

Final Project

The house price in Perth

Personal Project by

Do Tan Tai

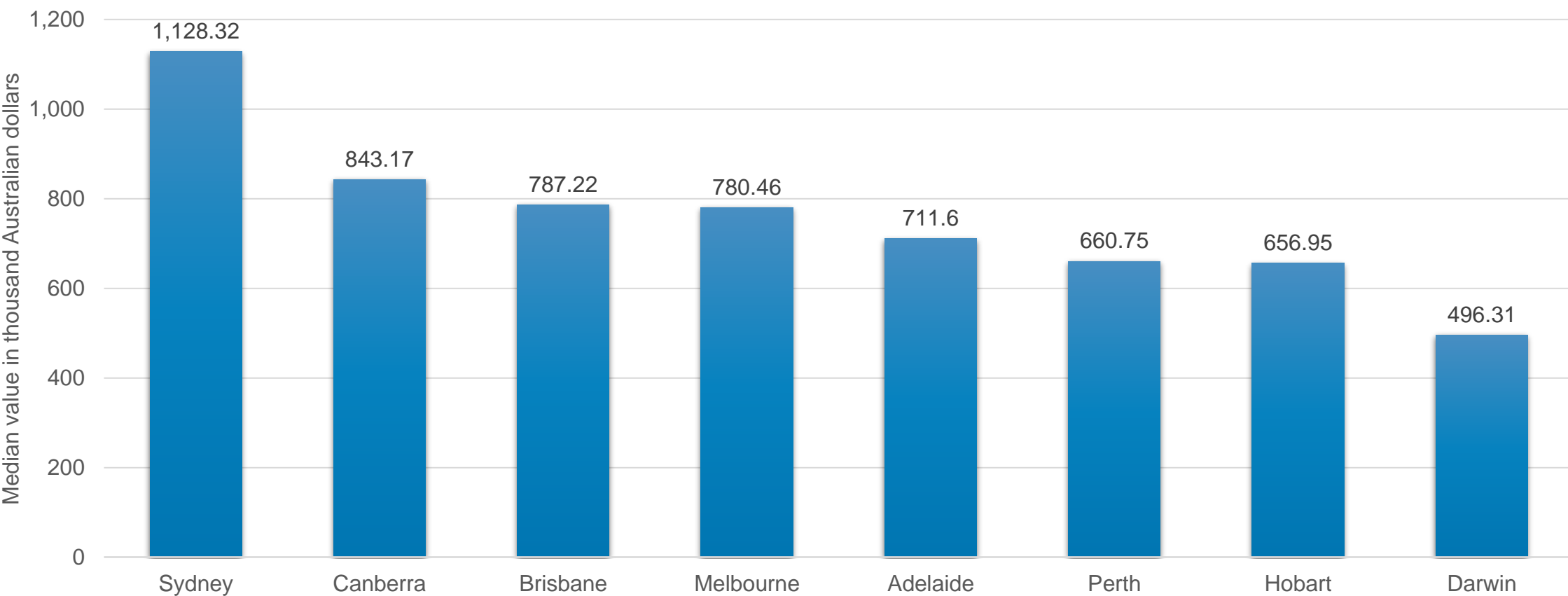


2.1. Perth

- Perth is the largest capital city of Western Australia.
- Perth's population is 2 million out of a total of more than 2.7 million across Western Australia
- Kings Park is the largest city park in the world

Median residential property value in Australia 2023 by city

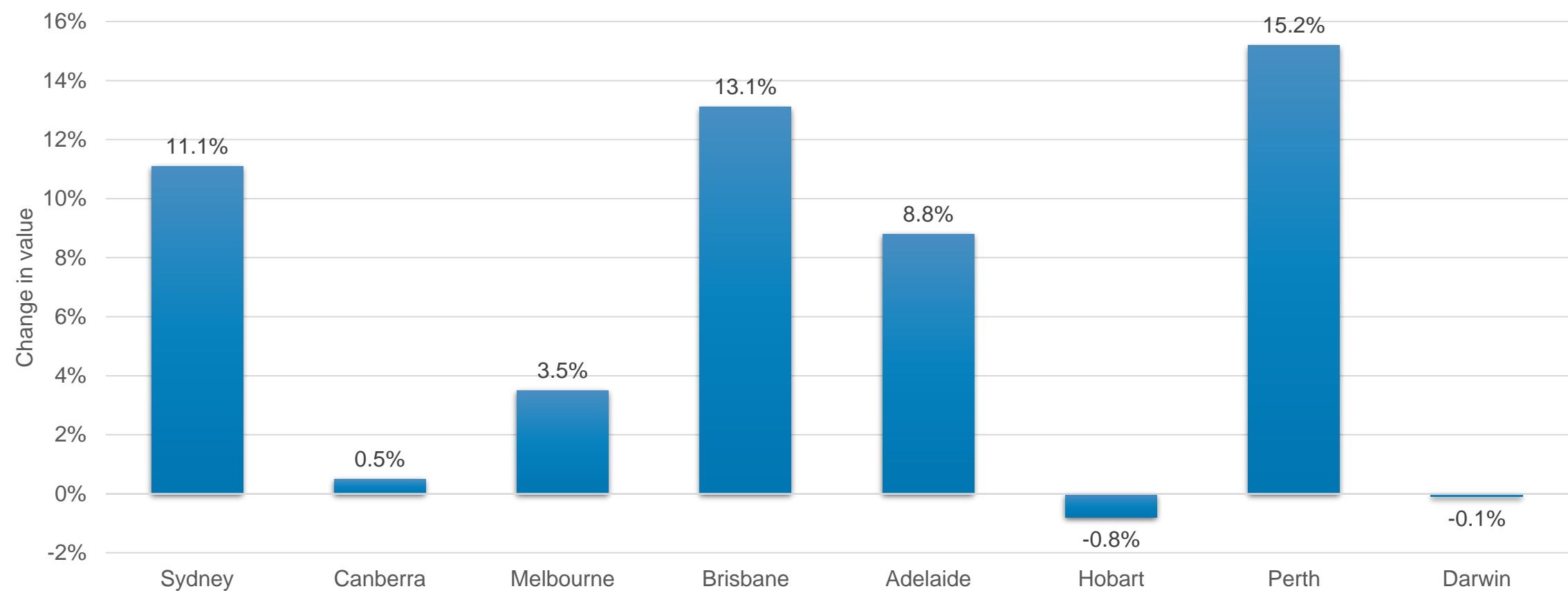
Median value of residential dwellings across Australia as of December 2023, by city (in Australian dollars)



Description: As of December 2023, Sydney had the highest median residential property value compared to other capital cities in Australia with a median dwelling value of around 1.13 million Australian dollars. Canberra followed with a median residential dwelling value of around 843 thousand Australian dollars. [Read more](#)
Note(s): Australia; as of December 31, 2023
Source(s): statista

Annual change in home value Australia 2023 by city

Annual change in residential property values across Australia as of December 2023, by city



Description: With an increase of about 15.2 percent, Perth experienced the largest annual change in the value of residential property compared to other capital cities in Australia for the year ended December 2023. Hobart witnessed the largest annual decrease in the value of residential property compared to other capitals. [Read more](#)
Note(s): Australia; as of December 31, 2023
Source(s): Statista

AGENDA

1. Introduction



Introduce big question and datasets, then the aim to resolve big question and Datasets well-being insights

2. Exploratory Data



3. Insight Data



4. Build Models

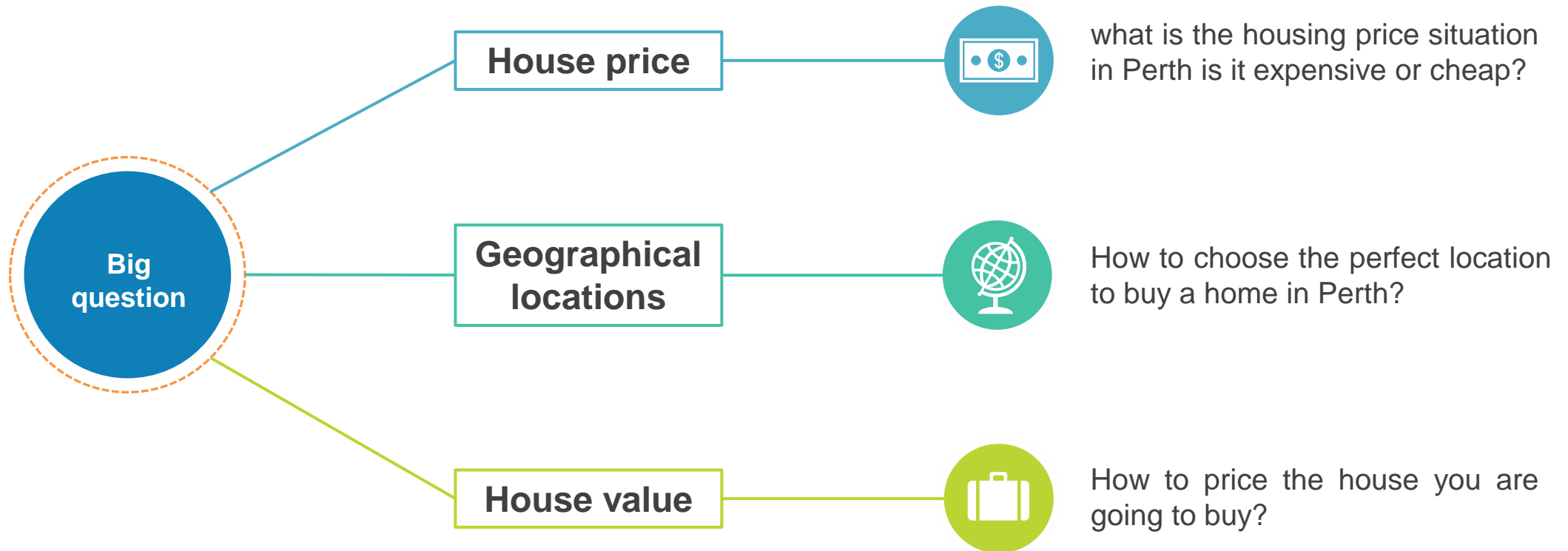


5. Conclusion



1. Introduction

BIG QUESTION



1.1. Working process

- 1 We are consultants in real estate who offer solutions that suit customer needs



- 2 Content of steps



Step 1

Explain to them the housing price situation in Perth is it expensive or cheap?



Step 2



Step 3



Step 4

1.2. Data overview

- The data used in this project was combined 4 datasets: Perth house Prices, CPI, REIT index, and GDP PC
- Data size: 23456 rows and 20 columns
- Null percentage in a dataset: 5.89% of Garage column

<u>Suburb</u> : Specific locality in Perth; a list of all Perth suburb can be found here	<u>Land area</u> : Total land area (m ²)
<u>Price</u> : Price at which a property was sold (AUD)	<u>Floor area</u> : Internal floor area (m ²)
<u>Bedrooms</u> : Number of bedrooms	<u>Dist SC & Dist ST</u> : Distance to the nearest school (km) & The nearest station distance (km)
<u>Bathrooms</u> : Number of bathrooms	<u>Dist CBD</u> : Distance from the centre of Perth (km)
<u>Garage</u> : Number of garage places	<u>Postcode</u> : Local Area Identifier
<u>GDP</u> : GDP per capita (\$)	<u>Month & Year</u> : Month & year in which the property was sold extracted by Date_Sold
<u>REIT index</u> : Real Estate Investment Trust Index provides a snapshot of the performance of the real estate.	<u>CPI</u> : Consumer Price Index is a measure of the average change overtime in the prices

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Overview to better understand the data and what factors affect house prices in Perth?

3. Insight Data

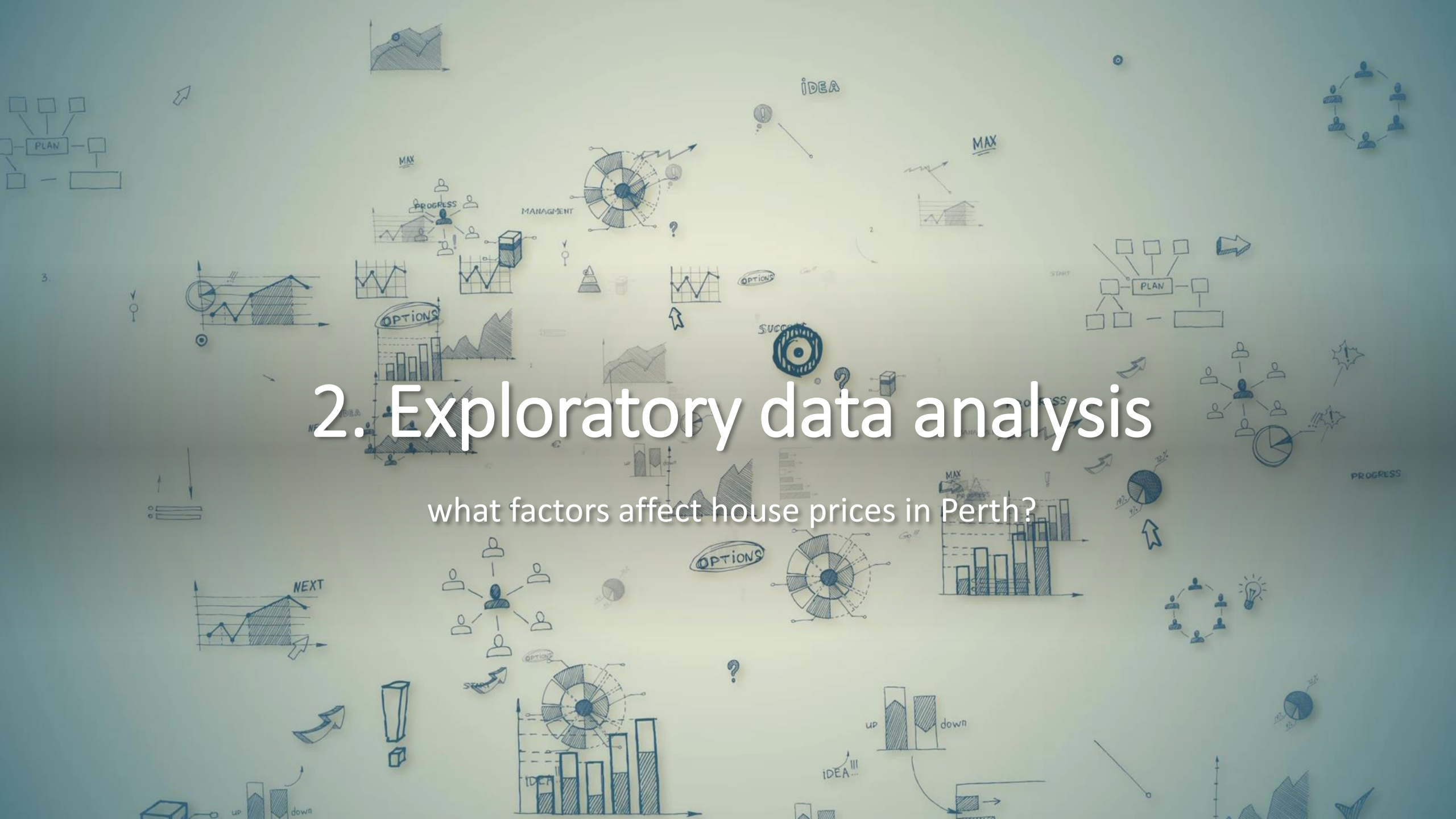


4. Build Models



5. Conclusion



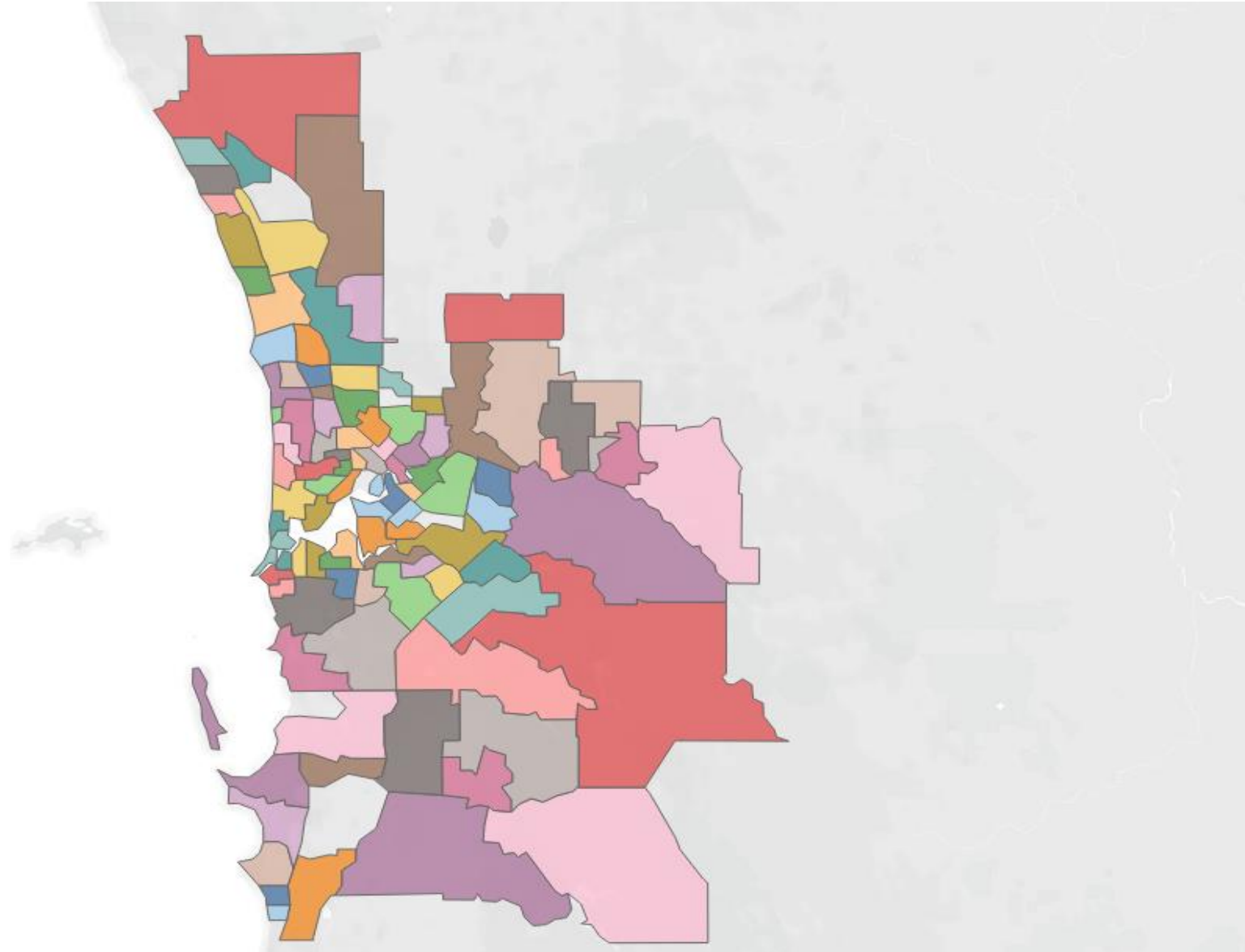
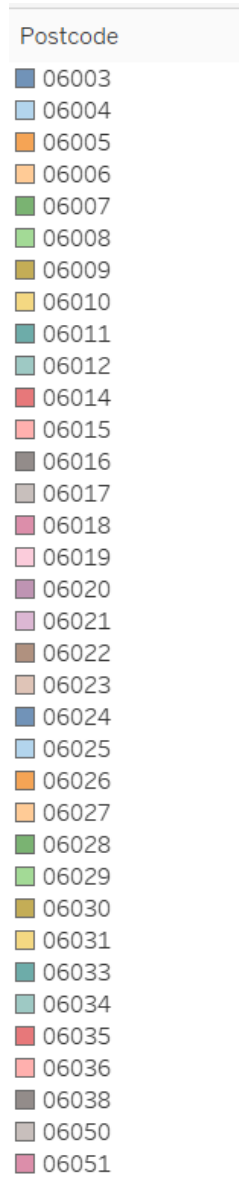


2. Exploratory data analysis

what factors affect house prices in Perth?

2.1. Perth

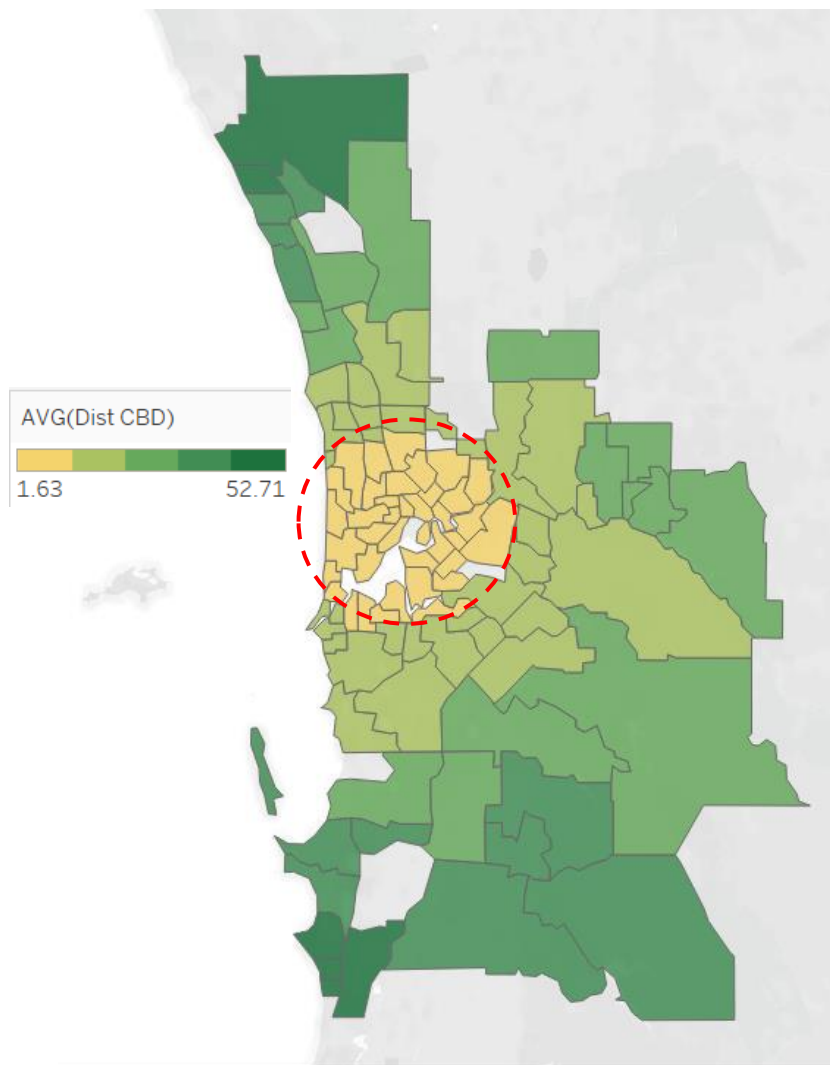
Postcode Distributions



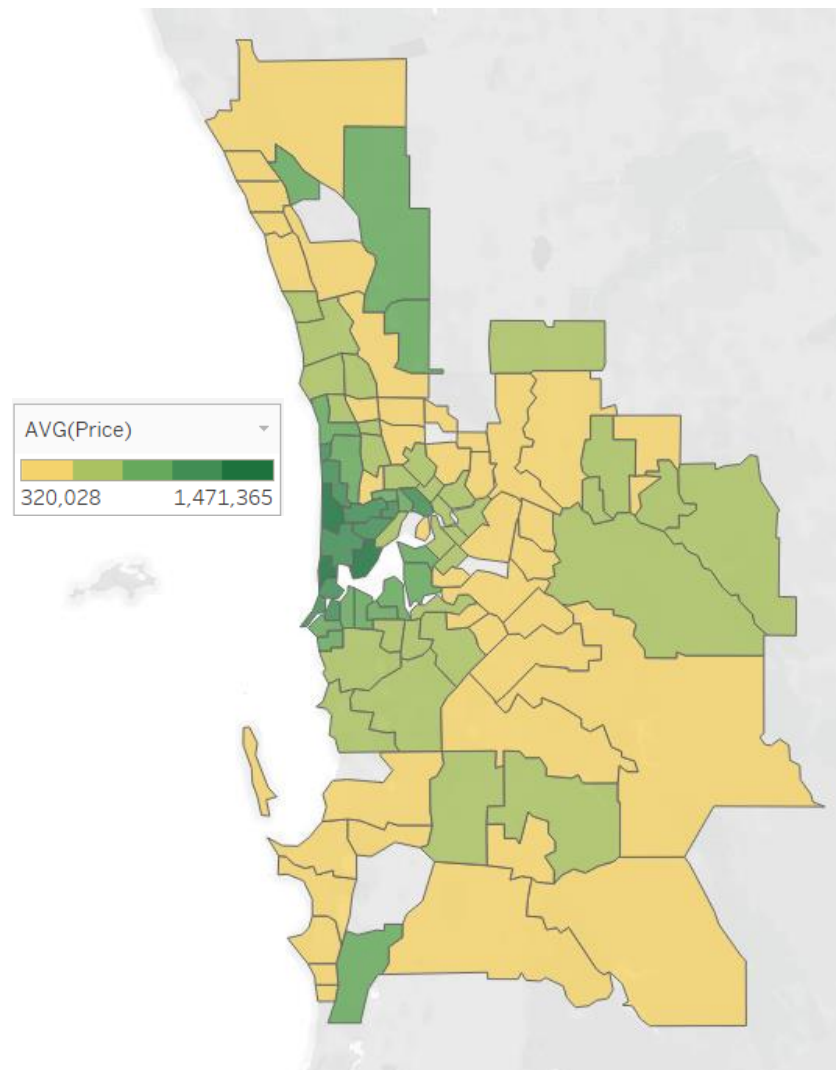
2.1. Perth

Postcode Distributions

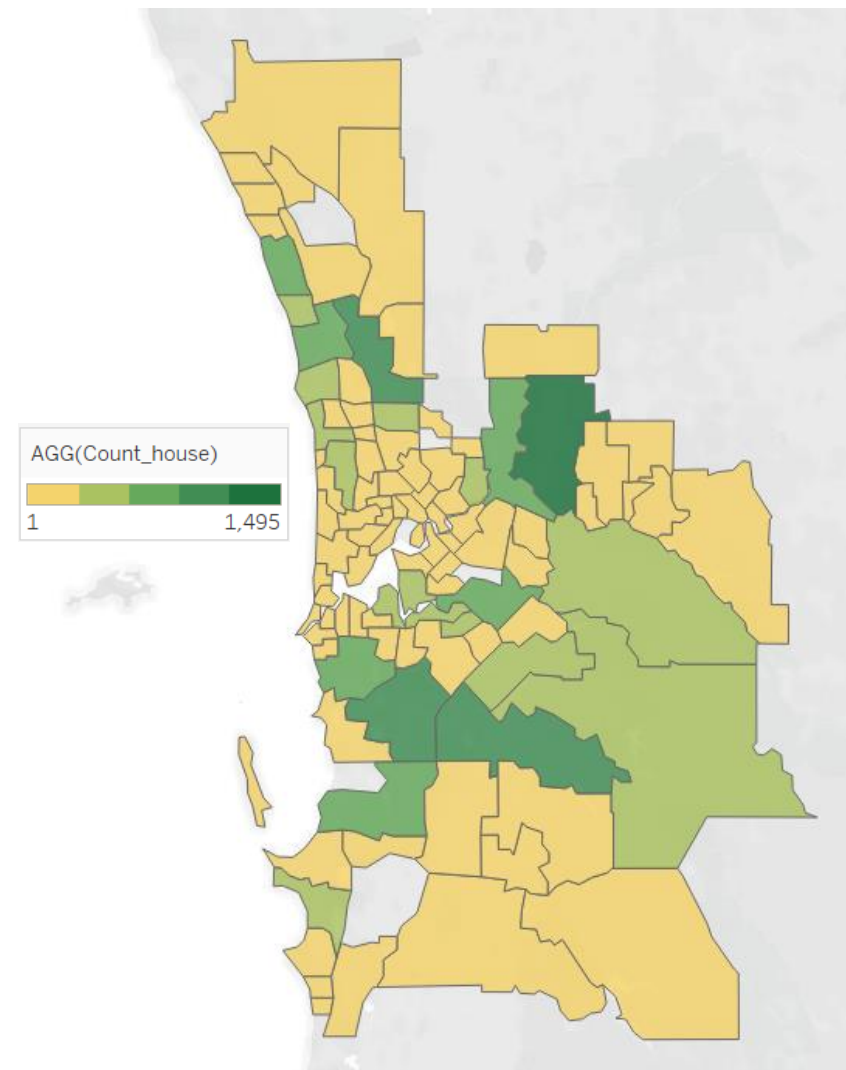
The central business district



The mean house price



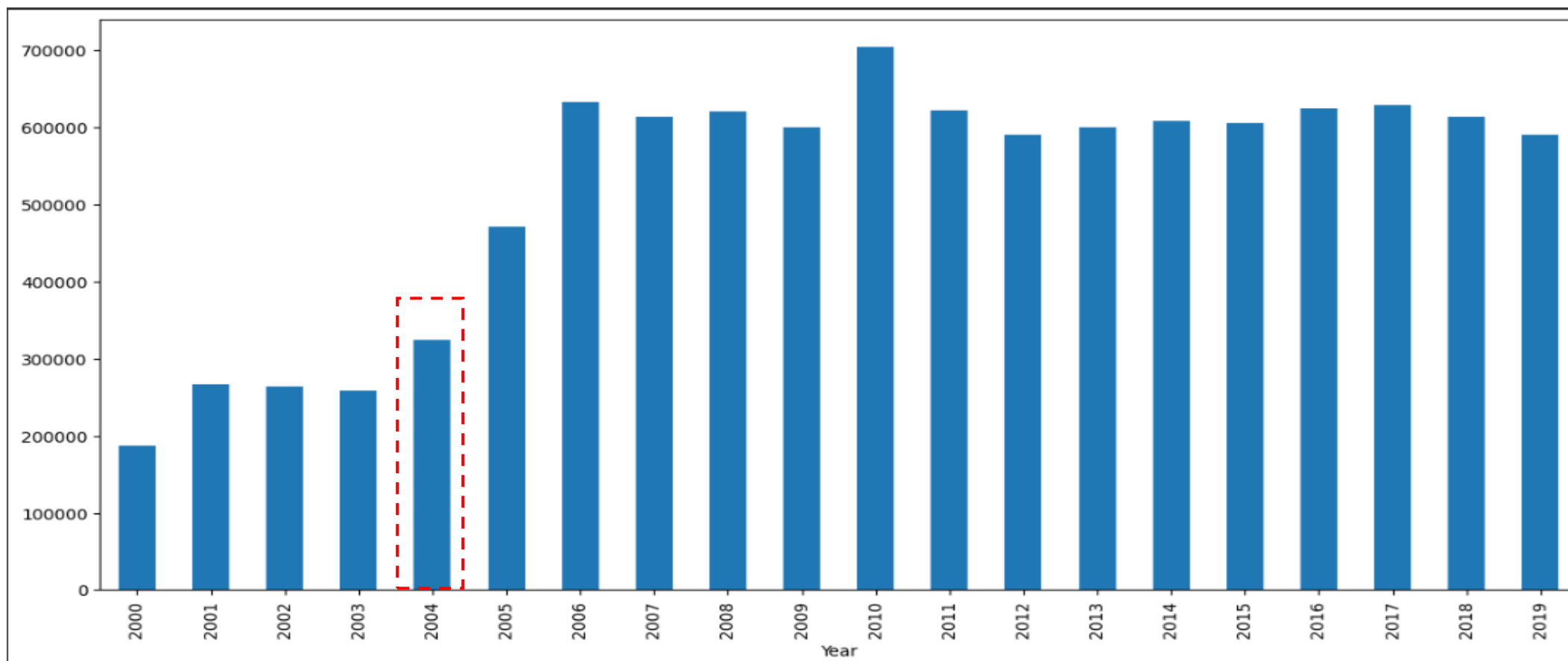
The volume transactions



2.2. Why are real estate prices skyrocketing?

- House prices skyrocketed from 2004 to 2006 and reached a peak at 700k\$ per house in 2010, before decreasing to and maintaining at 600k\$ per house.

House price over years



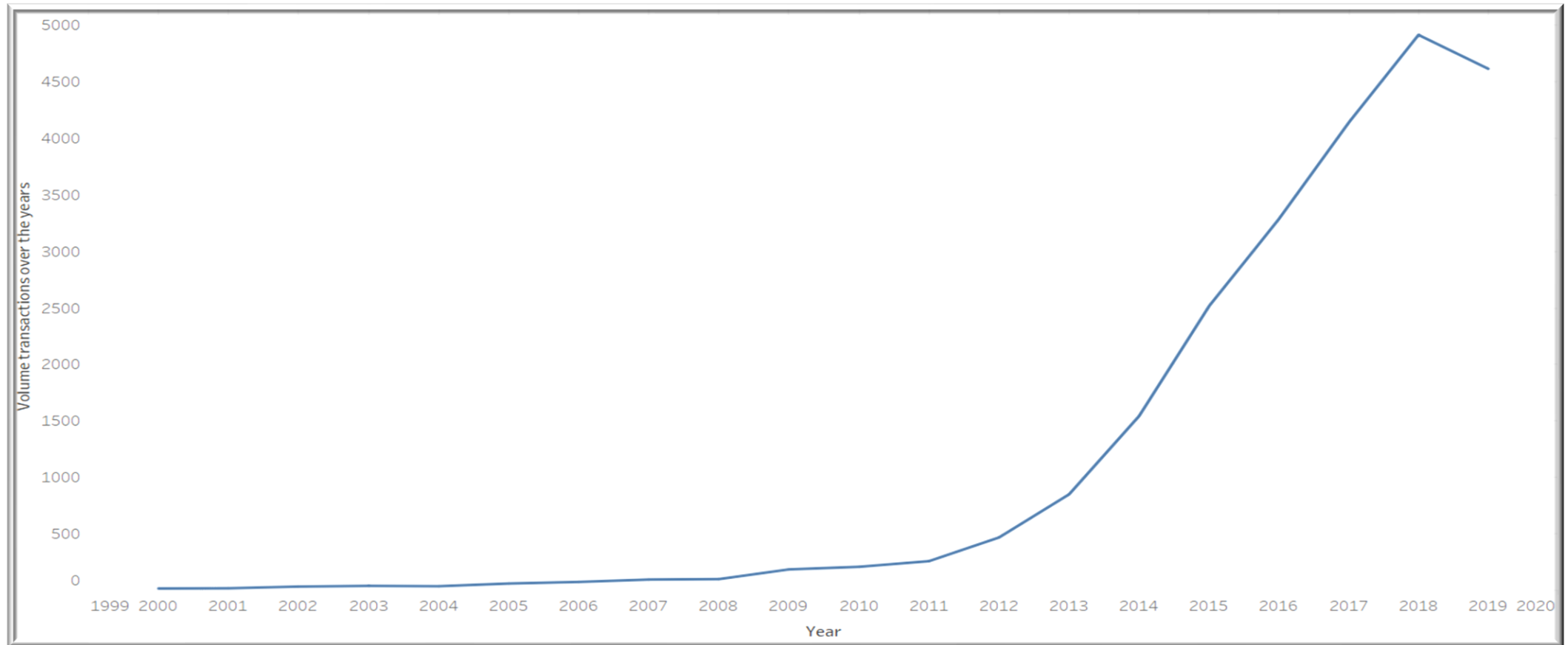
2.2. Why are real estate prices skyrocketing?

- House prices skyrocketed from 2004 to 2006 and reached a peak at 700k\$ per house in 2010, before decreasing to and maintaining at 600k\$ per house.
- People witnessed a sudden growth of house prices from 2000 to 2010 of 280%.

The ratio of house prices over the years compared to 2000

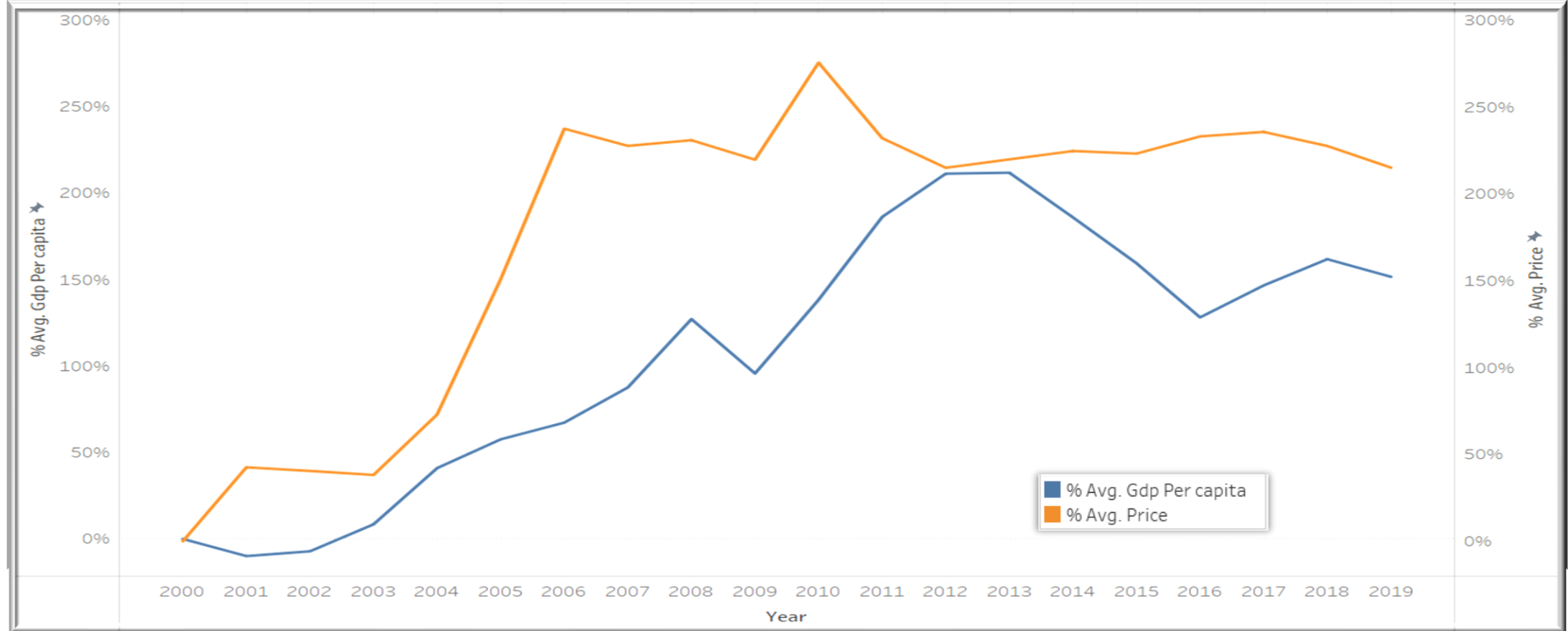


The volume of transactions by years



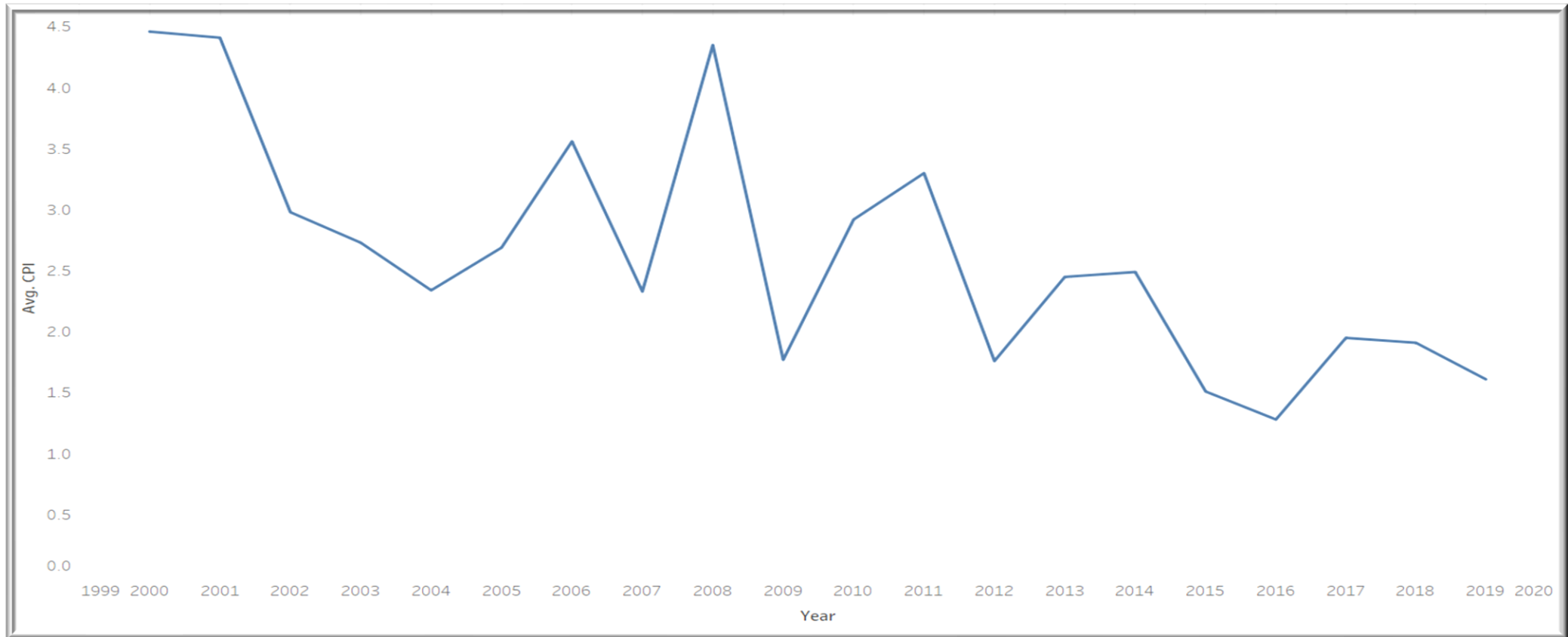
- In contrast, the charts illustrated the trading boom that began in 2011 and grew significantly in the following years while house prices skyrocketed before 2011 and declined and remained stable in cost later on.

Trend chart GDP per capita by years



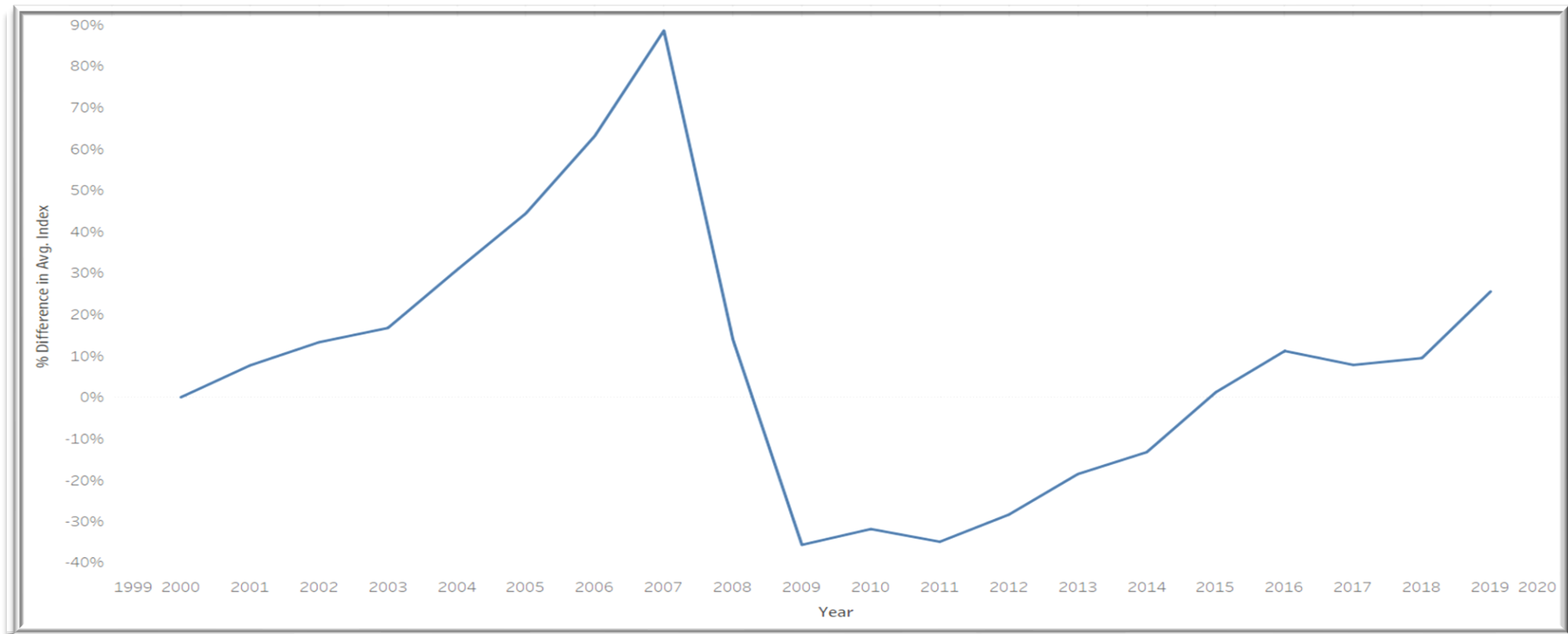
- The ratio of GDP per capita increased remarkably in 2010 at 140%, peaking in 2012 at about 220% while the percentage of house prices grew in 2012 at 220%.
- As home price growth slowed but GDP remained high, we witnessed a transaction boom in 2011.

The inflation rate charts



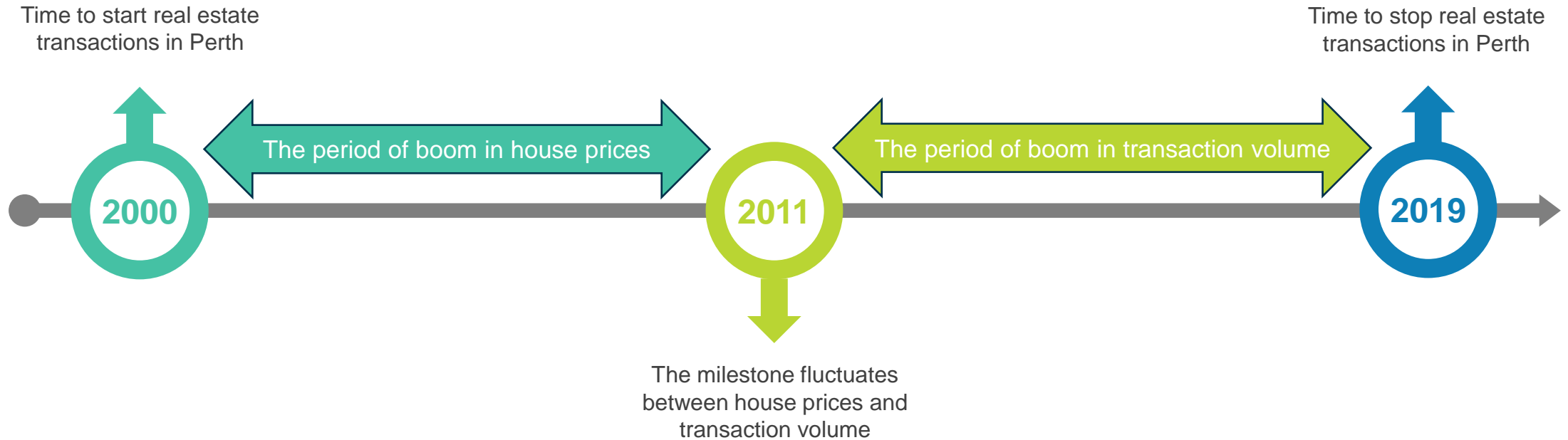
- Using CPI – Consumer Price Index evaluates the inflations of real estate in Perth.
- CPI tends to decrease over years.
- Although the number of transactions surged in 2011, housing prices began to stabilize, resulting in a steady decline in the CPI.

House price index charts



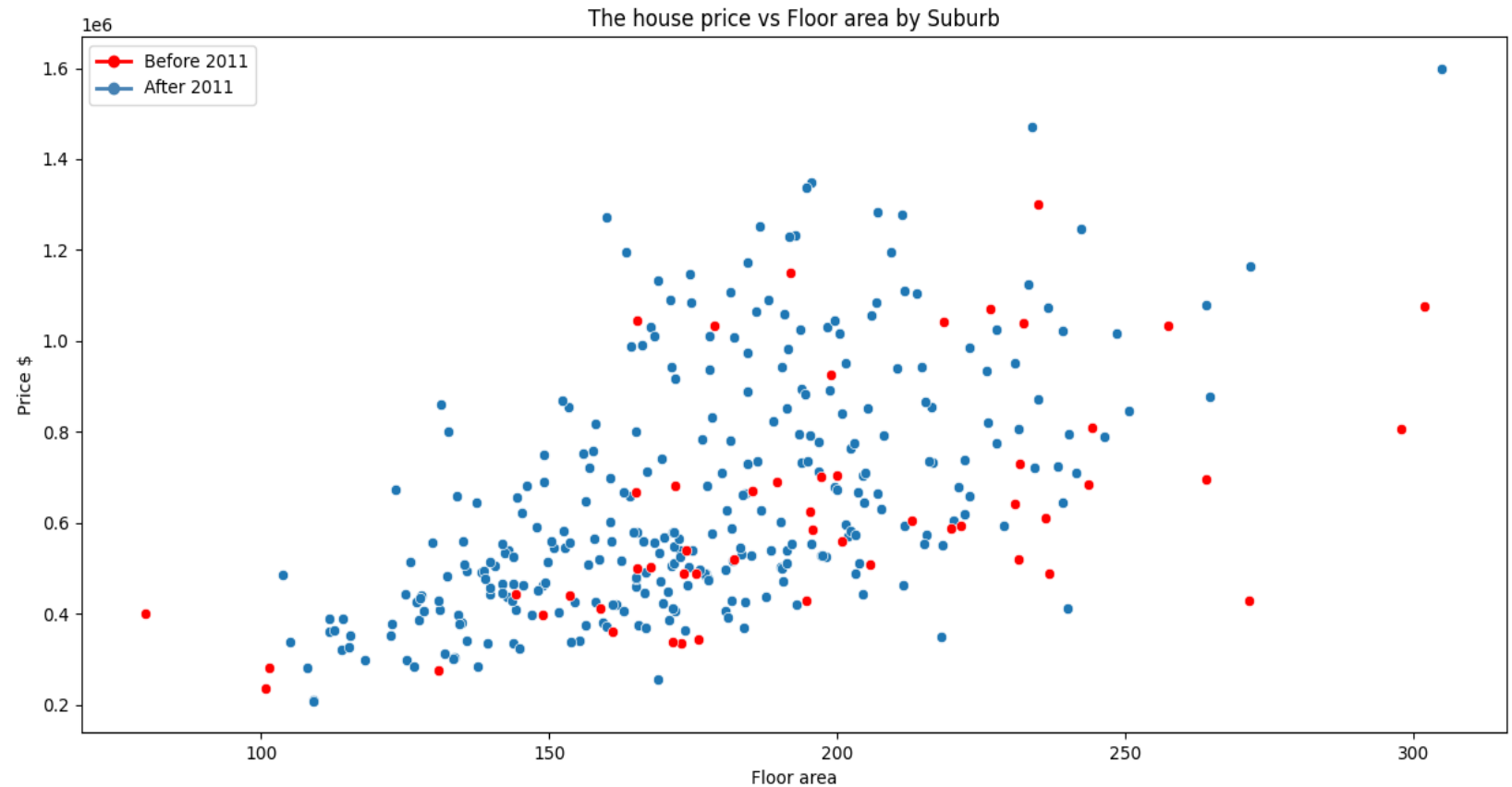
- Using REIT - Real Estate Investment Trusts evaluates the increase and decrease of real estate in Perth.
- The ratio of REIT increased remarkably in 2007 at 90% before dropping at -30% in 2009, followed by steady growth of the percentage of house prices at 20% in 2019.

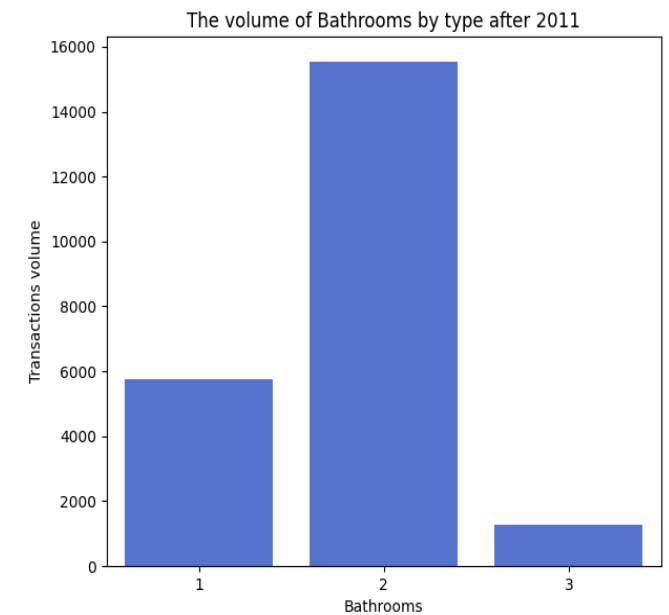
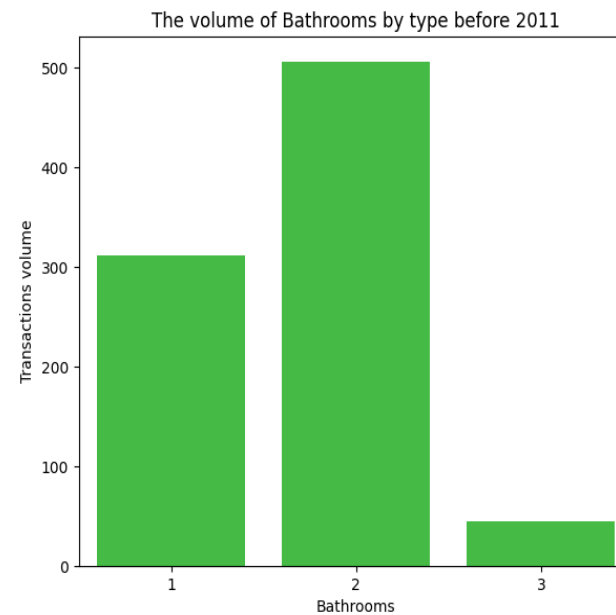
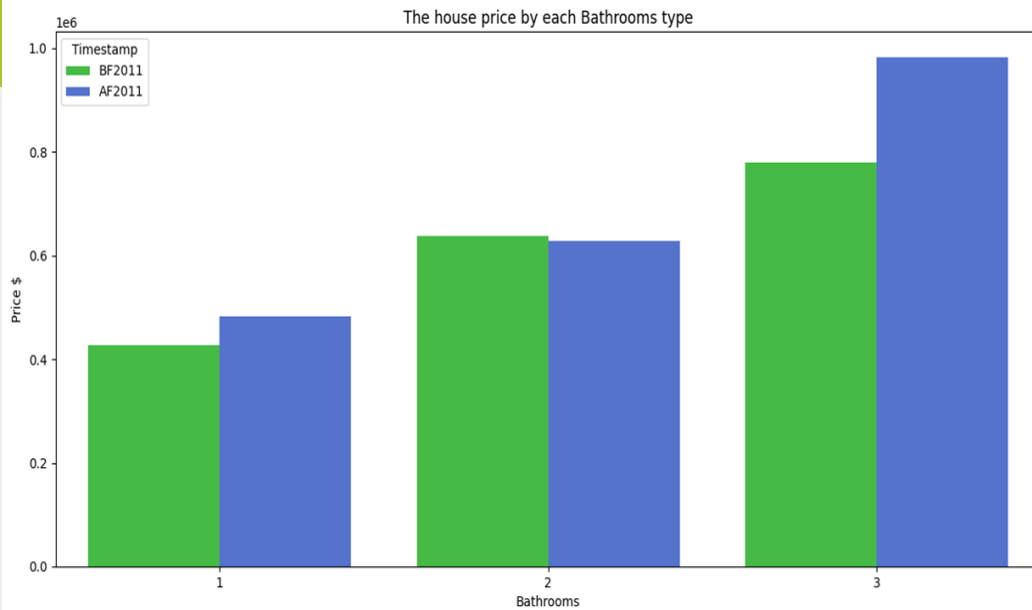
Timeline



Floor area

- In general, the scatter plot was distributed quite evenly without focusing on any area without recording differences between the years before 2011 and after 2011.

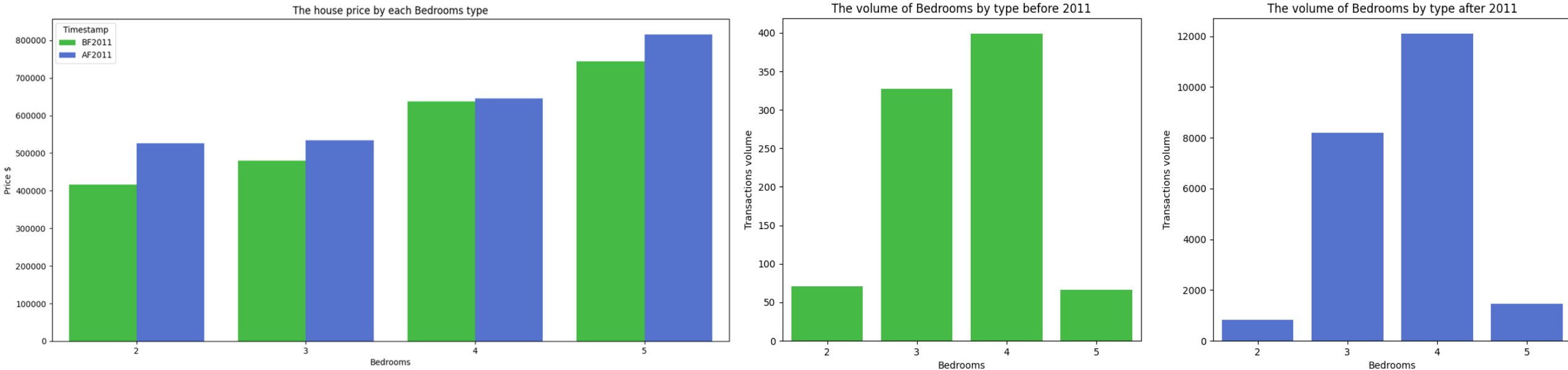




Bathrooms

- There are 3 main types of bathrooms 1, 2, and 3.
- Looking at the stages, there is also a continuous expansion in the volume of transactions and prices.
- After 2011, people tend to buy 2 bathrooms more than other types.

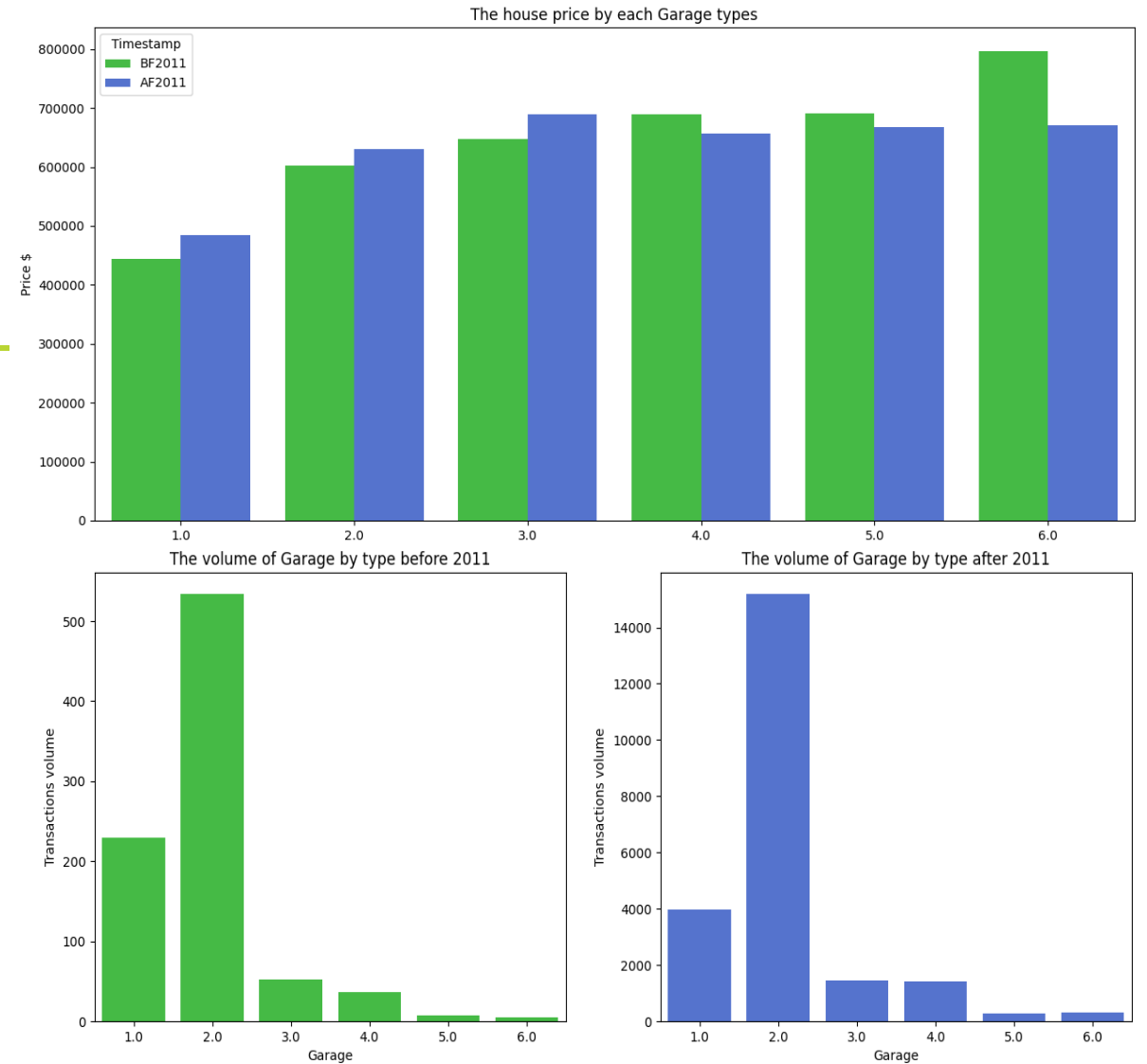
Bedrooms



- There are 4 main types of bedrooms 2, 3, 4, and 5.
- Looking at the stages, there is also a continuous expansion in the volume of transactions and prices.
- People tend to prioritize 2 types of bedrooms including 3 and 4.

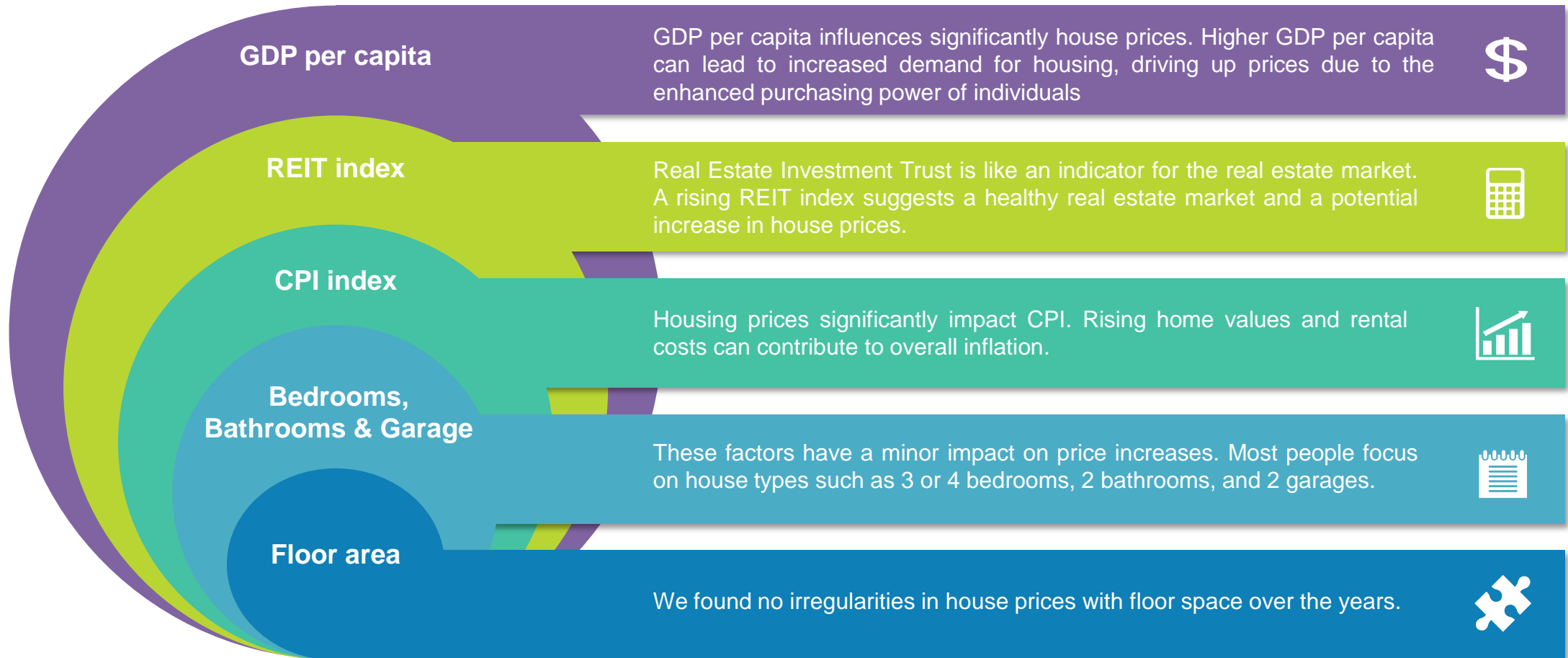
Garage

- There are 6 main types of garages.
- Looking at the stages, there is also a continuous expansion in the volume of transactions and prices.
- People tend to prioritize 2 types of bedrooms including 1 and 2.



Conclusion

House prices are impacted remarkably by the macro elements such as GDP per capita, CPI, and REIT while the micro factors including bathrooms, bedrooms, and garages influence insignificantly the house prices.



AGENDA

1. Introduction



Introduce big question and datasets, then the aim to resolve big question and Datasets well-being insights

2. Exploratory Data



Overview to better understand the data and what factors affect house prices in Perth?

3. Insight Data



Gain insight into geographic location data and popular house types in Perth

4. Build Models



5. Conclusion

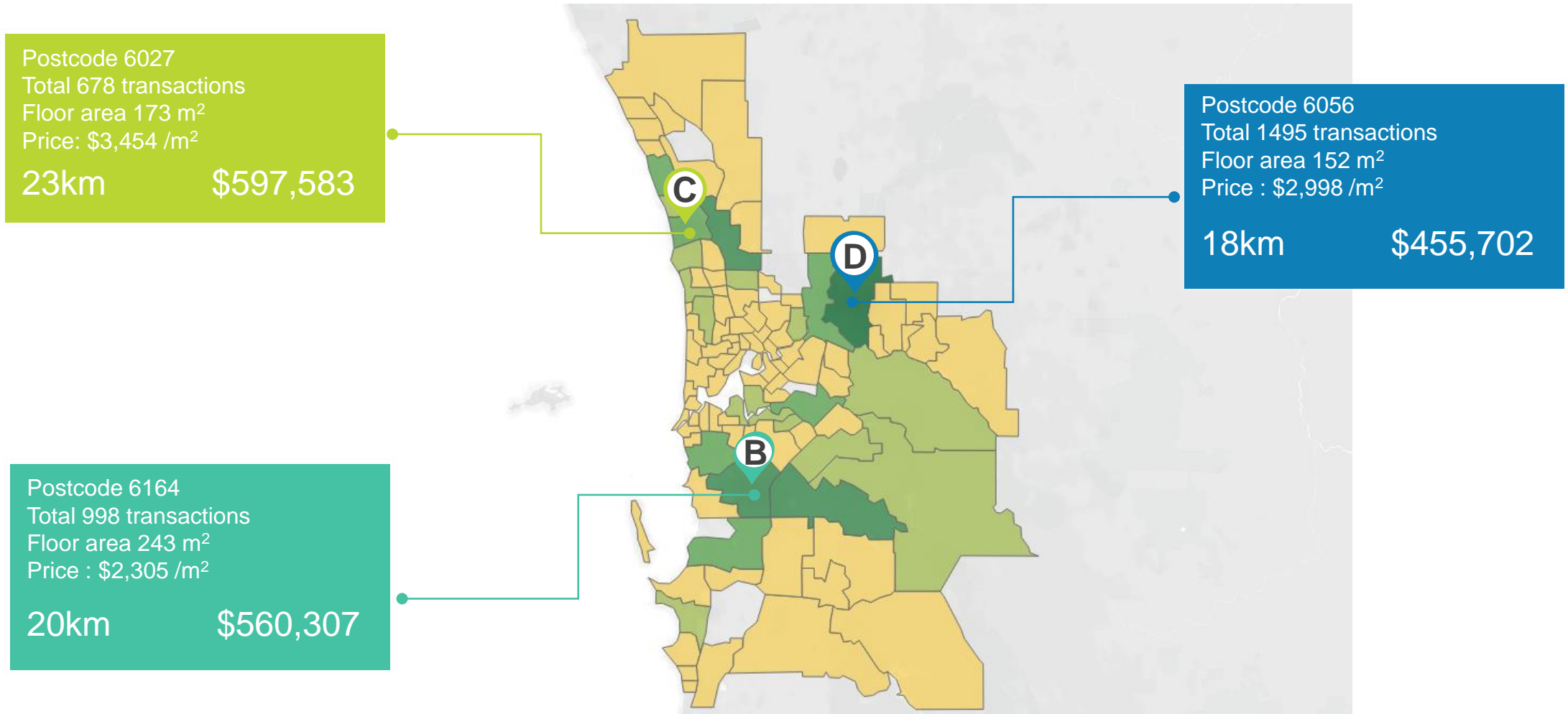


3. Insight data analysis

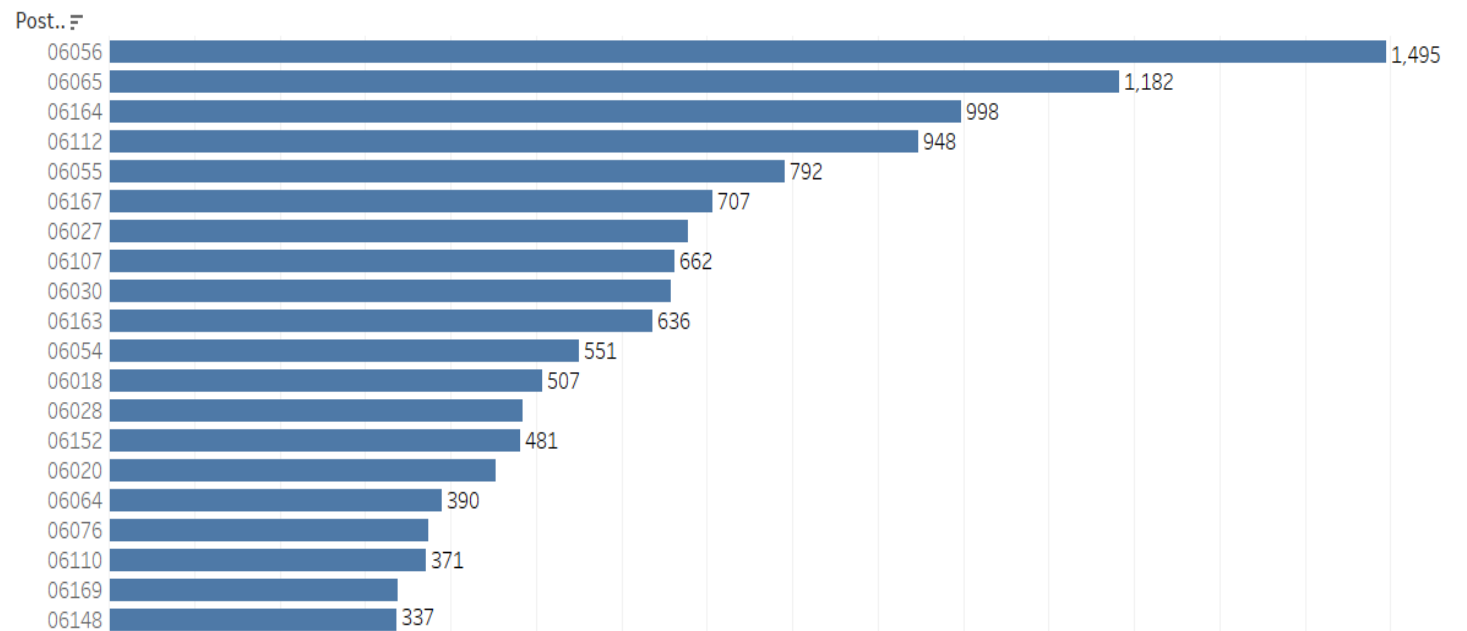
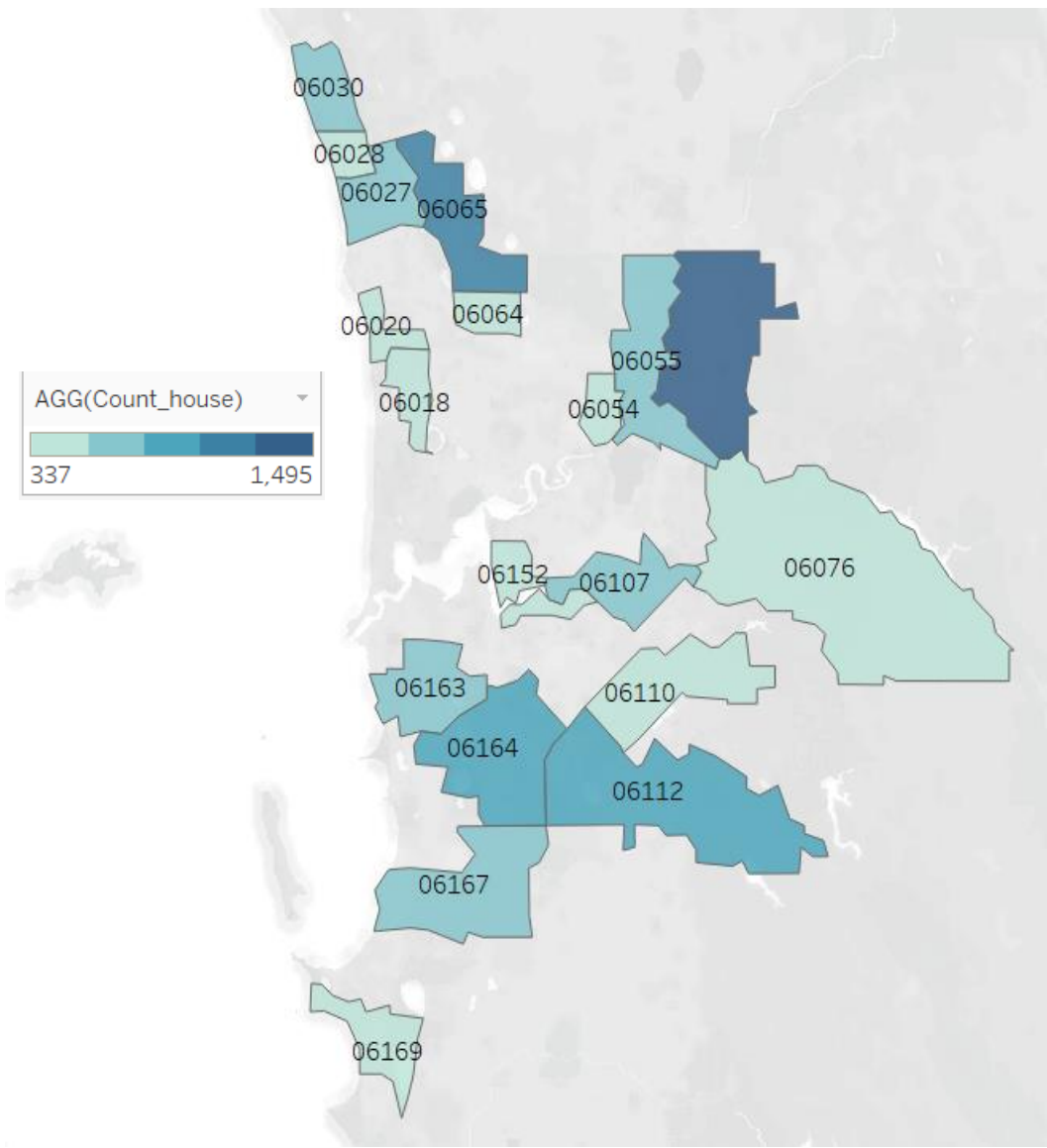
Geographic location data
and popular house types
in Perth



3.1. Geographical locations

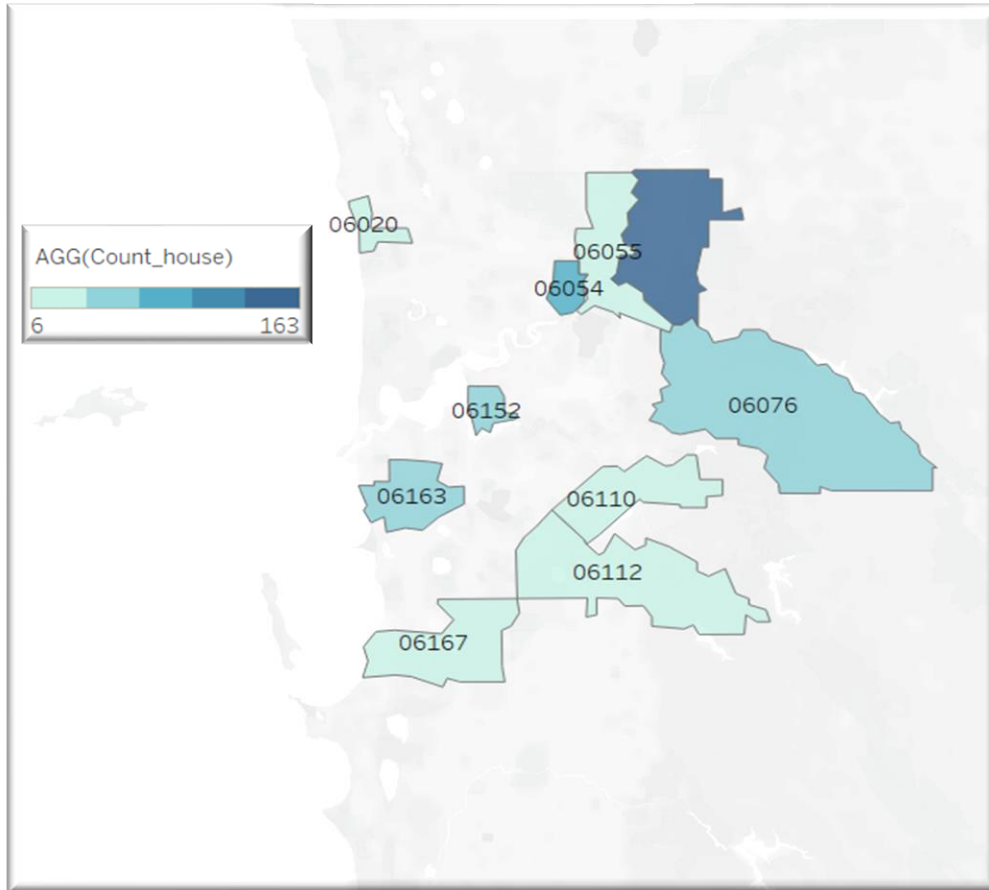


Top 20 Postcode largest volume of transactions

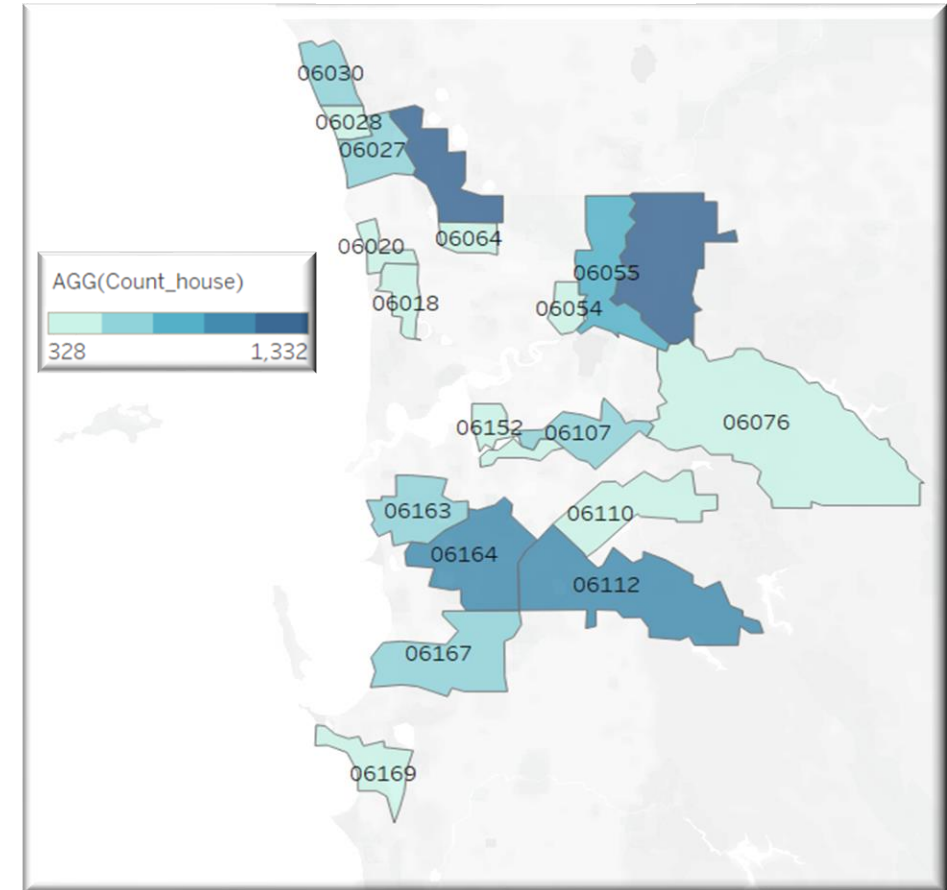


- The center area has little transactions while the neighborhood constitutes a major transactions.
- The largest volume of transactions site in Perth's Northeast area, followed by the Northwest area in front of sea.
- The Southern has more opportunities for investment with huge advantages such as flexible floor area and affordable prices.

Before 2011



After 2011

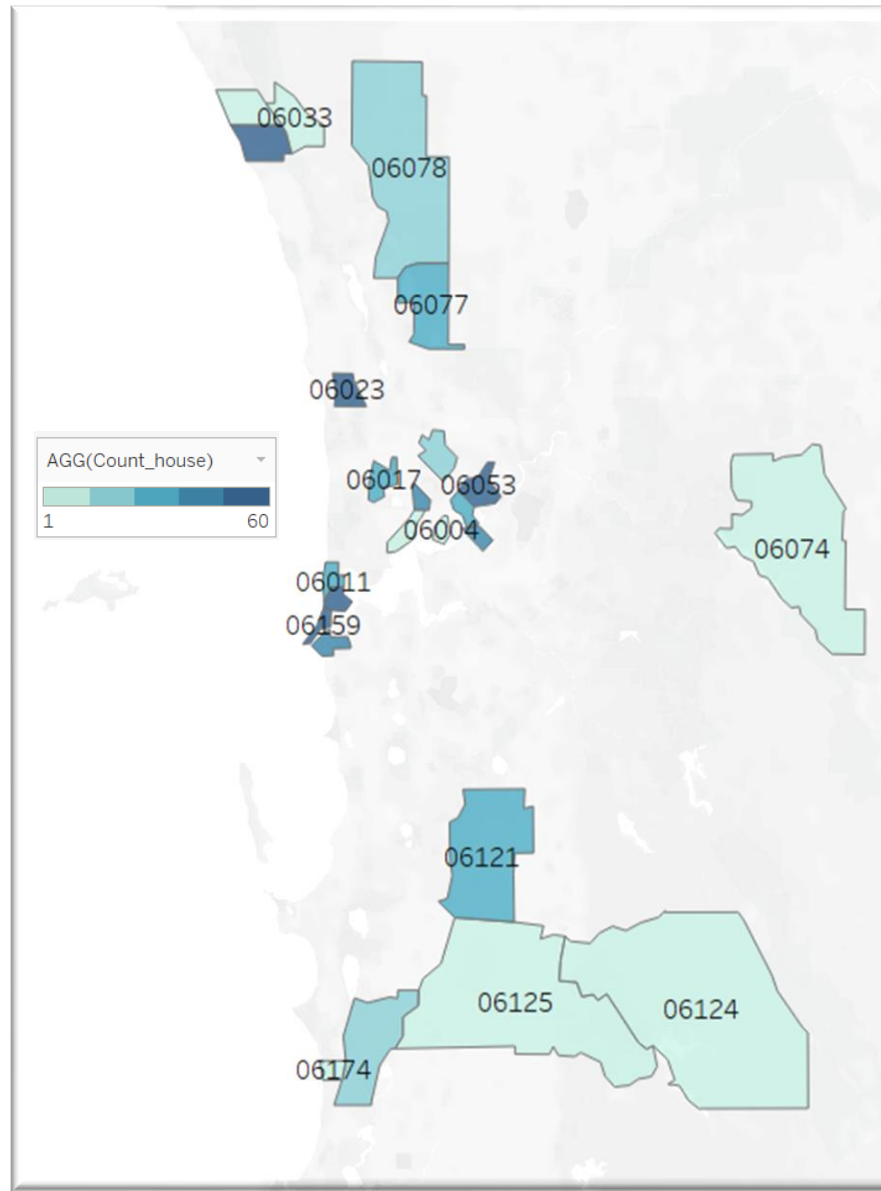
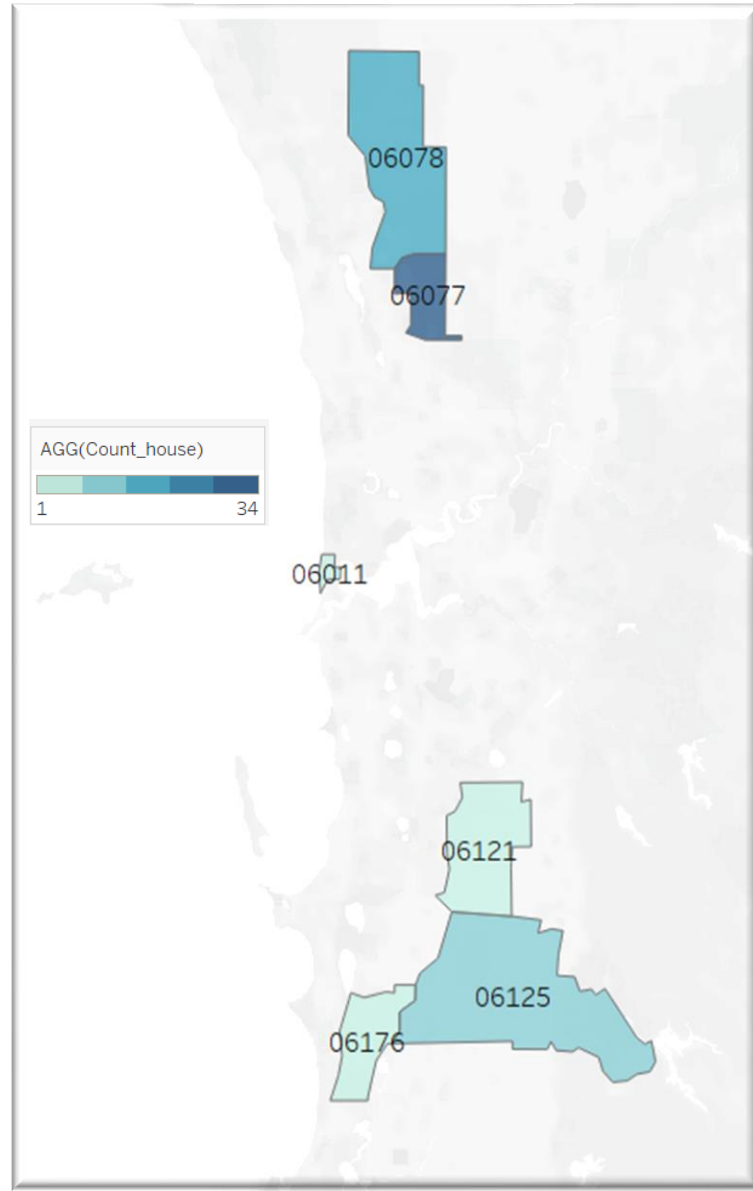


- The center area has little transactions while the neighborhood constitutes a major transactions.
- From 2000 to 2010, Most people focus on buying houses in the Northwest and exchange few transactions in the Southern .
- After 2011, we witnessed a wave of house buying to the Northwest which has views front of sea and to the South.

Top 20 Postcode fewest volume of transactions

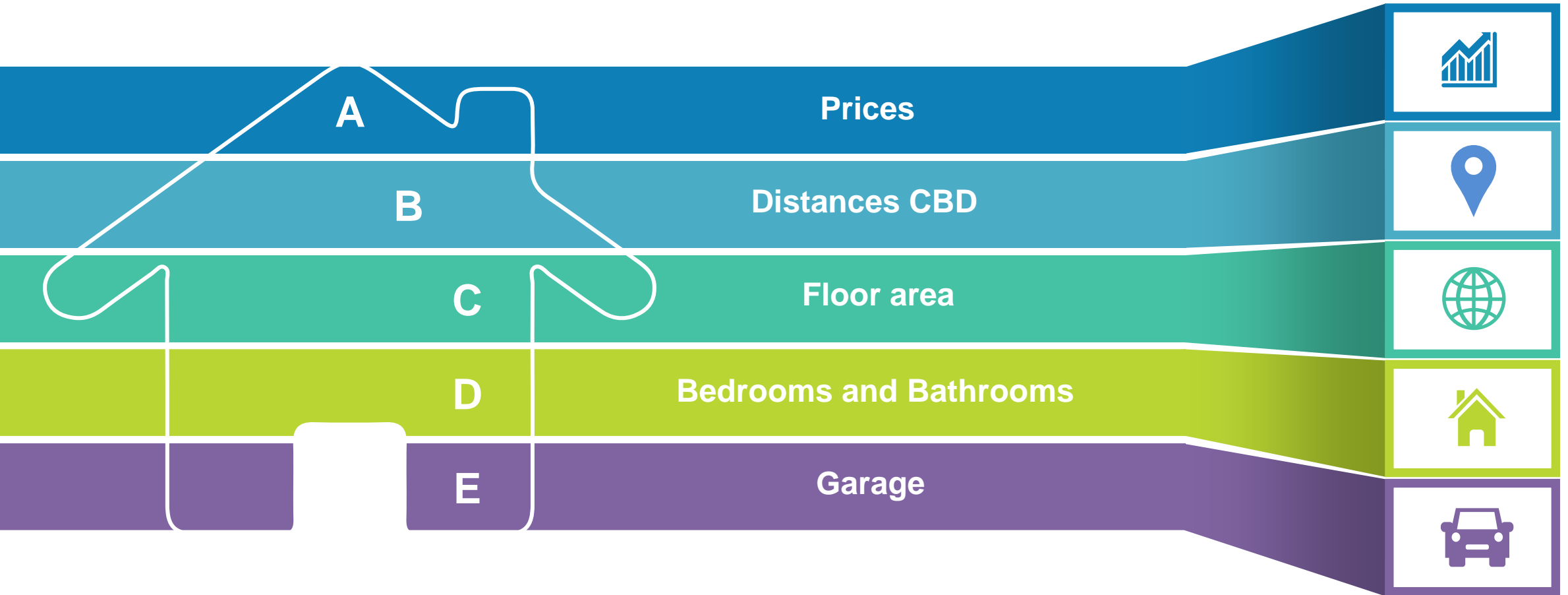
Before 2011

After 2011



- The map illustrates places that have few transactions, mainly places in the center or far from the center.
- One compelling factor is the places far away from the center that have a great deal of good prices. In contrast, people have to spend plenty of time commuting.
- After 2011, the volume of transactions emerges in the center area. Overall, the high house prices make the real estate market in the center more difficult for transactions.

Main factors



3.2. Type of houses



Catergoies	Type 1	Type 2	Type 3
Bathrooms	2	2	1
Bedrooms	4	3	3
Garage	2	2	1
A. Floor area	198 m ²	156 m ²	114 m ²
A. House prices	\$624,000	\$594,600	\$433,600
A. House price per square	\$3,151/m ²	\$3,811/m ²	\$3,798/m ²
A. Distance Central business	20km	16km	17km
A. Quantity transactions	8602	3112	2115

3.2. Type of houses

The percentage of volume transactions distributed based on type of house



37%

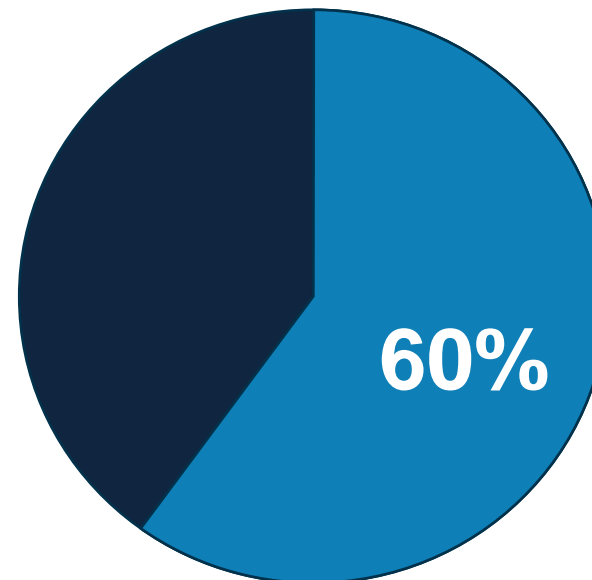
A sum of **8602** transactions constitutes 37% the total amount of transactions.

14%

A sum of **3112** transactions constitutes 14% the total amount of transactions.

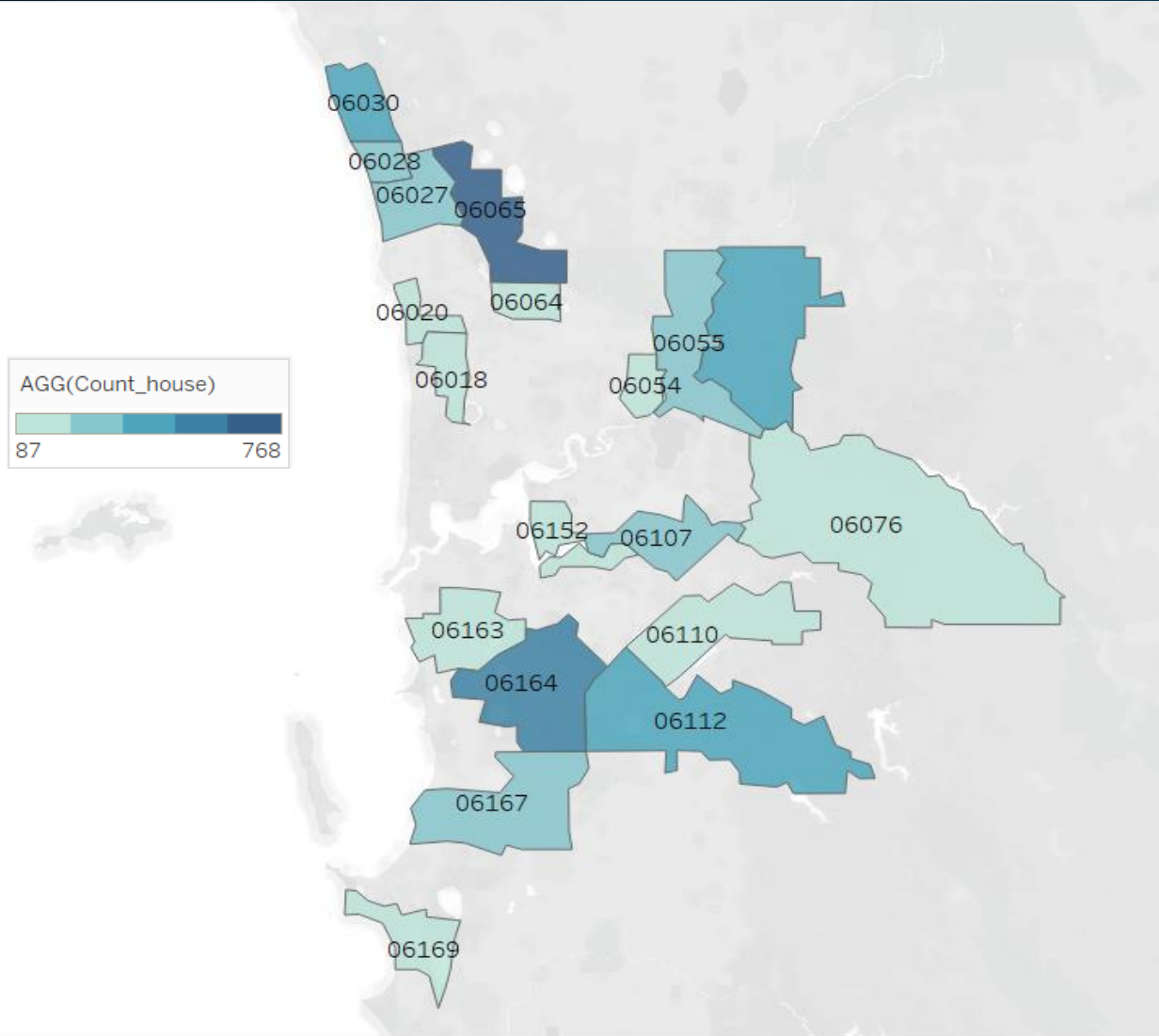
9%

A sum of **2215** transactions constitutes 9% the total amount of transactions.



- ◆ The top 3 best-selling home types over the years account for more than 60% of the total transaction volume of other types.
- ◆ We will gain insight into the characteristics of 3 house types.

House type 1 || 2 Bathrooms, 4 Bedrooms, and 2 Garages



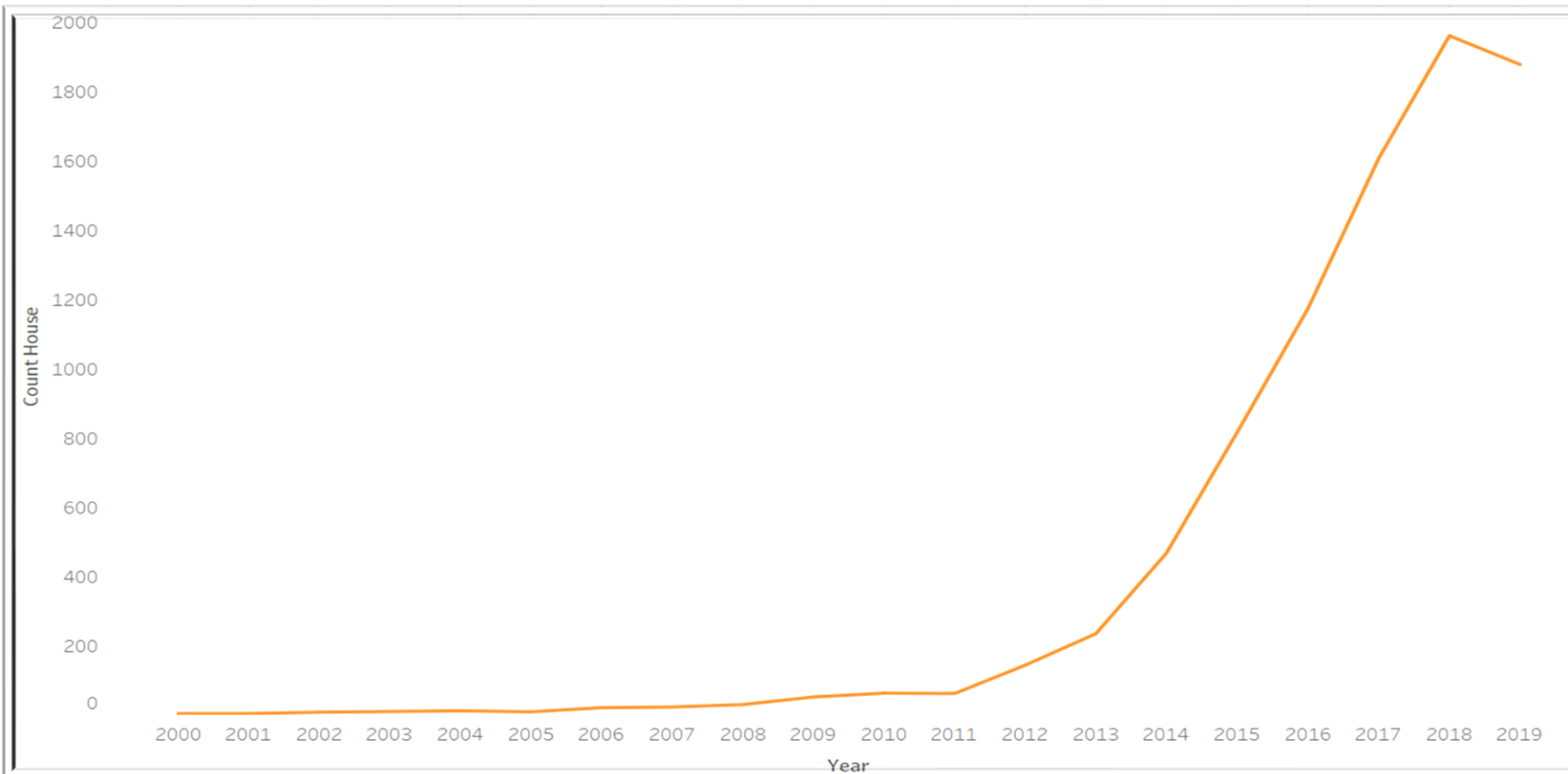
Top 20 Postcode largest volume of transactions house type 1. The familiar places' top 20 best-selling.



People focus on buying houses in the southern area and the Northwest rather than the Northeast.

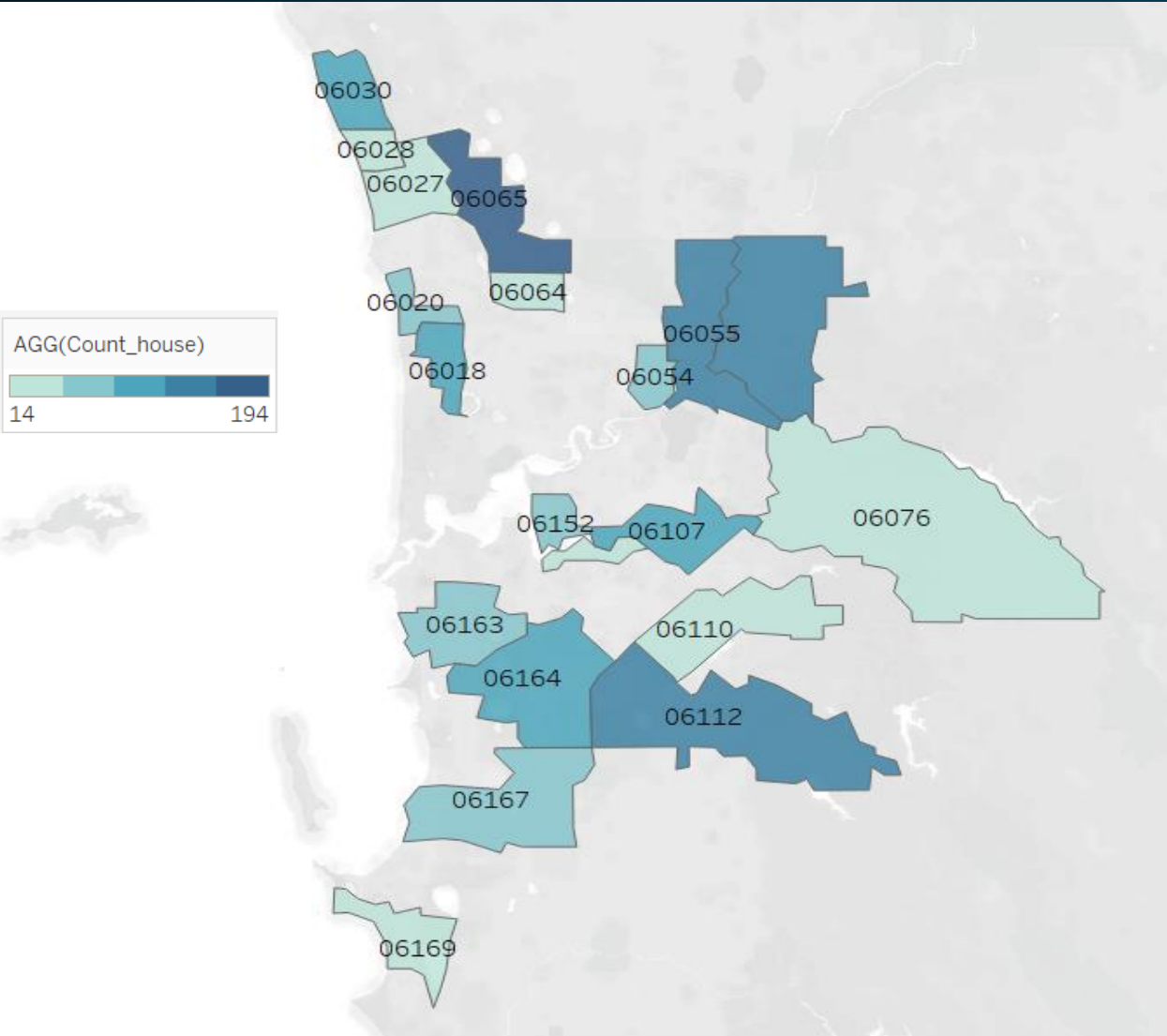
House type 1 || 2 Bathrooms, 4 Bedrooms, and 2 Garages

The volume of transactions' house type 1



- We witnessed common features experienced in the boom of transactions in 2011.
- This type of house mainly contributed to the transaction boom in 2011.

House type 2 || 2 Bathrooms, 3 Bedrooms, and 2 Garages



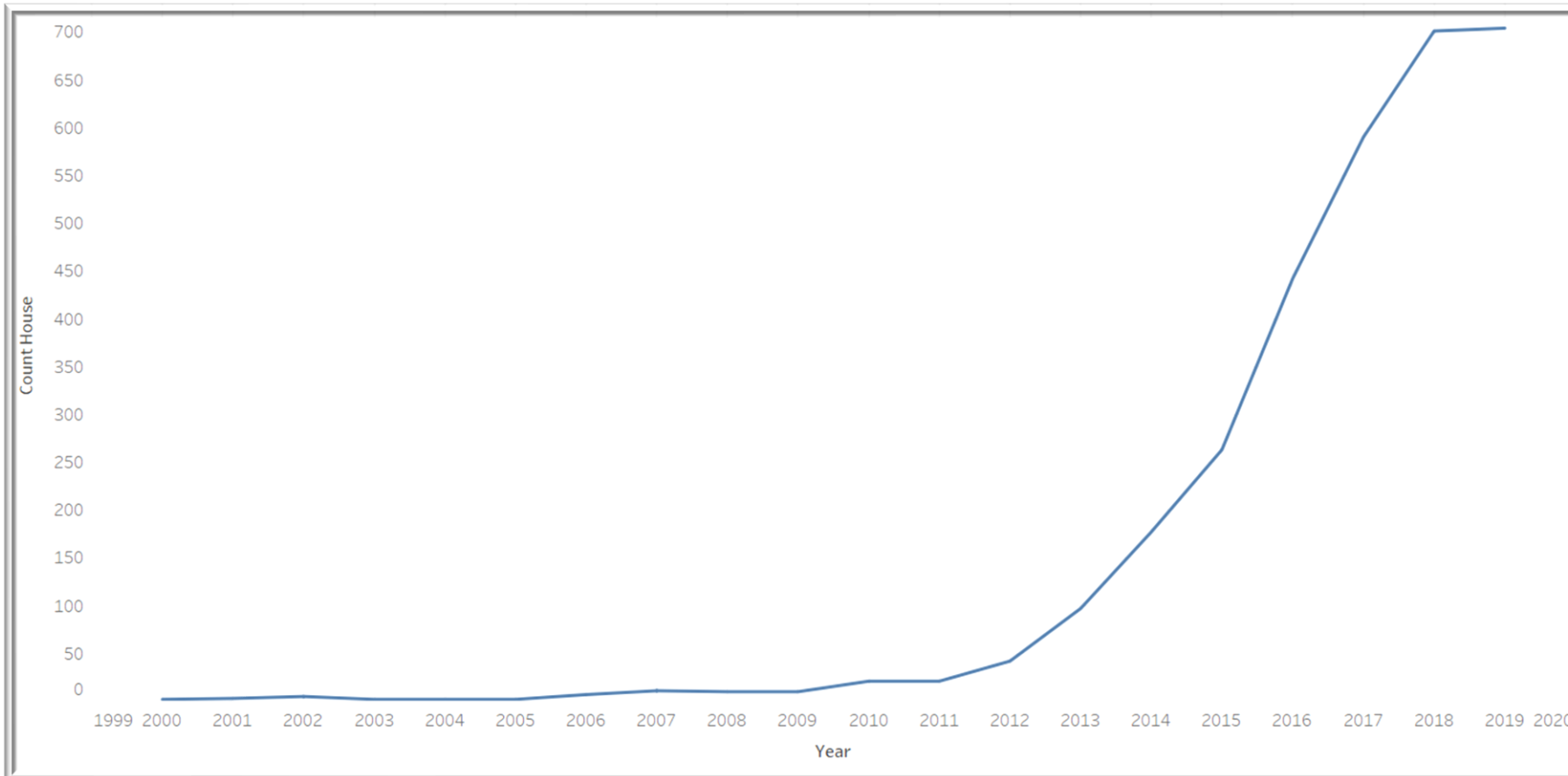
Top 20 Postcode the largest volume of transactions house type 2. The familiar places' top 20 best-selling.



People focus on buying houses in the southern area and the Northeast rather than the Northwest.

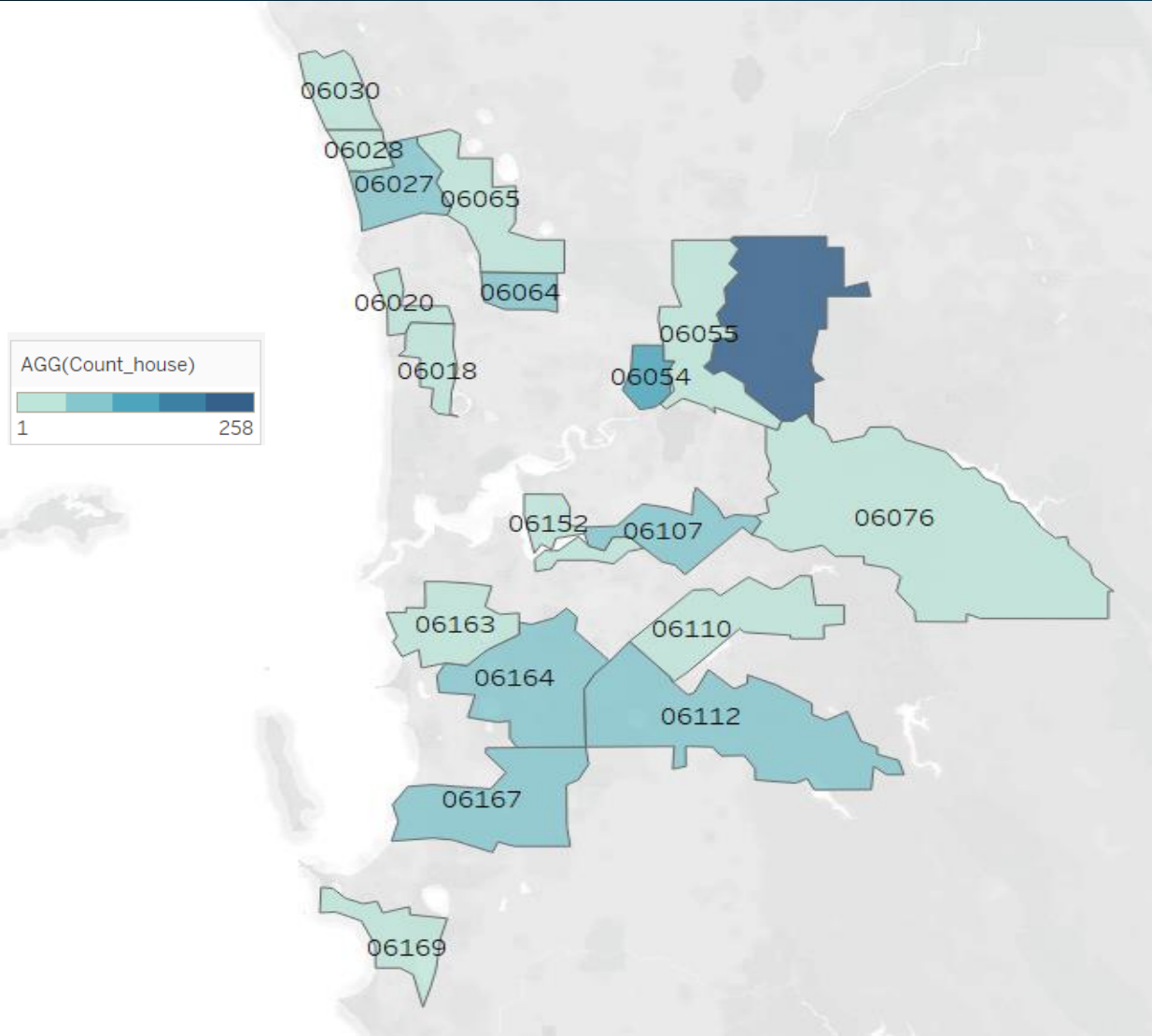
House type 2 || 2 Bathrooms, 3 Bedrooms, and 2 Garages

The volume of transactions' house type 2



- We witnessed common features experienced in the boom of transactions in 2011.
- The trend charts of House type 2 look similar to charts of House type 1 and the general charts.

House type 3 || 1 Bathrooms, 3 Bedrooms, and 1 Garages



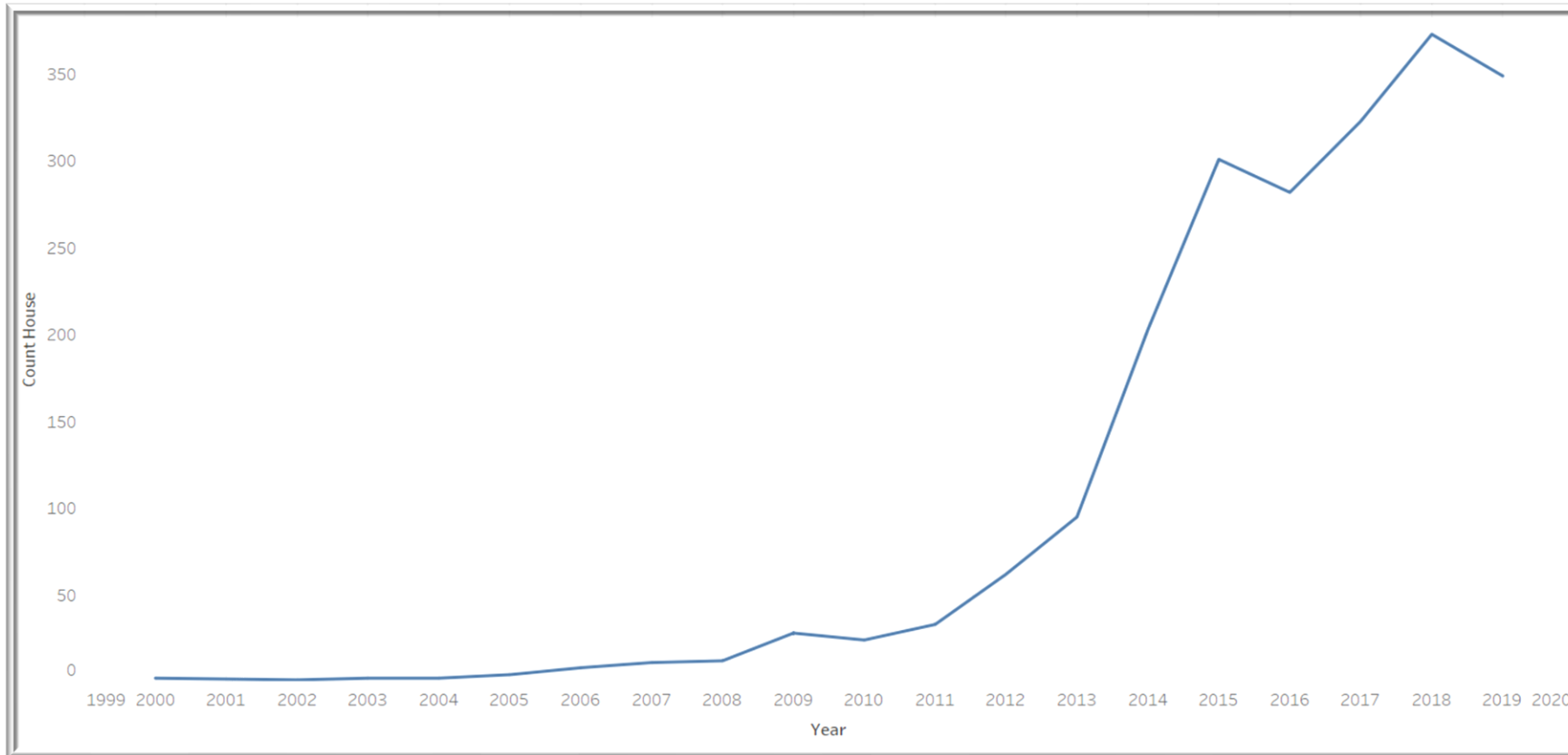
Top 20 Postcode the largest volume of transactions house type 3. The familiar places' top 20 best-selling.



People focus on buying houses in the Northeast area rather than other area.

House type 3 || 1 Bathrooms, 3 Bedrooms, and 1 Garages

The volume of transactions' house type 3



- We witnessed common features experienced in the boom of transactions in 2008.
- The charts illustrated the skyrocket from 2008 at 35 transactions to 2015 at 310 ones, before decreasing slowly to 300 in 2016, followed by reached a peak 2018 at 360 ones.

Conclusion

01

3 popular house types account for more than 60% of total transactions, namely the majority house type 1 about 37%, type 2 about 14%, and type 3 appropriately 9%.

02

Most house types saw a boom in volume transactions in 2011.

03

3 house types of the location have relatively similar allocations, mainly concentrated surrounding the center with a radius of about 15-20 km.

04

Places located directly in the center or far from the center have very few transactions.

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2. Exploratory Data



Overview to better understand the data and what factors affect house prices in Perth?

3. Insight Data



Gain insight into geographic location data and popular house types in Perth

4. Build Models



Build model to suggest perfect locations and predict house values

5. Conclusion



4. Build Model



Working process

- 1 We are consultants in real estate who offer solutions that suit customer needs



- 2 Content of steps



Step 1

Explain to them the housing price situation in Perth is it expensive or cheap?



Step 2

We would consider seriously geographical locations to align with the needs of customers.

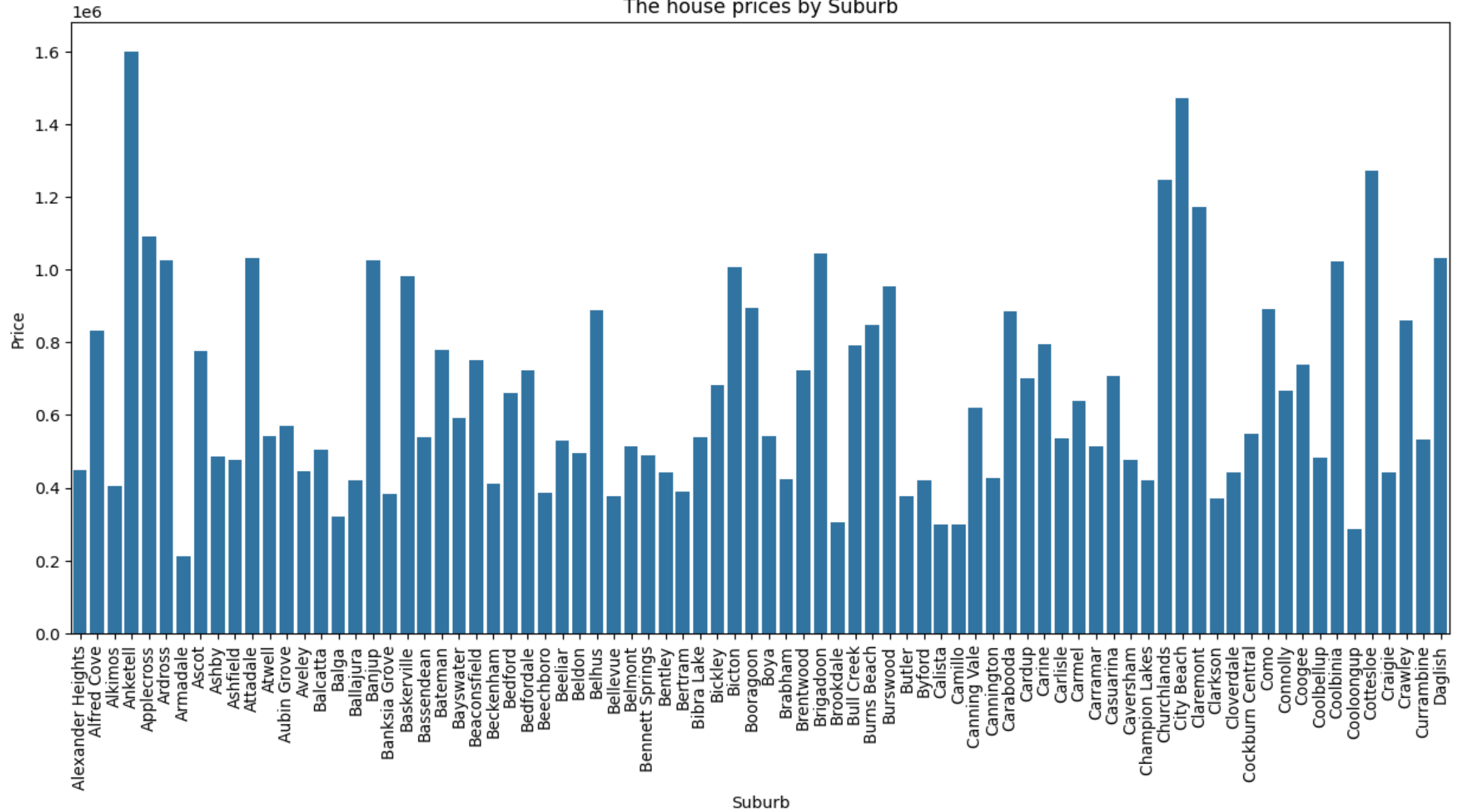


Step 3



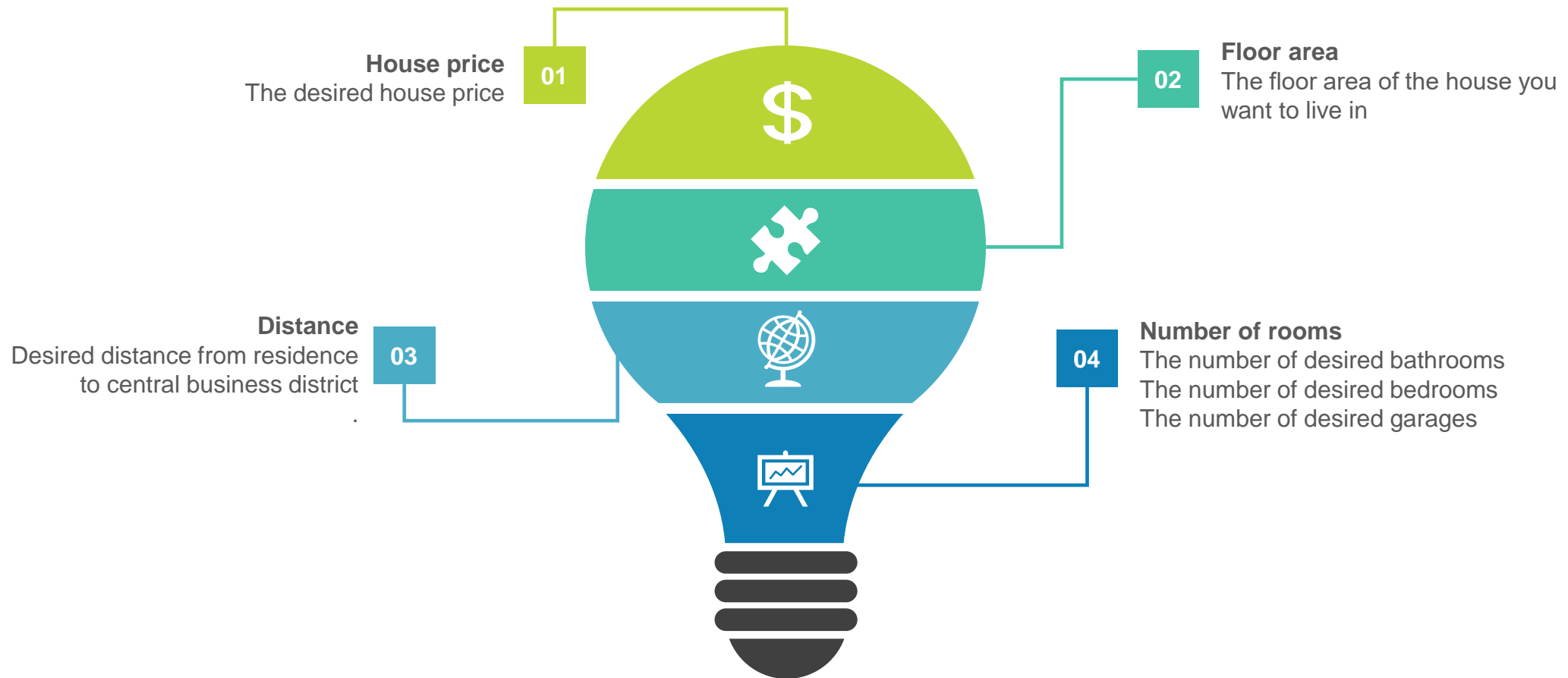
Step 4

The house prices by Suburb

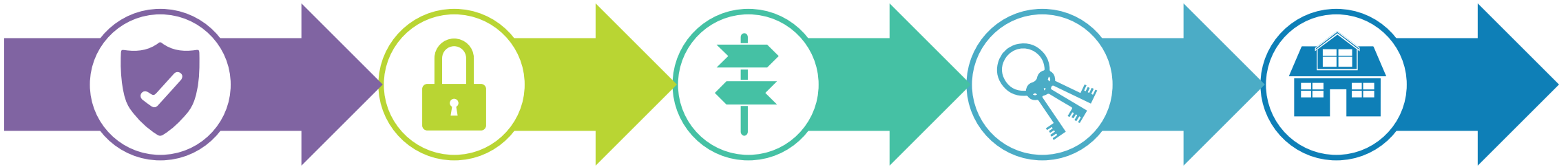


4.1. Location suggestion model

In order for customers to be able to buy the house according to their wishes, they will need to fill out a form with some basic information to find a location that matches the house of their dreams.



Build model



> Input information

Input basis information of house

> Prepare data

$a = \text{vectors}(\text{information of customers})$
 $b = \text{vectors}(\text{datasets})$

> Cosine function

$\text{Cosine} = \frac{\text{dot}(a, b)}{(\text{norm}(a) * \text{norm}(b))}$

> Return Suburb

The model returns the locations that best suit the customer's needs

> Choose location

The customers will choose Suburb locations of their preference

Models use Cosine function

The provided Python function cosine calculates the cosine similarity between two vectors a and b:

1. `dot(a, b)`: This calculates the dot product of vectors a and b. The dot product measures the similarity between two vectors by multiplying their corresponding elements and summing the results.
2. `norm(a)` and `norm(b)`: These calculate the norms (magnitudes) of vectors a and b, respectively. The norm of a vector is the square root of the sum of the squares of its elements.
3. `Cosine = dot(a, b) / (norm(a) * norm(b))`: The cosine similarity is calculated by dividing the dot product of the vectors by the product of their norms. This results in a value between -1 and 1, where:
 - 1 indicates perfect similarity (vectors are identical in direction)
 - 0 indicates no similarity (vectors are orthogonal)
 - -1 indicates perfect dissimilarity (vectors are opposite in direction)

This function effectively computes the cosine similarity between two vectors, which is a useful metric for measuring the similarity between documents.

Location suggestion model

*** Information customers ***

Desired price house \$: 500000

Floor area m2: 200

Bedrooms: 4

Bathrooms: 2

Garage: 2

Distance Central business district km: 20

	Suburb	Cosine Value	Price	Floor area	Bedrooms	Bathrooms	Garage	Dist CBD
0	Hocking	0.998322	503654.411765	190.294118	3.941176	1.970588	2.132353	20.668382
1	Success	0.997603	530035.294118	197.352941	3.917647	2.023529	2.176471	21.383529
2	Jane Brook	0.997257	501554.80791	190.418079	3.943503	1.983051	2.20339	20.763277
3	Landsdale	0.996278	552159.351648	218.241758	4.010989	2.021978	2.032967	16.015385
4	Bibra Lake	0.996192	540365.669903	172.76699	3.815534	1.825243	1.932039	16.112621
5	Hammond Park	0.996183	528835.263158	197.210526	3.868421	2.0	2.118421	23.725
6	Atwell	0.995775	541041.597315	191.295302	3.798658	1.979866	2.100671	21.368456
7	Kingsley	0.995538	577826.923077	178.211538	3.903846	1.846154	1.923077	16.788462
8	Tapping	0.995484	488825.496689	203.238411	3.960265	2.02649	2.152318	26.577483
9	Beeliar	0.995464	528452.016129	185.096774	3.814516	1.983871	2.137097	20.598387

Working process

- 1 We are consultants in real estate who offer solutions that suit customer needs



- 2 Content of steps



Step 1

Explain to them the housing price situation in Perth is it expensive or cheap?



Step 2

We would consider seriously geographical locations to align with the needs of customers.



Step 3

Clients will seek appropriate locations in the market that we have suggested to previous places.

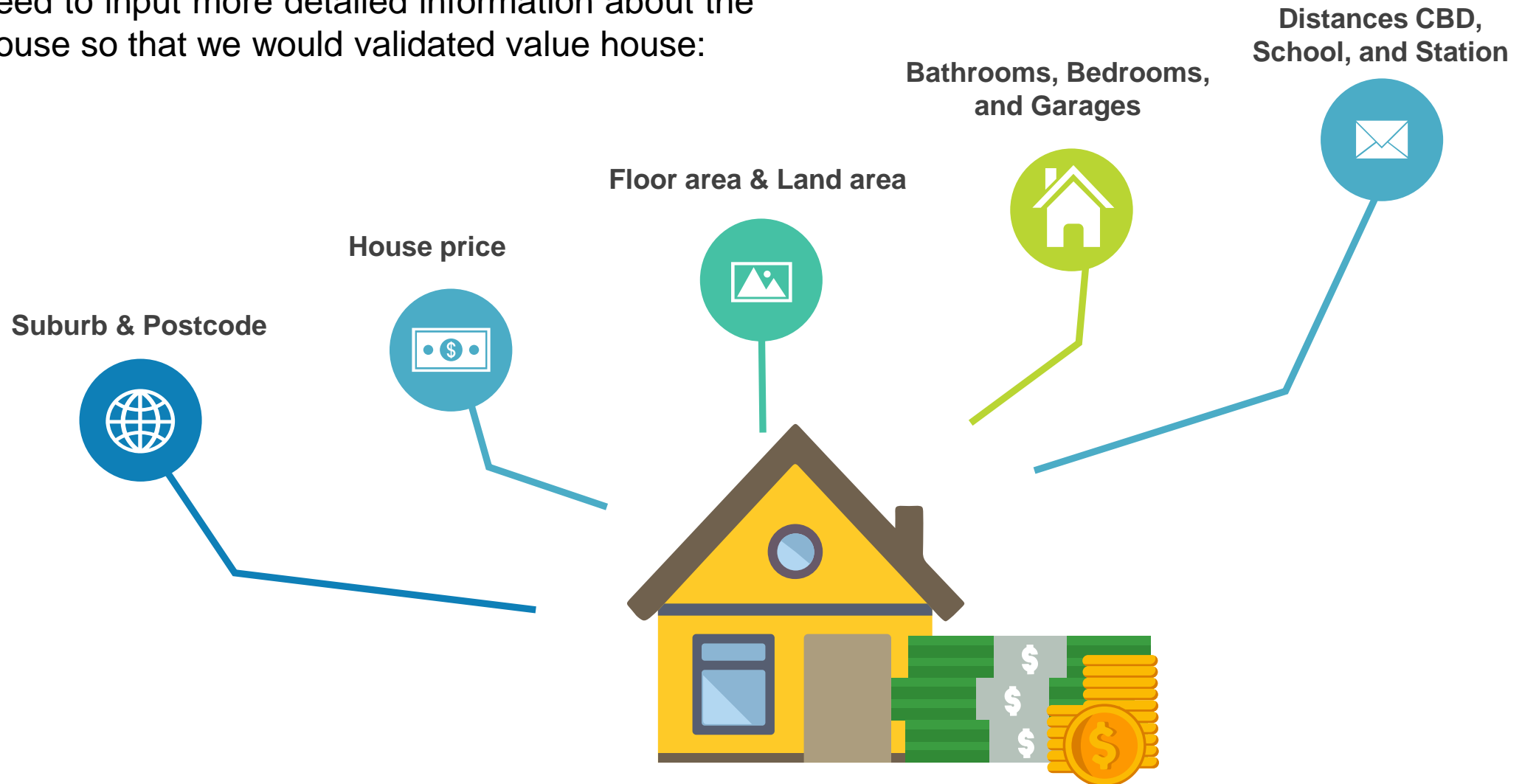


Step 4

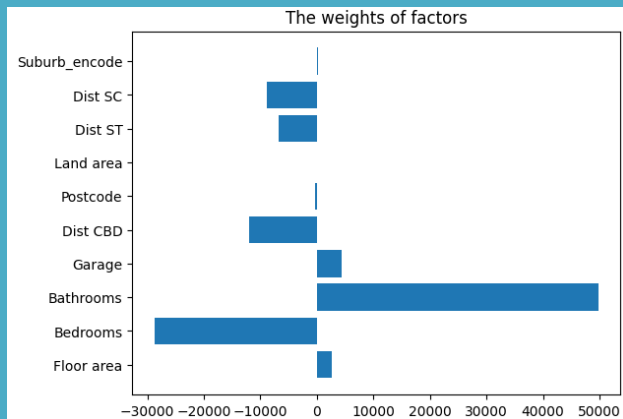
we re-evaluate the house's real value so that the customer can discuss the affordable price with the host holder.

4.2. Validation

After you have chosen the desired house, you need to input more detailed information about the house so that we would validated value house:

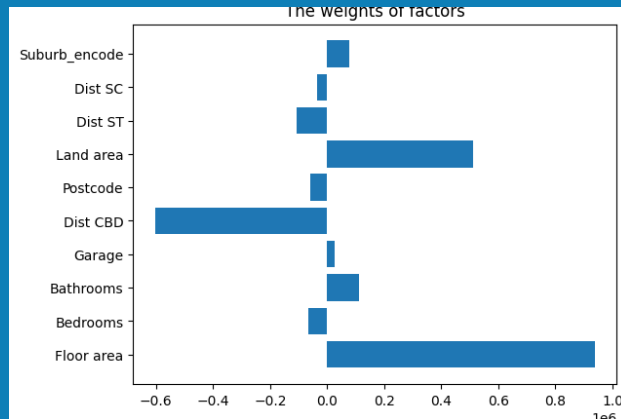


3 Prediction Models



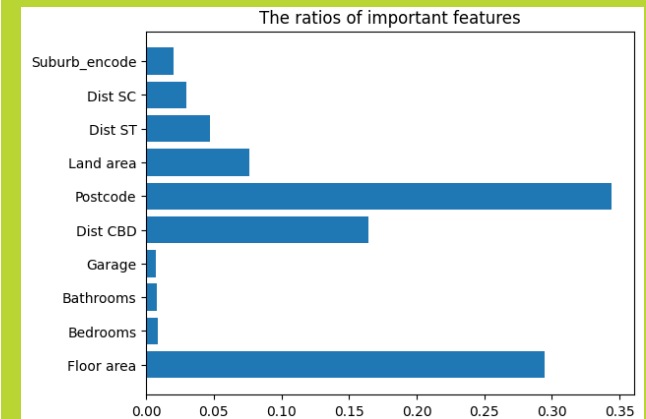
Linear Regression

- MAE: \$147,184
- MSE: \$39,055,411,621
- RMSE: \$197,624
- R2_score: 0.524



Ridge Regression

- MAE: \$147,498
- MSE: \$39,129,566,792
- RMSE: \$197,811
- R2_score: 0.523



Random Forest Regressor

- MAE: \$75,637
- MSE: \$12,781,637,752
- RMSE: \$113,055
- R2_score: 0.844

RESULTS

Customer informations

Suburb Location: **South Lake**

Suburb Location encode: **252**

Postcode: **6164**

House price \$: **570,000**

Floor area m²: **160**

Bedrooms: **4**

Bathrooms: **2**

Garage: **2**

Distance Central business district km: **18.3**

Land area: **600**

Distance Station km: **1.8**

Distance School km: **0.83**

Random Forest

Validation house

- House prices are at an affordable level
- Price of customers' input: **\$570,000**
- The evaluation of house prices: **\$530,000**
- The house price fluctuations: **\$75,000**

House price

\$570,000

Actual
prices

\$530,000

Predict
prices

\$605,000

Maximum
prices



**AWESOME
TRANSACTIONS**

5. Conclusion

Success Business

"The best investment on Earth is property"

- Louis Glickman -



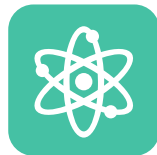
1. Introduction



**2. Exploratory
Data analysis**



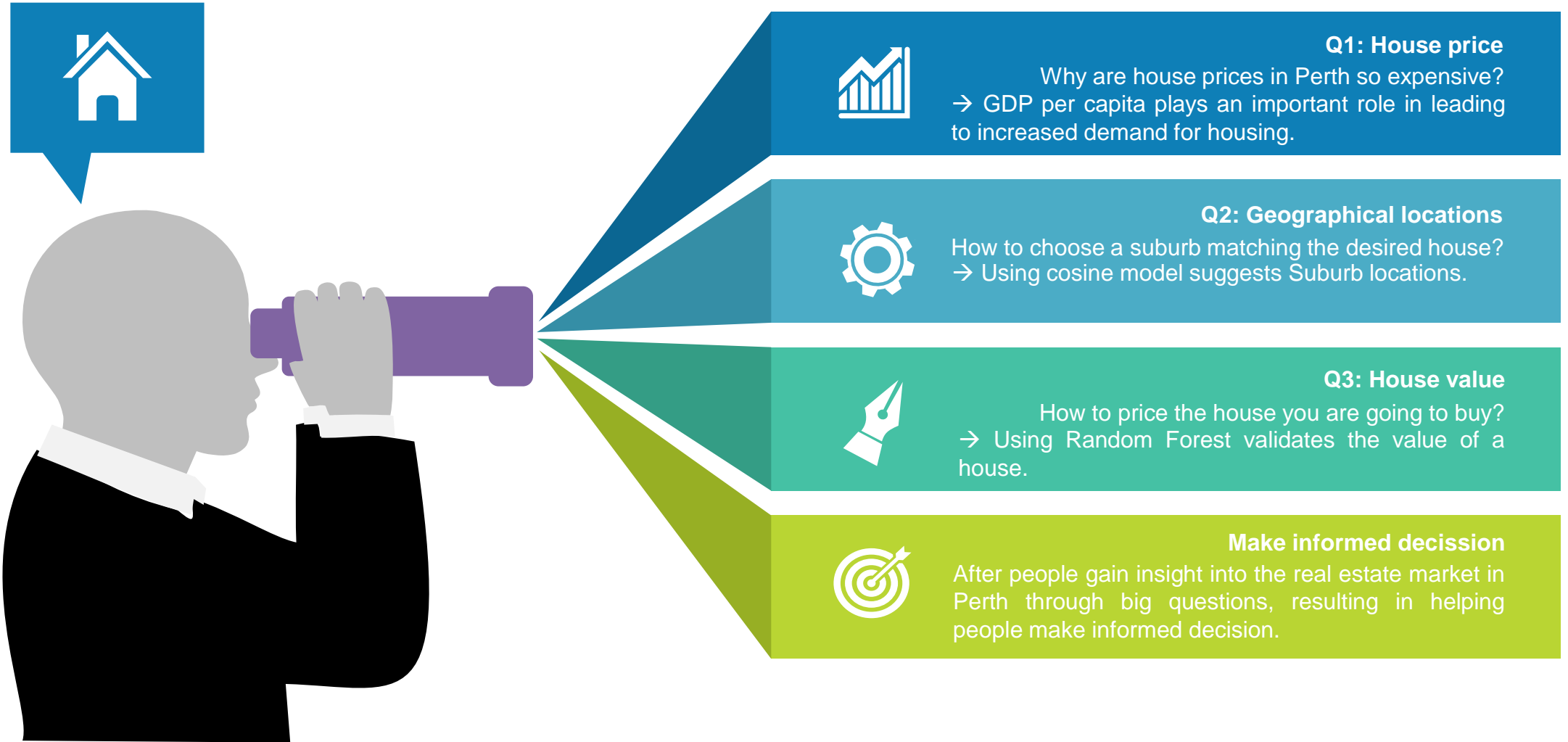
3. Insight data



4. Build model



BIG QUESTION-SOVELVING



Conclusion

- House prices are impacted remarkably by the macro elements such as GDP per capita, CPI, and REIT while the micro factors including bathrooms, bedrooms, and garages influence insignificantly the house prices.
- The trading boom began in 2011 and grew significantly in the following years while house prices skyrocketed before 2011 and declined and remained stable in cost later on.
- House-buying locations in Perth focus on surroundings in the center with a radius of about 15-20 km. Most geographical locations located directly in the center or far from the center have very few transactions.
- The largest volume of transactions site in Perth's Northeast area, followed by the Northwest area in front of the sea and the Southern.
- Three popular house types account for about 60% of total transactions, namely house types 1,2, and 3.
- Thanks to models, customers choose appropriate locations and validate the value's house with ease.
- Overall, customers can travel to the Southern area where house prices are affordable prices combined with geographical locations not too far from the center and large floor areas.

Resources



Reference books

- [REIT explanation](#)
- [Perth Property agent](#)
- [Papers](#)
- [King park](#)
- [Dataset Perth house Price](#)
- [REIT index / ASX 200](#)



Pictures

- [Perth](#)
- [Template powerpoint](#)
- [Statista residential housing market](#)
- [Inflation & CPI](#)



Thanks!

Do you have any questions?



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