

The purpose of this slide is to fulfill the requirements for DSI 39, Project 2.

Group Name: The Colony

Members:

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Role:

CPFB Data Science team

Audience:

CPFB Senior Management

Problem Statement:

With rising resale flat prices and record high prices such as the latest 4 room flat in Tiong Bahru at S\$1.5mil. How can CPF board assist potential homeowners to plan their housing finances better?

# **Analysis and Prediction of HDB Resale Flat Price**

**CPFB Senior Management Meeting**  
**15 Sep 2023**



# Meeting Agenda

01

**HDB RESALE FLAT LANDSCAPE**

02

**IMPORTANCE OF KNOWING RESALE PRICE**

03

**PREDICTIVE MODELLING**

04

**RECOMMENDATIONS**



# HDB Resale Prices are at a Record High

THE STRAITS TIMES SINGAPORE



HDB resale prices jumped 12.7% in 2021, record 259 million-dollar flats sold

Record of 259 million-dollar HDB resale flats in 2021!

A large blue arrow points from the headline text to the underlined "259 million-dollar" text in the summary.

Source:  
<https://www.straitstimes.com/singapore/housing/hdb-resale-prices-jumped-127-in-2021-record-259-million-dollar-flats-sold>

today Singapore World Big Read Adulting 101 Gen Y Speaks Gen Z Speaks Voices Commentary 8 Days More



**Record 21 4-room HDB resale flats sold for over S\$1m in Q1 2023; analysts expect trend to continue**

More than 20 4room HDB resale flats sold over S\$1 million!

A large blue arrow points from the headline text to the underlined "S\$1 million" text in the summary.

Source:  
[todayonline.com/singapore/record-4-room-resale-flats-2143666](https://todayonline.com/singapore/record-4-room-resale-flats-2143666)

# HDB Resale Flat Landscape

56%

40%

\$3.9 Bn

of Singaporeans who are in their 20s are **worried that they cannot afford a home.**

of Singaporeans are worried that they will **not be able to pay their monthly instalments for their mortgage.**

**CPF monies are used by homeowners to pay their housing loan** instalments in 2022.

*Source:*

<https://www.ocbc.com/group/financial-wellness-index/understand-the-index.html>

# Available data on HDB resale prices are limited

## 1. Toa Payoh

Size of flat	Price
3-room	S\$330,000 - S\$800,000
4-room	S\$530,000 - S\$1,100,000
5-room	S\$700,000 - S\$1,300,000

## 2. Queenstown

Size of flat	Price
3-room	S\$300,000 - S\$740,000
4-room	S\$600,000 - S\$950,000
5-room	S\$680,000 - S\$1,400,000

Estimated HDB resale  
prices found online  
varied significantly  
from  
**\$500k - \$700k !**

Source:

<https://www.singsaver.com.sg/blog/the-cheapest-and-most-expensive-hdb-estates-for-resale-flats>



How can our agency assist potential homeowners to plan their housing finances better?

# **Knowing the price of the HDB resale flat that they intend to purchase, aspiring homeowners can better plan their finances**



**AMOUNT OF CPF  
SAVINGS YOU CAN USE**



**HOUSING  
LOAN AMOUNT  
YOU CAN GET**

*Source:*

<https://www.propertyguru.com.sg/property-guides/hdb-valuation-sales-12882>

# Project Objective



Fast and High  
Accuracy



Intuitive &  
Easy to Use

We aim to deploy a HDB resale price calculator that is reliable and accurate ( $r^2 > 0.8$ , RMSE < \$50k) which is intuitive and easy (minimal number of interpretable features) for home owners to use.

RMSE is the measure of the differences between values (sample or population values) predicted by a model or an estimator and the values observed

Coefficient of determination,  $R^2$  is the proportion of the variation in the dependent variable that is predictable from the independent variable(s)



**HOW DO WE GET A USER-  
FRIENDLY & ACCURATE  
CALCULATOR?**

# Methodology for Price Prediction

## ● Understanding the Dataset

- 76 potential features\* to predict resale price
- Data period: Mar 2012 - Apr 2021

## ● Principle of Feature\* Selection

- High correlation with resale price (e.g., larger floor area leads to higher price)
- Literature Review & Domain expertise
- High variability (i.e., feature values that changes with the resale price)

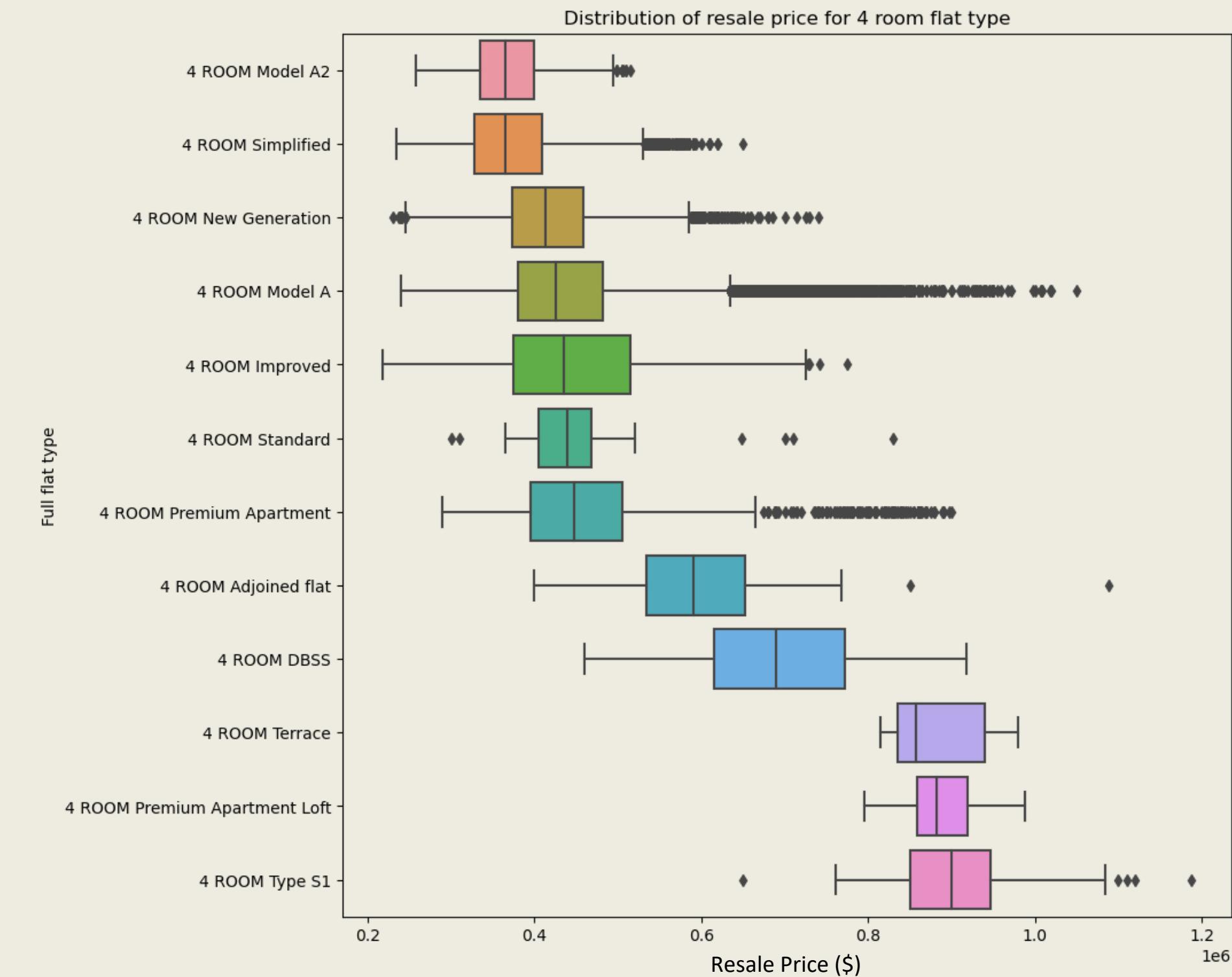
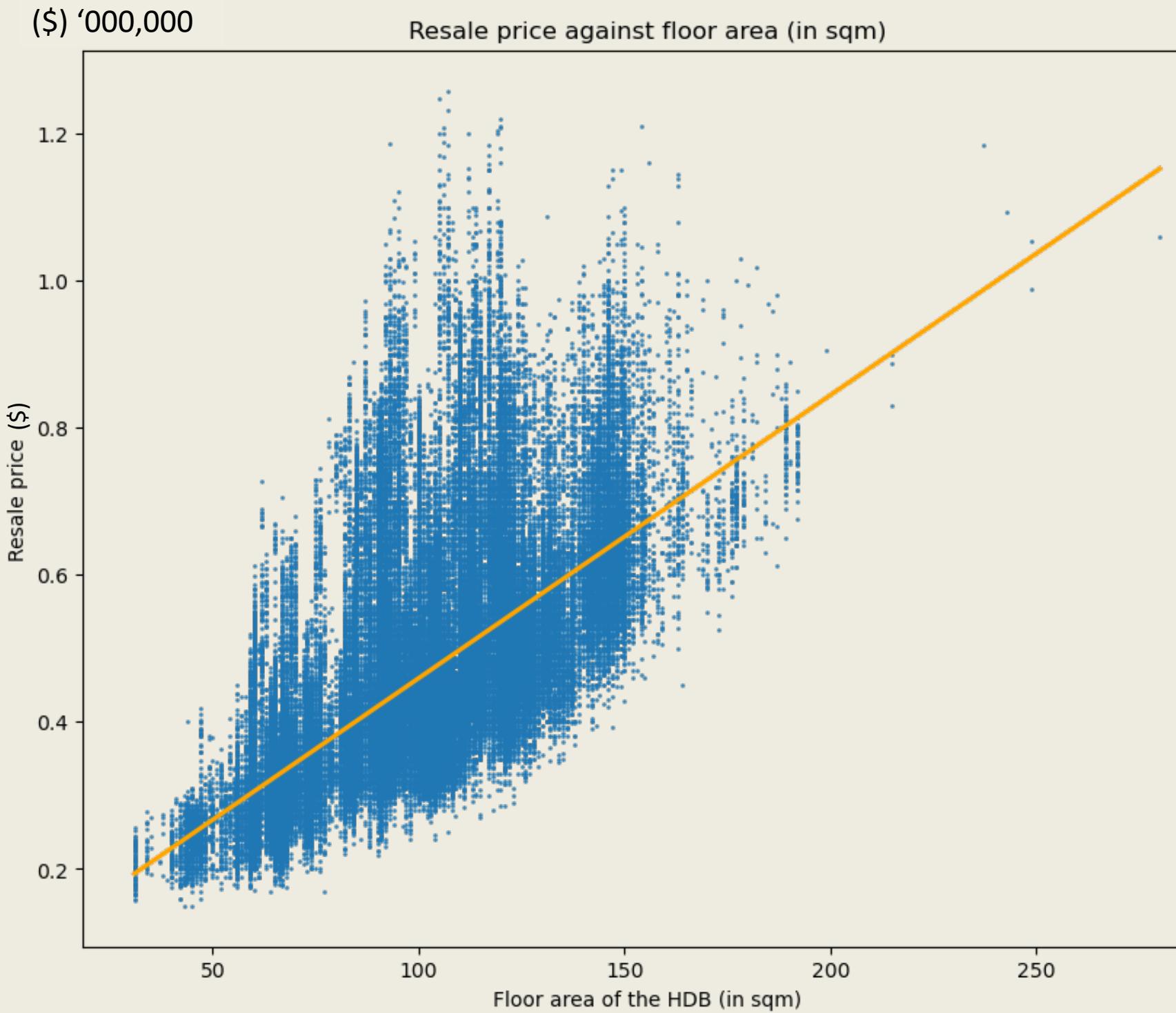
\*Note:

Feature = Potential factor that will affect the HDB resale price

# Main categories of features affecting resale price



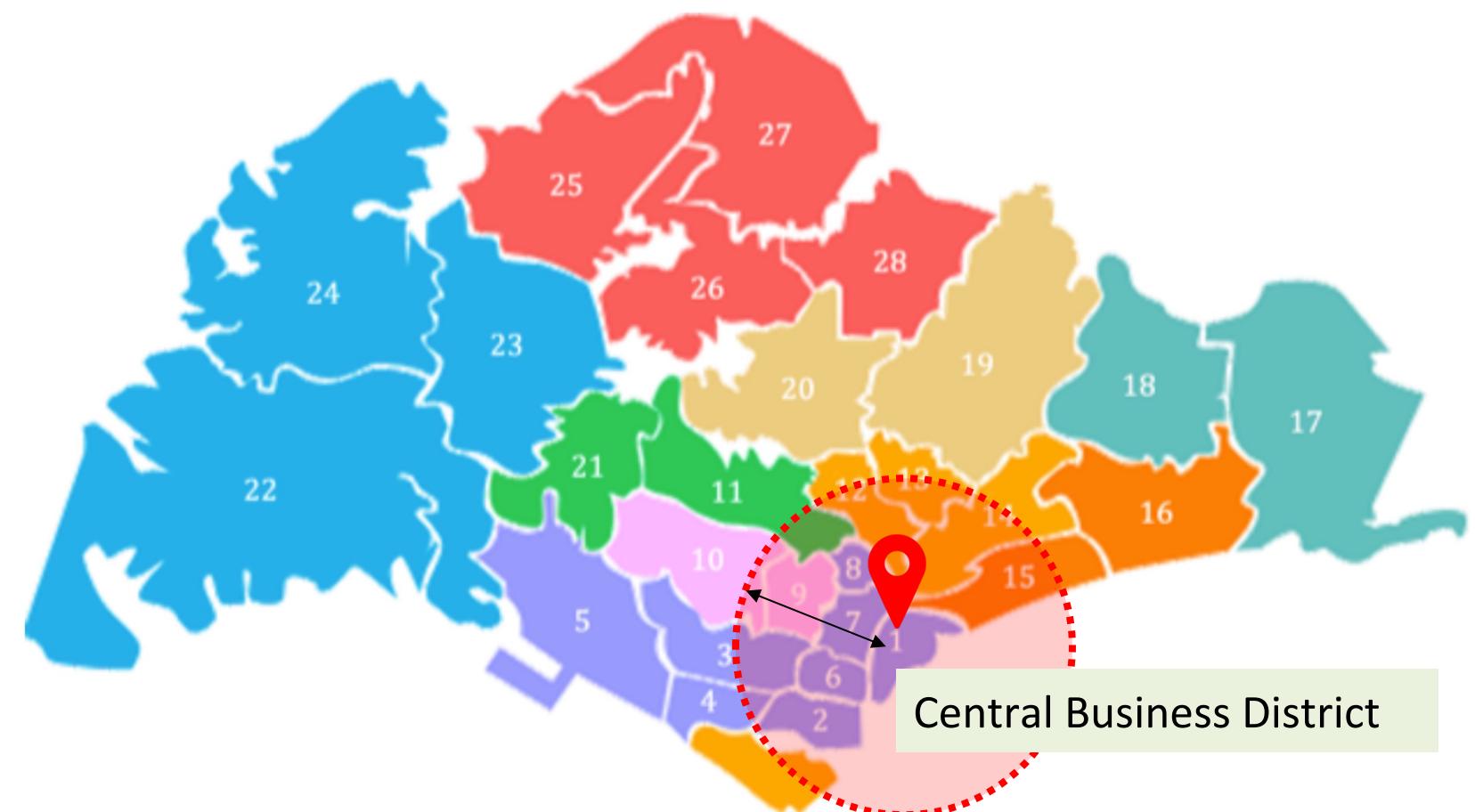
# A flat's floor size positively correlates with resale price; the flat model also shows varying median resale prices



# Postal information and proximities of flats to Central Business District (CBD) were surfaced as potential factors influencing property prices

Postal District	Postal Sector (1st 2 digits of postal codes)	General Location
01	01, 02, 03, 04, 05, 06	Raffles Place, Cecil, Marina, People's Park
02	07, 08	Anson, Tanjong Pagar
03	14, 15, 16	Queenstown, Tiong Bahru
04	09, 10	Telok Blangah, Harbourfront
05	11, 12, 13	Pasir Panjang, Hong Leong Garden, Clementi New Town

**Singapore District Code Map Demarcation**



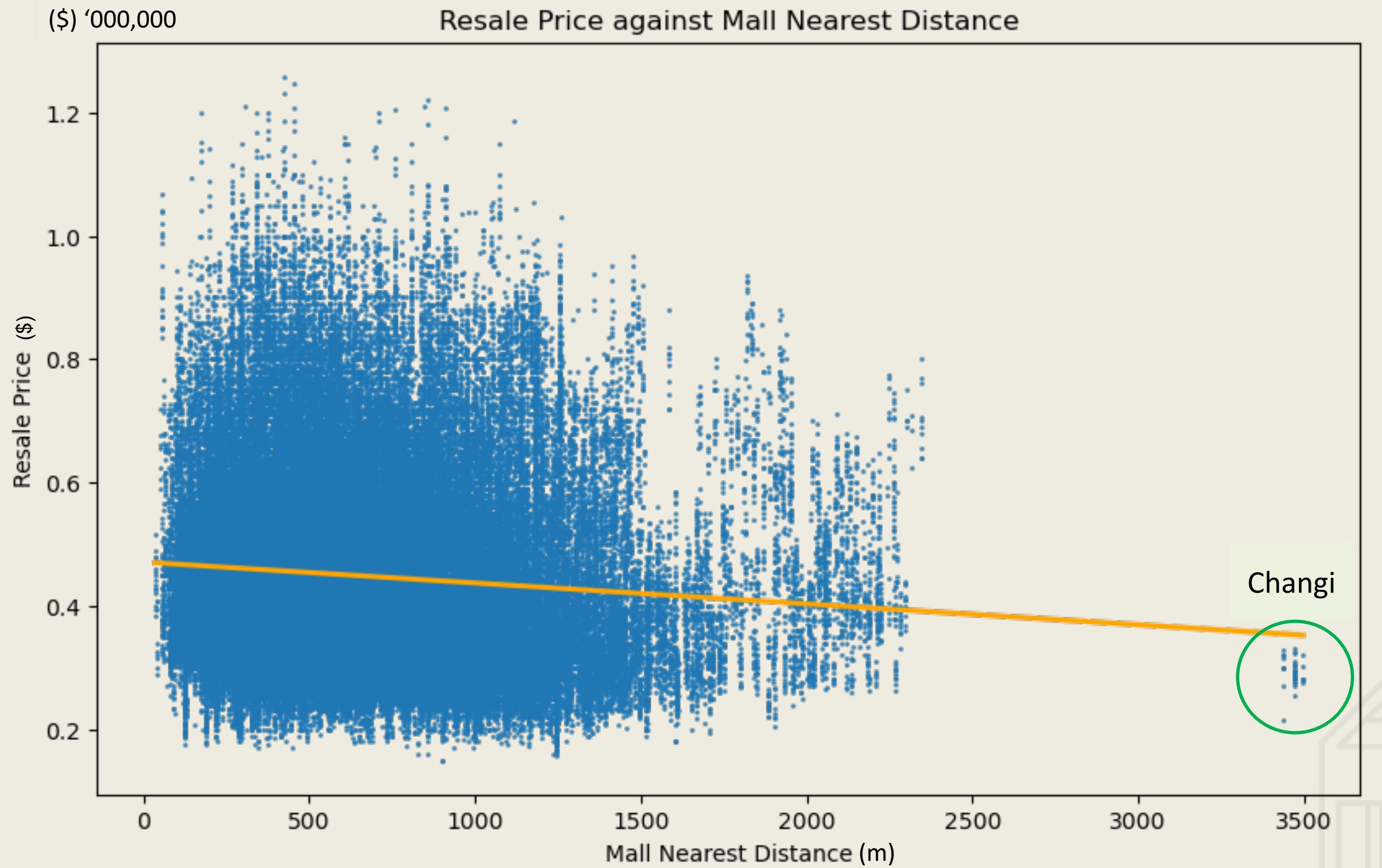
*Source:*

<https://dr.ntu.edu.sg/handle/10356/147773>

<https://www.mingproperty.sg/singapore-district-code/>

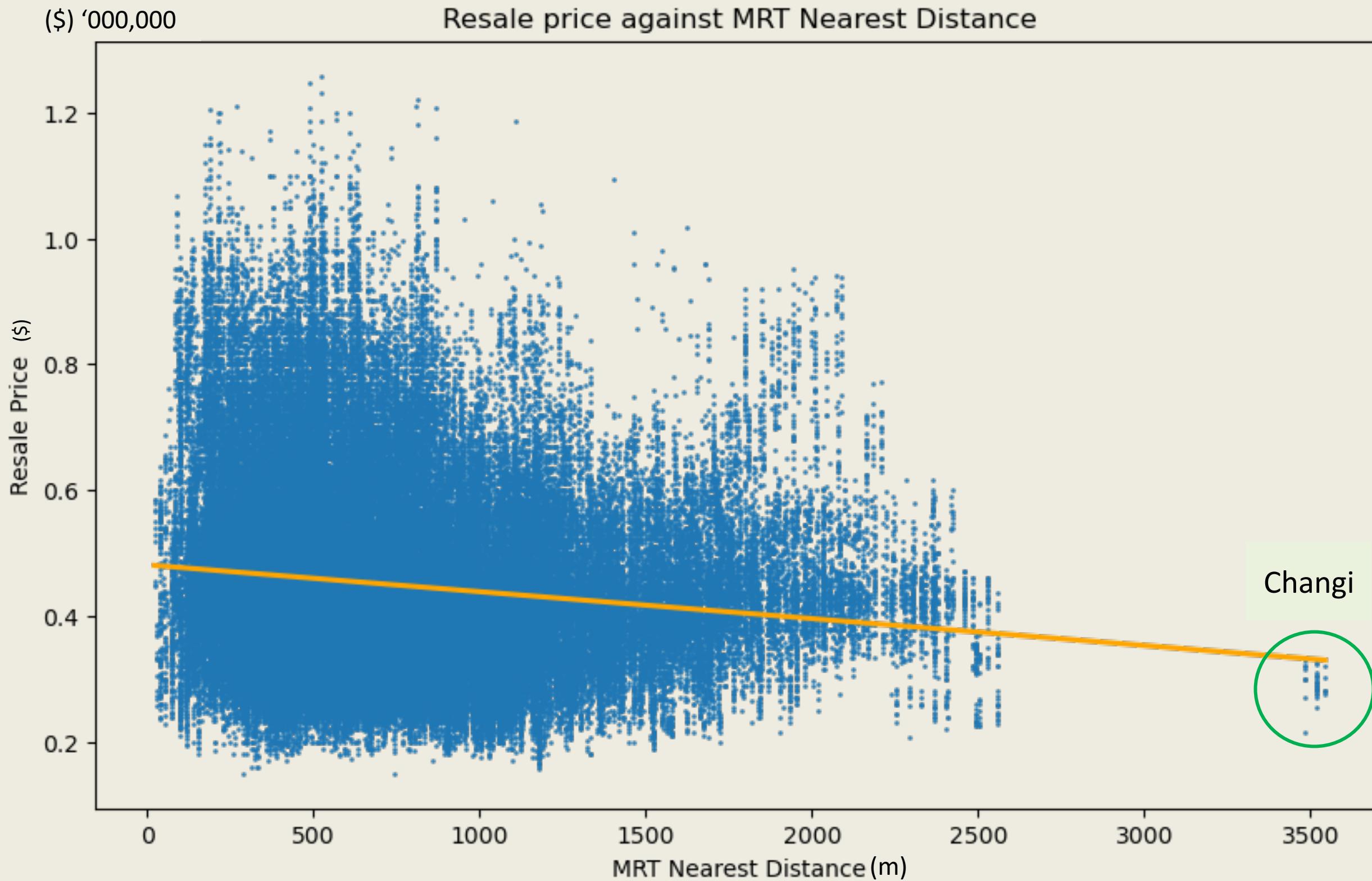
<https://blog.moneysmart.sg/property/rent-singapore-cost-guide/>

# Flats located near the Mall have a higher resale price



Potential homeowners looking for relatively cheaper resale flats, but want to have a mall nearby, should avoid Changi

# Flats located near the MRT have a higher resale price



Potential homeowners looking for relatively cheaper resale flats, but want to have a MRT nearby, should avoid Changi

# 9 Final Features Affecting Resale Price



FLAT ATTRIBUTES

- Year of HDB flat transaction
- Floor area of the HDB flat
- Age of the HDB flat
- Flat model and type of the HDB flat
- Storey of the HDB



LOCATION

- Postal sector of the HDB flat
- Distance of HDB flat from CBD area



AMENITIES

- Distance of HDB flat from nearest mall



ACCESSIBILITY

- Distance of HDB flat from nearest MRT

# Linear Regression Model chosen as it has the best performance and faster runtime than Lasso

Regression Model	Train R <sup>2</sup> Score (closer to 1 is better)	Test R <sup>2</sup> Score (closer to 1 is better)	Cross Validation Score (closer to 1 is better)	RMSE (lower is better)	Total Runtime (s) (lower is better)
Linear	0.89	0.89	0.89	48,132	11
Lasso	0.89	0.89	0.89	48,132	463
Ridge	0.89	0.89	0.89	48,135	3

- Train Score ≈ Test Score: No sign of underfitting and overfitting
- Consistent Cross Val score: Model reliability

Using linear regression model, 89% of the variations in resale price can be explained by our selected features, with ±\$48,000 price difference.

RMSE is the measure of the differences between values predicted by a model and the actual values observed

Coefficient of determination,  $R^2$  is the proportion of the variation in the dependent variable that is predictable from the independent variable(s)



# HDB RESALE PRICE CALCULATOR DEMO

SCAN HERE FOR  
CALCULATOR



<https://dsi39-project2-colony.streamlit.app/>

# Summary

- **Problem:** The price of HDB resale flats are rising and many are concerned about the finances. To help people better plan for it, there is demand for a HDB resale price calculator.
- **Result:**
  - 9 key features are selected.
  - A linear regression model built, that is reliable and shows consistent performance across different datasets.
  - A working web app that is accessible via internet devices



# Moving Forward

## IMPROVE PREDICTION SCORE

- Explore other factors (e.g. impact of cooling measures on resale price)
- Explore other machine learning models

## USER TESTING

- Test and improve app usability with focus groups

## PUBLIC LAUNCH

- Campaign launch to educate housing finance planning with calculation.

Phase 1

Phase 2

Phase 3



# Thank You



# Interesting find: Resale flat price is not affected by nearby primary schools

