Airbnb Dynamic Pricing Recommendation Engine

Objective

This project analyzes historical Airbnb data to recommend optimal listing prices by considering city, room type, guest reviews, superhost status, and seasonal demand patterns. The goal is to help hosts maximize revenue while ensuring competitive pricing and guest satisfaction.

Tools & Technologies

- Python (Pandas, Scikit-learn, Matplotlib/Seaborn)
- Power BI for dashboards & visualization
- Excel for initial exploration

Approach

1. Data Preparation – Cleaned and structured Airbnb dataset.
2. Model Building – Developed a regression-based pricing prediction model.
3. Predicted Pricing – Generated Predicted Prices and calculated Price Gaps against actual values.
4. Visualization – Designed interactive Power BI dashboards for pricing trends, city-wise comparison, and host performance insights.

Key Insights

- City-Wise: London and Paris have the highest predicted prices, while Budapest and Berlin remain lower-cost markets.
- Room Type: Entire home/apartment listings command premium pricing compared to private/shared rooms.
- Superhost Impact: Superhost status shows a moderate positive impact on pricing and guest trust.
- Mispricing Alert: Cities like Barcelona reveal large price gaps

  (predicted > actual), suggesting underpriced listings.
- Guest Satisfaction: Higher cleanliness and review scores are correlated with higher achievable prices.

Recommendations for Airbnb Hosts & Platform

◈ Optimized Pricing by Location

- Adjust prices upwards in high-demand cities (London, Paris).
- Correct underpricing in cities with large negative price gaps (e.g., Barcelona).
- Keep Berlin and Budapest competitively priced to attract demand.

◈ Room Type Strategy

- Position Entire Homes/Apartments as premium offerings.
- Keep Private/Shared Rooms at competitive entry-level prices to capture budget travelers.

◈ Superhost Advantage

- Encourage hosts to achieve and maintain Superhost status, since these listings show higher trust and willingness-to-pay.

◈ Dynamic Adjustments

- Apply weekend premiums and seasonal adjustments to better capture demand spikes.
- Use dynamic pricing engines instead of static pricing.

◈ Data-Driven Alerts

- Introduce alert systems to notify hosts when their listing is significantly underpriced compared to predicted values.

Recommended Price Example

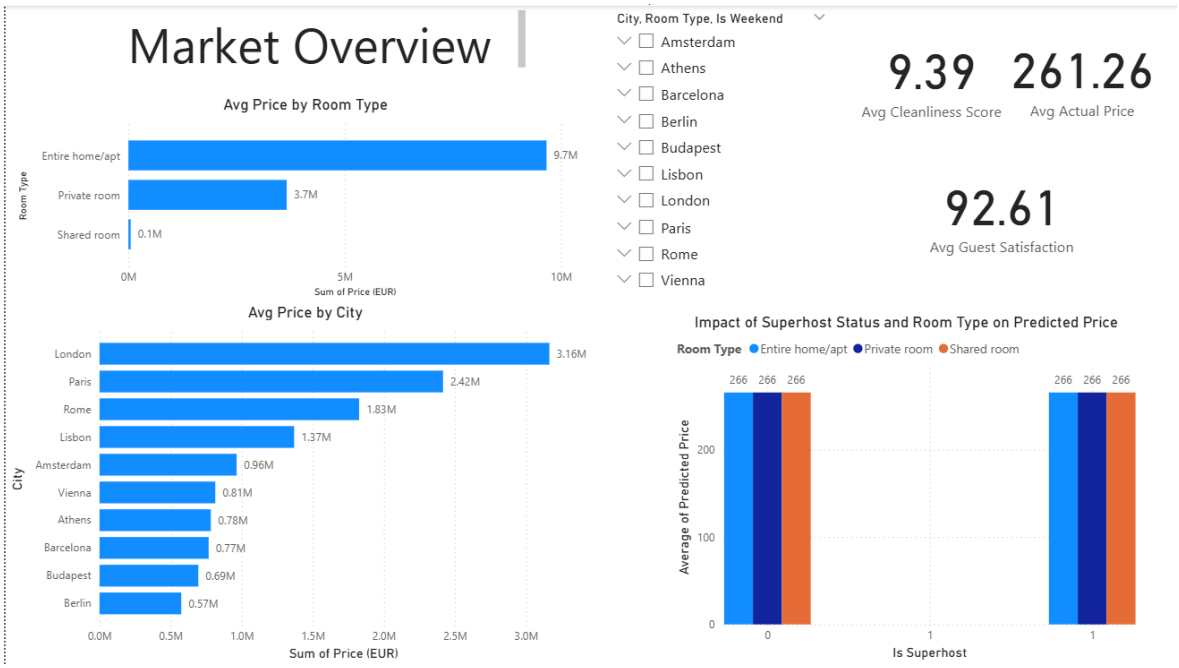
For one analyzed listing, the model suggested an optimal price of €687.42.

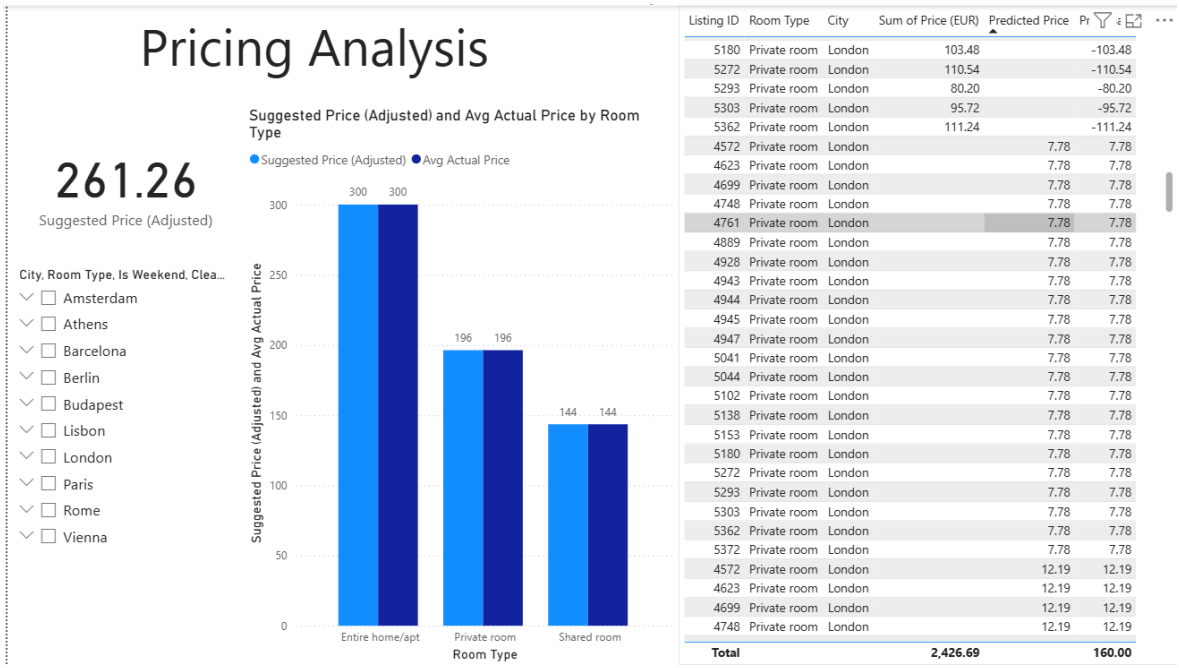
- How?
    - The model factored in location, room type, guest capacity, cleanliness score, and reviews.
    - Compared with market averages and adjusted for demand patterns.
- Why?
    - Ensures competitive positioning against similar listings.
    - Maximizes host revenue without reducing guest booking probability.
    - Aligns pricing with quality signals (reviews, Superhost, room type).

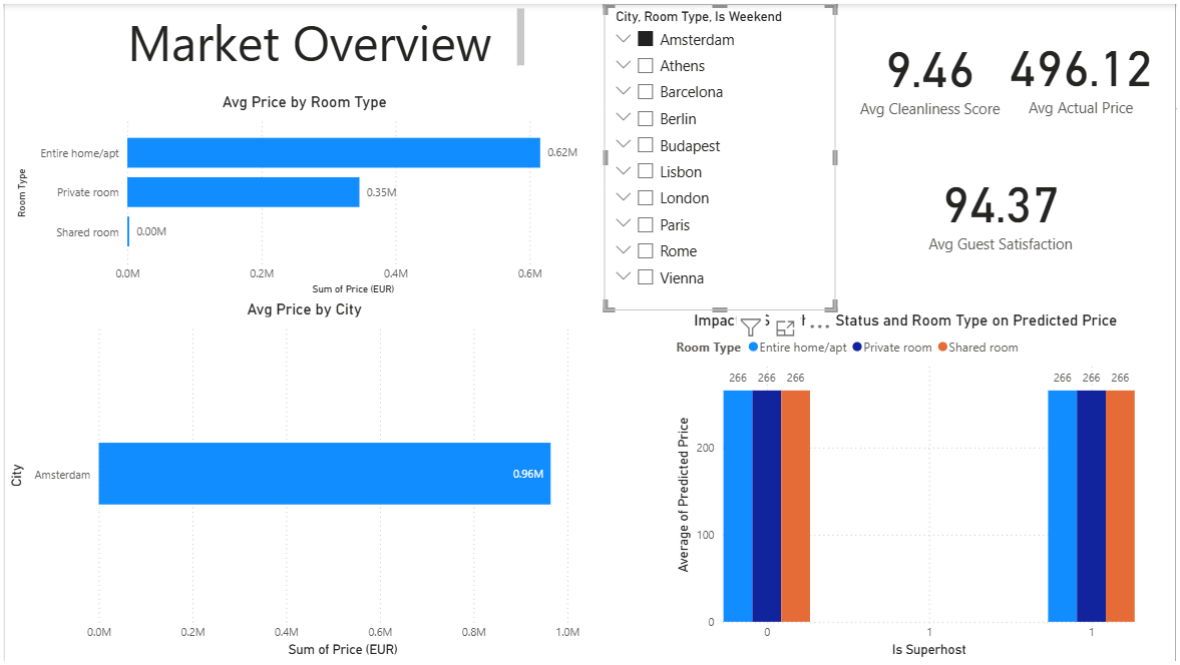
Dashboard Snapshots

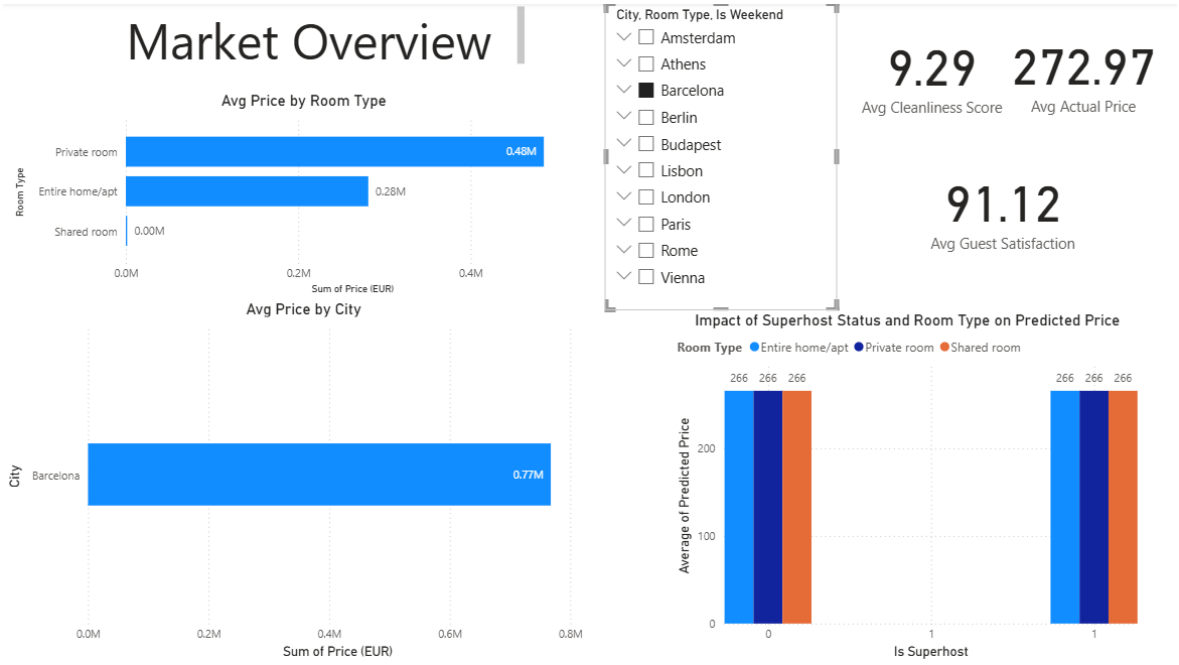
Dashboards provide actionable insights for hosts and the platform:

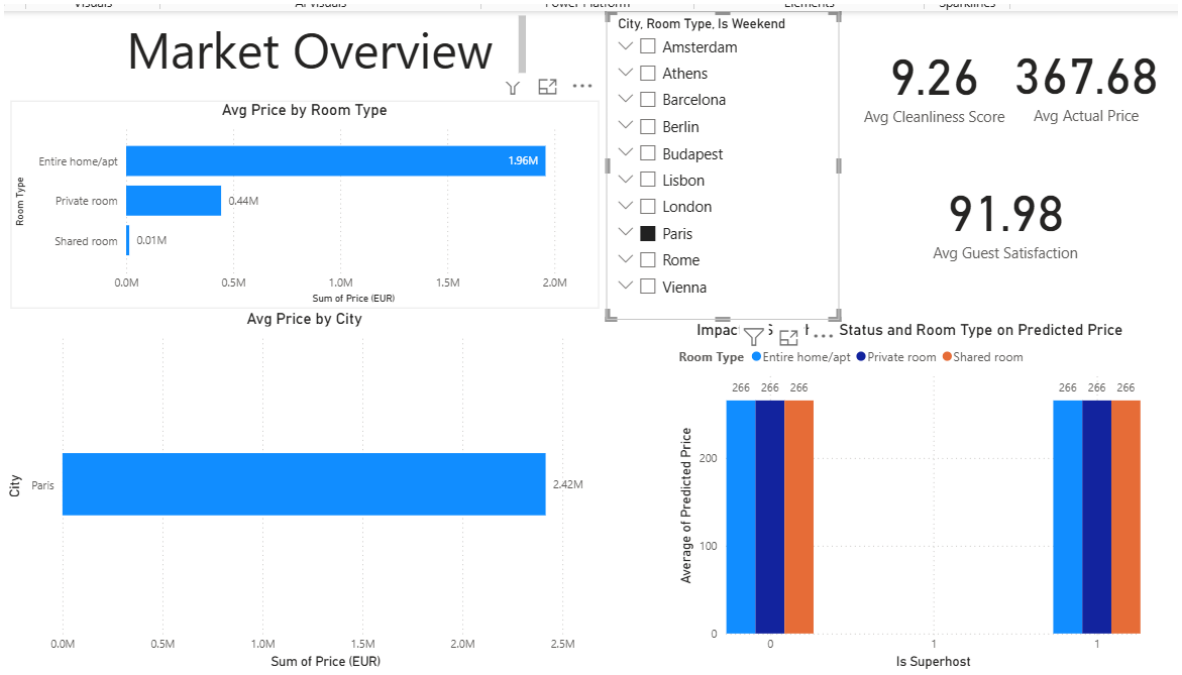
- Market Overview Dashboard → City-wise pricing distribution, top-performing cities.
- Pricing Analysis Dashboard → Actual vs Predicted Prices, Price Gaps, and Room Type Trends.
- Superhost & Guest Insights → Correlation of ratings, cleanliness, and Superhost status with pricing.

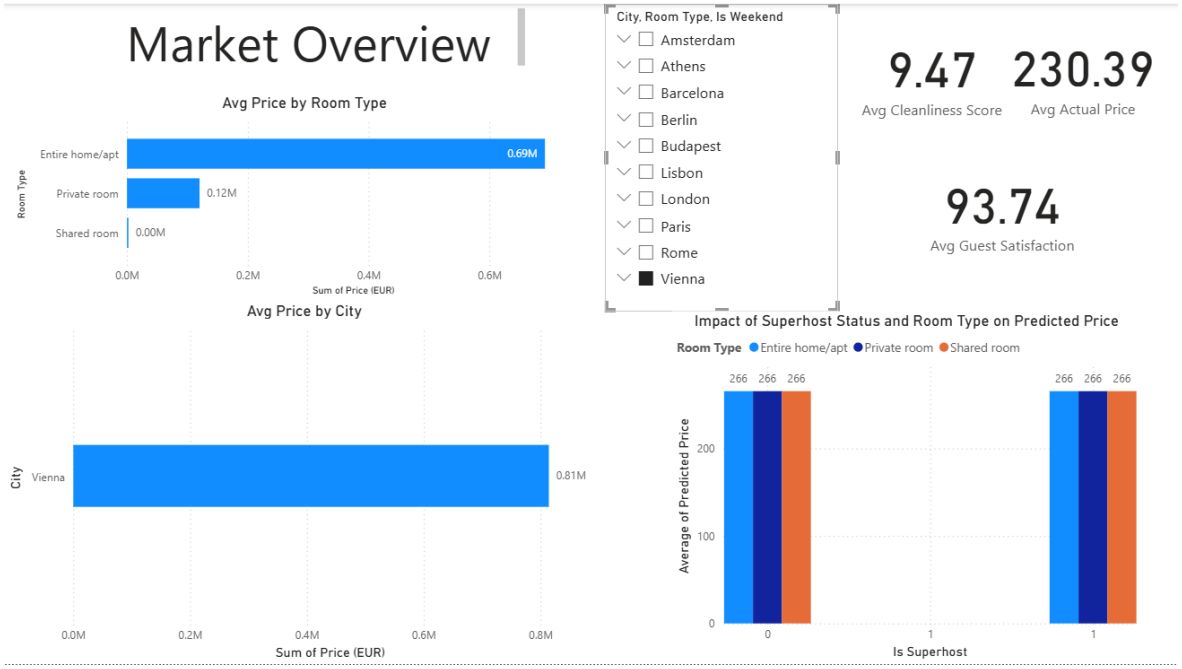


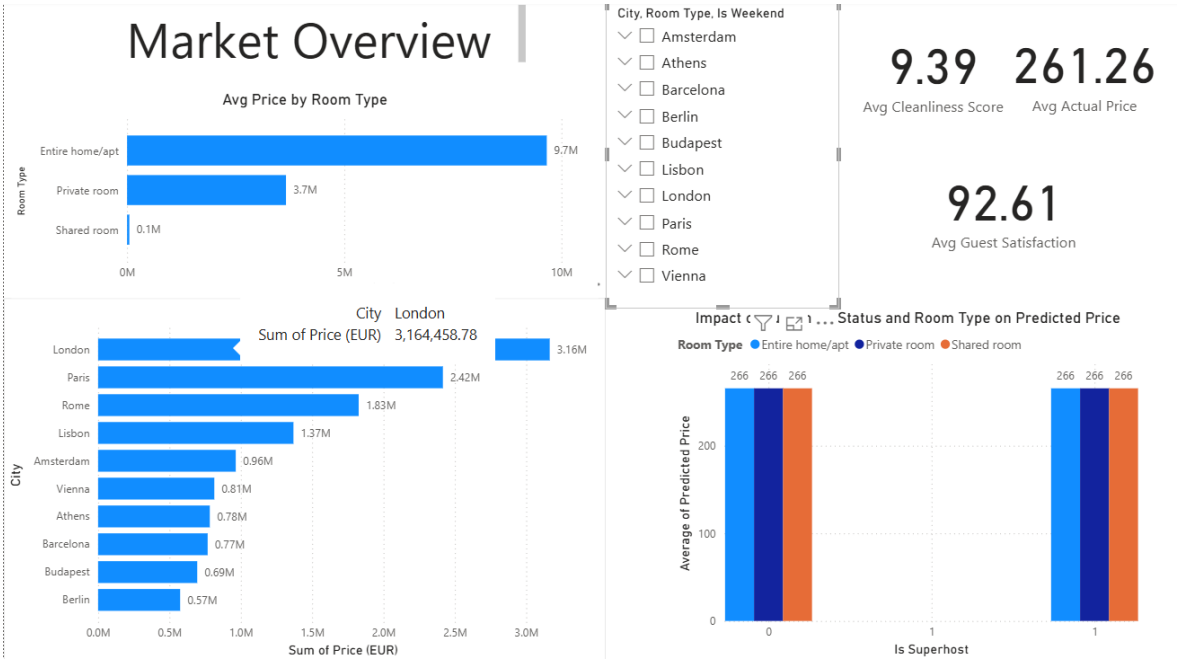


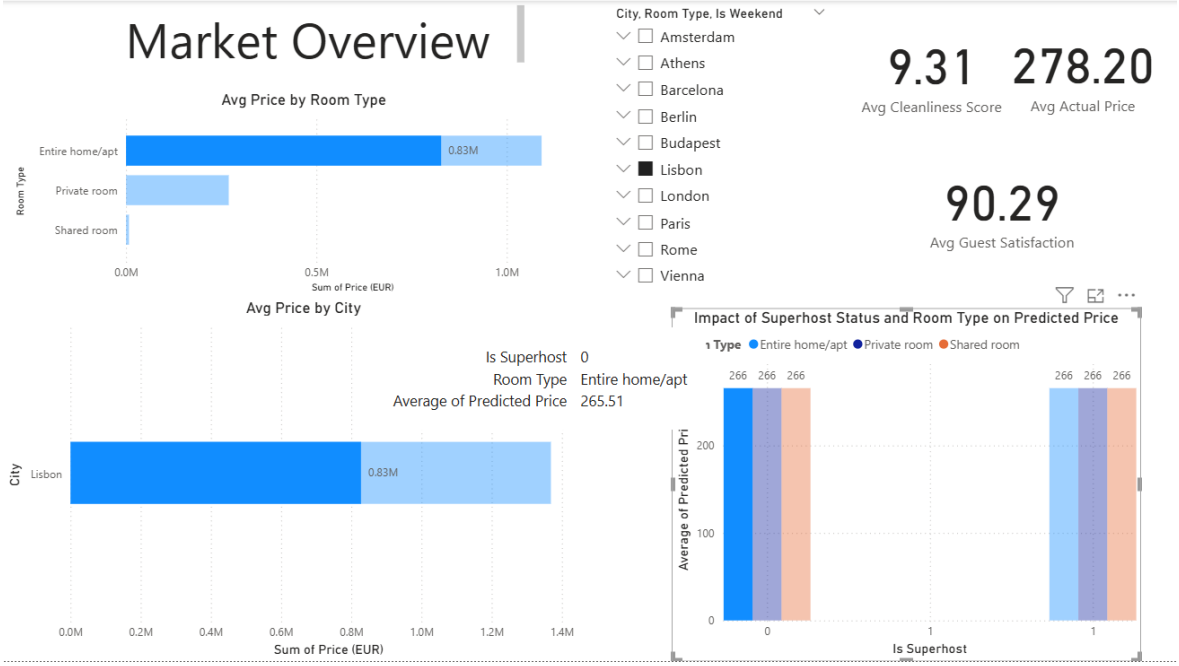

Market Overview
Avg Price by Room Type
Entire home/apt
Private room
Shared room
0.62M
0.35M
0.00M
Room Type
0.0M
0.2M
0.4M
0.6M
Sum of Price (EUR)
Avg Price by City
Amsterdam
0.96M
City
0.0M
0.2M
0.4M
0.6M
0.8M
1.0M
Sum of Price (EUR)
City, Room Type, Is Weekend
Amsterdam
Athens
Barcelona
Berlin
Budapest
Lisbon
London
Paris
Rome
Vienna
9.46
Avg Cleanliness Score
496.12
Avg Actual Price
94.37
Avg Guest Satisfaction
Impac... Status and Room Type on Predicted Price
Room Type
Entire home/apt
Private room
Shared room
266
Average of Predicted Price
200
100
0
0
1
Is Superhost


Market Overview
Avg Price by Room Type
Private room
Entire home/apt
Shared room
0.48M
0.28M
0.00M
Room Type
0.0M
0.2M
0.4M
Sum of Price (EUR)
Avg Price by City
Barcelona
0.77M
City
0.0M
0.2M
0.4M
0.6M
0.8M
Sum of Price (EUR)
City, Room Type, Is Weekend
Amsterdam
Athens
Barcelona
Berlin
Budapest
Lisbon
London
Paris
Rome
Vienna
9.29
Avg Cleanliness Score
272.97
Avg Actual Price
91.12
Avg Guest Satisfaction
Impact of Superhost Status and Room Type on Predicted Price
Room Type
Entire home/apt
Private room
Shared room
266
Average of Predicted Price
200
100
0
0
1
Is Superhost

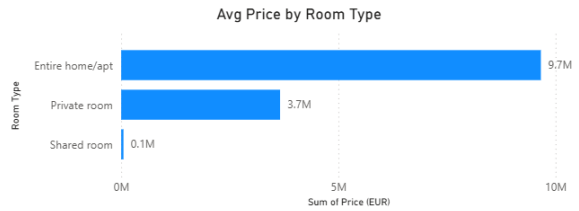

Market Overview
Avg Price by Room Type
Entire home/apt
Private room
Shared room
1.96M
0.44M
0.01M
Room Type
0.0M
0.5M
1.0M
1.5M
2.0M
Sum of Price (EUR)
City, Room Type, Is Weekend
Amsterdam
Athens
Barcelona
Berlin
Budapest
Lisbon
London
Paris
Rome
Vienna
9.26
Avg Cleanliness Score
367.68
Avg Actual Price
91.98
Avg Guest Satisfaction
Avg Price by City
Paris
2.42M
City
0.0M
0.5M
1.0M
1.5M
2.0M
2.5M
Sum of Price (EUR)
Status and Room Type on Predicted Price
Room Type
Entire home/apt
Private room
Shared room
266
Average of Predicted Price
200
100
0
0
1
Is Superhost

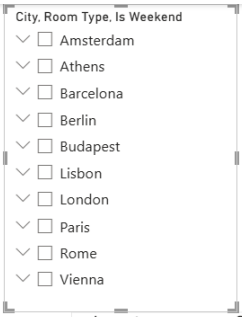

Market Overview
Avg Price by Room Type
Entire home/apt
Private room
Shared room
0.69M
0.12M
0.00M
Room Type
0.0M
0.2M
0.4M
0.6M
Sum of Price (EUR)
City, Room Type, Is Weekend
Amsterdam
Athens
Barcelona
Berlin
Budapest
Lisbon
London
Paris
Rome
Vienna
9.47
Avg Cleanliness Score
230.39
Avg Actual Price
93.74
Avg Guest Satisfaction
Avg Price by City
Vienna
0.81M
City
0.0M
0.2M
0.4M
0.6M
0.8M
Sum of Price (EUR)
Impact of Superhost Status and Room Type on Predicted Price
Room Type
Entire home/apt
Private room
Shared room
266
Average of Predicted Price
200
100
0
0
1
Is Superhost


Market Overview
Avg Price by Room Type
Entire home/apt
Private room
Shared room
9.7M
3.7M
0.1M
0M
5M
10M
Room Type
City, Room Type, Is Weekend
Amsterdam
Athens
Barcelona
Berlin
Budapest
Lisbon
London
Paris
Rome
Vienna
9.39
Avg Cleanliness Score
261.26
Avg Actual Price
92.61
Avg Guest Satisfaction
City London
Sum of Price (EUR) 3,164,458.78
3.16M
2.42M
1.83M
1.37M
0.96M
0.81M
0.78M
0.77M
0.69M
0.57M
0.0M
0.5M
1.0M
1.5M
2.0M
2.5M
3.0M
Sum of Price (EUR)
City
Impact ... Status and Room Type on Predicted Price
Room Type Entire home/apt Private room Shared room
266 266 266
266 266 266
200
100
0
Average of Predicted Price
0
1
1
Is Superhost


Market Overview
Avg Price by Room Type
Entire home/apt
Private room
Shared room
0.83M
0.0M
0.5M
1.0M
Sum of Price (EUR)
Room Type
City, Room Type, Is Weekend
Amsterdam
Athens
Barcelona
Berlin
Budapest
Lisbon
London
Paris
Rome
Vienna
9.31
Avg Cleanliness Score
278.20
Avg Actual Price
90.29
Avg Guest Satisfaction
Avg Price by City
Is Superhost 0
Room Type Entire home/apt
Average of Predicted Price 265.51
City
Lisbon
0.83M
0.0M
0.2M
0.4M
0.6M
0.8M
1.0M
1.2M
1.4M
Sum of Price (EUR)
Impact of Superhost Status and Room Type on Predicted Price
Entire home/apt
Private room
Shared room
266 266 266
266 266 266
200
100
0
Average of Predicted Pri
0
1
1
Is Superhost

Market Overview

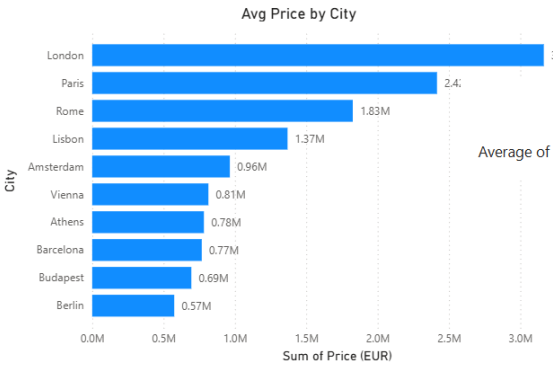




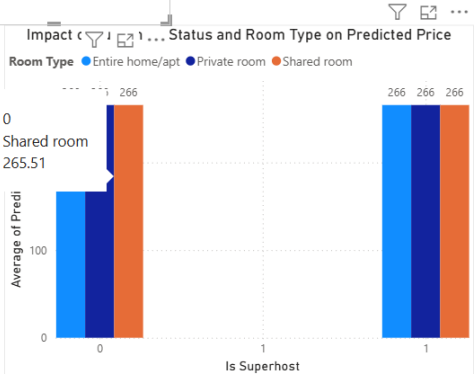
9.39
Avg Cleanliness Score

261.26
Avg Actual Price

92.61
Avg Guest Satisfaction

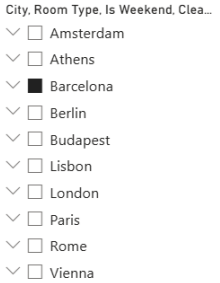


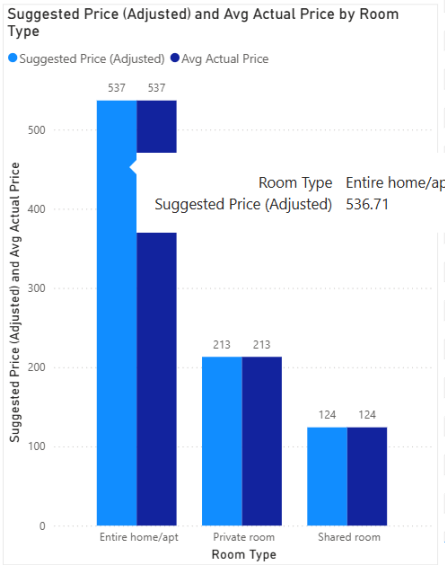
Is Superhost 0
Room Type Shared room
Average of Predicted Price 265.51



Pricing Analysis

272.97
Suggested Price (Adjusted)





Room Type Entire home/apt
Suggested Price (Adjusted) 536.71

Listing ID	Room Type	City	Sum of Price (EUR)	Predicted Price	Price Gap
929	Private room	Barcelona		-73.05	-73.05
1018	Private room	Barcelona		-73.05	-73.05
1025	Private room	Barcelona		-73.05	-73.05
1042	Private room	Barcelona		-73.05	-73.05
1090	Private room	Barcelona		-73.05	-73.05
1321	Private room	Barcelona		-73.05	-73.05
1322	Private room	Barcelona		-73.05	-73.05
1331	Private room	Barcelona		-73.05	-73.05
1336	Private room	Barcelona		-73.05	-73.05
1385	Private room	Barcelona		-73.05	-73.05
1404	Private room	Barcelona		-73.05	-73.05
1424	Private room	Barcelona		-73.05	-73.05
1441	Shared room	Barcelona		-73.05	-73.05
1456	Private room	Barcelona		-73.05	-73.05
1457	Private room	Barcelona		-73.05	-73.05
1471	Private room	Barcelona		-73.05	-73.05
1472	Private room	Barcelona		-73.05	-73.05
1477	Private room	Barcelona		-73.05	-73.05
1484	Private room	Barcelona		-73.05	-73.05
1487	Private room	Barcelona		-73.05	-73.05
1488	Private room	Barcelona		-73.05	-73.05
1491	Private room	Barcelona		-73.05	-73.05
929	Private room	Barcelona		-21.48	-21.48
1018	Private room	Barcelona		-21.48	-21.48
1025	Private room	Barcelona		-21.48	-21.48
1042	Private room	Barcelona		-21.48	-21.48
1090	Private room	Barcelona		-21.48	-21.48
1321	Private room	Barcelona		-21.48	-21.48
1322	Private room	Barcelona		-21.48	-21.48
1331	Private room	Barcelona		-21.48	-21.48
1336	Private room	Barcelona		-21.48	-21.48
Total			**2,348.98**		**171.55**