BARCELONA STATE OF THINGS

A perspective of the relation between income and rent prices

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1. Introduction

This project carries out an analysis about how the situation of the rent prices and income have been in Barcelona for the past recent years.

The main goal of this project is to give an insight on how both variables, rent and income, relate to each other and what this relationship suppose for each neighbourhood.

For that I worked on two hypothesis to see whether they are fulfilled:

- The first one, get to know which are the neighbourhoods on where the rent has increased more in a range of time and see if it is true that those neighbourhoods that are meant to be in a gentrification status, basically those which belong to Ciutat Vella district, are the ones that this variation accused more seriously.

- The other one, to check if people in each neighbourhood are addressing more expenses to pay the rent than what it is meant to be. As Bank of Spain states, people should not spend more than 35% of their income to pay the rent.

2. Methodology

As with the rent prices being the core of this project, first of all, it is necessary to define what household income stands for and how we can interpret the indicator to have real statistically insights.

Since the main source of datasets has been collected from Open Data from Barcelona City Council, it is convenient to show how Statistical Institute of Catalonia (IDESCAT) defines household income:

'The Gross Disposable Household Income statistical operation is the main aggregate which measures the disposable income of the residents of a territory for use in consumption or savings. This income depends on the income of families directly associated with payment for their contribution to productive activity (payment of employees and gross operating surplus) is also influenced by Public Administration activity through taxes and social benefits.' [1]

The indicator though is expressed per habitant. So from this point on, we will refer to the Gross Disposable Household Income per habitant as income or household income.

Also, when analysing the household income by itself or in its relation with the rent price, we will be working with data until the year 2017 since this is the year with the most recent information.

[1] https://www.idescat.cat/pub/?id=rfdbc&lang=en

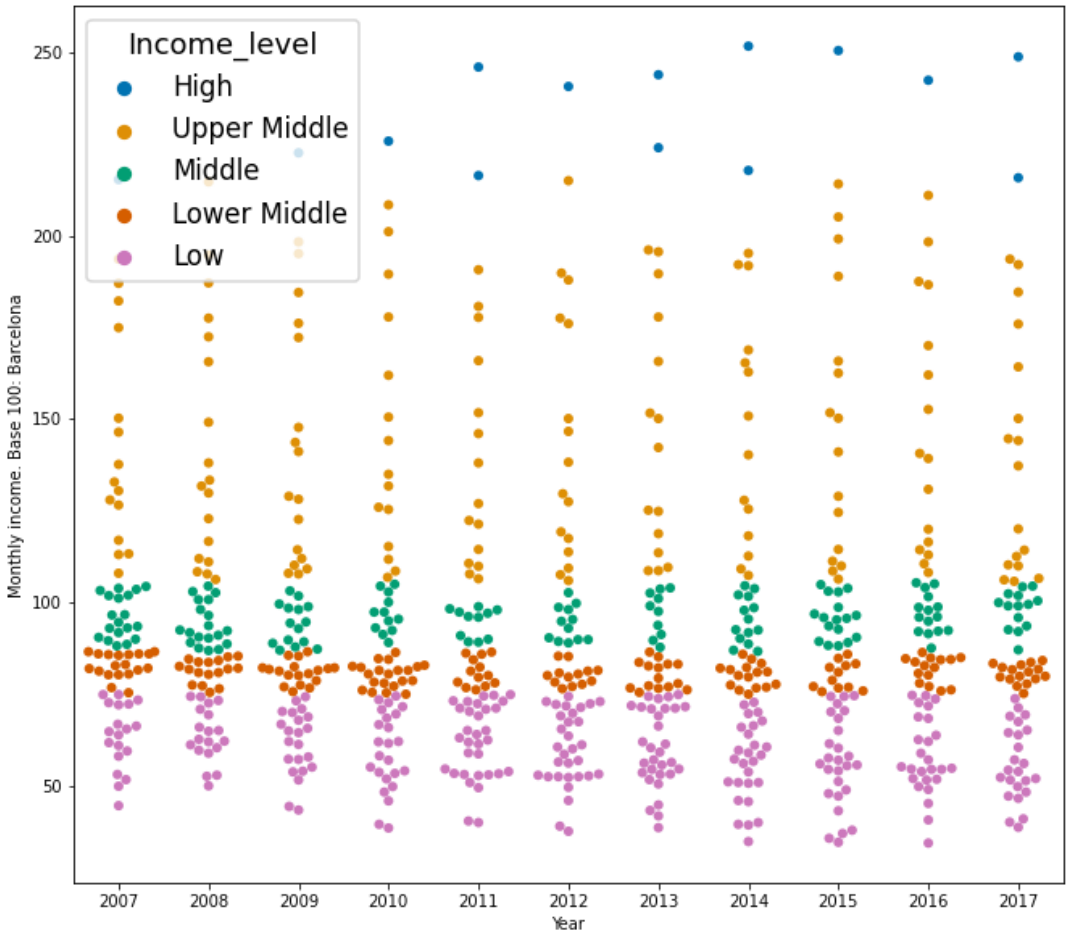
2.1. Household income by neighbourhood and level

In this part the aim is to get to know which is the income for each neighbourhood by classifying them into 5 income class levels: Low, Lower Middle, Middle, Upper Middle, High, and if there is any trend on its evolution.

At this stage, I worked with household income expressed by indexes (Base 100 = Barcelona) to make comparisons between years easier.

In order to bin the levels, the first step was to set a base year , in this case 2007, on which we applied the splitting. Secondly, was to calculate the quartiles for 2007 to divide our set of neighbourhoods proportionally. From this point on, the objective was to know how income varied until 2017.

The chart outcome that sums up the analysis is the following:



At first look, we can see that the bigger part of neighbourhoods fall close to or below the Barcelona's average (base 100). Even so, low to middle class neighbourhoods tend to be so close from each other, but as higher the rent is, the more spread the points get.

The summary of variation from 2007 to 2017 would be the following:

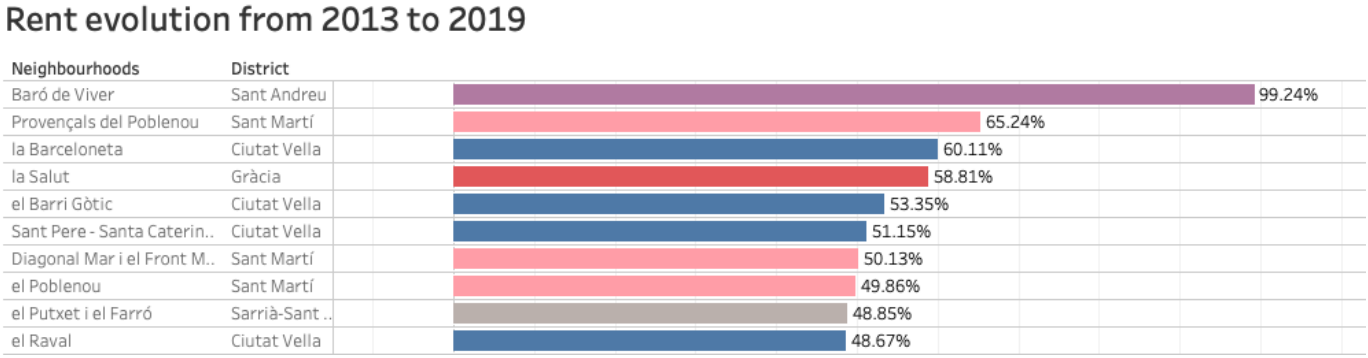
	Income_level	Annual_income_2007	Annual_income_2017	Variation
0	High	0.013699	0.027397	1.000000
1	Low	0.260274	0.328767	0.263158
2	Lower Middle	0.260274	0.219178	-0.157895
3	Middle	0.260274	0.191781	-0.263158
4	Upper Middle	0.205479	0.232877	0.133333

2.2. Rent price evolution per neighbourhood

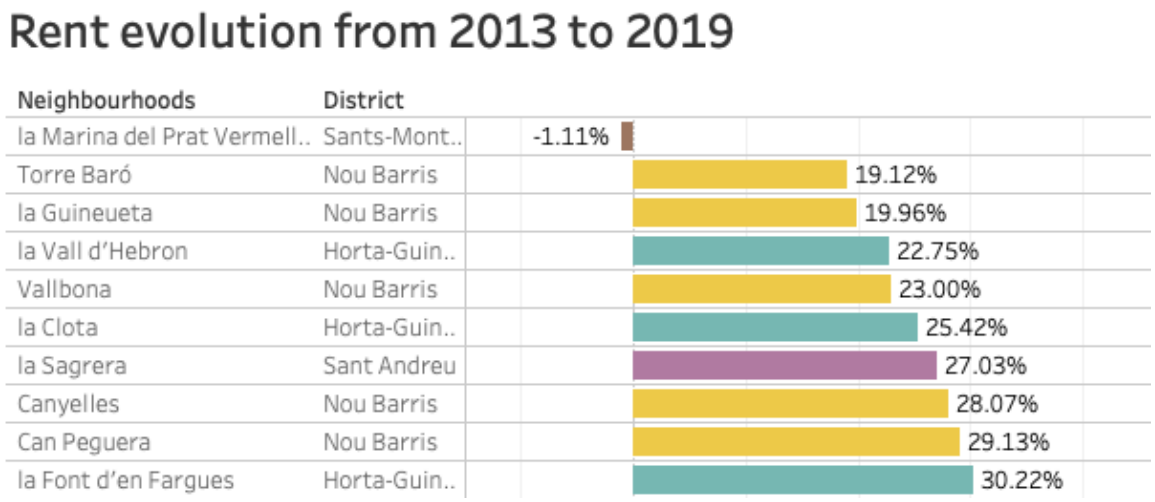
In this second part, we grouped both rent price table and district table to have a wide vision of each neighbourhood and district too. And then calculate the variation from 2013 to 2019 and sort the results to look for the top 10 and the bottom 10.

Here it enters our first hypothesis, to see if gentrification (meaning high rent price growth in a short time) in the city centre neighbourhoods was a reality and if there were other neighbourhoods to have a look on to also.

The graph of the top 10 neighbourhoods by rent growth from 2013 to 2019 is the following:



The bottom 10 neighbourhoods in rent growth are the next ones:

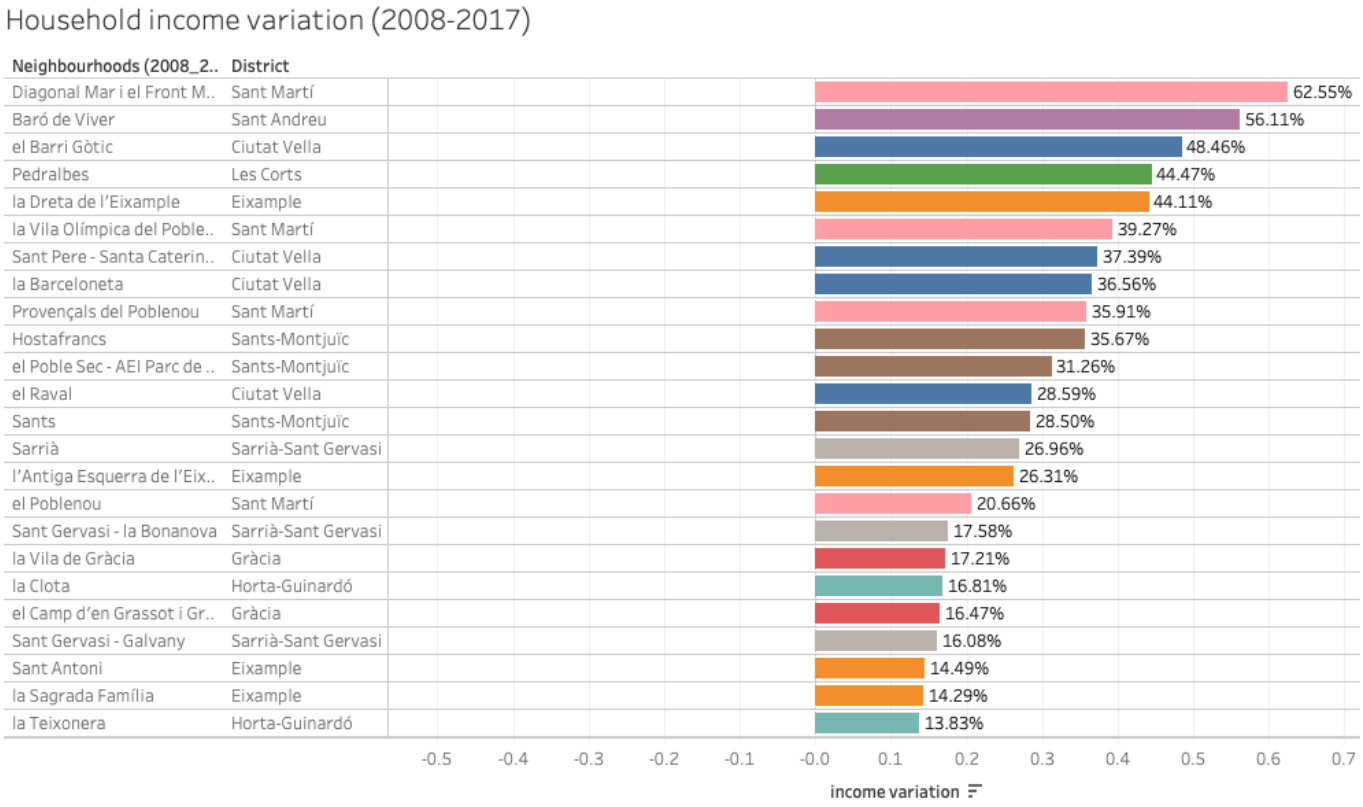


2.3. State of household income in 2017

At this point, we are not analysing income by class levels but how each neighbourhood has evolved from 2008 and how the situation for the year 2017 is.

Differently from our first topic covered, here we work with real numbers to see how much income varies in terms of cash.

Let's take a look which are the neighbourhoods on where income has grown more for that period of time.



Seems that some of the top-income growth neighbourhoods are the same ones that were on the top for rent prices growth, reaffirming that growth in rent prices could be a key factor for people to have to move to other neighbourhoods and be replaced for others with higher income.

2.4. Ratio income-rent for 2017

Since 2017 is the last year of reference for the household income, we want to compare here how much part of the income a neighbour have to assume paying the rent.

For that, we introduce our second hypothesis, that is to test if neighbourhoods in Barcelona are spending more than 35% of their income to pay the rent, as Bank of Spain stated this is the maximum amount people should spend.[2]

[2] https://www.businessinsider.es/cuanto-dinero-deberias-destinar-alquiler-casa-418749

To verify it we define our hypothesis as the following:

- H0: ratio of rent-income <= 35%
- Ha: not H0
- Confidence level = 95%

And perform a t-test statistic to see whether the ratio aligns with Bank of Spain states.

```
In [102]: # Applying t-test statistic to see whether the ratio aligns with the hypothesis or not
          stats.ttest_1samp(a=rent_income_ratio['Rent_income_ratio'], popmean=0.35)

Out[102]: Ttest_1sampResult(statistic=15.141488177014013, pvalue=4.477975753114318e-24)
```

Since p-value << (alpha= 0.05) we can reject the null hypothesis and say that with a 95 % of confidence people in Barcelona are addressing more income to pay the rent than recommended.

Here we can see how neighbourhoods follow the hypothesis tested. There is any neighbourhood that for the year 2017 accomplishes the recommendation.

Rent / Income Ratio for 2017

Neighbourhoods	District	Rent/income ratio
Canyelles	Nou Barris	71.45%
la Guineueta	Nou Barris	66.22%
la Verneda i la Pau	Sant Martí	66.21%
el Turó de la Peira	Nou Barris	64.99%
Vallbona	Nou Barris	63.84%
Verdun	Nou Barris	63.21%
Sant Martí de Provençals	Sant Martí	62.22%
Ciutat Meridiana	Nou Barris	61.81%
la Trinitat Nova	Nou Barris	61.57%
la Prosperitat	Nou Barris	61.47%
Vilapicina i la Torre Llobeta	Nou Barris	61.40%
el Carmel	Horta-Guinardó	61.01%
les Roquetes	Nou Barris	58.82%
la Trinitat Vella	Sant Andreu	57.90%
el Raval	Ciutat Vella	57.62%
Porta	Nou Barris	56.34%
el Besòs i el Maresme	Sant Martí	55.62%
la Bordeta	Sants-Montjuïc	54.80%
la Marina de Port	Sants-Montjuïc	54.68%
la Font de la Guatlla	Sants-Montjuïc	53.62%
el Congrés i els Indians	Sant Andreu	53.33%
el Bon Pastor	Sant Andreu	52.82%
Navas	Sant Andreu	52.23%
el Camp de l'Arpa del Clot	Sant Martí	52.20%
Sant Andreu	Sant Andreu	51.77%
Sants - Badal	Sants-Montjuïc	51.37%
el Baix Guinardó	Horta-Guinardó	45.93%
les Corts	Les Corts	45.78%
el Coll	Gràcia	45.67%
Can Baró	Horta-Guinardó	45.20%
la Vila de Gràcia	Gràcia	45.18%
el Camp d'en Grassot i Gr..	Gràcia	44.80%
Can Peguera	Nou Barris	44.47%
la Maternitat i Sant Ramon	Les Corts	44.40%
Vallcarca i els Penitents	Gràcia	44.38%
Sant Genís dels Agudells	Horta-Guinardó	43.96%
Sants	Sants-Montjuïc	43.58%
l'Antiga Esquerra de l'Eix..	Eixample	42.34%
la Vila Olímpica del Poble..	Sant Martí	42.04%
les Tres Torres	Sarrià-Sant Gervasi	41.50%
Hostafrancs	Sants-Montjuïc	41.36%
la Salut	Gràcia	39.89%
Diagonal Mar i el Front M..	Sant Martí	39.87%
Pedralbes	Les Corts	39.33%
la Marina del Prat Vermell..	Sants-Montjuïc	39.31%
Sarrià	Sarrià-Sant Gervasi	38.32%
la Clota	Horta-Guinardó	38.17%
Sant Gervasi - Galvany	Sarrià-Sant Gervasi	37.42%
la Dreta de l'Eixample	Eixample	37.24%
Sant Gervasi - la Bonanova	Sarrià-Sant Gervasi	36.71%
Baró de Viver	Sant Andreu	36.46%
el Putxet i el Farró	Sarrià-Sant Gervasi	35.25%

3. Conclusions

With the methodology carried out, we are now able to answer the hypothesis made in advance and what results we haven taken from them.

One of the main conclusions is that there seems to be a trend in the growth variation of rent prices from some neighbourhoods to another ones.

The top 10 neighbourhoods in price variation are mainly located around city centre except for Baró de Viver. On the other hand, the bottom 10 neighbourhoods with less variation are all located around the outskirts of the city. Reinforcing then the theory that are those neighbourhoods in the city centre the ones that are experimenting deeper changes on its rent structure.

By the other side, we can affirm that people in Barcelona city are living above their means following the Bank of Spain recommendations. The neighbourhoods that are further from this, address more than 60% of income to pay the rent and they share a common thing that is that are also the neighbourhoods with less income level.
By the other hand, those areas with higher incomes spend around 40% or even less to pay the rent.

By looking at the results, it is palpable that there is a trend of polarization between higher and lower incomes, resulting in greater differences when comparing the different neighbourhoods. The rent is therefore, without any doubt an issue in the city since represents a crucial expense part of the inhabitants' income.

The growth in the income has gone hand in hand with the rent price growth, assuming that in those areas with higher rent rates there is this tendency of the income to still grow. Nevertheless, in a lower income neighbourhoods there is a gap between these two variables.