

Three Gap Analysis of Macroeconomic Consistency: A Case Study of the Ecuadorian Economy 2007-2016

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Abstract

This paper studies the macroeconomic consistency of the Ecuadorian economy from 2007-2016. Initially, the paper develops a Three-Gap Model to carry out a basic consistency check on all three macroeconomic accounts, public, private and current accounts. Then, five simple linear regression models with time series are done in an attempt to analyze the impact variables such as private savings and investment, public consumption, investment and revenues, and exports and imports have on one another and how each affects the whole gross domestic product of Ecuador. The analysis is done with data sets obtained from the World Bank and the Ecuadorian Central Bank. Finally, the paper explores whether the economy experienced a crowding-out effect caused by an increase in government spending. The main conclusions obtained by this paper is that Ecuador has been experiencing a macroeconomic inconsistency fostered by an irresponsible government that spends more than it receives. The five regressions showed that the Real Effective Exchange Rate is not significant when determining growth in Ecuador while consumption is the biggest factor that can drive growth. Finally, it is proven that the economy crowded out and the private sector stopped being the biggest player and instead the public sector took over.

1. Introduction

In 2007, the most important participant in the Ecuadorian economy was the private sector, but after almost a decade of major economic changes, that role has shifted to the public sector. Significant policy shifts introduced by the administration of President Rafael Correa began a debate over whether the economy is better or worse off with increased public-sector participation. However, a major study on the impact of the different variables within a macroeconomic consistency framework on economic performance as a whole is still missing. This paper will examine how variables such as private savings, private investment, public consumption, public investment, imports, and exports impact each other and Ecuador's gross domestic product. Gaps in different macroeconomic accounts present in Ecuador's accounts throughout the period from 2007 to 2016 will be used as a case study in order to analyze the proposed thesis and determine if the economy experienced a crowding out of the private sector.

Bardomiano (2014) suggests that, after Ecuador adopted the dollar as the official currency in 2000, the country lost two main government policy making tools—the monetary and exchange rate policies. As a result, fiscal policy became the only way for the government to maneuver the economy, making it more susceptible to external shocks. Still, Onur Tas and Togay (2014) argue that with the dollar as the official currency, macroeconomic performance improved. Inflation fell to lower levels, GDP growth was much higher, inflationary uncertainty was minimized, and money offer was endogenous rather than exogenous as it had been before. In the following years, the economy was driven by the private sector, with liberal policies and low government intervention. In 2007, though, President Rafael Correa's administration delineated an economic strategy in which the public sector was the most important player and was responsible for driving economic growth.

In particular, the government attempted to boost the economy through an expansionary fiscal policy. For instance, as Carrillo Maldonado (2017) points out, various businesses were nationalized in a struggle to increase the state's share in specific markets, government expenses almost tripled during this period; most of the big investment projects were driven, funded and carried out by state-owned companies; and the production of oil, the most important industry in the Ecuadorian economy, was conducted by the state through Petroecuador or Petroamazonas. With this, the economy saw an increase in public investment and consumption. Ponce, Sanchez and Burgos (2010) suggest that this expansion was funded mainly by two favorable external shocks: increased oil prices and higher remittances. However, the government also acquired more external public debt and raised taxes. The situation as a whole reduced private consumption and investment, resulting in a decline in the private sector's participation in the economy.

This study is necessary in order to understand the current macroeconomic situation in Ecuador and to be able to delineate a new strategy that may help increase economic growth and output. In 2017, the Ecuadorian Central Bank's estimates for economic growth in the following years were 1.60% for 2018, 2.39% for 2019 and 2.49% for 2020 after the country's economy grew only 0.7% in 2017 (Subgerencia de Programacion y Regulacion Monetaria y Financiera, 2017). The Ecuadorian economy experienced a recession in the years leading up to 2017, but despite promising forecasts for growth, no study has examined the impact of different macroeconomic variables have on economic output and on one another. This question is particularly important since Ecuador lacks monetary and exchange rate policies.

In order to complete this analysis, this paper first creates a three-gap model as proposed by Bacha (1990) that will be used to explain the macroeconomic consistency in the Ecuadorian economy. At the same time, the model explains how finances are carried out within the country, and how expenses flow inside the economy to assess if the country experienced a crowding out of

private investment when public spending increased. Second, this paper replicates the study on Pakistan by Zafar, James and Pyatt (2000), which has consistent results when using a three-gap model to determine the impact of different variables on one another such as, exports of goods and services, imports of goods and services, public sector revenues and investment, private savings and investment and the level of GDP as a whole. The study carried out by Zafar, et al. also assesses the impact of external shocks. This paper will not replicate the second part of that study, since it is based on structural adjustment programs and reforms suggested by the World Bank for the Pakistani economy and Ecuador does not have these recommendations.

This paper will first present the three-gap model for Ecuador with specific graphs that show the fiscal, balance of payments, and private savings gaps. Second, it will present a simple linear regression model with time series with 5 regressions that simulate the impact of macroeconomic variables on certain target variables.

1.1 Literature Review

Using the examples of Zimbabwe and Colombia, Easterly (1989) discusses the importance of clear and concise accounts that facilitate the analysis of macroeconomic policies. According to this idea, all governments need to pursue budget constraints to achieve consistency in their accounts through four main macroeconomic identities: national accounts, fiscal, balance of payments and monetary. These identities are the basis for managing a budget in a country and should be consistent for all participants, including the private sector. Khadr and Schmidt-Hebbel (1989) present the case for Zimbabwe and suggest that the presence of the four main budget constraints ensures the consistency of all accounts, provided that money is transferable from one of the accounts to another and establishes that total expenditures by an agent should equal total receipts.

According to Uribe, et al. (2007), Ecuador's macroeconomic accounts have historically been consistent within each sector but not necessarily between sectors, meaning that money has been transferred from one account to another, but expenditures have not equaled all receipts in each account. As Easterly (1989) and Uribe, et al. (2007) suggest, the budget constraints in the economy need to follow a specific path through a cash-flow method and a social accounting matrix. This means that when one expense goes beyond the income of a sector, it must be financed by the other sectors. Moreover, when this excess in spending occurs, the only way to fund it is through external income in the current account. This observation gives rise to the three-gap model proposed by Bacha (1990), and when applied to the Ecuadorian economy, which does not have monetary or exchange rate policy, the gaps can prove a crowding out or crowding in effect.

As for studies conducted in other countries, a simple analysis using macroeconomic constraints with a three-gap model in Kenya was used to determine which gap is the binding constraint on growth, leading Mwega, Mwangi and Olewe-Ochilo (1994) to conclude that an increase in exports and capital inflows to the country along with lower imports may have a positive impact on the different gaps and lead to better macroeconomic performance.

Zafar, James and Pyatt (2000) conduct a three-gap analysis of the Pakistani economy and also propose a simple regression linear model with time series to evaluate the impact of policies adopted by the Pakistani government from 1970-1993 on macroeconomic performance. Their model is the core model used for the analysis in this paper. Their paper also defines certain parameters to assess the level of impact of some variables, such as exports of goods and services, imports of goods and services, public investment and consumption, and private savings and consumption, on target variables such as gross domestic product. Using the same model, Ruan and Zhang (2013) present the situation in China and conclude that the model is valid when explaining the Chinese economy.

In terms of whether private investment crowds-out as a result of increased public spending, Argimon, Gonzalez-Paramo, and Roldan Alegre (1995) propose that better infrastructure created by an increase in public investment leads to a crowding-in effect by private investment. However, when government consumption rises, the opposite occurs, and private investment is crowded out. They propose that government consumption leads the private sector to save more in order to pay for the public expenditure as suggested by Uribe, et al. (2007). On the other hand, when the government invests to improve the state of public infrastructure, private investment increases since productivity rises. This thesis is supported by the results found by Xu and Yan (2014) who state that when government invests in public goods in China, private investment increases or crowds-in significantly, but when the state spends on private goods, industry, and commerce through state-owned enterprises, private investment crowds out. This is relevant to the analysis of Ecuador because the Ecuadorian government mainly invested in state-owned enterprises and tried to control the market.

However, not all studies support the conclusions drawn by Argimon, Gonzalez-Paramo, and Roldan Alegre (1995). A study of India and an analysis conducted in Asian countries such as Bangladesh, India, Indonesia, Malaysia, Pakistan and Thailand both suggest that the aforementioned hypothesis is not have supported (Muthu, 2016; Naqvi & Tsoukis, 2003). The study of India conducted by Muthu (2016) finds that non-infrastructure investment has a positive impact on private investment in the short run but finds no evidence to support a positive impact of public infrastructure on private investment in the long run. The analysis of six Asian countries by Naqvi and Tsoukis (2003) found no relationship between public and private investment that held in all six.

This paper will determine if private investment experienced a crowding-out effect during the period from 2007 to 2016. In Ecuador, a three-gap model can be used to test this hypothesis.

As Onur Tas and Togay (2014) suggest, in a dollarized economy, the lack of monetary and exchange rate policies cause the current accounts to shift the other variables in the GDP equation and when applying a three-gap model, the source of the investment or funding can easily be seen. An increase in state expenses means the economy experienced higher private savings and lower private investment, meaning that the private sector is funding the extra public spending. Furthermore, replicating Zafar, James and Pyatt (2000) will allow this study to determine whether or not the economy's behavior was a result of the government's policies and, in turn, what is the causality between different variables and the general macroeconomic performance of the Ecuadorian economy during 2007-2016.

2. Methodology

This section outlines the methodology that was used in order to analyze the afore mentioned hypothesis. The first sub-section describes the three-gap model and the second shows the construction of the five time series linear regression models.

2.1 A Three-Gap Model

The three-gap model proposed will carry out a basic macroeconomic consistency check with the objective of understanding the principal sources of investment within the Ecuadorian economy. The model is based on three main macroeconomic identities (Bacha, 1990). The construction of the model begins by taking the national accounting identity of GDP:

$$Y = C + I + G + X - M, \tag{1}$$

where Y refers to domestic output (GDP), C is private and public (government) consumption, I is fixed capital formation, M is imports of goods and non-factor services, and X accounts for the exports of goods and non-factor services.

Now, given that GNP is equal to GDP plus net foreign investment income and net unilateral transfers, we write the following:

$$GNP = Y + (Y_w^x - Y_w^m) + (tf_w^x - tf_w^m). \quad (2)$$

Where, $(Y_w^x - Y_w^m)$ refers to net foreign investment income and $(tf_w^x - tf_w^m)$ accounts for the net transfers in the economy. Disaggregating Y in terms of GDP we then write:

$$GNP = C + I + G + (X - M) + (Y_w^x - Y_w^m) + (tf_w^x - tf_w^m) \quad (3)$$

We can then write the equation in terms of the current account balance (CA):

$$GNP = C + I + G + CA \quad (4)$$

Equation (5) takes the point of view of income recipients. Each recipient has three choices: consume their income, save it, or pay taxes. We can write the equation of GNP from this point of view as follows,

$$GNP = C + S + T \quad (5)$$

Since equations (4) and (5) are equivalent calculations of GNP, we can write one equal to the other and obtain the following,

$$C + I + G + CA = C + S + T \quad (6)$$

Since we have consumption (C) in both sides, it cancels out and we are left with the following equation:

$$I + G + CA = S + T \quad (7)$$

Re organizing the equation, we finally obtain

$$(S - I) + (T - G) = CA \quad (8)$$

Where $S - I$ is the savings gap, $T - G$ accounts for the fiscal gap and CA considers the balance of payments gap. This three-gap model serves as the basis for this study.

Further analyzing the model, it is possible to say that the three gaps are responsible for macroeconomic performance and consistency in a country. Initially, the private sector has to save

at least as much as it invests. The government is capable of running deficits in its accounts, so it can save less than it spends. Conversely, as Gerber (2012) asserts, T (government income) can be less than G (government expenditure), so to be able to finance the current accounts, the government has to borrow money from the private sector of the economy, causing a reduction in private investment and participation in the economy.

Relating the equation to general macroeconomic performance, we can see that the country's savings (public plus private), can be counted as a source of funds for domestic investment (I), which can translate into higher economic growth (Gerber, 2012). As for government consumption, when a deficit is present, the amount of national savings is reduced and, *ceteris paribus*, investment decreases.

As for the current account, when it experiences a surplus, national savings finances can translate into the purchase of more foreign financial assets. This, along with an increase in sales of goods and services abroad means a healthier economy that is experiencing growth.

However, there is no fixed relationship between government savings (T) government investment (G), private savings (S) and private investment (I) and an alteration in any of these variables can influence the other three. One of the main goals of this paper is to determine the level of influence one of the variables might have on the other.

2.2 Simple Linear Regression Model as (Zafar, James and Pyatt 2000)

To construct the Three-Gap Model for the simple linear regression analysis, the following variables will be used:

First, the paper takes into account two types of capital transfers, net foreign capital inflows foreign capital inflows to the private sector (NF_p) and net foreign capital inflows to the public sector (NF_G). Total public revenues are divided into two main components, non-trade revenues

(T_{nt}) and trade revenues (T_t). Then, these public revenues are available to the government for financial public consumption (C_g) and public investment (I_g). Aggregate imports are divided into imports of goods (M_g) and imports of factor and nonfactor services (M_{sr}). On the other hand, aggregate exports are divided into exports of goods (X_g) and exports of factor and nonfactor services (X_{sr}). This, together, with private savings, S_p , and public saving, $T - C_g$, must exactly balance aggregate investment, which is denoted by I.

The following derivation of the model mirrors the one by Zafar, James and Pyatt (2000). The model is developed into two stages. First, the paper endogenizes seven of the original variables to produce a first approximation to the final model, Specifically, assuming that:

- i. $M_g = \beta Y$
- ii. $M_{sr} = \zeta M_g$
- iii. $X_g = \omega Y$
- iv. $X_{sr} = \varepsilon Y$
- v. $T_{nt} = \alpha Y$
- vi. $T_t = \xi M_g$
- vii. $S_p = \sigma(Y - T)$ where $T = T_{nt} + T_t$ (9)

This introduces a new variable, Y, which is the gross domestic product, the role of which is essentially to normalize the values of other variables.

Next, aggregate and private consumption is defined by C_g and C_p , respectively; where,

$$C = C_g + C_p \tag{10}$$

So, in turn, Gross Domestic Product can be written as follows:

$$Y = S_p + C_p + T \tag{11}$$

After some manipulation of equations (8) to (11), Zafar, James and Pyatt obtain the following equations:

$$Y = \left[\frac{1}{\mu - \psi} \right] \{NF_p + NF_g\} \quad (12)$$

$$I_p = \left[\frac{\sigma(1-\theta)}{\mu - \psi} \right] \{NF_p + NF_g\} + (NF_p - NSS_p) \quad (13)$$

$$I_g = \left[\frac{\theta}{\mu - \psi} \right] \{NF_p + NF_g\} + [NSS_p + NF_g - C_g] \quad (14)$$

$$I = \left\{ \frac{[\sigma(1-\theta) + \theta]}{\mu - \psi} \right\} \{NF_p + NF_g\} + (NF_p + NF_g - C_g) \quad (15)$$

$$C_p = \left[\frac{(1-\sigma)(1-\theta)}{\mu - \psi} \right] \{NF_p + NF_g\} \quad (16)$$

$$C = \left[\frac{(1-\sigma)(1-\theta)}{\mu - \psi} \right] \{NF_p + NF_g\} + C_g \quad (17)$$

Where,

$$\mu = \beta(1 + \zeta); \psi = \omega + \epsilon$$

And

$$\theta = \alpha + \xi \beta \quad (18)$$

Were introduced in order to simplify the expressions for the target variables.

The variables appearing on the left-hand side of Equations (12) to (17) are the target variables for the study. Those on the right-hand side are assumed to be the exogenous or policy-driven variables. The simple version of the model is, therefore, to assume that the various parameters that enter into the Equations (9) and (14) are constant, so the target variables are driven by public consumption and net capital transfers in a linear relationship.

Then, it is assumed that each of the parameters introduced in Equations (9) is constant and so, they are all replaced with a model of how each parameter is thought over time. The results are shown in Table 1.

This study will estimate the following linear regressions in order to determine the parameters stated in Equation (9) parts i. through vii.:

$$(1) \log\left(\frac{M_g}{Y}\right) = \beta_0 + \beta_1 \log(REER) + \log\left(\frac{I}{Y}\right) + \beta_3 \log\left(\frac{C}{Y}\right) + \beta_4 \log\left(\frac{X_g}{Y}\right) + \beta_5 \log\left(\frac{X_{sr}}{Y}\right) + \beta_6 \log\left(\frac{M_g}{Y}\right)_{t-1} + \mu$$

$$(2) \log\left(\frac{T_{nt}}{Y}\right) = \beta_0 + \beta_1 \log\left(\frac{I_P}{C_P}\right) + \beta_2 \log\left(\frac{T_{nt}}{Y}\right)_{t-1} + \mu$$

$$(3) \log\left(\frac{T_t}{M_g}\right) = \beta_0 + \beta_1 \log(REER) + \beta_2 \log\left(\frac{X_g}{M_g}\right) + \beta_3 \log\left(\frac{X_{sr}}{M_g}\right) + \beta_4 \log\left(\frac{X_{sr}}{M_g}\right)_{t-1} + \mu$$

$$(4) \log\left(\frac{X_g}{Y}\right) = \beta_0 + \beta_1 \log(REER) + \beta_2 \log(PPI) + \beta_3 \log(W^d) + \beta_4 \log\left(\frac{X_g}{Y}\right)_{t-1} + \mu$$

$$(5) \log\left(\frac{X_{sr}}{Y}\right) = \beta_0 + \beta_1 \log(REER) + \beta_2 \log\left(\frac{I_{Lat}}{Y_{Lat}}\right) + \beta_3 \log\left(\frac{X_{sr}}{Y}\right)_{t-1} + \mu$$

It is necessary to clarify that this paper uses data up until 2016, since data from official government databases is not yet available for for 2017-2019. The data starts in 2007, when the Correa administration started, because data was categorized differently before 2007.

3. Results

The results presented in this section will be divided into three subsections. The first presents the results obtained after conducting the macroeconomic consistency check with the three-gap model. The second lays out the results obtained after carrying out five linear regression models. The third contains the empirical results of the regressions and explains how and why the target variables are affected by other variables.

3.1 Macroeconomic Consistency Framework

Figure I shows the fiscal gap in the Ecuadorian economy during the years studied. The gap is negative, meaning that the government spent more money in public consumption that it gained

as part of non-trade and trade revenues. In 2007, the deficit Ecuador experienced in its fiscal gap was 1.03 billion USD, the lowest point in the last nine years. The government of President Rafael Correa spent more than it had, increasing the fiscal deficit. From 2008-2012 and 2014-2015, the government improved its situation experienced by lowering the gap, resulting in a significant expenditure cut since public revenue did not increase as much as the deficit fell. The most interesting year is 2016, which shows that the government raised public expenditure without regard for declining public revenues, increasing the fiscal gap to a deficit of 3.9 billion USD.

Figure I: Fiscal Gap

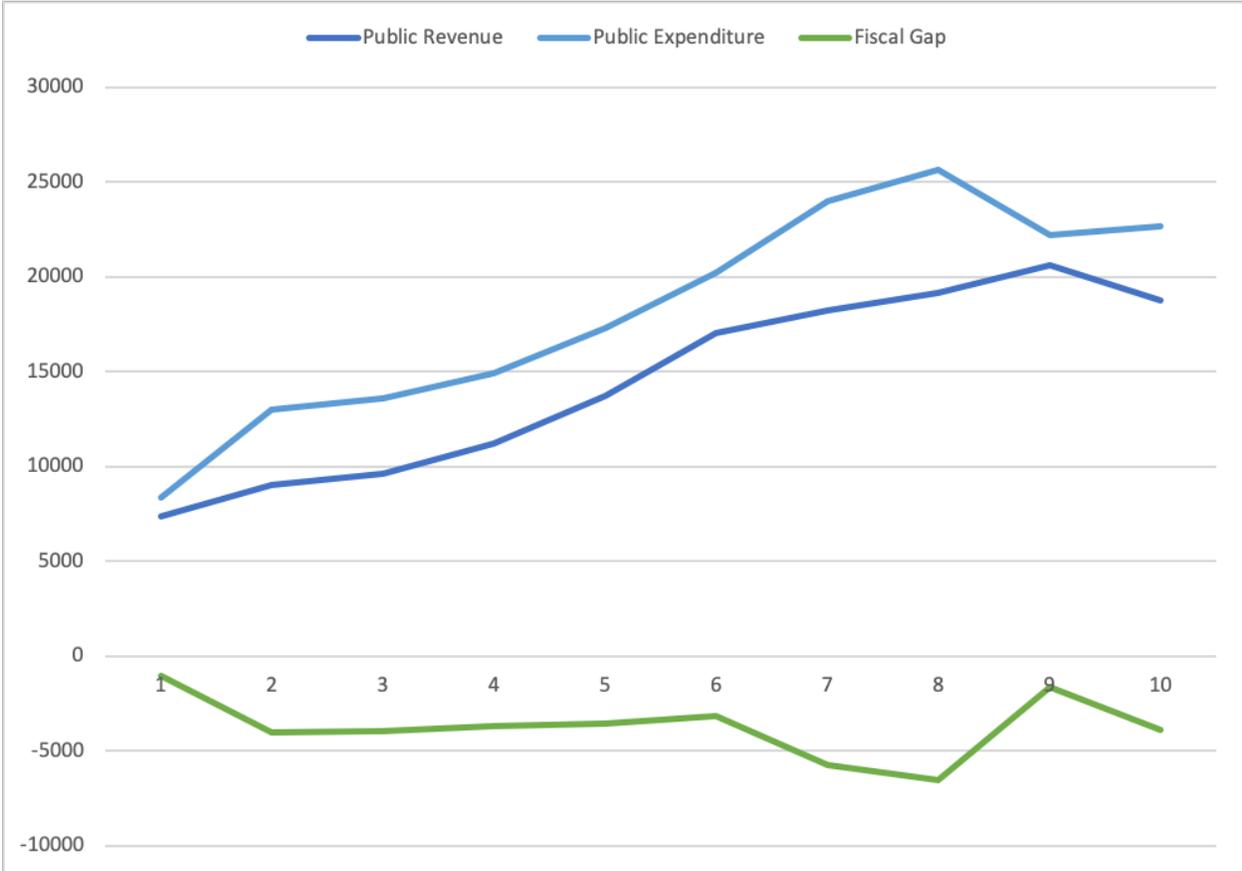


Figure II shows the private gap in the Ecuadorian economy. The gap was positive except for 2015, meaning that the private sector has been saving more money than it invests. In general, this means that the private sector is not investing at its full capacity and is saving for two possible reasons. The first reason is that the private sector is funding the public sector’s over-expenditure

year by year. The second reason is based on the application of the Ricardian equivalence, which states that households are forward-looking and decide whether to spend or save by looking at the fiscal gap and government spending patterns. In this case, households are saving instead of spending because they expect new taxes in the future to finance the government’s deficit spending. The private gap has fluctuated constantly. In 2015, the gap fell below zero, meaning that investment overcame private savings, though only for one year.

Figure II: Private Gap

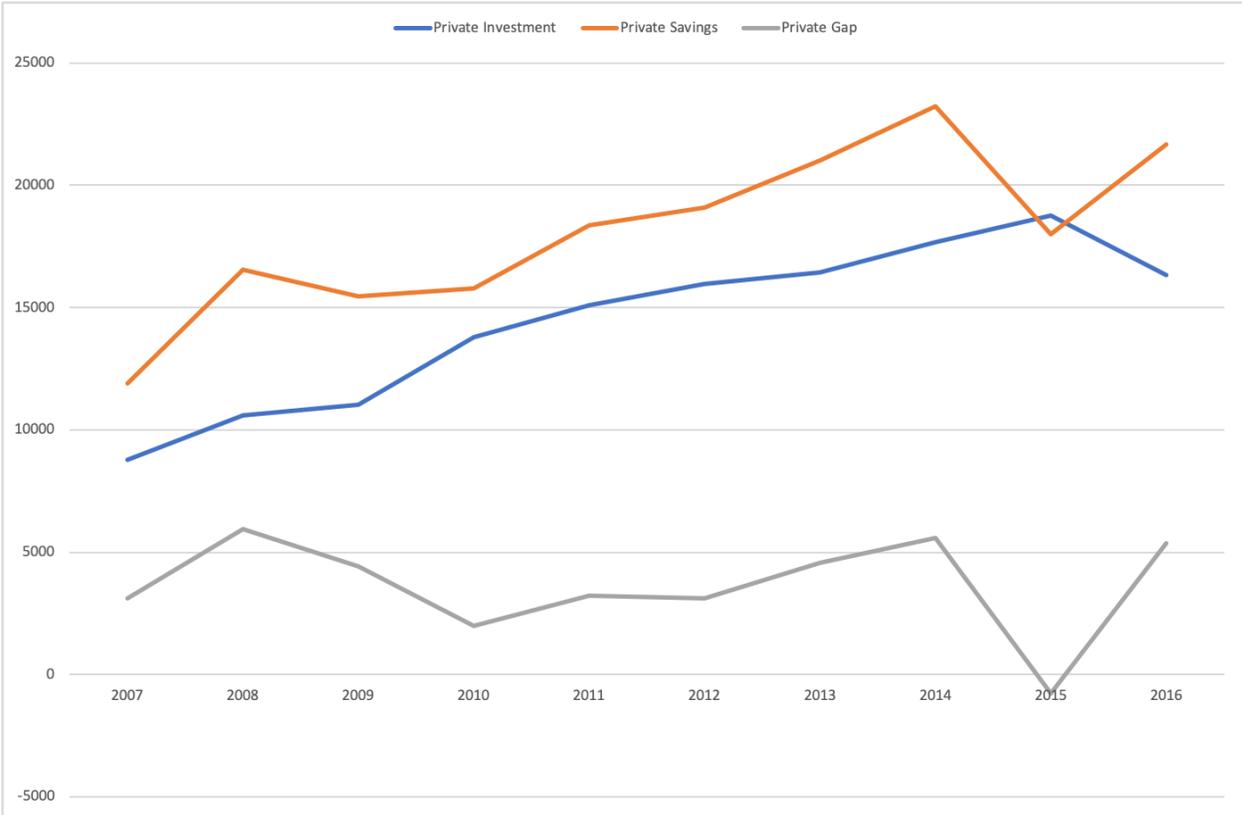
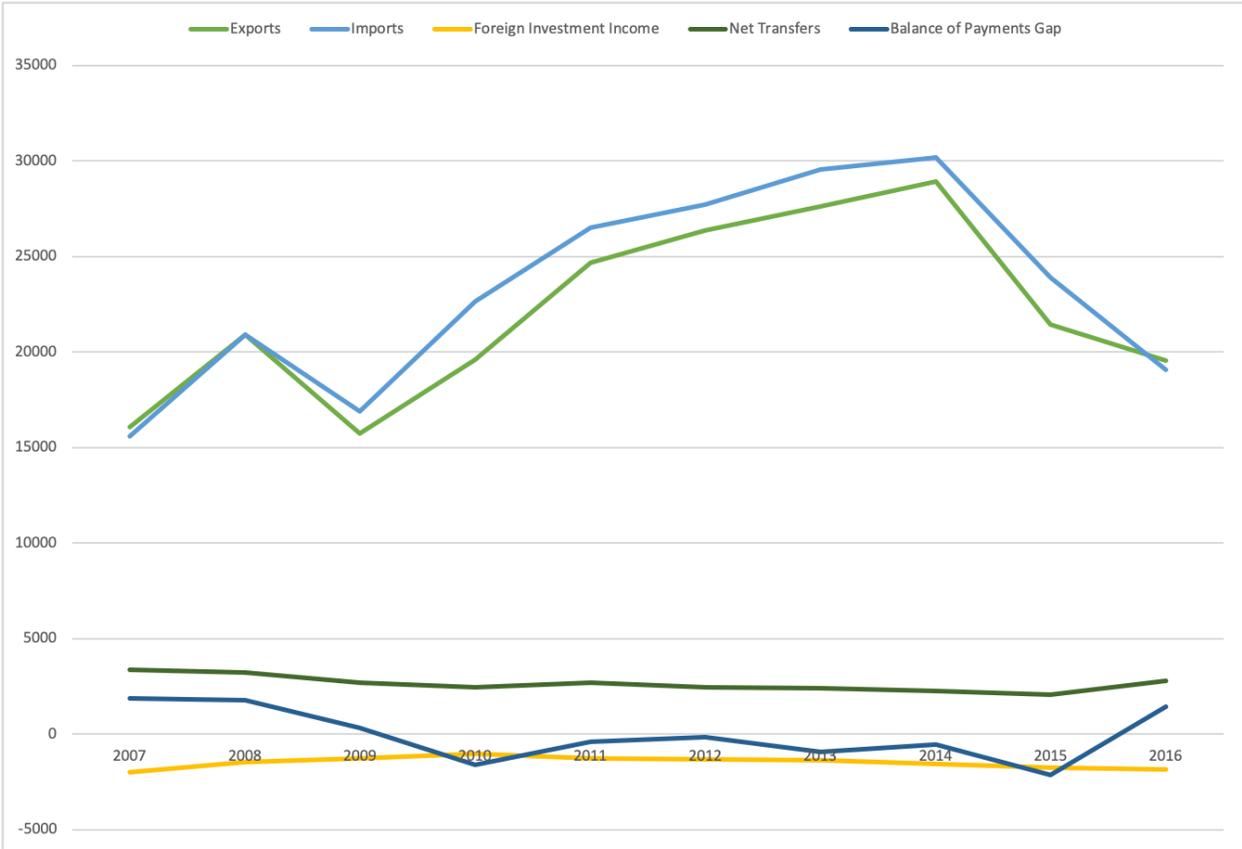


Figure II shows that investment has increasing each year, except for 2016 when it declined. Private savings also increased in most years, although private savings have been more volatile than private investment.

Figure III shows that Ecuador experienced a trade deficit from 2009 to 2015 with a shift to a trade surplus in 2016. Ecuador has had negative foreign investment income and positive net

transfers in each of the years studied. Thus, the balance of payments gap was positive from 2007 to 2009 and in 2016, when it reached its highest point. A positive balance of payments means that the country receives more than it spends when dealing with the international community and that positive balance is later used as investment within the country. It is important to note that the driving factor in Ecuador’s balance of payments gap is net transfers. It is this value, not the trade balance, which balances the current account in Ecuador.

Figure III: Balance of Payments Gap



In 2016, the balance of payments gap improved relative to previous years. The decline in imports during this period was due to a series of tariffs imposed by the government in 2015 on various products, which forced people to lower their import consumption. Net transfers, on the other hand, were sustained by the remittances received from Ecuadorians living abroad.

3.2 Regression Results (Table 1)

	<i>Dependent variable:</i>				
	$\log(T_{nt}/Y)$ (1)	$\log(M_g/Y)$ (2)	$\log(T_t/M_g)$ (3)	$\log(X_g/Y)$ (4)	$\log(X_{sr}/Y)$ (5)
$\log(Ip/Cp)$	0.350 (0.427)				
$\log(T_{nt}/Y)_{-1}$	0.824*** (0.185)				
$\log(REER)$		1.224 (0.520)	3.090 (3.110)	0.076 (0.612)	0.947* (0.469)
$\log(I/Y)$		1.432** (0.148)			
$\log(C/Y)$		3.176*** (0.299)			
$\log(X_g/Y)$		1.274** (0.153)			
$\log(X_{sr}/Y)$		-0.141 (0.138)			
$\log(M_g/Y)_{-1}$		0.201* (0.049)			
$\log(X_g/M_g)$			1.885** (0.632)		
$\log(X_{sr}/M_g)$			-1.698 (0.942)		
$\log(X_{sr}/M_g)_{-1}$			-0.252 (0.264)		
$\log PPI$				0.532** (0.125)	
$\log W^d$				-1.252** (0.423)	
$\log(X_g/Y)_{-1}$				-0.099 (0.114)	
$\log(I_{Lat}/Y_{Lat})$					2.259* (1.028)
$\log(X_{sr}/Y)_{-1}$					0.397 (0.350)
Constant	0.189 (0.646)	-2.762 (2.425)	-19.961 (17.042)	1.467 (2.885)	-3.095 (2.625)
Observations	9	9	9	9	9
R ²	0.768	1.000	0.935	0.984	0.648
Adjusted R ²	0.691	0.998	0.871	0.968	0.437
Residual Std. Error	0.056 (df = 6)	0.008 (df = 2)	0.069 (df = 4)	0.034 (df = 4)	0.046 (df = 5)
F Statistic	9.926** (df = 2; 6)	764.948*** (df = 6; 2)	14.502** (df = 4; 4)	61.997*** (df = 4; 4)	3.069 (df = 3; 5)

Note:

*p<0.1; **p<0.05; ***p<0.01

3.3 Empirical Results

Table 1 shows the results obtained with ordinary least squares regression using the time-series data for the period 2007-2016 for Ecuador. A full list of datasets used for the analysis is included in the Appendix. Additionally, a hypothesis test was conducted for all the regressions:

H_0 : None of the variables was significant

H_1 : At least one of the variables was significant

An analysis of the results for the parameters from Equation (9) follows. The analysis includes five of the seven parts of Equation (9). Parts ii. and vii. could not be carried out because of a lack of data. After 2006, Ecuador did not calculate the real domestic interest rate, which is used in these two models.

Parameter β : Imports of goods and services—Equation (9) i. and Table 1, Column(2)

Parameter β is described in Equation (9), part i. and results are taken from Table 1, Column 2.

The results for this parameter, which relates the import of goods to GDP, follows the expectations established in the beginning. Of all the dependent variables analyzed, four—total investment, total consumption, exports of goods and lagged import of goods—are significant when determining the imports of goods in comparison with the Gross Domestic Product in Ecuador. The other two variables—Real Effective Exchange Rate and exports of goods—are not significant. This may be explained by the fact that Ecuador's official currency is the U.S. dollar, so variations in the exchange rate index with other currencies are small. Exports of services is not only significant but negatively correlated with the dependent variable. This can be explained by the fact that Ecuador mainly exports transport or tourist services, so consumption occurs locally rather than seeking imported services. Of the variables that are significant, the one with the largest effect is

total consumption, which is significant at the $p < 0.01$ level and has an elasticity greater than 1. This may indicate higher demand for imported consumer goods because most of the goods imported are used at a primary level for production and at a tertiary level to provide services to the public. People in Ecuador also tend to prefer imported goods to domestic ones. Total investment and exports of goods are both significant at the $p < 0.1$ level.

In terms of the p-value analysis, the results obtained for this regression are that, even though all variables are not independently significant, the value of $p \approx 0.0016$ suggests that they are jointly significant.

Parameters ω and ϵ : Exports of goods and services

Parameters ω and ϵ are described in Equation (9), part ii. and results are taken from Table 1, Columns 4 and 5, respectively.

These parameters' results, when estimating exports of goods in terms of GDP gave results that were not initially expected. Two of the four variables—world consumption of oil and the Petroleum Price Index—are significant when determining the level of exports of goods in Ecuador while the other two (Real Effective Exchange Rate and lagged exports of goods) were not significant. The petroleum price index variable has a positive impact on the export of goods in the country, which is explained by the fact that Ecuador's main export is oil and the fact that the economy is energy-intensive. When petroleum prices go up, Ecuador tries to export more in order to gain higher revenues. As for world consumption of oil, the negative coefficient suggests an inverse relation between exports of goods and world consumption of oil. A further analysis of the industry is needed to explain this relationship. The results obtained in this case were jointly $p \approx 0.001$, suggesting that the variables are jointly significant in determining the export of goods in Ecuador.

Regarding exports of services, the results are as expected and provide evidence that two out of the three variables—Real Effective Exchange Rate and total investment over GDP in the region—affect exports of services. Both variables are significant, with the latter having a higher coefficient. Ecuador’s biggest services exported are transportation and tourism, so when investment as a percentage of GDP in Latin America increases, an increase in tourism is expected, since people have more money to spend and since the tourism sector itself benefits from increased investment. Growth in tourism attracts more people to the country and the transportation industry grows as well. Regarding the real effective exchange rate, when the dollar depreciates, services such as tourism and transportation become cheaper and are highly exported. The last variable (lagged export of services) was not significant. The p-value obtained in this case is $p \approx 0.099$, so the variables are jointly significant at the $p < 0.1$ level, but not at the $p < 0.05$ level.

Parameters α and ξ : Public non-trade and trade tax revenues—Equation (9), parts v. and vi.

Parameters α and ξ are described in Equation (9), parts v. and vi. and results are taken from Table 1, Columns 1 and 3, respectively.

The first parameter produces interesting results, since one of the two variables is significant when determining the non-trade and tax revenues in the Ecuadorian economy. It shows first of all, that the level of private investment as a fraction of private consumption does not significantly affect the dependent variable. On the other hand, lagged public non-trade revenues over GDP is significant at the $p < 0.05$ level. This indicates that tax revenues in Ecuador are not only dependent on current income but on income from the previous year as well. This may be explained if the private sector pays taxes to the government with income from previous years, so government revenue depends on the trend of private income.

As for trade revenues in terms of import of goods, the only variable that is significant is the ratio of export of goods over import of goods. Taxes on exports of goods contribute positively to government revenue, while taxes on the export of services produces the opposite relation. This may be because, when services are taxed, the economy stops exporting services. Tourism and transportation become more expensive when taxed, and foreigners may not be willing to sustain demand. As for exports of goods, the results obtained indicate that exports of goods are highly inelastic relative to imports of goods, meaning that producers of goods still export no matter the taxes imposed.

The p -value obtained in the first parameter was $p \approx 0.44$, so the null hypothesis was not rejected, and the variables are not jointly significant. This may occur because non-trade revenues in the economy rely on other factors besides the ones proposed in the regression. Ecuador may generate more public revenue through indirect taxes than direct taxes, which are the ones that businesses and the private sector pay. As for the second parameter, the hypothesis was not rejected since $p \approx 0.001$, meaning that all variables are jointly significant.

4. Conclusion

Ecuador has experienced a harsh economic situation from 2007 to 2016, with fiscal deficits, low economic growth, and poor macroeconomic performance overall. The main purpose of this study was to address the consistency of the economy so that new policies can be adopted to establish budget constraints in the economy followed by policies that foster economic growth.

The study was successful in determining the economy's macroeconomic inconsistency by demonstrating that budget constraints are not applied. In the public sector, the fiscal gap is negative, meaning public investment surpasses revenues received. This inconsistency in the account means money must be taken from other sectors to fund the excess expenditures. On the

other hand, the private sector has been saving more money than it invests. Ideally, the private sector should invest more to keep the economy growing. The balance of payments gap was shown to be positive when trade balance is positive, though remittances also have a large influence.

Section 3.1 shows that the private sector crowded-out during the administration of Rafael Correa. Year after year, despite increases in private investment, the private gap grew, meaning that savings surpassed investments. The crowding-out effect may be because the private sector lacks the participation it had before 2007 and has seen lower growth rates as public expenditure has grown, specifically in industries where private companies had significant participation, such as oil and construction. The results suggest that the private sector has become the government's financier, but further analysis is needed to establish what percentage of this might be due to households following the Ricardian equivalence and saving for future tax increases.

The study also concluded that public investment, funded mainly by private revenues, is now driving the economy. This can be explained by the fact that private investment has crowded out in the country for the last nine years. Still, in order to increase economic growth in Ecuador, greater participation of the private sector is needed, first by decreasing public expenditure to a point where budget constraints are achieved and second, through policies which encourage lower savings and higher investment levels in the private sector.

Two important conclusions about the regression models should be highlighted. First, the Real Effective Exchange Rate (REER) is, in general, not significant in the Ecuadorian economy. Four of the five models in which the REER was used, resulted in this variable not being significant. Since Ecuador uses the U.S. dollar as its official currency, variations in the exchange rate are minimal, so, it does not significantly impact the target variables studied. Furthermore, the United States has been the most important trade partner for Ecuador, so having the same currency has helped minimize the impact that exchange rates have on the economy.

The second conclusion is that consumption is more significant than investment when driving economic growth in Ecuador. In general, macroeconomic performance in Ecuador has benefitted more when consumption increases than when investment does, which can be explained by the fact that households in Ecuador tend to consume more than they invest, and the government's biggest non-trade revenue is the value added tax on consumption.

It is important to highlight, though, that two of the seven regressions initially proposed could not be carried out because of a lack of data. After 2006, Ecuador stopped calculating the real domestic interest rate in the economy and two of the seven initial models use this variable to analyze its impact on private savings as a fraction of private income (Parameter σ) and on the rate of imports of services over imports of goods. Another limitation was that the coefficient on world demand for oil in regression (4) turned out to be negative, which was not expected. Further analysis is needed to address this.

Both models proved effective in addressing the initial questions posed by this study. The connection between the two gives a deeper analysis of Ecuador's economic performance and may help Ecuador develop new policies to foster economic growth.

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6. Appendix: Datasets Used

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