

Analysis of Crime Statistics from 2014 to 2023 in Neighborhoods of Varying Home Price*

A Statistical Basis for Policy Improvement

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This paper analyzes crime rates across Toronto's neighborhoods from 2014 to 2023, focusing on the 10 neighborhoods with the highest home prices and the 10 neighborhoods with the lowest home prices. Home price acts as a proxy for socio-economic conditions, with higher home prices suggesting wealthier neighborhoods, and lower prices implying economically disadvantaged areas. It investigates crime rate trends across nine categories, comparing the average crime rates between high-price and low-price neighborhoods. The analysis reveals a significant disparity in crime rates, with lower-priced neighborhoods consistently exhibiting higher violent crime rates such as shootings, assaults, and murders while high-price neighbourhoods experience higher theft crime rates. These findings underscore the importance of targeted crime prevention strategies for varying economic standing neighborhoods and suggests that housing affordability is closely linked to public safety concerns.

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*Code and data are available at: <https://github.com/chenikabukes/TorontoDataset>

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1 Introduction

Housing prices are often regarded as a key indicator of socioeconomic status, with higher-priced neighborhoods typically associated with lower crime rates, greater economic stability, and improved access to social services. Conversely, lower-priced neighborhoods are frequently linked to higher crime rates, financial instability, and reduced access to critical resources (Kitchen 2006). While these patterns may hold true in many instances, the relationship between housing prices and crime rates is not universally consistent across regions. This complexity underscores the need for a more detailed investigation into how these factors interact in specific urban environments, such as Toronto.

This paper analyzes crime trends and their fluctuations over time across Toronto’s neighborhoods from 2014 to 2023, focusing on the 10 neighborhoods with the highest and lowest average home prices as a proxy for socioeconomic status. Using this comparison, I examine the relationship between neighborhood wealth and crime rates to uncover potential socioeconomic patterns in crime prevalence. The analysis explores nine distinct crime categories and compares trends between high-priced and low-priced neighborhoods. The objective is to identify significant crime patterns, assess whether wealthier neighborhoods consistently experience lower crime rates, and investigate which types of crimes are most prevalent in different socio-economic contexts.

Our findings reveal marked disparities, particularly in violent crimes such as shootings and assaults, which are more prevalent in lower home price neighbourhoods. As well, non-violent crimes such as theft, had significantly higher rates in higher home price neighbourhoods. Violent crimes (assault, homicide, shootings) and autotheft showed the most significant up trend from 2014 to 2023. All crimes stagnated or dropped during 2020-2021 which can be attributed to the Covid-19 pandemic lockdowns. These insights are crucial for urban planning and policy development, as they highlight the need for targeted crime prevention strategies. By understanding how crime rates vary across neighborhoods with different economic conditions, city

planners and policymakers can allocate resources more effectively and design interventions tailored to specific socio-economic groups.

The analysis in this paper was conducted using R (R Core Team 2023). The paper is structured as follows: first, I review the selected data sources, their relevance to the subject, and how the data was cleaned using the `janitor` (Firke 2023), `readxl` (Wickham and Bryan 2023), `tidyverse` (Wickham et al. 2019) packages. Second, I present key visualizations using the `scales` (Wickham, Pedersen, and Seidel 2023) and `knitr` (Xie 2014) packages to explore the relationships between neighborhood home prices, crime rates, and temporal trends from 2014 to 2023. Third, I provide an analysis of these visualizations and discuss their potential implications for public policy and future research into neighborhood-specific crime prevention strategies, based on the observed temporal trends in crime rates.

2 Data

2.1 Raw Data

The data for this analysis comes from two primary sources obtained from Toronto’s Open Data portal (Gelfand 2022):

Housing Price Data: This dataset includes information on average home prices across various neighborhoods in Toronto (Social Development Finance & Administration 2015). It serves as an indicator of the socio-economic status of each neighborhood. The data is extracted from the “Wellbeing Toronto” dataset, which records various socio-economic variables across the city. Wellbeing Toronto is a “website that allows you to learn more about the neighbourhood you work, play or live in” according to the City of Toronto. Many City of Toronto divisions, Agencies, Boards and Commissions are involved in gathering this data. Wellbeing Toronto only uses municipal information for each of the indicators it publishes. They have comprehensive information on how data was gathered for their indicators (City of Toronto 2024) and seem to have taken every precaution for as accurate as possible statistic collection for the neighbourhoods of Toronto. For this analysis, the focus is on the average home price for each neighborhood, identified by the neighborhood name and ID. This variable acts as a proxy for socio-economic conditions, with higher home prices suggesting wealthier neighborhoods, and lower prices implying economically disadvantaged areas.

Crime Statistics Data: This dataset contains detailed annual crime statistics for each neighborhood between 2014 and 2023. It was originally published by the Toronto Police Service on the Public Safety Data Portal (Toronto Police Services 2024). The data does not include occurrences of crime that were deemed “unfounded” according to Statistics Canada. To determine the rate of a crime, the Toronto Police Service use their police records for crime numbers in each neighbourhood and used data from Environics Analytics for population estimates during the year of crime. All of these sources are reputable and it appears thoughtful methods of

measurement were applied to most closely capture the population statistics presented in this dataset. It includes crime rates per 100,000 residents for a range of crimes:

- Assault
- Auto theft
- Bike theft
- Break and enter
- Homicide
- Robbery
- Shooting
- Theft from motor vehicle
- Theft over \$5,000

The crime data provides a robust view of criminal activity across various categories, offering insight into both violent and non-violent crime trends in different neighborhoods.

Data Selection Reasoning: While Toronto’s census data also contains valuable socio-economic information, the housing price dataset was chosen because it was updated more frequently and provides clearer spatial links between neighborhoods and socio-economic status. The census data, recorded in 2015 and 2021, presented two key limitations for this analysis:

- The features I would have used were not updated to 2021 data, and
- the census dataset organizes data by individual household income rather than neighborhood-level data, making it more challenging to compare neighborhoods directly.

The housing price data, already grouped by neighborhood code, was easier to integrate with the crime statistics for this study’s purpose.

Variables and their Roles: The key variables under examination are:

- Neighborhood Name and ID: Each neighborhood is identified by both a name and a unique ID code.
- Home Prices: Average home prices across neighborhoods, reflecting the relative affluence of each area.

- **Crime Rates:** Crime statistics for nine different crime categories, measured as the number of incidents per 100,000 residents annually. These crime rates provide a normalized metric for comparing areas with different population sizes. These variables allow for a detailed analysis of the relationship between socio-economic status (as proxied by home prices) and crime rates, both across crime categories and over time.

2.2 Data Cleaning and Preparation

Housing Price Data: The housing data was prepared by filtering out invalid entries and ensuring that all price data was numeric. To investigate the potential relationship between socio-economic status and crime, the analysis focuses on the neighborhoods with the 10 highest and the 10 lowest average home prices. Thus, home price data for all other neighbourhoods were filtered out. These neighborhoods represent a wide socio-economic spectrum and are expected to exhibit varying patterns of criminal activity. By isolating these groups, we can assess whether wealthier neighborhoods experience lower crime rates and determine which types of crimes are more prevalent in less affluent areas.

Crime Statistics Data: The crime data was cleaned by removing any missing entries and focusing exclusively on the crime rates. Non-relevant columns (i.e., raw crime counts) were removed in favor of normalized rates per 100,000 residents, making comparisons across neighborhoods more meaningful.

2.3 Summary Statistics and Visualisation

2.3.1 Summary Statistics of Housing Price Data

Below, we provide an overview of the housing price data for the top 10 highest and bottom 10 lowest-priced neighborhoods.

Table 1: Summary Statistics of Housing Price Data (Top 10 Highest and Lowest)

Group	Mean_Price	Median_Price	Max_Price	Min_Price
Top 10	1261440	1203215	1849084	993491
Bottom 10	254165	255320	280187	204104

2.3.2 Mean Crime Rate Changes over Time

Crime rate trends over the years (2014-2023) were analyzed for each crime type to understand patterns and shifts. This is visualized in the following plots:

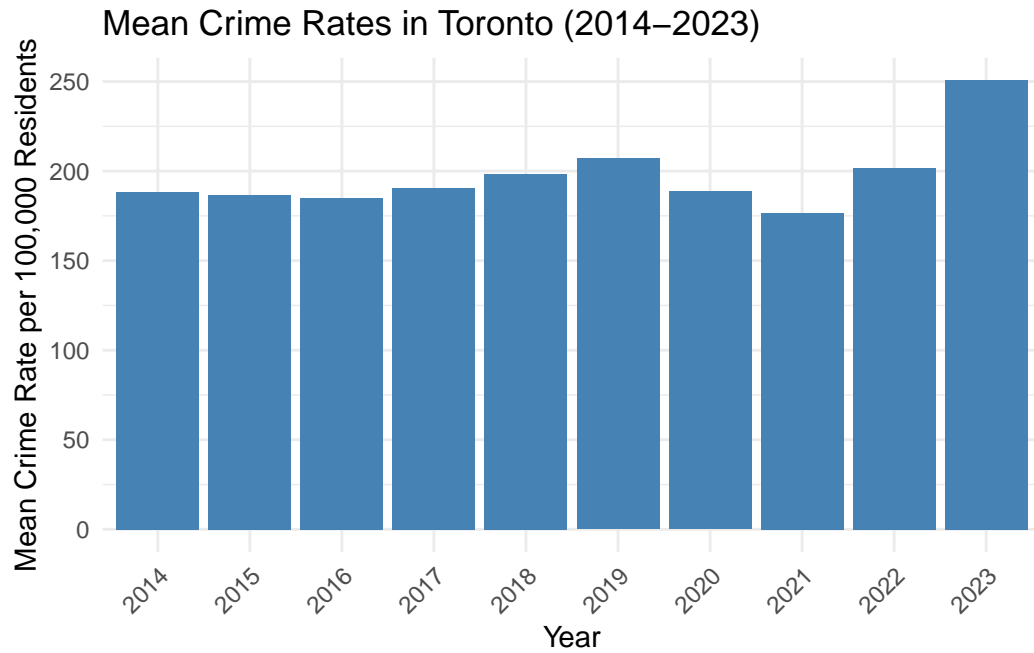


Figure 1: Total Crime Rates from 2014-2023

Figure 1 showcases a rather steady trend in crime rates with a dip in 2020 and 2021 which could be attributed to Covid-19 lockdowns, followed by a spike in 2023 of approximately 25% increase in mean crime rates across the city of Toronto's neighbourhoods.

2.3.3 Mean Individual Crime Rate Changes over Time

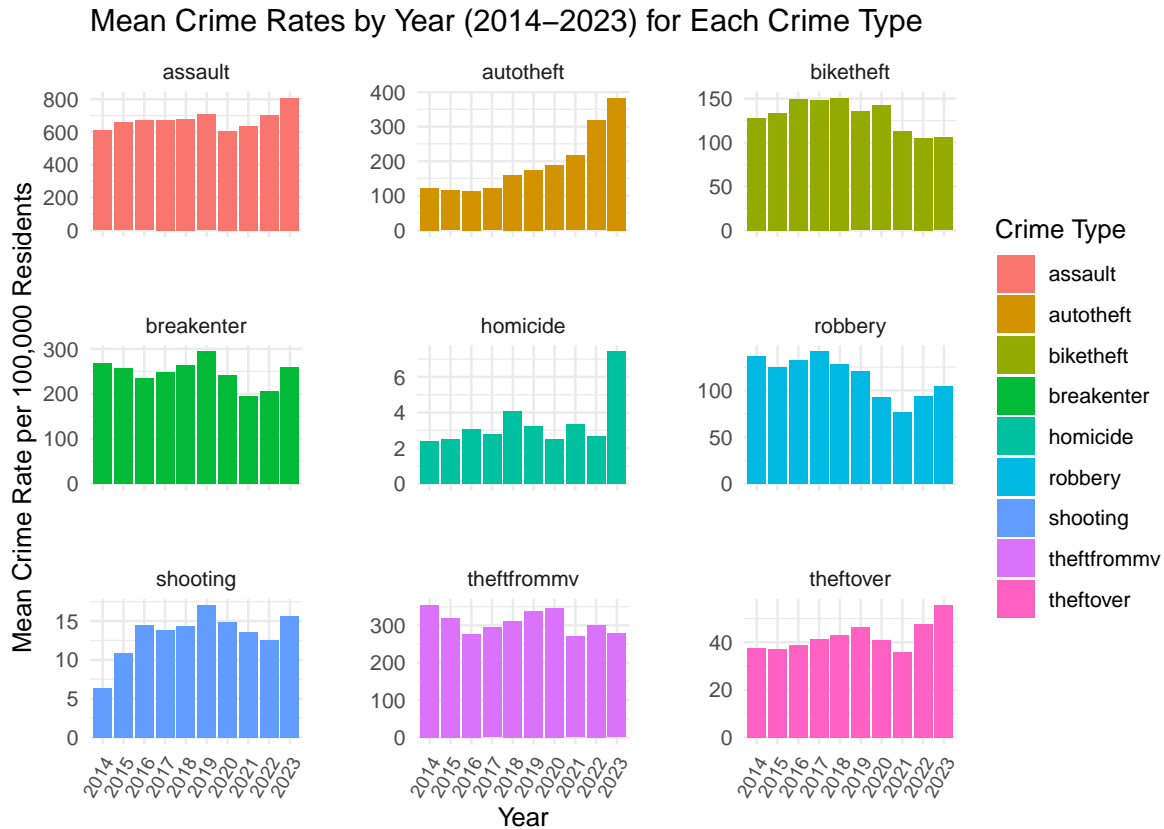


Figure 2: Average Individual Crime Rates over all Neighbourhoods (2014-2023)

Figure 2 displays the mean crime rate for each crime type individually. There is a clear pattern of crime rates being at their lowest levels during 2020-2021 for all crime types, which can be argued to be due to Covid-19 lockdowns.

Up-trending Individual Crime Rates

- Autotheft displays an exponential trend, increasing drastically from 2015 levels.
- Homicide was stagnant until the sudden increase 300% from 2 to 6 in 2023.
- Assaults have increased by 34% since 2020 to 2023.
- Theftover \$5000 has also increased by 22% from 2019 levels to 2023.
- Shooting has increased by over 300% since 2015 levels

Down-trending or Stagnant Individual Crime Rates

- Theft from motor vehicles rates has remained around 300 per 100,000 from 2015 to 2023.
- Robbery rates have decreased significantly from 2015 to 2023 by about 34%.
- Bike theft rates has decreased from highs in 2017-2019 of 150 to 2023 lows of 100.
- Break and enter rates have remained relatively stagnant from 2015, with dips corresponding to Covid-19 lockdowns.

Overall, there is a clear up-trend in violent crimes and down-trend in “pettier”, less-violent crimes.

3 Results

3.1 Average Crime Rate Comparison Between High and Low-Priced Neighborhoods for Individual Crimes

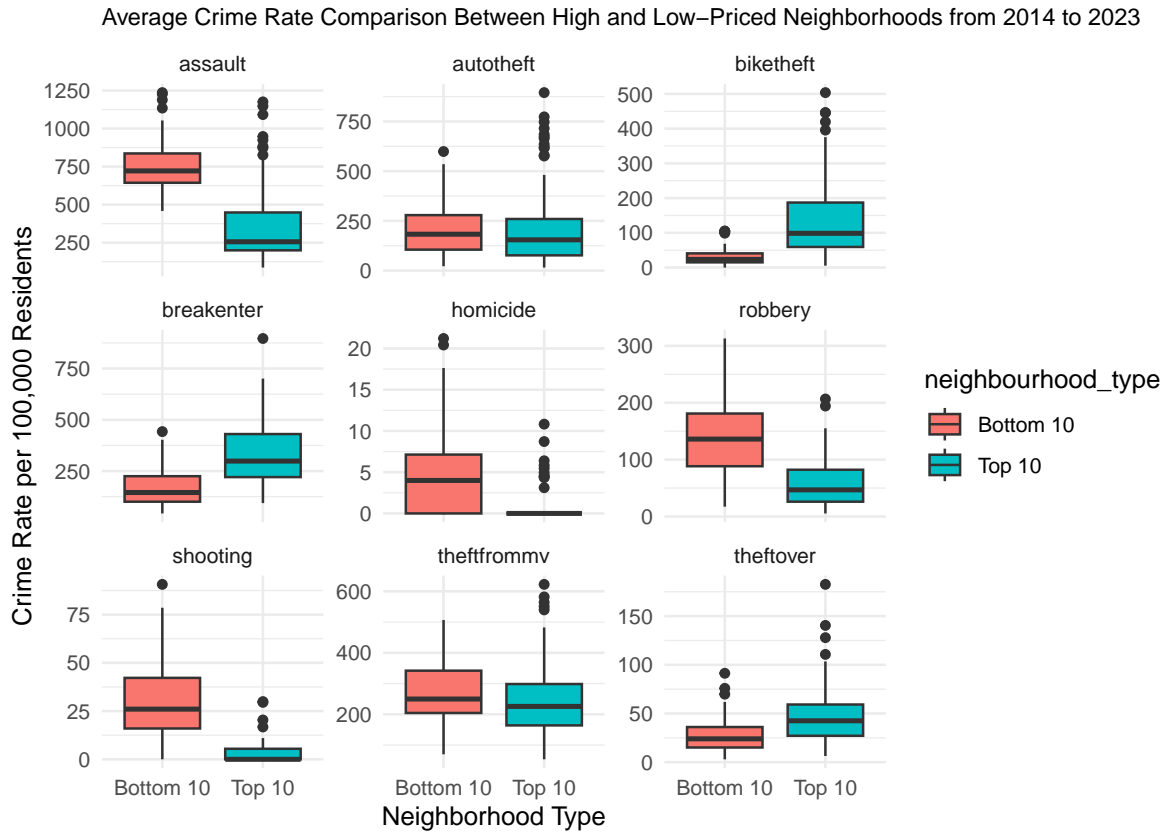


Figure 3: Box Plots comparing Crime Rates in Top 10 vs Bottom 10 Home Price Neighborhoods

Figure 3 shows a comparative analysis of crime rates between the top 10 highest and bottom 10 lowest home price neighborhoods in Toronto from 2014 to 2023.

Key Observations:

- **Assault:** Assault rates are notably higher in low-priced neighborhoods than in high-priced ones. The median assault rate in the bottom 10 neighborhoods is around 500, while in the top 10 neighborhoods, it is closer to 250. The top neighborhoods also show less variability in assault rates.

- **Autotheft:** Auto theft rates are slightly higher in bottom-priced neighborhoods, but the difference between the two groups is not as pronounced as for assault. Both groups exhibit a broad distribution, with several outliers in low-priced neighborhoods indicating significantly higher rates in certain years.
- **Biketheft:** High-priced neighborhoods have a notably higher rate of bike theft compared to low-priced ones. The median bike theft rate in top neighborhoods is significantly larger, suggesting that wealthier neighborhoods may experience more of these types of non-violent crimes, possibly due to the greater number of bikes or higher-value targets.
- **Break and Enter:** The break and enter crime rate appears to be higher in low-priced neighborhoods, with a median crime rate around 400 incidents per 100,000 residents, compared to around 250 in high-priced neighborhoods. The spread of crime rates is more pronounced in low-priced areas.
- **Homicide:** Homicide rates in low-priced neighborhoods are significantly higher than in high-priced ones. While most of the values cluster around low rates (under 10 per 100,000 residents), there are some extreme outliers in low-priced neighborhoods.
- **Robbery:** Robbery rates are consistently higher in low-priced neighborhoods compared to high-priced ones. The difference in medians is noticeable, with the bottom 10 neighborhoods showing a broader range of robbery rates.
- **Shooting:** Shootings are more common in low-priced neighborhoods, with significantly higher variability and outliers. In contrast, high-priced neighborhoods show a relatively small number of shootings, with rates clustering below 25 incidents per 100,000 residents.
- **Theft from motor vehicles:** this shows similar crime rates between both neighborhood groups. However, there is a slightly higher median and more variability in bottom-priced neighborhoods.
- **Theft over \$5,000:** Both groups exhibit similar trends in “theft over \$5,000” rates. There is not a significant difference between the two groups, and both have fairly consistent rates over the years.

Altogether, we see that there is higher violent crime in low-priced neighborhoods. Violent crimes like assault, break and enter, homicide, robbery, and shooting tend to be more prevalent in neighborhoods with lower home prices. These areas also exhibit greater variability in crime rates, possibly reflecting more social instability or economic distress. As well, there is higher non-violent Crimes in high-priced neighborhoods. Interestingly, non-violent crimes like bike theft are more common in higher-priced neighborhoods, possibly reflecting the availability of more valuable goods in these areas.

3.2 Average Crime Rate Comparison Between High and Low-Priced Neighborhoods from 2014 to 2023 for Overall Crime

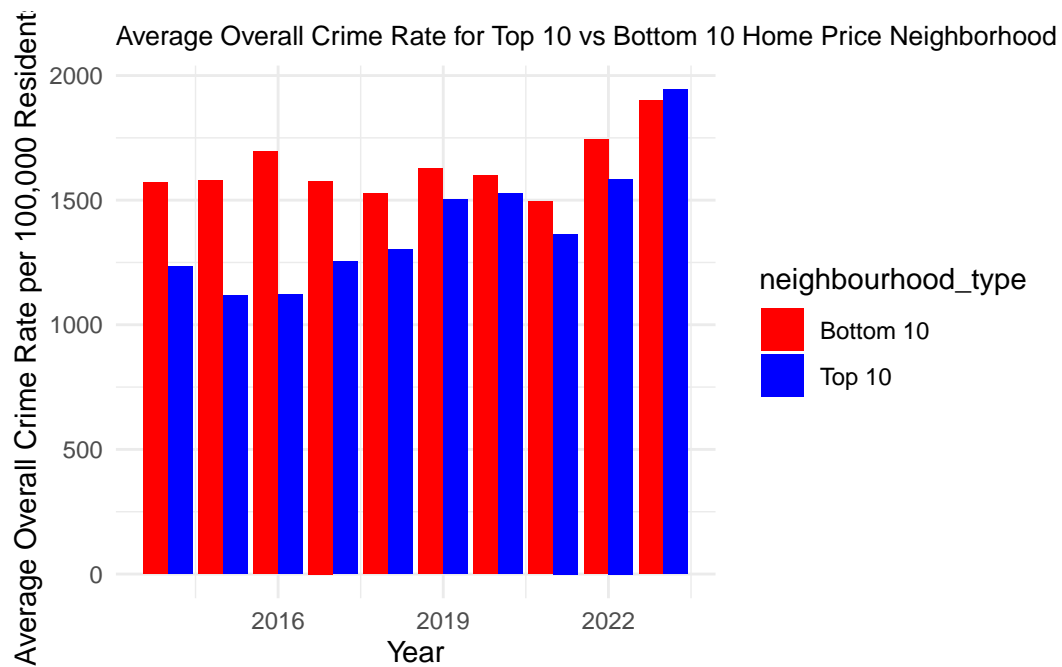


Figure 4: Crime Rate Time Series from 2014 to 2023 for Top 10 vs Bottom 10 Housing Price Neighbourhoods

Figure 4 shows that the overall crime rate has increased at a much higher rate in the top 10 highest price neighbourhoods than in the bottom 10 lowest price neighbourhoods. Both the highest and lowest priced neighbourhoods have experienced a steady increase in overall crime rates from 2015 to 2023, with the highest crime rate being that of the top 10 highest price neighbourhoods in 2023.

3.3 Average Crime Rate Comparison Between High and Low-Priced Neighborhoods from 2014 to 2023 for Individual Crimes

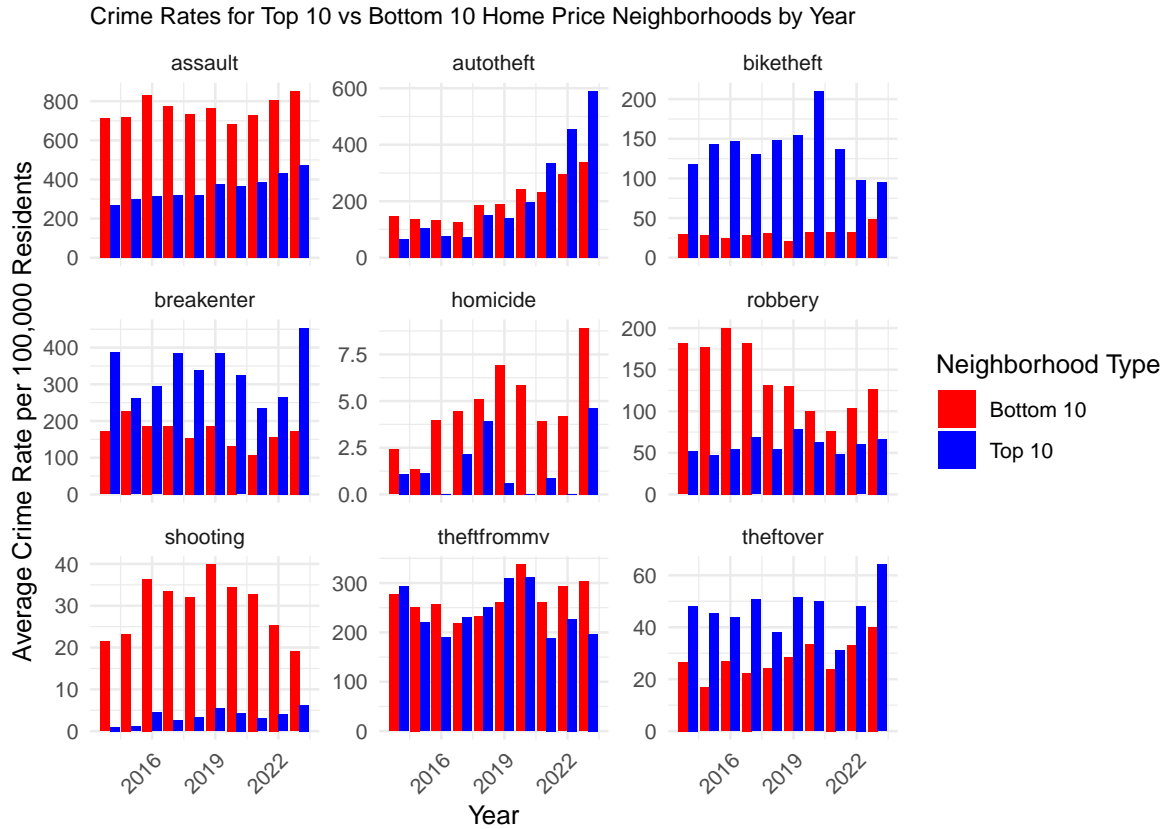


Figure 5: Crime Rate Time Series from 2014 to 2023 for Top 10 vs Bottom 10 Housing Price Neighbourhoods

Figure 5 displays the average crime rate amongst the top 10 and bottom 10 priced neighbourhoods for each individual crime over the years 2014-2023.

- **Assault:** The assault rates remain consistently higher in Bottom 10 Lowest neighborhoods than in Top 10 Highest neighborhoods across all years. There seems to be a slight downward trend in the top neighborhoods around 2019–2021, while rates in lower neighborhoods remain relatively stable.
- **Autotheft:** Bottom 10 Lowest neighborhoods show a steady increase in autotheft rates from 2015 onward, peaking around 2022. Top 10 Highest neighborhoods have significantly lower autotheft rates throughout the period, but they also show a slight upward trend, though the increase is far more gradual.

- **Biketheft:** In the earlier years (2015–2017), Bottom 10 Lowest neighborhoods have higher bike theft rates, but Top 10 Highest neighborhoods catch up around 2018–2020. From 2020 onwards, the bike theft rates in Top 10 Highest neighborhoods are actually higher than those in the Bottom 10 Lowest neighborhoods.
- **Break and Enter:** Rates for break and enter crimes fluctuate more in Bottom 10 Lowest neighborhoods, peaking around 2016–2017 and then decreasing slightly. Top 10 Highest neighborhoods show more stable but much lower break and enter rates overall.
- **Homicide:** Both neighborhoods show very low homicide rates (as expected), but Bottom 10 Lowest neighborhoods exhibit slightly higher rates. There is a gradual upward trend in homicides in Bottom 10 Lowest neighborhoods from 2016 to 2023, although the scale is relatively small (0 to 7.5 per 100,000 residents).
- **Robbery:** Robbery rates in Bottom 10 Lowest neighborhoods are consistently higher than in Top 10 Highest neighborhoods. The gap between the two neighborhood types widens in 2020 and onwards, with a notable increase in robbery rates in Bottom 10 Lowest neighborhoods.
- **Shooting:** Bottom 10 Lowest neighborhoods experience a significant peak in shooting rates around 2018, after which they decline. Top 10 Highest neighborhoods have almost negligible shooting rates in comparison.
- **Theft from Motor Vehicle:** The theft from motor vehicle rates are much higher in Bottom 10 Lowest neighborhoods, and they fluctuate over the years, with no consistent trend. The rates for Top 10 Highest neighborhoods remain fairly stable and low across the entire time period.
- **Theft over \$5,000:** This crime shows stable but relatively low rates for both neighborhood types, though Bottom 10 Lowest neighborhoods have a slight edge. There’s an increasing trend in Bottom 10 Lowest neighborhoods starting in 2020.

4 Discussion

This analysis confirms the hypothesis that wealthier neighborhoods experience lower rates of violent crimes, while economically disadvantaged areas face greater exposure to violent crime. However, non-violent crimes seem more prevalent in wealthier neighborhoods, suggesting different socio-economic dynamics at play.

The analysis of crime rates from 2014 to 2023 across Toronto’s neighborhoods, focusing on the top 10 highest and bottom 10 lowest-priced neighborhoods, reveals significant disparities in crime patterns based on socioeconomic status. The results highlight a clear trend where violent crimes—such as assault, homicide, and shootings—are more prevalent in lower-priced neighborhoods, suggesting a direct correlation between economic disadvantage and exposure to violence. On the other hand, non-violent crimes like thefts (especially bike thefts and theft

from motor vehicles) are more common in wealthier areas, reflecting different crime dynamics in these neighborhoods.

Key observations include:

- **Violent Crimes:** Assault, shootings, and homicides show higher rates in low-priced neighborhoods, with noticeable outliers and variability, indicating potentially greater social instability.
- **Non-Violent Crimes:** Higher-priced neighborhoods experience more theft-related crimes, likely due to the presence of higher-value targets.
- **Temporal Trends:** There is a city-wide spike in crime rates in 2023, following a period of lower crime during the 2020–2021 COVID-19 lockdowns, emphasizing the complex interactions between public health crises and crime patterns.

These findings suggest that public policy should be tailored to address the specific needs of different economic groups. Low-income neighborhoods require increased focus on violence prevention, while higher-income areas might benefit from enhanced property crime deterrence. Moreover, the evidence points to the need for long-term, community-based crime reduction strategies that consider the broader social and economic factors contributing to crime.

Future work should focus on expanding the scope of the analysis to include more socioeconomic indicators, such as employment rates and education levels, to better understand the root causes of crime and inform more effective policy interventions.

Appendix

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