

Estimation of The Total Value of Land in Port Moody

Sandy Wu (301273729)

STAT 410

Derek Bingham

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Purpose:

The purpose of this study is to estimate the total value of land in Port Moody with Port Moody real estate data from BC Assessment¹.

Port Moody real estate will be the value of any land in Port Moody that can be assessed by BC Assessment, which is not limited to buildings that people reside in. The target population is land in Port Moody and the population surveyed is addresses in Port Moody's Parcel Information data². These are not the same since there are a few pieces of land that are not shown in the Parcel data map interface. This should not change my conclusion by much since the value of land should not fluctuate much. For the sampling frame, it will be based on the area covered in the Parcel data, which will be based on plots of land at a specific unique address to address possible problems, for example, one plot of land that contains multiple addresses because it is an apartment or multiple businesses. For real estate areas that cannot be sampled, those values can often be estimated by using the mean or median of the price of land in that area within a certain radius. We can see in the analysis that plots of land mainly used for housing has a general price.

Procedure and Analysis:

Using Parcel Information data², we now have a list of addresses that can be sampled on along with specific information regarding street, lot sizes, etc. We will focus on estimating the total value of land using Port Moody's Parcel Information data.

In this study, a Simple Random Sample (SRS) will be used in determining the addresses used to collect data on the value of land from BC Assessment.

First, the data was cleaned so that duplicate addresses did not appear multiple times, which would affect sampling. This step would remove multiple listings of the same building (i.e. apartment buildings). Then I removed all addresses that was listed as "0". This reduced the Parcel Information from 12,968 observations down to 5,197 observations.

Then, a pilot survey of size 10 was conducted to test SRS with the data and to determine the sample size before the land prices are manually collected from BC Assessment.

¹ BC Assessment: <https://www.bcassessment.ca/>

² Port Moody Parcel Information Data via:
https://data.portmoody.ca/datasets/7bc8ca82182141d2b3f0452fe593d528_30?geometry=-122.918%2C49.268%2C-122.825%2C49.288

After using different methods to calculate sample size, I used Cochran's rule for deciding the sample size. Cochran's rule³ says that the minimum sample size would be of size 28.

Finding a sample size for a population proportion:

$$n \geq \frac{(1.96)^2(\frac{1}{2})(1 - \frac{1}{2})}{0.05^2}$$

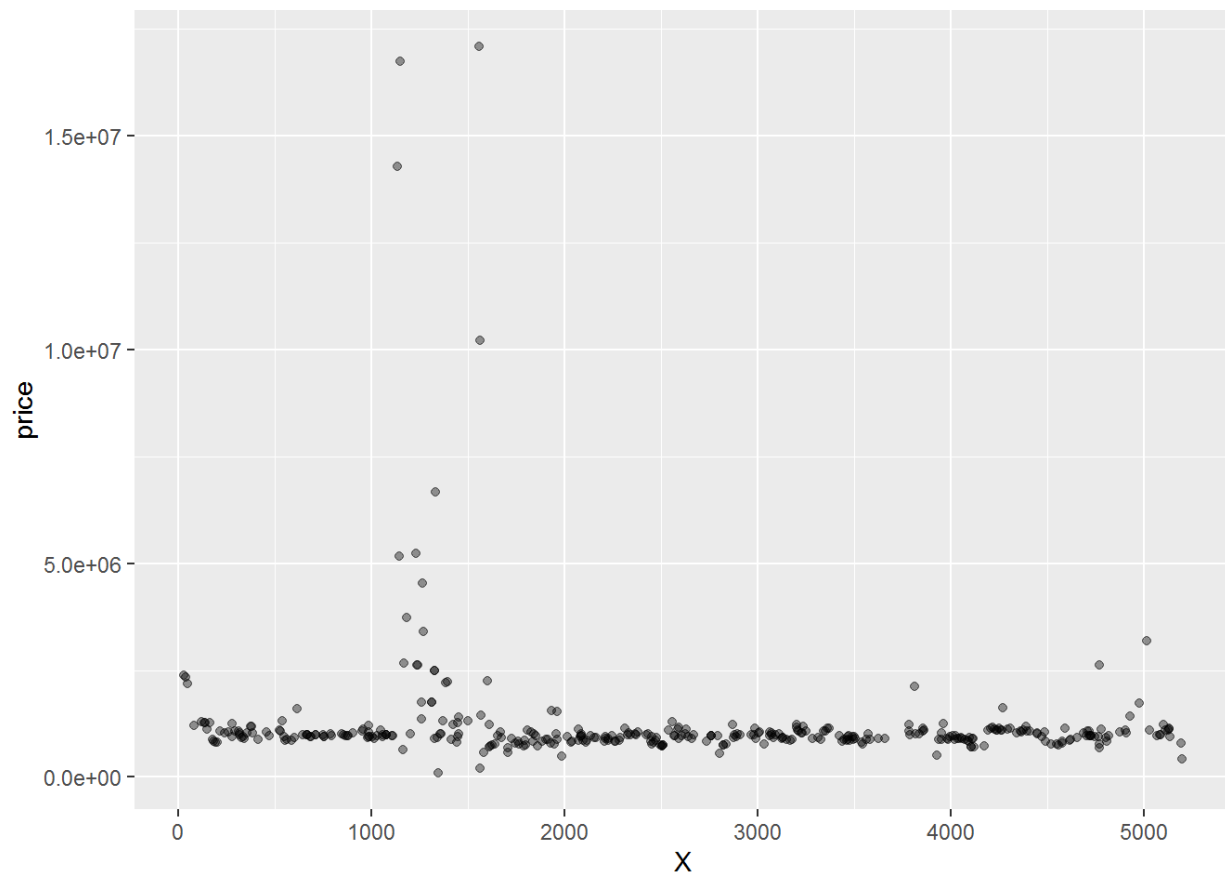
Where n is greater than or equal to 385. Therefore, I will use a sample size of 385.

When collecting the prices, there were four specific addresses that had no data on BC Assessment or was strange. I will remove these four specific datapoints from the sample. Now the sample size is 381.

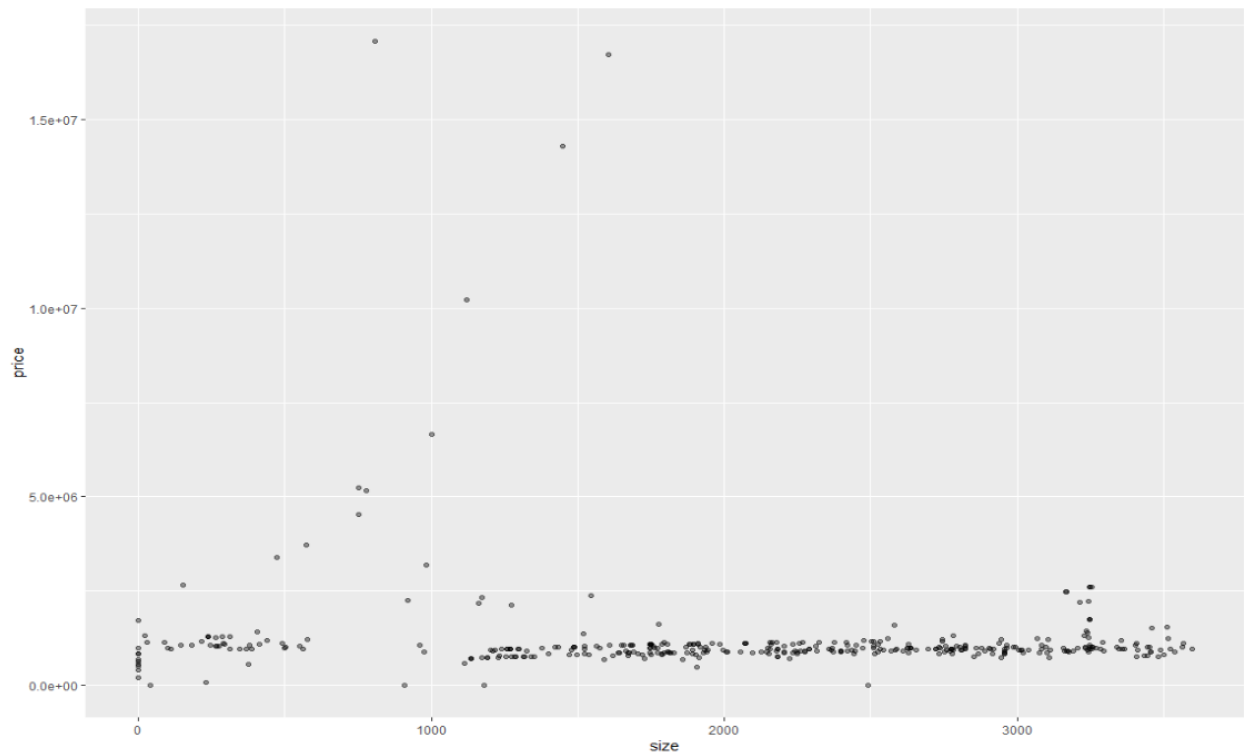
3275 MURRAY ST	Worth \$1 on BC Assessment
100 FOREST PARK WAY	No data
3002 MURRAY ST	No data
644 BENTLEY RD	No data

³ Sugden et al. (2000) and Cochran (1997, p. 42)

Plotting the data, we can see that there is a general price for houses in Port Moody. The higher price points are apartments, shops, or larger pieces of land.



We could also attempt to look at the data by lot size (in square feet) vs. price. However, there are problems with this data due to several points having a lot size of unknown or values not in square feet. This is similar to the previous plot, but organized by size.



Then I added the finite population correction (fpc) using the number of observations (12,968) from the Parcel data to the sample data to then be used in the survey design function in the survey package. I'm using the observation number since I do not know the population of all land plots in Port Moody. The Statistic Canada's census data on Port Moody only mentions the total number of private dwellings (13,318⁴ in 2016), which does not include plots that contain multiple businesses. That is why I decided on using the Parcel data because the sample data contains private dwellings, plots of land containing multiple businesses, and empty plots of land.

```
fulldat3$totaldwellings=12968
full.des = svydesign(data=fulldat3, ids=~1,
                    variables=~price,
                    fpc=~totaldwellings)
est.totals = svytotal(~price, full.des)
est.totals
```

```
##          total      SE
## price 1.5999e+10 997709357
```

Estimated total population price = 1.5999e+10 = \$15,999,000,000

```
p.est.totals
```

```
##          total      SE
## price 1.3881e+10 2472680655
```

The estimates of the total price of land is \$15,999,000,000.00. With a 95% confidence interval of (14043082524, 17954031337). This is higher than the estimate in the pilot study.

We can see that the standard error of our estimation of the total price of land is better than our standard error in the pilot study with sample size 10.

⁴ Statistics Canada via: <https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/details/page.cfm?Lang=E&Geo1=CSD&Code1=5915043&Geo2=PR&Code2=12&Data=Count&SearchText=Port%20Moody&SearchType=Begins&SearchPR=01&B1=All>

We can also compare this result to a calculation of data from BC Assessment's Lower Mainland Property Assessments⁵ and Statistic Canada's Census⁴ data.

(Single-family residential properties price * Number of Single-detached houses) + [Strata residential properties price * (Apartment in a building with 5 or more storeys + Other attached dwellings)]

```
(1192000*3930)+(615000*(1910+7125))
```

```
## [1] 10241085000
```

We get a number that is similar to the estimated total, however this is lower due to the fact that it does not include land that is not a private dwelling.

We can also compare our results from BC Assessment's "Lower Mainland Region Property Assessments"⁶ where Port Moody is small part of the Lower Mainland, which has a total value of real estate of \$1.41 trillion⁵.

⁵ Lower Mainland 2020 Property Assessments in the Mail via: <https://info.bccassessment.ca/news/Pages/Lower-Mainland-2020-Property-Assessments-in-the-Mail.aspx>

⁶ Lower Mainland Region Property Assessments via: <https://info.bccassessment.ca/property-information-trends/property-assessment-of-bc/Lower-Mainland>

Conclusion:

Looking back at our estimate for the total value of land in Port Moody, it looks reasonable when comparing the result to other estimates using available data from BC Assessment. We can see that the errors have been reduced by a large amount when using a larger sample size. Overall, I am satisfied with the results from the sample size used and that there is always room for improvements.

There are several ways to improve this study by finding more information or having a complete dataset from BC Assessment. The Parcel data that I used contained lot sizes, but there are missing values, which would cause problems if I were to use lot sizes as a form of weights over the total land area of Port Moody (25.89 km²). It would also be difficult to estimate the total value due to the methods used in measuring a piece of land's value. For example, it is possible that different types of land that have the same area, but have different prices due to a number of properties. Finally, the best way to improve a study is to have enough time and money to sample the entire population instead of a portion of the population.

APPENDIX

Resources Used:

- BC Assessment:
 - <https://www.bccassessment.ca/>
 - Lower Mainland 2020 Property Assessments in the Mail: <https://info.bccassessment.ca/news/Pages/Lower-Mainland-2020-Property-Assessments-in-the-Mail.aspx>
 - Lower Mainland Region Property Assessment: <https://info.bccassessment.ca/property-information-trends/property-assessment-of-bc/Lower-Mainland>
- Port Moody Parcel Information
 - https://data.portmoody.ca/datasets/7bc8ca82182141d2b3f0452fe593d528_30?geometry=-122.920%2C49.268%2C-122.823%2C49.288
- Statistics Canada
 - Statistics Canada. 2017. *Port Moody, CY [Census subdivision], British Columbia and Nova Scotia [Province]* (table). *Census Profile*. 2016 Census. Statistics Canada Catalogue no. 98-316-X2016001. Ottawa. Released November 29, 2017. <https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/index.cfm?Lang=E> (accessed April 7, 2020).
 - <https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/details/page.cfm?Lang=E&Geo1=CSD&Code1=5915043&Geo2=PR&Code2=12&Data=Count&SearchText=Port%20Moody&SearchType=Begins&SearchPR=01&B1=All>
- Sampling: Design and Analysis
 - Lohr, Sharon L. *Sampling : design and analysis*. Boston, MA: Brooks/Cole, 2010. Print.