partner for Ecuador: since they share a same currency, the appreciation will have no effect on their trade. During the second phase of the J-curve the expected decline in the revenues from exports are only observed briefly around 4 months after the shock. A possible reason that might explain this fast recovery is the fact that Ecuador, an economy using a strong and credible currency, might have more stable trade, less subject to exchange rate fluctuations.

In the case of the Colombian depreciations occurred during the period analyzed, we observe a first decrease of approximately 0.002% of the growth rate of exports revenues during the first 3 months after the shock, followed by a brief increase of 0.002% approximately. After that, the increase in the variable is not significantly above zero. This might be due to the fact that other competitors might tend to depreciate their currency simultaneously, leading Colombian exporters to lose their potential competitive gain. Therefore, although the J-curve is observed, the underlying benefits of it are not of a significant magnitude.

With respect to imports, the theoretical view suggests that a real appreciation should lead to an increase in this variable, following a first brief decline due to the relative decrease in prices. In Ecuador, the SVAR suggests that a real appreciation causes an initial and brief decline in imports, but the following increase is not of a significant
magnitude. Indeed, data from developing countries have shown that the response of their imports to a real appreciation is not significant in absence of growth incentives. In Colombia, there is no evidence that the depreciation causes any fluctuation in imports growth, probably due to the inelasticity of the demand for imports in this type of economy.

**GDP growth and unemployment**

Due to the countercyclical behavior of the unemployment rate, the two variables are studied together.

Having the U.S. dollar as the national currency could either impose a drain on the real GDP growth of Ecuador during the crisis due to the lack of monetary policy tools, the absence of the shock absorption mechanism through a monetary expansion and the loss of international competitiveness of exports, or it could help recover faster through the market reliability given by the U.S. dollar. As seen previously, the channel of cheaper imports is not observed due to the tariffs imposed, thus consumption is not increased through cheaper imports. As the drop in consumption, exports and GDP growth was larger in Ecuador, unemployment rate is expected to increase more than in Colombia. Figure 12 indicates that the rise in unemployment was indeed sharper in Ecuador than in Colombia. However, Colombia’s systematically has had a higher unemployment rate. This could be linked to a different structure of the labor market which are beyond the scope of this paper.

![Figure 11: Real GDP growth](image)

The data reveals a slower recovery for Ecuador as from the last quarter of 2008 to the second quarter of 2009 it experienced negative growth, while Colombia had negative growth for only one quarter and of about the same magnitude.

As in the trade balance analysis, to see how the GDP growth would have reacted if Ecuador were not dollarized, we have used the Synthetic control method. In this case the explanatory variables used are real variables, such as unemployment and industrial production. All variables used were quarterly growth rates. Again, four different counter-factuals have been constructed.

---

Figure 12: Unemployment rate

![Unemployment Rate Graph]

Data taken from Banco Central de Ecuador and from Banco de la República Colombia

Figure 13: GDP per capita growth

(a) All countries

![GDP per capita Growth All Countries Graph]

(b) Latin America

![GDP per capita Growth Latin America Graph]

(c) All countries - Institutions variables

![GDP per capita Growth All Countries Institutions Graph]

(d) Latin America - Institution variables

![GDP per capita Growth Latin America Institutions Graph]

Notes: The explanatory variables used for matching graphs a) and b) were unemployment growth, industrial production growth, exports over GDP growth and different pre-periods periods. Graphs c) and d) include also the Gini index and a corruption indicator.
Figure 13 shows us that the GDP growth if Ecuador would follow a similar drop during the financial crisis if it was not dollarized. Nevertheless, after several quarters, the growth rate of Ecuador seems to be lower than the growth rate of its counter-factual, meaning that the recovery is weaker in the dollarized economy.

Unfortunately, we have not been able to use the synthetic control method for the case of the unemployment rate. This variable behaved very unusually during the period 2000-2008, so it is not possible to build a counter-factual. This may be due to some particularities of the Ecuadorian labor market. Nevertheless, the graphs for unemployment can be found on the Appendix F.

With regards to the SVAR for the case of GDP, the theory is only complied with in the case of Ecuador. We find evidence of a significant decrease of the GDP growth of about 0.0005% that lasts for a minimum of twenty months in figure 14. This reaction does not take place until two months after the shock takes place. In Colombia, GDP growth does not seem to react to the real depreciation. This result is in accordance with the previous results, since there is no evidence in favor of an improvement of the trade balance after a real depreciation. The reaction of the unemployment rate is very similar to the one observed for the case of the GDP growth: in Ecuador, the rate increases significantly for 20 periods approximately, by an initial magnitude of more than 0.005%. The reaction does not take place until 1 month after the shock is observed. In Colombia, the shock produces an increase in the uncertainty in the unemployment, but there is no evidence that the rate is decreased due to a depreciation.

![Figure 14: GDP and unemployment response to a RER shock](image)

GDP and unemployment response to a 1% increase (decrease) in the RER of Ecuador (Colombia).

Data taken from Banco Central de Ecuador and Banco de la República Colombia
Consumption

Now, we turn to look at the evolution of consumption in both countries. Given that the dollar in Ecuador did not give an advantage over Colombia through higher purchasing power, it is then expected that consumption decreased in both countries due to lower imports and decreased exports income. As exports in Colombia did not decrease as much as in Ecuador, it could even be that consumption over GDP decreased less than in Ecuador.

Indeed, figure 15 reveals exactly this finding. As soon as the U.S. dollar started appreciating in mid-2008, consumption decreased sharply by about 1 percentage point more than Colombia. Moreover, the pattern of consumption growth, in general and during the crisis, shows greater volatility in Ecuador indicating that the dollarization had constraining effects. As Colombia uses a combination of monetary and fiscal policy, it responds to shocks through different channels, which seems to have smoothed out consumption patterns better than Ecuador, which could only respond to the crisis through fiscal policy. This means there was more instability in the welfare of Ecuadorians at the time of the crisis.

As for the results obtained with the SVAR method are in accordance with the ones obtained for GDP and unemployment in Ecuador (see figure 16): the real appreciation leads to a decrease in consumption that is visible three months after the shock and that lasts for about nine months. In contrast, the Colombian economy is not affected in terms of consumption as a response to a real depreciation. This should come from the fact that all real variables do not react significantly to a real depreciation, while the price does. This confirms the conclusion of the IS-LM model for economies with floating exchange rate: with an negative external shock, the currency depreciates moderating the impact on GDP and consumption by increasing exports.

Public debt over GDP

The Ecuadorian government seem to hold sound fiscal practices as its internal debt only rose by 1 percentage point despite the increased spending while Colombia’s total public debt was rising through out the crisis period (figure 17). However, this hides the fact that Ecuador’s fiscal stimulus was mainly financed through the reserves it accumulated during the oil price boom (Ray & Kozameh, 2012, p.5).
Figure 16: Consumption response to a RER shock

Consumption response to a 1% increase (decrease) in the RER of Ecuador (Colombia).

Data taken from Banco Central de Ecuador and Banco de la República Colombia

Figure 17: Public debt over GDP

(a) External debt over GDP
(b) Internal debt over GDP

Data taken from Banco Central de Ecuador and Banco de la República Colombia

It must be noted however, that the sharp decrease in Ecuador’s external debt in 2008-2009 is due to a default on the Global 2012 and Global 2030 bonds that were deemed illegitimate by an auditing commission. The restructuration involved steep haircuts, where Ecuador repurchased the bonds at 35 cents on the dollar (The Economist, 2009a).

Figure 18: Government spending over GDP

Data taken from Banco Central de Ecuador and Banco de la República Colombia
Moreover, figure 18 illustrate the spike in government spending amid the crisis in Ecuador, which is much more pronounced than in Colombia. Hence, it confirms that instead of adjusting to the crisis through a combination of monetary and fiscal policy, a dollarized country shifts all its resources to fiscal policies.

5 Policy recommendations

Bearing in mind the results obtained, there is evidence that in Colombia the IS-LM model is complied with when there is a nominal depreciation, which is due to the price flexibility underlying the economy. This provokes the real variables not to react substantially as a response to the variability in the exchange rate. In contrast, Ecuador does not show the same pattern, given the lack of significant response of prices to nominal fluctuations in the exchange rate. As a consequence, when an appreciation happens, as in the case of the financial crisis, the macroeconomic variables worsen in the short run, until the shock vanishes. One possible explanation of this effect is the lower level of competition present in the Ecuadorian economy. This allows firms, which have greater market power, not to adjust to nominal exchange rate fluctuations.

In consequence, the Ecuadorian government should incentivize competition among firms to make companies adjust to nominal exchange rate shocks through prices. This is especially important in the case of a dollarized economy since it has no control over its prices, whilst Colombia, through its monetary policy, can influence its inflation rate.

Regarding the trade balance, the main obstacle to Ecuador’s exports is related to the lack of the capacity to depreciate to incentivize competition. An alternative for the government is to introduce fiscal benefits to incentivize exports. By improving its exports, Ecuador’s trade balance’s performance would improve in time of crisis and dollar appreciation and its negative effects would be smoothed.

As it has already been pointed out, dollarization leads to a lower degree of diversification, since the exporting sector cannot be incentivized through monetary policies. Moreover, the high correlation between inflation and commodity prices brings more uncertainty and diminishes the stability given by the U.S. dollar. A higher diversification on Ecuador’s exports could, then, help reduce the dependence on commodity prices. One way to attenuate the market concentration would be to remove the current oil subsidy, which disincentives investing in other sectors.

With regards to GDP, unemployment (strongly countercyclical) and consumption (strongly cyclical), it has been pointed out that not only these variables worsened as a consequence of the financial crisis, but also they do when a real appreciation takes place. In these cases, the unique tool available for the government is a fiscal expansion. Although this type of policies have already been implemented, the evidence suggests that they have not been sufficiently important to offset the negative shock. Possible ways to design this stimulus are to invest in new and necessary infrastructures. In the short run, it would be beneficial due to the employment of workers necessary for their construction. If the policy is well designed, in the medium and long run it would increase productivity and therefore, it would also bring benefits.

Finally, as it has already been noted, the public debt to GDP ratio is relatively not large. Consequently, the fiscal expansion could be financed with the issue of new debt.
This alternative source of income would allow Ecuador to reduce its dependence on oil reserves, which have decreased sharply during the last financial crisis. However, this needs to be considered with prudence: as oil prices are falling, the revenue the government can make from the resources are becoming limited, hence this implies that the small increase in public debt was a special case of that crisis. In the future, Ecuador might have to increase its debt much more to finance a fiscal stimulus package without high oil revenues.

6 Conclusions

This paper seeks to evaluate the implications of dollarization during financial crisis, focusing on the case of Ecuador during the 2008 meltdown, period in which the US dollar appreciated significantly. In order to assess the extent to which the economy suffers comparatively more with respect to non-dollarized countries due to the exchange rate regime, two econometric methodologies are implemented: first, a synthetic control method is constructed with data of many non-pegged developing countries to evaluate whether the behavior of the main macroeconomic variables differed as a consequence of the crisis. Indeed, the commonly observed response of developing counties during the crisis was a depreciation of their currency, while the US dollar appreciated as a consequence of the safe asset condition.

So as to assess whether worsening of macroeconomic variables (mainly, the trade balance) is driven by the appreciation during the financial crisis, a Structural Vector Autoregression method is applied. The results are compared with the ones obtained for the case of a nominal depreciation in Colombia, a country that, as it has been explained, is very similar to Ecuador, with the difference that it has a floating exchange rate.

The first method suggests that Ecuador’s trade balance would have decreased less if had not been dollarized. In accordance to this finding, the GDP growth of Ecuador compared with its counter-factual was worse off. Concerning the SVAR method, results suggest that in Colombia inflation reacts significantly to a nominal exchange rate shock (i.e. a depreciation), whilst in Ecuador, the reaction is not statistically significant. This difference has an important implication: in Colombia, the IS-LM model is complied with, whilst it is not in Ecuador. In the latter, the temporal shock is absorbed through a fluctuation in real variables such as trade balance, GDP, consumption, and unemployment. In the case of an appreciation such as the one experienced during the financial crisis, all these variables are therefore worsened in Ecuador.

The results obtained shed light on different policy implications. First, the lack of monetary policy of the dollarized economy leaves as a unique tool to offset negative shocks the fiscal policy. In this sense, the worsening of the macroeconomic variables suggests that the tool could be used more strongly in order to fight against negative shocks. However, until nowadays, these expansions have been mainly financed through oil reserves, which are decreasing sharply. Therefore, one should be cautious with a potential surge of debt. Second, it is important to increase competition in Ecuador in order for firms to absorb nominal shocks through prices and offset the worsening of the trade balance and other macroeconomic variables. Third, Ecuador should also diversify their exports, which could be implemented by benefiting other sectors apart from oil product. For instance, the government could eliminate the current oil subsidies.
7 Bibliography


International Monetary Fund (2001). Norway; 2000 Article IV Consultation Staff Report; Staff Statement; Public Information Notice on the Executive Board Discussion; and Statement by the Authorities of Norway (IMF Staff Country Reports). IDEAS Working Paper Series from RePEc. International Monetary Fund.


A Composition of Imports and Exports in 2008

Ecuador’s 2008 export composition

Source: the Observatory of Economic Complexity

Ecuador’s 2008 import composition

Source: the Observatory of Economic Complexity

Colombia’s 2008 export composition

Source: the Observatory of Economic Complexity

Colombia’s 2008 import composition

Source: the Observatory of Economic Complexity
B  Export Diversification and Industrial Production

Export diversification index

Industrial production over GDP

Data taken from the IMF

Data taken from the Global Economic Monitor
C Terms of Trade

Data taken from Banco Central de Ecuador and from Banco de la República Colombia
D  Data and sources

For the comparative analysis of Ecuador and Colombia, data has been obtained from their respective Central Banks (Banco Central de Ecuador and Banco de la República de Colombia) and the Federal Reserve Bank of St. Louis (FRED). The inflation rate was extracted from their central banks and it describes the monthly inflation rate. The data for oil prices was obtained from the FRED and represents the monthly average indexed in December 2007. The data on the nominal effective exchange rates are also taken from the FRED and is indexed at December 2007. The data on the Real effective exchange rate was obtained from the IFS and is indexed in 2010.

Regarding the trade balance over GDP, data for imports and exports was obtained separately from the IFD. The GDP was obtained quarterly from the Global Economic Monitor (GEM). To obtain the monthly data we have divided every quarter equally among its three months. Lastly we have divided trade balance over GDP.

For the synthetic method control, we have collected monthly data from every developing country non dollarized nor pegged to another currency on industrial production, unemployment, exports and imports from the GEM. GDP was obtained also from the GEM, but quarterly. Again, we converted into monthly by splitting the GDP equally among the three months of the quarter. Real and nominal exchange rate was obtained monthly from IFS as an index with base year 2010. Finally, population was obtained from the United Nations. For the many missing data, we have looked individually for its data either in FRED, the statistics institute or the central bank of that country.

Finally, the Gini Index has been obtained annually from the World Bank and its measured from zero to one hundred, with a lower value translating into a less unequal economy. Due to the lack of disaggregated data, the same value was assumed for all the months within every year. The corruption index has been obtained from the Worldwide Governance Indicators of the World Bank. In particular the variable captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. Estimate gives the country’s score on the aggregate indicator, in units of a standard normal distribution, i.e. ranging from approximately -2.5 to 2.5. Finally, data on annual population for each country was also obtained from the World Bank. In this case, due also to the lack of a more disaggregated data, we have assumed constant population within each month for every year.
E Vector Autoregressive (VAR) approach

The Vector Autoregressive (VAR) model is a model for multivariate time series analysis in which each variable is simultaneously explained by its own lagged values and current and past values of the remaining variables. This framework captures the joint dynamics among multiple time series and can be easily interpreted using an Impulse-Response Function (IRF). The Impulse-Response Functions show the response of current and future values of a specific variable ($Y_{j,t+s}$ for $s=1,2,...$) of a shock on another specific time series at time $t$ ($Y_{i,t}$).

In order to identify the structural shocks we are interested in (an appreciation and a depreciation of the exchange rate), a Structural Vector Autoregression (SVAR) model is used. The SVAR requires a complete macroeconomic model of the simultaneous determination of all variables, imposing restrictions on how structural shocks impact variables of the system by using economic theory, which allows correlations to be interpreted as causal.

To implement this analysis, we have transformed all the variables to make them stationary. Moreover, in order to determine the optimal number of lags we have based our decision on the Akaike Information Criterion (AIC) and economic reasoning. Further, to impose the necessary restrictions for the Cholesky decomposition we have used economic theory. Finally, we have checked that the stability condition holds in all the regressions implemented.

E.1 Additional results

To assess whether the nominal appreciation (depreciation) leads to a real appreciation (depreciation) during the period studies (2000-2006), we construct a SVAR analysis. The results for this analysis are shown in figure 19.

Figure 19: RER response to a NER shock

GDP and unemployment response to a 1% increase (decrease) in the NER of Ecuador (Colombia).

Data taken from Banco Central de Ecuador and Banco de la República Colombia

First, regarding Ecuador, a 1% nominal appreciation leads to a real appreciation of 0.6% that lasts for, approximately, 6 months. The results are similar for the case of Colombia: a 1% nominal depreciation is translated into a 1.6% decline in the real exchange rate, and is expected to last for 2 months. The more rapid adjustment in prices in Colombia...
than in Ecuador might be partly explained by the higher degree of competition that we find in this economy and by the fact that dollarization is sometimes criticized for increasing price stickiness.
F Synthetic control method

This method was used for the first time in Abadie and Gardaezabal (2003) and it constructs a counter-factual similar to the treated observation, according to a set of variables and weights on each comparable country. Formally:

\[ J = 20, \quad W = [w_1...w_J], \quad \sum_{j=1}^{20} w_j = 1 \]

where \( J \) are the number of countries with their own currencies, and not pegged to any other, for which there is available and reliable data and \( W \) is a \( J \times 1 \) vector which assigns to each comparable country a weight for the mathematical construction of an alternative treated unit. The weights are assigned to each country such that the distances of the variables chosen for the treated unit and the synthetic control group are minimized. Formally;

Distance matrix = \((X_E - X_JW)'V(X_E - X_JW)\) (3)

where \( X_E \) is a \( K \times 1 \) matrix with the explanatory variables selected, \( X_J \) is a \( K \times J \) matrix with the same variables for each country \( J \) and \( V \) is the weighting matrix for the predictors. \( V \) is determined in Stata such that it minimizes the average squared prediction error for the outcome variable before the selected date, in our case Aug-2008. From this minimization problem we obtain the optimal \( W^* \) and we can construct the outcome for the alternative treated unit for the period analyzed.

\[ Y_t^{Synth} = \sum_{j=1}^{20} w_j^* Y_{jt} \] (4)

For every variable we have built four different counter-factuals. The difference of these counter-factuals come from the use of different countries and use of institutional variables. For graphs a) and c) the list of countries available were all developing countries not dollarized nor pegged to another currency. For graphs b) and d) only Latin American countries were listed. Moreover, in graphs b) and d) we have added institutional variables for the matching, aside with the rest of the explanatory variables.

To check the robustness of the results of the synthetic control method, we have to do for every country selected the graph of the gap between its actual value and its counter-factual. When plotting all the graphs together, if there is any different effect for, in our case, Ecuador, we would ideally see that its line outstands in any extreme: if Ecuador’s variable decreases, all the other country’s gap should be above Ecuador’s, and vice versa.

For the trade balance, there are less than 10% countries below Ecuador after the crisis in the four different specifications. Just for a few countries the distance of their trade balance with their respective counter-factual is greater than for Ecuador. This result suggests that the fall in Ecuador is big enough for any specification.

The placebo test for the exports is as robust as the trade balance, which confirms our finding that the fall in the trade balance is mainly driven by the shrinkage in exports.
The placebo test for imports is not as robust as for the one for trade balance or exports, meaning that imports in some other countries were relatively higher than their counter-factual compared to Ecuador. Nevertheless, result is seen specially when comparing the Latin American countries, not all developing countries.

For GDP growth we can see that the results of the placebo test are positive. Few countries react more than Ecuador compared with its counter-factual, neither in the first positive gap, nor in the following negative gap.

For unemployment, instead, the gap between Ecuador and its counter-factual is different from zero most of the periods before July 2008. In accordance with this mismatch, the placebo test is not positive.

### F.1 Fitness of Matching

In this section the result of the matching of the synthetic control method, with the Root Mean Square Prediction Error (RMSPE), which indicates the fitness of the outcome variable, is presented. A lower number indicates that the counter-factual outcome variable is very similar to actual Ecuador. Also, the weights assigned to every country in each different Synthetic control group are presented. In this table, as in the graphs presented in the paper, $a$ and $c$ cases include all developing countries which are not dollarized and whose currency is not pegged to the US Dollar or to the Euro. Cases $b$ and $d$ only include Latin American countries. Also, $c$ and $d$ include, apart from other explanatory variables, the Gini index and a measure for corruption obtained from the Worldwide Governance Indicators of the World Bank.

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Table 3: GDP

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Table 5: Exports

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F.2 Additional results

Next, we present some graphs which we referred to in the paper.
Figure 20: Exports over GDP

(a) All countries

(b) Latin America

(c) All countries - Institutions variables

(d) Latin America - Institution variables

Notes: The explanatory variables used for matching graphs a) and b) were real exchange rate, inflation, terms of trade and different pre-periods periods. Graphs c) and d) include also the Gini index and a corruption indicator.
Figure 21: Gap of exports over GDP

(a) All countries

(b) Latin America

(c) All countries - Institutions variables

(d) Latin America - Institution variables
Figure 22: Imports over GDP

(a) All countries

(b) Latin America

(c) All countries - Institutions variables
(d) Latin America - Institution variables
Figure 23: Gap of imports over GDP

(a) All countries

(b) Latin America

(c) All countries - Institutions variables

(d) Latin America - Institution variables
Figure 24: Gap of GDP per capita growth
Figure 25: Unemployment growth

(a) All countries
(b) Latin America
(c) All countries - Institutions variables
(d) Latin America - Institution variables

Notes: The explanatory variables used for matching graphs a) and b) were GDP per capita growth, industrial production growth and different pre-periods periods. Graphs c) and d) include also the Gini index and a corruption indicator.
Figure 26: Gap of unemployment growth

(a) All countries
(b) Latin America
(c) All countries - Institutions variables
(d) Latin America - Institution variables
Figure 27: Placebo test for trade balance over GDP

(a) All countries

(b) Latin America

(c) All countries - Institutions variables

(d) Latin America - Institution variables
Figure 28: Placebo test for exports over GDP

(a) All countries
(b) Latin America

c) All countries - Institutions variables (d) Latin America - Institution variables
Figure 29: Placebo test for imports over GDP

(a) All countries

(b) Latin America

(c) All countries - Institutions variables

(d) Latin America - Institution variables
Figure 30: Placebo test for GDP growth

(a) All countries  (b) Latin America

(c) All countries - Institutions variables  (d) Latin America - Institution variables
Figure 31: Placebo test for unemployment growth

(a) All countries
(b) Latin America

(c) All countries - Institutions variables
(d) Latin America - Institution variables