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Research Article

Historical Analysis of the Fiscal Pressure of Ecuador Period 2010 - 2021

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ABSTRACT

The tax burden is the real contribution made by companies and individuals to the government as a percentage of the Gross Domestic Product. The research is oriented to the analysis of the Ecuadorian tax burden in the period 2010 - 2021. For this purpose it was necessary to apply a quantitative, descriptive, explanatory cross-sectional study including the historical and correlational method, it was also necessary to apply statistical techniques such as Bayesian correlation and confirmatory factor analysis. The results reflect that the Ecuadorian fiscal pressure reflects fluctuations, the tax pressure of the central government is the largest component of the fiscal pressure and is reduced from 2016 to 2018, the tax pressure of the subnational government reflects low and constant items, for its part the contribution to social security has variations but remains stable at an average of 5% of GDP. The Bayesian correlation reflects the strength and direction of the linear relationship, highlighting the central government tax burden with the highest and most significant correlation with respect to fiscal pressure. The confirmatory factor analysis suggests that there is a positive relationship between tax burden and GDP growth. In the analysis, the model has an excellent fit, suggesting that the proposed model fits the observed data very well.

Keywords: Fiscal pressure, tax burden, Gross Domestic Product, central government, social security, GDP growth.

INTRODUCTION

The imposition of taxes (taxes, fees and contributions) is a mechanism used worldwide as a means of financing public spending. The higher the tax burden or pressure, the higher the income of the countries. Latin America is a region considered to have a high tax burden due to the varied rates it applies to taxpayers' income. (Quispe & Ayaviri, 2021). It is important to analyze the tax burden and pressure since they can increase the gap and inequality between the rich and poor by not being efficient in the redistribution of wealth. Therefore, progressivity is the main principle that achieves the redistribution of poverty by applying according to the purchasing power of taxpayers, a clear example of this principle is the Income Tax where the taxpayer contributes according to his income relatively the rate decreases or increases. (Zamora & Osorio, 2022). The tax burden or pressure goes hand in hand with economic development, in this sense Barrantes (2021) states that countries that do not strengthen the tax burden cannot guarantee the fulfillment of the primary rights of citizens and reflects an interesting fact by stating that rich countries have a percentage of tax pressure corresponding to more than 40% of GDP, while in developing countries it is between 10% and 20%, that is, low percentages of tax pressure is synonymous with the weakness of the government.

Latin America has generally throughout history managed low levels of collection below the potential of its economic development, which translates into low levels of tax effort. But from 2003 onwards, significant increases were observed in direct taxation and its share in GDP, the adoption of new tax items increased final collection. (Quishpe & Ayaviri, 2021)

This study is oriented to the historical analysis of the tax burden of Ecuador in the period 2010 – 2021, for this purpose the general context of the tax pressure in Latin America and the Caribbean is raised, extending the study in the tax pressure of Ecuador through statistical analyses that confirm the significant relationship between the tax pressure and the growth of the Ecuadorian GDP and the tax pressure and its three components: tax pressure of the central government PTGC, tax pressure of the sectional governments PTGS and contributions to social security CSS.

THEORETICAL FRAMEWORK

1.1 Tax Burden in Latin America and the Caribbean

The tax burden (PF) for Bravo & Hidalgo (2020) represents the contribution made by companies and individuals (NP) (individuals) to the state as a percentage of the Gross Domestic Product (GDP), represented by Equation 1 where: PF: tax pressure, PTGC = Central Government Fiscal Pressure and PTGS = Subnational Government Fiscal Pressure, in the case of Ecuador GADs decentralized autonomous governments.

Figure 1 Tax pressure formula

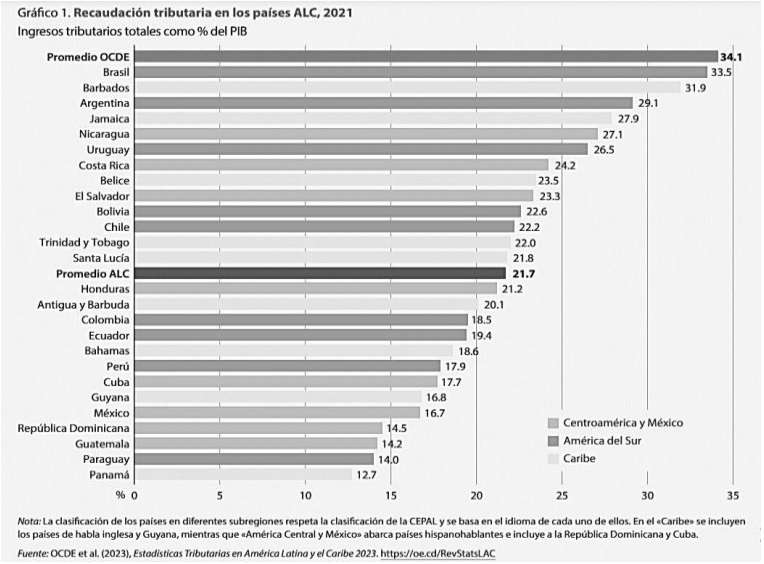
$$PF = PT_{GC} + PT_{GS} + C \quad (Ecuación\ 1)$$

For the Internal Revenue Service SRI (2023) the tax burden is composed of:

- The Central is constituted by national, internal and external taxes.
- Subnational Pressure constituted by the taxes of subnational governments.
- And Social Contributions, corresponding to Social Security contributions.

According to figures presented by the OECD (2023), tax collection in Latin American and Caribbean (LAC) countries increased throughout the region after the economic recession caused by the pandemic, raw materials rose and tax reduction measures ended. The average tax collection as a proportion of OECD GDP increased by 0.6 pp between 2020 and 2021, to 34.1%. In the Caribbean, Central America, Mexico and South America, tax collection as a proportion of GDP stood at 22.8%, 19.2% and 22.8%, respectively. It is highlighted that, in South and Central America, there was a 1.1 pp increase in tax revenues between 2020 and 2021, while in the Caribbean, the increase was only 0.1 pp. In all three subregions, VAT was the main driver of tax revenue growth, although in the Caribbean, income tax collection declined due to declines in corporate tax. As reflected in the following image:

Figure 2 Historic tax burden in Latin America and the Caribbean



Note: Retrieved from fiscal statistics in Latin America and the Caribbean. In original language Spanish

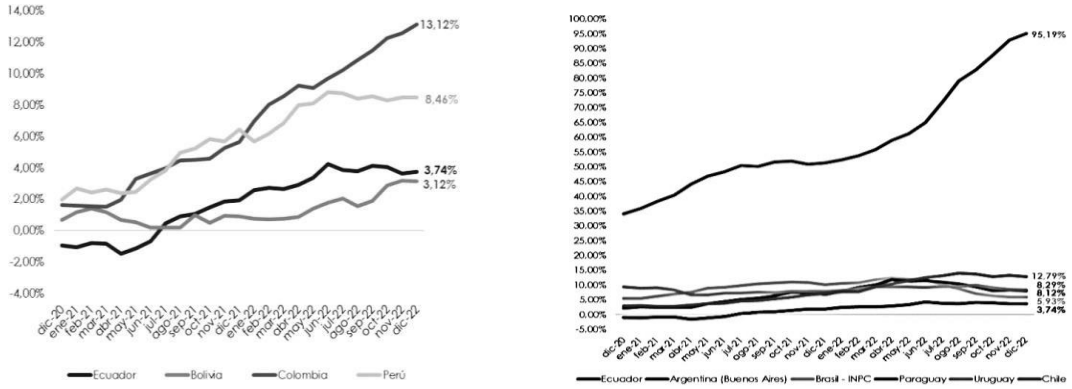
The tax system according to the Constitution of the Republic of Ecuador (2021) is governed by the principles of: "*generality, progressiveness, efficiency, administrative simplicity, non-retroactivity, equity, transparency and collection sufficiency. Direct and progressive taxes will be prioritized*." (p.141)

In Ecuador, tax revenues are collected by the Internal Revenue Service (SRI) and the National Customs Service of Ecuador (SENAE). The Tax System is one of the main instruments of fiscal policy through which the state obtains the necessary revenues to guarantee public spending. (Ministry of Economy and Finance, 2023)

1.2 Inflation in the Andean Community of Nations (CAN) and the Southern Common Market (MERCOSUR)

According to INEC in the technical bulletin CPI, Ecuador is in second place below the average.

Figure 3 Ecuador's annual inflation with the CAN countries and Ecuador with Mercosur



Note: Retrieved from technical bulletin No. 01-2023-IPC. In original language Spanish

1.3 Ecuador's non-financial public sector revenues NFPS

The revenues of the NFPS (Non-Financial Public Sector) of Ecuador in 2022 were referenced by higher tax revenues attributed to the tax reform in force in that year called "Organic Law for Economic Development and Fiscal Sustainability", achieving an annual growth of 13.2% compared to the previous year (2021). For the 2022 period, tax revenues represent 33.8% of non-oil revenues, obtaining 10.8% growth compared to 2021, as detailed in the following table according to the Central Bank of Ecuador (2023):

Figure 4 Non-financial public sector revenues NFPS

En millones de USD, porcentaje del PIB y porcentaje, 2021 - 2022

	USD Millones		% del PIB		Variación		% de part.
	2021 (*)	2022 (*)	2021 (*)	2022 (*)	Absoluta	Relativa (%)	2022
Ingresos Totales	**38.459**	**44.734**	**36,2**	**38,9**	**6.275**	↑ **16,3**	**100**
Petroleros	**13.103**	**16.614**	**12,3**	**14,4**	**3.511**	↑ 26,8	**37,1**
Por exportaciones	8.677	11.132	8,2	9,7	2.455	↑ 28,3	24,9
Por venta de derivados	4.425	5.482	4,2	4,8	1.057	↑ 23,9	12,3
No Petroleros	**25.356**	**28.120**	**23,9**	**24,4**	**2.764**	↑ **10,9**	**62,9**
Tributarios	**13.623**	**15.100**	**12,8**	**13,1**	**1.476**	↑ **10,8**	**33,8**
Impuesto a la renta	3.854	4.450	3,6	3,9	596	↑ 15,5	9,9
IVA	5.986	6.440	5,6	5,6	454	↑ 7,6	14,4
ICE	821	852	0,8	0,7	30	↑ 3,7	1,9
Arancelarios	1.207	1.267	1,1	1,1	60	↑ 5,0	2,8
Otros impuestos	1.755	2.091	1,7	1,8	336	↑ 19,2	4,7
Contribuciones a la Seguridad Social	**5.305**	**5.827**	**5,0**	**5,1**	**522**	↑ **9,8**	**13,0**
Transferencias	**544**	**467**	**0,5**	**0,4**	**-76**	↓ **-14,0**	**1,0**
Intereses ganados	**1.160**	**1.269**	**1,1**	**1,1**	**109**	↑ **9,4**	**2,8**
Otros ingresos	**4.724**	**5.457**	**4,4**	**4,7**	**733**	↑ **15,5**	**12,2**

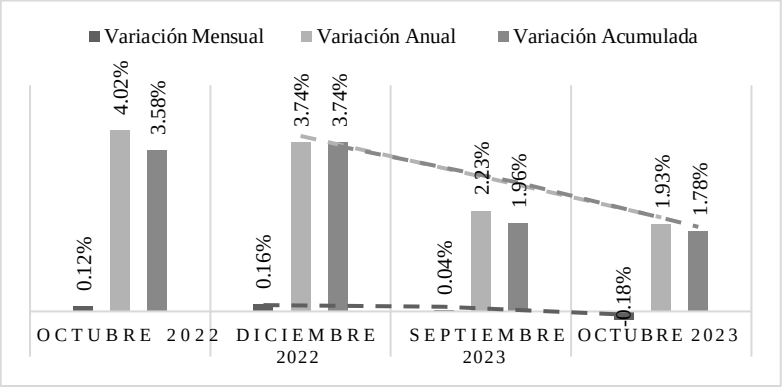
Nota: (*) Cifras provisionales
Fuente: Banco Central del Ecuador, Ministerio de Economía y Finanzas y otras entidades del SPNF

Note: Retrieved from the Report on the evolution of the Ecuadorian economy in 2022 and prospects 2023. In original language Spanish

1.4 Consumer Price Index Official Measure of Inflation in Ecuador

It is an economic indicator that represents the evolution of the level of consumer prices, it is the official figure used in Ecuador to measure inflation. According to the Ecuadorian Institute of Statistics and Census (INEC) (2023) there are three types: Monthly, Annual and Cumulative. High inflation, represented by a significant increase in the CPI, can have impacts on the tax burden and fiscal policy. According to the most up-to-date data, the historical variation of the CPI is:

Figure 5 CPI variation in Ecuador



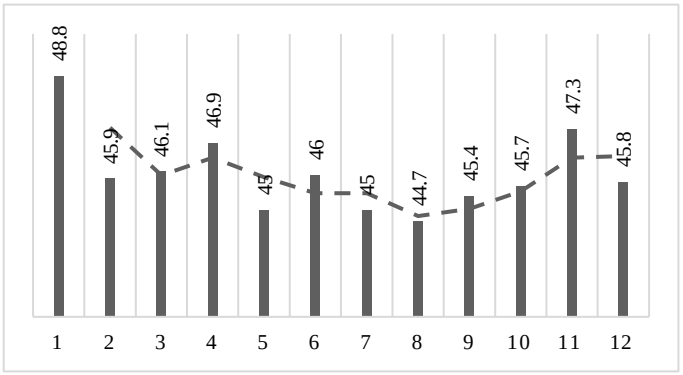
Note: Own elaboration based on INEC 2023. In original language Spanish

The figure reflects a decrease in the monthly variation of the CPI in October 2023 and a reduction in the cumulative variation People's nominal incomes tend to increase if there is higher inflation. Giving rise to a phenomenon called "fiscal growth", where people contribute higher tax brackets due to higher nominal incomes, even though their purchasing power has not actually increased. This can result in increased tax collection for the government

1.5 Gini Index Ecuador

The Gini index that measures the level of income inequality in the countries in the case of Ecuador when analyzing the period 2010 – 2021, it is observed that the Gini index has shown a downward trend from 2013 to 2017 (46.9 to 44.7), which indicates a possible reduction in income inequality in that period. Although inequality has decreased compared to the highest levels observed in 2010 (48.8) and 2020 (47.3), it remains a major challenge, as values remain at relatively high levels in recent years.

Figure 6 Gini index in Ecuador



Note: Own elaboration based on 2022 macro data. In original language Spanish

The relationship between the Gini Index and the tax burden lies in the unequal distribution of income and its impact on tax collection. A higher Gini index, which indicates greater inequality in income distribution, may lead to a more challenging tax burden, as a smaller proportion of the population with higher incomes may be contributing significantly to tax collection. This situation may require more precise fiscal strategies and equitable fiscal policies to address inequality and ensure a stronger and fairer fiscal base.

METHODOLOGY

The research is oriented to the analysis of the fiscal pressure of Ecuador, a quantitative methodology was necessary, when analyzing figures of tax revenues, percentages of GDP. It is descriptive and explanatory, since it aims not only to present the figures, but rather to understand and explain those underlying factors that affect the Ecuadorian tax burden.

It is cross-sectional since it studies a defined period of time, this temporal approach facilitates the identification of trends and patterns in the behavior of the tax burden.

In addition, it was necessary to apply the bibliographic review to obtain information to support the analysis with a solid theoretical framework that enriches the understanding and interpretation of results to provide an overview of the tax burden in the international context.

The historical method contributes to understanding the historical evolution of the tax burden in Ecuador, offering a more complete and contextualized and significant perspective of the tax burden in the country.

It is also a correlational research since the Bayesian correlation between the tax burden and the three factors that compose it was applied, the tax pressure of the central government, the tax pressure of sectional governments and the contribution to social security. Factor analysis was also applied between the study variables.

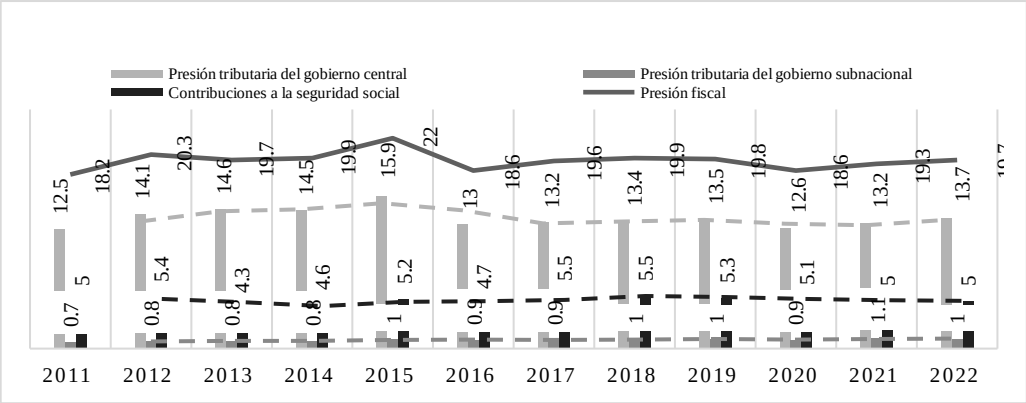
The data used are quantitative and were obtained from the official platforms of the World Bank, the internal revenue service SRI, etc., corresponding to the period 2010 – 2023.

RESULTS

When analyzing the data on the tax burden in Ecuador and the figures of each of its components, it represents the variations that the tax burden has suffered with respect to the economy, in general from 2011 to 2015 an increase is identified and decreases in 2016, presenting slight fluctuations until 2022.

The central government's tax burden is reduced from 2016 to 2018 and there is a slight increase in the following years. It is important to emphasize that this component is the one that has the greatest representation in the tax burden. On the other hand, the tax burden of the subnational government is presented in low and constant values throughout the period of analysis, the incidence in the general tax pressure is low and of lower contribution compared to the other components. Finally, social insurance contributions represent a significant part of tax revenues, although it has variations reflects stability remains at an average of 5% of GDP.

Figure 7 Tax Pressure in Ecuador 2011 - 2022



Note: Prepared by the author based on the 2023 SRI Tax Pressure Comparison. In original language Spanish

Bayesian correlation

Bayesian correlation reflects the statistical relationships between the factors examined. Pearson's correlation indicates the strength and direction of the linear relationship between variables, while Kendall's tau assesses the relationship of agreement or discordance between the classifications of variables. Higher and more significant correlation values such as 0.847 between PF ECUADOR and PFGC ECUADOR, suggest stronger and more consistent relationships between these specific variables, this indicates dependencies or direct influences in the economic context.

The correlation between PFGS ECUADOR and CSS ECUADOR, with a Pearson coefficient of 0.557, shows a stronger positive relationship, suggesting a more marked association between PFGS ECUADOR and CSS ECUADOR. These findings highlight the interconnectedness between key economic variables in Ecuador, providing valuable insights

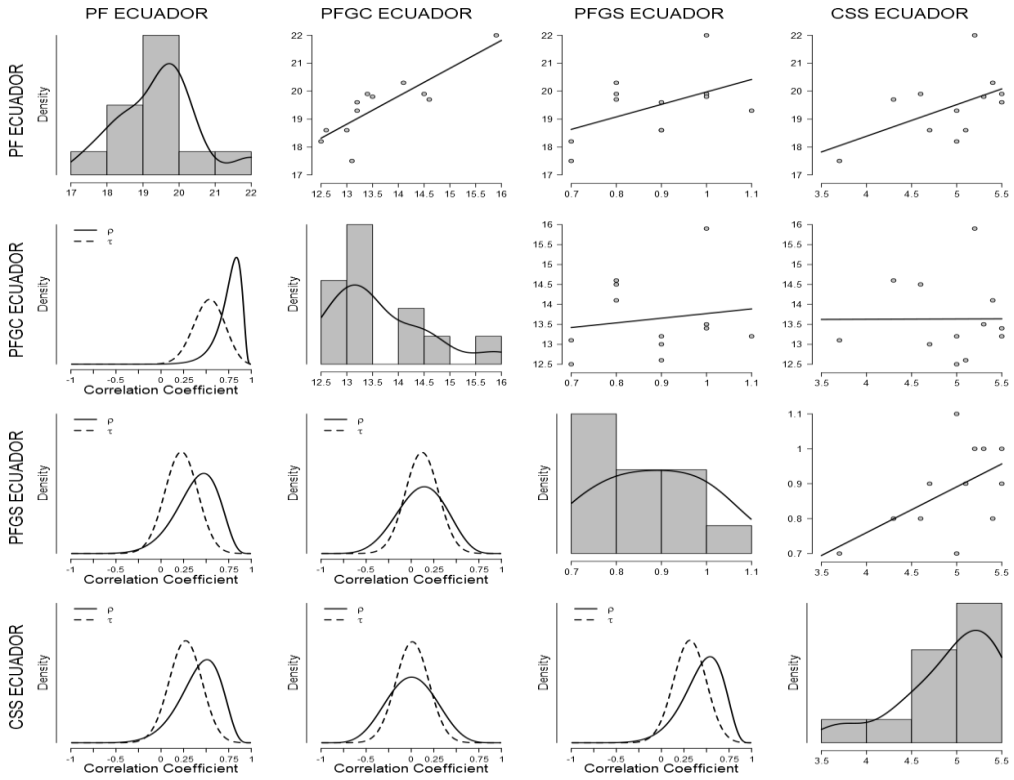
into how economic growth and the performance of different sectors may be correlated, which may be useful for formulating more accurate and effective political and economic strategies.

Figure 8 Bayesian correlation of PF, PFGC, PFGS and CSS

	BF_{10}	PF ECUADOR	PFGC ECUADOR	PFGS ECUADOR	CSS ECUADC
PF ECUADOR	Pearson's r	—			
	BF_{10}	—			
	Kendall's tau	—			
	BF_{10}	—			
PFGC ECUADOR	Pearson's r	0.847 **	—		
	BF_{10}	74.52	—		
	Kendall's tau	0.698 **	—		
	BF_{10}	30.722	—		
PFGS ECUADOR	Pearson's r	0.491	0.15155	—	
	BF_{10}	1.16	0.392	—	
	Kendall's tau	0.284	0.1492	—	
	BF_{10}	0.765	0.445	—	
CSS ECUADOR	Pearson's r	0.527	0.00403	0.557	—
	BF_{10}	1.43	0.354	1.75	—
	Kendall's tau	0.344	0.0155	0.401	—
	BF_{10}	1.082	0.363	1.60	—

Nota. * $BF_{10} > 10$, ** $BF_{10} > 30$, *** $BF_{10} > 100$

Figure 9 Correlation Plot



CONFIRMATORY FACTOR ANALYSIS

Confirmatory factor analysis contributes to evaluating and confirms the relationships between latent and observed variables When analyzing the tax burden and GDP growth over the period 2010 – 2021, the following results are obtained:

Board 1 Factor loads

Factor Loads

Factor	Indicator	Estimator	USA	Z	P
Factor 1	PF Ecuador	1.11	0.226	4.90	<.001
Factor 2	Crec. GDP Ecuador	3.89	0.794	4.90	<.001

Factor Estimators

Board 2 Covariance of factors

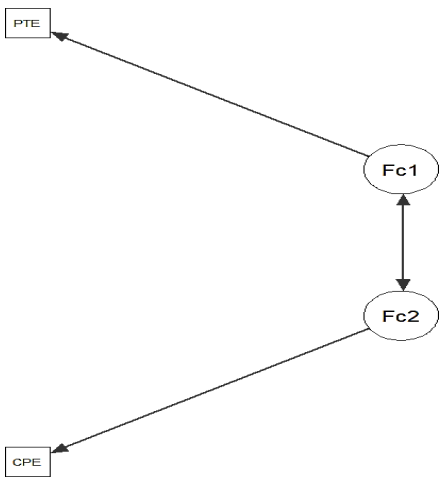
Covariances of Factors

		Estimator	USA	Z	p
Factor 1	Factor 1	1.0000 to			
	Factor 2	-0.0147	0.289	-0.0509	0.959
Factor 2	Factor 2	1.0000 to			

The values represent the strength of the relationship between the latent variables (tax burden and GDP growth). Estimators indicate the magnitude and direction of the relationship between the factors. In this case, an estimator of 1.11 for Factor 1 and 3.89 for Factor 2 suggest that there is a positive relationship between the tax burden and GDP growth in the context of Ecuador. The Standard Error (EE) shows the accuracy of the estimator's estimate. Lower EE values indicate a more accurate estimate. The Z-value is a measure of statistical significance. High values of Z (in this case, 4.90) indicate greater confidence in the statistical validity of the results. The p-value < 0.001 indicates that the relationship between the tax burden and GDP growth is very unlikely to be the result of chance. This suggests a high statistical significance in the relationship between these factors.

There is a positive and statistically significant relationship between the tax burden and the growth of Ecuadorian GDP. What is represented in the following flowchart

Figure 10 PF & GDP Flowchart



In addition, it was necessary to apply the same confirmatory factor analysis study between the FP of Ecuador and the three factors: Central Government Tax Pressure, Sectional Government Tax Pressure and Social Security Contributions, obtaining the following results.

Board 3 Factor Load

Factor Loads

Factor	Indicator	Estimator	USA	Z	p
Factor 1	PF Ecuador	1.106	0.2257	4.90	<.001
Factor 2	PTGC Ecuador	0.937	0.1912	4.90	<.001
Factor 3	PTGS Ecuador	-0.121	0.0248	-4.90	<.001
Factor 4	CSS Ecuador	0.516	0.1052	4.90	<.001

Factor estimator

Board 4 Covariance of factors

Covariances of Factors

		Estimator	USA	Z	p
Factor 1	Factor 1	1.00000 to			
	Factor 2	0.84736	0.0814	10.4101	<.001
	Factor 3	-0.49072	0.2192	-2.2391	0.025
	Factor 4	0.52705	0.2085	2.5281	0.011
Factor 2	Factor 2	1.00000 to			
	Factor 3	-0.15155	0.2820	-0.5373	0.591
	Factor 4	0.00403	0.2887	0.0140	0.989
Factor 3	Factor 3	1.00000 to			
	Factor 4	-0.55732	0.1990	-2.8005	0.005
Factor 4	Factor 4	1.00000 to			

to fixed parameter

Adjustment Measures

Covariances of Factors

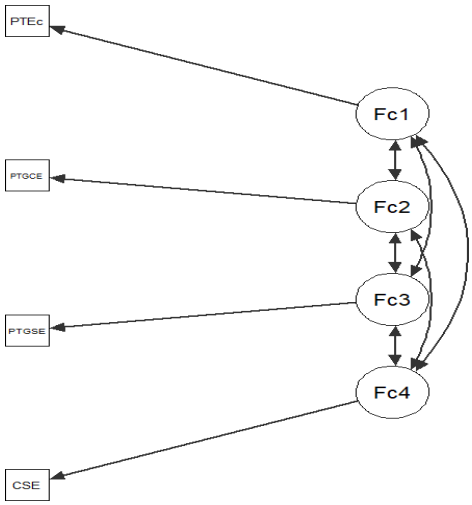
Estimator		USA		Z	p
		90% RMSEA CI			
CFI	TLI	RMSEA	Inferior	Superior	AIC
1.00	1.00	0.00	0.00	0.00	-4.94

As observed for Factor 1: The loads of the FP Ecuador and PTGC Ecuador indicators are positive (1.106 and 0.937 respectively), indicating a positive relationship between these indicators and Factor 1. However, PTGS Ecuador has a negative charge (-0.121), suggesting an inverse relationship with Factor 1. All these estimators have significant values ($p < 0.001$), which indicates a high reliability in these relationships. For Factor 2: The PTGC Ecuador and CSS Ecuador indicators have positive charges (0.847 and 0.527 respectively), which shows a positive relationship with Factor 2. The other loads are negligible ($p > 0.05$).

For Factor 3: Only the PTGS Ecuador indicator shows a significant and negative charge (-0.490) with Factor 3, suggesting an inverse relationship. For Factor 4: The CSS Ecuador indicator shows a significant and positive load (0.527) with Factor 4, while the other indicators have non-significant loads.

Covariances between factors indicate how latent factors relate to each other. The results indicate associations between factors, with some showing significant relationships and others not. Fit measures (90% CI of the RMSEA, CFI, TLI, RMSEA, AIC) are used to assess how well the model fits the data. In the analysis the model has an excellent fit (CFI and TLI = 1.00, RMSEA = 0.00, AIC = -4.94), which suggests that the proposed model fits very well with the observed data. In summary, the results of the confirmatory factor analysis indicate the relationships between the latent factors and their observed indicators, as well as the goodness of the proposed model's fit to the collected data. This is reflected in the flowchart:

Figure 11 Flow chart PF, PTGC, PTGS & CSS



DISCUSSION

The analysis of the tax burden in Ecuador reveals significant fluctuations and trends in the tax burden over the years. Between 2011 and 2015, a general increase in the tax burden is identified, followed by a reduction in 2016 and slight fluctuations until 2022. The central government's tax burden decreases from 2016 to 2018, with a slight increase in subsequent years. This component accounts for the largest share of the tax burden. On the other hand, the fiscal pressure of the subnational government remains constant and low throughout the period, contributing minimally to the general fiscal pressure. Tax contributions constitute a significant part of tax revenues, remaining on average around 5% of GDP, showing some stability despite variations.

Bayesian correlation analysis provides a deeper understanding of the statistical relationships between different key economic variables in Ecuador. Significant correlations, such as the value of 0.847 between PF ECUADOR and PFGC ECUADOR, suggest a stronger and more coherent connection between these variables, indicating possible dependencies or direct influences on the country's economic context. In addition, the more robust correlation between PFGS ECUADOR and CSS ECUADOR, with a Pearson coefficient of 0.557, highlights a more marked association.

The confirmatory factor analysis between the tax burden and GDP growth in Ecuador reveals a statistically significant relationship between both variables. The estimators obtained (1.11 for Factor 1 and 3.89 for Factor 2) indicate a positive relationship between the tax burden and the country's economic growth. Low Standard Error (EE) values suggest an accurate estimation of these estimators, while high Z-value values (4.90) and p-value < 0.001 indicate high confidence in the statistical validity of the observed relationship. This result implies that the relationship between tax burden and GDP growth is not likely to be random, but is supported by statistical evidence.

A positive and significant association between the tax burden and Ecuador's economic growth is confirmed. This analysis confirms the direct connection between these factors and suggests that an increase in the tax burden can positively influence the country's GDP growth. This relationship is summarized and represented in a flowchart for a clear visual understanding of this direct and statistically significant connection between tax pressure and economic growth in the Ecuadorian context.

The confirmatory factor analysis carried out between Ecuador's tax burden and its components - Central Government Tax Burden, Sectional Government Tax Burden and Social Security Contributions - reveals complex relationships between these factors. The results show that Factor 1 is positively influenced by the general tax burden and the tax burden of the Central Government, while there is an inverse relationship with the tax burden of the sectional government. On the other hand, Factor 2 is positively related to the Central Government's tax burden and Social Security Contributions, showing a stronger association with these indicators. Factor 3 is mainly influenced by the fiscal pressure of the sectional government, exhibiting a negative relationship with it. Finally, Factor 4 is positively linked to Social Security Contributions, this indicator being the main driver of this factor.

The values of the covariances between the latent factors reveal the associations between them, showing some significant relationships and others not so relevant. In addition, model fit measures, such as CFI, TLI, RMSEA, and AIC, indicate an excellent fit of the proposed model to the observed data. This suggests that the explanatory model provides a robust representation of the relationships between the factors analyzed in relation to the tax burden in Ecuador, which may be critical to understanding how these interrelated variables affect the country's tax system. In summary, confirmatory factor analysis offers valuable information on the relationships between latent factors and their observed indicators, supporting the understanding of the underlying structure of the tax burden and its components in the Ecuadorian context.

CONCLUSIONS

This study provides a detailed view of the dynamics of the tax burden in Ecuador, revealing not only trends over time, but also the complex relationships between different economic factors, which may be crucial for the design of effective economic policies and strategies in the country.

A notable fluctuation in the tax burden is observed between 2011 and 2015, followed by a reduction in 2016 and slight fluctuations until 2022. The central government's tax burden has fluctuated, while the subnational government's tax burden has remained low and constant over time. Despite the variations, tax contributions remain around 5% of GDP, showing some stability.

A positive and statistically significant relationship is established between the tax burden and GDP growth, suggesting that an increase in the tax burden could positively influence economic growth.

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