Effects Of The Entry Of Immigrants To Colombia On International Flights On The Hotel Occupancy Rate: A Regression Analysis

John Buelvas Parra* , Lorena Hoyos Babilonia** , William Niebles Nuñez***

ABSTRACT

This research revolved around the analysis of the influence of the entry of immigrants to Colombia through international flights on the hotel occupancy rate in Colombian territory. This analysis consisted of a simple linear regression model structured by the entry of immigrants as an independent variable and hotel occupancy as a dependent variable. The observations were collected from data collected from the website of the Ministry of Commerce, Industry and Tourism (MINCIT) and the National Administrative Department of Statistics (DANE), delimited between January 2021 and November 2023. The results obtained demonstrated the existence of a significant correlation between the variables studied, serving as a starting point for the subsequent results, defined by the regression equation $Y = 30.8 + 0.00003287X$, where Y represents the hotel occupancy rate in the Colombian territory and immigrants who arrive in Colombia through international flights. The simple linear regression model generated had a significant slope, with a P value of 4.66×10^{-9}, much lower than the significance level of 0.05, while the R^2 value of 0.6411 indicated that the model obtained explained 64.11% of the variation in hotel occupancy within the time period studied. Finally, the results of testing the assumptions of linearity, normality, and homoscedasticity indicated that the relationship between the variables is linear, the residuals are normally distributed, and the variance of the residuals is constant at all levels of the response variable. These results contribute to understanding the dynamics of immigration and tourism in Colombia, making clear the need for a comprehensive analysis when evaluating the factors that determine hotel occupancy rates.

***Key words:** migration, hotel occupancy, immigrants, international flights, linear regression.*

INTRODUCTION

In the current context of gl[1]obalization and large-scale population mobility, international migration plays an increasingly important role in the fabric of societies and economies around the world (Hollifield and Foley, 2022). Colombia, with its strategic location in Latin America and a growing economy, is no stranger to this reality. The arrival of immigrants to Colombia, especially through international flights, raises various questions about how these dynamics affect different aspects of the country's life, including the hotel industry (Dempster and Zimmer, 2020).

*,**,***Universidad de Sucre (Colombia)*, Universidad de Sucre (Colombia)**, Universidad de Sucre (Colombia)***
*corresponding author: John Buelvas Parra.

Since ancient times, various migratory flows converged in the current Republic of Colombia and enriched its social and economic structure (Garces et al., 2023; Ramírez, 2022). However, in recent decades there has been a significant increase in immigration flows to Colombian territory, especially those arriving by air. Traveling by plane to Colombia has acquired special relevance in the current situation (Celis and Ortiz, 2021); The country's economic growth and political stability, as well as the opening of its borders to tourism and international business, have led to an increase in the number of people arriving in Colombia via international flights (Olariaga and Alonso-Malaver, 2022). This phenomenon reflects Colombia's growing integration into the global economy, as well as its attractiveness as a tourist and business destination (Aïdi and Fabry, 2022).

Colombia's hotel sector has experienced significant advances in response to the growing demand for accommodation. From boutique hotels in the city center to luxury resorts on the Caribbean coast, the country offers a variety of options to meet the needs of both domestic and international travelers (Bassols and Leicht, 2021). This expansion of the hotel sector has not only generated employment and contributed to the economic development of many parts of the country, but has also helped strengthen Colombia's image as a world-class tourist destination (Ríos-Reyes, 2021). Hotel occupancy rates in Colombia are an important indicator of the tourism sector and the economy as a whole (Perez et al., 2022). Hotel occupancy rates not only reflect the demand for accommodation in the country, but also affect the profitability of establishments, the creation of jobs in the tourism sector and the perception of Colombia as a safe and welcoming destination for travelers (García-Mendez, 2023).

One of the key questions that arises, based on everything explained in previous paragraphs, is how international migration affects the demand for housing in Colombia. As more and more people visit the country to look for work, study or simply explore tourist attractions, the need for temporary and permanent housing increases (Job et al., 2021). This could have a major impact on Colombia's real estate market, affecting the availability and prices of homes in different regions of the country (Botello-Peñaloza, 2020). Furthermore, the concentration of immigrants in certain urban areas can create tensions in real estate markets and lead to gentrification or urban segregation (Díaz-Parra, 2021).

All of this leads to the consequent importance of analyzing how international migration affects the business, social and economic dynamics of hotels in Colombia. Hotels are not only a place of residence for national and international travelers, they are also businesses that generate employment, contribute to regional development and contribute to national economic growth (Provotorina et al., 2020). The arrival of migrants can have a direct impact on the demand for hotel rooms, especially in major cities such as Bogotá, Medellín and Cartagena, where the majority of international migratory flows are concentrated (Rochlin, 2023). This can lead to increased revenue for hotel properties, as well as capacity and demand management issues, especially during peak seasons or major events (Rocca and Zielinski, 2022).

On the other hand, the presence of immigrants in the hotel industry can have social and labor implications. Meanwhile, employing migrant workers in hotels enriches the experiences of both employees and guests by promoting cultural diversity and facilitating the sharing of experiences in the workplace (Hasnat, 2021). However, this can cause problems in terms of labor integration, access to labor rights and social protection for migrant workers. It is essential to address these issues from a human rights and sustainable development perspective to ensure adequate working conditions and growth opportunities for all hotel workers, regardless of nationality (Espasandín-Bustelo and Bayter, 2022).

In this context, among many others, the need arises to develop research on the relationship between international migration to Colombia and hotel occupancy in Colombia. Among the

important questions raised are: How will migratory flows affect the demand for housing in Colombia? How does immigration affect the business, social and economic dynamics of hotel occupancy? These questions are essential to better understand the interactions between immigration and the hospitality industry in Colombia and identify possible areas of opportunity and challenges for the future development of the sector.

From this perspective, this study aims to analyze the impact of immigration to Colombia through international flights on hotel accommodation in Colombia. To do this, statistical methods are used to examine the influence of the entry of immigrants to Colombia through international flights on the hotel occupancy rate in Colombian territory (Mendoza-Ocasal et al., 2022); the tool selected to make this possible consisted of a simple linear regression model structured by the entry of immigrants as an independent variable and hotel occupancy as a dependent variable (Amat, 2016). Through a better understanding of how immigration affects the demand for accommodation in the Colombian territory, this study will not only contribute to academic knowledge about the dynamics of immigration and tourism in Colombia, but will also provide valuable information for the development of public policies and business strategies aimed at promoting the sustainable development of the hotel and tourism sector globally.

MATERIALS AND METHODS

As a starting point in the research process addressed in this study, data were collected from the official websites of the Ministry of Commerce, Industry and Tourism (MINCIT, 2024) and the website of the National Administrative Department of Statistics (DANE, 2024). The number of national and non-national immigrants who entered Colombia via international flights between January 2021 and November 2023 was collected from the MINCIT website, constituting the observations corresponding to the variable "Entry of immigrants to Colombia on international flights." For its part, the information related to the behavior of the establishments that provided the accommodation service in Colombian territory during those same periods was extracted from the official DANE website through indices, variations and indicators of the service sector, thus forming the observations corresponding to the variable "Hotel occupancy rate in Colombia".

Table 1 Data from the variables "Entry of immigrants to Colombia" and "Hotel occupancy rate in Colombia" from the years 2021 to 2023.

No	Period	Immigrants	Hotel Occupation	No	Period	Immigrants	Hotel Occupation
1	Jan 2021	184991	31.9	25	Jan 2023	768167	53.5
2	Feb 2021	126587	31.5	26	Feb 2023	631871	54.3
3	Mar 2021	170266	35.3	27	Mar 2023	673829	52.1
4	Apr 2021	182461	28.9	28	Apr 2023	697842	48.9
5	May 2021	221080	25.6	29	May 2023	729548	48.5
6	Jun 2021	297150	36.2	30	Jun 2023	780247	51.8
7	Jul 2021	394947	43.4	31	Jul 2023	939864	54.4
8	Aug 2021	366528	45.2	32	Aug 2023	853663	54.1
9	Sep 2021	337934	47.0	33	Sep 2023	764930	51.5
10	Oct 2021	410441	52.4	34	Oct 2023	808010	50.0
11	Nov 2021	470356	55.9	35	Nov 2023	843754	56.9
12	Dec 2021	594443	54.3				
13	Jan 2022	521890	52.1				

14	Feb 2022	416624	50.4
15	Mar 2022	487136	53.6
16	Apr 2022	557201	54.7
17	May 2022	628092	49.9
18	Jun 2022	657664	54.3
19	Jul 2022	772452	59.2
20	Aug 2022	699917	58.5
21	Sep 2022	641899	58.0
22	Oct 2022	709770	58.8
23	Nov 2022	703364	60.4
24	Dec 2022	794200	56.3

Once the data for each variable was collected, a regression analysis was developed, which produced a simple linear regression model, made from the construction of the linear equation that best describes the effect of an independent variable (predictor). on a dependent variable (response) (Carrasquilla-Batista et al., 2016). In this way, the simple linear regression model developed in the present study has been structured based on the following equation:

$$Y = \alpha + \beta X + \epsilon$$

Where:

X: Entry of immigrants to Colombia on international flights. Predictor variable.

Y: Hotel occupancy rate in Colombia. Response variable.

α: Intersection of the line with the Y axis, value of the variable Y when the value of X is zero (0).

β: Slope of the line, magnitude of the change in the value of Y each time the value of X changes.

ε: Residual error generated by the probabilistic nature of the model.

For the purposes of the model developed in this research, the entry of immigrants to Colombia on international flights has been considered as the independent or predictor variable (X), which produces changes on a response or dependent variable (Y), which for this model was represented by the hotel occupancy rate in Colombia (Abu-Bader and Jones, 2021). In practical terms, the simple linear regression model generated in the study evaluates the changes generated by immigration to Colombia on international flights on hotel occupancy in Colombian territory during the period delimited between January 2021 and November 2023 (Amat, 2016).

In the aforementioned regression model, the α coefficient represents the value of the hotel occupancy rate in Colombia (Y) when the entry of immigrants to Colombia on international flights (X) is equal to zero (0), while the coefficient β corresponds to the value by which the hotel occupancy rate in Colombia increases or decreases for each immigrant who enters Colombian territory through an international flight (Duran et al., 2021).

Data processing was carried out with the statistical software Excel and RStudio Team (2020). Once the linear regression model to be developed was defined, the RStudio program was used to carry out a residual analysis with which the three necessary conditions were verified to determine that the model produced is valid (Carollo-Limeres, 2011):

1) Linearity, verified by means of a scatter diagram on which a straight line is drawn through the greatest number of points possible.

2) Homoscedasticity, verified once it is determined that the variance of the residuals, defined by the equation $e_i = (\hat{y}_i - y_i)$, is equal to the variance of the real observations of the variable Y. For this, the Breusch-Pagan test was applied (Raza et al., 2023).

3) Normality, determined using the Shapiro-Wilk test, to verify that the residuals fit a normal distribution with mean 0.

Finally, hypothesis tests were formulated to determine whether the observed correlation was statistically significant.

RESULTS

As the first basis for the regression analysis developed, it was necessary to evaluate the observed data through a scatter diagram that included the variable "Entry of immigrants to Colombia on international flights" as a horizontal axis, representing the independent variable, and the variable "Rate of hotel occupancy in Colombia" as a vertical axis, representing the dependent variable of the study.

Figure 1 Scatter diagram of the variables "Entry of immigrants to Colombia" and "Hotel occupancy rate in Colombia" made in Rstudio.
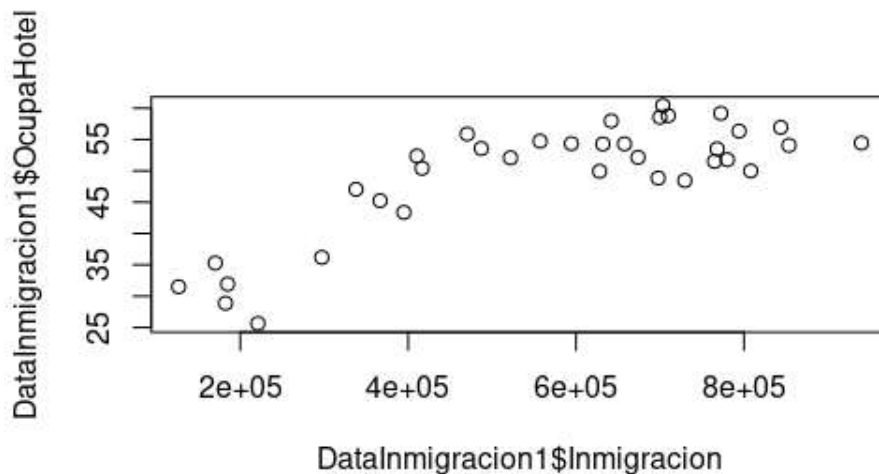

Figure 1 shows a linear relationship between the study variables "Entry of immigrants to Colombia on international flights" and "Hotel occupancy rate in Colombia" in the period from January 2021 to November 2023. This shows the bases to implement a simple linear regression analysis to the aforementioned variables.

Figure 2 Results of the simple linear regression model carried out in RStudio.

```
Call:
lm(formula = OcupaHotel ~ Inmigracion, data = DataInmigracion1)

Residuals:
    Min      1Q  Median      3Q     Max
-12.4255  -4.5446  -0.5627   4.7186   9.6235

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 3.080e+01  2.547e+00  12.091 1.14e-13 ***
Inmigracion 3.287e-05  4.183e-06   7.858 4.66e-09 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 5.507 on 33 degrees of freedom
Multiple R-squared:  0.6517,     Adjusted R-squared:  0.6411
F-statistic: 61.74 on 1 and 33 DF,  p-value: 4.66e-09
```

Figure 2 shows the results of the simple linear regression model, from which it can be interpreted that, in the formula, the dependent variable is represented with the name OcupaHotel and the independent variable by Immigration, from the data called DataInmigracion1. The calculated p-value of 4.66×10^{-9} observed at the end of the graph is much lower than the significance level of 0.05, which allows to conclude that there is sufficient evidence to affirm that the simple linear regression model that has been developed explains significantly the behavior of the response variable (Y) under the influence of the predictor (X), that is, the number of immigrants entering Colombian territory by international flights significantly influences the occupancy rate in hotels in the Colombian territory.

Subsequently, an adjusted R^2 with a value of 0.6411 has been obtained. This value is the coefficient of determination that defines the regression model constructed, and can be interpreted as follows: for a significance level of 0.05, the simple linear regression regression model obtained explains the changes in the response variable (Y) by 64.11%, or in practical terms, the entry of immigrants on international flights to Colombian territory explains the occupancy in hotels in Colombian territory by 64.11%. Finally, the values of the intercept $\alpha = 30.8$ and the slope $\beta = 0.00003287$ had a p-value of 1.14×10^{-13} and 4.66×10^{-9}, respectively; Being both much lower than the significance level of 0.05, there is sufficient evidence to affirm that both coefficients are significant and can be included in the simple linear regression model.

Subsequently, to check the assumptions of linearity, homoscedasticity and normality, the graphs provided by RStudio were used, which can be interpreted as shown below.

Figure 3 Scatter diagram with regression line of the variables "Entry of immigrants to Colombia" and "Hotel occupancy rate in Colombia" carried out in RStudio.
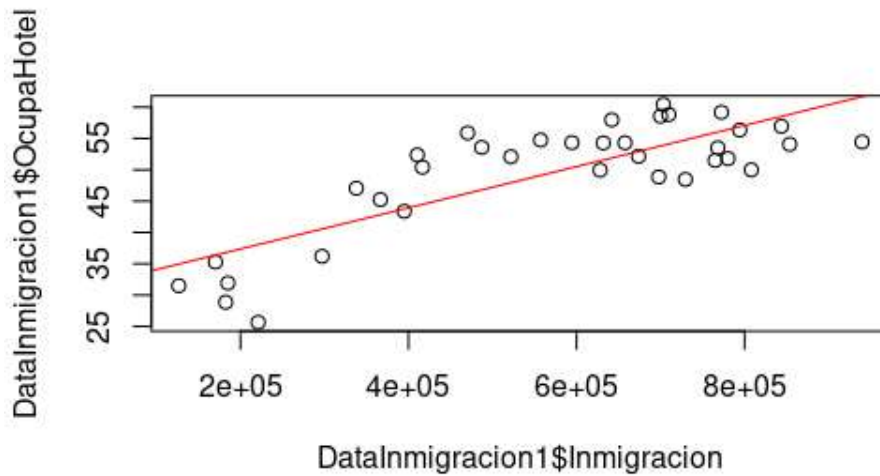
The regression line that crosses the point cloud of the scatterplot, shown in Figure 3, fits the data points and graphically represents the estimated linear relationship between the variables, the slope of the line obtained indicates a positive relationship and strong between the variables, that is, the assumption of linearity is met.

The next assumption to evaluate was the normality assumption. For this, the following hypotheses were formulated:

H_0: The residuals fit a normal distribution.

H_1: The residuals do not fit a normal distribution.

Figure 4 Histogram of errors or residuals
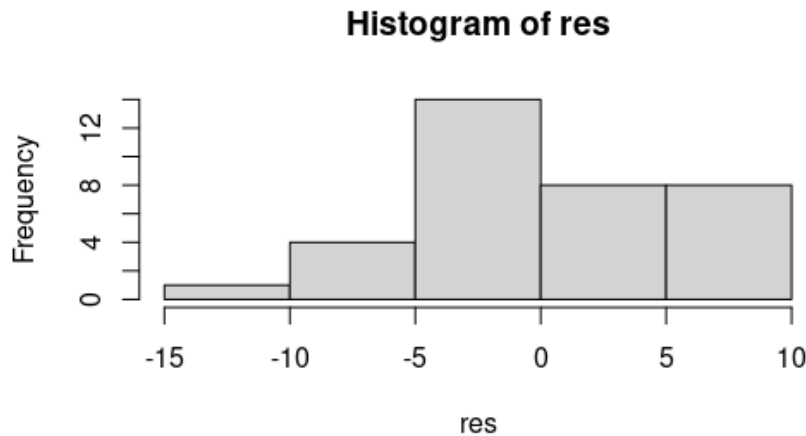
Histogram of res

The histogram of the residuals is presented in Figure 4, where it is observed that they fit a normal curve. To confirm this assumption, when performing the Shapiro-Wilk test, shown in Figure 5, it can be noted that the p-value returned is greater than 0.05, which confirms that there is no evidence to reject the null hypothesis, that is, it is verified that the errors fit a normal distribution.

Figure 5 Shapiro-Wilk normality test for residuals

```
        Shapiro-Wilk normality test

data:  res
W = 0.96473, p-value = 0.3154
```

Finally, to evaluate the assumption of homoscedasticity of variances between observations and residuals, the following hypotheses were formulated:

H_0: The variances of the residuals and observations of Y are equal

H_1: The variances of the residuals and observations of Y are not equal

Figure 6 Test for homogeneity of variables

```
        studentized Breusch-Pagan test

data:  modelo1
BP = 2.0116, df = 1, p-value = 0.1561
```

Taking into account Figure 6, which shows the result of the homogeneity of variances test, it can be seen that the calculated p-value was 0.1561 which is greater than 0.05, which confirms that there is no evidence to reject the hypothesis. null, that is, the assumption of homoscedasticity of the variances is verified.

Fitted equation of simple linear regression model

In the adjusted equation of linear regression of the variable "Entry of immigrants to Colombia on international flights" on the "Hotel occupancy rate in Colombia" the model is obtained:

$$\hat{Y} = (30.8) + (0.00003287)X$$

Where Y is the "Hotel occupancy rate in Colombia" and X is the "Entry of immigrants to Colombia on international flights".

Finally, the regression coefficient is $\beta = 0.00003287 > 0$, which indicates that, when the value of X increases, the value of Y also increases, that is, the greater the number of immigrants who enter Colombia through international flights, the higher the occupancy rate of hotels in Colombian territory.

CONCLUSIONS

The regression analysis carried out shows a significant relationship between the number of immigrants arriving on international flights to Colombia and hotel occupancy rates in Colombia. The results show that hotel occupancy rates increase with the increase in the number of immigrants arriving in Colombia, indicating that international immigration has a positive impact on the Colombian hotel industry. This association, in turn, is supported by the positive regression coefficient obtained from the model. This indicates that hotel occupancy increases as the number of immigrants increases.

As seen in the previous pages, the findings of this research have demonstrated a significant impact of the number of immigrants arriving in Colombia through international flights on the hotel occupancy rate in Colombian territory. The simple linear regression model generated, structured under the equation $Y = 30.8 + 0.00003287X$, proved to be significant by virtue of the P value of its slope of 4.66×10^{-9} and also the P value of its intercept of 1.14×10^{-13} , both much lower than the 0.05 significance level.

Also from the statistical point of view, it was possible to determine that the coefficient of determination R^2 for this simple linear regression model was 0.6411, which provides the necessary arguments to conclude that it indicated that the model obtained explains 64.11% of the variation in hotel occupancy within the time period studied, that is, the entry of immigrants on international flights to Colombian territory explains the occupancy in hotels in Colombian territory by 64.11%.

It can be concluded then, in general terms, that the number of immigrants arriving on international flights has a significant impact on the hotel occupancy rate in Colombia. It is important to note that these findings have commercial, social and economic implications. From a business perspective, the results show that Colombian hotels can benefit from the arrival of immigrants. This is because it can increase demand for accommodation, which can lead to higher revenues for the hospitality sector. This can contribute to the growth and expansion of hotel companies and the creation of jobs in the tourism sector.

Furthermore, the impact of immigration on hotel occupancy has broader social and economic implications. On the one hand, the arrival of immigrants can contribute to the cultural diversity and the exchange of experiences in Colombia, enrich the country's tourism product and strengthen international relations. However, this creates challenges for social and labor integration, as well as for the management of infrastructure and public services to meet the needs of a diverse and growing population.

Research conducted from this perspective provides a solid foundation for a better understanding of the interaction between immigration and the hospitality industry in Colombia. The results obtained may be of interest to politicians, urban planners, businessmen and other subjects related to the economic and social development of the country. It also provides the opportunity to reflect on the importance of encouraging orderly and managed migration that maximizes the economic and social benefits of the country and its people.

However, it is always important to remember that the existence of a linear association between variables does not mean that there is a causal relationship. On the contrary, other contexts or factors that may influence the increase or decrease in the hotel occupancy rate in Colombia should be explored. What is certain is that these results contribute to understanding the dynamics of immigration and tourism in Colombia, making clear the need for a comprehensive analysis when evaluating the factors that determine hotel occupancy rates.

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