Migration Letters

Volume: 20, No: S2(2023), pp. 1123-1129

ISSN: 1741-8984 (Print) ISSN: 1741-8992 (Online)
www.migrationletters.com

Received: 20 March 2023
Published: 28 July 2023

Evaluation of the Level of Statistical Association between the Gross Domestic Product and the Percentage of Male Population among Colombian Emigrants

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Abstract

In the context of Colombia's changing migration landscape, this study delves into the specific cohort of Colombian male emigrants, with the aim of unraveling the intricate relationship between economic dynamics and male emigration patterns. In this context, the variation in Colombia's Gross Domestic Product (GDP) emerges as a fundamental economic indicator, which reflects the economic vitality, growth prospects and employment possibilities of the nation. In turn, male Colombian emigrants represent a notable facet of the broader emigration phenomenon, and their journeys are influenced by a variety of motivations, including economic opportunities, educational pursuits, and personal aspirations. In this way, for the purposes of this study, two variables have been parameterized to measure the level of association between them through a correlational study, these being the "Percentage variation of the Gross Domestic Product (GDP)" and the "Percentage variation of emigrants Colombian men". Subsequently, the data collected have been evaluated with exhaustive statistical evaluation analysis using Pearson's evaluation coefficient, which has resulted in a remarkably low P-Value of 0.0001221, much lower than the significance level = 0.05, which has allowed us to conclude that the relationship between both variables is significant, and likewise, a Pearson correlation coefficient of 0.92, which shows a strong positive correlation between the variables studied. These results reveal a statistically significant association between the fluctuations of the GDP and Colombian male emigration, with sufficient statistical evidence to affirm that, as Colombia's GDP grows or decreases, there is a synchronous increase or decrease in the number of Colombian male emigrants.

Keywords: *Gross Domestic Product, emigration, correlation, statistical analysis, demography, gender, male emigrants.*

INTRODUCTION

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For centuries, migration has been a defining characteristic of human societies and has affected demographics, economies and cultures around the world (Pevtsova et al., 2020; Akaev et al., 2023). The phenomenon of migration has become more significant in today's world as globalization accelerates and borders become more permeable (Triandafyllidou, 2022). Economic opportunities, political stability, social networks and personal aspirations are just some of the many variables that influence migration (Czaika et al., 2021; Wu et al., 2022). We begin our investigation of the statistical relationship between two important variables (GDP and the percentage of men among Colombian immigrants) in the context of this dynamic environment.

One aspect of migration that requires careful examination is the gender distribution of immigrant populations. With varying proportions of men and women among emigrants, historical migration patterns often exhibited clear gender biases. Different labor market opportunities, social norms, and family considerations, among other things, can contribute to these gender disparities (Pitoyo et al., 2022; Conover, 2021). Understanding the gender-specific aspects of migration and its implications for countries of origin and destination depends on knowing how many men there are among emigrants (Yang y Bansak, 2020; Acosta, 2020).

The health and economic vitality of a country are fundamentally measured by its GDP. It is an indicator of the total monetary value of goods and services produced within a nation's borders during a specific time period (Irshad et al., 2022). A high GDP usually indicates a healthy economy with many employment opportunities, while a low GDP can signal economic difficulties, including poor job prospects (Cook & Davíðsdóttir, 2021). To gain a deeper understanding of the economic factors that influence migration, it is useful to examine the relationship between GDP and emigration patterns. The relationship between GDP and the male share of emigrants in Colombia, a nation with a long history of migration, presents a challenging and fascinating research question (Durán et al., 2021; Ham et al., 2022). Colombia, a country in South America, has experienced waves of both internal and foreign migration. Its diverse geographic, economic and cultural regions have created a mosaic of migration patterns, and the gender dynamics of these movements are equally complex (Ramírez et al., 2023; Ramírez et al., 2022).

To thoroughly examine the relationship between two fundamental variables: the "percentage change in gross domestic product (GDP)" and the "percentage change in Colombian male emigrants", this study uses a statistical correlation analysis. The decision to use statistical correlation analysis was made to conduct an empirical and data-driven investigation into any potential relationship between economic indicators and emigration trends. The main objective of this study is to shed light on the complex dynamics of Colombian emigration, particularly in relation to the distribution of emigrant populations by gender.

First, statistical correlation analysis offers a quantitative framework to accurately determine the type and strength of association between variables (Mohajan, 2020; Del Giudice and Gangestad, 2021). We can determine whether changes in Colombia's GDP are statistically related to corresponding changes in the proportion of male emigrants by quantifying the degree of correlation. This analytical strategy goes beyond qualitative conjectures and provides data on the dynamics at play. Second, statistical correlation analysis offers a methodical way to identify patterns and trends in large, complex data sets (Xia, 2020; Pesämaa et al., 2021). This makes it possible to determine whether particular economic circumstances, as shown by GDP, have a discernible impact on the gender distribution of emigrants.

The objective of this research is to generate empirical knowledge through careful statistical analysis that can guide policy decisions and improve our understanding of the complex interaction between economic factors and migration patterns. To know the statistical relationship between Colombia's GDP and the percentage change in its male emigrant population, a stochastic search has been carried out in this article. To shed light on the complex dynamics of Colombian emigration, statistical correlation analysis has been used. In doing so, we hope to advance the conversation about how economics and migration interact in an increasingly interconnected world.

MATERIALS AND METHODS

The objective of this section is to determine if there is any correlation between the "Percentage variation of the Gross Domestic Product (GDP)" and the "Percentage variation of Colombian male emigrants". The first variable, which represents GDP growth (annual percentage) in Colombia from 2013 to 2022 (World Bank, 2023) was taken from the World Bank website, and the second was taken from the Colombian government's Open Data website, where the variation in the total number of departures of Colombian men from the country since 2012 is represented (Government of Colombia, 2023). The statistical program R Studio Team (2020) was used for data processing.

Since there were less than 50 data points in the sample, the Shapiro-Wilk normality test was first applied to perform statistical analysis. Next, the data for the variable "Percentage change in Colombian male emigrants" were transformed to put them on the same plane as the variable "Percentage change in Gross Domestic Product (GDP)" and ensure that they were normally distributed. To achieve this objective, the following formula was used: Percentage variation = [(Current value - Previous value) / Previous value] x 100%. This measure is used to compare two values in different periods of time and express the difference in percentage terms (Velasco, 2023). Once it was determined that the two variables behaved normally, a Pearson correlation analysis was performed. Two variables are related if changes in one variable have an impact or influence changes in the other variable, which is why correlation coefficients were used to express the degree of association or relationship between variables to measure both. In other words, correlation coefficients evaluate the degree (direction and magnitude) of an association or relationship between two variables. The magnitude and direction of the correlation coefficients can vary and can be high or low. Correlation coefficients range from -1 to 1; a correlation coefficient of 0 denotes no correlation (no relationship), while -1 and 1 denote perfect negative and perfect positive correlation coefficients, respectively. Additionally, correlation coefficients less than 0.40 (whether negative or positive 0.40) are considered low, those between 0.40 and 0.60 are considered moderate, and those greater than 0.60 are considered high (Obilor and Amadi, 2018).

RESULTS

Data

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

Var GDP	Var Male

5,1	11,7
4,5	7,7
3	-1,7
2,1	-1,9
1,4	15,7
2,6	-1,9
3,2	2,2
-7,3	-71,3
11	127,8
7,5	67,2

Normality test.

Table 2. Results of the normality test performed in R studio.

Shapiro-Wilk		
Data	W	P-value
Df$VarMale	0.84823	0.05534
Df$VarGDP	0.89823	0.02095

The results of the normality test for the variables “Percentage variation of Colombian emigrants” and “Percentage variation of GDP” are shown in Table 2. Given that the two variables under study are greater than 0.05, it is determined that they are normally distributed and the Pearson test can be used.

Hypothesis Testing and Correlation Coefficient

H_0: There is no correlation between the variables, “Number of Colombian male emigrants” and “Percentage variation in the Gross Domestic Product (GDP)”.

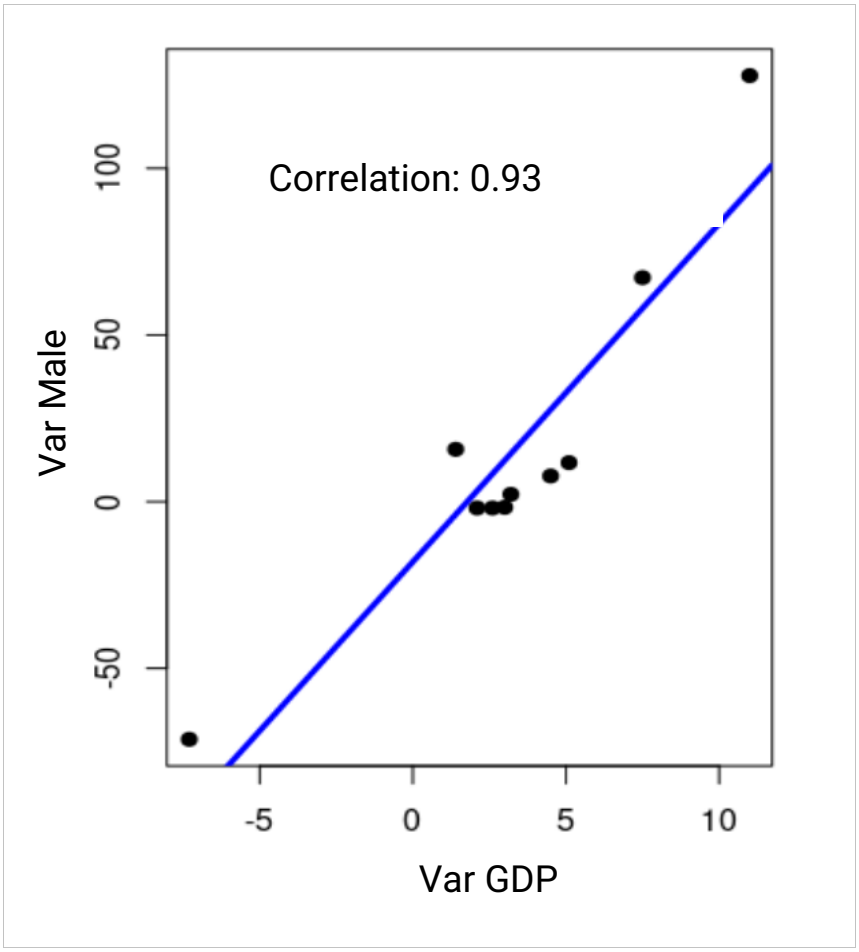
H_1: There is a correlation between the variables “Number of Colombian male emigrants” and “Percentage variation in the Gross Domestic Product (GDP)”.

Table 3. Results of the Pearson test carried out in R studio.

			Df$VarTot	Df$VarGDP
Rho Pearson		Rho	1	0.9256532
	Df$VarMale	p-value		0.0001221
		N	10	10
		Rho	0.9256532	1
	Df$VarGDP	p-value	0.0001221	
		N	10	10

As evident in Table 3, the hypothesis test yielded a P value of (0.0001221). Since the P value is less than the significance level of α = 0.05, the null hypothesis is rejected in favor of the alternative, that is, the variables are associated.

Graph 1. Scatter plot made in R studio software.



The Pearson correlation coefficient calculated for the variables “Percentage variation of Colombian male emigrants” and “Percentage variation of GDP” was approximately 0.93. This value suggests a positive direction in the association and a high correlation strength as seen in Graph 1.

CONCLUSIONS

From the correlation analysis of the “Variation of GDP” and the “Percentage variation of Colombian emigrant men” that yielded the results, the following conclusions can be drawn.

With a correlation coefficient of 0.92, it is evident that the “Variation of GDP” and the “Percentage variation of migrant Colombian men” are significantly positively correlated. This shows that overall there has been a notable increase (or decrease) in the number of Colombian men who have emigrated along with the growth (or decrease) of Colombia's GDP. Compared with the typical significance level of 0.05, the P value calculated in this analysis is 0.0001221, which is significantly lower. This suggests that the observed correlation is statistically significant and not the result of chance.

These findings represent a significant generation of knowledge for the analysis of the Republic of Colombia in terms of economy and society. The strong positive correlation may suggest that Colombia's economy has a significant impact on the flow of male emigration. This may indicate that more Colombian men decide not to emigrate during times of economic expansion. On the other hand, more men may emigrate during economic crises in search of better opportunities abroad.

Correlation does not necessarily imply causation; it is important to remember this. Although there is a significant correlation between these two factors, we cannot draw the conclusion that GDP expansion is directly responsible for the emigration of Colombian men, since this relationship can also be influenced by other economic, social and political factors that are not within the scope of the statistical model developed in the present work, but which should be addressed in future research.

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