

Correlation Analysis between the Variation of GDP and the Percentage Variation of Colombian Emigrants

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Abstract

This research has highlighted the connection between economic conditions and the aspirations of Colombians to explore opportunities beyond their homeland, a trend that has experienced substantial variations since the Republic of Colombia exists as an independent nation. In an increasingly interconnected world, understanding the motivations and determinants of emigration is crucial, and that is why this study adds depth to the discourse on the complex interaction between economic variables and emigration decisions and, ultimately, leaves the open door to inquire into the factors that drive Colombians to seek new horizons abroad. Based on all of the above, this study rigorously examines the intricate relationship between the variable "Percentage variation in the Gross Domestic Product (GDP)" and the emigration patterns quantified by the variable "Number of Colombian emigrants" through an analysis of statistical correlation in which the Spearman coefficient was determined. With a P value of 0.00557, lower than the significance level worked on $\alpha = 0.05$, it has been determined that there is a significant correlation between the variation in GDP and the percentage variation in the number of Colombian migrants. Subsequently, the Spearman correlation coefficient was calculated, obtaining a value $r = 0.83$, which allowed us to conclude that the interdependence of these two variables responds to a strong correlation between them. Generally speaking, there is sufficient statistical evidence to affirm that, as Colombia's GDP grows or decreases, there is a concomitant increase or decrease in the number of Colombian emigrants. These results shed light on the multifaceted nature of Colombian emigration, in which economic variations play a fundamental role in shaping emigration patterns, and in turn have substantial importance for policy makers and researchers, as they offer a data-driven perspective on the intricate dynamics driving emigration.

Keywords: GDP, migration, correlation.

Introduction

It is essential to take into account the demographics of emigrant populations, particularly the proportion of people who voluntarily leave their country of origin, when analyzing Colombian emigration in its broader context (Rodríguez Álvarez, 2023). Understanding the complex interaction of factors that push people to seek new horizons requires understanding this demographic aspect (Malmberg, 2021). Examining whether changes in Colombia's economic climate, as shown by changes in GDP, are closely related to changes in the country's emigration rate is a crucial component to generating knowledge on this topic (Helgason, 2020).

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A fundamental indicator to take into account in this research is the Gross Domestic Product (GDP), which includes elements such as economic growth, employment opportunities and income levels and serves as a reflection of the general economic health of the country (Dědeček and Dudzich, 2022). When a country's GDP changes, this can have a significant impact on the lives of its population, possibly influencing their emigration decisions (Wu et al., 2019). That is, emigration can be caused by changing economic conditions, which are frequently reflected in changes in GDP.

People may be more motivated to seek better opportunities abroad when the economy is struggling (Durán, Guilliany, Bilbao, 2021; Ramírez et al., 2022), as evidenced by low GDP growth or high unemployment rates. Conversely, times of economic prosperity, as evidenced by rapid GDP growth and expanded employment opportunities, can motivate people to remain in their home countries (Czaika and Reinprecht, 2022; Cramer et al., 2020). In this way, economic crises can encourage people to look for opportunities elsewhere, while a booming economy can create opportunities that encourage immigration and maintain local talent (He et al., 2022). Consequently, the dynamic nature of the relationship between GDP and emigration justifies a more exhaustive examination than a strictly empirical one.

Due to the factors described above, this study employs a statistical correlation analysis to carefully evaluate any potential association between the "Percentage change in the Gross Domestic Product (GDP)" and the "Number of Colombian emigrants." The need for a systematic and data-driven exploration of the intricate relationship between economic indicators and emigration patterns led to the selection of statistical correlation analysis. Statistical correlation analysis offers a quantitative framework to accurately assess the nature, magnitude and direction of the relationship between variables (Paul and Barari, 2022), making it possible to determine whether variations in Colombia's GDP are statistically linked. with variations in the number of Colombian emigrants, quantifying the degree of correlation. This analytical strategy goes beyond qualitative assumptions and allows us to verify whether there is sufficient statistical evidence to provide veracity to the complex dynamics between the economy and migratory movements.

Furthermore, statistical correlation analysis offers a methodical approach to identifying patterns and trends in large and complex data sets (Zhao et al., 2021) and, for the purposes of this work, contributes to visualizing whether particular economic circumstances, as demonstrated by GDP variations have a significant impact on emigration patterns. The main objective is to shed light on empirical findings that can influence political decisions and advance the understanding of the complex interaction between economic factors, particularly GDP, and Colombians' decision to emigrate.

In short, this article carries out a correlational investigation through the following sections, where it is verified whether the changes in the GDP of the Republic of Colombia are statistically related to the level of emigration from the country. By using statistical correlation analysis, we aim to contribute to the analysis of the complex dynamics that comprise Colombian emigration and, ultimately, contribute to a broader conversation about the relationship between the economy, particularly GDP fluctuations, and migratory movements that arise every day in the international context.

Methodology

The objective of this section is to evaluate whether there is a significant relationship between the "Percentage variation in the Gross Domestic Product (GDP)" and the "Number of Colombian emigrants". The data used in this analysis were obtained from secondary sources of information, the first was taken from the World Bank website and represents the GDP growth (annual %) in Colombia from the years 2013 to 2022 (World Bank, 2023) and the second taken from the open data website of the Colombian

government, which shows the variation in the consolidated departures of Colombians from the national territory starting in 2012 (Government of Colombia, 2023).

As a first measure to determine the existence of an association between the variables mentioned above, the Shapiro-Wilk normality test was applied, since the sample size is less than 50 data. Next, the data of the variable "Number of Colombian emigrants" were transformed with the objective of placing it on the same plane as the variable "Percentage variation in the Gross Domestic Product (GDP)" and ensuring that it behaves in a normal way, the formula used for this purpose was the following: Percentage variation = [(Current value - Previous value) / Previous value] x 100%, which is a measure used to compare two values in different periods of time and express the difference in terms percentages (Velasco, 2023). Next, a Spearman correlation analysis was performed, because the variable "Percentage variation of Colombian emigrants" did not show a normal distribution. This test is used to determine the degree of correlation between two sets of paired observations.

Its formula is the following:

$$r_s = 1 - \left(\frac{6R}{n(n^2 - 1)} \right)$$

(Mendivelso, 2022).

The data was processed using RStudio, which is free-to-use software that is used to create data processing, analysis and creation of statistical figures using packages and functions (RStudio Team, 2020).

Results

Table 1. Data on the "Percentage variation of the Gross Domestic Product (GDP)" and the "Percentage variation of Colombian emigrants" from the years 2013 to 2022.

Var Tot	Var GDP
13,7	5,1
8,5	4,5
-1,3	3
-1,7	2,1
5,9	1,4
8,8	2,6
2,5	3,2
-71,5	-7,3
135,6	11
64,1	7,5

Normality test.

Table 2. Results of the normality test performed in Rstudio.

Data	W	P-value
Df\$VarTot	0.82654	0.03039
Df\$Var GDP	0.89823	0.02095

Shapiro-Wilk

Table 2 shows the results of the normality test applied to the variables “Percentage variation of Colombian emigrants” and “Percentage variation of GDP”, because the first variable is not greater than 0.05. It is concluded that they are not normally distributed, and for this reason the Spearman test is applied.

Hypothesis Test and Spearman Correlation Coefficient

H₀: There is no correlation between the variables, “Number of Colombian emigrants” and “Percentage variation in the Gross Domestic Product (GDP)”.

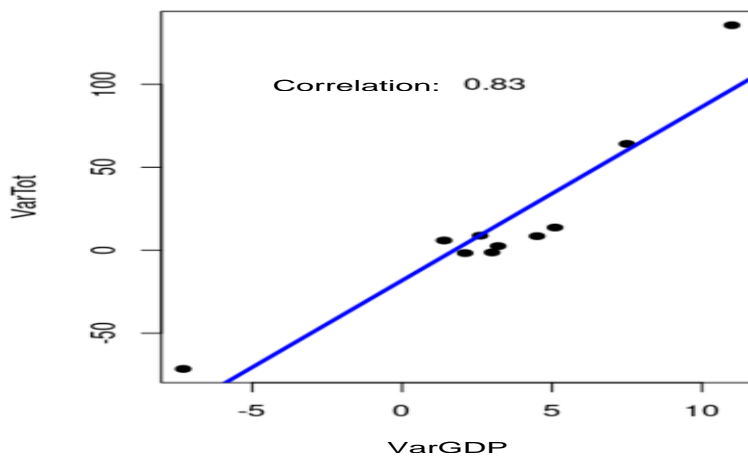
H₁: There is a correlation between the variables “Number of Colombian emigrants” and “Percentage variation in the Gross Domestic Product (GDP)”.

Table 3. Results of the Spearman test performed in Rstudio.

Rho Spearman			Df\$VarTot	Df\$Var GDP
		Rho	1	0.830303
	Df\$VarTot	p-value		0.00557
		N	10	10
		Rho	0.830303	1
	Df\$Var GDP	p-value	0.00557	
		N	10	10

As can be seen in Table 3, the hypothesis test yielded a p value of (0.005557). Since the P value is less than the significance level of $\alpha = 0.05$, the null hypothesis is rejected in favor of the alternative, that is, that there is sufficient statistical evidence to affirm that there is a significant correlation between the variables.

Graph 1. Scatter plot made in Rstudio software.



The rho value calculated for the variables “Percentage variation of Colombian emigrants” and “Percentage variation of GDP” was approximately $r = 0.83$. This value suggests a positive direction in the correlation and a high correlation strength, as illustrated in Figure 1.

Conclusions

Based on the results obtained in the correlation analysis between the "Variation of GDP" and the "Percentage variation of Colombian emigrants", the following conclusions can be drawn:

A very strong positive correlation is observed between the "Variation of GDP" and the "Percentage variation of Colombian emigrants" with a rho value of 0.83. This indicates that, in general, as Colombia's GDP has experienced growth (or decline), there has been a notable increase (or decline) in the number of Colombian emigrants.

The p-value for this analysis was 0.005557, which is significantly less than the standard significance level of 0.05. This shows that there is enough statistical data to prove that the observed correlation is real and statistically significant.

Colombia will be significantly impacted by these findings in terms of the economy and society. The significant positive correlation might mean that Colombian emigration is greatly impacted by the nation's economic performance. This might imply that when the country's economy is struggling, more Colombians decide to emigrate, perhaps in search of better opportunities abroad. However, during periods of economic expansion, Colombians may stay in the country longer as a result of the opportunities that arise there.

Correlation does not necessarily imply causation; it is important to remember this. Despite the fact that these two factors exhibit a strong correlation, we cannot say that the rise in the GDP is directly responsible for Colombians' emigration. Future research should thoroughly examine additional economic, social, and political factors that may be significantly influencing this relationship.

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