

IIT GANDHINAGAR



# A Data-Driven Analysis of Airbnb Hotels in the Netherlands and Belgium

## Group 7

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22 September 2024

# INDEX

1. Introduction

2. Nomenclature

3. Statistical Overview

4. Inference

5. Conclusion

6. Appendix

## 1. Introduction

In a world increasingly interconnected by the internet, Airbnb has revolutionized the hospitality industry. It has transformed traveling, making it more accessible, personalized, and authentic by being a global online accommodation marketplace. Airbnb is an American company founded by Brian Chesky, Joe Gebbia, and Nathan Blecharczyk in 2008. It is a popular online platform connecting people who want to rent their homes, apartments, hotel rooms, or shared rooms with travelers looking for unique short- and long-term stays. It offers various options in worldwide destinations, from cozy apartments to luxurious villas. Airbnb platform acts as a broker and earns by charging a commission and service fee from every booking. It charges from both the host as well as the customer.

Airbnb allows the owners and host to list their villas, homes, apartments, and rooms for short-term or long-term rentals. It allows the owners to put all the information regarding their rentals on the Airbnb online platform. This information involves the property's name, the property's location, the country it is situated in, the neighborhood, and the exact location on the map. Then, the host adds other important information like the room type, price, minimum number of nights the traveler can stay at that property, and the days of rental availability in last year. These are some of the important information the host needs to put on the website.

To supervise all the properties and the host, the company assigns a unique property ID to every property registered, and it also assigns a unique ID to the host to distinguish between two different hosts and properties. This makes it easy to manage all the properties, keep a check, and count how many properties are registered by a single host. A few neighborhoods help the company understand the region and the property's locality. But, it is taken from the map to find the property's exact location. The property's location on the map is tabulated at the backend for analysis as the latitude and the longitude of that location, which helps to trace the location directly. Other data involves the average number of reviews per month the property received and the number of reviews on the Airbnb platform. The number of reviews helps the customer judge the accommodation's quality and helps the host improve the service to attract more customers.

We are given similar data from Airbnb that refers to the properties of the Netherlands and Belgium for accommodation. The data shared is from the company's end, which is more related to analyzing the properties' location, price, and attributes in the Netherlands and Belgium. We analyze the pricing data so property owners and investors can understand market trends, identify pricing gaps, and optimize rental rates. Analyzing the location helps determine popular areas and neighborhoods. Understanding which types of rooms, like personal, apartments, or shared ones,

help us understand which types of rooms are more likely preferred in a location than the others. In summary, studying, understanding, and analyzing Airbnb property data is crucial for understanding market trends, improving property performance, making informed investment decisions, and enhancing guest experiences.

## 2. Nomenclature

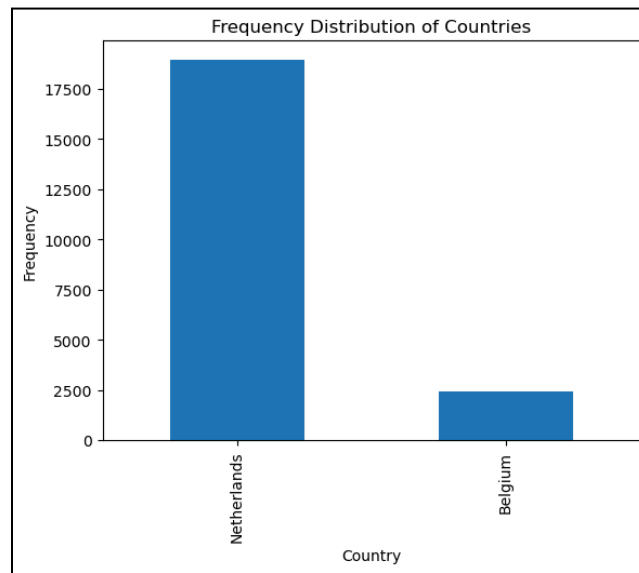
**Table 1:** Specification of the variables used in the data

Column	Variable Name	Variable Definition
A	id	ID of property
B	name	Name of the property
C	host_id	ID of host
D	country	Dummy variable where 1 = Netherlands and 2 = Belgium
E	neighborhood	Locality or region
F	latitude	Latitude of the property
G	longitude	Longitude of the property
H	room_type	Qualitative variable describing the type of room
I	price	Price per night at the property
J	minimum_nights	Minimum number of nights allowed for a stay at this specific property
K	number_of_reviews	Number of reviews on the Airbnb platform for that property
L	reviews_per_month	Average number of reviews per month that the property received
M	calculated_host_listings_count	How many properties does that specific host have in Air Bnb
N	availabilty_365	Days the property was available in the last year (365 days)

### 3. Statistical Overview

#### General Analysis

A study of 21,317 Airbnb listings was conducted to understand pricing dynamics, property optimization, investment strategies, and guest satisfaction. The whole dataset revolves around the two countries, the Netherlands and Belgium, so we first analyze how the dataset is segmented over the two countries.



**Figure 1:** Frequency distribution of countries

The figure shows that data has more information about accommodation in the Netherlands, which has a count of 18949 (covers 88.89% of the dataset), and for Belgium, the count is 2422 (covers only 11.10% of the dataset). Before analyzing the data, we studied whether all the major qualitative variables have the same count, i.e., if data is missing in some variables of the Excel cells or not. The variable monthly average reviews (reviews\_per\_month) has some missing values as the data count is 18600, less than 21317, implying. The table below provides all major qualitative variables' count, mean, minimum, maximum, and standard deviation values.

**Table 2:** Statistical Overview of Columns I, J, K, L, M, and N from the dataset

	price	minimum_nights	number_of_reviews	reviews_per_month	calculated_host_listings_count	availability_365
Count	21371	21371	21371	18600	21371	21371
Mean	154.57	3.730	25.31	77.53	2.68	69.56
Std.	161.14	18.28	54.10	129.73	7.43	117.09

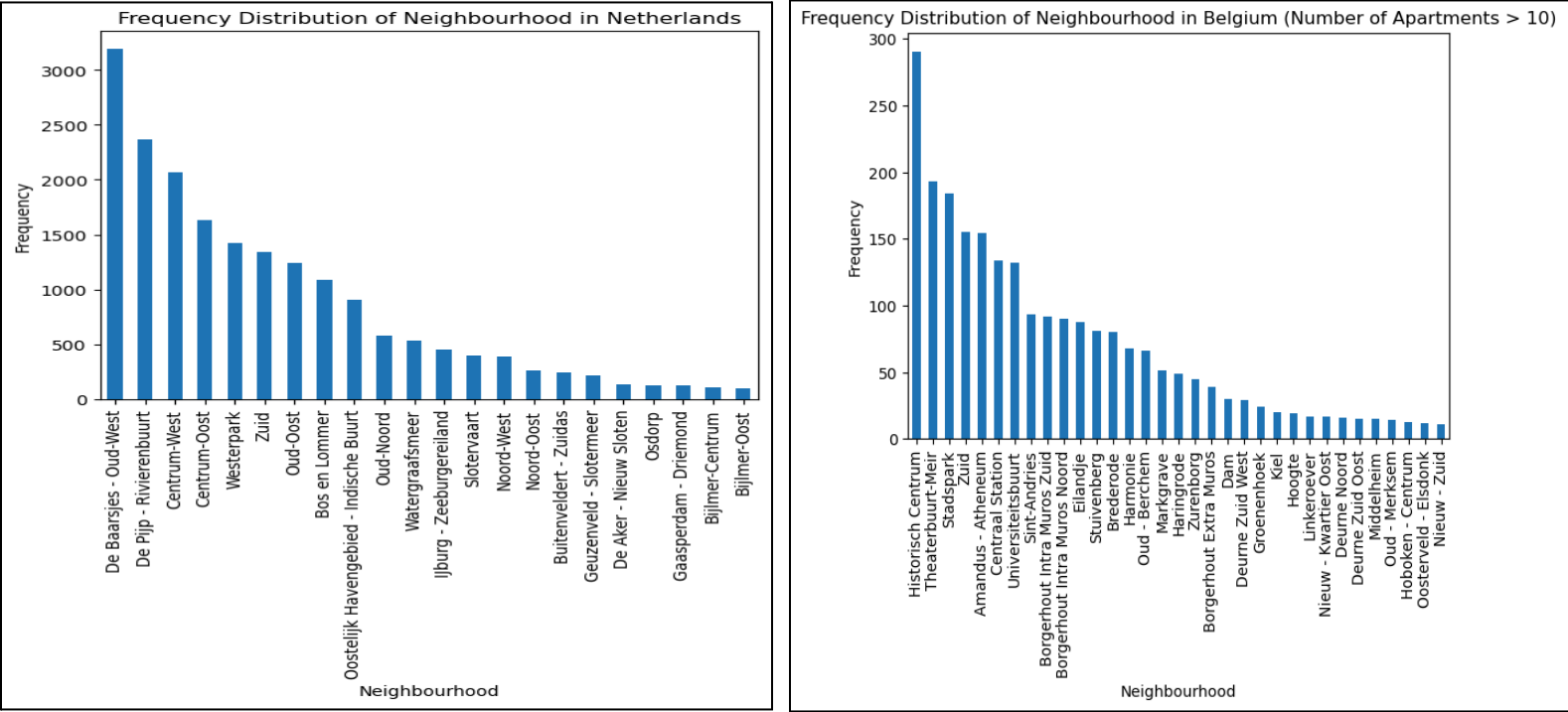
<b>Min</b>	0	1	0	1	1	0
<b>Max</b>	8000	1125	850	4461	85	365

The dataset has many variables, so we have categorized the analysis we will perform to avoid information overload and confusion and do a more coherent analysis. The following analysis we performed:

- Location Analysis
- Room type Analysis
- Price Analysis
- Host Listings Count Analysis

### Neighborhood Analysis

Airbnb is a platform that connects travelers seeking accommodation to people who have apartments, spare rooms, hotels, etc. When seeking accommodation, location and neighborhood become among the most important factors travelers consider while searching for lodging. The prices, types of rooms, availability, and other factors all depend on the location of the room or apartment.

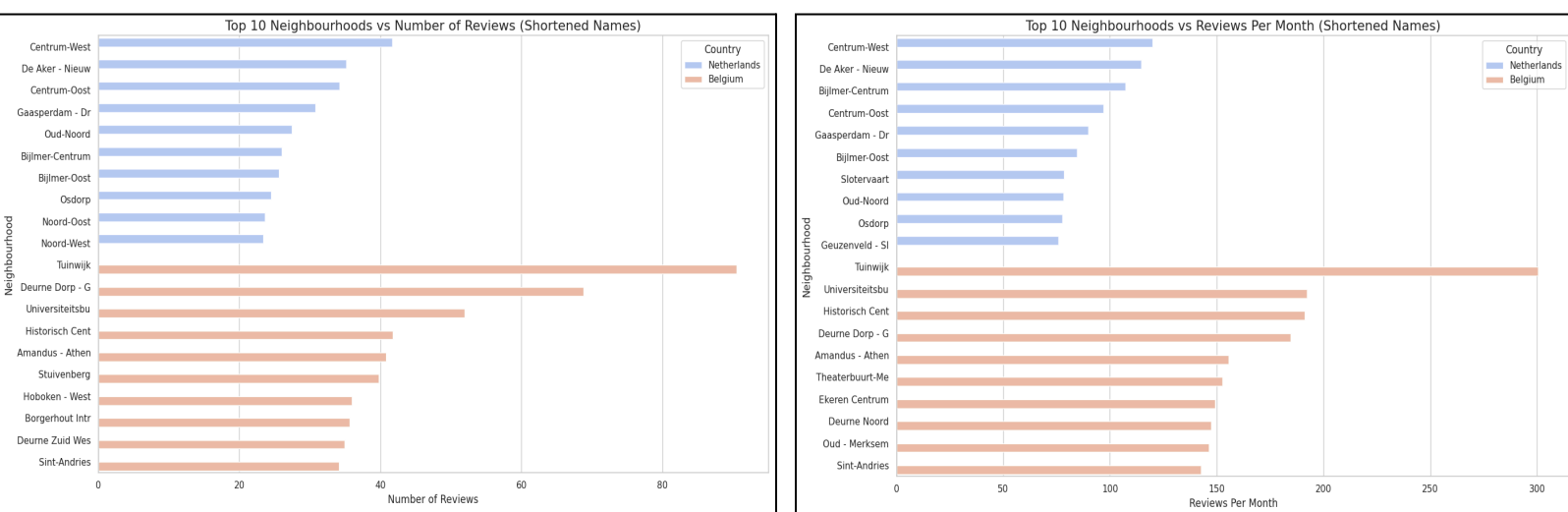


**Figure 2:** Frequency distribution of Neighborhoods in the Netherlands (left) and Belgium (right)

According to the dataset, there are 21 neighborhoods in the Netherlands, and the number of accommodations in each neighborhood is quite high. The De Baarsjes-Oud-West neighborhood is the most popular, with 3191 accommodations, and the least popular is the Bijlmer-Oost, with

102 accommodations. While the Netherlands has only 21 neighborhoods, Belgium has much more than 21 neighborhoods. Still, for the case of simplicity in the graph, only 33 neighborhoods (these are selected based on the number of apartments or accommodations >10) are shown. The most popular among all the neighborhoods of Belgium is Historic Centrum, with 290 accommodations. There are quite a few neighborhoods with fewer than ten apartments, so they are the least popular. Observing the graphs and the data, we can conclude that the accommodations are quite scattered in Belgium compared to the Netherlands.

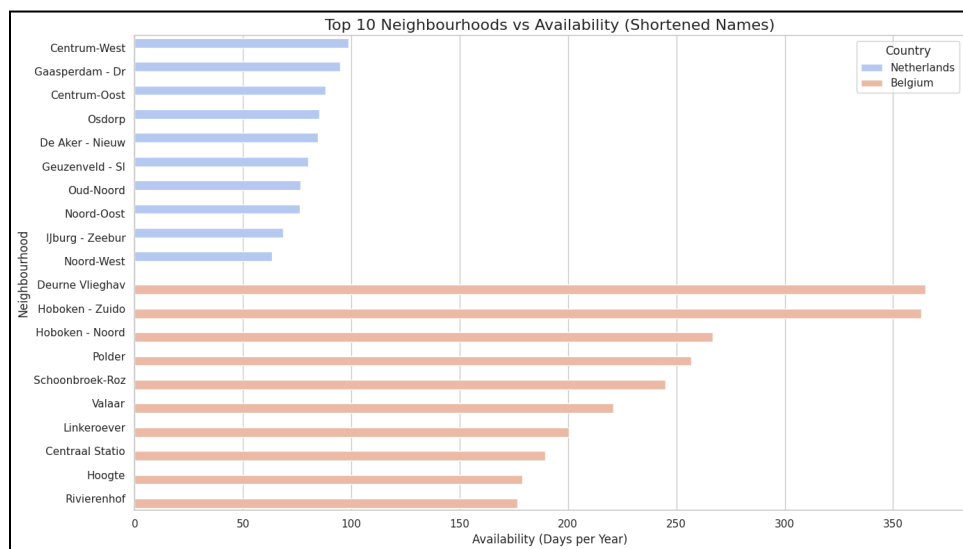
The most popular neighborhoods in terms of the number of accommodations may not be the most popular among travelers. This is evident from Figure 3, which shows a plot between the top 10 neighborhoods in the Netherlands and Belgium with the highest number of reviews. It is also evident that the average number of reviews or reviews received per month by a property in Belgium is more than that in the Netherlands. We also see that the monthly reviews received are higher than the overall number because both reviews differ. The number of reviews is on the Airbnb platform, while the monthly reviews can be reviews received by the host, which may not be on the Airbnb website. This could be because not many people like to review or rate the places on the online website but are ready to give a review directly to the host when asked.



**Figure 3:** Top 10 Neighborhoods in the Netherlands and Belgium vs. Number of Reviews (left) and Top 10 Neighborhoods in the Netherlands and Belgium vs. Reviews per Month (right)

In terms of availability, Belgium has a higher availability of rooms and apartments than the Netherlands. This suggests that the Netherlands is better for tourist attractions than Belgium. High availability shows lower demand and less popularity, possibly because of unappealing neighborhoods, lack of amenities, or negative reviews. It can be observed from Figure 4 that the neighborhoods in Belgium that have very high availability are very different from the ones that have received a good number of reviews again, indicating that those places are unpopular or have inappropriate locations for travelers.

There are many neighborhoods in Belgium (more than 32 neighborhoods) compared to the Netherlands (only 21 neighborhoods) where hosts have their rentals, and it is more likely to have higher availability in some of those rentals. This is because the demand for travelers' accommodation is lower in Belgium, and the rental supply is higher, leading to higher availability in many neighborhoods. We see a lower availability of rentals in the Netherlands, indicating that the supply of rentals is optimal for the demands for travelers' accommodation.

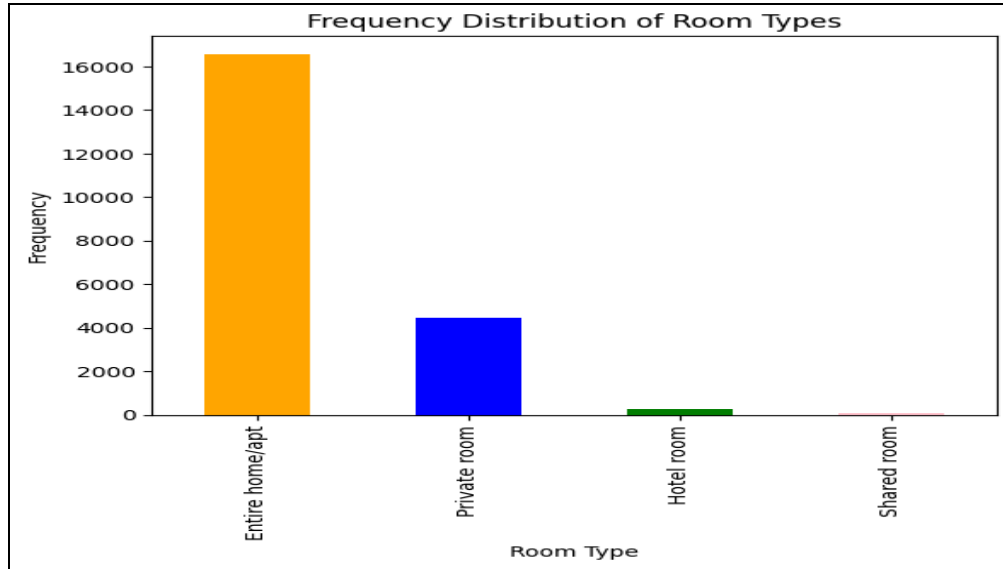


**Figure 4:** Top 10 Neighborhoods in the Netherlands and Belgium vs. Availability (Days per Year)

## Room Type

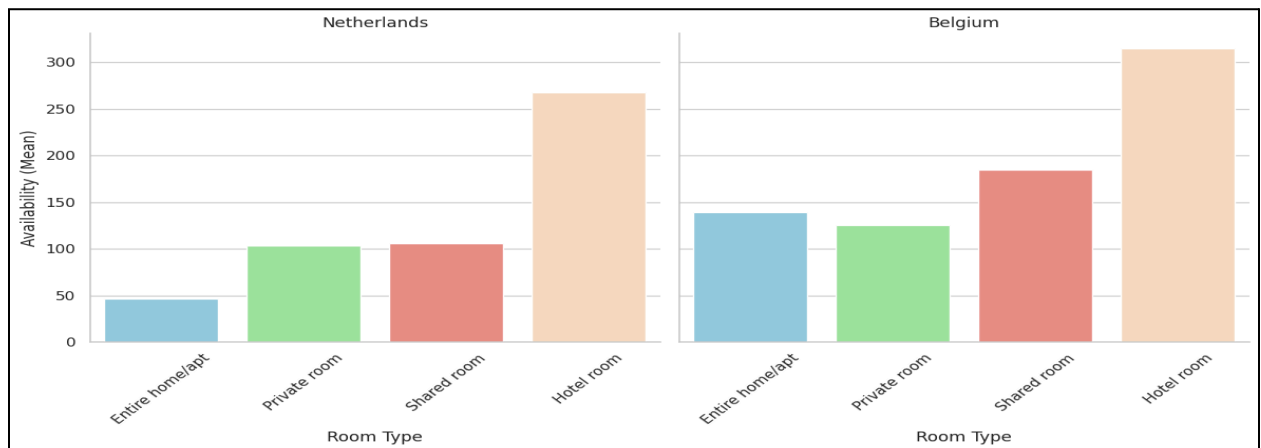
Airbnb offers a wide range of accommodations, ranging from shared spaces to entire homes, catering to the needs of different types of travelers. The platform is popular for its unique, home-like options, often providing a more personal experience than traditional hotels. Travelers can choose from a variety of listings based on their needs and budgets.





**Figure 5:** Frequency distribution of room type

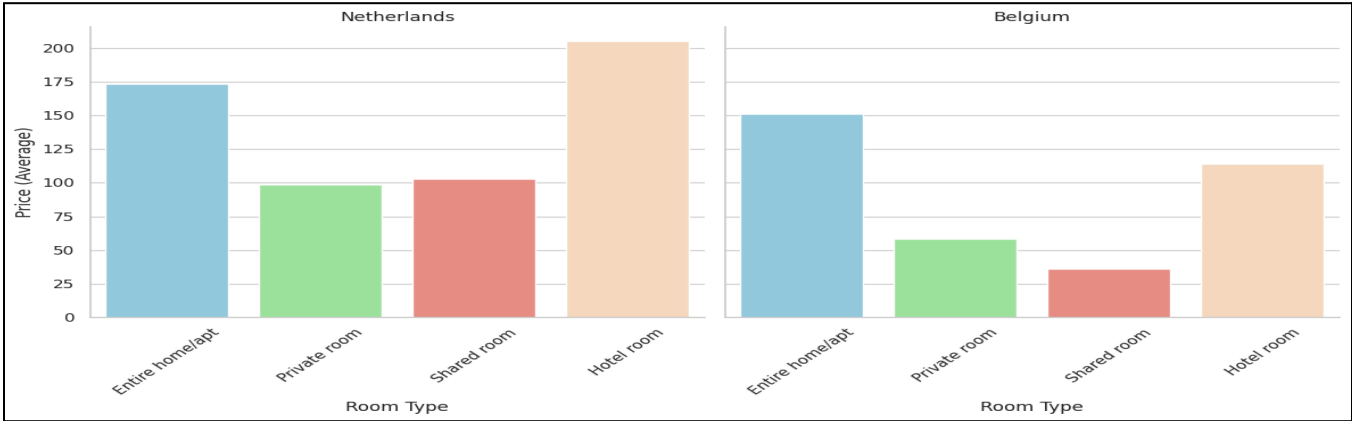
Among all accommodation types, entire homes or apartments are the most popular, with approximately 16,500 listings. These are often favored by families or travelers planning longer stays. Private rooms, with around 4,460 listings, are the second most common choice, appealing to solo travelers or couples who seek a more affordable stay but still value privacy. Hotel rooms make up a small portion of the listings, with fewer than 250 available. Finally, shared rooms are the least represented category, with only around 95 listings. These are typically chosen by budget-conscious travelers, such as backpackers, who are comfortable with sharing a living space with others.



**Figure 6:** Mean availability of different Room Types in the Netherlands and Belgium

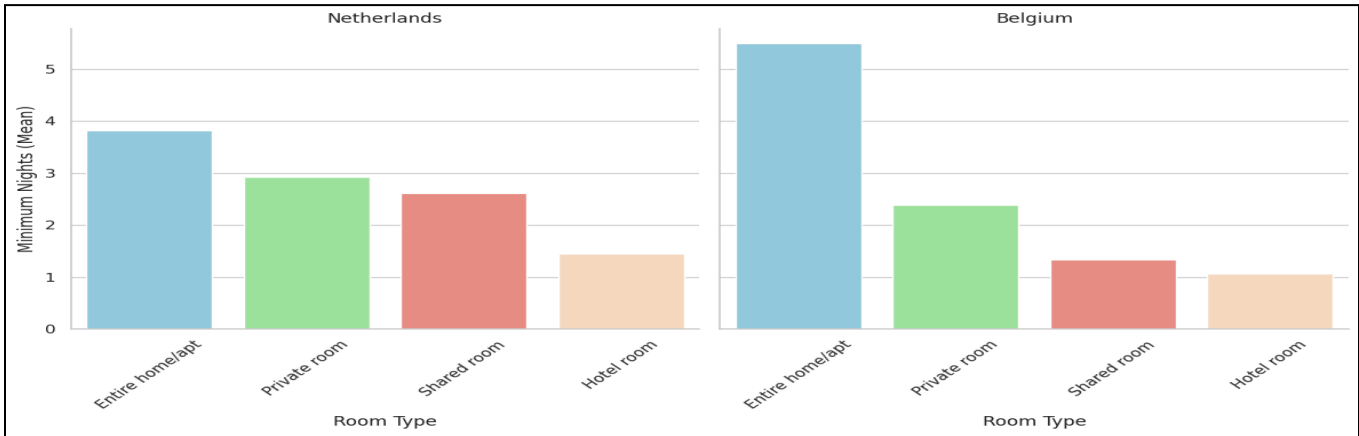
In both countries, the hotel room has significant availability, implying that these rooms are not in as high demand or that there's simply a larger inventory available, often due to these being commercial rather than private listings. The fact that hotel rooms are available so much of the year could indicate they're not being booked as quickly as other types of accommodations, perhaps because they lack the homey feel of private rooms or entire apartments. In contrast,

entire homes/apartments are in higher demand, or hosts limit their availability, perhaps because these properties are also used by the hosts themselves. However, private and shared rooms show moderate availability, suggesting a consistent demand, possibly due to their affordability compared to other room types.



**Figure 7:** Average Price of different Room Types in the Netherlands and Belgium

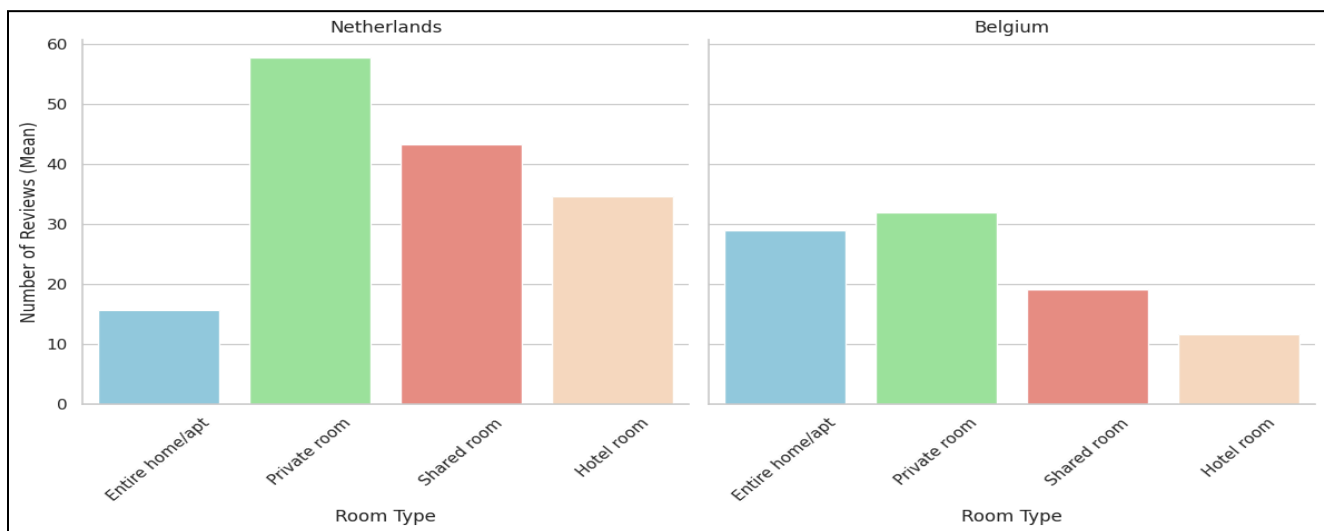
A notable difference in pricing can be observed between the two countries. In the Netherlands, shared rooms are priced around 103 EUR, likely due to limited availability or higher demand, whereas in Belgium, shared rooms are more budget-friendly at just 35 EUR. While entire home/apartments are popular in both countries, with averaging around 175 EUR in the Netherlands and 150 EUR in Belgium. These accommodations provide privacy and ample space, making them a preferred choice for travelers. Private rooms, on the other hand, are more affordable in Belgium, with an average price of 60 EUR, compared to 100 EUR in the Netherlands. Lastly, hotel rooms are the most expensive accommodation type in the Netherlands, with an average price exceeding 200 EUR, suggesting that hotel listings cater more to premium stays. In Belgium, hotel rooms are more affordable, priced around 115 EUR, making them accessible to a wider range of tourists. These pricing differences reflect the distinct market dynamics in each country.



**Figure 8:** Mean Minimum Nights Requirement for different Room Types in the Netherlands and Belgium

The comparison between the two countries shows that entire homes/apartments in both the Netherlands and Belgium require longer stays compared to other room types, reflecting the nature of this room type as ideal for extended trips or family vacations. Hotel rooms consistently have the shortest minimum stay requirements, catering to short-term, flexible bookings, while private and shared rooms fall in the middle, appealing to travelers seeking affordability with reasonable stay durations.

The number of reviews can guide Airbnb hosts in understanding the dynamics of guest engagement across different room types, helping them to tailor their offerings and marketing strategies to meet the expectations and preferences of their target demographics.

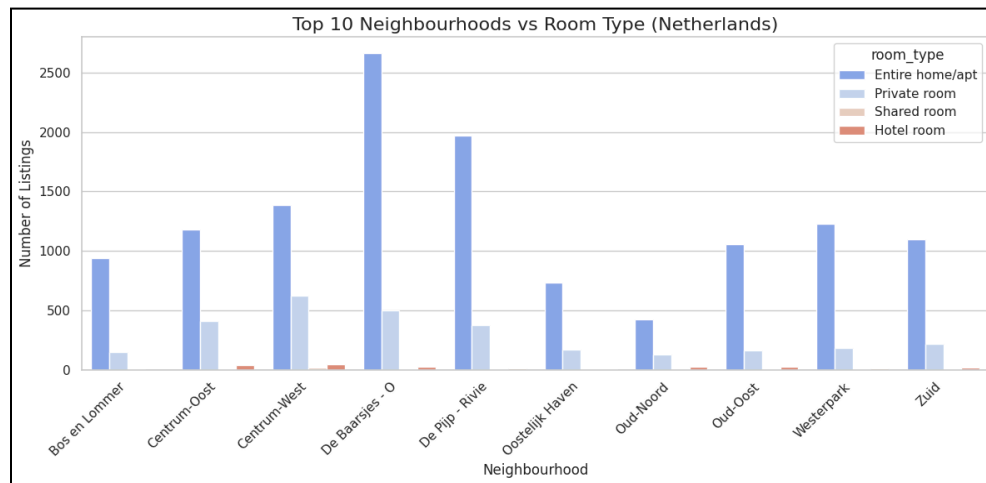


**Figure 9:** Mean number of reviews for different Room Types in the Netherlands and Belgium

Private rooms are more actively reviewed in the Netherlands and Belgium, possibly due to the affordability and popularity of private rooms among travelers who are also active online and likely to leave reviews. However, entire homes/apartments are more actively reviewed in Belgium, with 30 reviews, suggesting higher guest interaction or shorter and more frequent stays as compared to the Netherlands, where entire homes receive fewer reviews.

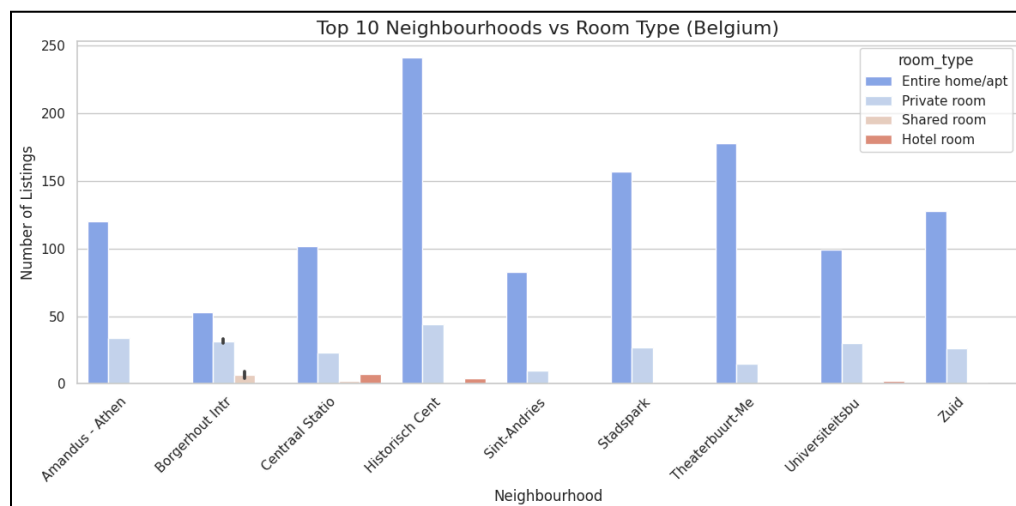
Hotel rooms in the Netherlands receive an average of around 35 reviews, reflecting moderate engagement and indicating that hotels still play a role on Airbnb but might not attract as much feedback as private homes or rooms, whereas, in Belgium, it receives the fewest reviews, averaging only around 11, which suggests that hotel accommodations on Airbnb are not as frequently booked or reviewed in Belgium.

The types of rooms that are most preferred in the Netherlands are entire homes/apartments, followed by private rooms, and then hotel rooms. The least favored are the shared rooms. The neighborhood De Baarsjes-Oud-West has the highest number of accommodations, including 2666 entire homes/apartments. The highest number of private rooms in a single neighborhood of the Netherlands is 625 in the Centrum-West neighborhood.



**Figure 10:** Room Type vs. Top 10 Neighborhoods in the Netherlands

Similarly, the types of rooms that are most preferred in Belgium are entire homes/apartments. Private rooms are a second priority. Very few neighborhoods of Belgium have hotel rooms or shared rooms. The neighborhood Historisch Cent has the highest number of accommodations, including 241 entire homes/apartments. The highest number of private rooms in a single neighborhood of Belgium is 63 in the Borgerhout Intr neighborhood. This can be observed in Figure 11. This indicates that travelers in the Netherlands or Belgium prefer entire homes/apartments and private rooms more than shared rooms and hotel rooms.

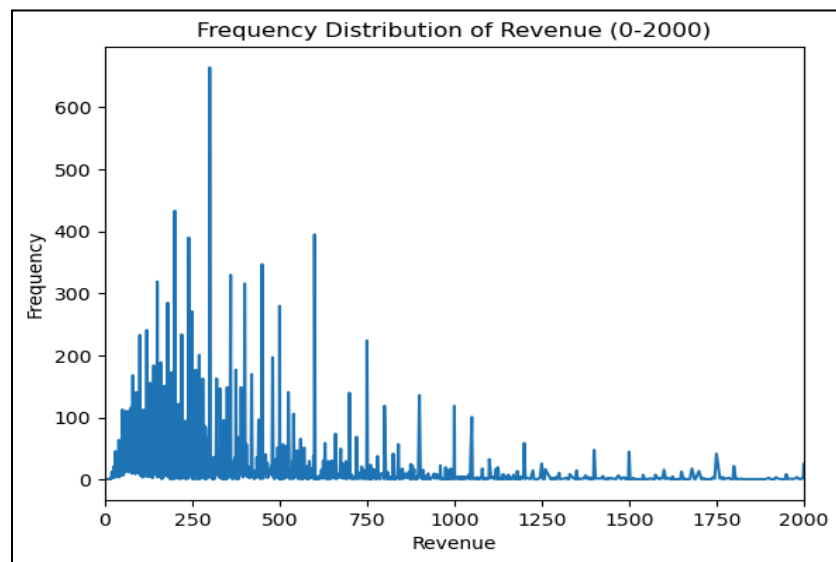


**Figure 11:** Room Type vs. Top 10 Neighborhoods in the Belgium

## Price Analysis

In Airbnb's marketplace, price is a critical factor that influences both the supply and demand of accommodations. Understanding the price dynamics allows hosts to set competitive rates while attracting the right type of travelers, and for guests, it helps in finding options that fit their budget and preferences.

Based on Airbnb data, properties can range from budget-friendly options like shared rooms or private rooms to luxury listings such as entire homes and high-end accommodations. Prices can also vary significantly depending on the location, with central, popular urban areas often commanding higher rates, while rural or less-touristed areas may offer more affordable options. Entire homes or apartments typically fetch higher prices than private rooms or shared spaces due to the privacy and space offered. Properties with additional amenities like pools, gyms, or scenic views generally charge more. Seasonal demand and local events can also drive prices up during peak periods



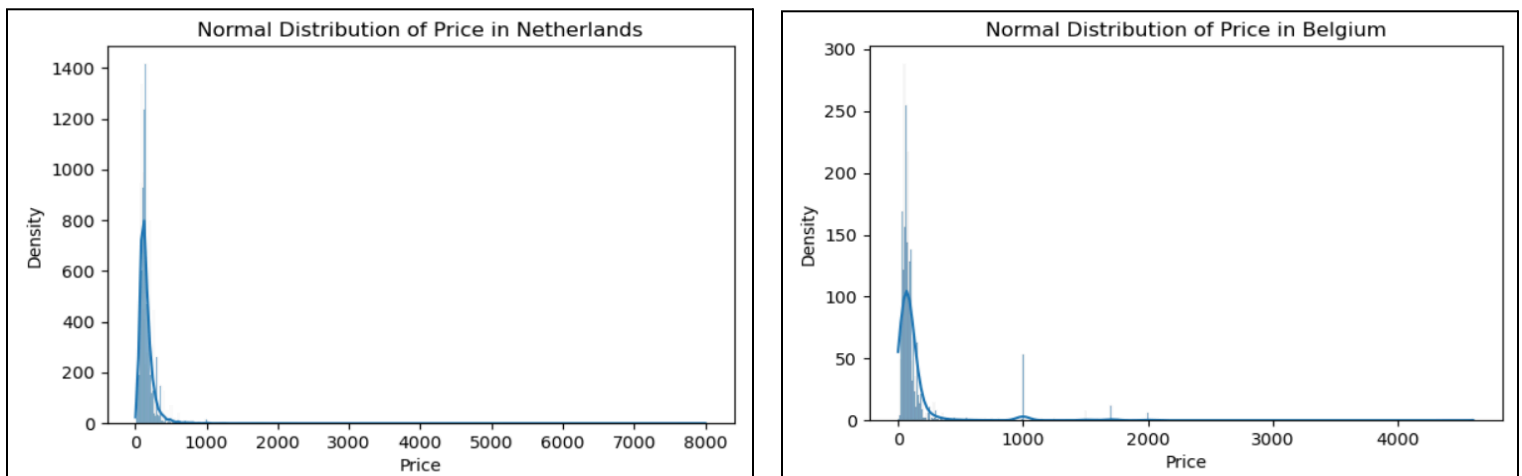
**Figure 12:** Frequency distribution of price

The majority of properties generate revenue between 0 to 1000 units, as indicated by Figure 12. Peaks can be seen around 250 to 300 units, which suggests that many properties on Airbnb fall within this moderate revenue range. As revenue increases beyond 1000 units, the frequency of properties generating this revenue drops significantly. This suggests that high-revenue-generating properties are far less common compared to those making moderate revenue.

A small number of properties generate higher revenues, between 1000 and 2000 units, but the frequency is very low. This could indicate that these properties are either luxury or highly exclusive listings that cater to a niche market, contributing a small fraction of overall revenue

distribution. The graph displays a long tail, with a few properties generating very high revenue (closer to 2000 units), but these are extremely rare. Most properties make less than 1000 units, and only a small fraction crosses into the higher revenue brackets.

The price distribution suggests that while there are plenty of affordable places to stay in both countries, the Netherlands offers a wider variety of pricing, reaching into higher-end luxury more often than Belgium. This could make the Netherlands appealing to both budget travelers and those looking to splurge, whereas Belgium might attract more budget-conscious visitors due to its sharper focus on lower-priced accommodations



**Figure 13:** Normal distribution of price in the Netherlands (on the left) and Normal distribution of price in Belgium (on the right)

The graphs for both countries show a majority of Airbnb prices clustering at the lower end, implying plenty of affordable options available in both countries. This right skew suggests that whether in the Netherlands or Belgium, budget accommodations dominate the market.

In Belgium, the concentration of lower-priced listings is really sharp and drops off quickly, meaning there's a big jump from the most common low prices to the rare high prices. This makes Belgium seem like a place where you can expect mostly budget stays, with few expensive outliers. On the other hand, the majority of listings cluster at the lower price range in the Netherlands, with the highest density occurring close to the zero mark. This suggests that affordable accommodations dominate the market in the case of the Netherlands.

The correlation charts below display the average price by room type in the top 10 neighborhoods in both countries, categorized into entire home/apartment, hotel room, private room, and shared room. This analysis provides valuable insights into how location and room type influence pricing

strategies, which can help both travelers in planning their stays and hosts in making informed decisions about property management and investments.

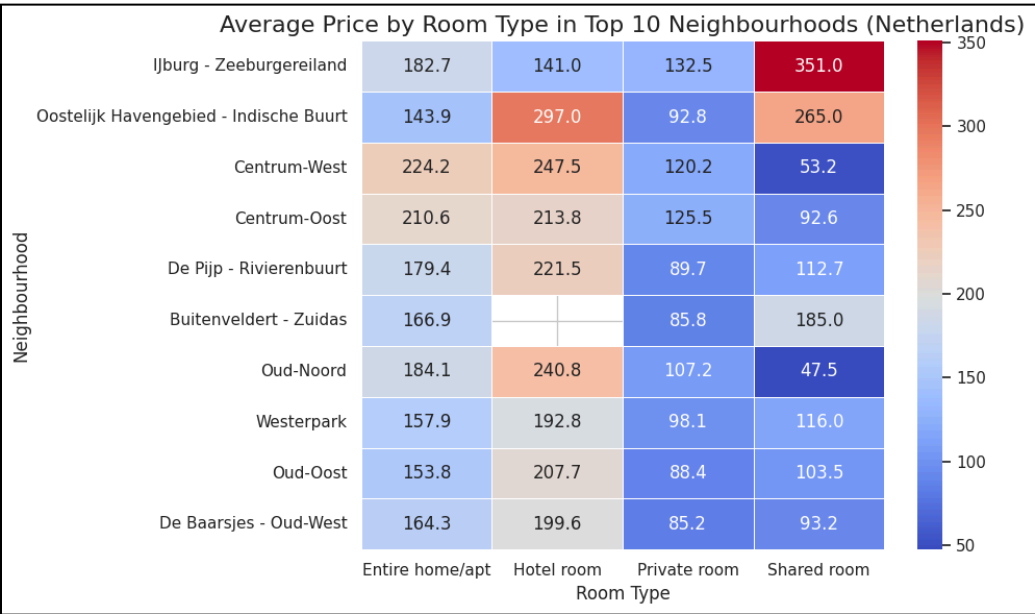
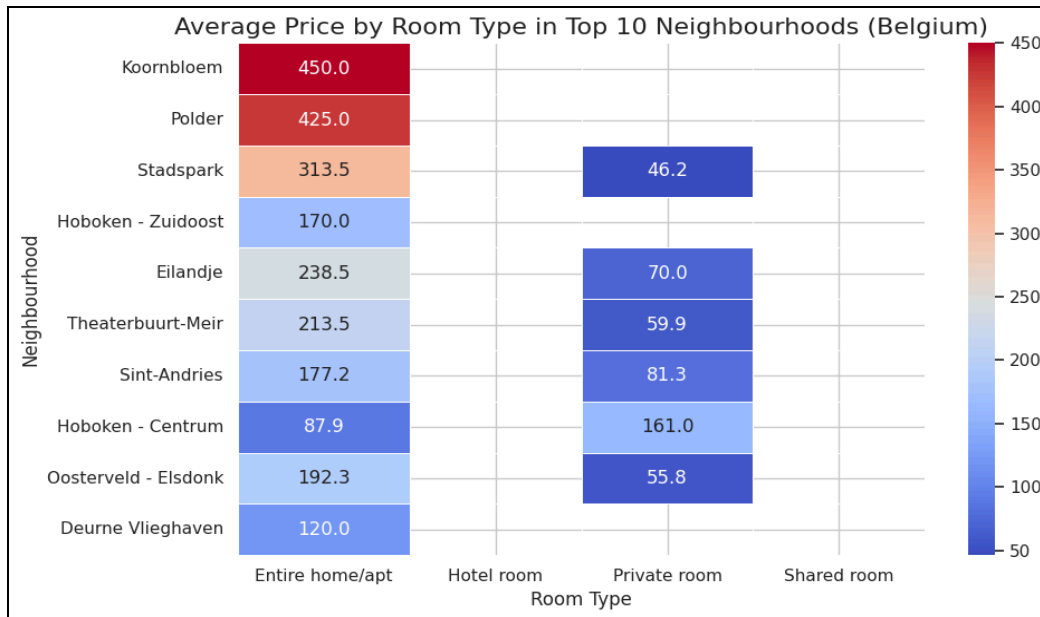


Figure 14: Average price by room type in the Top 10 Neighborhoods in the Netherlands

In the Netherlands, neighborhoods closer to the city center, such as Centrum-West and Centrum-Oost, tend to have higher prices across all room types, which could correlate with their proximity to major attractions and amenities in the city, whereas, more peripheral areas like Buitenveldert - Zuidas and Oud-Oost offer more moderate pricing, potentially offering better deals for longer stays or residents favoring quieter parts of the city.

In terms of room type, hotel rooms consistently fetch higher prices than other room types in nearly all neighborhoods, reflecting a higher demand or due to the availability of premium amenities. Entire homes/apartments also command a premium in certain neighborhoods, suggesting areas with higher tourist appeal. However, shared rooms generally offer the most affordable accommodation, except in IJburg - Zeeburgereilan, where the price spikes unusually. Private rooms present a moderately priced option across most neighborhoods.



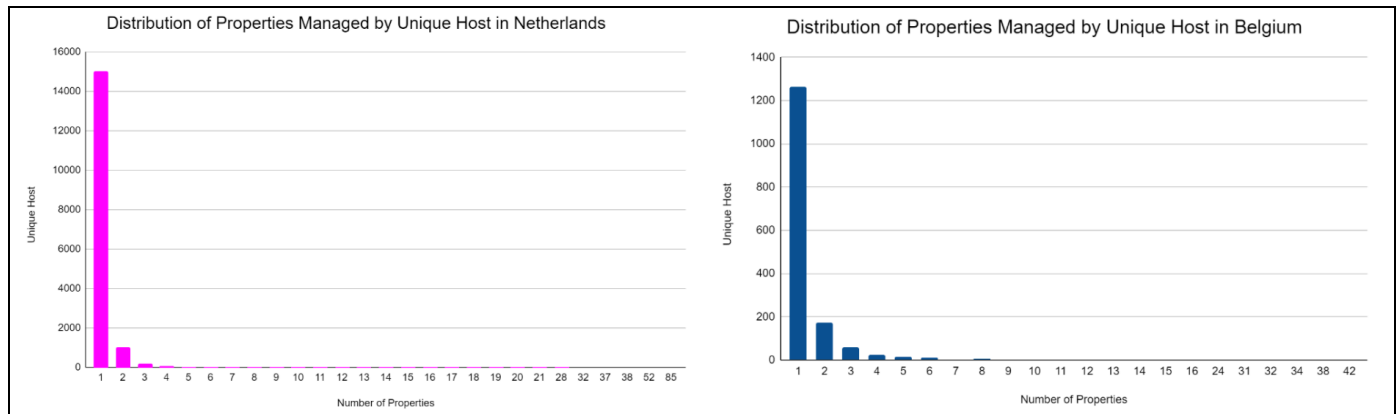
**Figure 15:** Average price by room type in Top 10 Neighborhoods in the Belgium

In Belgium, there's a significant disparity in pricing based on room type and locality. Essentially, entire homes/apartments tend to be the most expensive, especially in areas like Koornbloem and Polder, where prices are as high as 450 EUR and 425 EUR, respectively. This suggests that travelers are willing to pay more for these places' extra space and privacy. On the other hand, private rooms appear in fewer neighborhoods but exhibit a broad price range, with Hoboken-Centrum having the highest hotel room rate at 161 EUR, contrasting sharply with other areas where hotel accommodation is more modestly priced or not available at all.

## Host Listings Count Analysis

Figure 15 shows the count of properties each host manages within the dataset. It shows that the single-property hosts dominate, whether in the Netherlands or in Belgium. The number of single-property hosts in the Netherlands is 15019 (implying 91.63% of the total unique hosts in the Netherlands (16391) are single-property hosts). The number of single-property hosts in Belgium is 1265 (implying 80.62% of the total unique hosts in Belgium (1569) are single-property hosts). As the number of properties managed by a host increases, the count of such hosts sharply declines. Hosts managing two properties are notably fewer than those managing one, and the numbers continue to diminish progressively for hosts managing more properties. Given the dominance of single-property hosts, Airbnb might focus support and resources on these individuals to enhance their hosting capabilities and satisfaction, potentially leading to better overall service quality and guest experiences.





**Figure 16:** Distribution of Properties Managed by Unique Hosts in the Netherlands and Belgium

## 4. Inference

Our group did a comprehensive analysis of Airbnb accommodations in the Netherlands and Belgium, which offers several important insights into the dynamics of the sharing economy of these two countries, specifically in the real estate and hospitality sectors.

Our analysis shows a significantly larger number of room types available in the Netherlands (88.89%) compared to Belgium (11.10%), suggesting a more mature or popular Airbnb market in the Netherlands. Even in terms of location and Neighborhood Dynamics, the Netherlands features a more concentrated Airbnb market, with fewer neighborhoods having more accommodation than Belgium, which has a wider distribution of accommodations across more neighborhoods.

Belgium shows higher availability of different room types and fewer reviews than the Netherlands, suggesting a lower demand or potentially less frequent bookings in Belgium. The significant availability of Airbnb accommodation in certain neighborhoods in Belgium suggests there might be either an excess supply or insufficient demand, which could be addressed with focused marketing campaigns or by improving the appeal of accommodation with enhanced amenities and unique experiences.

Also, most Airbnb hosts in both countries manage only one property, highlighting the dominance of individual hosts over commercial players in the Airbnb market. This could suggest a market driven by personal hospitality rather than commercial hospitality ventures.

## 5. Conclusions

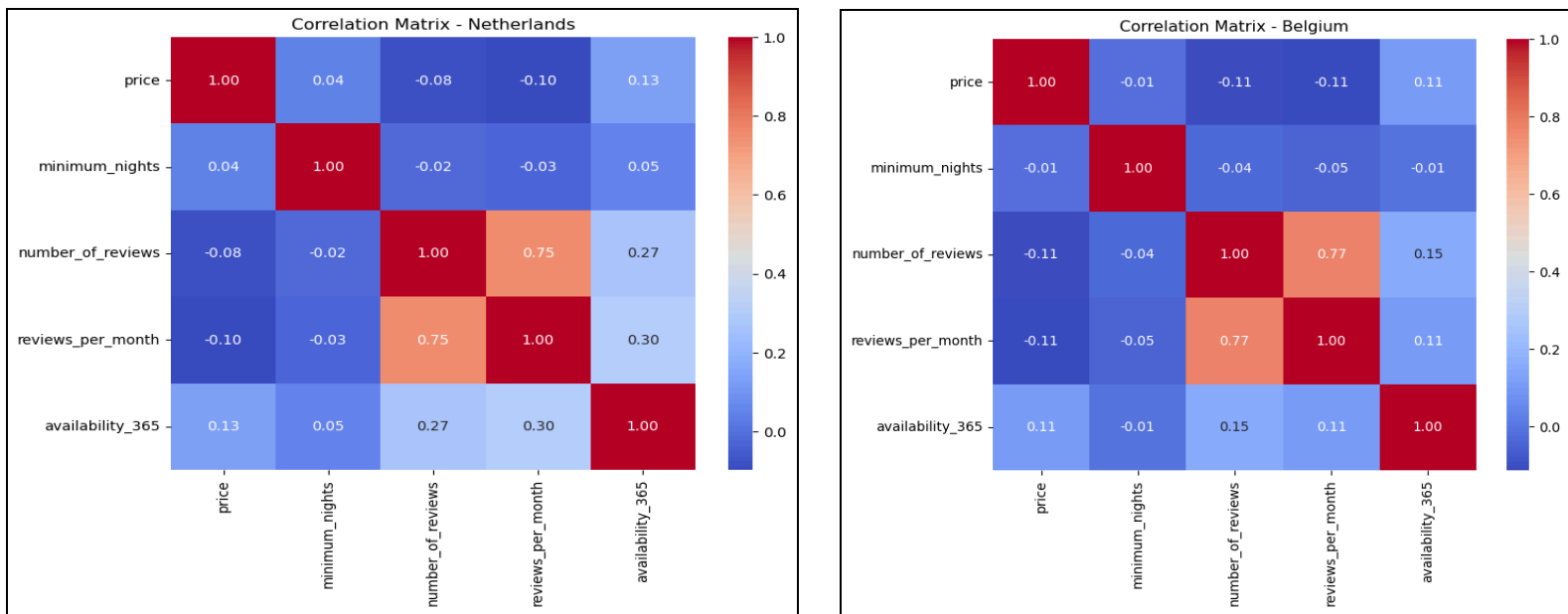
The detailed analysis of Airbnb's performance in the Netherlands and Belgium provides quantitative data crucial for understanding the company's market presence and operational nuances in these regions. However, it primarily focuses on tangible metrics like pricing, availability, and types of rooms and doesn't delve deeply into qualitative aspects such as customer behavior, preferences, and overall satisfaction.

It is important to recognize that while the existing data lays a strong foundation for understanding key structural and economic factors affecting Airbnb's performance, there's a clear lack in capturing the behavioral patterns of customers. These patterns include their motivations, how they make decisions, and their satisfaction with their Airbnb stays. Integrating customer feedback, behavioral analytics, and satisfaction surveys into the analysis could provide a more comprehensive picture of market dynamics.

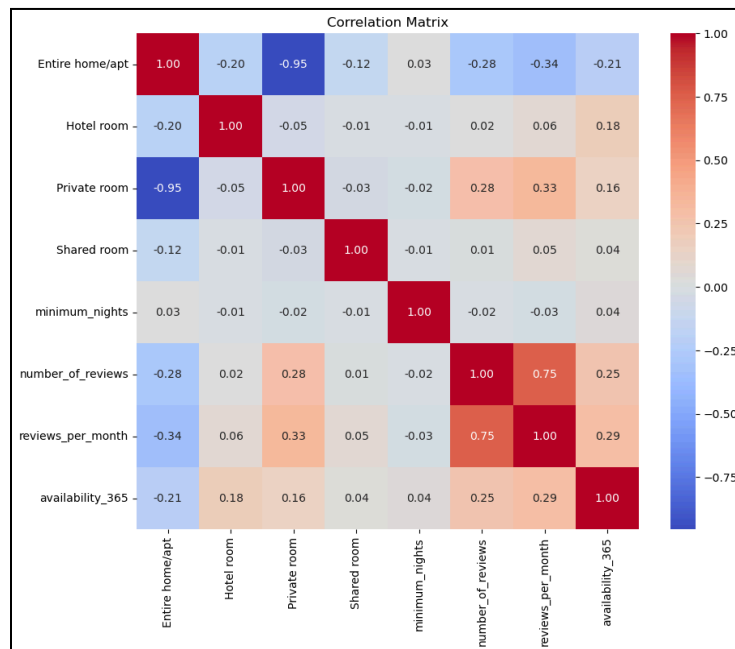
Additionally, the fluctuation in review frequencies highlights the critical role reviews play in influencing consumer choices. It is essential for hosts to proactively manage their online presence, which includes motivating guests to submit reviews and responding thoughtfully to their feedback. This will not only boost guest satisfaction but also enhance the appeal of the listings.

In conclusion, our analysis is aimed at helping property hosts understand market dynamics to optimize rental strategies. By understanding popular locations, preferred room types, and pricing strategies, stakeholders can make informed decisions to enhance profitability and guest satisfaction. It highlights current trends and provides a basis for predicting future movements in the Airbnb market in these regions. Our study effectively uses statistical tools to analyze and present Airbnb data, offering insights. By understanding these patterns, stakeholders can better prepare for shifts in consumer behavior, economic impacts on tourism, and evolving competitive landscapes in the hospitality industry.

## 6. Appendix

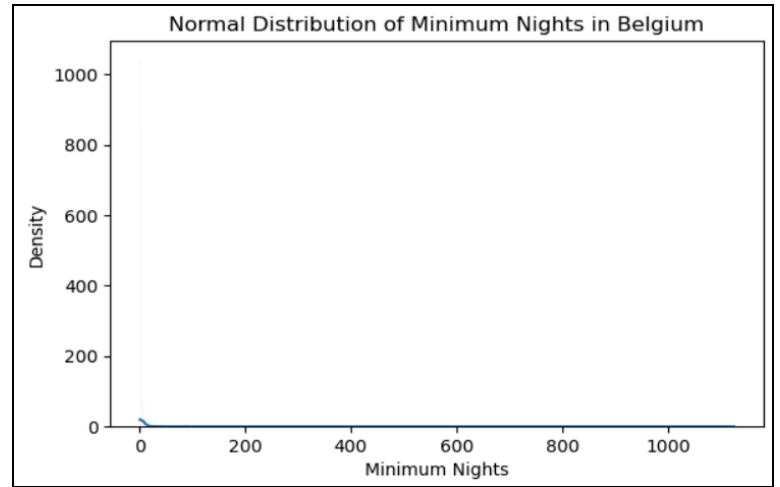
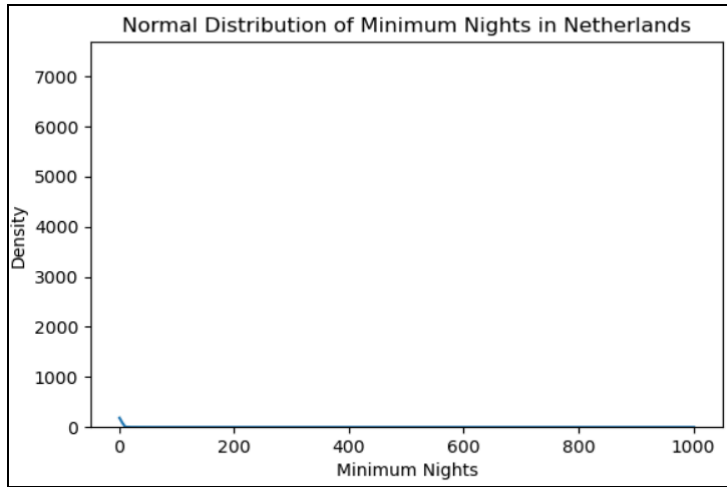


**Figure 17:** Correlation matrix of the Netherlands (left) and Belgium (right)

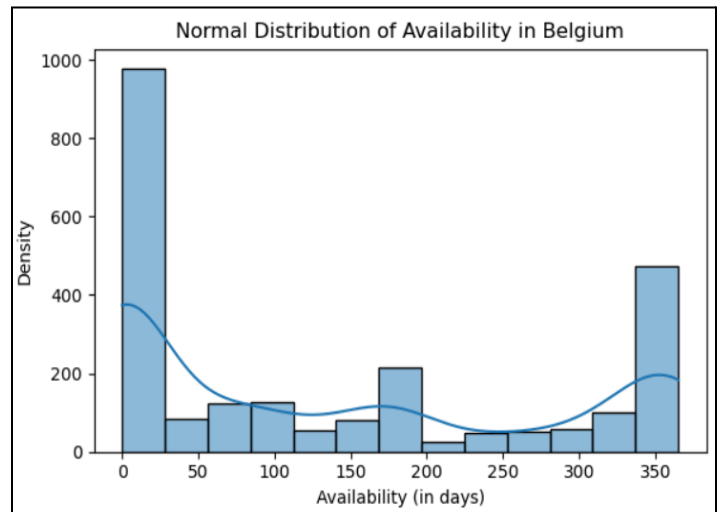
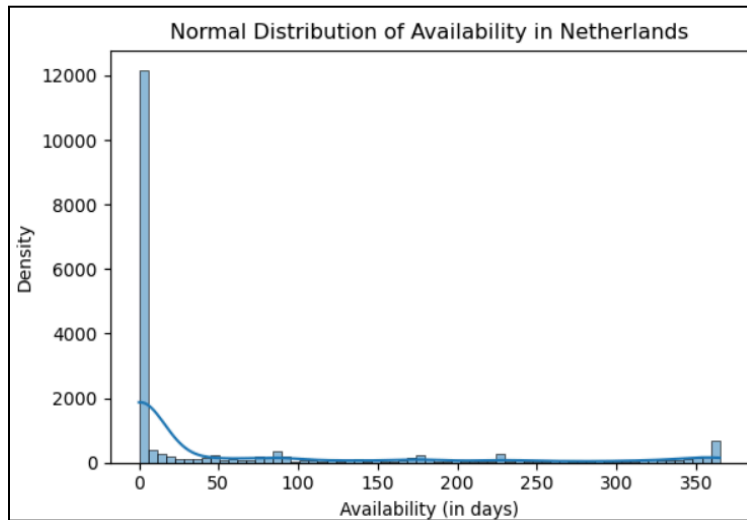


**Figure 18:** Overall Correlation matrix

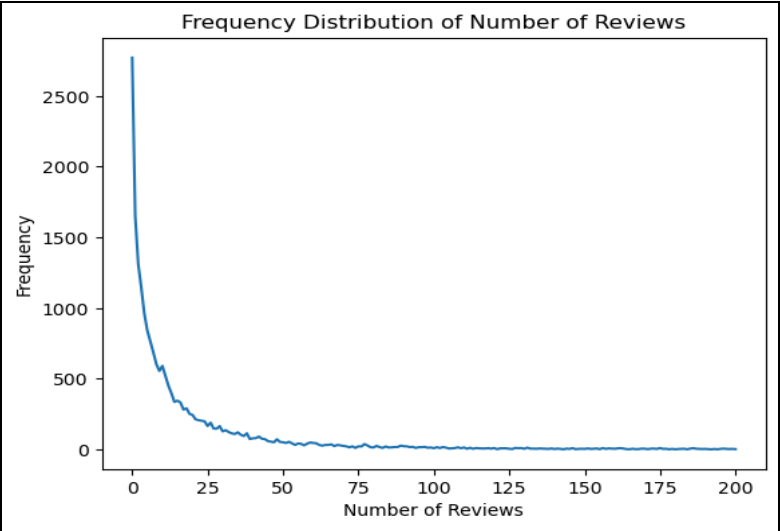
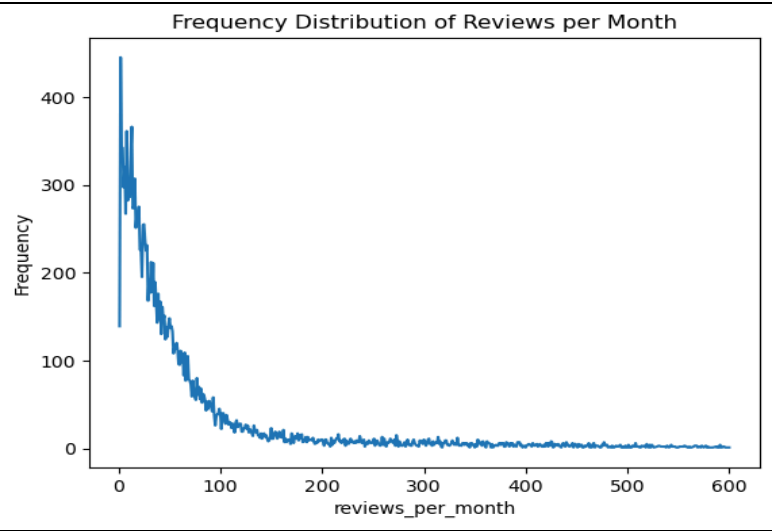
- Weak or no strong correlation between price and any of the other variables.
- The number of reviews and reviews per month shows a high positive correlation (0.75), indicating that listings with more overall reviews also tend to be reviewed frequently monthly.



**Figure 19:** Normal distribution of minimum nights required in the Netherlands (on the left) and Normal distribution of minimum nights required in Belgium (on the right)



**Figure 20:** Normal distribution of availability in the Netherlands (on the left) and Normal distribution of availability in Belgium (on the right)



**Figure 21:** Frequency distribution of reviews per month (on the left) and frequency distribution of Number of reviews (on the right)