



COR1305: Spreadsheet Modelling and Analytics Group 2 Final Report

Airbnb as an Investment: A Financial Analysis and Modelling System for Singapore's Market Dynamics

Name	Student ID
Chung Kar Chun	01435923
Lee Pei Yi	01466725
Ryan Lim Tse Han	01417858
Soh Bing Cheng	01423960
Tan Zhu Kou	01468863
Zia Kok Nuan Fei	01463932

1. Executive Summary

This report outlines the development of an innovative spreadsheet modelling tool designed to assist potential Airbnb investors in navigating Singapore's complex real estate market. Faced with fluctuating property taxes, rising maintenance costs, and an increasingly competitive landscape, investors require a sophisticated analysis tool to guide them to make informed decisions. Our project, undertaken by Group 2, seeks to address this need by offering a clear, data-driven system for evaluating investment opportunities in private properties in Singapore in the Airbnb sector.

2. Introduction to Airbnb

Airbnb is a global online marketplace that connects people looking to rent out their homes with those seeking accommodations in that locale. Founded in 2008, Airbnb has revolutionised the way people think about travel lodging, offering a diverse range of options from single rooms to entire homes, castles, and even treehouses. It enables homeowners to earn income from their property and provides travellers with unique and often more affordable accommodation experiences compared to traditional hotels. With millions of listings across more than 190 countries, Airbnb has become a key player in the sharing economy, making it easier for people to explore the world with a sense of belonging.

3. Problem Statement and Justification

With the growing investment potential of Airbnb increasing to the general public, more and more investors are looking to invest in properties specifically with the intention of renting them out for Airbnb.

However, buying properties in Singapore has always been extremely time consuming. This is due to both the volatility of the real estate market and the apprehension faced by some buyers on the suitability of potential properties in the realm of Airbnb rentals and their potential return on investment. Therefore, our mission is to create a one stop spreadsheet that encompasses all the potential decisions that an investor would need to consider and to break it down into easily digestible bits of information.

Firstly, many buyers can face decision paralysis on the type of location and property to purchase with an abundance of options. Therefore, they need an indication of where the best revenue generating regions are. This suggests a need to summarise the revenue generating potential of the types of apartments in each neighbourhood and region.

Given that a large part of property investments include not only rental income but also property appreciation, investors need to find out the potential returns after selling their property. Therefore, a property appreciation calculation for investors to gauge the full potential return on investment for each potential property is necessary.

Additionally, the purchasing and renting of proposed properties also come with a myriad of fees and monthly payments that are to be made. It is extremely confusing and tedious for first-time investors to research, therefore we include an estimated value of all the required fees and taxes depending on the type of property the investor intends to purchase.

Lastly, the majority of potential investors are unable to make a lump-sum payment and require loans to finance their investment. Therefore, the inclusion of a loan calculator to allow users to easily assess the payments that need to be made each month and also to internalise the interest that accumulates over years.

4. Performance Measures

The success of any property investment is largely influenced by the ability to manage and optimise operational and financial costs. Our model evaluates performance based on a comprehensive understanding of both direct and indirect investment costs. Key among these is the cost associated with financing the property purchase.

Return on Investment (ROI): Our model includes both operational ROI, which looks at the return over the annual cost excluding the initial investment, and total ROI, which takes into account the initial investment cost. The latter gives a holistic view of the investment's profitability over time.

Break-even Analysis: To measure how long it takes for the investment to start generating profit, we calculate the break-even point. It is defined as the number of years it will take for the total net profit to cover the initial investment, allowing investors to set expectations on when they may recover their initial outlay.

Investment Growth Rate: Beyond the annual operational returns, we also measure the asset's appreciation by looking at the increase in property value. This growth rate complements the ROI by showing potential profit from selling the property in the future.

By utilising these metrics, the model provides a robust framework for evaluating property investment performance, ensuring investors can make informed decisions to maximise their returns while minimising costs.

5. Data Collection and Analysis

5.1 Comprehensive Data Collection

We primarily used Airbnb Proprietary data to accurately gauge Airbnb's proprietary datasets to gauge rental price fluctuations, occupancy rates, assets' appreciation. We used a dataset that split rental prices and occupancies by neighbourhoods and property types(*refer to appendix, figure 1 & 2*).

Additionally, to further bolster our dataset, we sourced data through multiple authoritative sources such as real estate market databases in the URA website to extract property valuations and trends. This also included us accessing government and other reliable databases to obtain up-to-date information on property tax rates, relevant regulatory changes, BSD, ABSD, and other miscellaneous fees required for our model.

This also included certain information sources, for miscellaneous fees such as average insurance costs, renovation costs, utility, renovation and agent fees.

All of this data needed to go through our own extraction and cleaning process to be able to filter out irrelevant information and to highlight what was important for us.

Our analytical methods include a suite of Excel's statistical and financial modelling functions to craft detailed investment scenarios, compute ROI analyses, and make informed financial investment. We leverage dynamic functions within Excel to present complex data in an accessible format, revealing patterns, drawing comparisons with historical benchmarks, and enabling predictive modelling for future market conditions.

5.2 Analysis of the data

The data we sourced serves as the foundation for the system's investment scenario simulations, ROI calculations, and financial predictions, ensuring that the analyses are based on trustworthy and consistent information. As a result, any inconsistencies, duplicates, or unnecessary data points are removed from the dataset. For real estate and Airbnb market data, this entails standardising property descriptions and removing listings that do not comply with local standards.

6. Proposed System Scope and User Functionalities

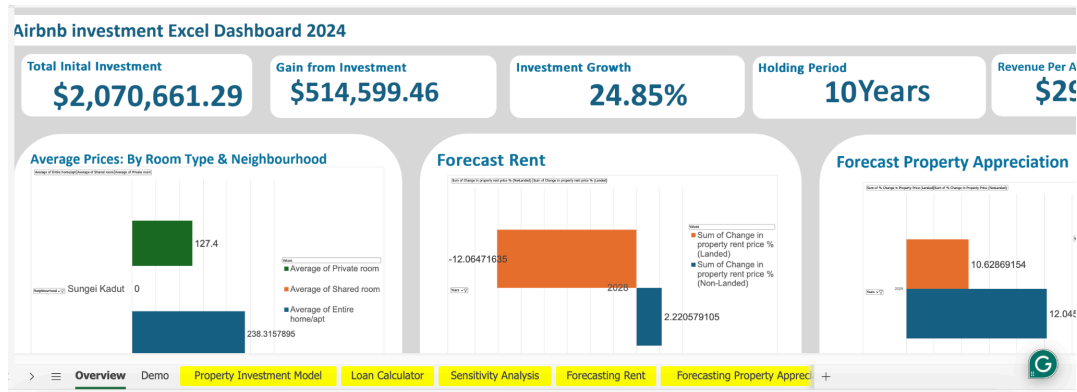


Figure 3: Dashboard of the model showing key output

6.1 Objective 1: Revenue indication based on neighbourhood and property

Our first objective was to allow investors to determine the revenue generating potential of each neighbourhood and type of property. This can be calculated by taking the average daily rental price and the average occupancy rate by region filtered by apartment type using the AVERAGEIFS() function.

Inputs	
Property Location/Type	
Neighbourhood	Pasir Ris
Property Type	Condo
Region	Outside Central Region
Room Type	Private room
Bedrooms	1
Beds	2
Profile Of Buyer	
No of owned property	1
Citizen	Singaporean
Revenue	
Price	\$80.00
Rented out (out of 365 days)	365
Occupancy	100%
Revenue per Annum	\$29,200.00

Figure 4: Inputs and Revenue of model

As can be seen in the figure above, users can select certain parameters such as:

- Neighbourhood
- Property Type
- Region
- Room Type
- Number of Bedrooms
- Number of Beds

These parameters were chosen to be as user friendly as possible with many of the parameters being used on the official Airbnb website, therefore avoiding as much confusion as possible.

With these parameters, the spreadsheet would show the average daily rental price of previous properties with the same parameters as selected, as well as the average occupancy. These values would then be used to calculate the average revenue that investors can expect from a property of the values that they have chosen.

6.2 Objective 2: Inclusion of fees and loans

To assist potential investors in navigating the complex financial aspects of property investment, we pull the property valuation estimates from transaction dataset based on inputs of the user given in objective 1, this is done by using FILTER(SEARCH()) function to allow for keywords search as no fixed neighbourhood was given. Afterwhich, using this valuation, we've accounted for all the requisite duties and taxes, which vary based on the investor's residency status as previously indicated. Our comprehensive approach also encompasses additional costs, such as legal fees, agent commissions, and any expenses related to property renovation.

<i>Financial Investment</i>		<i>Assumptions/Comments</i>
Property valuation Estimate	\$1,474,129.03	
Renovation	\$100,000.00	\$81,376.50-\$284638.20
Buyer Stamp Duty	\$43,565.16	
Add Buyer Stamp Duty	\$294,825.81	
Legal fee	\$3,000.00	Assumption
Agent Fee	\$14,741.29	1.00%
Valuation Fee	\$400.00	200-500
Do you want to take loan? (Yes/No)	Yes	
Loan Amount	\$1,000,000.00	
Annual Interest	4.40%	Fixed Rate at 4.40%
Total Loan Duration (years)	10	
Loan Interest (If taking loan)	\$440,000.00	
Total Initial Investment	\$2,370,661.29	

Figure 5: One-time investment costs and loan

If the user indicates “Yes” as an input to whether they want to take out a loan, the loan amount and the down payment, the calculator will calculate the loan interest based on a default fixed input of 4% interest rate. They can then use the Loan Calculator model (*shown in figure 6*) which helps in showing key information such as

monthly repayment, loan and how long it is needed to pay for the property. Otherwise, the total initial investment will use SUM() to sum up valuation, BSD, ABSD, Fees without the loan interest.

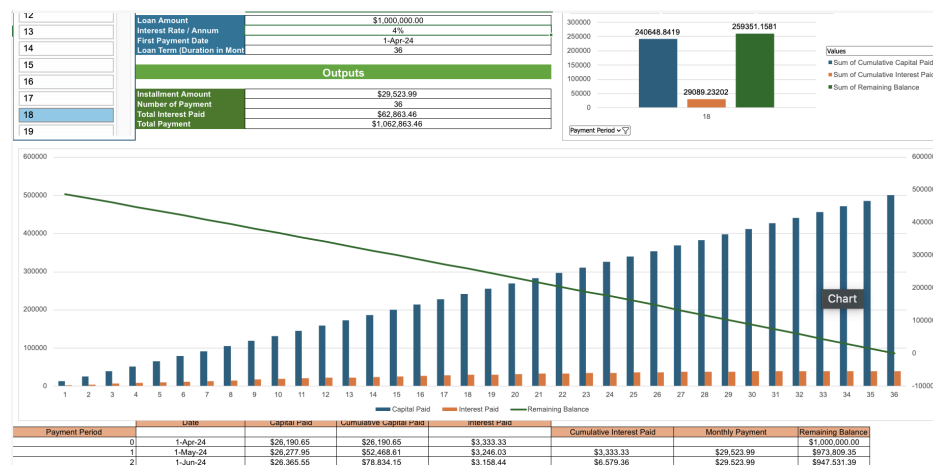


Figure 6: Loan Calculator

6.3 Objective 3: Profit Analysis

With the automated calculations, potential investors can have a comprehensive forecast for profit within a glance. Which takes into account the aforementioned factors to give users their total rental profit, time to break even, depending on whether they choose to keep or sell their property in the future. If they wish to sell the property, they get to see the difference in holding period for the property affecting the gains from investment using [Final forecasted property value + (Total Profit per Annum*Holding Period)] - Total Initial Investment. The User can then use solver to see the Holding Period needed to breakeven for their investment (*Shown in figure 8*).

Profit Analysis	
Without property investment value	
Revenue per Annum	\$29,200.00
Cost per Annum	\$9,459.75
Total Profit per Annum	\$19,740.25
Operational ROI	208.68%
With property investment value	
Total Initial Investment	\$2,370,661.29
ROI (Include Initial investment)	0.83%
Years to Breakeven	120.1
After selling property	
Holding Period	10
Final forecasted property value	\$2,387,858.25
Gains from investment	\$214,599.46
Investment Growth	9.05%

Figure 7: Profit Analysis

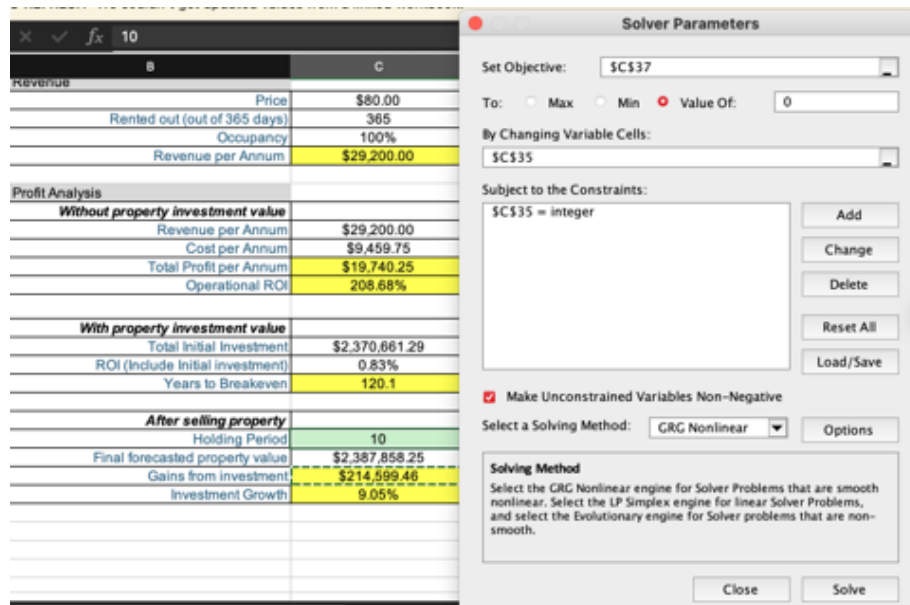


Figure 8: Solver to use for break-even analysis

6.4 Objective 4 : Forecasting Property and Rental Appreciation

With the apparent volatility of the real estate and rental market, we have included 2 forecasts to be one step ahead. This is done by sourcing for datasets of change in property and property rent prices to see the pattern of each year's appreciation or depreciation. For both forecasts, we used 2000-2023 empirical data and used the PERCENTILE() function to predict prices 10 or 20 years down the line due to the volatility of property and property rent prices.

#1 Rental Forecast

By getting the predictions of rent prices, we then allow users to filter by region, property type (landed and non-landed) and room type to search for the adjusted average rent prices per night that is predicted (Refer to appendix, figure 9). Assuming that it is rented out all year round, we calculate the revenue gained from rental and accumulate it throughout the years that the user wishes to hold. This allows them to see the changes in rent prices and a more predictive forecast of revenue they are going to get from renting.

#2 Property Appreciation

This model allows users to choose their current property type and prices to receive their personalised forecast for the next 20 years. Some assumptions are made whereby the cost is uniform throughout the years and the year of property purchase

is in 2023. Overall, this model suggests optimal holding period for ROI maximisation.(Refer to appendix, figure 10)

These 2 forecasts would come together to give investors an accurate depiction of the future.

6.5 Model Limitations:

This model is limited to data taken from the latest 2023. Therefore, should no data be added, forecasting may not be as accurate.

Model is limited to the 5 most common types of private property found in Singapore. Other types of property are not included. Additionally, users cannot use this model should they choose to rent out their HDB flats, or to forecast its appreciation.

The loan calculator provided is limited in the types of loans available. Calculations are only meant for simple loans with a standard interest rate with no down payment or final payment, though they can provide rough estimations for more complex cases. This is because we assumed that potential investors have the financial capacity to cover the necessary balloon payments.

Some variations of property type, neighbourhood, bedroom and beds do not have enough data to make a forecast for certain users. Therefore, users would need to assume that these regions are not popular enough and it may not be ideal to invest in a property there.

7. BlackBox Model and Influence Diagram

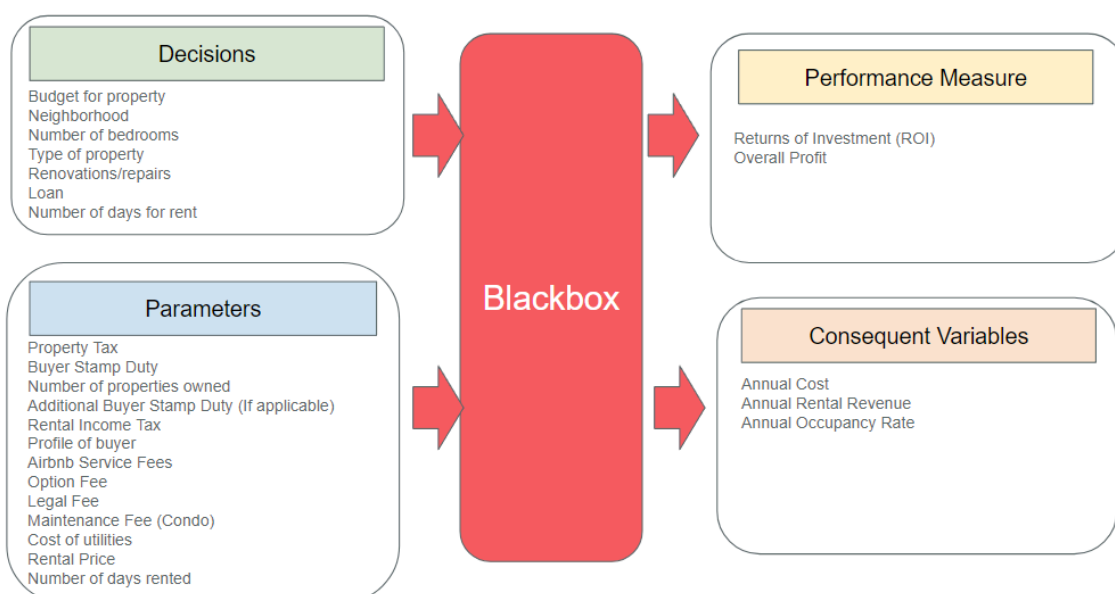


Figure 11: Blackbox Diagram

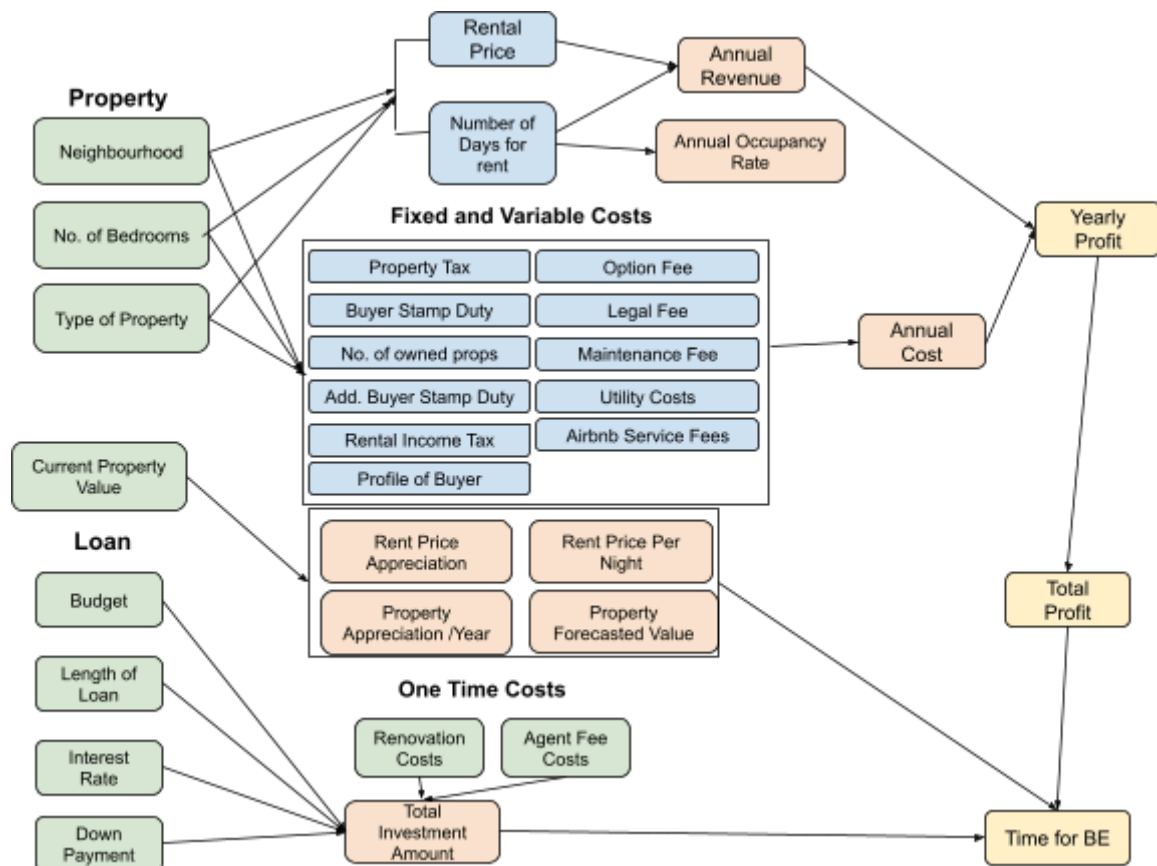


Figure 12: Influence Diagram

8. Lessons learnt and Conclusion

One of the key lessons that we have learnt as a group was on how to make models that are user friendly, but yet still packed with data. With there being many steps in the purchase of property, we needed to condense all of the options into an easy to use sheet. This was done with the inclusion of a dashboard and a mainpage with colour coding between the user inputs and the results that are shown.

Additionally another lesson that we had learnt was the importance of having a large dataset. As this current model is limited by the lack of variations in beds, bedrooms and property types in different neighbourhoods, we are unable to forecast for certain variations. We therefore needed to rely on certain assumptions that these variations that had no data were not present and were not as profitable as others.

Therefore to conclude, although this spreadsheet might not be the most accurate tool for calculating ROI for future Airbnb investments due to the limitations stated above. It is a useful tool for potential investors to accurately determine a ballpark idea for when they should determine certain parts of their investment. Additionally, it provides a one stop solution for investors to understand all the complexities of investing in Airbnb properties and to ensure that there are no surprises when they eventually do decide to invest in such a property.

9. Member's Roles

Chun Kar Chun: Data Collection and cleaning, Forecasts for Rent and Property Appreciation

Lee Pei Yi: Dashboard, Property, Loan Calculator and various taxes

Ryan Lim Tse Han: Revenue Calculations, Filters for different variations, Data Collection and cleaning

Soh Bing Cheng: Property Investment Model, Forecasts for Rent and Property Appreciation

Tan Zhu Kou: Data Collection and cleaning, Forecasts for Rent and Property Appreciation

Zia Kok Nuan Fei: Loan Calculator, Dashboard

10. Appendix

Main Airbnb Dataset

<http://insideairbnb.com/get-the-data/>

Property Appreciation Dataset

<https://www.ura.gov.sg/property-market-information/pmiResidentialTimeseries>

Utility Estimations

<https://www.valuechampion.sg/budgeting-saving/average-cost-monthly-singapore-power-sp-bills>

Renovation Estimations

<https://www.valuechampion.sg/renovation-loans/average-cost-home-renovation-singapore>

Insurance Estimations

<https://www.valuechampion.sg/home-insurance/average-cost-home-insurance>
<https://www.moneysmart.sg/home-insurance/fwd-home-insurance-condo-1-room>

Past Property Sales Dataset

<https://www.ura.gov.sg/property-market-information/pmiResidentialTransactionSearch>

BSD Rates

[https://www.iras.gov.sg/taxes/stamp-duty/for-property/buying-or-acquiring-property/buyer's-stamp-duty-\(bsd\)](https://www.iras.gov.sg/taxes/stamp-duty/for-property/buying-or-acquiring-property/buyer's-stamp-duty-(bsd))

ADBSD Rates

[https://www.iras.gov.sg/taxes/stamp-duty/for-property/buying-or-acquiring-property/additional-buyer's-stamp-duty-\(absd\)](https://www.iras.gov.sg/taxes/stamp-duty/for-property/buying-or-acquiring-property/additional-buyer's-stamp-duty-(absd))

Figures

neighbourhood	latitude	longitude	room_type	price	minimum_nights	number_of_reviews	annual_unrented_days	occupancy_rate	Bedroom	Beds
Tampines	1.34754	103.95958	Private room	\$80.00	92	24	91	75.07%	1	1
Tampines	1.34531	103.961	Private room	\$80.00	92	46	91	75.07%	1	2
Tampines	1.34798	103.9617	Private room	\$89.00	92	8	362	0.82%	1	1
Tampines	1.34361	103.95717	Private room	\$83.00	92	76	0	100.00%	1	1
Tampines	1.3464	103.96256	Private room	\$70.00	92	286	365	0.00%	1	1
Tampines	1.346	103.9626	Private room	\$80.00	92	248	365	0.00%	1	1
Tampines	1.3446	103.96223	Private room	\$60.00	92	296	181	50.41%	1	1
Tampines	1.34806	103.95858	Private room	\$98.00	92	13	365	0.00%	1	1
Tampines	1.34571	103.96073	Private room	\$170.00	92	151	365	0.00%	1	1
Tampines	1.34159	103.95805	Private room	\$89.00	93	11	91	75.07%	1	1
Tampines	1.35329	103.93195	Shared room	\$119.00	92	0	0	100.00%	1	1
Tampines	1.34537	103.95973	Private room	\$80.00	92	1	85	76.71%	1	1
Tampines	1.3582	103.93872	Private room	\$70.00	92	0	365	0.00%	1	1
Tampines	1.32683	103.95444	Private room	\$70.00	92	2	296	18.90%	1	1
Tampines	1.34045	103.95894	Private room	\$70.00	180	0	0	100.00%	1	1
Tampines	1.3380006	103.9581479	Shared room	\$70.00	92	0	0	100.00%	1	1
Tampines	1.34816	103.93238	Private room	\$100.00	180	0	0	100.00%	1	1
Tampines	1.34537	103.95887	Private room	\$180.00	92	19	55	84.93%	2	3
Tampines	1.3455	103.96045	Private room	\$130.00	92	203	85	76.71%	2	1
Tampines	1.35549	103.95915	Private room	\$120.00	92	28	88	75.89%	2	2
Tampines	1.34896	103.92735	Entire home/apt	\$180.00	92	0	0	100.00%	2	2
Tampines	1.34048	103.9519	Entire home/apt	\$170.00	92	0	326	10.68%	2	2
Tampines	1.3449	103.95979	Private room	\$130.00	92	12	54	85.21%	3	5
Tampines	1.34789	103.93969	Entire home/apt	\$200.00	100	148	365	0.00%	3	3
Tampines	1.35841	103.94056	Private room	\$80.00	92	0	181	50.41%	Studio	1

Figure 1: Airbnb dataset

Project Name	Transacted Price	Area (SQF)	Unit Price (\$ PS)	Sale Date	Street Name	Type of Sale	Type of Area	Area (SQM)	Unit #
MARINA ONE RESIDENCES	1540000	731.95	2104	Feb-24	MARINA WAY	Resale	Strata	68	
THE SAIL @ MARINA BAY	1300000	656.6	1980	Feb-24	MARINA BOULEVARD	Resale	Strata	61	
THE SAIL @ MARINA BAY	1630000	861.12	1893	Feb-24	MARINA BOULEVARD	Resale	Strata	80	
ROBINSON SUITES	1800000	936.47	1922	Jan-24	ROBINSON ROAD	Resale	Strata	87	
ONE SHENTON	1350000	871.88	1548	Jan-24	SHENTON WAY	Resale	Strata	81	
THE SAIL @ MARINA BAY	3500000	1625.36	2153	Jan-24	MARINA BOULEVARD	Resale	Strata	151	
ONE SHENTON	1620000	968.76	1672	Jan-24	SHENTON WAY	Resale	Strata	90	
ONE SHENTON	4060000	2217.38	1831	Jan-24	SHENTON WAY	Resale	Strata	206	
ONE SHENTON	1148000	581.26	1975	Jan-24	SHENTON WAY	Resale	Strata	54	
THE SAIL @ MARINA BAY	1330000	678.13	1961	Jan-24	MARINA BOULEVARD	Resale	Strata	63	
THE SAIL @ MARINA BAY	1650000	882.65	1869	Jan-24	MARINA BOULEVARD	Resale	Strata	82	
ONE SHENTON	1700000	904.18	1880	Jan-24	SHENTON WAY	Resale	Strata	84	
THE CLIFT	970000	495.14	1959	Jan-24	MCCALLUM STREET	Resale	Strata	46	
PEOPLE'S PARK COMPLEX	1020000	1119.46	911	Jan-24	PARK ROAD	Resale	Strata	104	
SPOTTISWOODE 18	918000	387.5	2369	Feb-24	SPOTTISWOODE PARK ROAD	Resale	Strata	36	
THE BEACON	1800000	1162.51	1548	Feb-24	CANTONMENT ROAD	Resale	Strata	108	
SPOTTISWOODE SUITES	2070000	871.88	2374	Feb-24	SPOTTISWOODE PARK ROAD	Resale	Strata	81	
ONE BERNAM	2238000	871.88	2567	Feb-24	BERNAM STREET	New Sale	Strata	81	
SPOTTISWOODE 18	1180000	505.91	2332	Feb-24	SPOTTISWOODE PARK ROAD	Resale	Strata	47	
ONE BERNAM	2318000	828.83	2797	Feb-24	BERNAM STREET	New Sale	Strata	77	
ICON	1348888	785.77	1717	Feb-24	GOPENG STREET	Resale	Strata	73	
INTERNATIONAL PLAZA	1300000	1033.34	1258	Feb-24	ANSON ROAD	Resale	Strata	96	

Figure 2: Transaction prices of private properties

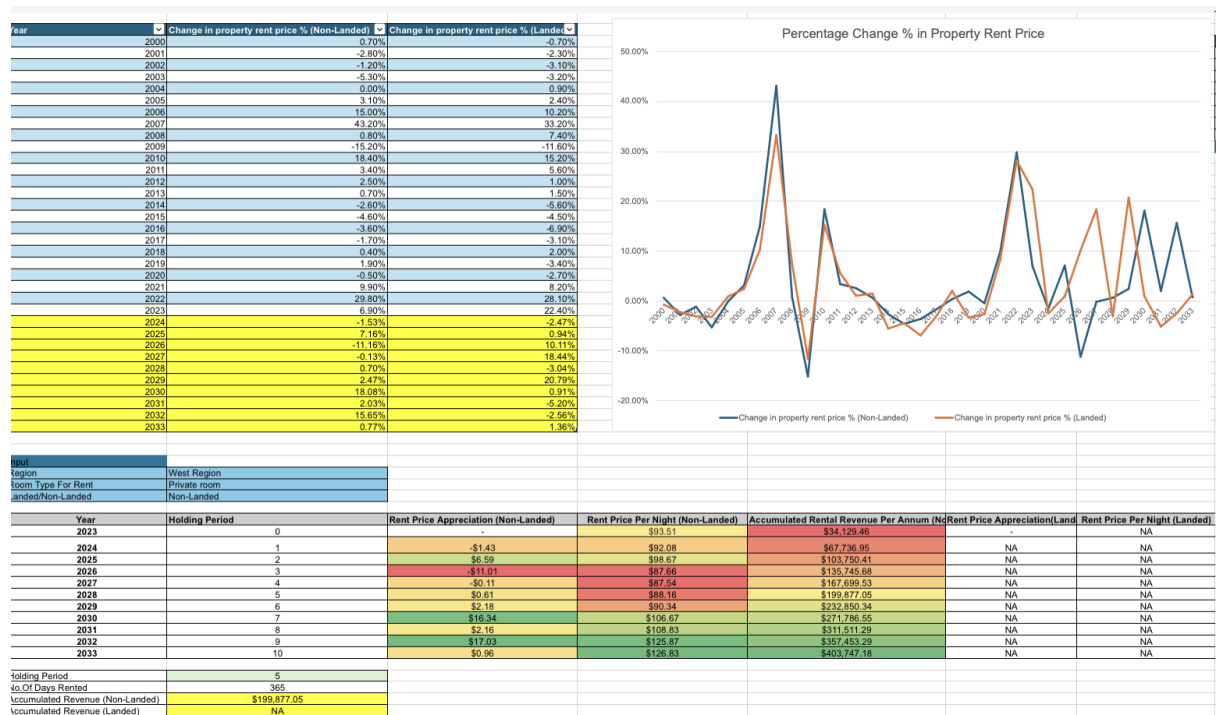


Figure 9: Forecasting of Property Rent Prices Model

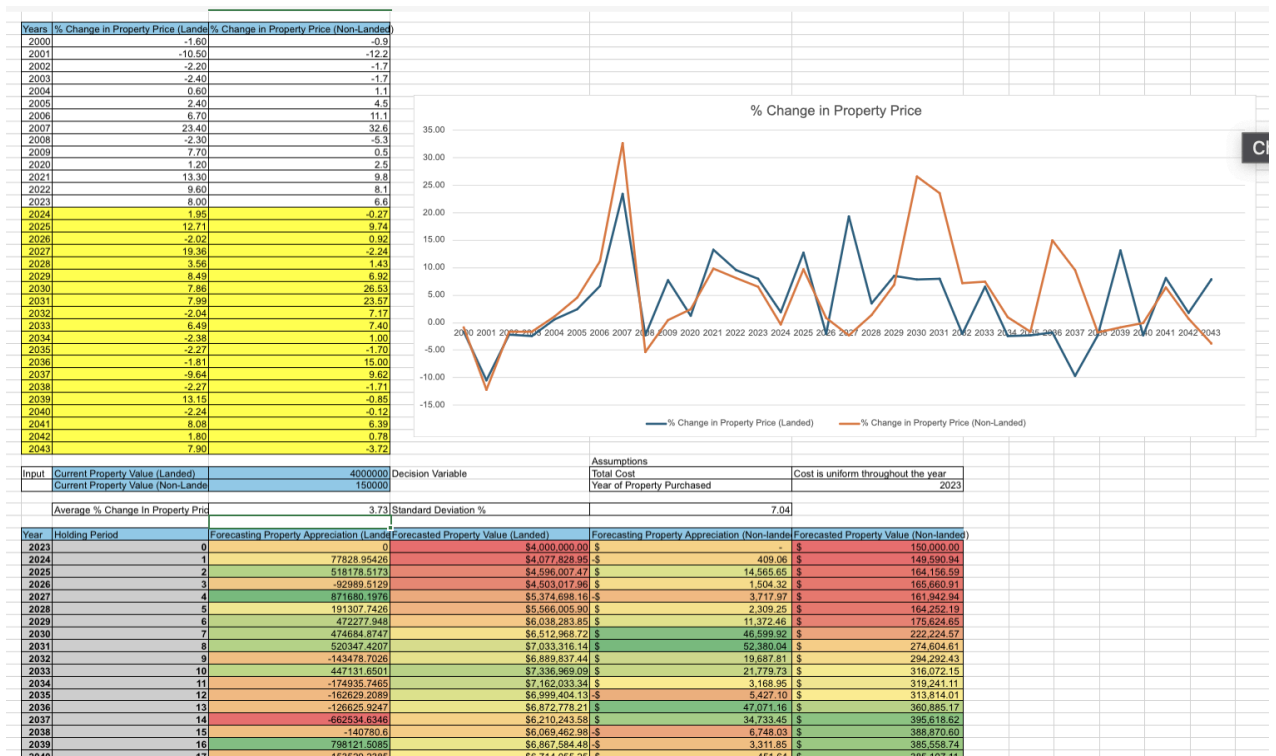


Figure 10: Forecasting of Property Prices Model