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Research Article

The Evolution of Oil Exports in Ecuador's Economic Growth

La evolución de las exportaciones petroleras en el crecimiento económico del Ecuador

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Abstract

The present study is crucial to establish the link between oil exports and Ecuador's Gross Domestic Product (GDP), to provide empirical proof of the nation's oil dependence. The research used a descriptive analysis of the exogenous variables (oil exports, foreign direct investment, and inflation) to establish their level of incidence in the endogenous variable (GDP). To determine the statistical influence between the study variables, a multiple linear regression model was estimated using the Ordinary Least Squares (OLS) method through Stata statistical software. The influence on GDP was determined, creating validations on the independent variables, whose findings allowed us to confirm that there is a clear link between crude oil exports and gross domestic product, which affects the economic growth of the country. In this context, exports demonstrated a statistically significant positive effect, that is, for each additional unit of the oil exports variable, the expected effect will be, on average, an increase in gross domestic product.

Key words: Economic Growth; Neoclassical; Gross Domestic Product; Econometric Model; Oil Exports.

Resumen

El presente trabajo de investigación es crucial para establecer el vínculo entre las exportaciones de petróleo y el Producto Interno Bruto (PIB) del Ecuador, a fin de proporcionar una prueba empírica de la dependencia petrolera de la nación. En la investigación se utilizó un análisis descriptivo de las variables exógenas (exportaciones petroleras, inversión extranjera directa e inflación) para así establecer su nivel de incidencia en la variable endógena (PIB). Para determinar la influencia estadística entre las variables de estudio se estimó un modelo de regresión lineal múltiple utilizando el método de mínimos cuadrados ordinarios (MCO) a través del software estadístico Stata. Se determinó la influencia sobre el PIB, creando validaciones sobre las variables independientes, cuyos hallazgos permitieron confirmar que existe un vínculo claro entre las exportaciones de crudo y el producto interno bruto, lo que repercute en el crecimiento económico del país. En este contexto, las exportaciones demostraron un efecto positivo estadísticamente significativo, es decir, que por cada unidad adicional de la variable exportaciones petroleras el efecto esperado será en promedio un aumento en el producto interno bruto.

Palabras clave: Crecimiento económico; Neoclásico; Producto Interno Bruto; Modelo econométrico; Exportaciones petroleras.

INTRODUCTION

Cepeda *et al*. (2016) argue that economic growth has been, over time, one of the most prominent topics in research centres. The most recurrent variables in this context are capital accumulation, foreign trade and the endowment of natural resources, emphasizing particular scenarios related to oil. Likewise, in the 20th century, the theory of the "natural resource curse" began to develop, which postulates that those countries with a vast endowment of oil deposits do not experience sustainable growth in the long term. This situation occurs because such countries need to adequately prioritize other economic sectors, such as innovation and knowledge. The abundance of natural resources can lead to corruption and inefficiencies in the management and allocation of public resources. In addition, governments that receive substantial revenues from these natural resources often incur unnecessary expenditures.

Ecuador's contemporary economic trajectory has been intrinsically linked to oil activity, especially since the beginning of crude oil exports in 1973. Although total GDP shows a stronger correlation with non-oil branches, the country's economic performance is closely linked to fluctuations in the oil sector.

According to Mateo & Garcia (2014), the branches associated with oil activity experienced a 7.6% growth between 2000 and 2006 and registered a 0.8% decline from 2007 to 2012. On the other hand, non-oil branches proved to be more resilient during the last mentioned period, achieving a positive variation of 5.2% on average, in contrast to the 4.5% recorded between 2000 and 2006. It is important to note that, under President Rafael Correa in 2007, Ecuador strengthened its relations with the Organization of Petroleum Exporting Countries (OPEC) and enacted a new Constitution in 2008.

Oil GDP comprises both the primary section related to oil and mining and the industrial section of oil refining. In Ecuador, the oil sector is under the administration of Empresa Estatal Petrolera del Ecuador (Petroecuador), which was established in 1989 as a holding company.

With respect to the recent situation, Ecuador's oil exports are emerging from the global impacts of the COVID-19 pandemic. Davila (2021) reports that in 2021, oil exports have shown a significant increase, driven mainly by an improvement in prices. This recovery is attributed to the reactivation of the global economy following the relaxation of physical distancing measures and mobility restrictions.

Between January and February 2020, with the outbreak of the pandemic, crude oil prices began to plummet. The price of West Texas Intermediate (WTI), the benchmark for Ecuadorian oil, fell from USD 61.18 per barrel on January 1, 2020 to USD 44.76 on February 28. Surprisingly, on April 16, it reached a negative value, standing at USD -37.63 per barrel. This decline in prices is attributed to the oil glut and the closure of several refineries globally. However, a year later, oil prices recovered to pre-pandemic levels, spurred by progress in the vaccination process.

Fontaine (2006) notes that, since 1972, oil has been the most important commodity for the Ecuadorian economy and society. Between 1995 and 2004, oil revenues contributed one-third of the total state budget, and this resource accounted for 40% of exports. In 2004, oil accounted for 55% of total exports due to both high prices and an increase in production spurred by the construction of the heavy crude oil pipeline (OCP). However, despite its current relevance, oil is a finite resource. In 2003, proven reserves stood at 4.63 billion barrels, suggesting that its exploitation could continue for approximately another two decades. This challenge is compounded by the considerable environmental impact of oil production, as evidenced by deforestation and loss of biodiversity in the Amazon.

In Ecuador, oil exports have had a determining influence on the trade balance for decades. According to Benavides et al. (2017), since the oil boom in the 1970s, crude oil exports have been established as one of the fundamental pillars of income for the nation. Indeed, since the beginning of exports in 1972, the oil sector not only boosted foreign exchange but also progressively improved the country's economic situation. Oil exports, therefore, occupy a primordial place in the Ecuadorian economic structure.

The economy of oil-rich nations, particularly their Gross Domestic Product (GDP), is susceptible to fluctuations in crude oil exports and variations in the price of a barrel of oil. These nations often find themselves in a position of dependence on this resource.

Fariza (2021) argues that this dependence places Ecuador at a crossroads in the face of recent changes in the price of crude oil. Despite initial forecasts based on a price per barrel of around US$37, the Ecuadorian government has adjusted its expectations. By September, this projection increased to US$59 and, currently, prices have risen even higher. This has led the government to estimate an additional injection into the public coffers, which could add between 1.5 and 2 billion dollars by the end of the year, thus reflecting a revision of its budget for 2021.

Against this backdrop, state oil policies are essential. Their main objective is to transform oil revenues into a sustainable improvement of citizens' living conditions while minimizing the ecological impact of production. After 33 years of exploitation, the achievements with respect to these goals still need to be improved. The economy has been stagnating for a long time, and social and environmental conditions have worsened. This research aims to provide valuable data for public policymakers since understanding the dynamics of these economic variables will allow them to design more focused and effective strategies that will result in tangible benefits for the population. In the context of an economy affected by the COVID-19 health crisis, these insights are more relevant than ever.

The central purpose of this study was to examine how economic growth has influenced Ecuador's oil exports during the period from 2000 to 2020. To do so, we resorted to an econometric model based on the country's main macroeconomic indicators. In this way, we seek not only to confirm whether our findings are consistent with the previously estimated theoretical relationships but also to explore what other variables might be relevant to understanding Ecuador's specific dynamics in this area.

This study was not conceived as an endpoint but rather as a starting point for future econometric analysis in this area. We highlight the significance of economic growth and show how it is related to different macroeconomic variables. Beyond providing a theoretical basis, our work lays the groundwork for expanding research in this field. We are interested in understanding economic growth not only as a determinant variable in itself but also as an engine that, in interaction with other variables, can influence oil exports and, therefore, the country's overall economic outlook.

METHODOLOGY

The research had a quantitative approach; the design was non-experimental. The scope of the research was descriptive, explanatory and correlational.

Approach

This research had a mixed approach (qualitative and quantitative) based on literature review and empirical evidence. It should also be noted that the theory underlying the research question of the study was based on findings from similar and previous studies and was not constructed exclusively from the empirical evidence collected.

Research design

The study design was non-experimental and longitudinal because the variables were not manipulated, and the phenomenon under study was observed and measured in its natural and original context in order to analyze its relationship and effect. Data collection was carried out during a single moment in time.

Scope

The scope of this research was descriptive, explanatory and correlational. It was descriptive because we tried to identify and define, both theoretically and statistically, which were the determinants that intervened in oil exports in order to understand their economic growth perspectives in the short, medium and long term; in the same way, we studied their effects on the other variables considered. It was of the explanatory type because one of the specific objectives of this research was to estimate the effect of oil exports on the economic statistical variables. Likewise, it was considered to have a correlational scope since its purpose was to measure the degree of relationship that existed between the variables under study through an econometric model.

Data and sources

The type of data used in this research was a time series that covered a period of 20 years, 2000-2020, expressed on an annual basis, the same that was presented in the empirical evidence of the research. For the collection of quantitative data, information was obtained through secondary sources such as the Central Bank of Ecuador and the World Bank (2020).

Statistical analysis

The statistical software implemented for the elaboration of this work were EViews and Stata, which provided reliable results for the analysis of any variable under study. Likewise, an analysis of the graphs and tables presented in this work was carried out.

Economic model

In this economic model, we establish the variables of study to carry out the previous analysis of this research the following:

$$pib = f(expetro, precpetro, inflación, inverextran)$$

pibWhere:

gdp = GDP billions expetro = Oil exports thousands of dollars precpetro = Oil price dollars per liter inflacion = Inflation Percentage inverextran = Foreign Direct Investment Percentage of GDP.

Model results

A log - level model has been estimated in order to analyze the incidence of oil exports on Ecuador's economic growth.

Table 1:
Results of endogenous and exogenous variables
Results for endogenous and exogenous variables

Variables	Observations	Media	Standard deviation	Minima	Maxima
GDP	21	4.11	0.55	2.91	4.68
Oil exports	21	2.63	0.57	1.54	3.25
Oil price	21	60.51	25.05	25.95	99.57
Inflation	19	0.10	0.21	-0.003	0.96
Foreign investment	20	-4.65	0.67	-6.21	-3.61

Source: Stata data

Estimated equation

$$\widehat{logpib}_t = 2.38 + 0.91 expetro_t - 0.01\, precpetro_t - 0.04\, inflacion_t - 0.01 inverextran_t + \mu_t$$

Table 2
Regression results
Endogenous variable: logpib

Variables	Coefficients	Standard error
exogenous logexpetro precpetro inflacion loginverextran Prob > F	0.91***	0.07
R - Squared	-1.00***	0.0005
R - Adjusted square	-4.00	0.04
Observations	-0.01	0.005
	0.0001 0.7595	
	0.7595	
	20	
Note: t statistics ***p <0.05.		
Source: Stata data		

The overall significance gave a p-value of 0.0001 when measured at the significance level, we say that this model is statistically significant at the global level, whose adjusted R-squared explains 75.95% of the dependent variable. When measuring the t-value, only two variables are statistically significant at the level of 1.65 (t >1.65); therefore, there is 60% that allows explaining the individual significance in the model.

Results and discussion

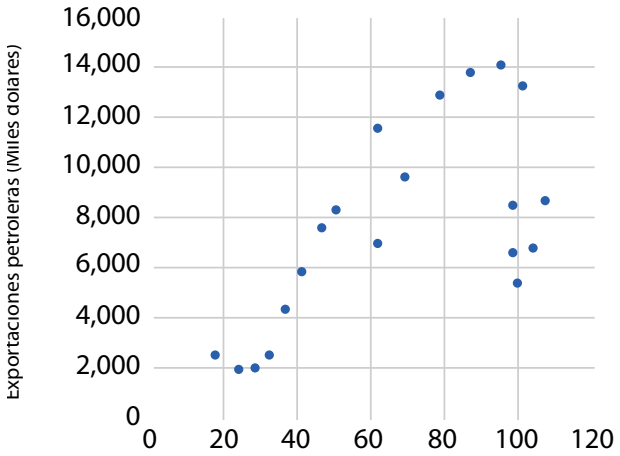
In this section, we present the results obtained for the variables related to oil exports and economic growth during the period 2000-2020. The research provides a broad perspective on the main indicators that contribute to the country's economic growth.

Oil exports

Exports show a positive significance. This indicates that, for each additional thousand dollars in oil exports, an average increase in economic growth of 0.91% is expected. In this framework, these findings are consistent with those of Palma & French-Davis (2002), who, in their paper on the impact of exports on Chile's growth, found that their influence was positive. They noted that the export boom was accompanied by modest average GDP growth. In other words, an annual increase in export volume of 10% between 1974 and 2001 coincided with GDP growth of 4.3%.

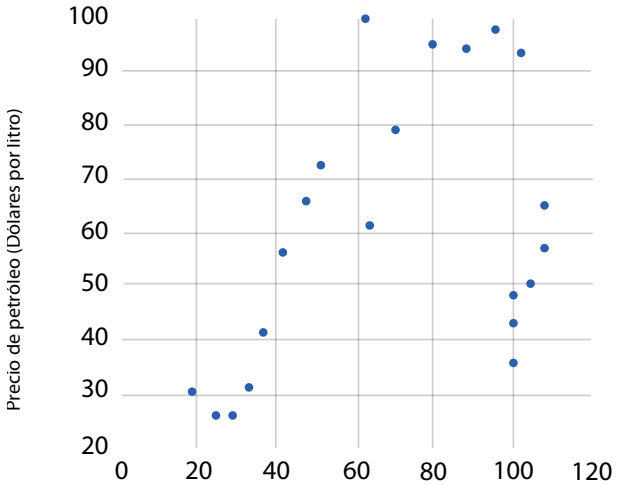
On the other hand, Ibrahim (2002), in his updated estimates, establishes a positive relationship between GDP and exports. His findings are based on data from six countries: Korea, Malaysia, Thailand, Hong Kong, Singapore and the Philippines. Similarly, Alavinasab (2013) endorses the positive relationship between exports and economic growth in Iran. His research, covering the period 1976-2010, evidences a positive and significant effect of exports on growth.

Figure 1.
Oil exports



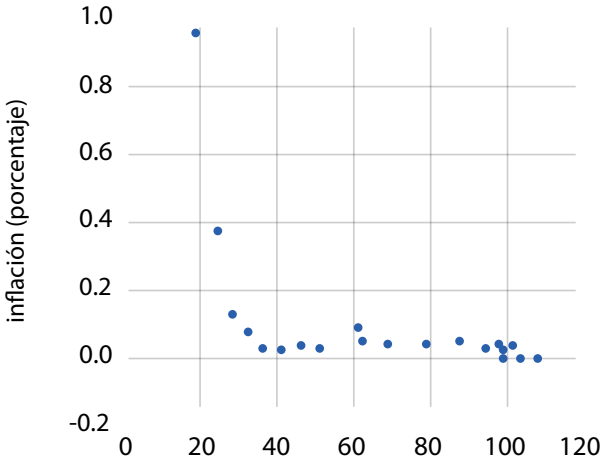
The price of oil has a negative impact on economic growth. Specifically, for every additional thousand dollars in the price of oil, average GDP growth is expected to decrease by 0.01%. This observation contrasts with the study by Alonso & Quintero (2017), who found that oil price variations were in symmetry with GDP, generating a negative effect on economic activity in countries such as Chile, Mexico and Colombia. However, in the case of Mexico, Alarco (2006) points out that higher oil prices correlate with higher output growth rates. As for Peru, Gallardo *et al.* (2005) along with Pedersen & Ricaurte (2014), show that volatility in oil prices, both in the short and long term, affects economies directly through economic growth. On the other hand, Perilla (2010) identifies a positive relationship between fluctuations in oil prices and economic growth.

Figure 2.
Oil price



Inflation has a negative impact on economic growth. Specifically, an increase in inflation by one percent results in an average decrease in GDP of 0.04%. This finding aligns with what was observed by Moreno-Brid et al. (2014). Their analysis reflected an inverse relationship between these two variables; that is, they recorded a negative coefficient between economic growth and inflationary tax that was statistically significant in their panel study. For their part, Gutiérrez and Zurita (2006) argue that, in the case of Bolivia, inflation has an adverse effect on the economy at various levels, particularly because it tends to affect the flow of financing negatively. Similarly, Alvarez (2016) in his study on Honduras, found a non-linear relationship between growth and inflation for the period 1980-2014. This research revealed that beyond certain levels of inflation, economic growth was negatively affected, regardless of subsequent inflationary trends.

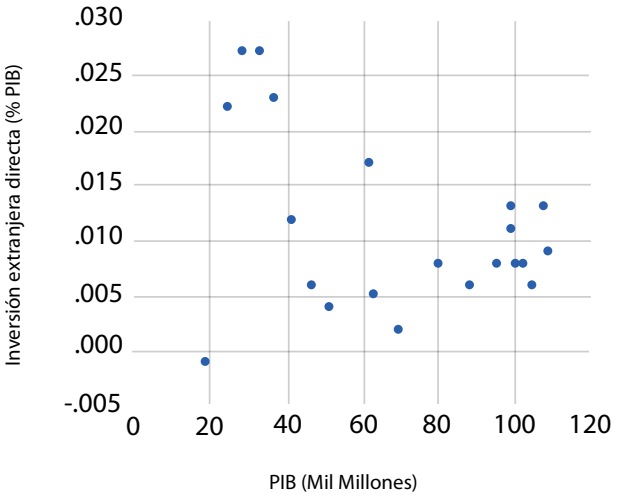
Figure 3.
Inflation



Foreign Direct Investment (FDI) shows a negative effect in relation to economic growth. This means that when foreign investment increases by one per cent, the average expected impact on GDP is a decrease of 0.01%. This finding contrasts with that of Reig (2016) on Uruguay, where he noted a potentially negative effect when there is a crowding out of domestic direct investment in favor of an increase in FDI.

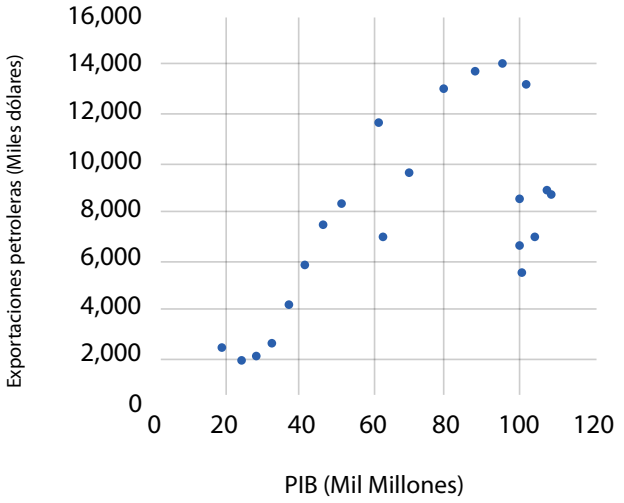
On the other hand, according to Gil et al. (2014), there is a positive correlation between economic growth and increases in FDI. They argue that a growing economy, evidenced through GDP, becomes more attractive to manage medium and long-term investments. Their results indicated that the growth of a country's Gross Domestic Product is a key factor determining FDI behavior.

Figure 4.
Foreign Direct Investment



Since 2000, there have been significant improvements in Ecuador's terms of trade, particularly due to the evolution of oil prices. This dynamic favored the growth of the Ecuadorian economy. However, the behaviour of GDP and exports during the period analyzed proved to be highly sensitive to oil price fluctuations, external and internal shocks, and to global crises in the international market, such as the one caused by COVID-19, which triggered a sharp decline during the pandemic. These findings are consistent with those of Alavinasab (2013), who investigated the relationship between economic growth and oil exports in Iran using time series data for the period 1976-2010. His study revealed a positive and significant impact between the aforementioned variables.

Figure 5.
GDP and export performance 2000-2020 period



CONCLUSIONS

Throughout this study, one of the central objectives was to discern and clarify the variables that play a preponderant role in shaping Ecuador's economic growth, measured through the Gross Domestic Product (GDP). The empirical evidence gathered shows that, among these variables, oil exports, remittances, oil prices and inflation play key roles. These components, individually and collectively, contribute to shaping GDP and, consequently, the country's economic growth.

Beyond mere identification, in-depth analysis revealed that the influence of these variables is currently significant. This finding supports and validates the initial hypothesis of the research, which postulated that a nation's economic strength is intrinsically linked to its ability to export natural resources, in this case oil, and manage factors such as remittances and inflation. This finding is essential because it highlights the interdependence between internal and external factors in the process of economic growth. Specifically, exports emerge as an external factor with an undeniable positive impact on the dependent variable, thus providing a clearer understanding of the fluctuations in economic growth over time.

Derived from the above, this research concludes with a compelling recommendation for policymakers in Ecuador: It is essential to design, implement and fine-tune economic policies that maximize and strengthen these key factors, thus promoting long-term sustainable growth. Based on data collected from 2000 to 2020, it is clear that exports, in particular, are a catalyst for economic growth in both developing and developed nations. It is therefore imperative that economic strategies and policies be oriented toward innovation, improvement and diversification of production, especially in emerging countries. This is the only way to sustainably increase the well-being and prosperity of the population.

Contribution to scientific knowledge

This study sheds light on the complex dynamics between oil exports and economic growth in Ecuador in the first two decades of the 21st century, offering a detailed perspective of their interactions and consequences. In addition to its immediate relevance for the Ecuadorian context, the research provides a methodological and empirical framework that could be invaluable for similar research in other geographic or thematic settings. Its deep empirical basis not only lays the groundwork for future academic inquiries, but also stands as an essential source for policy makers in Ecuador. The latter, having findings based on robust evidence, are better equipped to outline strategies aimed at optimizing the economic and social well-being of the population.

Limitations

The geographic and contextual nature of this research was strictly circumscribed to the particularities of Ecuador, which suggests caution in attempting to extrapolate or generalize its findings to other national settings or different economic contexts. Furthermore, it is important to recognize that, although the economic model used in the study offers valuable insights, its specificity and design may make it susceptible to certain variations. There may be variables not included in our analysis that, if considered, could shed light on additional dimensions of the impact on GDP.

Author contributions

Bernal Yamuca Jorge Luis: Conceptualization, Data Curation, Formal Analysis, Research, Methodology, Resources, Supervision, Validation, Writing - original draft, Writing: review and editing

Rivera Velasco José Luis: Conceptualization, Research, Methodology, Validation, Visualization, Writing - original draft, Writing: proofreading and editing

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Conflicts of interest

The authors declare that there are no conflicts of interest.

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