HDB Resale Price Analysis

Background

- HDB resale data were obtained from Data.gov in 5 separate files and were combined

- Coordinates were obtained for HDB resale flats, MRT stations and shopping malls using Onemap API

- COE prices data were obtained from LTA Data Mall

- Data visualisation were mostly done on Tableau ([link](#))

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Data Visualisation

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HDB Resale Market Trend

Yearly HDB Median Resale Price by Towns

Year of Month
1990 to 2023

Town	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
ANG MO KIO	47,200	47,000	50,000	88,000	106,000	140,000	200,000	245,000	183,000	171,000	175,000	160,000	165,000	180,000	191,000	190,000	185,000	200,000	256,000
BEDOK	57,000	57,000	64,000	89,000	140,000	169,000	223,000	280,000	228,000	209,000	218,000	200,000	190,000	195,000	200,000	200,000	190,000	208,000	257,000
BISHAN	65,500	100,000	138,800	222,400	270,000	340,000	430,000	421,500	362,000	337,000	342,750	320,000	321,250	310,000	298,000	293,000	300,000	348,000	411,000
BUKIT BATOK	72,000	65,000	75,000	118,000	150,000	170,000	198,000	242,000	192,000	203,000	180,000	208,500	213,000	189,000	192,750	195,000	188,000	209,000	285,000
BUKIT MERAH	52,950	61,000	61,000	98,000	115,000	143,900	200,000	227,000	180,000	170,000	188,000	175,000	177,000	186,000	200,000	206,500	239,000	307,000	356,500
BUKIT PANJANG		81,000	80,000	140,500	175,000	197,000	233,000	270,000	228,250	216,000	218,000	207,000	205,500	216,250	222,375	230,000	230,000	250,000	300,000
BUKIT TIMAH	46,500	71,500	72,250	185,000	290,000	385,000	419,500	510,000	352,000	380,000	352,400	318,500	300,000	288,000	302,750	308,000	306,250	340,000	436,000
CENTRAL AREA	64,000	63,000	78,000	102,000	130,000	160,000	209,500	232,000	188,500	175,000	198,000	182,000	188,000	210,000	219,500	212,000	225,000	260,000	312,900
CHOA CHU KANG	57,000	57,000	63,000	100,000	205,000	232,000	312,000	330,000	285,000	316,500	292,000	257,000	239,000	243,000	246,000	246,000	240,000	257,000	310,000
CLEMENTI	55,000	52,000	61,500	95,000	111,000	150,000	208,000	250,000	194,250	182,000	180,500	181,500	171,000	188,888	200,000	198,000	193,000	230,000	280,000
GEYLANG	51,500	65,000	66,000	93,000	133,000	178,000	218,000	265,000	206,000	184,000	172,400	175,500	171,000	171,750	179,000	175,000	169,500	193,000	237,400
HOUGANG	63,000	70,000	88,000	140,000	175,000	222,650	295,000	315,000	242,000	238,000	245,000	246,000	241,000	235,000	235,000	225,000	226,750	250,000	302,000
JURONG EAST	63,000	70,000	73,500	125,000	155,000	191,000	238,000	277,500	223,800	209,000	198,000	187,000	228,000	240,000	210,000	215,000	218,000	225,000	294,000
JURONG WEST	50,000	70,000	64,630	115,000	160,000	198,000	260,000	265,000	237,000	221,500	230,000	209,000	205,000	203,000	225,000	225,000	225,000	232,000	290,000
KALLANG/WHAMPOA	55,000	58,400	62,000	95,500	115,000	150,000	202,000	232,500	173,750	171,000	178,500	171,500	166,000	185,000	190,000	196,000	195,000	240,500	300,500

Town
☑ ANG MO KIO
☑ BEDOK
☑ BISHAN
☑ BUKIT BATOK
☑ BUKIT MERAH
☑ BUKIT PANJANG
☑ BUKIT TIMAH
☑ CENTRAL AREA
☑ CHOA CHU KANG
☑ CLEMENTI

Flat Type
☑ 1 ROOM
☑ 2 ROOM
☑ 3 ROOM
☑ 4 ROOM
☑ 5 ROOM
☑ EXECUTIVE
☑ MULTI GENERATION

Median Resale Price by Year
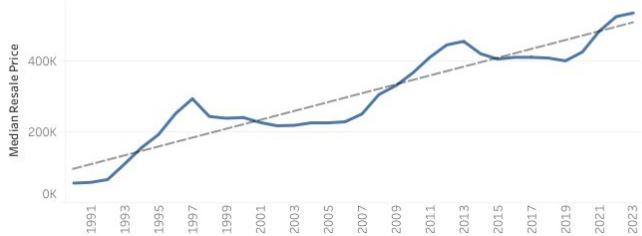
Median Resale Price across Towns by Year

BUKIT TIMAH

Median Resale Price
21,300 — 818,000

Town
■ ANG MO KIO
■ BEDOK
■ BISHAN
■ BUKIT BATOK
■ BUKIT MERAH
■ BUKIT PANJANG
■ BUKIT TIMAH
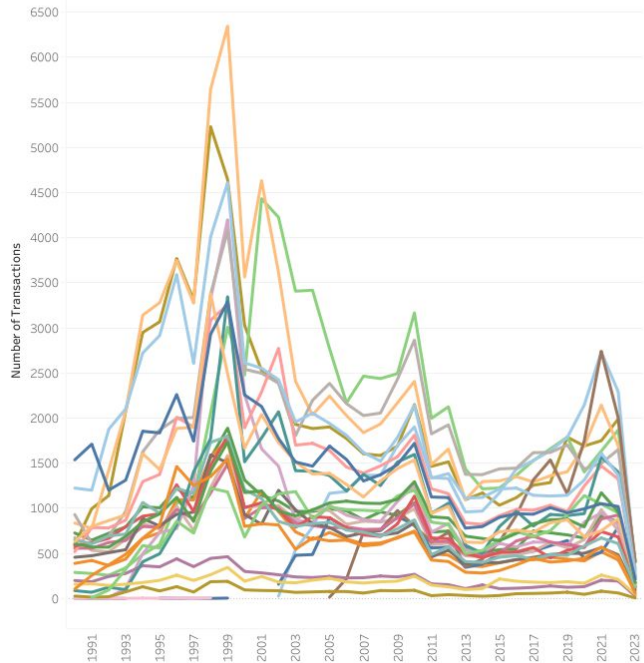■ CENTRAL AREA
■ CHOA CHU KANG
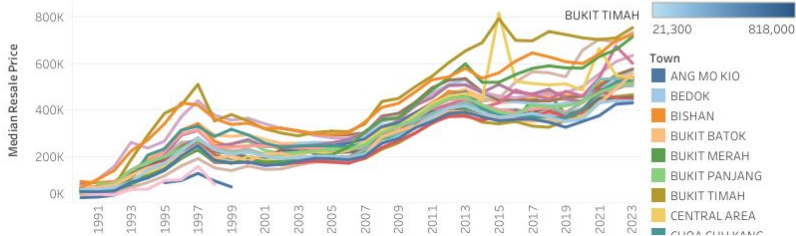
- Resale prices have been increasing over the years.

- This is true across all towns.

- The last spike is most likely driven by Covid-19 (2019), resulting in increasing demand of resale flats due to construction delays in BTOs.
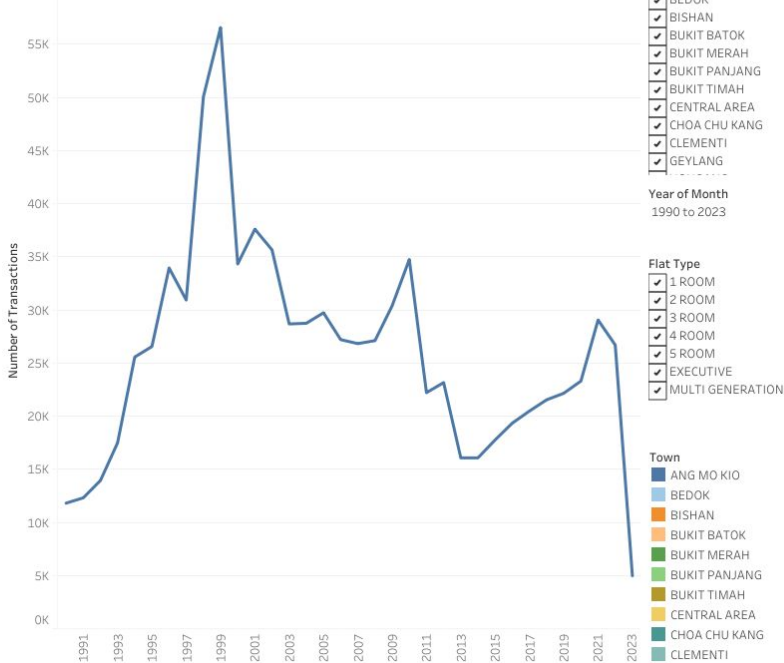
Section 1 A: Overview of property transactions

Number of Transactions by Year across Towns

HDB Resale Transaction by Year

- Number of transactions falling and increase in resale prices most likely indicate a limited supply of resale flats and causing prices to soar.

Section 1 B & C: Budgeting Tool for Potential Buyers

Resale Market Trend	Number of Transactions	Budgeting Tool	Sample flat sold in 2017	HDB Resale Price across all years by town	HDB Resale Price from 2015 onwards by town	Has Flat sizes gotten smaller over the years?

Flat Type
- (All)
- 1 ROOM
- 2 ROOM
- 3 ROOM
- 4 ROOM
- 5 ROOM
- EXECUTIVE
- MULTI GENERATION

Budget (Resale Price)
400,000 — 700,000

Min Distance To Mrt (km)
0.0361 — 1.0000

**Min Distance To Shopping Mall (km)**
0.000 — 1.000

YEAR
2015 — 2023

Budgeting Tool for potential Buyers

This tool allows for potential buyers to view the possible Towns and Flat Types available to them based on their budget, distance to shopping malls and MRT stations.

Budgeting Tool based on Town and Flat Type

Town	2 ROOM	3 ROOM	4 ROOM	5 ROOM	EXECUTIVE	MULTI GENERA..
ANG MO KIO		445,000	478,888	620,000	645,000	
BEDOK		427,000	431,000	560,000	680,000	
BISHAN		425,000	550,000	669,000	660,000	
BUKIT BATOK		470,000	450,000	548,444	620,000	
BUKIT MERAH	445,000	556,500	590,000	648,000		
BUKIT PANJANG		416,500	465,000	528,000	610,000	
BUKIT TIMAH		456,000	655,000	700,000		
CENTRAL AREA	420,000	451,000	562,500	639,999		
CHOA CHU KANG		421,000	448,888	461,288	560,000	
CLEMENTI		461,000	520,000	645,000	695,000	
GEYLANG		438,500	557,000	630,000	657,000	
HOUGANG		449,000	450,000	530,000	650,000	
JURONG EAST		422,000	460,000	605,000	650,000	
JURONG WEST		440,000	439,000	480,000	572,888	
KALLANG/WHAMPOA		505,000	550,000	635,000	690,000	
PASIR RIS		480,000	469,000	527,500	650,000	
PUNGGOL		418,000	468,000	590,000		
QUEENSTOWN	430,000	488,944	620,000	655,000		
SEMBAWANG		435,000	460,000	450,000	498,000	
SENGKANG		430,000	488,000	485,000	572,000	
SERANGOON		411,500	510,000	650,000	686,500	
TAMPINES		415,000	458,000	550,000	650,000	

Map

© 2023 Mapbox © OpenStreetMap
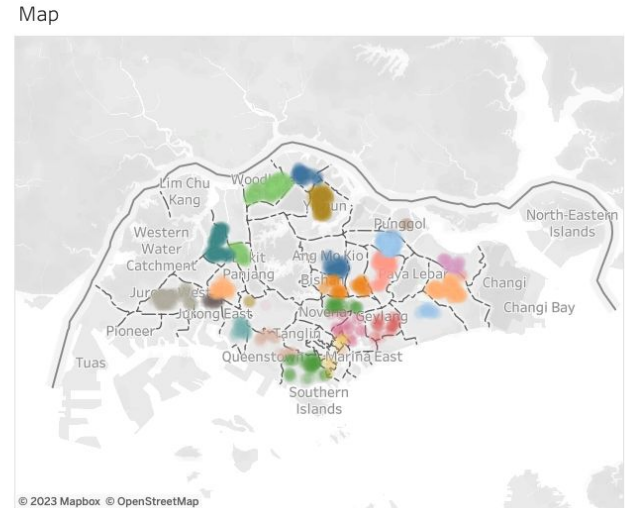
- A dashboard is created to allow input for given budget (estimation based on past resale prices), proximity to MRT stations and shopping malls.

- A potential buyer may filter out the results by flat type and a map for visualisation purposes.

02
Data Modeling

Section 2 A: Predicting Resale Flat Transaction Price in 2014

- Using features flat type, flat age and town to predict resale transaction price in 2014.

- 3 models were built, linear regression model as baseline model, ridge and lasso model.

- Get dummies is applied to categorical features. Standardscaler applied to numeric features after train test split (to prevent leakage). Hyperparameters tuning (gridsearch) were done with ridge and lasso model.

- Lasso model returned the best performance with RMSE of 55,150 and R^2 score of 0.79 for train and test.

- All three models performed well including base model. Lasso model coefficient did not reduce any feature to 0.

	features	coef
0	remaining_lease	38642.917858
1	flat_type_2 ROOM	101094.962742
2	flat_type_3 ROOM	209394.938658
3	flat_type_4 ROOM	315625.035382
4	flat_type_5 ROOM	406389.804611
5	flat_type_EXECUTIVE	523879.693013
6	flat_type_MULTI GENERATION	622999.205386
7	town_BEDOK	-30351.023768
8	town_BISHAN	48143.476167
9	town_BUKIT BATOK	-71826.071123
10	town_BUKIT MERAH	88245.565291
11	town_BUKIT PANJANG	-124643.447073
12	town_BUKIT TIMAH	173333.942286
13	town_CENTRAL AREA	79086.852308
14	town_CHOA CHU KANG	-136313.678261
15	town_CLEMENTI	24856.273708
16	town_GEYLANG	-10617.957610
17	town_HOUGANG	-69589.619880
18	town_JURONG EAST	-50763.130307
19	town_JURONG WEST	-120512.273702
20	town_KALLANG/WHAMPOA	28298.848097
21	town_MARINE PARADE	109877.257321
22	town_PASIR RIS	-94225.944999
23	town_PUNGGOL	-140460.374437
24	town_QUEENSTOWN	88736.782380
25	town_SEMBAWANG	-178471.019534
26	town_SENGKANG	-128664.620544
27	town_SERANGOON	-24173.389351
28	town_TAMPINES	-45112.973503
29	town_TOA PAYOH	22728.829782
30	town_WOODLANDS	-142892.739585
31	town_YISHUN	-101856.574582

Section 2 B: Flat sold in Nov 2017 in Yishun at $550,800
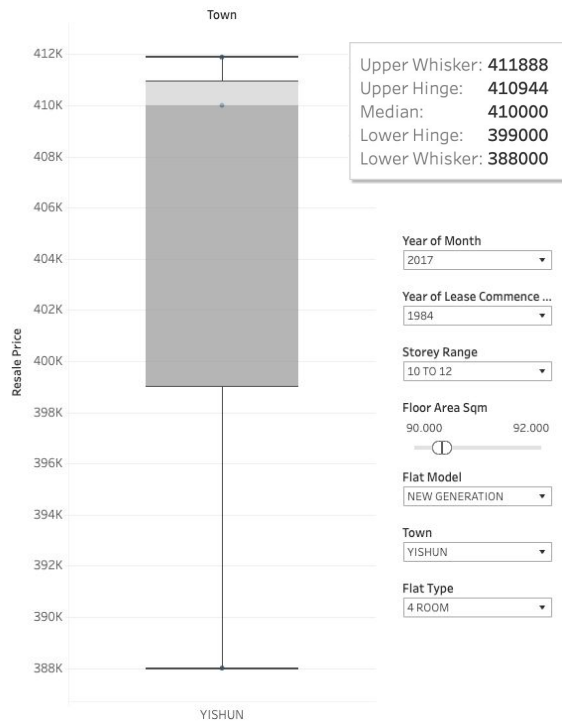
- Filtering features from Tableau shows that the median for a flat sold in Nov 2017 in Yishun is $410,000 with highest being $411,888 and lowest being $388,000.

- A Lasso model was also built using features 'flat_type', 'town', 'flat_model', 'storey_range', 'floor_area_sqm' and 'lease_commence_date' to predict resale price.

- Gridsearch used to find best parameters, returning RMSE of $51,411 and R^2 score of 0.88 for train and test.

- Predicted resale value of $324,498 + RMSE of $51,411 sums up to $375,909.

- In conclusion, the resale price of $550,800 was **not reasonable**.

Section 2 C: Predicting flat type

```
flat_type        k_labels
1 ROOM           2          0.000692
2 ROOM           0          0.000010
                 1          0.001732
                 2          0.009706
                 3          0.000063
3 ROOM           0          0.019689
                 1          0.064602
                 2          0.230937
                 3          0.001621
4 ROOM           0          0.018189
                 1          0.241751
                 2          0.084364
                 3          0.036908
5 ROOM           0          0.005444
                 1          0.016547
                 2          0.016303
                 3          0.174398
EXECUTIVE        0          0.004249
                 3          0.072187
MULTI GENERATION 3          0.000608
dtype: float64
```

Using k=4 on full dataset

Silhouette Score over k
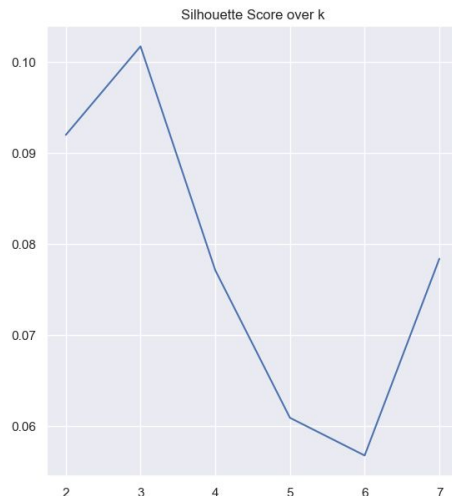
- Silhouette score over k returns optimal k = 3

- As this was done on a smaller dataset (last 100k transactions) there may be some inaccuracy. It may be also tough to predict classes which are imbalanced (ie, Executive and Multi Generation)

- K-means is preferred for unsupervised learning, since we know how many clusters (flat_type) there are.

- Rerunning on full dataset, input k=4, it is observed that a majority of Multi Gen, Executive and 5 room are clustered together, 4 room is one cluster and finally 1 room, 2 room and 3 room are clustered together.

- Assuming that the feature 'flat_type' is not available, training K-NN with supervised learning would not be possible. Its high score of 0.99 may also prove to be unreliable.
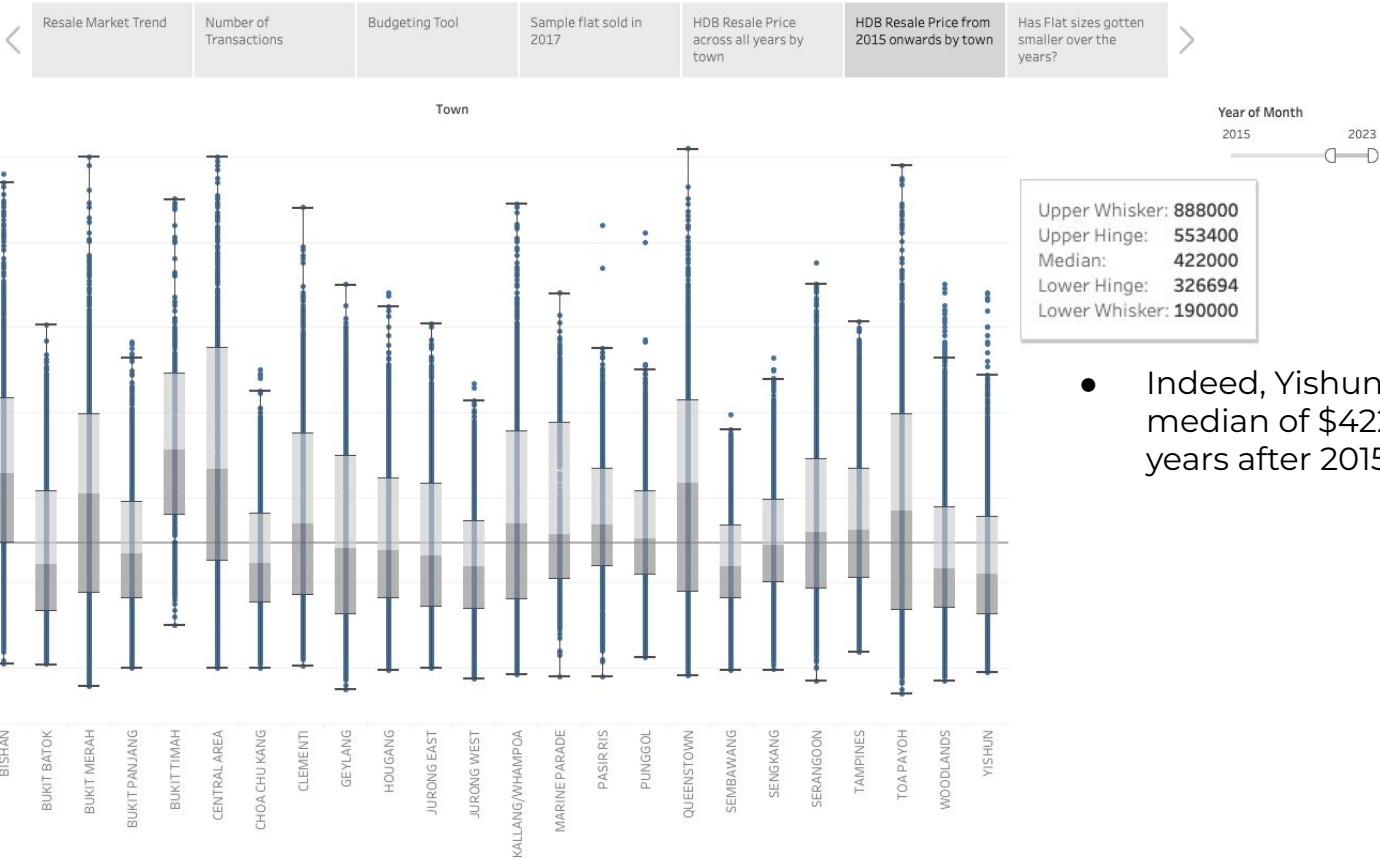
03
Policy Analysis

Section 3 A: Are Yishun flats the cheapest in the country?

Town

Year of Month
1990   2023

Upper Whisker: 805000
Upper Hinge: 425594
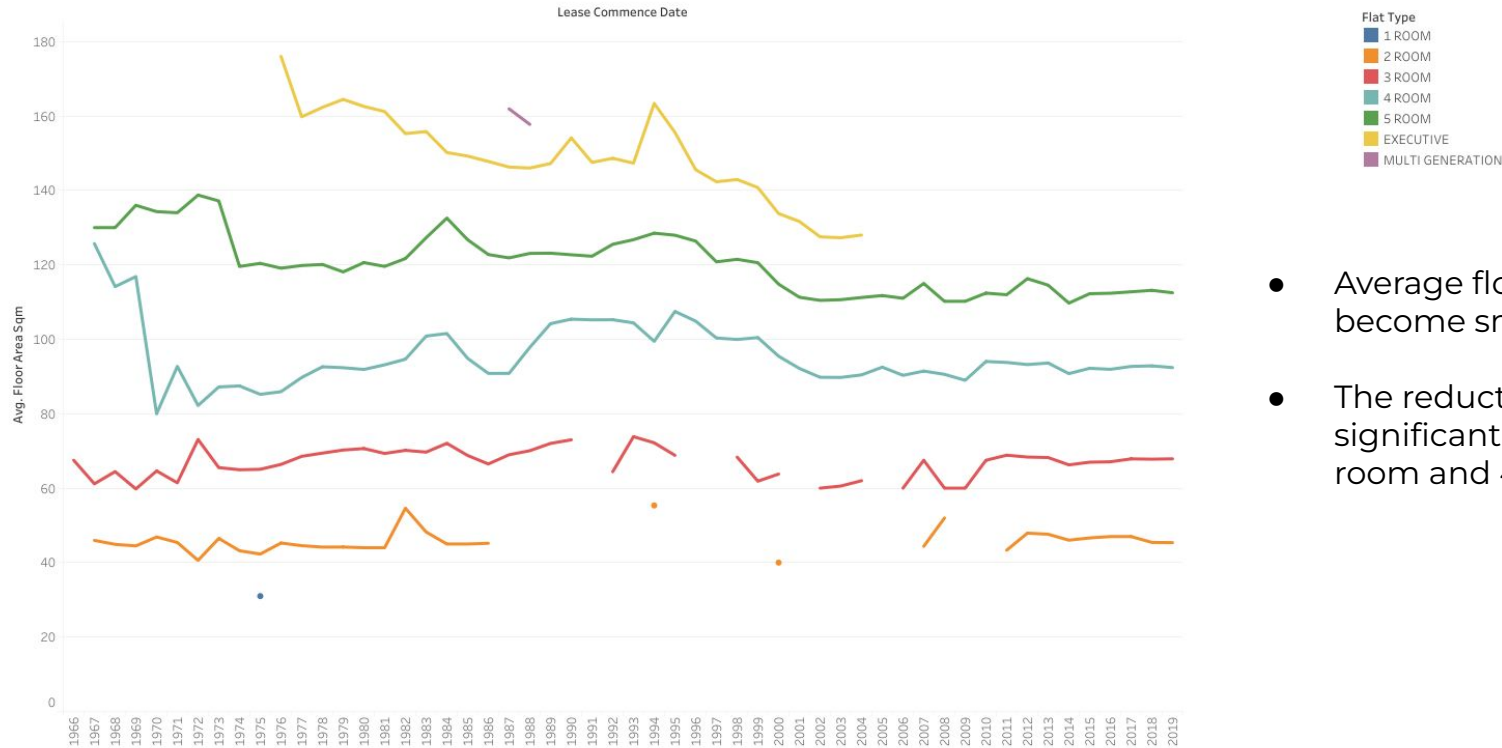Median: 282750
Lower Hinge: 170900
Lower Whisker: 27000
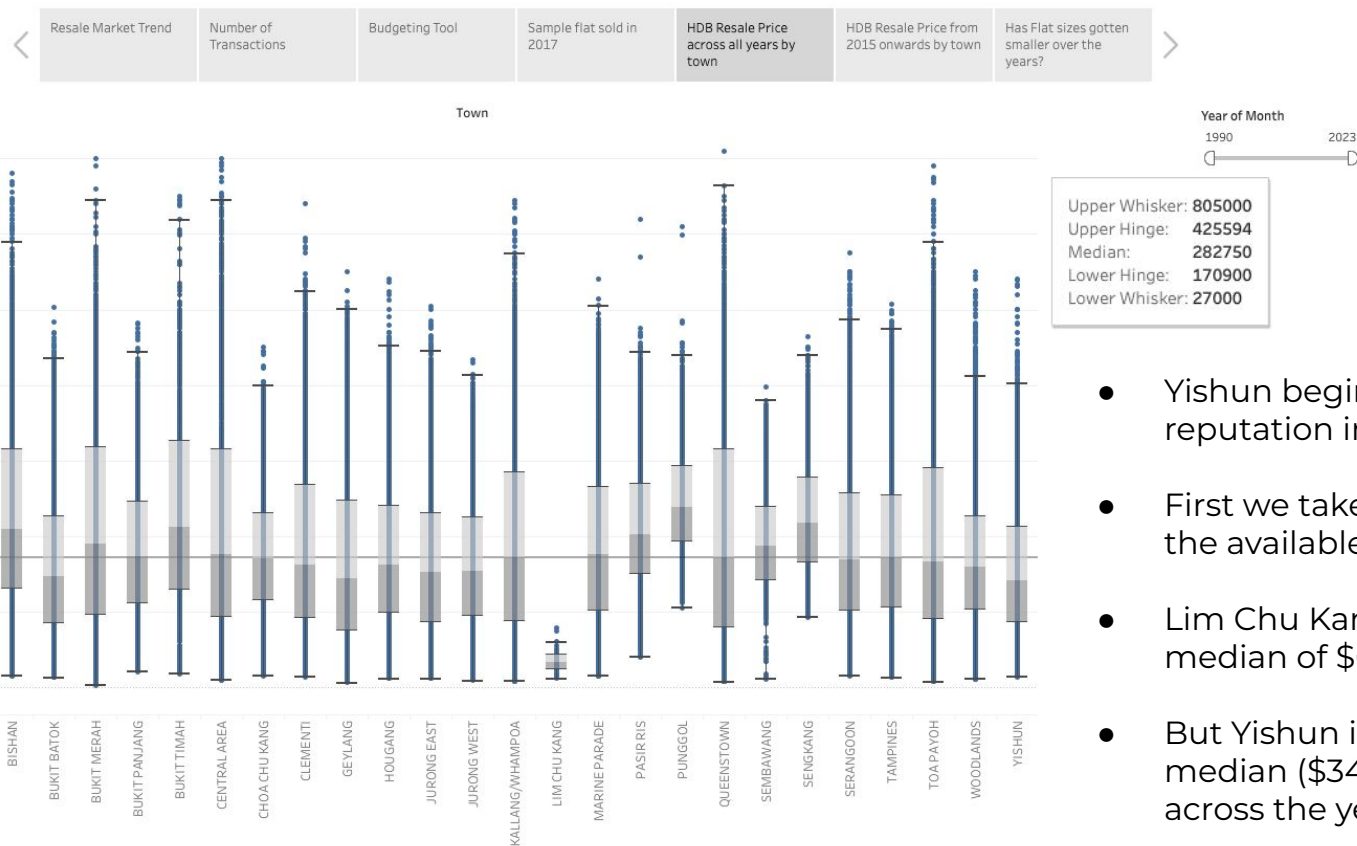
- Yishun begin getting its bad reputation in 2015.

- First we take a look across all the available years.

- Lim Chu Kang has the lowest median of $65,500.

- But Yishun is below the median ($343,050) of all towns across the years.

Resale Price: 1400K, 1200K, 1000K, 800K, 600K, 400K, 200K, 0K

Median

Towns: ANG MO KIO, BEDOK, BISHAN, BUKIT BATOK, BUKIT MERAH, BUKIT PANJANG, BUKIT TIMAH, CENTRAL AREA, CHOA CHU KANG, CLEMENTI, GEYLANG, HOUGANG, JURONG EAST, JURONG WEST, KALLANG/WHAMPOA, LIM CHU KANG, MARINE PARADE, PASIR RIS, PUNGGOL, QUEENSTOWN, SEMBAWANG, SENGKANG, SERANGOON, TAMPINES, TOA PAYOH, WOODLANDS, YISHUN

Section 3 A: Are Yishun flats the cheapest in the country?

Upper Whisker: **888000**
Upper Hinge: **553400**
Median: **422000**
Lower Hinge: **326694**
Lower Whisker: **190000**

- Indeed, Yishun has the lowest median of $422,000 for the years after 2015.

Section 3 B: Did flat sizes become smaller over the years?

Resale Market Trend	Number of Transactions	Budgeting Tool	Sample flat sold in 2017	HDB Resale Price across all years by to..	HDB Resale Price from 2015 onwards by town	Has Flat sizes gotten smaller over the year...

Lease Commence Date

Flat Type
- 1 ROOM
- 2 ROOM
- 3 ROOM
- 4 ROOM
- 5 ROOM
- EXECUTIVE
- MULTI GENERATION

- Average floor square area has become smaller over the years.

- The reduction is more significant across Executive, 5 room and 4 room flat types.

Section 3 C: Impact of Downtown Line Stage 2 on Bukit Panjang Resale Flats

Comparison between Bukit Panjang Town HDB Resale Flats within 1km and outside 1km to Downtown line MRT Stations
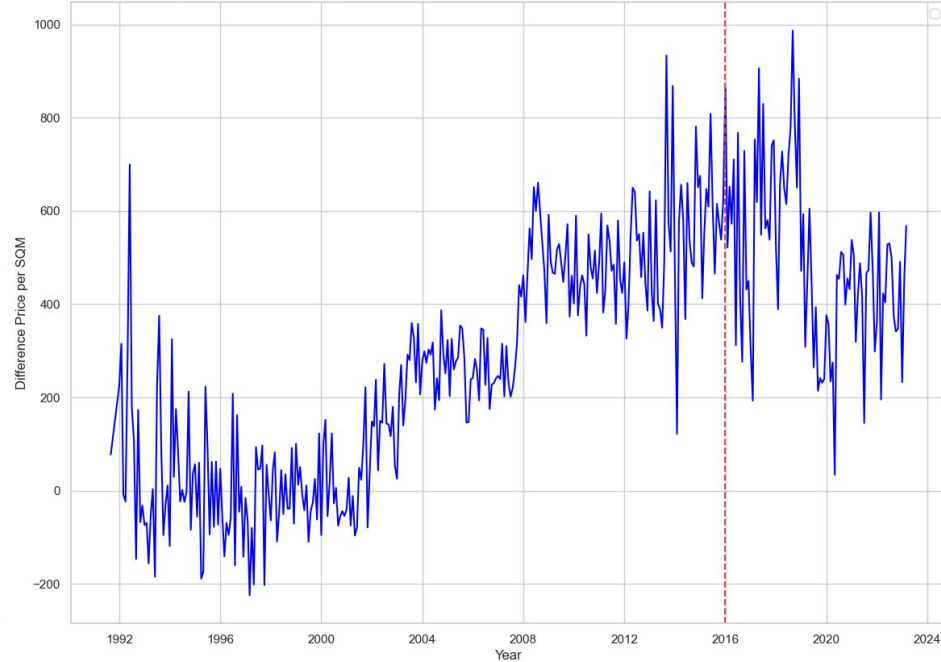
HDB resale prices within 1km and outside of 1km of MRT stations in Bukit Panjang Town started differing around 2002 even before Downtown Line Stage 2 opening on 27 December 2015.
Interestingly the difference of price per sqm is getting less after approximately 2019 (could be due to Covid affecting all resale prices in Singapore - prices have increased even for flats outside of 1km radius to MRT stations).

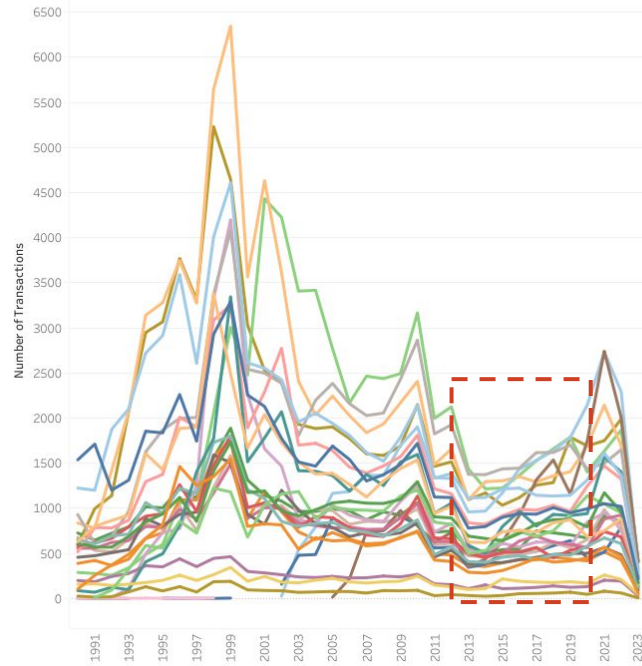# Section 3 D: Are resale prices in HDB towns further from city impacted by COE prices for cars?

- Number of transactions for towns further from city centre were relatively stable except Sengkang and Punggol showing sharp increase.

- COE for Cat A, B and C has been falling from 2012 to approx 2019.

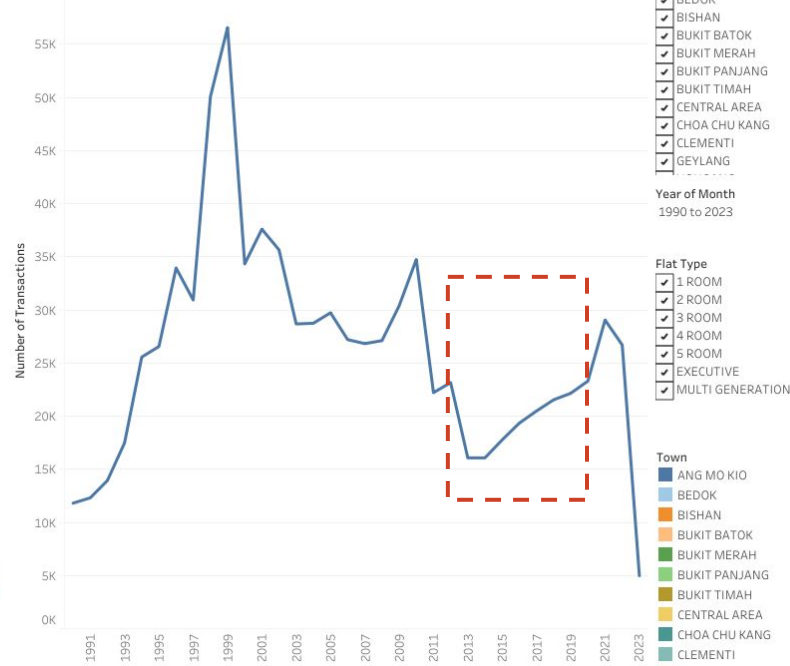- HDB resale value for the same period had also been falling.

Section 3 D: Are resale prices in HDB towns further from city impacted by COE prices for cars?

- COE prices data are limited (only from 2010 to 2023).

- While number of transaction across all towns increased during the period, this was not the case for towns that were far away from city centre (except Sengkang and Punggol).

- If COE prices for cars had affected resale prices in HDB towns further from city, we would expect to see prices driven up.

End