

Analysis of possible investment in Santiago, Chile.

Where should I buy a new apartment?

If you plan to buy a property in Chile, either to live in it or as an investment, one of the first questions you should ask yourself is how expensive or cheap is the property you are going to buy. A metric that can help you answer this question is the value of the square meter in the commune in which the property that interests you is located. In this introduction I will briefly explain what the value of the square meter means and what the square meter values are for some communes in Santiago.

What is and how is the value of the square meter calculated?

The square meter is a unit measure that represents the commercial value of a real estate. The higher the value of a property's square meter, the more expensive the property is. And, logically, the lower the value of the square meter, the cheaper the property is.

The value of the square meter is calculated by dividing the commercial value of a property by its area. In Chile, the commercial value of the property is generally expressed in development units (UF), while the surface of the property is expressed in square meters (m²) (hence the name of the value of the square meter). Therefore, the value of the square meter is generally expressed in terms of UF / m².

For example, a property A that has a commercial value of 4,000 UF and an area of 70 m² has a value per square meter of $4,000 \text{ UF} / 70 \text{ m}^2 = 57 \text{ UF}$.

The value of the square meter is a unit measure because it does not depend on the size of the property. That is, it allows you to compare 2 or more properties regardless of their size. This is possible because its calculation is done by dividing by the size of the property as mentioned above.

Let's continue with the example: If I have a property B with a commercial value of 5,000 UF and an area of 95 m²:

Logically, property B is more expensive than property A in absolute terms: 5,000 UF for property B vs 4,000 for property A.

In terms of square meter value, property A is more expensive than property B: $5,000 \text{ UF} / 95 \text{ m}^2 = 52.6 \text{ UF} / \text{m}^2$ for property B vs $57 \text{ UF} / \text{m}^2$ for property A.

What are the values of square meter in Chile?

We present below the values of the square meter of new apartments, for the main communes of the metropolitan region, according to studies carried out by the company GFK Chile. These values are updated to the last quarter of 2019 [1].

Departamentos nuevos	
Comuna	UF por m ²
Vitacura	106,9
Las Condes	100,6
Providencia	97,5
Lo Barnechea	93,2
Ñuñoa	82,0
La Reina	78,8
Santiago	71,2
Colina	67,9
Peñalolén	64,4
Macul	62,8
San Joaquín	62,0
San Miguel	58,4
Independencia	58,4
La Florida	57,4
Recoleta	55,3
Estación Central	54,9
Conchalí	54,7
La Cisterna	54,5
Huechuraba	54,0
Maipú	53,6
Quinta Normal	52,2
Quilicura	49,9
San Bernardo	47,7
Pudahuel	46,1
Cerrillos	43,8
Puente Alto	43,7
Renca	41,2
Buin	40,2
Lampa	31,7

Figure 1. UF/m² values for different communes.

The most expensive square meter values

From these values we can highlight that the 5 communes with the highest values of square meter (that is, the most expensive communes to buy a property) are:

- **Vitacura**, with a value of **106.9 UF/m²**
 - **Las Condes**, with a value of **100.6 UF/m²**
 - **Lo Barnechea**, with a value of **93.2 UF/m²**
 - **Providencia**, with a value of **97.5 UF/m²**
 - **Ñuñoa**, with a value of **82.0 UF/m²**

The cheapest square meter values

On the opposite sidewalk, the 5 communes with the lowest square meter values (that is, the cheapest communes to buy a real estate) are:

- **Puente Alto**, with a value of **43.7 UF/m²**
 - **Cerrillos**, with a value of **43.8 UF/m²**
 - **Renca**, with a value of **41.2 UF/m²**
 - **Buin**, with a value of **40.2 UF/m²**
 - **Lampa**, with a value of **31.7 UF/m²**



Figure 2. Map of Santiago city divided by its main communes.

One of the first questions to ask a real estate investor close to making the investment in a real estate is what will be the capital gain that your property will have in a few more years. That is, what will be the increase in its commercial value over time. As you know, the capital gain of a property will be fundamentally conditioned by the development of the area where it is located. Although no human being who does not have supernatural powers (or privileged information) can predict with certainty what the urban development of a neighborhood or commune will be like, being clear about the factors that influence the increase in value of a property helps to better understand the possibilities of added value of a real estate and betting on certain real estate investments with better prospects for the future.

Key factors influencing the capital gain of a property.

- Infrastructure: Starting from the basics, it is evident that an urban area establishes a higher base value if it has fundamental services of drinking water, electricity and sewerage, among others. In an urban area this may seem obvious but in an area moving from rural to urban it does make a difference. Along the same lines, the fact that an area improves its public lighting or its road infrastructure will also contribute to increasing the value of its properties.
- Services: Hospitals and medical centers, schools and colleges. Supermarkets, malls, bars, restaurants, etc. In short, an area will increase its surplus value to the extent that it knows how to better satisfy the health, education, and certain consumption and leisure needs of its inhabitants.
- Connectivity: Many people know the immediate rise in prices experienced by properties in a borough where the extension of a subway line or the construction of a highway has been announced. And it is that facilitating mobilization to an area opens up the possibility for many people to live in a commune that they had previously ruled out due to logistical issues (for example, it takes a long time to move to their workplace). In addition, a greater flow of passers-by comes hand in hand with the development of commerce and services, which in turn contributes to increasing the quality of life of the commune.
- Security: A neighborhood or commune stigmatized by crime or violence does not represent a very attractive option to live. On the contrary, a commune that knows how to keep crimes at bay and become a safe option for living will foster the interest of new inhabitants. That is to say, your demand will increase and with it the added value of your properties.
- View: Although this factor does not influence too much in developed urban areas in which the housing density is high and the possibilities of obtaining a clear view are increasingly scarce, if it gains weight in real estate projects whose value proposition lies in locating a privileged sector with natural environments, in coastal areas among others.

I will focus this analysis on the study of 50m2 new apartments, and complement my findings taking a closer look on the 'Services' and 'Connectivity' indicators, with the support of the FOURSQUARE website/API.

DATA Section.

The datasets that are going to be used for this study/analysis come from 2 main sources:

- Figure 1 has been extracted from the following web [1]:

This image had to be converted to a csv file in order to be readable, so the following service was used [2]:

```
In [126]: ### Retrieving and Wrangling data
import pandas as pd
file1 = '/Users/diegop/Desktop/Capstone_Project/new.csv'
df_new = pd.read_csv(file1, decimal=',')
df_new.head()
```

Out[126]:

Departamentos nuevos	
Comuna	UF por m2
Vitacura	106,9
Las Condes	100,6
Providencia	97,5
Lo Barnechea	93,2

Once the file was successfully converted, the UF was transformed to USD. A thorough Data wrangling process allowed to obtain a clean and neat dataframe:

```
In [133]: # Adding prices of new apartments with different square meters.

df_new['30m2'] = df_new['USD/m2']*30
df_new['50m2'] = df_new['USD/m2']*50
df_new['80m2'] = df_new['USD/m2']*80
df_new['100m2'] = df_new['USD/m2']*100

df_new.style.set_caption("Prices in Thousand dollars")
df_new.head()
```

Out[133]:

	USD/m2	30m2	50m2	80m2	100m2
Vitacura	3.73081	111.9243	186.5405	298.4648	373.081
Las Condes	3.51094	105.3282	175.5470	280.8752	351.094
Providencia	3.40275	102.0825	170.1375	272.2200	340.275
Lo Barnechea	3.25268	97.5804	162.6340	260.2144	325.268
Ñuñoa	2.86180	85.8540	143.0900	228.9440	286.180

Some clean plots were obtained after arranging the dataframe:



- b) FOURSQUARE API usage: In order to complement my findings, Foursquare data will be used. Specifically to visualize what was stated on the introduction section regarding Services and Connectivity within the communes.
- c) Machine Learning algorithms such as k means will also be part of the data set.

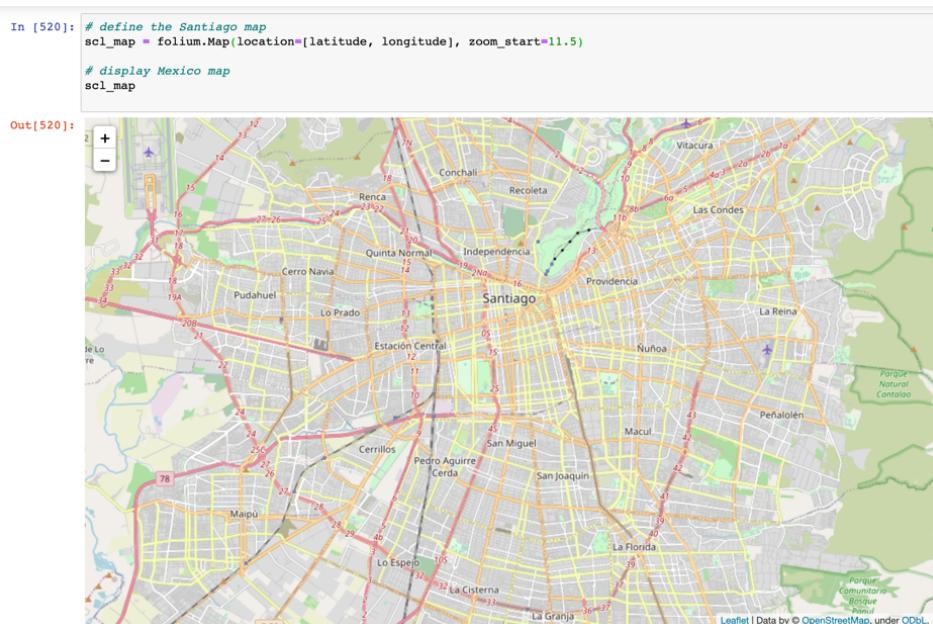


Figure 4. Santiago map obtained using Folium library.

The whole set of dataframes, plots and maps won't be added to this section, otherwise the document would become too extensive and boring to the reader.

Methodology section.

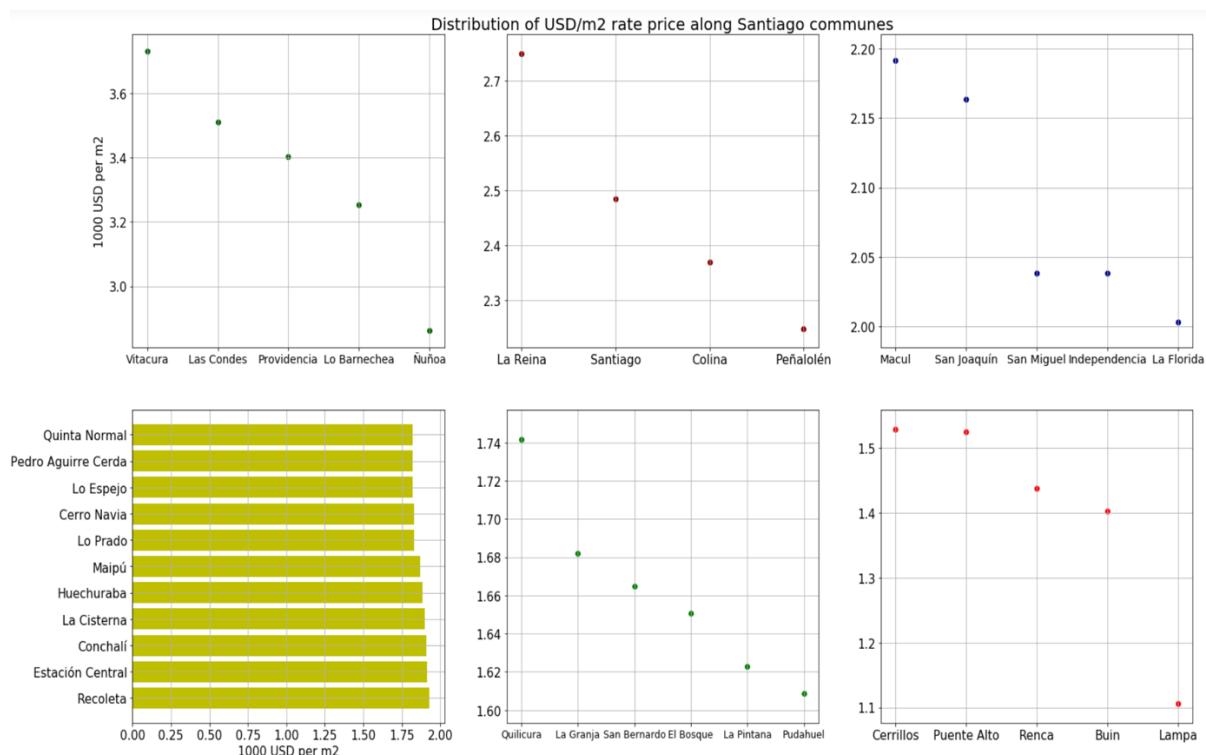
Using our original dataset, composed by the whole set of Santiago communes (35 in total) and its corresponding UF/m² price rate, it will be transformed into a more well-known unit, which will be 1000 USD per m²:

Out[159]:

USD/m ²	
Vitacura	3.73081
Las Condes	3.51094
Providencia	3.40275
Lo Barnechea	3.25268
Ñuñoa	2.86180

This means, in Vitacura, 1 m² costs 3730,81 USD.

I now present you a distribution of 1000 USD/m² price rate along Santiago city. The dataset has been divided into 6 sub-zones, ranging from the most expensive one to the cheapest one (for proper visualization purposes).

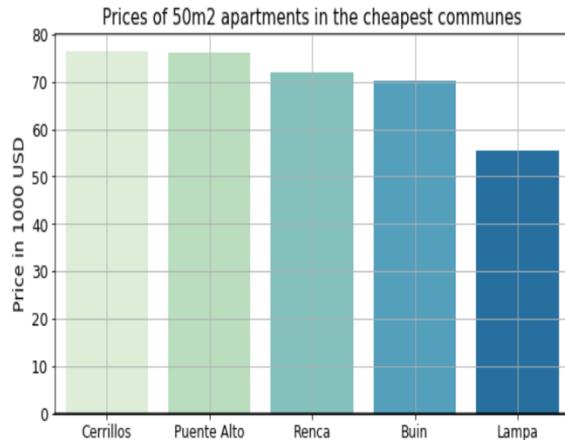
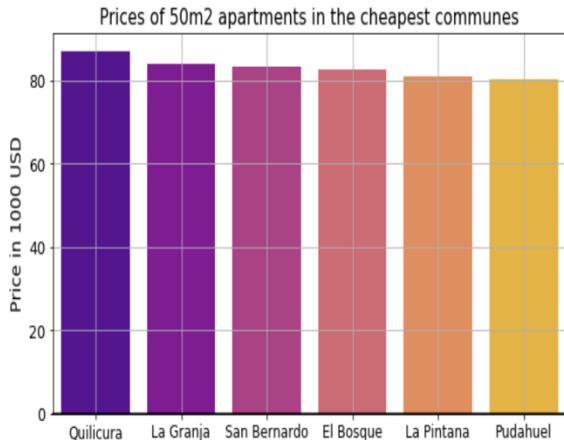
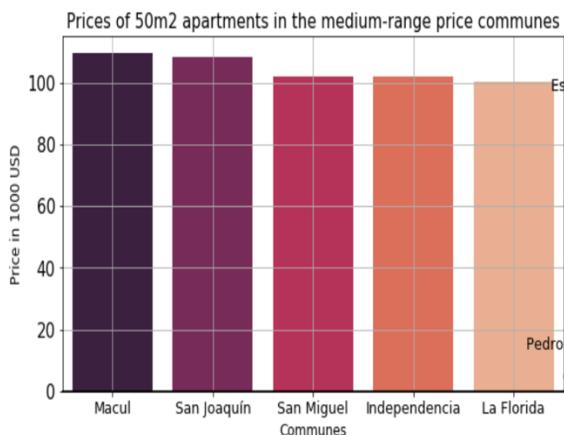
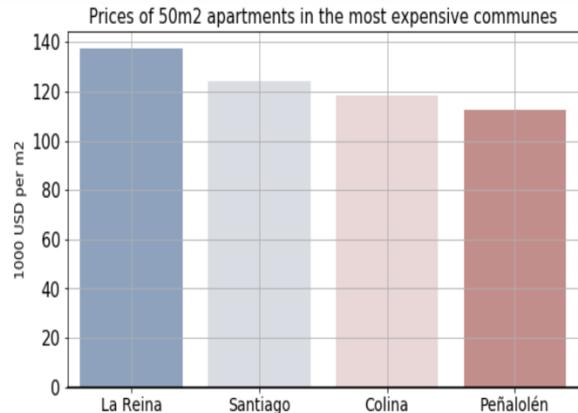
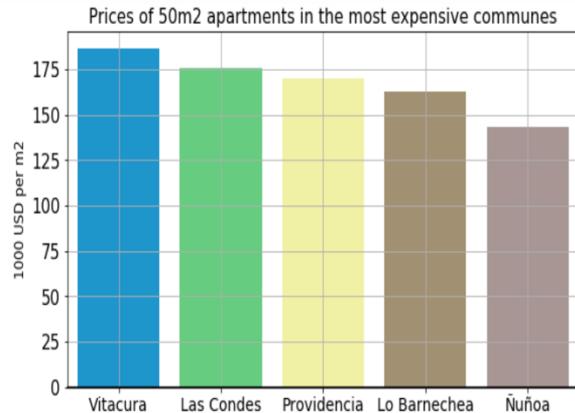


Some insights can be spotted by looking at the charts:

- The rates range from ~3700 USD/m² to ~1100 USD/m².
- The most common rate prices range from ~1800 USD/m² to 2000 USD/m².

According to [3], the most sold new apartments in Santiago city are rather small ones (below 50m²), so we will focus our attention to that specific kind of residence rather than focus on rates.

The following picture illustrates the prices of 50m² new apartments in Santiago, divided into 3 zones (most expensive, medium range and cheapest):

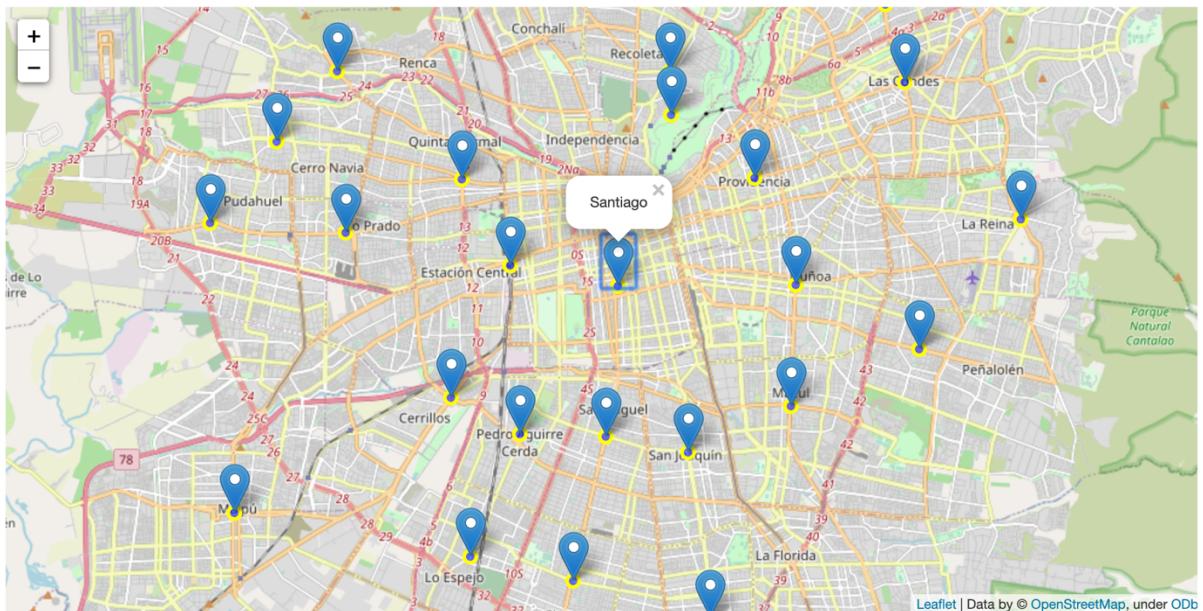


In order to have a notion of where these communes are located within the city of Santiago, we will use another dataframe, with the proper coordinates in Latitude and Longitude:

Out[97]:

	Commune	Latitude	Longitude
0	Vitacura	-33.390521	-70.572412
1	Las Condes	-33.408784	-70.567069
2	Providencia	-33.431447	-70.609332
3	Lo Barnechea	-33.352669	-70.518517
4	Ñuñoa	-33.456668	-70.597841

With this dataframe, we are in position to present a map of Santiago, with markers to help you identify the communes.



However, we still need to adjust our dataframe in order to display the prices of 50m², so we will add that info from the previous dataframe:

Out[169]:

	Commune	Latitude	Longitude	50m ²
0	Vitacura	-33.390521	-70.572412	186.5405
1	Las Condes	-33.408784	-70.567069	175.5470
2	Providencia	-33.431447	-70.609332	170.1375
3	Lo Barnechea	-33.352669	-70.518517	162.6340
4	Ñuñoa	-33.456668	-70.597841	143.0900

Results Section.

At this point, we are ready to retrieve data from Foursquare in order to explore each commune.

We first obtained a dataframe containing all available venues from each commune, with proper names, categories and coordinates:

	Commune	Commune Latitude	Commune Longitude	Venue	Venue Latitude	Venue Longitude	Venue Category
0	Vitacura	-33.390521	-70.572412	Alemán Experto	-33.390304	-70.570132	Sandwich Place
1	Vitacura	-33.390521	-70.572412	La Punta	-33.388667	-70.574879	Diner
2	Vitacura	-33.390521	-70.572412	Figurella	-33.387283	-70.571282	Spa
3	Vitacura	-33.390521	-70.572412	Club Deportivo Manquehue	-33.392995	-70.575027	Athletics & Sports
4	Vitacura	-33.390521	-70.572412	Bierstube Club Manquehue	-33.392455	-70.574623	Gastropub

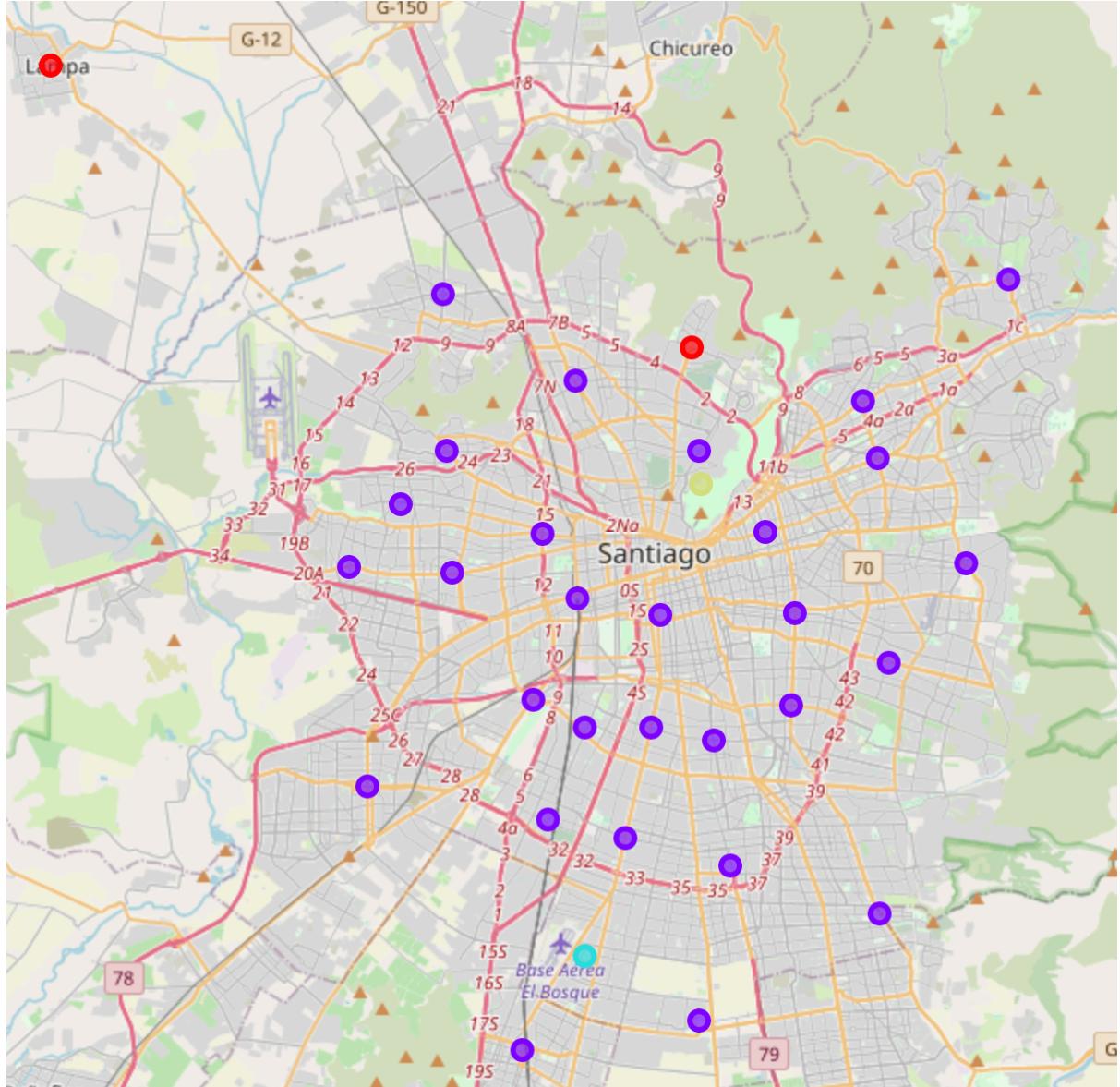
After a lot of coding, we present you a table of every commune with its top 5 most common venues, gathered from Foursquare API.

	Commune	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
0	Buin	Sushi Restaurant	Café	Soccer Field	Plaza	Department Store
1	Cerrillos	Dessert Shop	Bus Station	Planetarium	Rental Car Location	Bakery
2	Cerro Navia	Pharmacy	Bakery	Grocery Store	Yoga Studio	Food
3	Colina	Grocery Store	Basketball Court	Brewery	Pool	Bowling Alley
4	Conchalí	Gym	Metro Station	Athletics & Sports	Liquor Store	Pharmacy
5	El Bosque	Liquor Store	Pizza Place	Yoga Studio	Electronics Store	Food
6	Estación Central	Pharmacy	Shopping Mall	Sandwich Place	Fast Food Restaurant	Fried Chicken Joint
7	Huechuraba	Basketball Stadium	Plaza	Snack Place	Outdoors & Recreation	Yoga Studio
8	Independencia	Other Great Outdoors	Scenic Lookout	BBQ Joint	Yoga Studio	Elementary School
9	La Cisterna	Pizza Place	Chinese Restaurant	Fried Chicken Joint	Bar	Middle Eastern Restaurant
10	La Florida	Pizza Place	Nightclub	Sushi Restaurant	Gym	Pharmacy
11	La Granja	Grocery Store	Gym	Farmers Market	Salad Place	Theater
12	La Pintana	Plaza	Pharmacy	Farmers Market	Sushi Restaurant	Grocery Store
13	La Reina	Playground	Gym / Fitness Center	Café	Plaza	Chinese Restaurant
14	Lampa	Plaza	Supermarket	Steakhouse	Snack Place	Cupcake Shop
15	Las Condes	Hotel	Coffee Shop	Spa	Pizza Place	Cosmetics Shop
16	Lo Barnechea	Pizza Place	Sushi Restaurant	Burger Joint	Gym	Shopping Mall
17	Lo Espejo	Elementary School	Liquor Store	Café	Grocery Store	Yoga Studio
18	Lo Prado	Sushi Restaurant	Pharmacy	Nightclub	Food Truck	Grocery Store
19	Macul	Sushi Restaurant	Comfort Food Restaurant	Bar	Seafood Restaurant	Sandwich Place
20	Maipú	Pizza Place	Sandwich Place	Pharmacy	Bar	Pub
21	Pedro Aguirre Cerda	Gym	Cafeteria	Bus Station	Soccer Field	Department Store
22	Peñalolén	Food Truck	Liquor Store	Flea Market	Fast Food Restaurant	Farmers Market
23	Providencia	Restaurant	Café	Bakery	Yoga Studio	Pizza Place
24	Pudahuel	Grocery Store	Hot Dog Joint	Skate Park	Fast Food Restaurant	Restaurant
25	Puente Alto	Bus Station	Market	Burger Joint	Flea Market	Sandwich Place
26	Quilicura	Sushi Restaurant	Pharmacy	Grocery Store	Chinese Restaurant	Supermarket
27	Quinta Normal	Bus Station	Food Truck	Bakery	Campground	Restaurant
28	Recoleta	Chinese Restaurant	Asian Restaurant	Coworking Space	Flea Market	Parking
29	Renca	Plaza	Trail	Burger Joint	Flea Market	Bar
30	San Bernardo	Seafood Restaurant	Chinese Restaurant	Pharmacy	Plaza	Bar
31	San Joaquín	Hot Dog Joint	Coffee Shop	BBQ Joint	Pie Shop	Soccer Field
32	San Miguel	Sushi Restaurant	Japanese Restaurant	Plaza	Pharmacy	Chinese Restaurant
33	Santiago	Food & Drink Shop	Plaza	Diner	Café	South American Restaurant
34	Vitacura	Diner	Pizza Place	Pharmacy	Café	Bookstore
35	Ñuñoa	Sushi Restaurant	Middle Eastern Restaurant	Rock Club	Bar	Burger Joint

The above data will be used on our next stage, in which we will cluster the communes using the K means machine learning algorithm.

Using the Elbow method, we determined that our optimum number of clusters will be $k = 4$.

A map of Santiago displaying the 4 clusters is presented:

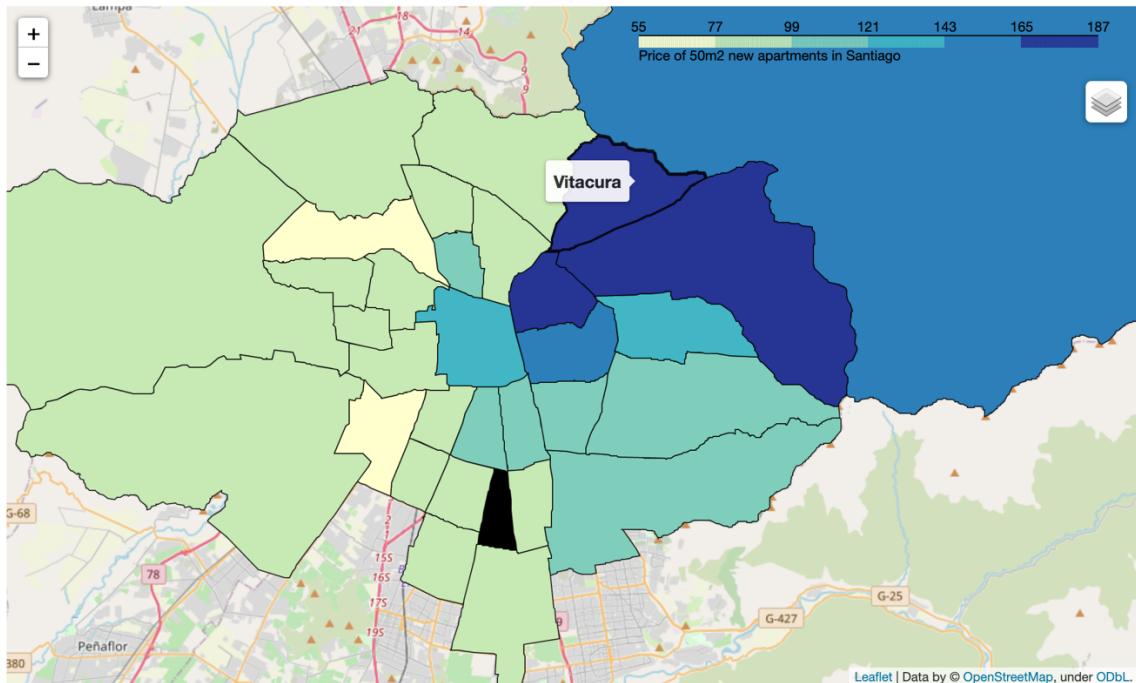


As an example, exploratory data is shown related to Cluster 0 and 2:

Commune	50m2	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
18	Huechuraba	94.2300	0	Plaza	Snack Place	Restaurant	Outdoors & Recreation
28	Lampa	82.5385	0	Plaza	Supermarket	Steakhouse	Snack Place

Commune	50m2	Cluster Labels	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue
35	El Bosque	55.3165	2	Liquor Store	Pizza Place	Yoga Studio	Farmers Market

Finally, a Choropleth map with the distribution of prices of the whole set of Santiago communes is displayed:



Discussion section.

Based on the whole set of information already provided, such as venues, clusters, distribution of prices and communes location, I would recommend to buy an apartment in the following top 3 communes (in order): Vitacura, Las Condes or Providencia.

Conclusion section.

The eastern sector of Santiago city is well known for being where the wealthiest people use to live. Even-though it was not included in the report, the best clinics and shopping centers are located within this area.

Definitively, I would recommend to buy a property in one of these communes, not only because it would be a great investment. Mainly, because these are the best communes to live in Santiago, Chile.

References.

[1] <https://www.tinsa.cl/sala-de-prensa/notas-de-prensa/precio-m2-comunas-santiago/>

[2] <https://convertio.co/es/ocr/>

[3] http://www.cchc.cl/uploads/comunicacion/archivos/Informe_de_Actividad_Mercado_Inmobiliario - Primer Trimestre 2018.pdf