

# Geographic Distribution of Las Vegas Airbnb Pricing

Team A, MIS 761, Spring 2023

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## Executive Summary

Airbnb has operated in Las Vegas for several years, and during that time has been met with varying levels of resistance from the local community, concerned about the spread of “party houses” throughout their neighborhoods, and an increase in the price of homes for residents due to housing competition from investors (Mueller, 2022). Numerous state laws and local ordinances have been passed governing the operation of short-term rentals (Johnson, 2021), and the public has a vested interest in understanding the nature of housing and tourism in our community.

Unlike the hotel industry in Nevada, Airbnb is not required and does not publish statistics. This lack of transparency can make it difficult to accurately assess Airbnb’s impact on the local economy and housing market. To help understand how geography affects Airbnb pricing, this study investigated whether Las Vegas visitors pay a premium to stay closer to the tourist hotspots: the Strip and Downtown.

A dataset was compiled by scraping Airbnb listings data from their website, calculating distances to the nearest Vegas tourist site, and removing outliers. Pearson’s correlation was calculated, and a linear regression model was fitted to the data.

This study found small but statistically significant negative relationship between Airbnb listing price and distance to Las Vegas tourism centers, in accordance with location theory. However, the small magnitude of correlation and the wide geographic dispersions in listing density and pricing suggest either that short-term renters are interested in more than just the Strip and Downtown, or that the offerings are not priced efficiently.

This study was limited by lack of access to actual bookings data, being forced to rely on Airbnb offerings rather than bookings. Further study using non-public data may be needed in order to fully understand the pricing of short-term rentals in the Las Vegas area.

## Research Question

Do Las Vegas Airbnb rentals charge a higher price for units closer to the centers of tourism?

## Applicable Literature

According to location theory, the price of a rental unit is determined by its location and proximity to various amenities and attractions (Thisse, 2008). In the case of tourism centers, short-term rental units that are closer to popular tourist destinations, such as the Strip and Downtown Las Vegas, are more desirable and will therefore command a higher price (Eugenio-Martin, 2019).

Short-term rentals have been prohibited in Clark County until recently, and the county is still in the process of issuing the first round of licenses (Torres-Cortez, 2023), so most Las Vegas Airbnb listings are illegal. As such, the operators may be less professional and less likely to have expertise in pricing, resulting in possible inefficiencies (Dogru, 2019).

## Hypothesis

Las Vegas Airbnb rental prices are negatively related with distance to the centers of tourism (the Strip or Downtown).

## Data and Variables

- Dependent Variable: Price per day for the listing
- Independent Variable: Distance to the nearest tourism center (Strip or Downtown)

The listings dataset was compiled by Inside Airbnb, by scraping the Airbnb website on March 27, 2023, for all Airbnb listings in Clark County, Nevada. For each listing, the dataset includes latitude, longitude, and price.

Listings in Clark County but outside the Las Vegas metro area, such as Mesquite and Bullhead City, are not expected to obey the same pricing patterns as those within the Las Vegas metro area, so they were removed from consideration. See Figure 1. Only listings within a 28km radius of a tourist center (the Strip or Downtown) were retained, as they fall within a contiguous geographic cluster, while still excluding listings for outlying areas such as Boulder City and Mount Charleston. As the price distribution was highly right skewed, price outliers were also removed from consideration.

The Strip coordinates are considered to be (-115.174246, 36.112950), the Bellagio fountain. The Downtown coordinates are considered to be (-115.144030, 36.170754), the center of the Fremont Street Experience.

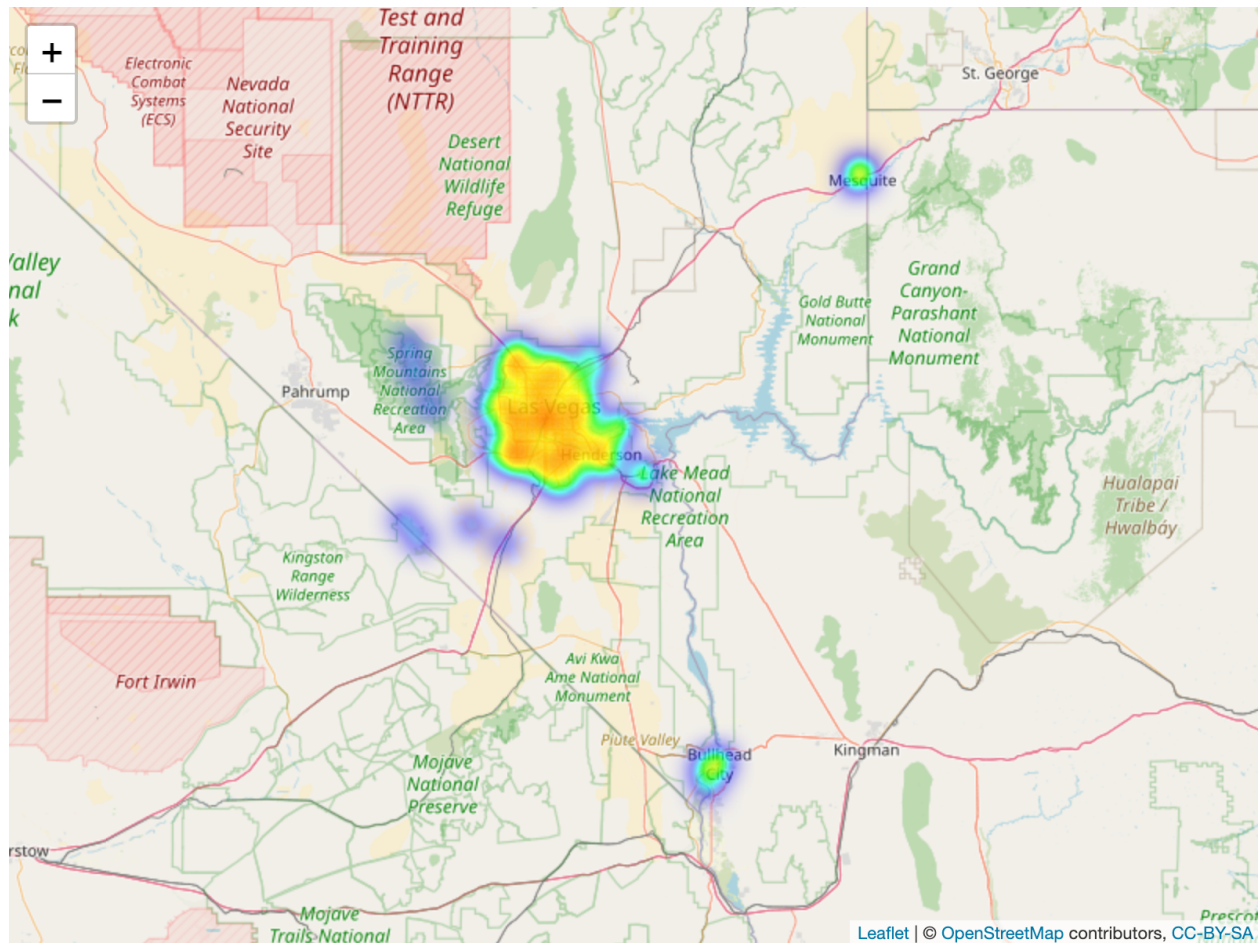


Figure 1: Airbnb listings across Clark County, Nevada

## Graphs

Tables 1 and 2 show descriptive statistics before and after outlier removal. The highest price listing asks for an astounding \$90k, prompting us to remove outliers before continuing.

	N	Min	Median	Mean	Max
Price (\$)	13933	10	180	441.30	90180
Distance (km)	13933	0.03	5.10	7.53	125.65

Table 2: Descriptive statistics, before outlier removal

	N	Min	Median	Mean	Max
Price (\$)	12368	10	163	190.50	599
Distance (km)	12368	0.03	5.52	6.33	26.39

Table 2: Descriptive statistics, after outlier removal

Figures 2 and 3 display histograms of the Price and Distance, respectively.

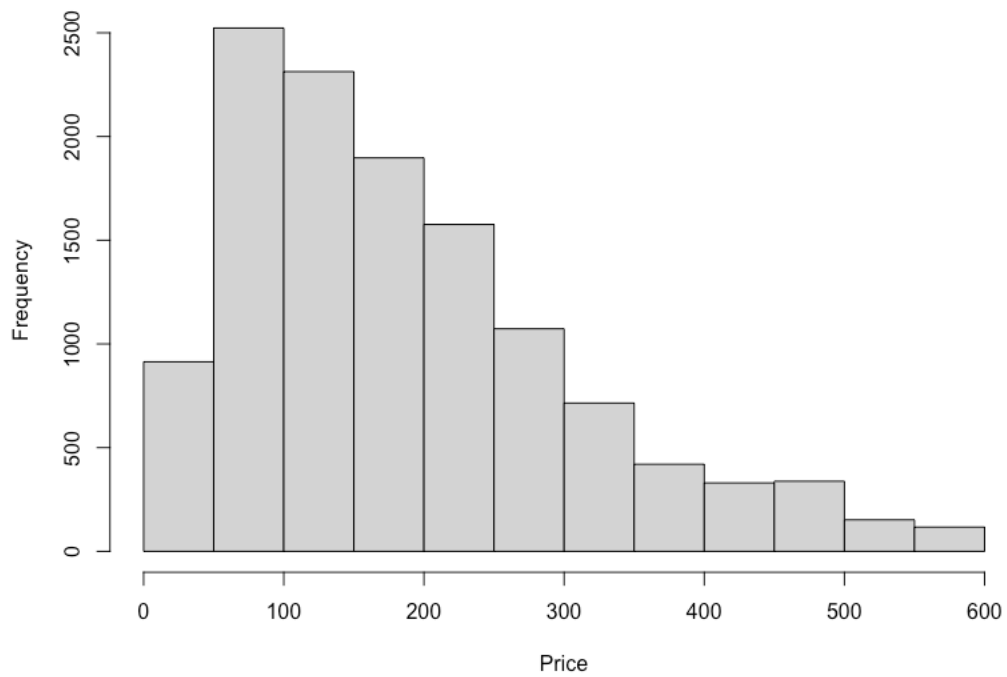


Figure 2: Histogram of Price of Airbnb listings

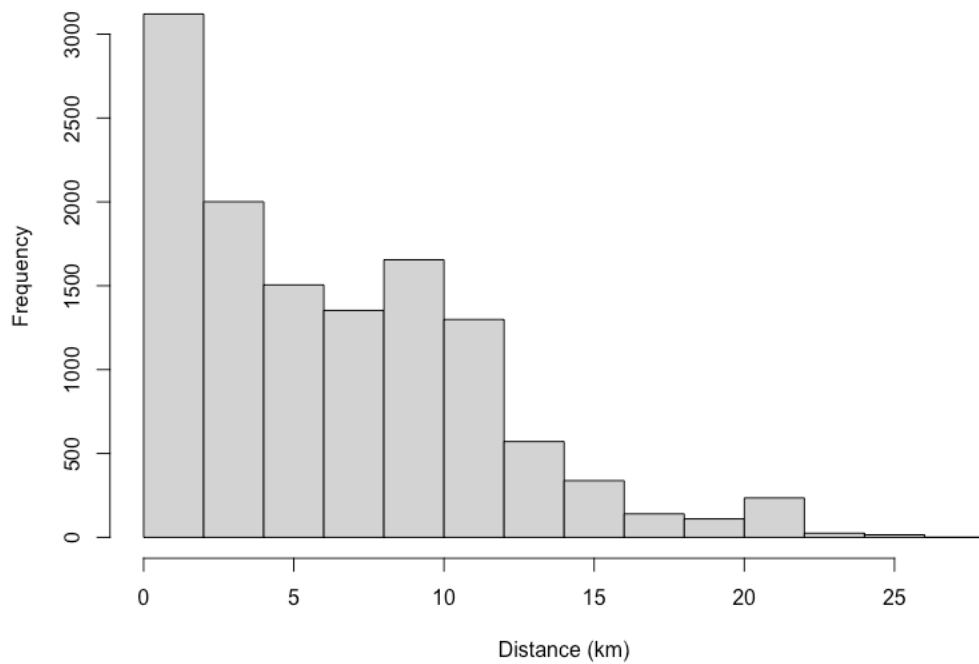


Figure 3: Histogram of Distance to the nearest tourism center

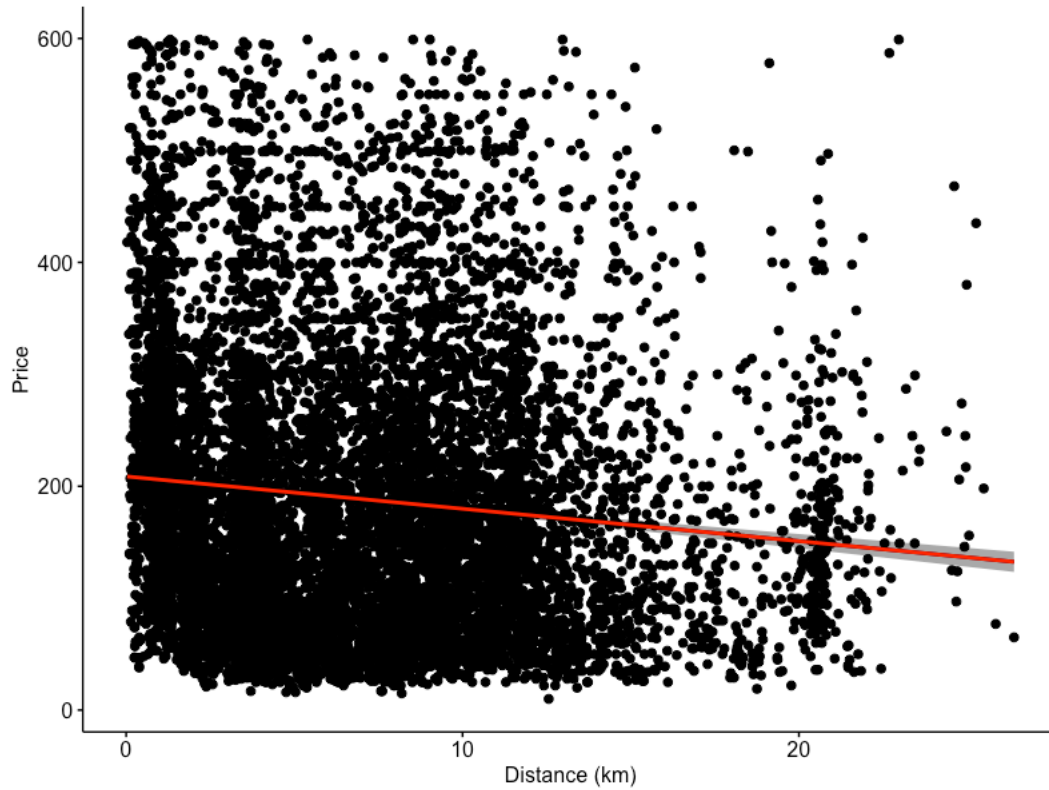


Figure 4: Scatterplot of Price vs Distance, with linear regression line and 95% CI

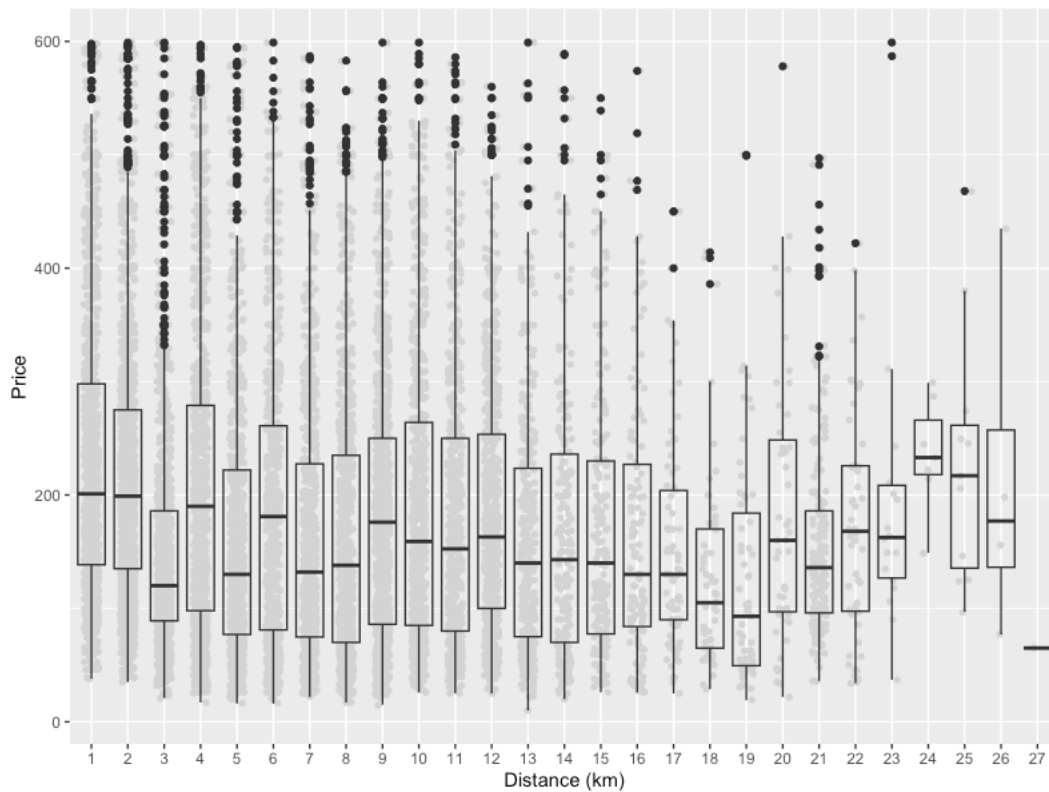


Figure 5: Boxplots of Price for each Distance interval

Figure 4 shows a scatterplot of Price vs Distance. The red regression line allows us to see the overall trend. However, the huge number of points makes it visually difficult to see their distribution in detail, as most of them are potted on top of each other.

In order to more effectively visualize such dense overlapping points, the data were gathered into bins based on distance, and plotted as individual boxplots in Figure 5, allowing us to more easily see the change in price distribution across multiple distance intervals.

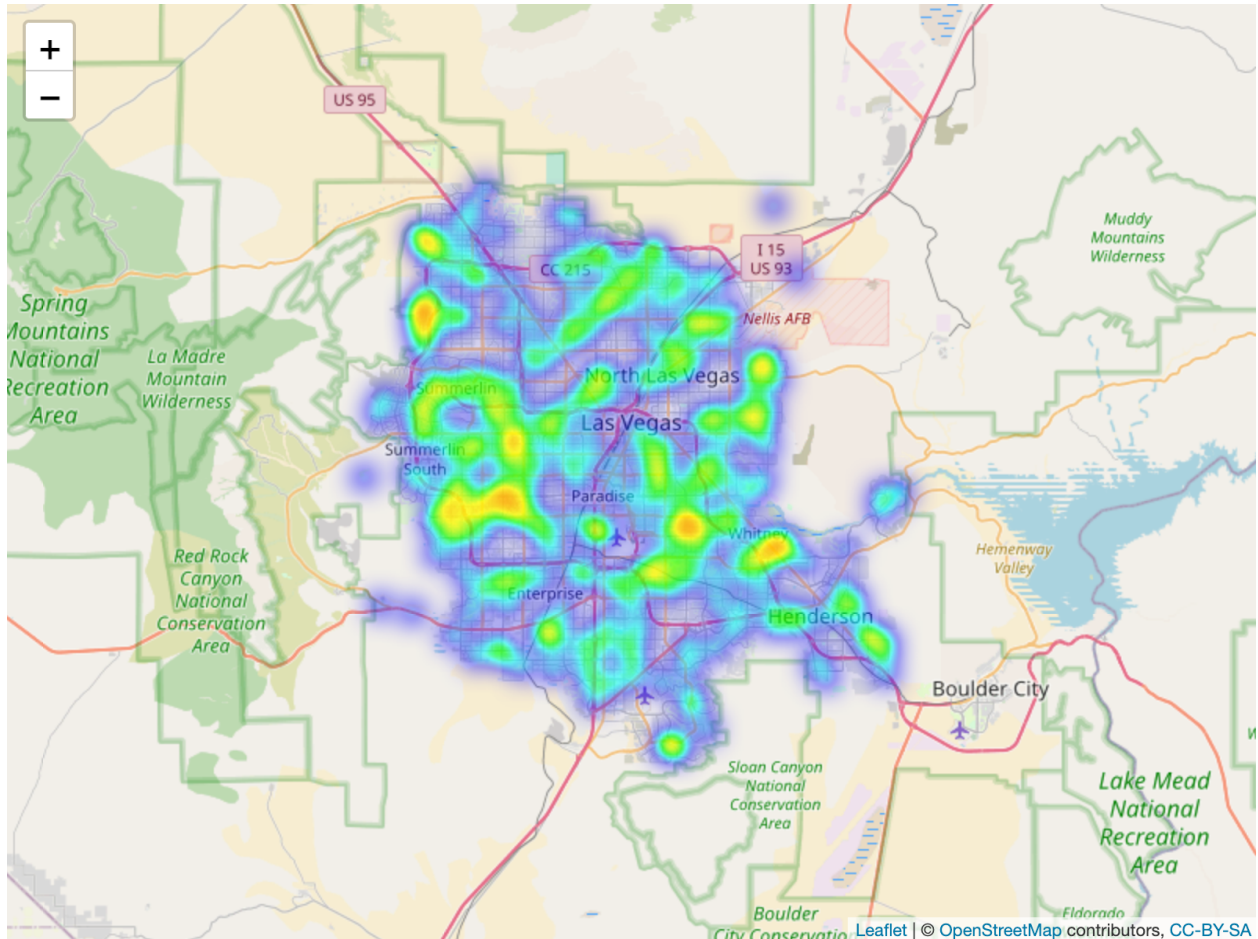


Figure 6: Heat map of Airbnb prices

Plotting numerous points on top of each other on a map can mislead the reader into seeing patterns dependent on the draw order of the points, rather than true patterns in the data (Brus, 2019). A heat map with properly adjusted color gradient is preferable. The heat map of Airbnb listing prices, Figure 6, shows a wide dispersion of high and low prices across the Las Vegas valley.

## Analysis

Analysis was performed using both correlation and regression.

```
Pearson's product-moment correlation

data: listings_filtered$price and listings_filtered$distance
t = -12.924, df = 12366, p-value < 2.2e-16
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 -0.13279762 -0.09801911
sample estimates:
      cor
-0.1154437
```

The p-value of 2.2e-16 indicates a statistically significant correlation. However, the correlation coefficient of -0.115 indicates relation is small in effect. Thus, there is strong evidence for a small negative correlation between price and distance.

```
Call:
lm(formula = price ~ distance, data = listings_filtered)

Residuals:
    Min       1Q   Median       3Q      Max
-181.08  -94.45  -26.72   63.71  456.61

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)  208.7902     1.7900   116.64  <2e-16 ***
distance     -2.8911     0.2237   -12.92  <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 121.8 on 12366 degrees of freedom
Multiple R-squared:  0.01333, Adjusted R-squared:  0.01325
F-statistic: 167 on 1 and 12366 DF, p-value: < 2.2e-16
```

The linear model's t-value of -12.92 with p-value of 2.2e-16 would indicate strong support against the null hypothesis, assuming the residuals were normally distributed. However, the normal Q-Q plot in Figure 7 deviates significantly from the normal line, indicating the residuals are not normally distributed, so estimates of the regression coefficients may be biased, the standard errors may be incorrect, and the hypothesis tests may be invalid. Thus, our regression model is inconclusive.



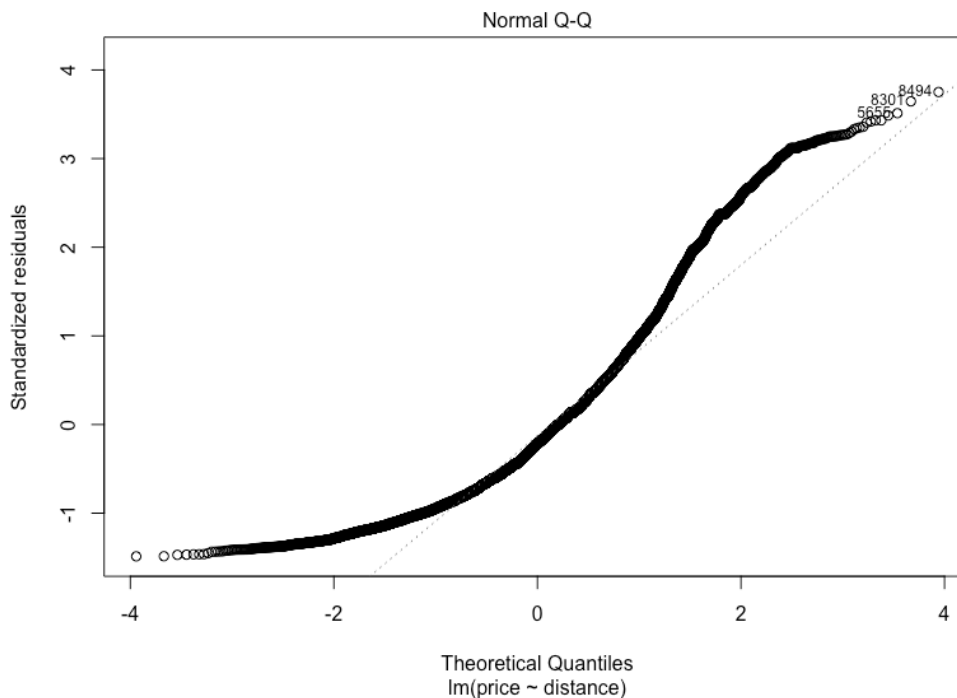


Figure 7: Non-normal residuals

## Results

Though the linear regression was inconclusive, the correlation test yielded sufficient evidence to support the hypothesis that Las Vegas Airbnb rental prices are negatively related with distance to the centers of tourism. However, the correlation is quite weak, as may be seen in the heat map, Figure 6, showing high prices scattered throughout Las Vegas.

## Conclusion

The wide geographic dispersions in listing density and pricing suggest either that short-term renters are interested in more than just the Strip and Downtown, or that the offerings are not priced efficiently. Perhaps the short-term renters are locals using Airbnb as temporary housing in response to the housing shortage (Molasky, 2022). If they are visitors, they may be visiting outlying attractions, such as the motor speedway or the Station or Red Rock casinos, or they may be conducting business around town.

This study is limited in that it examined offerings (supply) rather than actual bookings (supply and demand). It's quite possible that an analysis of actual bookings would reveal significantly different patterns. As Airbnb does not publish statistics, the public has little way of knowing.

Nevada has long required hotels to report monthly statistics, freely available from the Las Vegas Convention and Visitors Authority (LVCVA, 2023). In the public interest and to better understand the nature of housing and tourism in our city, it may be time to require Airbnb, VRBO, and other short-term rental providers to do the same.



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