



Cambridge Property Analysis with Qlik

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Introduction

Background

In United States, the annual assessed value of the property evaluates the sales of similar properties and home inspection results (Kilroy, 2022). In Massachusetts, the property tax is calculated according to the assessed value of the property and it uses different tax rates for residential and commercial property. ("How we tax your property", 2022).

Purpose of this report

The purpose of this report is to analyze the sale price, assessed value, and tax of the properties in Cambridge, especially the residential properties.

The analysis and data visualizations of this report are based on the Cambridge property data set provided by [City of Cambridge](#). The original data set contains the 43 variables with 174,504 records of the properties in Cambridge. In this paper, we analyzed data and aim to answer below the questions:

1. What is the average price per square feet of residential property in Cambridge?
2. What are the top 5 residential property classes that have the highest avg price per sq. feet in Cambridge?
3. What is the trend of the assessed value of property in Cambridge?
4. Which area has the highest average growth in assessed value?
5. What is the situation of the Cambridge area's tax revenue from the property?
6. Which one contributes more to the tax revenue in the Cambridge area, commercial property or residential property?
7. Which area in Cambridge has the highest property tax paid?
8. What are the top 5 residential property classes by median tax amount?
9. Which residential property class has the largest living area? Are they expensive?

The variables we used to build the visualizations are as followed: <Property Class>, <Sales Price>, <Latitude>, <Longitude>, <InteriorLivingArea>, <AssesedValue>, <PreviousAssessedValue>, <TaxDistrict>, and <PropertyTaxAmount>.

The visualization methods we chose to answer the questions are bar chart, line chart, density map, simple text, treemap.

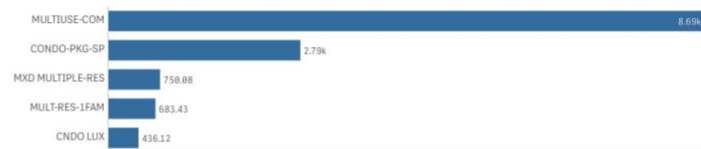
Visualizations & Interpretations

Average Residential Property Sale Price per Square Feet

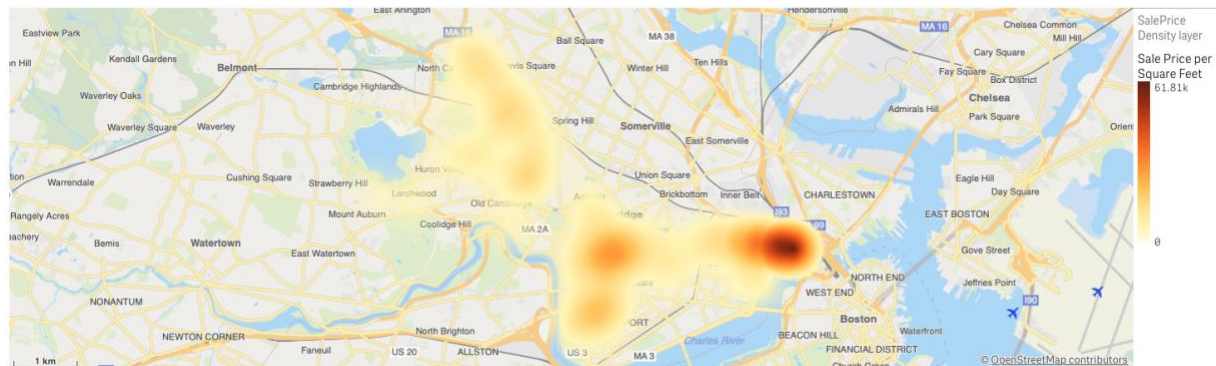
Average Price per Square Feet

301.9

Top 5 Property Classes with Highest Average Price per Square Feet



Density Map of Sale Price per Square Feet *



* Currently showing a limited data set.

1. What is the average price per square feet of residential property in Cambridge?

The average price per square feet of residential property in Cambridge is \$301.9.

We used the simple text to show it because it just has one number, and the simple text could make it very clear to show the point.

2. What are the top 5 residential property classes that have the highest avg price per sq. feet in Cambridge?

The top 5 residential property classes which have the highest average price per square foot are multi-use-com, condo-PKG-SP, mixed multiple residencies, multi-residency-1family, and condo-luxury. The average prices (per square feet) of all these 5 residential properties are above the average price (per square feet) of the whole properties in Cambridge.

Also, we could see from the heat map, those properties with the highest average sale price per square feet are mainly located in the east part of Cambridge.

We used a bar chart because it is easy to show the price difference among the different properties. We also added a heat map because it provides direct information regarding the price difference in locations.

Assessed Value

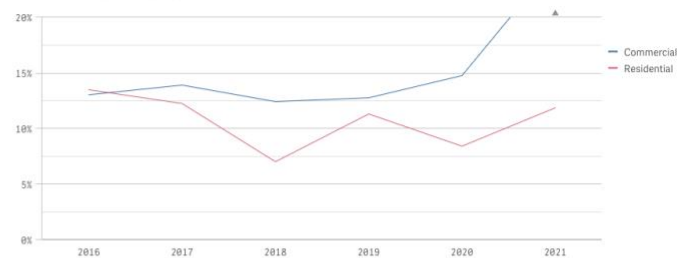
Residential Avg. Assessed Value

1.01M

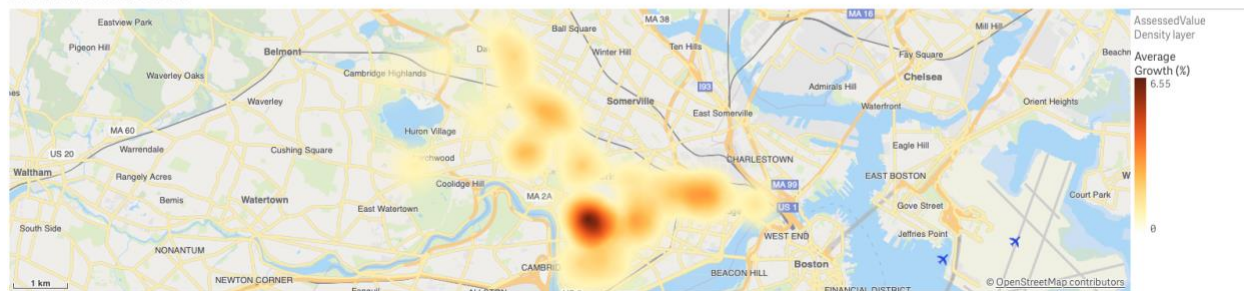
Commercial Avg. Assessed Value

73.85M

Annual Growth Rate of Assessed Value



Density Map of Average Growth *



* Currently showing a limited data set.

3. What is the trend of the assessed value of property in Cambridge?

The line chart is a great way to demonstrate the changes over the period of time.

In the line chart, from 2016 to 2021, the assessed property value shows an upward trend in Cambridge. The assessed value of commercials shows a steady increase with 12 % growth from 2016 to 2020, then it soars to 23% growth in 2021. While in terms of assessed value of residences, the average growth fluctuates around 10%. The commercial properties have much higher assessed value compared to the residential ones.

4. Which area has the highest average growth in assessed value?

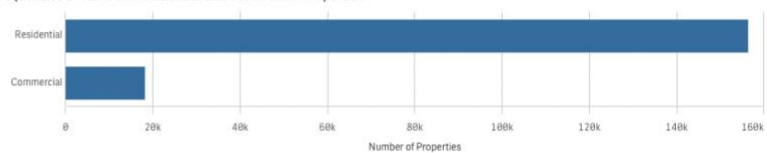
From the density map of average assessed value growth, in the downtown of Cambridge, the average growth of assessed value takes a higher growth percentage than other areas, with the largest average growth of 5.75%. While in the edge of Cambridge, due to the location, the average growth of assessed property value is relatively lower.

Annual Property Tax

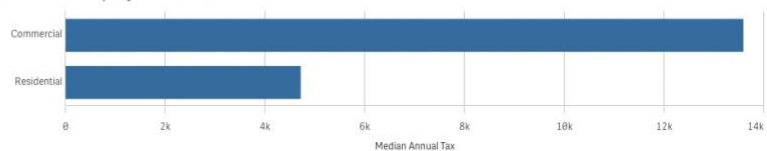
Tax from Commercial Property
\$ 1,257,973,629

Tax from Residential Property
\$ 526,775,105

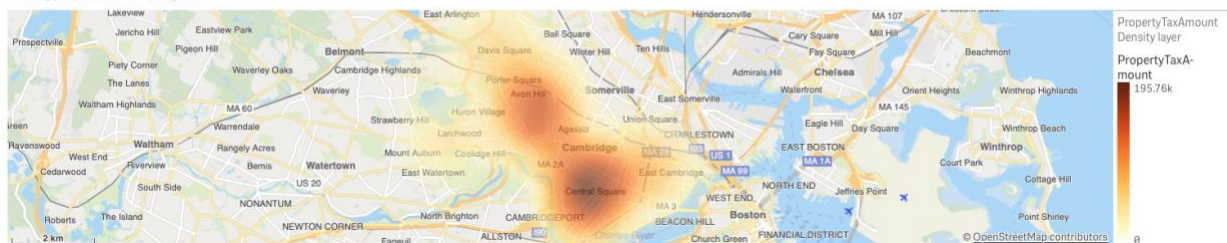
Frequencies of Tax from Residential and Commercial Properties



Median Annual Property Tax Amount



Density Map Annual Property Tax *



5. What is the status of the Cambridge area's property tax revenue?

From the simple text above representing the commercial and residential property property tax, we can say that commercial property tax is 2.4 times higher than the residential property, in other words Commercial Tax revenue is 70% and residential property tax revenue is contributing 30% in the Cambridge area. The total tax revenue sums to \$1,784,748,734.

6. Which one contributes more to the tax revenue in the Cambridge area, commercial or residential property?

From the two bar charts we can put the following analysis together. In terms of frequency the residential property tax is more, and median annual property tax is lower because of lower tax rate on this group. On the other hand, commercial property has lower count due to less number of commercial properties in Cambridge area but the median is the highest due to tax rate levied on commercial properties being highest. We have selected the Bar graph as it better displays the frequency and is also helpful in comparative analysis between the two segments.

7. Which area in Cambridge has the highest property tax paid?

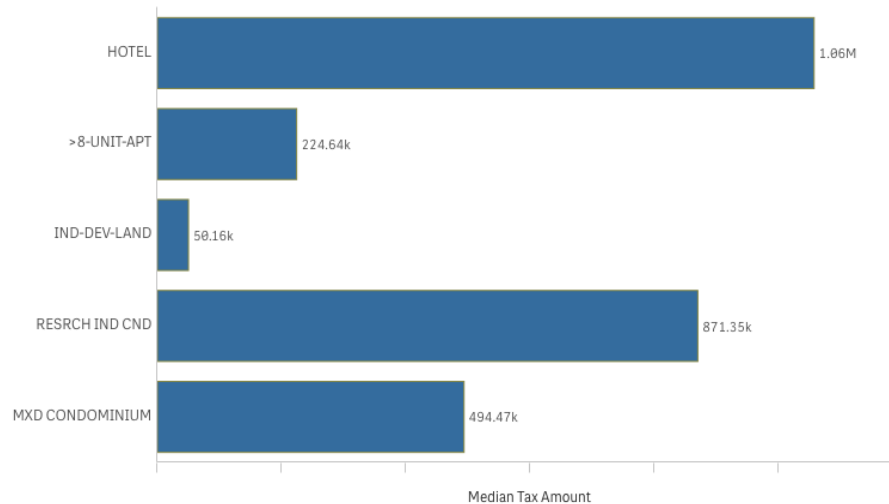
From the heat map, it is easy to see that the south part of Cambridge where is near the Charles River has the highest property tax paid and followed by the northeastern Cambridge. This might be explained by these areas having the most famous universities: Harvard and MIT, which attracts more tech companies, stores, restaurant, etc. to come here.

8. What are the top 5 residential property classes by median tax amount?

The bar chart below demonstrates the top 5 residential property classes in Cambridge that have the highest median tax amount. The Hotel is the largest shareholder, followed by RESRCH IND

CND, mixed-condominium, 8-unit apartment, and lastly, IND DEV LAND. It is not a surprise that the hotel pays the most tax amount as it has the highest tax rate of 5.7% (Commonwealth of Massachusetts, 2022). We were unable to sort the order in Qlik, although we tried all possible ways.

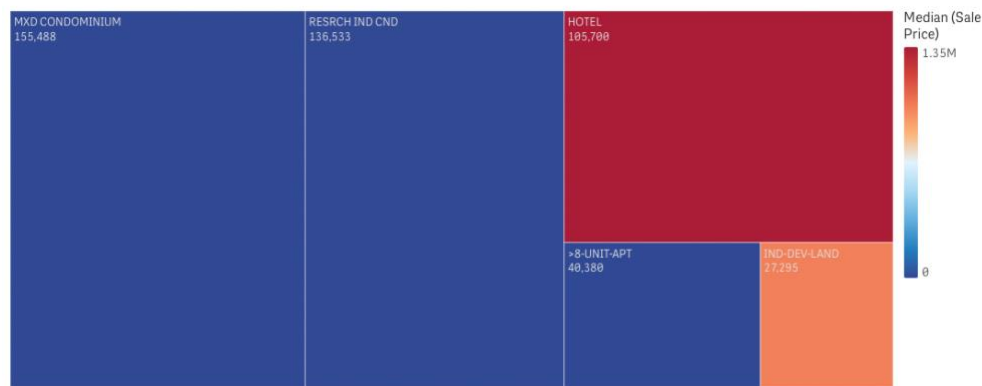
Top 5 Residential Property Class Types by Median Tax Amount



9. Which residential property class has the largest living area? Are they expensive?

The tree map shows the living area of the top 5 residential property classes that we discussed above. The Mixed condominium has the largest living area, followed by RESRCH IND CND, and the least out of 5 is IND DEV LAND. Although the hotel is placed in third place it is the most expensive among other residential properties. The same is with the IND DEV LAND, which has the smallest living area but has the highest median sale price following the hotel. Thus, we can assume that the size of the living area is not the main factor in setting the sale price. The tree map is a great way to demonstrate categorical variables with different sizes proportions which represent here the size of the living area, colored by the sale price.

Property Classes by Living Area



Reference:

Commonwealth of Massachusetts. (2022, March 9). *Room occupancy excise tax*. Mass.gov. Retrieved March 19, 2022, from <https://www.mass.gov/info-details/room-occupancy-excise-tax#:~:text=Massachusetts%20has%20a%20state%20room,breakfast%20establishments%2C%20and%20lodging%20houses>.

How we tax your property. Boston.gov. (2022). Retrieved 19 March 2022, from <https://www.boston.gov/departments/assessing/how-we-tax-your-property>.

Kilroy, A. (2022). *What Does Assessed Value Mean?*. Rocketmortgage.com. Retrieved 19 March 2022, from <https://www.rocketmortgage.com/learn/assessed-value>.

Appendix

The Qlik Dashboard for the graphs above is uploaded in the assignment submission