(RESEARCH ARTICLE)

# Fiscal policy and economic performance in dollarized countries: El Salvador, Panama and Ecuador between 2000-2022

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## Abstract

This article seeks to determine the behaviour of fiscal policy indicators in dollarized countries during the period 2000-2022 and the impact of these indicators on economic growth in: Panama, El Salvador and Ecuador. It is considered that, although all three countries are governed by dollarization, however, the results in terms of economic performance are dissimilar. In the period analysed, two major crises were experienced, the one of the world "crack" of 2008 and the one of covid-19, which strongly impacted in 2009 and 2020, respectively. By means of the fixed effects panel data model and the elasticity calculation, having as a variable dependent on economic growth, the theoretical relevance and statistical significance in fiscal variables is evidenced, such as: total government expenditure and tax revenues; also in other macroeconomic sectors such as exports, imports, gross fixed capital formation, as well as the interest rate as a control variable. The results validate the theoretical background; the objective of fiscal sustainability in the dollarized countries studied must go hand in hand with the participation of the State, both in aggregate demand and in regulating the interest rate.

**Keywords:**  Economic growth; Fiscal spending; Tax revenue; Data panel models.

## 1. Introduction

The problem we will analyze in this article is related to the very dissimilar behavior in terms of growth, between Ecuador, El Salvador and Panama, the unique three dollarized countries in Latin America. Figure 1 shows that while Panama has the second highest per capita income in the region, just behind Chile, which is the first, the other two (Ecuador and El Salvador) are below the Latin American average. As a hypothesis, we argue that fiscal variables are those that directly affect GDP growth, and explain the differences in these dollarized economies. Therefore, we take up the challenge of approaching the explanation of growth, among these three nations. Consequently, it is Panama, a dollarized country, which is emerging as the nation that achieved development with growth rates of more than 5% year-on-year, in more than two decades. The question in this case is How did it? from this article we hope to approach the answer.

In figure 1 we can distinguish the impact of the global crisis of 2009 and also that of the Covid-19 in 2020. This will allow us to reflect on the measures taken by the Governments of the countries of the study at this time of tension. The characteristics of each country are then analysed to contextualize the environment in which each country operates.

It should be noted that, in Latin America, although dollarized countries have controlled inflation or the deficit and other fiscal variables, and that they have reached the level of satisfaction of needs and income, typical of intermediate

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societies, there are still strong social inequalities, which demand further deepening. That is, although inequality is a fundamental issue, it escapes the objectives we intend to achieve in this study.
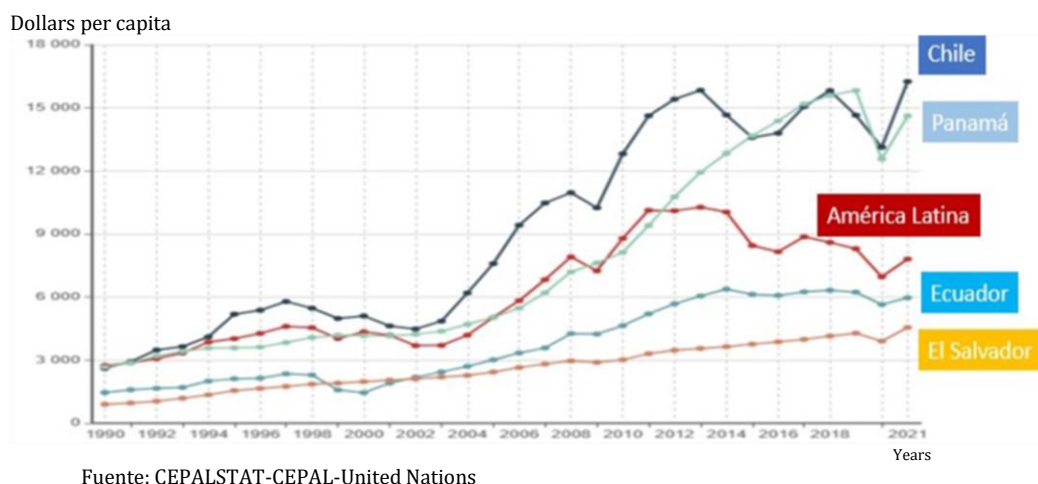
Dollars per capita



Fuente: CEPALSTAT-CEPAL-United Nations

**Figure 1** Annual gross domestic product (GDP) per capita at current dollar prices by country

The financial crises experienced by Latin America in the last 35 years end up generating macro crisis, as noted by Corbo (1); in the Ecuadorian case, the biggest crisis that the economy endured in the late nineties (1999), occurs when Ecuador had its own currency (sucre) as a result of the combination of weak financial regulation and supervision, moral hazard problems and asymmetric reporting in financial institutions and deep macroeconomic imbalances. The difference between revenues and fiscal expenditures generated a deficit, due to the bias that much of the world's governments have to spend more of the income they manage to collect, behind is a reason for political economy that justifies this action (2), although it is recommended to ensure fiscal sustainability, that is to say to control the deficit in order to reduce unsustainable indebtedness.

Finding macroeconomic and financial stability are necessary but not sufficient conditions for achieving sustainable growth intertemporal, or in the long term. An economy falls into macroeconomic instability, especially when it manifests symptoms such as the unsustainable increase in indebtedness. Moreover, controlling inflation is a substantive element in stability, an aspect that, as we shall see, is not a problem for dollarized countries.

In this research we seek to determine the consequences of fiscal policy on the economic performance of dollarized economies, for which we will analyse comparatively what happened with that policy in the period 2000 - 2022, whereas models with inflation targets take a back seat, as inflation, the main source of which is the growing fiscal deficit in own-currency economies, is a problem practically overcome in a dollarized country, because by renouncing the issuance of currency, the main source of inflation is eliminated. Excessive external and domestic public debt is a problem for a dollarized country. In this sense each dollarized country has a particular public debt - GDP ratio and the evolution of that ratio is what will determine a distinctive aspect of debt management, which responds to its particular structure of public revenue and expenditures, considering whether or not fiscal policy is counter-cyclical (3).

The second objective seeks to relate economic growth and the behaviour of fiscal indicators, based on a model that involves variables such as: oil or extraordinary or non-permanent income, tax or permanent income, public expenditure, key macroeconomic variables, etc. This second objective is expected to contribute to the effects in the three economies, with a data panel model, considering the expansion and recession.

Next, we will review the fiscal situation and debt in the three countries, focusing on the fiscal deficit and the debt-to-GDP ratio, then background on issues of fiscal policy and growth. A second section will address data sources and methodology, referencing descriptive statistics of variables and the performance of tests, until finding the most suitable panel model, which resulted in a robust panel model called Feasible Generalized Square Minima (FGLS). Then the results are analysed, discussed and finally the conclusions.

## 1.1    The fiscal and debt situation in the three countries

In figure 2, we observe the trajectory of the GDP growth rate of El Salvador, Panama and Ecuador throughout the analysis period, the impact of the international financial crisis on growth can be observed in the three countries, in 2009,

all three countries fell in growth to levels below 2% in the case of Panama and Ecuador and to about -2% in the case of El Salvador. Evidently, the fall in growth in 2020 was more severe due to the problems of compulsory isolation that prevailed throughout the planet.

As noted above, a comparative analysis between these countries and the rest of Latin America places Panama as the country with the highest growth in Latin America, even above Chile. This study aims to decipher some keys of its success, which can constitute a benchmark (benchmarking) for the rest. Average growth rates at constant prices in the period 2000 - 2022 have been 2.90% in Ecuador, 1.98% in El Salvador and 5.53% in Panama.
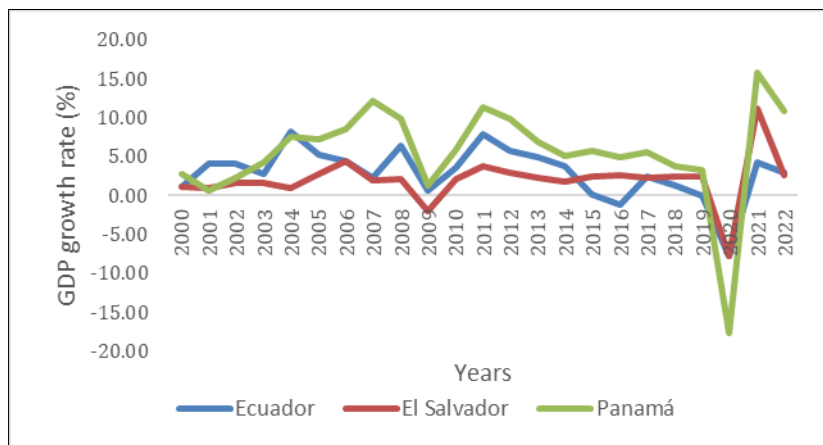


Fuente: CEPALSTAT-CEPAL-United Nations

**Figure 2** Ecuador, GDP Growth Rate - constant prices-

As previously reported, in the period of the international crisis 2008-2009, imported from the United States, Latin American countries were in one of the best moments of their history, since they continued to benefit from the "commodities boom" favouring the price of raw materials as a result of the high demand from countries such as China, which was forced to press for raw materials in order to maintain annual growth of more than 10% of GDP in those years, Hence, the 2009 housing crisis did not generate significant macroeconomic imbalances in Latin America. This was not the case with European countries or the United States where the international crisis hit hard, which were affected by the increase in prices of raw materials, causing an extension of their recovery phase. In this crisis, in addition to the relief that represented the increase in the prices of their raw materials for the countries of the region; the dollarized countries also adopted tariff measures to mitigate the devaluation processes of those countries with their own currency, in this way dollarized, protect the competitiveness of their domestic production.

In figure 1 we can see the growing trend that Latin America experienced, since 2003, when the price of raw materials and other commodities begins to grow, thanks to the increase in demand, especially from China, increasing the income of the economies of the region, a process that lasted into 2013. Evidently the impact of the Covid-19 crisis was much more severe than the 2009 crisis, although the rebound effect was also astonishing, although differentiated by country, being the most modest growth in the Ecuadorian case.

### 1.1.1 Fiscal deficit

We will call the deficit the negative global or primary result, that is when the public income is lower than the expenditure. With respect to the primary result this is generally lower since the expenses for payment of interest on external debt are subtracted. The deficit analysis will be separated into two parts, the first before the international crisis including 2009 (period 2000 - 2009) and the second after 2009 (period 2010 - 2017).

### Ecuador

The global and primary deficit on average in the first part (see figure 3), before the crisis (2000-2009), reached -0.85% in the case of the overall result, while the average primary result was 1.62% of GDP. In the post-crisis period (2010-2017), the overall deficit represents a result of -4.07%, while the primary result was -2.67%, that is to say that after the crisis the deficit, resulting from the gap between revenues and government expenditures, has been much wider than before the international crisis.
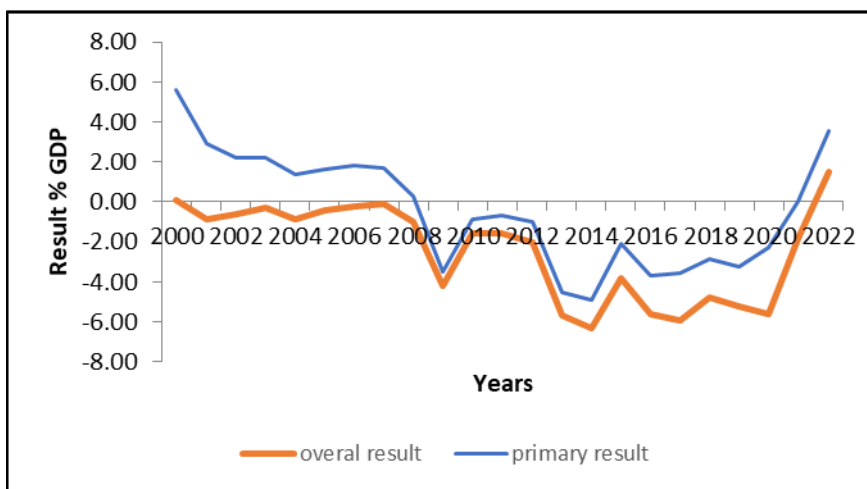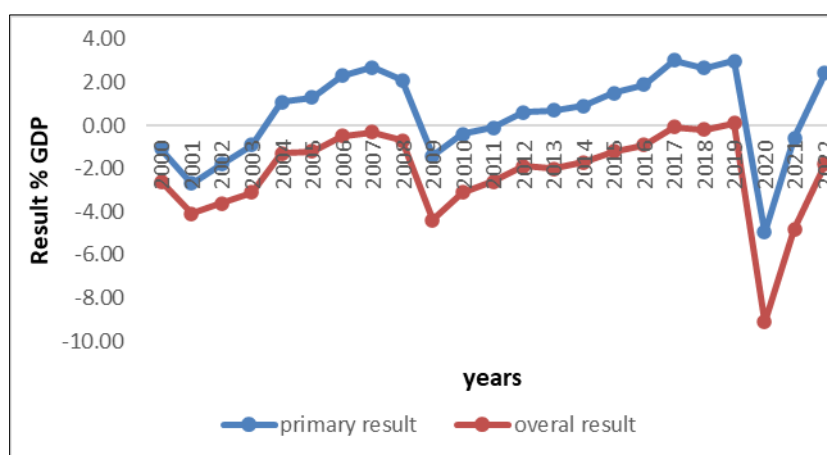
Fuente: CEPALSTAT-CEPAL-United Nations

**Figure 3** Ecuador. Primary and overal results (%GDP) 2000 - 2022

It should be emphasized that, in the last years, 2015 to 2020, the difference between the global deficit and the primary deficit has been 1.70 and 3.32% respectively, that is to say, it has grown, which is worrying because it means that the debt service has increased, every 0.1% means about 100 billion dollars more for debt service and the same amount is no longer used to pay social debt.

*El Salvador*

In January 2001, El Salvador embarked on an official dollarization, complementing its structural reform aimed at increasing investment and economic growth (1). In the Salvadoran case, the deficit management has been much more measured, since in the first period (2000-2009) this primary result has meant a surplus in the order of 0.16% and an overall result of -2.18%. While in the second period (2010-2017) these figures improved and meant that on average there was a surplus in the order of 1.02%, while the overall deficit was -1.68%, see graph 4.



Fuente: CEPALSTAT-CEPAL-United Nations

**Figure 4** El Salvador. Primary and overal results (%GDP), 2000-2022

In El Salvador, the debt service payment, measured by the difference between primary deficit and global deficit, has an average gap of 0.2% a year, which is increasing, but less volatile than in the case of Ecuador.

*Panamá*

The primary and overall result in the first period (2000-2009) was respectively 2.03 and -1.65% of GDP respectively, while for the second period (2010-2017) the deficit was exacerbated or complicated, reaching -1.39% in the case of the primary and -3.28% overall, a difference of about 1.9%, between the two average results for the second period, as shown in figure 5.
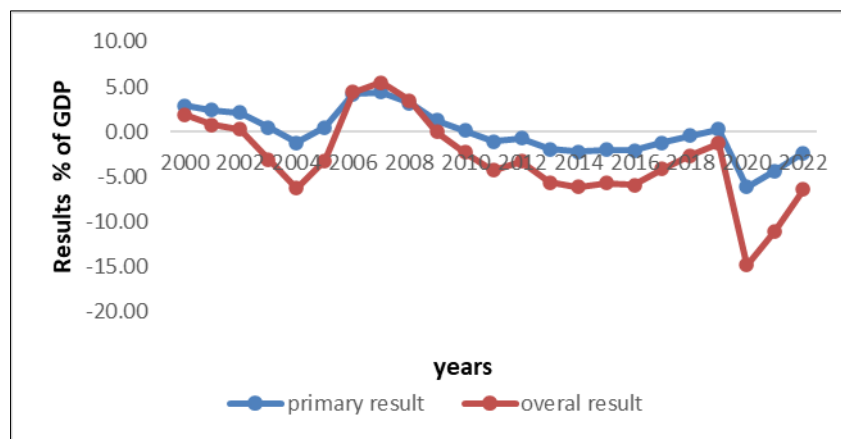
**Figure 5** Panamá. Primary and overal results (%GDP), 2000 - 2022

The primary and global deficits in the last 3 years are around 1.7%, almost constantly, which means that each year they were paying for debt service, or interest payments an ascending magnitude, Since GDP growth as shown in figure 1, for Panama it has been upwards and, by keeping the difference of the last three years constant, meant that the resources allocated to the payment of debt interest, have been positive.

*1.1.2    The debt – GDP ratio*

In the Ecuadorian case, the GDP debt ratio falls until 2009, the year of the international financial crisis, after which it begins to rise to reach about 45% of GDP in 2018. El Salvador maintains a constant trend until 2009, when it makes a leap and makes the debt - GDP ratio reach 45% of GDP up to more than 50%, remaining constant during subsequent years. In Panama, the downward trend changes until 2008, in 2009 the trend changes and is around 40% of GDP (Figure 6).
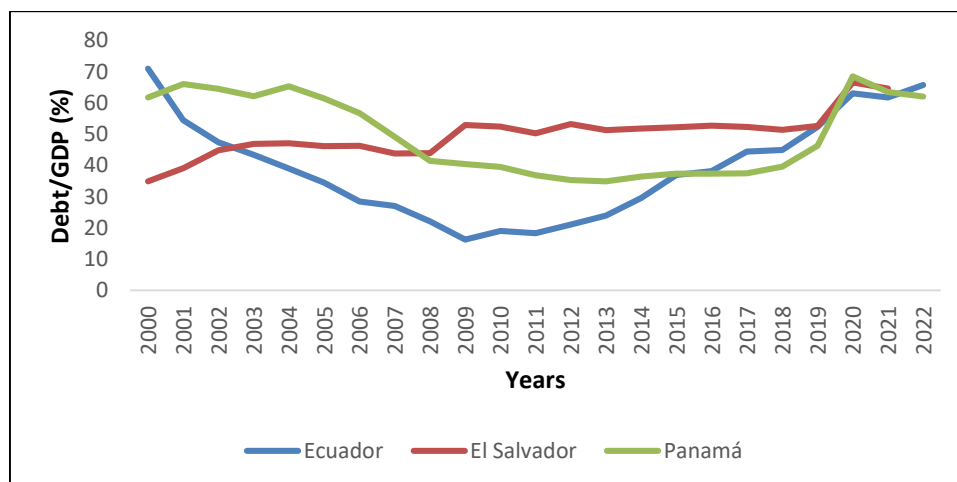
**Figure 6** The debt – GDP ratio, 2000-2022

As can be seen, in the case of Ecuador, the debt-to-GDP ratio is inversely proportional to the deficit level, that is to say, the higher the deficit, a growing debt-to-GDP ratio is expected. While for El Salvador since 2010, the debt-to-GDP ratio is around 50%, in Panama the same ratio is 40%; while for the Ecuadorian case that ratio has gone from 20% in 2010 to 45% in 2018. By 2022, the debt in the three countries tends to stabilize at around 65% of GDP.

The debt - GDP ratio in 2018 was in the three countries (Panama, Ecuador and El Salvador), between 40 and 50%, being for Panama this ratio of 40% and for El Salvador, close to 50%, while for Ecuador it was 45%; however, it is noted that the debt service, corresponding to the payment of interest on the debt contracted, for Ecuador corresponds to double the effort, measured in terms of GDP; that is, while Panama and El Salvador serve the debt with resources that border

3% of the GDP, for Ecuador, this service reaches between 5 and 6% of the GDP, which affects the welfare of its inhabitants, given the level of uncertainty due to the volatility of its oil revenues, which impacts on country risk, that is to say on the interest rate that Ecuador must pay to service the debt.

## 1.2    Background

Comparative experience shows that the absence of a fiscal rule, marking the direction of economic policy, can exacerbate the crisis (4). Let us cite two cases, the first, Europe simply states that the deficit cannot be greater than 3% of the GDP of their countries, however, it is noted that it has not been sufficient to stabilize and generate confidence among actors, Thus, the crisis extended into the second decade of the twenty-first century. The second, the worsening of the crisis until 2019, in Brazil, Argentina and Venezuela, among other countries, has its origin in the absence of an adequate fiscal rule (5).

On the other hand, the Chilean case is the example of the implementation of a sustainable fiscal policy, based on maintaining a structural balance objective, also known as cyclically adjusted balance, where the level of public expenditure is determined according to structural but not effective tax revenues, being established by the potential product level and the long-term price of copper (6).

One of the serious unresolved problems on the part of economic policy in dollarization, which countries like Ecuador still have no answer (although it is already 23 years dollarized), is related to the inability of governments to reactivate the productive apparatus, at a time, such as the present, when external conditions are not favourable, even before the recent health crisis; this inability became evident, due to the decline in prices of "commodities" including the raw materials that Latin America produces and exports. On the contrary, what was experienced during the period 2003-2014, which allowed a sustained growth of the region. After the covid crisis, some countries appear to be the best placed in terms of economic dynamism and performance, such as Chile, Panama and the Dominican Republic.

The economic reactivation of fiscal policy, means that with the injection of budgetary resources from the government, especially investment, or also called non-permanent, that make it possible to generate employment and boost various sectors of the economy; in this regard, several authors (7)(8) point out the relevance of employment generation with infrastructure works such as roads, roads, water dams, hospitals, schools, etc., especially in construction but generating virtuous combinations with other sectors such as manufacturing or tourism, improving the living conditions of the population as a whole, through a "crowding-in" effect or attraction to private sector activities. This role, of the public sector, generates dynamism and systemic competitiveness, thanks to the multiplier effect of public spending.

Another instrument of fiscal policy that turns out to be positive for the reactivation relates to the possibility of reducing taxes, even if it is at certain junctures such as, for example, the possibility of reactivating tourism from the partial or total reduction of taxes on holidays or holidays that would be beneficial for the tourism sector and the economy as a whole.

One of the most important measures taken by Panama, related to the need to reactivate the economy, relates to the integration of the international financial system into the Panamanian economy, which has generated as an advantage, the existence of one of the lowest interest rates in the region, a factor that is important and takes advantage of the status of a dollarized country. Otherwise, not to integrate into the international financial system, is like putting gasoline airplane (the dollar) to a car from the end of the last century (the economic structure - Ecuadorian or Salvadoran financial). Considering that opening the economy to the international financial system in no way means ignoring the need to strengthen the supervisory and control measures of the entities in charge of doing so (Superintendence of Banks, Central Banks, etc.) and approaching the recommendations of Basel III; although the barriers to entry of new financial institutions into the country must be dismantled.

Although this study focuses on fiscal policy and growth, the relevance of monetary policy (interest rates, evolution of the money supply, etc.) in the explanation of economic growth cannot be ignored, or absence of this, in a dollarized economy.

With respect to inflation (9), it is argued that official dollarization may result in lower inflation rates, improvement in fiscal discipline (as long as there are fiscal rules that reduce discretion) eliminates the risk of devaluation and improves a country's trade and financial integration. However, official dollarization relinquishes monetary authority control over the money supply, eliminates the financing of fiscal deficits through seigniorage, and imposes restrictions on policy makers in response to financial and real shocks. Alesina and Barro (10) said that assuming an appropriate choice of foreign currency, official dollarization gives a signal to the international community regarding the country's

commitment to a stable monetary policy. In fact, a current monetary anchor eliminates inflationary bias and the corresponding inflationary uncertainty of discretionary monetary policy. The Friedman-Ball hypothesis states that an increase in inflation will induce greater uncertainty about future inflation when the public faces uncertainty about the willingness of policymakers to reduce inflation (11)(12).

Regarding dollarization in Panama, in effect since 1904, Edwards (13) argues that when compared to other countries, dollarized nations have: i) a significant low inflation, ii) a significantly low GDP growth rate; iii) have had a similar fiscal record; and, iv) have not been exempt from major current accounts. Additionally, Edwards (13) points out that the Panamanian case suggests that shocks translate into higher costs-in terms of low investment and growth-in dollarized countries than in non-dollarized countries.

Alberola et al., (14) analyses the fiscal position and impact of financing conditions and fiscal rules for the period 1990 - 2014 in Argentina, Brazil, Chile, Colombia, Costa Rica, Mexico, Peru and Uruguay. The analysis covers the non-financial public sector, that is, central government entities, subnational entities, state-owned enterprises; obtaining three main results: i) the discretionary fiscal policy reacts against - cyclically to the financial crisis, but this positive development does not have continuity; ii) the conditions of financing, is confirmed, is key in the fiscal position in the region, although its relevance has diminished recently; and iii) fiscal rules are associated with improved fiscal performance in terms of stabilization.

By 1995, most central banks in Latin America had achieved administrative independence: Brazil 1988, Chile 1989, Colombia 1992, Peru 1993, and Mexico in 1994. Some of the central banks mentioned above worked with a fixed inflation target, such as Chile (2-4%), Peru (2.5%+-1) and Mexico (3%+-1), while others set targets that varied over time, as was the case in Brazil (15). In this way, the effectiveness and fulfilment of the objectives of the inflation target model will depend on the effective capacity and independence that each Central Bank has to choose its instruments and manage monetary policy, as well as the technical characteristics of the inflation targeting regime and the credibility of individuals over the monetary policy measures to be carried out.

Between 1999 and 2005, most Latin American countries moved progressively towards the complete adoption of the inflation targeting regime, which meant:

- To set monetary stability as the priority objective of monetary policy.
- Define and set a target or range for the inflation rate, which implies adopting a monetary rule.
- Adopt a free-floating regime, in order to contain the effects of external shocks; and
- Operate monetary policy through the interest rate, as the sole instrument.

For their part, Marí del Cristo and Gomez Puig (16) unravel the dynamic relationship between fiscal variables and economic activity in Ecuador, finding that fiscal policy appears to be sustainable; such sustainability is explained by its policy of debt payments through oil revenues, rather than by a fiscal discipline that dollarization is supposedly feeding. So the variable tax revenue is only an adjustment variable. This result suggests that in a dollarized country that does not benefit from "seigniorage" revenues, reliance on volatile oil revenues and mild tax revenue growth make it vulnerable to fiscal policy sustainability.

In the study on the current impact of dollarization in Serbia (17) and on the channels of monetary policy, Drab (8) found that monetary policy in Serbia has very little impact on real activity, where the price level is mainly determined by the exchange rate channel. The interest rate channel is not operational because the price level in Serbia is more influenced by the amount of foreign deposits over which the National Bank of Serbia has little control, except for the volume of Dinars (Serbian currency) in circulation. The most important determinant of the structure of money holdings (Dinars vs. foreign currency) is the interest rate in the Euro Area.

In relation to the economy of El Salvador (18), dollarization in that country has offered potential benefits for real estate or real estate markets, due to lower and stable inflation and interest rates. Hedonic analysis indicates that dollarization depresses home prices when interest rates and economic growth are controlled. This new evidence reorients the political debate for countries considering dollarization.

In the article on monetary policy and its relation to interest rates, in dollarized countries (19), including the United States, Ecuador, El Salvador and Panama, using an econometric strategy of panel data with fixed and individual effects, As a result, the application of expansionary monetary policy (read: interest rate reduction) fulfils the objective of boosting economic growth after the Great Recession, without significant effect on inflation in these economies.

## 2. Data and Methodology

The information corresponds to the period 2000 - 2022 for the three countries: El Salvador, Ecuador and Panama. Annual data from ECLAC and IMF statistical information are used. The latter institution publishes International Finance Statistics (IFS) and Government Finance Statistics (GFS).

In view of the fact that we have only 23 observations for each country, Ecuador, Panama and El Salvador, in the period 2000-2022; it was decided to opt for a sample available through the grouping in balanced panel data, of 69 observations, to be used to explain the impact of fiscal policy instruments on the macroeconomic growth of dollarized economies. We will also use as a control variable the interest rate, which, although it responds to discretionary criteria of the authorities of each country, however, will give interesting estimates regarding the behaviour of the dependent variable, the variation of the GDP.

Then, after describing the variables to be used in the model, we will apply a series of tests in the regressions obtained, in order to achieve the most accurate and efficient model, the tests to follow are: first, a panel data model or MCO, through the Breusch Pagan Random Effects Lagrangian Multiplier test; second, whether the model to follow is a random effects or fixed effects model, for which we apply the Hausman test; third, to monitor the existence of autocorrelation, the Wooldridge test was applied; fourth, the test to know if there is heteroscedasticity in the data panel, we used the modified Wald test only with fixed effects. Before the results of these tests, the variables are released.

### 1.3 Descriptive statistics of variables

The data are explained in table 1, the results show that the largest GDP (PIBcorrMill) is in the order of 115 billion US dollars and the lowest of 11.78 billion US dollars, the standard deviation is 31.3 million US dollars, and the average of 43.8 billion dollars; the total income of the government (Ingtotgob) has a high level of 225.8 billion US dollars, the lowest is 1.6 billion US dollars, a standard deviation of and a standard deviation of $6.3 million and an average of $7.7 million; similarly tax revenues (Ingtrib), have a maximum level of 18.2 billion US dollars, the minimum is 1.04 billion US dollars, a standard deviation of 4.4 billion US dollars and an average of 5.4 billion dollars; Non-tax revenues (Ingnotrib) range from a maximum level of US$10.5 billion, a minimum of US$127.2 billion, a standard deviation of US$2.4 billion and an average of US$2.3 billion.

Regarding the total expenses of the government (Gastototgob), we can determine on the plan1 that these, oscillate at a maximum level of 26.8 billion US dollars, a minimum of 1.9 billion US dollars and a standard deviation of 7.56 billion US dollars, while the average is 9.02 billion US dollars; regarding government capital expenditures (Gastcapitgob), the values are at a maximum level of 1.2 billion US dollars, a minimum of 277 million US dollars , a standard deviation of US$3.2 billion, and an average of US$2.9 billion; the primary results (deficits) (Resprim), have a maximum level of 4.1 billion US dollars, a minimum value of -5.02 billion US dollars, a standard deviation of 1.5 billion dollars and a mean of -423 million US dollars; the overall results (Resglob) has a maximum value of 1.7 billion US dollars, a minimum of -6.4 billion US dollars, a standard deviation of 1.8 billion US dollars, and an average of -1.3 billion US dollars.

In relation to monetary variables, in Table 1 we find that the liquidity measured through M2 (liquidezM2), reaches a maximum of 73.2 billion US dollars, a minimum of 5.5 billion US dollars, a standard deviation of 16.3 billion US dollars, and an average of 21.99 billion US dollars; for the interest rate (T_interes_act), the maximum is 15.5%, the minimum of 5.7% the standard deviation is 2.01 percentage points and the average is 8.02%.

The macroeconomic variables that entered the model are the following (see table 1): The investment (fbkf) reaches a maximum value of 27.7 billion US dollars, a minimum of 2.08 billion US dollars, a standard deviation of 8.9 billion US dollars and an average of 10.8 billion dollars; Exports (Exp), has a maximum of 33.6 billion US dollars, a minimum of 3.07 billion US dollars, a standard deviation of US$9.3 billion and an average of US$14.8 billion; Regarding imports (Imp), these reach a maximum of 33.5 billion US dollars, a minimum of 4.9 billion dollars, a standard deviation of 8.8 billion dollars and an average of 16.8 billion US dollars. Correlations between variables can be found in the Annex to this article.

**Table 1** Descriptive Statistics, Ecuador, Panama and El Salvador in Millions of US dollars or %

| Variables | Observations | Mean | Standard deviation | Mínimum | Máximum |
|---|---|---|---|---|---|
| PIBcorrMill | 69 | 43859,27 | 31318,27 | 11784,93 | 115049,48 |
| Ingtotgob | 69 | 7681,83 | 6268,96 | 1584,70 | 25581,12 |
| Ingtrib | 69 | 5416,46 | 4416,31 | 1039,00 | 18209,32 |
| Ingnotrib | 69 | 2314,51 | 2391,90 | 127,20 | 10481,36 |
| Gastototgob | 69 | 9024,07 | 7565,96 | 1883,90 | 26793,80 |
| Gastcapitgob | 69 | 2885,60 | 3160,20 | 277,00 | 11812,41 |
| Resprim | 69 | -413,92 | 1504,27 | -5016,20 | 4111,57 |
| Resglob | 69 | -1342,23 | 1835,87 | -6413,17 | 1711,19 |
| liquidezM2 | 69 | 21995,59 | 16317,92 | 5500,00 | 73198,00 |
| T_interes_act | 69 | 8,02 | 2,01 | 5,70 | 15,50 |
| fbkf | 69 | 10868,10 | 8953,62 | 2083,93 | 27684,23 |
| Exp | 69 | 14763,55 | 9331,23 | 3071,77 | 33562,10 |
| Imp | 69 | 16768,55 | 8810,04 | 4935,86 | 33503,03 |

Fuente: CEPALSTAT, CEPAL, United Nations

## 1.4 Tests to determine the appropriate model

### 1.4.1 Determine the panel database

First we confirm in Stata the existence of a panel database, in this respect the result obtained is the following:

- panel variable: país (strongly balanced)
- time variable: Año, 1 to 23
- delta: 1 unit

The obtained result shows that it is a panel of data, strongly balanced with 23 years, of observations with which it counts, each country.

### 1.4.2 Lagrangian Multiplier Test

This test is used to decide which of the fixed or random effects models should be used. Both models are intended to reinforce the elimination of heterogeneity concerns that plague most research (20). Often the researcher faces the dilemma of deciding which model to choose to use panel data.

The Lagrangian Multiplier Test for random effects of Breusch and Pagan, indicates that if the p-value is larger than 0.05, we should use the MCO model, in this test a value of significance p-value = 1 >0.05 was obtained. It is therefore recommended to use the OLS model, which is why we first opted for the OLS regression model grouped by fixed coefficients.

*Regression model with OLS clustered of fixed coefficients*

Following Gujarati (21), the model has been detailed as follows:

$$Y_{it} = \beta_1 + \beta_n X_{it} + u_{it} \qquad (1)$$

$i$ = 1, 2, 3
$t$ = 1, 2, …, 23 (del 2000 al 2022)
*n: Number of explanatory variables*

*Where i is the th country and t is the period for dependent and independent variables, and n is the number of explanatory variables*
$X_{it}$: Explanatory or independent variables
$Y_{it}$: Explained or dependent variable = $LPIBcorrM_t$

The dependent variable is LPIBcorrM, corresponding to the logarithm of GDP. The explanatory or independent variables are: crisis2009 _it, corresponding to the crisis of the year 2009; crisis2020 _it, corresponding to the covid crisis; then the fiscal and other macroeconomic variables, expressed in logarithms are: LIngtotgob, is the total income of the government; LIngtrib _it, are tax revenues, LIngnotrib_it, are non-tax revenues, here are included revenues from oil exports; $LGastototgob_{it}$, are the total expenses incurred by the government; Resprimit, is the primary result (deficit); Resglobit, corresponds to the overall result (deficit); LliquidezM2it, expresses the monetary offer M2; Lfbkfit, is the gross fixed capital formation (investment), the LExpMit are exports and LImpMit, are imports.

$$X_{it} = [\, crisis2009_{it}, crisis2020_{it}, LIngtotgob_{it}, LIngtrib_{it}, LIngnotrib_{it},$$

$$LGastototgob_{it}, LGastocapit_{it}, Resprim_{it}, Resglob_{it}, LliquidezM2_{it}, LT\_interes\_a_{it}, Lfbkf_{it}, LExpM_{it}, LImpM_{it}]$$

**Table 2** Regression results

| LPIBcorrM | Coef. | St.Err. | t-value | p-value | [95% Conf | Interval] | Sig |
|-----------|-------|---------|---------|---------|-----------|-----------|-----|
| LfbkfM | 0.227 | 0.072 | 3.14 | 0.002 | 0.085 | 0.368 | *** |
| LExpM | 0.418 | 0.153 | 2.74 | 0.006 | 0.119 | 0.717 | *** |
| LImpM | -0.529 | 0.177 | -2.99 | 0.003 | -0.875 | -0.183 | *** |
| LT_interes_act | -0.297 | 0.112 | -2.66 | 0.008 | -0.517 | -0.078 | *** |
| LliquidezM2 | -0.047 | 0.069 | -0.68 | 0.497 | -0.181 | 0.088 | |
| Resglob | 0 | 0 | -1.08 | 0.279 | 0.0 | 0.0 | |
| Resprim | 0 | 0 | 1.00 | 0.318 | 0.0 | 0.0 | |
| LGastcapitgob | 0.103 | .06 | 1.71 | 0.087 | -0.015 | 0.22 | * |
| LIngnotrib | 0.079 | .036 | 2.19 | 0.028 | 0.008 | 0.15 | ** |
| LIngtrib | 0.426 | .064 | 6.63 | 0.0 | 0.3 | 0.552 | *** |
| crisis2009 | -0.018 | .024 | -0.76 | 0..447 | -0.064 | 0.028 | |
| crisis2020 | 0.015 | .027 | 0.57 | 0.57 | -0.038 | 0.069 | |
| Constant | 2.489 | .284 | 8.77 | 0.0 | 1.933 | 3.045 | *** |

| | | | |
|---|---|---|---|
| Mean dependent var | 4.534 | SD dependent var | 0.309 |
| Overall r-squared | 0.987 | Number of obs | 69 |
| Chi-square | 4329.462 | Prob > chi2 | 0.000 |
| R-squared within | 0.975 | R-squared between | 1.000 |

*** p<.01, ** p<.05, * p<.1

As a double-log function will be estimated, slope coefficients will give estimates of elasticity, except for budgetary results ( Resprim _it, and Resglob _it), which are not logarithmic, being many of these negatives. Below in table 1 the results.

 The 69 observations are grouped in total, among the assumptions of this model is that the regression coefficients are equal for all countries. In other words, there is no distinction between countries, which is a difficult assumption to sustain. It is further assumed that explanatory variables are not stochastic. If they are, they are not correlated with the error term. It is also assumed that explanatory variables are strictly exogenous, that is, they do not depend on the

present, past and future values of the $u_{it}$ error term. The error term is also assumed to be $u_{it} \sim iid(0, \sigma_u^2)$, that is to say independently and identically distributed, with zero mean and constant variance.

In addition, model (1) presents all regression coefficients not only are very statistically significant, but also agree with previous expectations and that the value of R2 is very high. Later we will see if the model has autocorrelation or spatial correlation of the data. But, the main problem of this model is that it does not distinguish between different countries or indicate whether the response of GDP growth to explanatory variables over time is the same for all countries. In other words, if we group different countries in different periods, the heterogeneity or singularity that may exist between countries is hidden.

Faced with this situation, the question is how unobservable effects or heterogeneity are taken into account, to obtain consistent and efficient estimates of the parameters of the variables of interest. As our interest is to obtain the effect of unobservable variables, we will do so from the Model of Least Squares with Dichotomous Variable (LSDV) of fixed effects.

*Model of Least Squares with Dichotomous Variable (LSDV) of fixed effects.*

The LSDV model takes into account the heterogeneity between subjects because it allows each entity to have its own intercept value, as shown in model (2). The LSDV takes into account heterogeneity between subjects because it allows each entity to have its own intercept value, as shown in model (1). In our case we have 3 countries and 23 years of each country.

$$Y_{it} = \beta_{1i} + \beta_n X_{it} + u_{it} \qquad (2)$$

*i* = 1, 2, 3
*t* = 1, 2, …, 23 (del 2000 al 2022)
*n: Number of explanatory variables*
$X_{it}$: Explanatory or independent variables
$Y_{it}$: Explained or dependent variable = LPIBcorrM$_t$

As before, following Gujarati (21), the subscript i is the term of the intercept to indicate that the intercepts of the three countries may be different. The differences respond to idiosyncratic characteristics of each country, such as culture, history, geography, public management, business partners, etc.

The functional form (2) is known as the fixed-effect model (regression). The term "fixed effects" is due to the fact that, although the intercept may differ between subjects (in this case the three countries), the intercept of each country does not vary with time, that is, it is invariant in time (21). Therefore, the coefficients (slopes) do not vary by individuals or over time.

The intercept (of fixed effect) varies between countries, and this is expressed in the equation by the technique of dichotomous variables with differential intercept that can be expressed as follows:

$$Y_{it} = \alpha_1 D_{1i} + \alpha_2 D_{2i} + \alpha_3 + \beta_1 X_{1t} + \cdots + \beta_n X_{nt} + u_{it} \quad (3)$$

Where $D_{1i}$ = 1 = país_EC, if observation is country 1 (Ecuador), and 0 otherwise; $D_{2i}$ = 2 = país_PA, if observation is country 2 (Panama), and 0 otherwise. As these are three countries, only two variables are used to avoid falling into the trap of the dichotomous variable (avoiding perfect collinearity). In this case, country 3 (El Salvador) is considered the base or reference category (21), so intercept $\alpha_3$ is the intercept value of country 3, and the other coefficients α represent the degree to which intercept values of the other countries differ from $\alpha_3$, the value of El Salvador's intercept. Therefore, $\alpha_1$ is the value of the intercept of country 1 (Ecuador). The sum $(\alpha_1 + \alpha_2)$ gives the real value of the intercept of country 2 (Panama).

In conclusion, to introduce a dichotomous variable for each country, it is necessary to omit the (common) intercept, otherwise it will fall into the trap of the dichotomous variable. Finally, it should be noted that the applied MCAs produce fixed effect estimators, the model has the name of unidirectional fixed effect model because it allows to see the intercepts between countries. It is called bidirectional fixed effects if we take into account the temporal effects, in this case the crises of 2009 and those of 2020.

According to the estimation of the parameters obtained in the function (3), some variables whose coefficients remained without statistical significance were removed, and the following independent variables were significant:

$$X_{it} = [\ crisis2009_{it}, crisis2020_{it}, LIngtotgob_{it}, LIngtrib_{it}, país\_EC_{it}, país\_PA_{it}$$

$$LGastototgob_{it}, LGastocapit_{it}, LliquidezM2_{it},\ LT\_interes\_a_{it}, Lfbkf_{it}, LExpM_{it}, LImpM_{it}]$$

### 1.4.3    Hausman test

This test is used to decide which model to use, whether fixed effects or random effects. It is a trade of deciding which. If the p-value is less than 0.05, we should use the fixed effects model. When the p-value is larger than 0.05, the random effects model surpasses the fixed effects model.

In the Model of Square Minima with Dichotomous Variable (MCVD) of fixed effects, with the Hausman test a P-value of 1 was obtained, being > 0.05 we must use the model of random effects.

Hausman (22) specification test:

|  | Coef. |
|---|---|
| Chi-square test value | 0 |
| P-value | 1 |

### 1.4.4    Wooldridge test for autocorrelation in panel data

The Test to detect autocorrelation of Wooldridge, for panel data, indicates that when the p-value is larger than 0.05 there is autocorrelation, if the p-value is less than 0.05, then there is no autocorrelation, when running the test, we find that the test F is greater than 21 and the p-value is equal to 0.0432, that is less than 0.05, so H0 is accepted that there is no first order autocorrelation.

**Table 3** Wooldridge test for autocorrelation

```
Linear regression        Number of obs   =     66
                         F(2, 2)      =      .
                         Prob > F     =      .
                         R-squared    =   0.8141
                         Root MSE     =   0.0194
                    (Std. Err. adjusted for 3 clusters in país)
```

| D.LPIBcorrM | Coef. | Std.Err. | t | P>t | [95%Conf. | Interval] |
|---|---|---|---|---|---|---|
| LfbkfM D1. | 0.168 | 0.083 | 2.010 | 0.182 | -0.191 | 0.527 |
| LExpM D1. | 0.129 | 0.178 | 0.720 | 0.545 | -0.636 | 0.893 |
| LImpM D1. | 0.075 | 0.140 | 0.530 | 0.648 | -0.529 | 0.678 |
| LT_inter_act D1. | -0.084 | 0.051 | -1.640 | 0.243 | -0.305 | 0.137 |
| LGastotgob D1. | 0.314 | 0.155 | 2.020 | 0.180 | -0.354 | 0.983 |
| crisis2020 D1. | -0.006 | 0.018 | -0.340 | 0.768 | -0.084 | 0.072 |
| crisis2009D1. | 0.014 | 0.004 | 3.470 | 0.074 | -0.003 | 0.031 |
| país_EC D1. | 0 | | | (omitted) | | |
| país_PA D1. | 0 | | | (omitted) | | |

Wooldridge test for autocorrelation in panel data; H0: no first order autocorrelation;  F ( 1, 2) = 21.657; Prob > F = 0.0432

*1.4.5   Wald Test Modified*

In the Wald test applied to heteroscedasticity, the null hypothesis is that there is no heteroscedasticity. When obtaining the significance < 0.05, as seen below, the null hypothesis is rejected, therefore, in the model there is heteroscedasticity Modified Wald test for group wise heteroscedasticity

in cross-sectional time-series FGLS regression model
H0: sigma(i)^2 = sigma^2 for all i
chi2 (3)  =    142.33
Prob>chi2 =    0.0000

In view of the existence of heteroscedasticity, although not of autocorrelation, it was proposed to use a robust panel model with generalized least squares, which corrects heteroscedasticity, considering that the relevant test indicated that there is no autocorrelation. The best performing model was the Feasible Generalized Least Squares (FGLS) model, the results of which are shown below.

## 3. Results

### 1.5   Feasible Generalized Least Squares Model (FGLS)

**Table 4** Cross-sectional time-series FGLS regression

| LPIBcorrM | Coef. | St.Err. | t-value | p-value | [95% Conf | Interval] | Sig |
|-----------|-------|---------|---------|---------|-----------|-----------|-----|
| LfbkfM | 0.272 | 0.067 | 4.09 | 000 | 0.142 | 0.403 | *** |
| LExpM | 0.406 | 0.113 | 3.61 | 000 | 0.186 | 0.627 | *** |
| LImpM | -0.561 | 0.118 | -4.75 | 000 | -0.793 | -0.33 | *** |
| LT_interes_act | -0.135 | 0.079 | -1.71 | 0.088 | -0.289 | 0.02 | * |
| LGastototgob | 0.379 | 0.109 | 3.47 | 0.001 | 0.165 | 0.593 | *** |
| LGastcapitgob | -0.006 | 0.04 | -0.15 | 0.882 | -0.084 | 0.072 | |
| LIngtrib | 0.264 | 0.121 | 2.18 | 0.029 | 0.027 | 0.5 | ** |
| país_EC | 0.014 | 0.034 | 0.41 | 0.684 | -0.053 | 0.081 | |
| país_PA | 0.023 | 0.05 | 0.46 | 0.648 | -0.075 | 0.121 | |
| crisis2009 | -0.016 | 0.017 | -0.94 | 0.349 | -0.048 | 0.017 | |
| crisis2020 | -0.041 | 0.022 | -1.88 | 0.06 | -0.084 | 0.002 | * |
| Constant | 1.894 | 0.172 | 11.00 | 000 | 1.556 | 2.231 | *** |
| Mean dependent var | 4.534 | | SD dependent var | | 0.309 | | |
| Number of obs. | 69 | | Chi-square | | 6974.510 | | |
| *** p<.01, ** p<.05, * p<.1 | | | | | | | |

The results of this model show that there are 5 statistically significant variables with a level lower than 0.01, variables such as logarithm of gross fixed capital formation (LfbkfM) and exports (LExpM) with the sign (positive)agree with economic theory; equally with the same level of significance are the logarithm to imports (LImpM) with the sign (negative), equally in line with the theory; also with a level of significance less than 0.01, one of the fiscal variables appears, as is the total government expenditure (LGatototgob), as well as the previous ones, The other significant variable <0.01 is the constant.

With a different sign from the theory, there is spending on government capital or public investment (LGascapitgob) although it is not statistically significant; nor did it show to be statistically significant, variables such as non-tax income (LIngnotrib), budget results such as primary (Resprim) and global (Resglob), so I exclude them in the selected model.

For significance levels between 0.05<sig. <0.01, are for example the logarithm of tax income (LIngtrib), which allows us to effectively expect that in the face of an increase (decrease) of GDP, an increase (decrease) of tax income will be expected, Given the high direct sensitivity existing between the variation of taxes and the variation of production (GDP); that is to say if there is greater production there will be greater transactions, therefore the government will increase the collection, resulting from the existing macro dynamism.

With a level between 0.1 < sig. < 0.05 there is the active interest rate (LT_interest_act), whose negative sign is the correct one, seen from the theory because, for investors, who increase production, it turns out a greater cost of opportunity when the interest rate increases, hence it is argued that there is an inverse relationship between the investment (which contributes directly to production) and the interest rate. Another variable that is statistically significant at 10%, with a p-value of 0.06 is the Covid crisis in 2020, with the expected negative sign, it is evident that the blow in economic growth, as expected, was considerably more traumatic than in 2009.

### 1.5.1    FGLS model with intercept for Ecuador

The funds from a non-renewable natural resource, such as oil, the non-tax revenue variable (LIngnotrib) appears, with a positive sign according to theory, even without significance. The variable active interest rate, which for Ecuador, contains opacity in the existing information, appears with the appropriate sign (negative) but is also not significant. It appears statistically significant, the Covid crisis with a p-value = 0.046.

### 1.5.2    FGLS model with intercept for Panamá

The variable active interest rate is statistically significant at 10% because it has a p-value = 0.070, likewise, the Covid crisis, has a statistical significance at 10%, can its p-value = 0.074.

### 1.5.3    FGLS model with intercept for El Salvador

The variable active interest rate is significant at 5% with a p-value of 0.029, while the Covid crisis has a significance at 5% with a p-value of 0.046.

## 4. Discussion

It is worth noting a comment to the article Mari del Cristo (6), in the sense that external shocks can to a certain extent affect relatively more, an officially dollarized economy, such as those of Ecuador, Panama or El Salvador, in the sense that depending on the devaluation of the countries with their own currency, with which the dollarized ones trade, and since the latter do not have the option of devaluing the currency and rather are obliged to use other foreign policy instruments (tariff policy) that allows them to protect themselves against the lowering of costs of imported products from their partners that have devalued their national currency.

Following the reasoning of the previous paragraph, the example of the Argentine crisis in convertibility, in 2001 suggests that it came from a permanent process of appreciation of the dollar throughout the 1990s, In other words, during the entire period of Argentine convertibility, an extreme fixed exchange rate regime, very similar to the dollarization regime. Argentine convertibility collapsed when neighbouring countries such as Brazil devalued in the year of the crisis, allowing Brazil to flood the Argentine market with its products, generating a fall in output and widespread unemployment, leading to the resignation of the then president De la Rúa. In conclusion, the vulnerability of dollarized or own currency countries is not always lower in the former, this vulnerability will depend on the management of decision makers, the context in which each particular economy finds itself and the soundness of macroeconomic fundamentals.

Collecting the reflection of Mari del Cristo a different hypothesis emerges, this is that contrary to what Mari del Cristo(16) points out that the adjustment variable is tax or permanent income, We maintain that the adjustment variable is non-permanent expenditure or investment expenditure instead of tax revenue, if we consider the fiscal rule in force in Ecuador until 2020. It may be noted that the time at which permanent expenses (salaries, subsidies, basic services, etc.) are tied to permanent (tax) income and that non-permanent (investment) expenses are tied to non-permanent or oil revenues; consequently, the adjustment variable will be public investment, which is part of the government's expenditure; in this sense, tax revenues are permanent, growing and counter-cyclical, also considered genuine revenues, contrary to oil revenues, rather volatile, non-oil and for investment expenditure, however, if used they are an important source for the positive displacement of aggregate demand and employment generation.

The opacity of the information in the active interest rate in Ecuador is manifested in the oscillation between 7.5% in the active rates that are delivered to corporations, versus 30% that is done to micro entrepreneurs (a difference of 22.5%, while that of Panama gives loans to different agents ranging from 5 to 7.5%, which is around 2.5%, that is, if we compare the differences are 900% (22.5/2.5). The argument for such a difference, on the part of financial institutions, in the Ecuadorian case, is that micro entrepreneurs have a higher level of risk. A valid reason for understanding the reasons why countries such as Ecuador do not grow economically is the dispersion around the excessively high average interest rate, which is not accurately reflected in the information obtained, since they are interest rates given by banks to large companies and are not considered other agents, such as individuals, that is to say the rates are actually much higher especially in the case of El Salvador and Ecuador, not so for Panama, whose rate dispersion level is much lower. The argument to point out that in Panama there is little dispersion is the level of competence of financial institutions, thanks to the level of integration that this system has with the outside, which generates competition between the entities. The argument to point out that in Panama there is little dispersion is the level of competence of financial institutions, thanks to the level of integration that this system has with the outside, which generates competition between domestic and foreign financial institutions. While in countries like Ecuador there are legal barriers to entry to the domestic financial market.

It cannot be assumed as a rule, the recommendation that postulates a "counter-cyclical" fiscal policy, perhaps applicable in countries like Norway, whose oil surpluses are guarded jealously. This "counter-cyclical" policy is not viable in the case of Latin American countries in general, because it is not possible to save existing resources in a context of serious levels of underdevelopment and poverty that engulfs our nations. I consider the need to contextualize and think twice before applying a "counter-cyclical" fiscal policy. The evidence of what is happening now in Ecuador, in a neoliberal environment of extreme shrinking of the State, is experiencing alarming figures of violent deaths, high levels of underemployment and unemployment, high levels of migration abroad, which forces us to rethink the viability of technical postulates.

## 5. Conclusion

The significant dependence that exists, in the Ecuadorian case, on tax revenues from exports of a non-renewable natural resource such as oil, is not favourable to Ecuador, because such revenues have a high volatility, and are also pro-cyclical, so it is an important source of uncertainty for Ecuadorian fiscal accounts. Therefore, if a counter-cyclical fiscal policy is to be expected, it is necessary to counteract dependence on tax revenues, which are a source of instability. This dependence, as we saw in the case of Ecuador, has repercussions on the service of the external debt, through rate increases due to increases in the country risk.

The vulnerability of dollarized countries or countries with their own currency is not always less in the former, overcoming this vulnerability will depend on several aspects, such as: the management of decision makers, the context of each particular economy and the soundness of macroeconomic fundamentals.

Excessively high interest rates discourage investment, in a context in which dollarization, with a hard currency like the official one, has a strong control of inflation, to achieve sustained growth is a necessary requirement to have a low interest rate. According to the econometric results, the interest rate plays a significant result in the economy, so it is necessary to consider this variable as an incentive for investment, trying to reduce the interest rate to improve private investment and consequently production.

The recession and the high levels of unemployment and underemployment require an active participation of the public sector, through its fiscal policy, increasing the resources of the State, for public works, for example; only then will it be possible in the short term, demand a significant part of the existing surplus of labour supply.

## Compliance with ethical standards

*Disclosure of conflict of interest*

No conflict of interest to be disclosed.

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## Anexo

### Pairwise correlations

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (1) LPIBcorrM | 1.000 | | | | | | | | | | | |
| (2) LfbkfM | 0.963 | 1.000 | | | | | | | | | | |
| | (0.000) | | | | | | | | | | | |
| (3) LExpM | 0.850 | 0.920 | 1.000 | | | | | | | | | |
| | (0.000) | (0.000) | | | | | | | | | | |
| (4) LImpM | 0.831 | 0.902 | 0.962 | 1.000 | | | | | | | | |
| | (0.000) | (0.000) | (0.000) | | | | | | | | | |
| (5) LT_interes_act | 0.070 | 0.079 | 0.047 | -0.168 | 1.000 | | | | | | | |
| | (0.566) | (0.520) | (0.704) | (0.169) | | | | | | | | |
| (6) LGastototgob | 0.986 | 0.938 | 0.818 | 0.818 | 0.030 | 1.000 | | | | | | |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.810) | | | | | | | |
| (7) LGastcapitgob | 0.966 | 0.956 | 0.836 | 0.814 | 0.116 | 0.962 | 1.000 | | | | | |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.341) | (0.000) | | | | | | |
| (8) LIngtrib | 0.927 | 0.856 | 0.681 | 0.740 | -0.116 | 0.953 | 0.886 | 1.000 | | | | |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.343) | (0.000) | (0.000) | | | | | |
| (9) paÃ-s_EC | 0.633 | 0.542 | 0.352 | 0.226 | 0.627 | 0.627 | 0.636 | 0.583 | 1.000 | | | |
| | (0.000) | (0.000) | (0.003) | (0.062) | (0.000) | (0.000) | (0.000) | (0.000) | | | | |
| (10) paÃ-s_PA | -0.062 | 0.117 | 0.416 | 0.359 | -0.068 | -0.121 | -0.049 | -0.319 | -0.500 | 1.000 | | |
| | (0.613) | (0.340) | (0.000) | (0.002) | (0.580) | (0.323) | (0.692) | (0.007) | (0.000) | | | |
| (11) crisis2009 | -0.030 | -0.028 | -0.022 | -0.032 | -0.027 | -0.012 | 0.012 | -0.027 | 0.000 | 0.000 | 1.000 | |
| | (0.808) | (0.821) | (0.859) | (0.797) | (0.828) | (0.924) | (0.920) | (0.827) | (1.000) | (1.000) | | |
| (12) crisis2020 | 0.127 | 0.057 | 0.046 | 0.022 | -0.049 | 0.173 | 0.084 | 0.126 | 0.000 | 0.000 | -0.045 | 1.000 |
| | (0.299) | (0.644) | (0.708) | (0.855) | (0.688) | (0.155) | (0.494) | (0.304) | (1.000) | (1.000) | (0.711) | |