

REPORT ON ANALYZING AIRBNB REAL ESTATE PORTFOLIO: INSIGHTS AND FINANCIAL EVALUATION

INTRODUCTION

The following report presents an analysis of a real estate portfolio consisting of Airbnb properties. The dataset was generated using Python in a Jupyter Notebook environment. This report aims to provide insights into the financial aspects of the portfolio, including rental income estimates, operating expenses, return on investment (ROI), and profitability and portfolio performance by location and property type.

CODE AND DATA

During the analysis, a dataset was generated in Python to simulate real estate scenarios. The dataset included key data such as property IDs, locations (like Beach, City, etc.), property types (Apartments, Houses, Condos), sizes, purchase prices, down payments, loan amounts, interest rates, and loan terms. This diverse dataset mirrors real-world property markets, enabling comprehensive analysis and decision-making.

GENERATING REAL ESTATE DATASET (AIRBnB PORTFOLIO)

```
In [2]: # Define the number of properties to generate
num_properties = 1000

# Generate property IDs
property_ids = ['PROP' + str(i).zfill(4) for i in range(1, num_properties + 1)]

# Define ranking of locations based on cost of purchase
location_ranking = ['Beach', 'City', 'Mountain', 'Countryside']

# Generate random locations based on ranking
property_locations = [random.choice(location_ranking[:2]) for _ in range(num_properties//2)] + \
    [random.choice(location_ranking[2:]) for _ in range(num_properties//2)]

# Generate random property types with more realistic distribution
property_types = np.random.choice(['Apartment', 'House', 'Condo'], p=[0.4, 0.4, 0.2], size=num_properties)

# Generate random property sizes in square feet, tailored to property type
property_sizes = []
for prop_type in property_types:
    if prop_type == 'Apartment':
        size = np.random.randint(500, 1500)
    elif prop_type == 'House':
        size = np.random.randint(1500, 4000)
    else:
        size = np.random.randint(800, 2000)
    property_sizes.append(size)

# Define price ranges for each location and property type (in $1000s)
price_ranges = {
    'Beach': {'Apartment': (600, 1200), 'House': (800, 2000), 'Condo': (500, 1000)},
    'City': {'Apartment': (400, 800), 'House': (600, 1500), 'Condo': (300, 700)},
    'Mountain': {'Apartment': (300, 600), 'House': (400, 1000), 'Condo': (200, 500)},
    'Countryside': {'Apartment': (200, 400), 'House': (300, 800), 'Condo': (150, 300)}
}

# Generate random purchase prices based on location and property type
purchase_prices = []
for location, prop_type in zip(property_locations, property_types):
    price_range = price_ranges[location][prop_type]
    price = np.random.randint(price_range[0], price_range[1]) * 1000
    purchase_prices.append(price)

# Define down payment percentage
down_payment_percentage = 0.20

# Calculate down payment
down_payments = np.round(np.array(purchase_prices) * down_payment_percentage, 2)
```

Figure 1: Code snippet of data generation

Portfolio Distribution

The generated dataset comprises various properties distributed across different locations and property types. Visualization through pie charts depicted the distribution by property type and location. While the distribution across locations is fairly even, there's a notable prevalence of apartments and houses compared to condos in the distribution by property types.

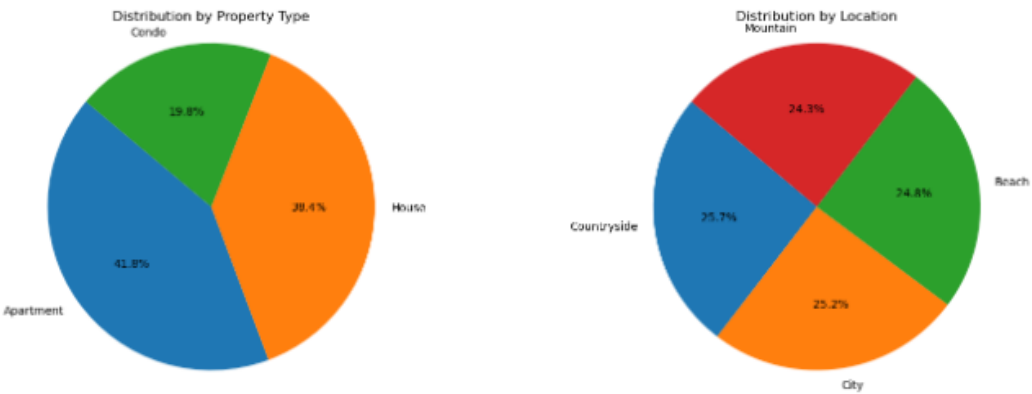


Figure 2: Pie chart of portfolio distribution

Rental Income Estimates

Rental income estimates were computed considering location, property type, and purchase price, with vacancy rates factored into the estimation process. Subsequently, both rental income and vacancy rates were incorporated into the dataset. The results indicate marginally higher vacancy rates in beach and city properties compared to countryside properties. Moreover, houses exhibited slightly lower vacancy rates than apartments and condos.

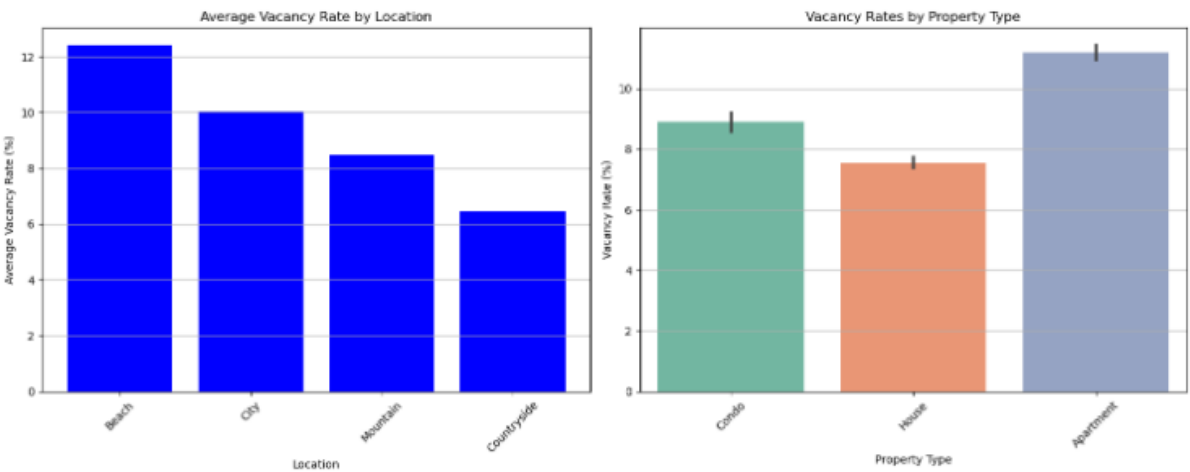


Figure 3: Average vacancy rates by location and property type

Total Expenses (Operating Expenses and Cost of Financing)

Operating expenses for each property were estimated, encompassing property taxes, insurance, maintenance, utilities, property management fees, and cleaning services. These expenses were utilized to compute the total operating expenses per year for each property. Additionally, the cost of financing, represented by property loan repayments, was incorporated into the operating costs to ascertain the total yearly expenses.

Net Operating Income (NOI) and Return on Investment (ROI)

NOI and ROI were calculated to assess the financial performance of the properties. Average ROI by location and property type were analysed to understand profitability trends.

Net operating income (NOI) formula:

$$NOI = \text{Yearly Rental income} - \text{Total Operating Expenses}$$

Return on investment(ROI) formula:

$$ROI = \left(\frac{\text{Net Operating Income}}{\text{Purchase Price}} \right) \times 100\%$$

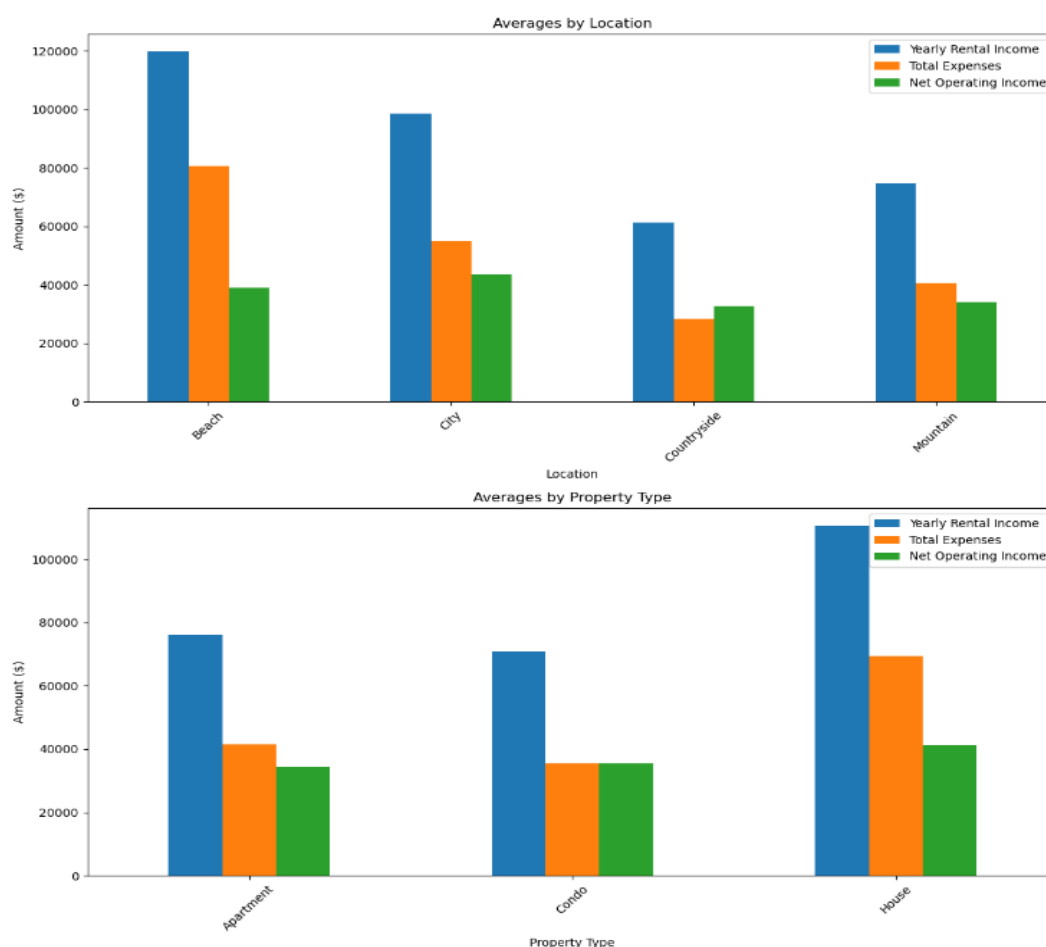


Figure 4: NOI AND ROI Averages by location and property type

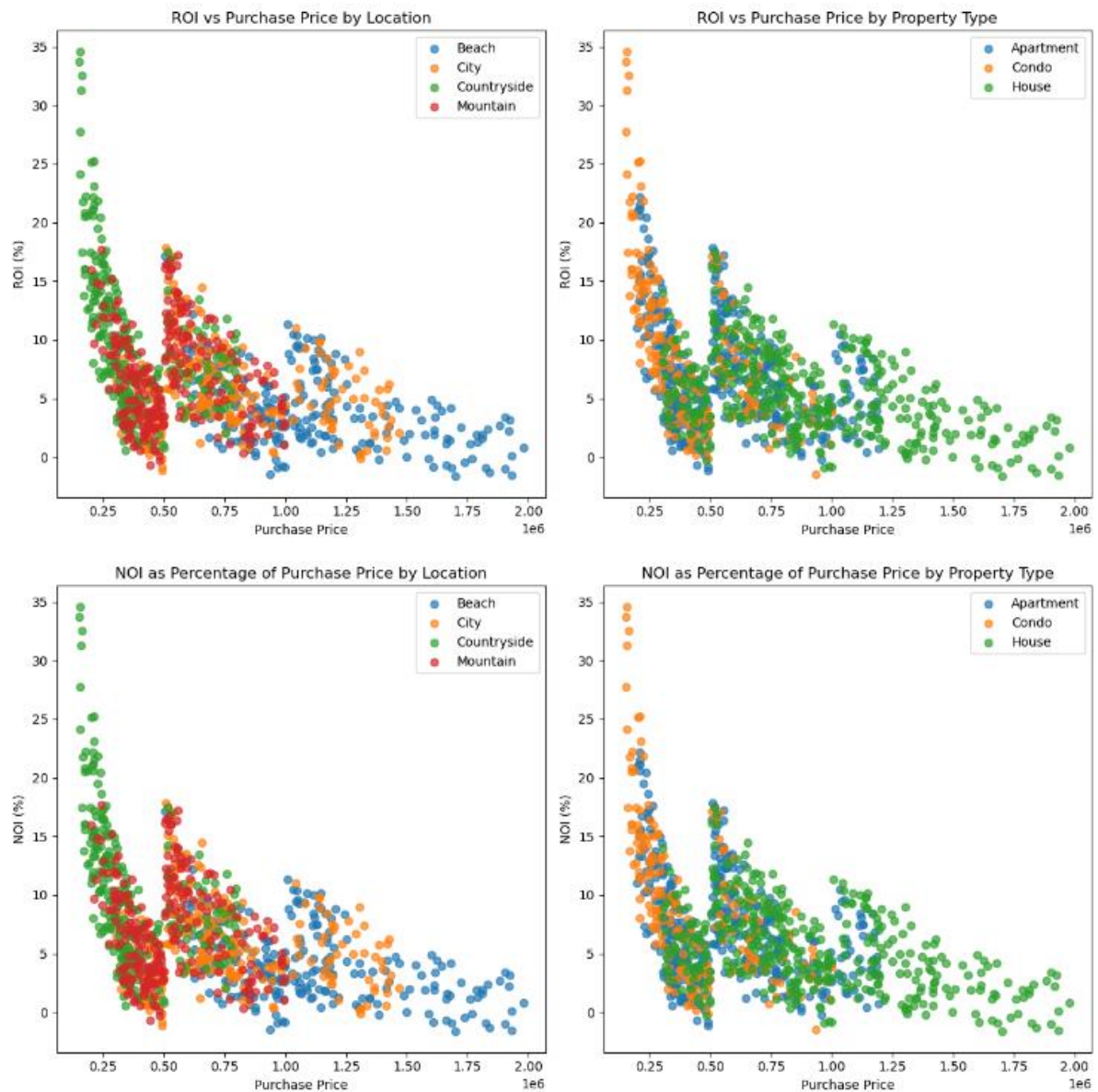


Figure 5: ROI & NOI Against purchase price by location and property types

Sensitivity Analysis

A sensitivity analysis was conducted by varying rental income by $\pm 10\%$ and recalculating financial metrics to assess the impact on profitability. See results in notebook.

Present Value of Portfolio

The present value of the portfolio over a 25-year holding period with a 2% discount rate was calculated to gain insight into the portfolio's long-term financial viability. The 25-year period was chosen to align with the loan term for all properties in the portfolio, ensuring complete repayment of all loans, considering maximum loan term of 20 years used in the data generation.

| | Property ID | Location | Property Type | Purchase Price | Year_1 | Year_2 | \ |
|---|-------------|----------|---------------|----------------|-----------|-----------|---|
| 0 | PROP0001 | City | Condo | 440000 | 941.37 | 922.91 | |
| 1 | PROP0002 | Beach | House | 1116000 | 109255.73 | 107113.46 | |
| 2 | PROP0003 | City | House | 1344000 | 37000.27 | 36274.78 | |
| 3 | PROP0004 | City | Condo | 552000 | 74346.50 | 72888.73 | |
| 4 | PROP0005 | Beach | Apartment | 620000 | 39970.88 | 39187.14 | |

| | Year_3 | Year_4 | Year_5 | Year_6 | ... | Year_17 | Year_18 | \ |
|---|-----------|-----------|-----------|----------|-----|----------|----------|---|
| 0 | 904.82 | 887.08 | 869.68 | 852.63 | ... | 685.74 | 672.29 | |
| 1 | 105013.19 | 102954.11 | 100935.40 | 98956.28 | ... | 79586.88 | 78026.35 | |
| 2 | 35563.51 | 34866.19 | 34182.53 | 33512.29 | ... | 26952.70 | 26424.21 | |
| 3 | 71459.53 | 70058.37 | 68684.67 | 67337.92 | ... | 54157.40 | 53095.49 | |
| 4 | 38418.76 | 37665.46 | 36926.92 | 36202.86 | ... | 29116.62 | 28545.71 | |

| | Year_19 | Year_20 | Year_21 | Year_22 | Year_23 | Year_24 | Year_25 | \ |
|---|----------|----------|----------|----------|----------|----------|----------|---|
| 0 | 659.11 | 646.19 | 633.52 | 621.09 | 608.92 | 596.98 | 585.27 | |
| 1 | 76496.42 | 74996.49 | 73525.97 | 72084.29 | 70670.87 | 69285.16 | 67926.63 | |
| 2 | 25906.09 | 25398.13 | 24900.12 | 24411.89 | 23933.22 | 23463.94 | 23003.87 | |
| 3 | 52054.40 | 51033.72 | 50033.06 | 49052.02 | 48090.22 | 47147.27 | 46222.82 | |
| 4 | 27985.99 | 27437.24 | 26899.26 | 26371.82 | 25854.73 | 25347.77 | 24850.76 | |

| | 25-Year Present Value |
|---|-----------------------|
| 0 | 18746.41 |
| 1 | 2175710.39 |
| 2 | 736820.71 |
| 3 | 1480530.66 |
| 4 | 795977.18 |

[5 rows x 30 columns]
Present Value of Entire Portfolio: \$ 731664969.57

Figure 6: Discounted Cash flow of portfolio over 25 years

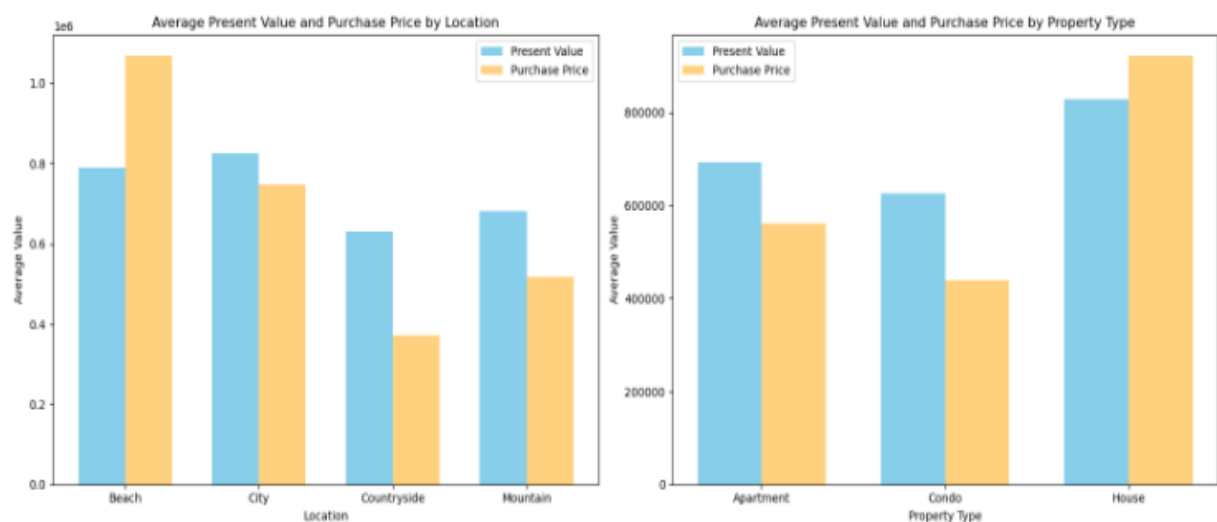


Figure 7: Present value of the 25 year hold against the purchase price

Summary Statistics

Additionally, summary statistics were computed to determine the average values of the numeric data across the entire portfolio.

```
Property Size (sqft)          1773.706000
Purchase Price                674905.000000
Down Payment                  134981.000000
Loan Amount                   539924.000000
Interest Rate                 0.022641
Loan Term (Years)             17.396000
Rental Income (per night)     241.559760
Vacancy Rate                  0.093370
Vacancy Rate (%)              9.337000
Yearly Rental Income          88169.312400
Total Operating Expenses (per year) 47535.608860
Yearly Loan Repayment         3157.503020
Total Expenses                50693.111880
Net Operating Income          37476.200520
ROI                           6.842758
NOI_percentage                6.842758
Name: mean, dtype: float64
```

Figure 8: Summary statistics of portfolio

Summary of Portfolio performance by Location and Property Type

The table below illustrates the performance of properties within the portfolio categorized by location and property type. "Profitable" indicates the number of properties generating profit, while "Unprofitable" represents those yielding losses.

```
Properties by Location:
      Profitable  Unprofitable
Location
Beach           231           17
City            248            4
Countryside     257            0
Mountain        241            2

Properties by Property Type:
      Profitable  Unprofitable
Property Type
Apartment       414            4
Condo           196            2
House           367           17
```

Figure 9: Summary of portfolio performance

Conclusion

In conclusion, the analysis offers crucial insights into the financial performance, profitability, and potential risks of the real estate portfolio. These metrics are essential for making well-informed investment decisions and optimizing portfolio management strategies.

The data reveals significant disparities in vacancy rates across different property types and locations. Specifically, apartments exhibit a higher vacancy rate compared to condos and houses, with beach properties showing the highest vacancy rates compared to properties in urban, mountain, and countryside areas.

Furthermore, the income analysis indicates that countryside properties are the most profitable, generating a net operating income higher than total expenses. Conversely, beach properties emerge as the least profitable among the analysed locations.

Moreover, the discounted cash flow analysis over a 25-year period underscores that beach properties may not be profitable to hold over that duration, while other locations prove to be financially viable. Particularly, countryside properties stand out as the most profitable option.

Additionally, examining the present value by apartment type reveals that apartments and condos exhibit high-profit potential, whereas houses appear to be unprofitable over the 25-year holding period.

In summary, this comprehensive analysis provides valuable insights that can guide investment decisions and portfolio management strategies, emphasizing the importance of considering property type and location dynamics for maximizing returns and mitigating risks.

****** For detailed code and visualizations, please refer to the Jupyter Notebook provided in the repository.