

## **The Effects of International Monetary Flows on the Ecuadorian Economy from 2002 to 2021**

### **Efectos de los Flujos Monetarios Internacionales sobre la Economía Ecuatoriana del 2001 al 2021**

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#### **Abstract**

*Ecuador's economic expansion has been shaped by diverse external factors that have impacted its performance. This study investigated the correlation between external debt, foreign direct investment, and gross fixed capital formation in relation to Ecuador's economic growth spanning from 2001 to 2021. Employing a quantitative approach, the research sourced data from various macroeconomic indicators of Ecuador's Central Bank, and an econometric model of logarithmic linear regression was devised, grounded in the principles of ordinary least squares. This model facilitated an examination of the interrelationships among the variables of interest. The results obtained from the analysis indicated that both external debt and foreign direct investment wielded significant influence on economic growth. Specifically, external debt demonstrated a favorable effect on the dependent variable, whereas foreign direct investment displayed an adverse relationship, painting a less promising scenario for Ecuador's economy.*

#### **Keywords**

*Economic Growth; Elasticity; External Debt; Foreign Direct Investment; Gross Domestic Production.*

#### **Resumen**

La expansión económica en Ecuador ha sido influenciada por diversos factores externos que han afectado su desempeño. Esta investigación examinó la relación entre la deuda externa, la inversión extranjera directa y la formación bruta de capital fijo en relación al crecimiento económico de Ecuador entre 2001 y 2021. Se realizó un estudio cuantitativo que involucró la recolección de datos de distintos indicadores macroeconómicos del Banco Central de Ecuador. Se formuló un modelo econométrico utilizando regresión lineal logarítmica basado en el método de mínimos cuadrados ordinarios, lo que permitió analizar la relación entre las variables estudiadas. Los resultados obtenidos indicaron que tanto la deuda externa como la inversión extranjera directa tuvieron un impacto importante en el crecimiento económico. Específicamente, la deuda externa tuvo una influencia positiva en la variable dependiente, mientras que la inversión extranjera directa mostró una relación negativa, lo que sugiere un panorama desfavorable para la economía ecuatoriana.

#### **Palabras Clave**

Crecimiento Económico; Deuda Externa; Elasticidad; Inversión Extranjera; Producto Interno Bruto.

## Introduction

During the period from 2001 to 2021, the Ecuadorian economy has been influenced by various external economic factors. Among which foreign direct investment (FDI) and external debt (ED) can be highlighted as the main sources of international monetary flows after foreign trade. Mamingi and Martin (2018), established that these two international flows have been important sources of monetary income that have participated and influenced the economy of several developing countries.

In the international economic scenario, developing countries have faced challenges in finding means to promote economic growth and improve their socio-economic conditions. Consequently, turned to different sources of financing to achieve this objective. Is essential identifying FDI and ED as crucial topics for economic policies and strategic planning in emerging economies.

It is necessary to highlight that ED has been established as the primary tool for financing economies in development, as it increases net income and solves the lack of national monetary funds to cover investment projects, economic growth, and development. However, mismanagement of ED can lead to economic insolvency and become an unbearable financial burden (Munevar, 2012).

Rubio et al. (2003) determined that ED leads to private investment, expands productive capacity, and encourages economic development of underdeveloped countries. However, excessive indebtedness turns its beneficial effect into a precarious one due to the improper management of funds, which significantly affects country's economic growth and renders it insolvent.

On the other hand, FDI, like ED, has been considered a fundamental factor in the growth and economic transformation of developing countries. Which has been an important source of foreign financing and tech-

nology transfer, which conduces to: private investment, job creation, capital production, knowledge enhancement and economic development in these economies.

Despite the favorable effects of FDI on developing economies, it has been determined that it may also have negative impacts on national economy. De la Garza (2005) established that despite the benefits that FDI can bring with it, there are also potential negative effects for recipient economies. These negative effects may include economic dependence, exploitation of national resources, unfair competition, negative impacts on the balance of payments due to imports, capital flight, among others.

According to data from the Central Bank of Ecuador (BCE) (2023), the Ecuadorian economy during the specified period, has shown an average annual growth of real GDP in millions of dollars in 2007 of 2.86 %, within which FDI accounted for 1.09 % of the total GDP, and ED averaged 38.85 % with respect to GDP. It is noteworthy that the percentage of debt flow participation is significantly higher than that of investment. Therefore, it is of utmost importance to explore the impacts these variables have on the national economic growth and determine whether their behaviors promote or discourage the Ecuadorian economy.

In spite of having carried out an extensive literature review with the different points of view of various author's art an international level, the relationship between FDI and ED on economic growth has been a highly controversial topic. While in some countries, they are seen as determining factors for economic growth, in others, they have been associated with negative outcomes such as economic stagnation and regression. This aspect strengthens the motivation and importance of evaluating the relationship of these international monetary flows on a country's economic performance.

Considering that both FDI and ED have become key components of Ecuador's economic and financial structure, it is essential in this context to analyze how these variables as a whole stimulate national production, in order to provide relevant and updated information on the impact of both factors on Ecuador's economic growth. As well as understand how these variables affect the national economy during the period under study.

## Literature Review

According to Samuelson and Nordhaus (2009), economics is the science and art that studies how society uses and allocates finite resources to produce goods and services that satisfy the unlimited needs of human beings. Therefore, it is of utmost importance that the different international economies expedite their growth, thus achieving greater economic development. But what exactly is economic growth?

According to Barriga-Yumiguano et al. (2018), economic growth can be defined as the quantitative variation of an economy explained by sustained increases in production, based on productivity, employment, and a country's competitiveness. On the other hand, Labrunée (2018) defines economic growth as a sustained process over time where levels of economic activity such as production, trade, industry, among others, increase constantly. In other words, economic growth can be understood as the sustained development or evolution of an economy over time due to the productive increase of economic activities in a country. But how is growth or such economic variation measured?

The answer is simple: Gross Domestic Product (GDP), GDP is a crucial indicator for measuring the evolution of a nation's economic growth. According to Coyle (2017), GDP is used to account for all economic output

generated within a nation's borders. Callen (2008) states that GDP measures the monetary value of final goods and services produced by a country within a specific period, generated within the borders of that country, and serves as a benchmark to discuss national and global economic health. The most common approach to measure GDP is in terms of expenditures, where GDP is understood as the sum of all a country's expenditures, and can be explained by the following equation:

### Equation 1

$$GDP = C + I + G + X - M$$

Where:

C = represents consumption expenditures.

I = equals investment expenditures.

G = government spending

X - M = represents net exports.

In other words, GDP is understood as an indicator that measures the wealth generated within a national territory during a specified period.

According to Callen (2008), nominal GDP can be defined as the value at market prices (current prices) of the production of final goods and services produced in a country during a given period of time, normally a year, this is the type of data that will be used in the present research. Undoubtedly, it is of utmost importance to understand the variables to be dealt with in the research. Which is why each of the explanatory variables is defined below to achieve a better understanding of them.

Starting with the definition of ED, in general terms, it can be understood as the financial obligations of natural or legal persons, public or private, contracted with international entities, such as public or private institutions from abroad. Munevar (2012) defines ED as the obligations contracted by a country through a foreign entity, and from the debtor's point of view is divided into two

types of debts: private external debt and public external debt. Private external debt can be defined as all obligations acquired in a foreign currency by private entities such as households, businesses, financial institutions, among others, without any public guarantee. While public external debt can be understood as all obligations in a foreign currency contracted by public entities such as the central government, states, ministries, among others.

Finally, Krugman and Obstfeld (2018) define FDI as international capital flows in which a company from a foreign country creates or expands a subsidiary in another country. However, FDI not only implies a transfer of resources, but also aims to acquire control or productive participation abroad, where such subsidiary becomes part of the same organizational structure as the investing company. On the other hand, Patterson et al. (2004) states that, according to the fifth edition of the balance of payments, FDI is defined as the investment by a resident of one economy in another foreign one with the aim of obtaining a lasting interest in a foreign enterprise.

Nevertheless, the previous concepts can be summarized in the ideas presented by Esquivel and Larraín (2007), where they define FDI as the transfer of any kind of capital that seeks to acquire a percentage of participation in the management, possession or control of companies located abroad to carry out productive activities. In other words, FDI can be understood as the amount of foreign capital transferred to acquire productive participation in a country different from its origin.

Economic growth can also be reflected as an increase in a country's productivity, which according to Munevar (2012), is a key determinant for a nation's development theory, where the mobilization of external savings/monetary flows in the form of credit or foreign investment are considered as mecha-

nisms that accelerate a country's productive and economic transformation process. In this way the theory of external financing justifies the need for external credit to bridge the gap of internal foreign exchange funds in developing economies, which are unable to manufacture the capital goods required to increase productivity and provide the necessary levels of savings to finance investment processes due to low income levels.

Through external financing, economies enable the inflow of external monetary flows that lead to capital investment, complementing domestic savings and increasing the investment rate, promoting productivity, and thereby achieving economic development.

Establishing the importance of external financing for economic development, a literature review was conducted to gather various author's perspectives on the topic of interest. In order to understand the overall landscape of research and identify the potential expected outcomes of this study.

## Foreign Direct Investment

Starting with the analysis of the impact of FDI in economic growth at an international scale, Belaşcu et al. (2018) examined the relationship between FDI flows and economic growth in the Eurozone countries (including those in Central and Western Europe, which are part of the European Union, during the period 1999-2013). The authors implemented a panel data model to analyze the relationship between the variables in Bulgaria, Czech Republic, Hungary, Poland, and Romania, in the aim to capture the evolution of the different economies and their specific differences while eliminating the difficulties encountered in other estimations and mitigating the low frequency of available FDI data.

The modeling results established that gross capital formation and FDI exhibited a robust relationship with economic growth,

given their significantly positive coefficients across all panel specifications of the model. These variables were identified as fundamental determining factors for economic growth within the analyzed Eurozone. However, the authors recommended including more variables, such as technology, education, among others, to obtain a more accurate understanding of the subject.

On the other hand, Rao et al. (2020) examined the relationship between foreign aid and FDI concerning economic growth in South Asia (SA) and Southeast Asia (SEA). This examination used a panel data regression model based on the Generalized Method of Moments (GMM) within the period of 1980-2016. The modeling results established that FDI flows were significant in explaining GDP growth, meaning they justify or support economic growth within SEA and SA. Additionally, it was determined that there is a positive inelastic relationship between FDI and economic growth, where a 1 % increase in FDI led to a 0.15 % increase in GDP.

It was concluded that the foreign inflows in SEA and SA should be directed towards domestic financial aid for private sector investment, thereby stabilizing their macroeconomic conditions and complementing FDI flows to achieve maximum economic growth possible.

Quoc and Thi (2018) analyzed the impact of FDI and its relationship with economic growth in Vietnam during the period 1986-2015. This analysis used a Vector Autoregressive (VAR) econometric model. The results of the research modeling presented a significant positive coefficient from FDI, confirming that this promotes economic growth in Vietnam within the specified period. However, it was determined that this positive relationship tends to decrease over time, which questions its long-term relationship and partly differing from previous authors.

It was concluded that it is of utmost importance for Vietnam to properly mana-

ge external funds and create various investment projects, as FDI serves as a significant source of financing for the country's development.

Alabi (2019) investigated the impact of FDI and economic growth in Nigeria during the period 1986-2017, where through a logit regression model, the relationship between the variables and their elasticity was analyzed. The results of the logarithmic regression established that FDI is statistically significant in explaining economic growth and showed a positive relationship with it. Additionally, it was determined that there is a positive inelastic relationship between the variables, where a one percentage point increase in FDI leads to a 0.63 % increase in GDP.

It was concluded that FDI is an influential factor in explaining Nigeria's economic growth. Therefore, efforts should be made to attract more foreign investors to achieve improvements in technology transfer, greater employment opportunities, and increased productivity, thereby leading to greater economic development nationwide (Alabi, 2019).

Approaching the analysis in a context closer to Ecuador, a review was conducted on the findings of authors who carried out their research in Latin America.

Álvarez et al. (2009) investigated the impact of FDI on economic growth in 14 Latin American countries from 1996-2003. They implemented a two-equation regression model based on the generalized method of least squares and the two-stage least squares method, in order to correct the correlation of the explanatory variables and the endogeneity problem of the regressors used. Only the first equation was analyzed since it is the one that interprets the relationship between GDP per capita and FDI per capita. The results of the model established that FDI had a positive and statistically significant influence on GDP per capita within the studied countries. It was concluded that FDI stimu-

lates both capital formation and economic growth in the countries analyzed.

Bustamante (2016) analyzed the impact of FDI flows on economic growth in Peru over the period 2009-2015. The analysis used a Johansen cointegration model between GDP and FDI flows. The results of the model established a positive but inelastic relationship between the variables. In other words, a one percentage point increase in FDI flows led to a 0.13 % increase in national GDP. Additionally, the impulse-response function determined that FDI flows had a positive and permanent impact with a growing trend in the medium term on economic growth. It was concluded that FDI was a significant variable in explaining economic development in Peru over the analyzed period. Therefore, it is of utmost importance for the country to continue providing economic, political, and structural conditions that attract foreign capital investors.

Maldonado Niño et al. (2019) through a literature review of 30 articles analyzed the impact of FDI on the economy in Latin America. It was determined that FDI plays a fundamental role within these countries, as there is a mutual benefit between the investing country, which seeks more flexible production constraints, and the recipient country, which attracts greater investment funds, that generates employment, increases productivity, encourages exports, facilitates technology transfer, and enhances intellectual development through capacitation. Promoting economic development which leads to a higher standard of living for the inhabitants of these economies. Concluding that in Latin America, FDI has positive effects that lead to greater economic development.

Cruz Vázquez et al. (2019) evaluated the impact of the degree of economic openness and FDI on economic growth in eighteen Latin American economies during the period 1996-2014. This included coun-

tries such as Brazil, Mexico, Colombia, Peru, Panama, Ecuador, among others. A vector autoregressive model with panel data was used to measure the relationship. The results of the model contributed to the ambiguity of the variables in explaining economic growth, where a positive but weak relationship was established for GDP due shocks from the degree of economic openness, while FDI presented a significant but negative relationship with economic growth.

The negative impact of FDI can be explained by the shift it causes to domestic investment, leading to adverse effects instead of promoting development. Therefore, it was concluded that Latin American countries should manage FDI flows more effectively to complement domestic investment in order to make the most of external financing and promote economic development.

Cerquera-Losada and Rojas-Velásquez (2020) studied the effects of FDI on economic growth in Colombia during the period 2000-2019, for which a cointegration and Vector Error Correction (VEC) model was implemented. The results established that there was a balanced and cointegrated growth relationship between the time series, meaning that both FDI and GDP grew at par. On the other hand, the VEC model analyzed the long-term relationship, which established that FDI had a moderate positive effect on GDP, indicating that an increase in FDI flows contributed moderately to Colombia's economic growth.

The conclusion drawn was that the relationship between FDI and economic growth in Colombia was balanced, meaning that the relationship between these variables is positive but moderate, rather than significant. It was also determined that economic growth tends to attract more foreign investors, implying that economic growth fosters FDI growth. This establishes that FDI does not necessarily lead to economic growth, as the

relationship depends on each country's economic conditions.

Finally, to conclude the literature review on FDI, took place an analysis of its impact on the economic growth of Ecuador's economy. Ortiz et al. (2018) through their research examined the effect of FDI and economic freedom on Ecuadorian economic growth during the period 1980-2017. For the interpretation of the relationship, were implemented an autoregressive distributed lag model (ARDL) and an error correction model (ECM). The results from the ARDL model indicated that the F-statistic was greater than the critical value, confirming cointegration of the data and establishing a positive long-term relationship between the variables.

Furthermore, the ECM model allowed the analysis of the short-term relationship between the variables. It confirmed that economic growth showed sensitivity to changes in FDI and economic freedom, as well as unidirectional causality from FDI to GDP per capita. Concluding that in the case of Ecuador, both FDI and economic freedom stimulate factor efficiency, leading to an increase in the country's rate of economic development.

Gonzalez Soriano et al. (2019) through their literature review and empirical data review, studied FDI as a substantial factor in a country's economic development. The following conclusions were drawn: FDI is a fundamental factor for the economic growth of a country, given that it helps finance productive investments, leads to increased exports through enhanced production, generates more employment, and stimulates the economy, creating more development opportunities.

Furthermore, the study established that FDI facilitates the transfer of technology and knowledge since foreign subsidiaries introduce new products or processes to the market, contributing to the enhancement of human capital. Lastly, FDI as a tool used by transnational corporations creates a more

competitive market and encourages local companies to improve their productivity, ultimately raising the income of the population.

Establishing FDI according to the literature review as a factor that fosters economic development of a country, for which Ecuador should facilitate the means to attract more foreign investors.

## External Debt

Following the literature review on the impact of the second explanatory variable of this research, we proceed to examine its effects on the economy at an international scale. Baum et al. (2013) investigated the relationship between public ED and economic growth in 12 countries of the eurozone over the period 1990-2010. The authors implemented a threshold model with panel data to determine the relationship between these variables. The results of the modeling led to the conclusion that, in the short term, public debt has a positive influence on economic growth. However, over time this relationship tends to lose significance and approaches zero, indicating a non-significant long-term relationship. Based on this, it can be inferred that in the short term, public debt fosters economic growth, but as debt increases over time, its positive effects within the eurozone turn negative. This is due to the fact that excessive debt becomes unmanageable, which is why the efficient management of public debt is essential.

Gövdeli (2019) —using an autoregressive distributed lag (ARDL) econometric model— studied the impact of ED, trade openness, and the Consumer Price Index (CPI) on economic growth in Turkey over the period 1970-2017. Through this time series analysis, they were able to determine the relationship between these variables. The results of the ARDL model established that all the variables were significant in explaining eco-



economic growth of the model. However, it was found that in both the short and long term, ED was the only explanatory variable that presented a positive relationship with the dependent variable.

Moh'd AL-Tamimi and Jaradat (2019) investigated the relationship between ED and economic growth in Jordan during the period 2010-2017 through an analysis of the annual incidence of debt on GDP. The results established that there is a negative relationship between public debt and GDP growth in Jordan within the stated period, attributed to the unmanageable level of debt. Therefore, they recommended seeking an alternative for external financing to encourage investment, such as FDI.

Concluding that in the case of Turkey, ED has a significant positive relationship with GDP both in the short and long term, indicating that it promotes economic development. However, debt must not become excessive, because it can lead to insolvency and economic burden. Therefore, it was recommended that ED funds and other international flows such as FDI, should be used efficiently to promote investment projects that increase productivity and foster economic development.

Ighodalo et al. (2020) investigated the relationship between ED and economic growth in 43 African countries during the period 2001-2018. The authors implemented a Johansen's cointegration test and the generalized method of moments. The results of the model established a negative relationship between ED and economic growth. However, it was determined that there is a non-linear relationship between this two, which means that ED is not necessarily a bad tool for promoting economic growth. The negative relationship is attributed to the improper management of ED, where it is not directed towards investment or growth-enhancing purposes. It was concluded that

African economies should create economic policies that efficiently manage debt usage, thus turning its negative effects into positive ones that promote economic growth.

Ajayi and Oke (2012) analyzed the effect of debt on economic growth in Nigeria during the years 1985-2012. The authors implemented an econometric regression model based on ordinary least squares (OLS) principles. It was determined that there was a positive relationship between the explanatory variable 'ED' and the dependent variable 'national income'. Additionally, the variables exhibited a positive elastic behavior, where an increase of one percentage point of debt, resulted in a 12.78 % increase of national income. The study concluded that the positive impact of debt in Nigeria was due to the insufficiency of domestic funds to meet the investment needs for sustaining economic growth, therefore external financing fostered the country's economic development.

On the other hand, a more recent study by Omodero and Alpheus (2019) examined the effect of ED on economic growth in Nigeria during the period 1997-2017. Using a regression model based on the principles of OLS, the results established that ED during period studied, exhibited a significant negative relationship, meaning that the variable contributed to explaining economic development. However, it showed diminishing returns.

The overall conclusion reached was that in underdeveloped countries like Nigeria, debt can foster economic growth, as long as the level of debt does not become unsustainable, turning its positive effects into diminishing returns that lead to economic insolvency.

Emerging economies tend to seek external financing in order to bridge the gap of insufficient funds and achieve greater economic development. Kharusi and Ada (2018) investigated the relationship between ED and economic growth in emerging econo-



mies as in the case of Oman during the period 1990-2015. The authors employed an autoregressive distributed lag cointegration model and an error correction mechanism. The results from the ARDL model were used to analyze the long-term cointegration of the variables, it was determined that ED had a positive impact on economic growth in the long run. However, the error correction mechanism revealed that ED was statistically significant in explaining the model, but had negative effects, where instead of stimulating economic growth, it led to a decrease in economic activity.

The analysis of the model also established an inelastic negative relationship between ED and economic growth, where an increase of one percentage point in debt reduced Oman's GDP by 0.04 %. It was concluded that in the case of Oman, in the short term, ED had a negative impact on the economy. But in the long run, its negative effects turned into positive. It was determined that Oman, as an emerging economy, should finance its investment and development projects through external debt in order to achieve greater economic growth and bridge the resource gap.

On the other side, Guei (2019) studied the relationship between ED and economic growth in 13 emerging economies, including countries such as Brazil, Argentina, Venezuela, Mexico, among others, during the period 1990-2016. The research implemented an ARDL econometric model with panel data to analyze the impact of debt on economic growth. The results of the model determined that in the long term, ED was not significant in explaining economic development. However, in the short term, a negative relationship between ED and growth was established, since the increase in debt discouraged development in the emerging economies observed during the specified period. Additionally, it was determined that there was no causality

from debt to explain economic growth, leading to the conclusion that external debt is a factor that discourages economic growth.

Mideros and Abad (2022) —who investigated the role of institutional quality in relation to ED and economic growth in Latin American countries during 2000-2019— implemented an econometric model based on OLS and Fully Modified OLS assumptions to calculate the long-term relationship between the variables and correct bias and inconsistencies problems. The results of the model established that ED had a positive impact on the increase of GDP per capita in the short term in the countries of the region analyzed, generating a positive effect on economic growth. However, it's crucial for debt to remain manageable and not become excessive, as an excessive amount of debt could lead to diminishing returns for economic growth and their investment capacities. In conclusion, debt plays a fundamental role as a determinant factor of economic development in Latin America. Nevertheless, debt should not become unsustainable, as it would lead to a negative impact on the region's economic development.

Delgado Gamboa et al. (2022), in their research, analyzed the influence of ED on economic growth in South American countries such as Ecuador, Colombia, Argentina, Brazil, among others, over a 21-year period (2000-2021). The authors, through a fixed-effects econometric model with panel data, established that the overall model was significant, and when analyzing the significance and impact of the explanatory variables, ED was found to be statistically significant with positive effects on economic development. Despite the positive relationship between the variables, it was determined that the relationship was moderate but not significant. Therefore, it was concluded that although there is a positive relationship between the variables, the positive impact that ED gene-

rates on South American economies is only moderate and not of high impact. Meaning thus, is not a tool that fosters large-scale development and can even lead to economic setback due to inappropriate usage, and excessive debt.

Finally, the example of Mexico as one of the emerging economies in Latin America and the effect of ED on economic development is considered. Germán-Soto (2020) investigated whether the relationship between ED and economic growth behaves like a Laffer curve in Mexico, over the period of 1970-2017. In this research, a two-stage regression model was used to correct modeling errors. The result of the first stage of the model established a negative relationship between the flow of ED and private investment in Mexico during the analyzed period. On the other hand, it was determined that the effect of ED on GDP per capita was represented through a Laffer curve. Where initially, ED encourages investment and production, but there is a limit point where excessive debt leads to diminishing returns. In conclusion, the impact of ED on GDP per capita and investments in Mexico over the analyzed period is negative and follows a Laffer curve behavior that slows down the process of economic growth and development.

## Material and Methods

This research was a correlational type because its purpose was to measure the relationship between Ecuadorian economic growth, FDI, and ED. According to Hernández et al. (2016), a correlational research aims to measure the relationship or degree of association between two or more variables in a specific sample or context, where the relationship of each of them is measured, quantified, analyzed and established. Therefore, it was appropriately adjusted to the purpose of the research. Additionally, the study's

approach was quantitative, as it involved a time series with numerical data, and used an econometric model to facilitate the interpretation of the linear association between the variables.

The research used a time series with 4 variables of the Ecuadorian economy, being GDP the dependent variable, and FDI, ED, and Gross Fixed Capital Formation (GFCF) the explanatory variables. All variables were measured in millions of dollars at nominal market value. Due to reasons of data availability and model adjustment, the research was conducted from the year 2001 to 2021. This period was chosen because, after the dollarization in 2000, Ecuador experienced significant economic growth in which both FDI and ED contributed throughout the period analyzed.

The data was collected from the microsite of economic and statistical information of the Central Bank of Ecuador. The dependent variable, GDP, was used as an indicator of economic growth and was obtained from the real sector section, under the annual national accounts section, except for the value corresponding to 2021, which was obtained by adding the four quarters of that year (BCE, 2023c). On the other side, the explanatory variables, FDI and ED, were implemented as possible determinant components of growth, which were obtained from the external sector section under Foreign Direct Investment and Total External Debt.

It is necessary to mention that the third and last variable of the study, GFCF, was implemented as an adjustment variable to improve the results of the econometric model. According to the Central Bank of Ecuador, 'GFCF' is considered as the engine of economic growth, as it allows the increase of productive capacity of a country over several periods" (BCE, 2021, p. 2). Moreover, various authors have used it for similar analyses, such as Germán-Soto (2020) in

their analysis of the relationship between ED and economic growth in Mexico. Therefore, it was considered appropriate to include it in the model. The adjustment variable was obtained from the real sector section, under the tables of supply and use of goods and services (BCE, 2022).

Annual data was considered because the quarterly values of FDI showed periods with negative totals, which presented complexities in achieving one of the main objectives of the research, which involves calculating the elasticity between the explanatory variables and economic growth. Therefore, an econometric model with logarithms was implemented. Based on that, it was decided to implement annual data, which did not exhibit inconsistencies in the model and facilitated the calculation of the elasticity.

An analysis of the elasticity at the log-log level of the variables was conducted, because elasticity measures the sensitivity of a variable 'Y' to the variation of one or more variables 'X' (Pindyck and Rubinfeld, 2018). Additionally, Gujarati and Porter (2010) pointed out that an interesting characteristic of the double-log model is that it measures the elasticity of Y with respect to X, meaning it measures the percentage of change of Y in

response to a percentage change in a variable X. Therefore, when discussing the analysis of the impact of both FDI and ED on economic growth, it is of utmost importance to examine the sensitivity of economic growth to variations in the aforementioned variables.

Once the data was collected, the time series data was organized with the help of Microsoft Excel, and the econometric model was developed using the software EViews 10.

A multiple linear regression model based on the principles of OLS was implemented because "it is more suitable for a ceteris paribus analysis, as it allows for explicit control of many other factors that simultaneously affect the dependent variable" (Wooldridge, 2010, p. 60), meaning that it allows to analyze the individual impact of several explanatory variables on the endogenous variable. Furthermore, Moral Peláez (2016) stated that linear regression models allow to examine the relationship between a dependent variable and explanatory variables, which is why it is of interest to implement this technique in the present research.

The model specification can be observed through the following equation 2:

## Equation 2

$$\text{Log}(GDP) = B_0 + B_1 \text{Log}(FDI) + B_2 \text{Log}(ED_{-1}) + B_3 \text{Log}(GFCF) + u_i$$

Where:

Log (GDP) = Logarithm of Gross Domestic Product

$B_0$  = Constant/intercept

Log (FDI) = Logarithm of Foreign Direct Investment

$B_1$  =  $\Delta$  GDP, to  $\Delta$  FDI

Log (ED-1) = Logarithm of External Debt with a lagged period

$B_2$  =  $\Delta$  GDP, to  $\Delta$  ED

Log (GFCF) = Logarithm of Gross Fixed Capital Formation

$B_3$  =  $\Delta$  GDP, to  $\Delta$  GFCF

$u_i$  = Error term

It is expected that all of the independent variables will have a positive impact on economic growth, where FDI, ED, and GFCF promote economic development.

The Ordinary Least Squares method was implemented in order to evaluate the validity of the model. According to Weisberg (2014), the OLS method is a technique used to estimate parameters that best fit the data in a linear regression model by minimizing the sum of squared errors between the observed values and the values predicted by the model. According to Gujarati and Porter (2010) there are 7 basic assumptions of the classical linear regression model:

1. The linearity of the parameters.
2. Independent values of X and the error term.
3. The homoscedasticity of the error term. Which implies that the variance of the residuals must be constant across all the observations.
4. The normality of the error distribution.
5. The absence of multicollinearity. Which means that the independent variables are not correlated with each other.
6. The absence of autocorrelation of the disturbances.
7. Non-endogeneity. Which implies that the explanatory variables are not correlated with the errors.

These assumptions are essential to evaluate the validity of the linear regression model and to obtain accurate and reliable estimates of the parameters. Therefore, tests for normality, homoscedasticity, and autocorrelation of the residuals were conducted to develop an accurate model and present appropriate results.

The explanatory variable 'ED' was lagged by one period in order to analyze its influence on the dependent variable in terms of previous periods and thus to examine the la-

gged effects on economic growth and obtain efficient results from the econometric model. The 'ED' variable was lagged by one period due to the reason that the impact of some income flows are not manifested instantly. For which it is necessary to analyze them in a lagged manner to estimate the relationships between the variables and obtain more precise results.

In the initial trial and error phase of modeling, only the variables FDI and ED were included, without incorporating the adjustment variable or the lag in ED. This resulted in issues and inconveniences in the model's outcomes, such as problems with meeting the MCO assumptions, a low coefficient of determination, and individual insignificance of the FDI variable. Based on the reasons stated above, the mentioned modifications were implemented in the model to correct these problems.

## Analysis and Results

In this section, the results obtained from the econometric model were explained, with the aim of identifying the impacts generated by the explanatory variables on the economic growth of Ecuador. Table 1 shows the database used to carry out the econometric model. In first place were analyzed the results of the descriptive statistics of the data incorporated in the model. This can be observed in table 2.

Based on the volatility of Ecuador's GDP over the period of 2001-2021, a growing trend has been observed. Meaning that the country's GDP has been gradually increased, indicating economic development over the analyzed period. On the other side, the arithmetic means of the dependent variable showed that Ecuador, on average, generated 73 496.26 million dollars annually in the production of final goods and services at a national scale during the period of analysis.

**Table 1. Database**

| Año  | PIB       | IED      | DE        | FBKF      |
|------|-----------|----------|-----------|-----------|
| 2001 | 24 468.32 | 538.57   | 14 410.80 | 4 661.58  |
| 2002 | 28 548.95 | 783.26   | 16 287.50 | 5 906.61  |
| 2003 | 32 432.86 | 871.51   | 16 765.20 | 62 40.68  |
| 2004 | 36591.66  | 836.94   | 17 212.90 | 7 209.13  |
| 2005 | 41507.09  | 493.41   | 17 237.70 | 8 476.75  |
| 2006 | 46802.04  | 271.43   | 17 012.20 | 9 759.71  |
| 2007 | 51007.78  | 194.16   | 17 478.80 | 10 593.95 |
| 2008 | 61762.64  | 1 057.37 | 16 972.30 | 13 818.51 |
| 2009 | 62519.69  | 308.61   | 13 557.20 | 14 257.69 |
| 2010 | 69555.37  | 165.87   | 13 993.90 | 17 127.89 |
| 2011 | 79276.66  | 646.08   | 15 258.80 | 20 470.79 |
| 2012 | 87924.54  | 567.41   | 15 992.80 | 23 707.84 |
| 2013 | 95129.66  | 727.06   | 18 817.80 | 26 211.66 |
| 2014 | 101726.33 | 776.65   | 24 213.40 | 27 684.23 |
| 2015 | 99290.38  | 1 331.31 | 27 947.50 | 26 390.46 |
| 2016 | 99937.70  | 764.33   | 34 619.80 | 25 080.79 |
| 2017 | 104295.86 | 629.66   | 40 363.60 | 26 496.26 |
| 2018 | 107562.01 | 1 389.97 | 44 300.30 | 27 517.68 |
| 2019 | 108108.01 | 979.03   | 52 734.60 | 26 908.01 |
| 2020 | 98808.01  | 1 094.69 | 56 980.00 | 21 068.72 |
| 2021 | 106165.87 | 647.58   | 57 648.60 | 22 502.66 |

Note: Own elaboration based on BCE (2023a), (2023b), (2023c)

In contrast to GDP, the explanatory variable FDI presented an irregular fluctuation over the period. This implies that foreign investors have been uncertain about their investment

decisions within the Ecuadorian economy, due to concerns about reliability in the country's economic stability and economic policies.

**Table 2. Descriptive statistics of the variables**

| Statistics   | GDP       | FDI       | ED        | GFCF      |
|--------------|-----------|-----------|-----------|-----------|
| Mean         | 73 496.26 | 717.8522  | 26 181.22 | 17 718.65 |
| Median       | 79 276.66 | 727.0642  | 17 237.70 | 20 470.79 |
| Maximum      | 108 108.0 | 1389.974  | 57 648.60 | 27 684.23 |
| Minimum      | 24 468.32 | 165.8663  | 13 557.20 | 4 661.579 |
| Std. dev.    | 29 894.43 | 336.9030  | 15 110.96 | 8 411.818 |
| Skewness     | -0.309760 | 0.213921  | 1.111163  | -0.247372 |
| Kurtosis     | 1 542.373 | 2.545358  | 2.694136  | 1.471023  |
| Jarque-Bera  | 2 194.921 | 0.341030  | 4.403250  | 2.259725  |
| Probability  | 0.333717  | 0.843231  | 0.110623  | 0.323078  |
| Sum.         | 1 543 421 | 15 074.90 | 549805.7  | 372 091.6 |
| Sum Sq. Dev. | 1,79E+10  | 2270073   | 4,57E+09  | 1,42E+09  |
| Observations | 21        | 21        | 21        | 21        |

Note: Own elaboration based on BCE (2023b).

In addition, the ED showed a growth trend, where in the year 2001 had a value of 14 410.80 million dollars, and by the year 2008 increased to 17 478.80 million dollars, as shown in appendix 1. However, the growth slowed down in the following 4 years, it did not remain stagnant for long as it started growing again. The abrupt increase in debt can be overwhelming, as it not only allows for external financing that promotes production and enables economic development, but the fact of facing an excessive amount of debt with international financial entities could lead to Ecuador's insolvency, which is detrimental to the national economy.

Finally, GFCF has been the variable with the highest growth during the period analyzed, its value has increased by approximately 383 % from the year 2001 to the year 2021. The increase in GFCF could be considered a beneficial aspect for the Ecuadorian economy, as it represents the amount of money allocated to non-monetary fixed assets within the national territory. These assets enhance productivity and, in turn, dynamize the national economy, appearing to be a stimulus of high impact for the economy of Ecuador.

By means of the econometric model, it was possible to analyze the impact of the variables on Ecuador's GDP, and thus quantifying the elasticity and impact they have on the growth of the national economy. First, the signs of the coefficients of the variables were analyzed in order to have a better understanding of their relationship with respect to GDP.

The analysis of the signs established that there is a positive relationship between ED and GFCF with Ecuador's GDP during the period of analysis; however, it was also determined that FDI had a negative impact on the dependent variable. Meaning that through the analysis of the signs of the coefficients in table 3, it was possible to interpret that ED and GFCF promote national economic development, while in the case of FDI, it discouraged Ecuador's economic growth. Despite of having interpreted the signs, its analysis alone is not sufficient to explain the relationship that each of the variables has with economic growth. Therefore, the analysis of the elasticity of the variables was conducted, along with the respective interpretation of the coefficients.

**Table 3.** *Logarithmic linear regression with one lag.*

| Variable     | Coefficient | Std. Error | t-Statistic | Prob.     |
|--------------|-------------|------------|-------------|-----------|
| LOG (FDI)    | 73 496.26   | 717.8522   | 26 181.22   | 17 718.65 |
| LOG (ED(-1)) | 79 276.66   | 727.0642   | 17 237.70   | 20 470.79 |
| LOG (GFCF)   | 108 108.0   | 1 389.974  | 57 648.60   | 27 684.23 |
| C            | 24 468.32   | 165.8663   | 13 557.20   | 4 661.579 |

*Note:* Own elaboration based on BCE (2023).

The analysis of elasticity allowed the interpretation of the variation of the percentage of sensitivity that Ecuador's GDP presented concerning changes in the explanatory variables. It was determined that ED and GFCF showed a positive inelastic rela-

tionship with GDP as expected. However, FDI exhibited a negative inelastic relationship with the dependent variable, which partially differs from the expected results. The coefficient analysis of the model is represented by the following equation 3:

**Equation 3**

$$\text{Log}(GDP) = 2,53 - 0,03\text{Log}(FDI) + 0,15\text{Log}(ED_{-1}) + 0,75\text{Log}(GFCF) + u_i$$

It was determined that an increase of one percentage unit in FDI, *ceteris paribus*, led to a decrease of 0.03 % in the national GDP. This is observed in the coefficient section for FDI in table 2, indicating a negative impact on economic growth, differing from the expected relationship. However, this outcome can be explained by the improper management of funds of the financing source, which might have been used for other purposes unrelated to investment and productivity that promote economic growth, resulting in negative impacts.

On the other side, it was established that an increase of one percentage unit in debt, *ceteris paribus*, led to a growth of 0.15 % in GDP, indicating that ED stimulated GDP growth.

Finally, the adjustment variable GFCF held the coefficient with the greatest contribution to the national economy, where an increase of one percentage unit, *ceteris paribus*, resulted in a 0.75 % increase in GDP during the period analyzed. Implying that the mo-

netary amount of non-financial fixed assets represented the variable with the most significant impact when discussing its influence on Ecuador's economic growth. The elasticity of the respective variables can be verified through the coefficient section of table 3.

Although the impacts of the independent variables on GDP have already been established. The results of the econometric model would be irrelevant without evaluating the validity of the model. Which is why the statistics that support the model's validity were analyzed.

As can be observed in table 4, the adjusted coefficient of determination indicated that the dependent variable is 99.58 % explained by the explanatory variables, which means that as a whole the observations of the model fit adequately. However, a very high coefficient of determination can also indicate a strong correlation between the explanatory variables, known as multicollinearity, which affects the regression coefficients and makes them unstable.

**Table 4.** *Linear regression statistics*

| Statistics            | Value   |
|-----------------------|---------|
| R-squared             | 0.9965  |
| Adjusted R-squared    | 0.9958  |
| S.E. of regression    | 0.0288  |
| Sum squared resid     | 0.0133  |
| Log likelihood        | 4.4805  |
| F-statistic           | 1.5048  |
| Prob(F-statistic)     | 0.0000  |
| Mean dependent var    | 1.1154  |
| S.D. dependent var    | 0.4446  |
| Akaike info criterion | -4.0805 |
| Schwarz criterion     | -3.8814 |
| Hannan-Quinn criter.  | -4.0416 |
| Durbin-Watson stat    | 1.3344  |

*Note:* Own elaboration based on BCE (2023).



To address this issue and eliminate any suspicion of multicollinearity, the variance inflation factors test (VIF) was conducted, which established that there was no

correlation between the predictor variables. All the statistics in the centered VIF section were found to be below 10, meeting the assumptions of the test, as shown in table 5.

**Table 5.** *Variance inflation factors test (VIF).*

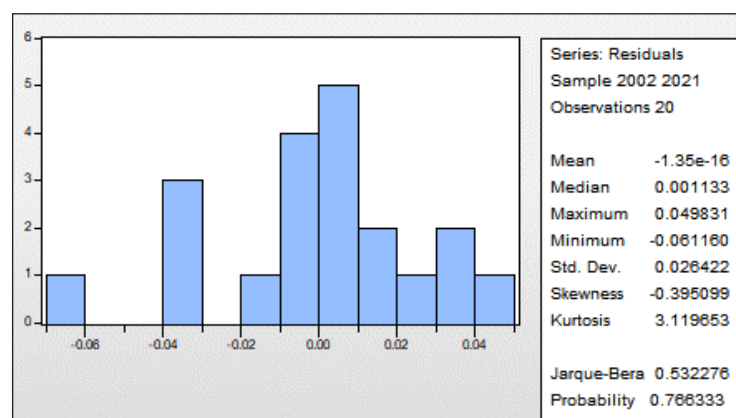
| Variable    | Coefficient Variance | Uncentered VIF | Centered VIF |
|-------------|----------------------|----------------|--------------|
| LOG(FDI)    | 0.000154             | 156.1551       | 1.256282     |
| LOG(ED(-1)) | 0.000317             | 765.3089       | 1.585778     |
| LOG(GFCF)   | 0.000202             | 460.4583       | 1.364298     |
| C           | 0.022842             | 551.0641       | NA           |

*Note:* Own elaboration based on BCE (2023).

However, when it comes to the validity of the model, it is essential to evaluate the significance of the variables. The results of both the overall and individual significance tests were statistically significant, as seen in tables 2 and 3. The p-values of the F-statistic and each of the explanatory variable's coefficients do not exceed 5 %, rejecting the null hypothesis and concluding that they fit the model adequately. However, despite having a high goodness of fit and both global and individual significance, these tests are not sufficiently suitable to assess the validity of the model itself. Therefore, the necessary tests were conducted to evaluate the fulfillment of the OLS assumptions.

As mentioned in the methodology section, the OLS assumptions imply that the residuals fulfill three essential aspects: a normal distribution, homoscedasticity and the absence of autocorrelation. Starting with the analysis of normality of the residuals, the Jarque-Bera statistic was implemented to evaluate the distribution of the errors, which can be observed in the appendix section as figure 1. The p-value of the statistic indicated that the null hypothesis should be accepted, as it exceeded the 5 % confidence level, thus concluding that the distribution is of normal nature.

**Figure 1.** *Histogram and Jarque-Bera test.*



*Note:* Own elaboration.

Secondly, the variance of the residuals was tested by means of White’s test (the test’s statistic can be found in table 6). The test in-

dicated that the variance of the residuals was constant across all observations, which aligns with the assumption of homoscedasticity.

**Table 6.** *Homoscedasticity Test, White’s Statistic*

|                     |          |                     |        |
|---------------------|----------|---------------------|--------|
| F-statistic         | 2.373891 | Prob. F(9,10)       | 0.0972 |
| Obs*R-squared       | 13.62347 | Prob. Chi-Square(9) | 0.1364 |
| Scaled explained SS | 9.240651 | Prob. Chi-Square(9) | 0.4154 |

*Note: Own elaboration.*

Finally, the Durbin-Watson and serial correlation tests evaluated the presence of autocorrelation of the residuals. The serial correlation test established that the errors were not autocorrelated, as the p-value

implied that the null hypothesis should be accepted (which can be verified in table 7). Additionally, the Durbin-Watson statistic presented in table 3, confirmed the absence of autocorrelation.

**Table 7.** *Serial Autocorrelation*

|               |          |                     |        |
|---------------|----------|---------------------|--------|
| F-statistic   | 0.722126 | Prob. F(2,14)       | 0.5030 |
| Obs*R-squared | 1.870278 | Prob. Chi-Square(2) | 0.3925 |

*Note: Own elaboration.*

Thus, concluding that the model as such complies with the OLS assumptions, implying that the results of the model are valid and can be relied upon.

**Discussion and Conclusions**

Regarding the positive effects of ED on economic growth obtained in the research, they align with the findings of Gövdeli (2019), where it was determined that there is a positive relationship both in the short and long term between the variables. Similarly, Mideros and Abad (2022) emphasized that debt plays a fundamental role as a determinant factor of economic development in Latin American countries, as long as it does not become unsustainable. Moreover, the results of the elasticity analysis are consistent with the findings of Ajayi and Oke (2012), who established a positive and inelastic relationship between debt and economic growth.

Parting from a different perspective, Omodero and Alpheus (2019), Moh’d AL-Tamimi and Jaradat (2019), and Ighodalo et al. (2020) established that ED presented a negative relationship with GDP growth. This implied that excessive levels of debt lead to diminishing returns on economic development, often resulting in insolvency and economic strain. Therefore, relying solely on ED is not advisable to stimulate economic growth, and it is recommended to combine various sources of external financing (such as FDI) to promote investment projects, enhance national productivity and achieve appropriate economic development. On the other hand, Delgado Gamboa et al. (2022) found that while ED has a positive impact on economic growth, its effect is moderate, therefore, it cannot be considered a significant tool that significantly stimulates economic development.

Regarding the second explanatory variable, the results of the impact of FDI diffe-

red from the ones expected. However, they are consistent with the findings of Cruz Vázquez et al. (2019), where it was established that the results supported the ambiguity of FDI in explaining economic growth. The econometric model established a significant negative relationship between FDI and economic growth. On the other hand, Quoc and Thi (2018), despite having determined that there was a positive relationship between the both variables, established that such relationship over the years tended to decrease, which questioned its long-term effect despite being considered a source of external financing that stimulates growth.

Despite the results obtained in this research, various authors established that FDI was a fundamental component for economic development as mentioned above. Álvarez et al. (2009) and Belaşcu et al. (2018) emphasized the importance of the adjustment variable 'GFCF'. Their study determined that both FDI and GFCF presented a positive relationship with economic growth, establishing these variables as fundamental determinants of economic growth. On the other hand, when discussing the elasticity of FDI, the results obtained contradicted the findings of Bustamante (2016), Alabi (2019), and Rao et al. (2020), which established a positive inelastic relationship between FDI and economic growth, suggesting that the variable moderately fosters economic growth. Similarly, Cerquera-Losada and Rojas-Velásquez (2020) determined that while the relationship between FDI and economic growth was positive, its effects on the dependent variable were considered moderate but not significant.

Ortiz et al. (2018) established that the impact of FDI on the Ecuadorian economy by differed from the results obtained. Where it was established that through 1980-2017, FDI had a positive relationship with economic growth, which contradicts the findings of this

study. However, it is important to consider the implementation of adjustment variables in both investigations, also that the inclusion of years prior to 2001 could have significantly influenced in this relationship. Therefore, it is recommended to conduct a detailed analysis of the evolution of FDI and its influence on Ecuadorian economic development.

In conclusion, the results obtained from the investigation contradicted the findings of various authors, in the sense that FDI exhibited a negative relationship and ED a positive one with respect to the dependent variable. However, this discrepancy is not necessarily a negative outcome, due to the fact that the behavior of these variables are subject to the different economic characteristics such as the different monetary and fiscal policies that regulate factors that condition the economic situation of a country, such as interest rates, money supply, investment, consumption, public debt, government spending, among other factors that govern the economic situation of each of the countries analyzed.

In the case of Ecuador, it was determined that ED promoted economic development by bridging the gap of insufficient national funds to undertake investment projects that stimulate the economy. However, it should not become excessive, due to the fact that its positive effects turn into diminishing ones that lead to a country's insolvency and indebtedness.

On the other hand, despite various studies establishing FDI as a component that creates new employment opportunities, increases national productivity, enhances technology transfer and capacitation, and boosts export levels (the case of Ecuador, it exhibited a negative relationship with economic growth). The detrimental behavior of the variable is explained by the possibility that it might displacing Ecuador's domestic investment. Therefore, it is recommended

that FDI is managed in such way that, instead of displacing domestic investment, it encourages it, by implementing policies that enhance FDI, such as fiscal incentives, protection of private property, free trade agreements, among others.

It is important to note the unique behavior of the adjustment variable GFCF, which was identified as the most significant variable within the econometric model. Therefore, this information could be used for future research, focused in the impact of the GFCF on the Ecuadorian economy.

An interesting aspect that could be taken into consideration for future research is: How does the relationship between ED and economic growth vary over time? Analyzing the behavior of ED in the short term and subsequently in the long term, also investigating whether the behavior of this variable approximates to that of a Laffer curve, where it initially exhibits a rising trend and then turns decreasing. Therefore, it would be an intriguing perspective to examine whether ED displays such behavior within the economic context of Ecuador.

This research is of interest to the Ecuadorian national government, as it provides valuable information that can be used to develop economic policies and measures that dynamize the national economy, with the aim of promoting Ecuador's economic growth and enhancing the quality of life of its citizens.

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