Visualising Singapore's HDB Resale Prices

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Abstract— In recent years, due to the introduction of online platforms such as DirectHome, there has been an increasing popularity to transact resale HDB flats without a property agent to save cost. Online tools such as HDB One Map only allows users to view each individual transaction record and there is a lack of tools for Singaporeans to visualise the overall HDB market in Singapore, which are essential for them to make the correct decision. To address this need, an interactive visualisation dashboard has been developed to help Singaporeans discover insights about the market, providing them with an overview and trend of the housing market, and the distribution of the resale prices in different towns.

Index Terms—HDB Resale Prices, HDB Transaction Volumes, Visual Analytics

1 Introduction

As of September 2018, the HDB Resale prices have dipped by 0.2% MoM as both mature and non-mature estate prices fell by 0.3% and 0.1%, respectively, according to an SRX report. With the increasing demand for housing, there is a need for homeowners to have a better understanding over the flats they are purchasing.

This research paper documents the exploration and development efforts taken to design and implement a data visualisation web application. The dataset used was provided by Singapore Data.gov platform.

2 Motivation & objectives

Our research and development efforts were motivated by the lack of information on HDB resale flats for homebuyers who want to understand and make decisions on the type of HDB flat to buy based on past transaction trends. The increase in online platforms that allow HDB transaction to take place without the need of a property agent further explains the needs for potential buyer and seller to be more informed about the housing market in Singapore.

HDBViz aims to provide a dashboard serving as a one-stop platform for HDB home buyers and sellers to gather information on the HDB resale transaction trends over the past 5 years and to support them in their HDB purchasing decision. Hence, there is a need to analyse the resale prices and transaction volume of the flats.

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3 Related Works

To have a better selection of visualisations we did a background survey of various related works.

3.1 HDB One Map

The visualisation from HDB One Map, shows detailed information on HDB flats but lacks the tool to show an overview of the HDB estates in Singapore by Region and Town. It's usability is limited by the lack of function to filter by different data variables e.g. region, town, model, floor range, floor area and etc.

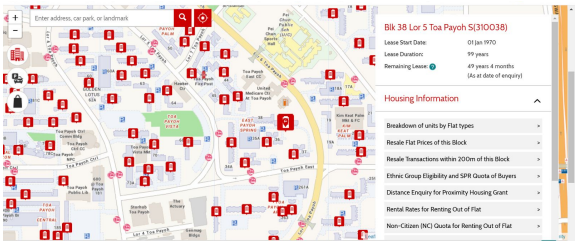

Figure 1: Interactive chart showing Geographical Map of HDB in Singapore [1]

3.2 SRX Heat Map

Based on the visualisation from SRX, it shows an overview of the price and transaction volume of the different types of estate in different towns. The chart lack of interactive elements and information such as displaying the information of the district and resale price have hovered.

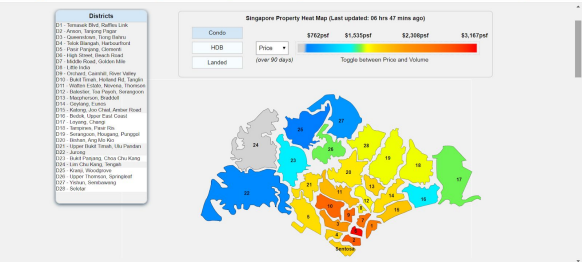

Figure 2: Interactive chart showing Heat Map of HDB in Singapore [2]

3.3 Line Chart

Based on the visualisation from Teoalida, it shows the trend based on different flat types. After using visualisation, it is messy and is not interactive as it does not show any highlighted fields when hovered over, making it difficult to visualise.

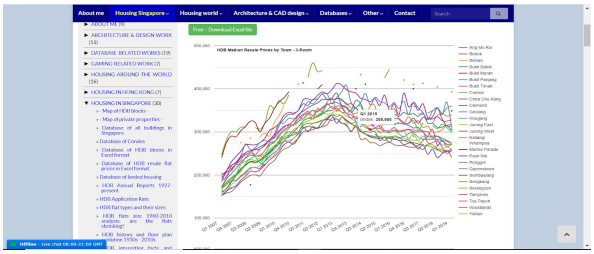

Figure 3: Interactive chart showing Line Graph of HDB in Singapore [3]

3.4 Horizon Chart

Based on the Horizon Chart from flowingdata.com, it allows users to look at patterns over time. It supports mouse interaction when hovered or selected and makes use of colour based code to separate positive and negative values. It collapses the negative values to the positive side of the axis taking up less space and shows the same data.

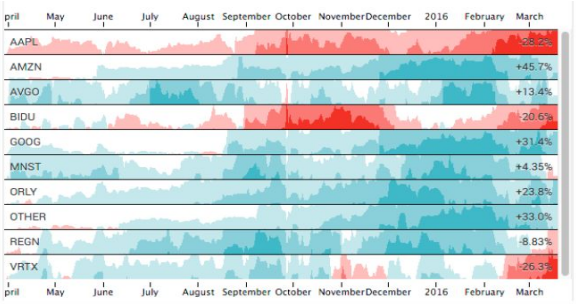

Figure 4: Interactive chart showing Horizon Graph of HDB in Singapore [4]

3.5 TreeMap

Based on the TreeMap provided from RPub by Dr. Kam Tin Seong, it makes efficient use of compact space, so that they can legibly display many items on the screen at the same time. But treemaps with too many items tend to be hard to read because of the many lines that enclose each small node.

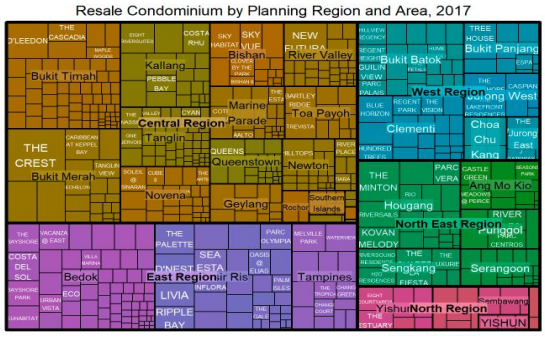

Figure 5: Interactive chart showing TreeMap of HDB in Singapore [5]

3.6 Overlay Bar Chart

Based on the visualisation from sas, overlay bar chart reduces the changes of frequency measurement error.

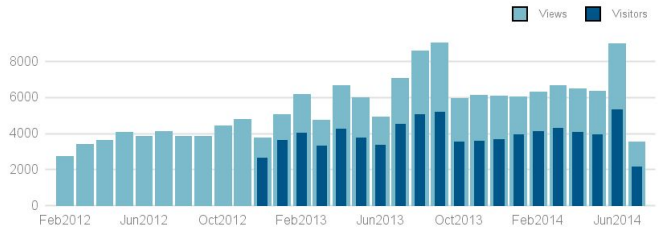

Figure 6: Interactive chart showing Overlay Barchart of HDB in Singapore [6]

4 The Approach

After identifying the problem and objectives, the following steps were taken to build the data visualisation: (1) exploratory data analysis and brainstorming, (2) data preparation, and (3) visualisation implementation.

4.1 Exploratory Data Analysis (EDA)

This research project is based on the Dataset which consists of the Housing Development Board (HDB) properties details from 2015 to 2019, provided by Data.gov.sg. [7]

Before building any visualisations on the HDB resale dataset, it is necessary to perform exploratory data analysis and understand the features in the data. In the EDA process, we utilised Tableau to explore the dataset features. It is also used during our brainstorming phase to generate ideas on possible visualisations that could provide meaningful insights and align with our project objectives.

4.2 Data Preparation

Before performing any visualisations, we have to first understand our dataset.

Table 1. Variables in dataset

Variable	Data Type
month	chr
town	chr
flat_type	chr
block	chr
street_name	chr
storey_range	chr
floor_area_sqm	num
flat_model	chr
lease_commence_date	num
remaining_lease	num
resale_price	num

4.2.1 Date Format

As seen from Table, “month” is of “character” data type. This poses a problem when we try to create the visualisations. As such, there is a need to convert “month” to the date format

4.2.2 Grouping Data together

The dataset contains each individual transaction that happened over the 5 years. For the purpose of our visualisations, we are more concern over the overall transaction that occurs across different town, flat type, flat model and year. Hence, depending on the

visualisation, the data has been grouped together based on the different attributes.

4.2.3 Matrix Table

To build a heatmap visualisation, we will need to transform the filtered data into a matrix table as the plotly heatmap library takes in a matrix table as the input data. Hence after applying the necessary filters based on the user inputs, we will transpose the data table whereby the various flat types becomes a data column each. Thereafter, we will convert the data table into a matrix table, where the individual towns are unique row names, flat types are data columns and the median resale transaction price (for each town) are the values for the columns. Initially, the data table contains 'NA' values which represents that no transaction is available for a particular flat type and town, however these 'NA' values are transformed to 0 values as a matrix table does not allow for NULL values.

5 User Interface

After conducting research on the existing visualisations used to present HDB resale transactions, we used R Shiny to deploy our application as the tool gives us flexibility to build visualisations that offer interactive elements such as filters on our graphs.

5.1 HDB Resale Price Overview

Our overview tab consists of two different charts that aim to present an outline of the past HDB resale prices and transaction volume in each estate town, displayed in a tree map and a geographically facted visualisation respectively.

5.1.1 Regional Past Transaction Prices/Volume

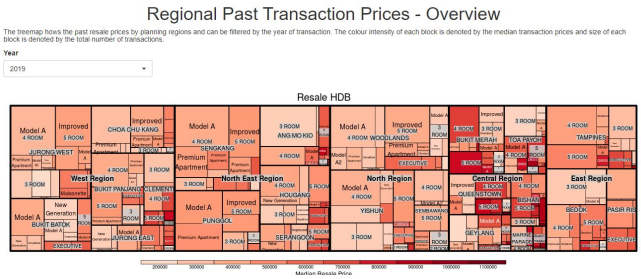

Figure 7: Interactive TreeMap

The Treemap visualisation enables us to display the information by regions, town, and flat type. With size by Total Unit Sold, color by Resale Prices. Filters are placed at the top to allow users to filter to a specific year and Planning region.

5.1.2 Number of Units Sold

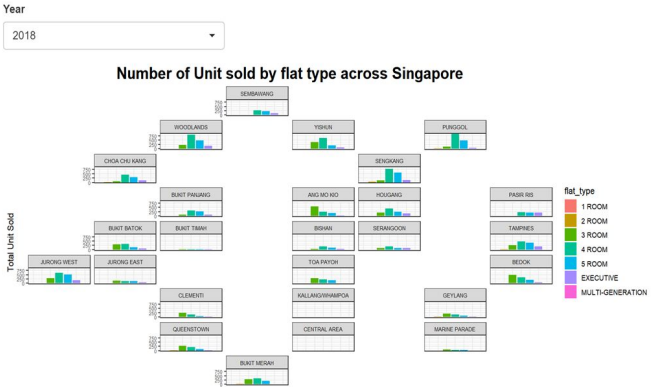

Figure 8: Interactive Geofacet

The geographically faceted map contains bar charts for each estate, positioned in a grid akin to the Singapore geographical map. It shows the transaction volume for each flat type within the individual estate towns. It contains an interactive filter for the user to display the past transaction volume by the year, from 2015 to 2019.

5.2 Resale Transaction Price/Volume Trends

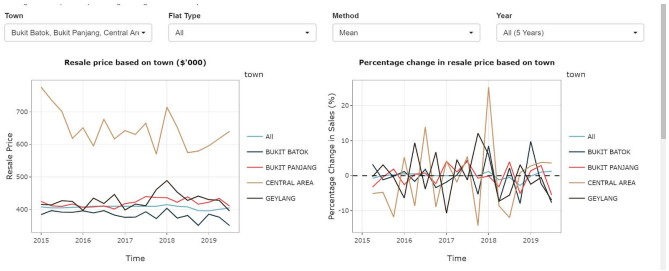

Figure 9: Resale Price Line Chart

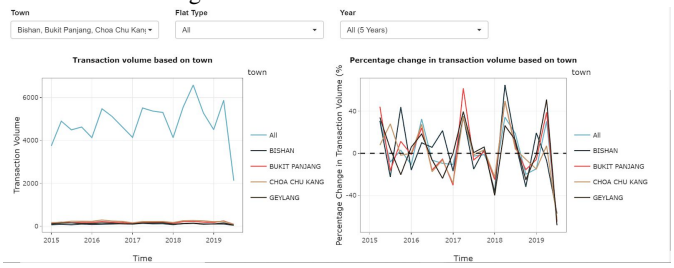

Figure 10: Transaction Volume Line Chart

The line chart visualisation shows the trends of resale prices and transaction volumes from 2015 to 2019 by displaying the absolute value and the percentage change in price/volume retrospective to various towns. This gives us a better insight from the treemap, understand the changes in price and transaction volume throughout the years. By inserting the trend for different towns in the chart also allows us to compare the price/volume and quarterly percentage change for each town against the average across Singapore.

Users can filter the dashboard by time range, towns, flat types and aggregation methods (median, mean, min and max). The towns has been limited to a maximum of 4 selections. This is to ensure that the graph is not complex with too many lines and users can see the lines clearly.

5.3 Price Distribution of Past HDB Resale Transactions

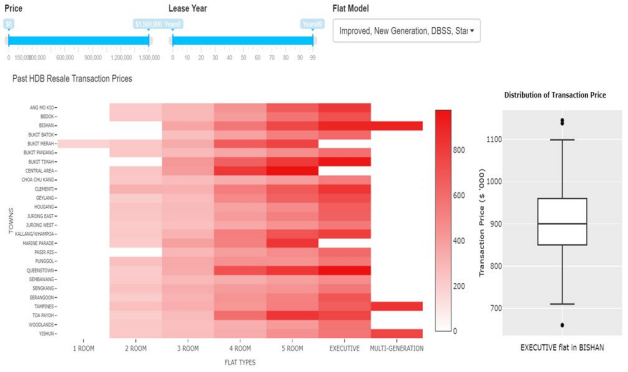

Figure 11: Interactive Heatmap and Boxplot

The HDB resale price distribution tab showcases a heatmap that shows the median transaction price for each town and flat type based on the user input filters: price range, lease year remaining and types of flat model. Resale prices from the same town does not necessarily have the same price. As the line chart provided in the previous page only shows the grouped resale price from each town. this page allows us to get more insights and understand more about the distribution of the transaction price in different towns. The colour intensity of each block denotes the median price. The visualisation also has a box plot to show the price distribution based on a particular flat type and town. It changes accordingly as the user clicks on a block in the heatmap (that is not NULL, i.e. a white block).

6 Key Findings

6.1 Increased transaction in Central Region

Based on the tree map, the west and north east region remain as the top 2 regions with the most transaction for HDB resale flats for the past 5 years.

Despite being the most expensive region, transaction volume for the central region has also surpass east region in 2017. This could be due to the increase in purchasing power Singaporeans have that allow them to buy resale flats in the central region which are more expensive. [9]

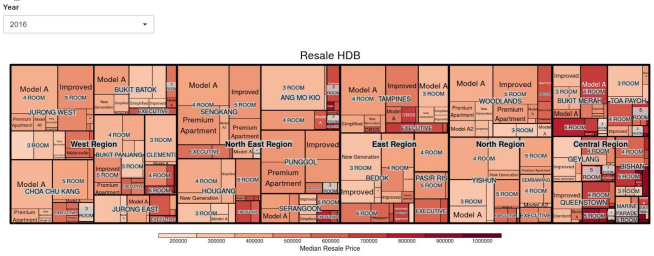

Figure 12: Treemap for HDB Resale Flats in 2016

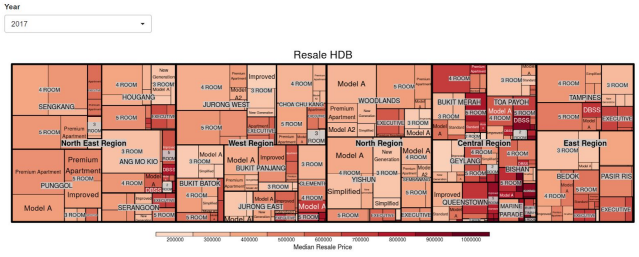

Figure 13: Treemap for HDB Resale Flats in 2017

6.2 HDB Resale Prices

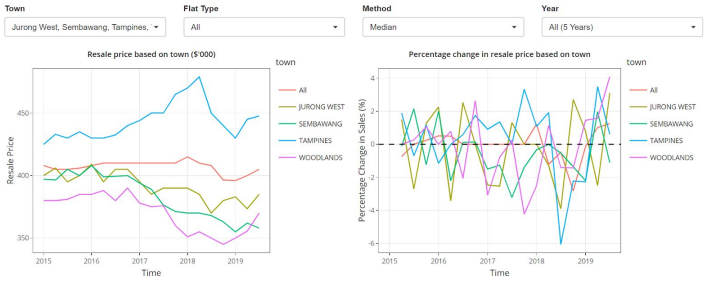

Figure 14: Transaction price based on town

As seen from the line chart, the resale price trend for Tampines is observed to be different from other towns like Woodlands, Sembawang and Jurong West. There was a substantial increase in resale prices on the second quarter of 2018 while the other towns experienced a relatively small change.

2018 was the year where many BTO flats in Tampines reached MOP (Minimum Occupation Period). [9] This causes demand for newer resale flats to increase. Moreover, the amenities within Tampines could likely contribute to the increase in demand for flats in the estate town. [10] Singaporeans who are looking to buy newer resale flats are willing to pay more to purchase these newer flats. Hence, this results in the increase in resale price and the difference in the trend for Tampines as compared to other towns.

6.3 Constant fluctuation in transaction volume

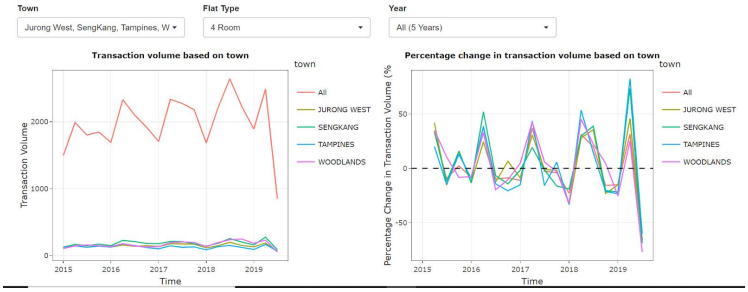

Figure 15: Transaction Volume based on town

Based on the graph above, generally, the number of HDB resale transactions follows a constant fluctuation for the past 5 years. This could be due to a range of factors such as an increase in housing grants, periodic BTO launches in certain housing estates and the introduction of Re-offer of Balance flats which happens in certain quarters each year. These are factors that will highly influence the demand for resale HDB flats and cause a constant fluctuation in transaction volume.

Using Jurong West, Sengkang, Tampines and Woodlands as an example, the fluctuation in transaction volumes are relatively similar across the different towns.

6.4 Surge in transaction volume in 2018

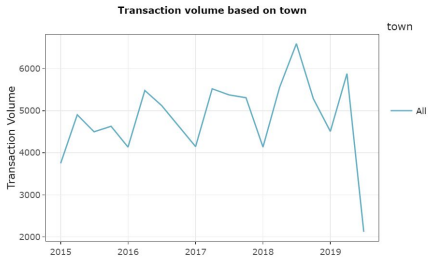

Figure 16: Transaction Volume based on town

Based on the graph above, there was a surge in the number of resale transactions in 2018, which has been the highest since 2015. According to the resale market analysis by OrangeTee, the transaction volume has hit a 5-year high and this could likely be attributed to lower supply of BTO flats leading to lower competition from prospective home buyers. [11]

6.5 Wide Price Distribution across Estate Towns

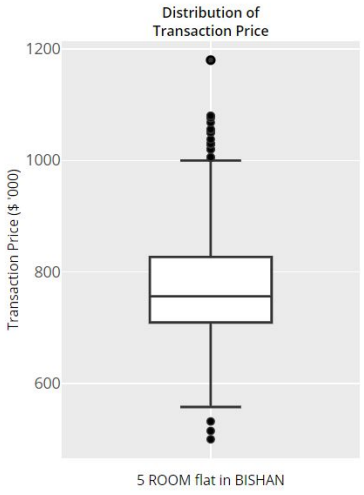

Figure 17: Price distribution of 5 Room flats in Bishan

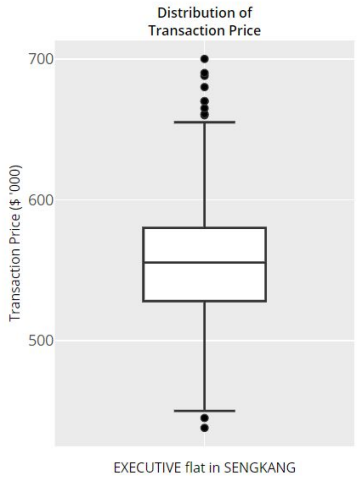

Figure 18: Price distribution of 5 Room flats in Seng Kang

Across the estate towns and various flat types, there are many instances where the price transaction distributions present with extreme outliers which lead to the large spread between the minimum and maximum transaction price. The existence of the wide spread in prices does not only occur between towns, but also within the town itself. Examples of such cases are 5 room flats in Bishan and Seng Kang. Based on Figures 17 and 18, it is seen that the price distributions for the respective flat types in Bishan and Seng Kang are relatively large, and there are many outliers beyond the lower and upper fences as well. Likewise, the ranges between the first and third quartiles for both estate towns are narrow. This would mean that whilst it is highly likely that most flats with similar flat types within these estate towns would fall within the median transaction price, there are many outliers perhaps due to factors such as the flat storey and amenities nearby.

7 Limitations

The following are the limitations of our project:

1. We did not take into account other factors such as facilities and the storey of the flat, which could affect the resale price and demand.
2. The dataset used might be inconsistent as some flats might have transaction for every month but some have transaction every few months.

8 Future works

For future work, we can consider the following enhancements:

1. For more detailed insights on past HDB resale transactions, we can include proportional symbol map that displays the number of transactions for each HDB block.
2. Include more datasets to the dashboards (e.g. facilities such as MRT station nearby) and identify correlation between the number of facilities each HDB block has and its past transaction prices.
3. Include the number of transactions upon hovering over each block in the heatmap, and identify particular HDB resale units which are outliers on the boxplot.

9 Conclusion

The Data visualisation in HDBViz enables users to explore and analyse the changes in HDB Prices and transaction volume, and customize the dashboard to view the specific information.

Acknowledgments

The authors wish to thank Professor Kam Tin Seong for his guidance in the completion of this project.

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