The Cost of Popularity: Analyzing Tourism's Effect on Medellín's Housing Market

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1 Introduction

Tourism can significantly impact local economies, particularly in rapidly growing cities like Medellín, Colombia. Medellín has experienced notable increases in both international and domestic tourism over the past decade. Anecdotal evidence suggests that surges in tourism could influence the local housing market by driving up demand for accommodations and, in turn, property prices. The **main questions** guiding this study are:

1. *To what extent do domestic and inbound (foreign) tourism trends correlate with fluctuations in housing market prices in Medellín?*
2. *What is the impact of domestic and inbound tourism on housing sales and rental prices?*

It was investigated whether increases in tourist arrivals anticipate (or "Granger cause") changes in housing sale and rental prices, and how these arrivals may correlate with potential price shifts over time.

2 Used Data

Monthly data from 2011 to 2021 were compiled into a unified SQLite database named *Housing Tourism Data.sqlite*. This database consists of three tables, each containing relevant information for analyzing the impact of tourism on Medellín's housing market.

2.1 Database Structure and Description

The database output from the data pipeline comprises the following tables:

Table Name	Description
sales rents 2011 2021	Contains data on property sales and rental offers from 2011 to 2021. Includes details such as property type (e.g., apartment), condition (new or used), price (total and per square meter), neighborhood, area (private and lot), and geospatial information (longitude and latitude).
monthly entry colombians foreigners	Records the monthly number of passengers entering Medellín through its airport, categorized by nationality (Colombians and foreigners).
monthly passengers origin	Provides information on the origins of passengers (both domestic cities and international countries) arriving in Medellín. The data is segmented by period, origin, and nationality.

Table 1: Structure and description of the database tables.

2.2 Domain-Specific Value Types

Period: Monthly time interval represented in YYYY.MM format. **Property Data**: Includes property type, condition, price (COP), area (m^2), and geospatial details (latitude, longitude). **Passenger Data**: Includes nationality (e.g., Colombian, foreigner), origin (city or country), and the number of passengers.

2.3 How to Comply with the Data License

This analysis uses data licensed under the Creative Commons Attribution-ShareAlike 4.0 International (CC BY-SA 4.0). As required, all derived data will be shared under the same CC BY-SA 4.0 license, and proper attribution is given to the original data providers: **MEData** (Medellín's official open data portal) and **the Medellín Real Estate Observatory (OIME)**. The complete database, analysis scripts, and reports are publicly available in the project's GitHub repository.

3 Analysis

The main objective of the analysis was to determine whether changes in domestic (Colombian) and inbound (foreign) tourism correlate with fluctuations in Medellín's housing market prices, and to assess whether tourism might serve as a leading indicator for these price movements. To address these questions, several visual and statistical approaches were implemented, as detailed below.

3.1 Overall Trends and Exploratory Time Series

A macro-level view of how tourism has evolved was first established by plotting the total number of domestic and foreign tourists by year (2011–2021). Figure 1 shows a generally increasing pattern for both categories, reflecting Medellín's rising popularity.

Figure 1: Total Number of Tourists by Year (2011–2021).

Next, a monthly time series (Figure 2) superimposed foreign and domestic tourist arrivals alongside the monthly average housing prices (sales and rentals). A positive overall trend emerged for both tourism metrics and housing prices, though the two did not always move in lockstep.

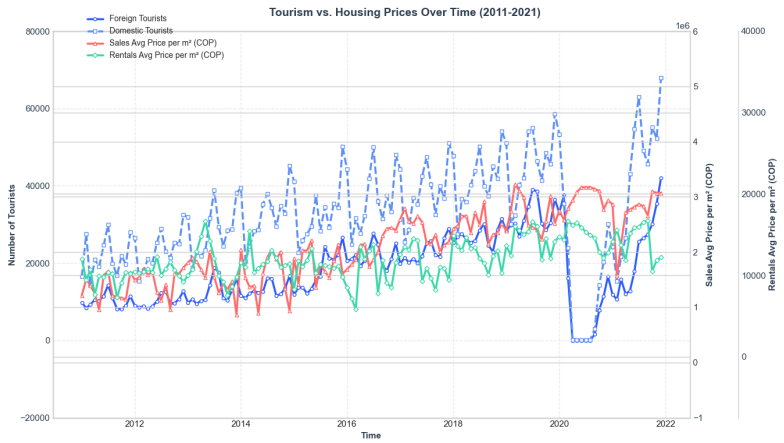

Figure 2: Tourism vs. Housing Prices Over Time (2011–2021).

Impact of COVID-19: A notable exception occurred in 2020, when strict travel restrictions caused tourist arrivals to fall drastically, nearing zero for both foreign and domestic categories. Although the long-term upward trend in prices remained, short-term disruptions during the pandemic underscore the influence of external shocks on both tourism and real estate markets.

3.2 Correlation Analysis and Lagged Effects

To quantify linear associations, a correlation matrix (Figure 3) was computed for: *Total_Colombian_Travelers*, *Total_Foreign_Travelers*, *Sales_Avg_Price_per_m2*, and *Rentals_Avg_Price_per_m2*.

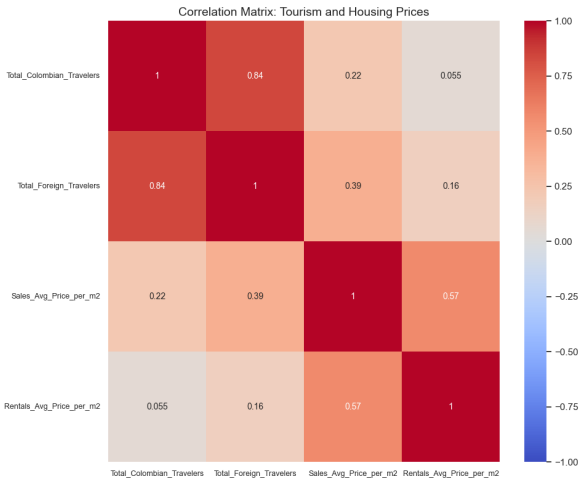

Figure 3: Correlation Matrix: Tourism and Housing Prices.

Overall, foreign arrivals exhibited a moderately higher correlation with sales prices (around 0.39) compared to domestic tourists (about 0.22), and both showed smaller correlations with rental prices (0.16 and 0.055, respectively). These moderate-to-low coefficients indicate that tourism is one factor among many that influence housing prices.

Additionally, lagged correlation analyses were performed to capture the possibility that changes in tourism precede housing price adjustments by several months. As shown in Figure 4, the correlation between *foreign travelers* and *sales prices* increased with lags, peaking at approximately 0.57 around 10 months. Domestic arrivals showed a weaker peak (around 0.35). Rental prices, in contrast, demonstrated lower correlations across all lags.

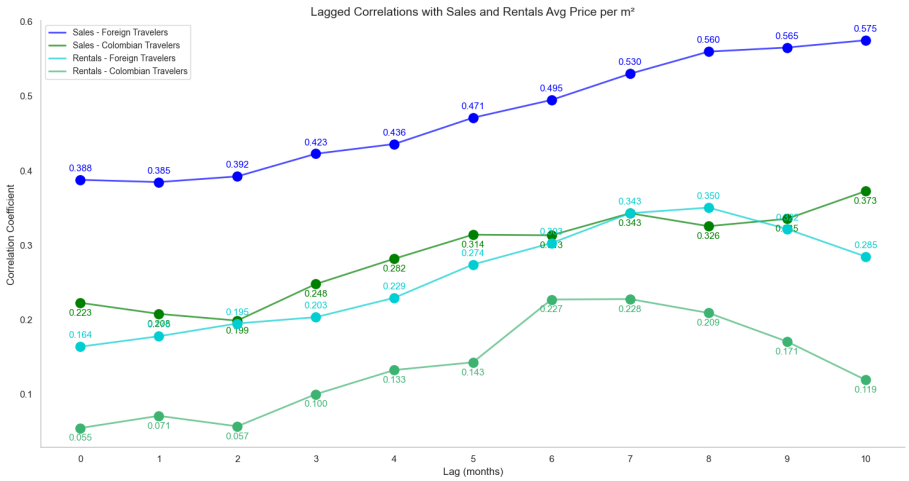

Figure 4: Lagged Correlations with Sales and Rentals Avg Price per m^2.

3.3 Granger Causality Tests and Scatter Plots

While correlation (even lagged) can reveal associations, it does not establish causality. Granger causality tests were thus applied to assess whether tourism "Granger causes" housing price changes. Table 2 highlights p-values at lag 1 and lag 10. None fall below 0.05 in a consistent manner, providing only weak evidence that tourism leads changes in housing prices.

Finally, scatter plots (Figure 5) were generated to visualize how monthly counts of Colombian or foreign tourists relate to average housing prices. Both sets of plots reflect a positive but modest slope with relatively low R^2 values, underscoring that tourism alone accounts for a small fraction of the variance in property prices.

Table 2: Excerpt of Granger Causality p-values (tourists → housing prices).

Cause → Effect	Lag 1	Lag 10
Total_Foreign_Travelers → Sales_Price	0.069	0.190
Total_Foreign_Travelers → Rentals_Price	0.512	0.429
Total_Colombian_Travelers → Sales_Price	0.335	0.495
Total_Colombian_Travelers → Rentals_Price	0.795	0.616

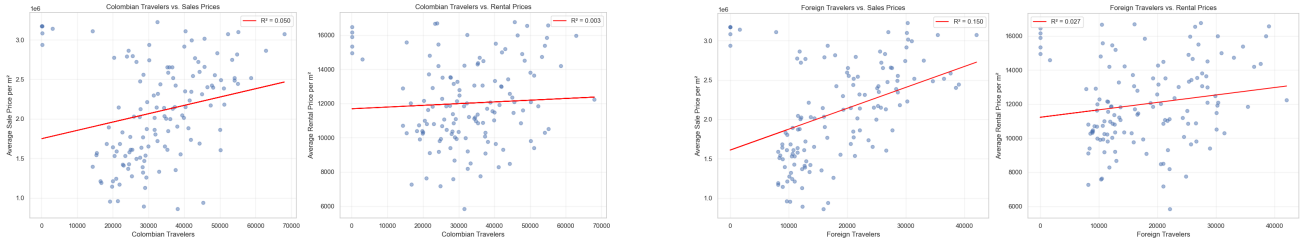

Figure 5: Scatter Plots: Tourist Arrivals vs. Sales (left) and Rental (right) Prices.

Summary of Findings

- **Overall Trends:** Tourism and housing prices have both trended upward over the study period, aside from the steep drop in tourist arrivals during COVID-19.
- **Correlation Strength:** Foreign tourist arrivals exhibit a moderately stronger correlation with sales prices than domestic arrivals; rental prices remain less correlated with tourist volumes.
- **Lag Effects:** Peak correlations appear around 6–10 months for foreign arrivals and sales prices; however, the overall strength remains moderate.
- **Causality:** Granger tests do not show robust evidence that tourism *causes* housing price changes, though a delayed relationship is plausible.

4 Conclusions

Answer to the Main Questions:

- **Correlation with Housing Prices:** There is a *moderate* positive correlation between foreign tourist arrivals and average sale prices, most noticeable after a 6–10 month lag. Domestic (Colombian) travelers show a weaker correlation with sale prices, and both foreign and domestic arrivals appear to have only a small direct correlation with rental prices.
- **Causal Inference:** Based on Granger causality analyses, there is no conclusive evidence that tourism *causes* changes in housing prices. Any delayed relationship suggested by lag correlations does not translate into definitive predictive power.

Reflections and Limitations:

- **Partial Explanation:** Tourism volume, though influential, likely contributes only partly to housing price changes. Other macroeconomic factors (e.g., foreign direct investment, local incomes, and economic policies) also shape real estate dynamics.
- **COVID-19 Impact:** The analysis period includes a drastic decline in tourist numbers during COVID-19. Though housing prices continued to exhibit an overall upward trend, short-term disruptions may have temporarily decoupled the relationship between tourism and housing values.
- **Data Granularity:** This study evaluated citywide averages. More granular data (e.g., at the neighborhood level) could reveal localized effects, especially in tourist-heavy districts.
- **Future Research:** More sophisticated models (e.g., vector autoregressions with additional control variables) would help isolate the role of tourism from other market drivers and clarify the potential for true causal effects.

In summary, while tourism—particularly foreign arrivals—does show a measurable association with housing sales prices in Medellín, it remains only one component among many influencing the real estate market. Future research and finer-grained data could provide further insight into the precise mechanisms behind these observed relationships.