Who Gets What: How Population and Income Shape Toronto's Budget Decisions*

Understanding the Impact of Demographics and Economic Factors on City Spending Across 25 Wards

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This study investigates how population density and average household income affect budget allocations across Toronto's 25 wards. Using data from the city's 2023-2032 Capital Budget Plan and 2021 Ward Profiles, we analyze spending patterns in key areas like health and safety, infrastructure, and community services. Our findings reveal that higher population densities do not guarantee proportionally greater investments in essential services, while wealthier wards often receive larger capital expenditures. These insights highlight potential disparities in resource distribution, emphasizing the need for more equitable urban budget planning to address diverse community needs.

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*Code and data are available at: https://github.com/Aviral-03/Toronto-WardWide-Budget-Analysis

1 Introduction

In urban governance, equitable allocation of municipal budgets is crucial for addressing the
diverse social, economic, and infrastructural needs of cities. This challenge is particularly acute
in Toronto, one of Canada's largest and most diverse cities, where 25 wards compete for limited
resources. Effective allocation requires a careful balance, but understanding how demographic
and economic factors influence these decisions remains an underexplored area. This study
addresses this gap by investigating the relationship between these factors and Toronto's budget
allocations, with implications for more informed, data-driven urban planning.

Following her election in 2023, Mayor Olivia Chow prioritized resolving Toronto's housing
crisis, improving transportation, and addressing social inequities (Toronto 2024c). The city's
2024 budget reflects these priorities, with notable investments in affordable housing, transit,
and community safety initiatives. Simultaneously, the Chief Financial Officer underscored the
importance of long-term infrastructure development, highlighting the city's 10-year capital
plan (Toronto 2024c). However, it remains unclear to what extent these priorities translate
into equitable budget allocations across Toronto's wards, particularly in health and safety or
growth-related expenditures.

To explore this issue, this study leverages multiple datasets from the City of Toronto's Open
Data Portal, including demographic information from the 2021 Ward Profiles and budget
data from the 2023-2032 Capital Budget Plan. Our analysis focuses on two key demographic
factors—population density and average household income—and examines their causal effect
on budget allocations across categories such as Health and Safety, Growth-Related Expendi-
tures, and Service Improvement. By focusing on these variables, we aim to uncover whether
Toronto's budget distribution aligns with the priorities of Mayor Chow and the city's Chief
Financial Officer.

Our findings reveal that wards with higher population densities do not consistently receive a
proportionate share of investments in essential areas like health and safety. While wealthier
wards tend to receive more substantial capital expenditures, however, the budget does not
show a strong bias in their favor overall for other categories. These results raise concerns about
potential disparities in resource distribution and highlight the need for more equitable budget
planning. This paper is structured as follows: Section 2 discusses the data and methodologies
used, followed by discussions of the relationship between variables of interest, and Section 3
explores the broader implications for urban governance and fiscal policy.

2 Data

The raw data was sourced from the City of Toronto's Open Data Portal using the `opendatatoronto` (Gelfand 2022) package. Three data sets were downloaded: `2023 Ward Profiles (25-Ward Model)`(Toronto 2024a), `2023-2032 Capital Budget and Plan Details`(Toronto 2024b), and `City Wards`(Toronto Open Data Portal 2024). The data, provided in Excel and CSV formats, was cleaned and analyzed using R (R Core Team 2023) programming language. The `readxl` (Wickham and Bryan 2023) package was used for reading Excel files. Other R packages used include `tidyverse` (Wickham et al. 2019), `styler` (Müller and Walthert 2024), and `dplyr` (Wickham et al. 2023) for creating tables. The `ggplot2` (Wickham 2016) and `kableExtra` (Zhu 2024) were used for data visualization and table formatting. The `patchwork` (Pedersen 2024) package was used for combining multiple plots, and `sf` (Venables and Ripley 2002) for spatial data analysis.

2.1 Measurement

Our research question and estimand analyse the relationship between key demographic and economic factors—specifically, population and average household income—and the budget allocation across various categories in Toronto's 25 wards. Population is a critical demographic indicator, representing the number of residents in each ward, while average household income reflects economic well-being, influencing access to resources and quality of life (Schaeffer 2021). Our primary aim is to estimate the impact of these variables on budget allocations for different categories, including Health and Safety, Growth-Related expenditures, State of Good Repair, and Service Improvement and Enhancement.

Population density is expected to affect the demand for services and infrastructure, while average household income may shape how resources are distributed across wards, reflecting broader economic disparities. The estimand is the causal effect of these factors on the allocation of funds, and the estimator will quantify how shifts in population and income levels influence budgetary decisions. By understanding this relationship, we aim to offer insights into how demographic and economic variables drive municipal spending patterns in different categories across the city.

2.2 Ward Profiles (25-Ward Model)

The 2021 Ward Profiles (Toronto 2024a), based on the 25-Ward model were provided by City Planning. These profiles included census data from the 2021, 2016, and 2011 Census of Population, covering demographic, social, and economic information for each ward in Toronto. This data-set was included in this analysis to provide insights into the population and average household income for each ward, providing insights into the city's socioeconomic landscape.

25-Ward model was used instead of the 44-Ward model as it was the most recent data available at the time of analysis and matched the Capital Budget data.

The data was stored in an Excel workbook with multiple tabs, but for this analysis, we used the first tab, `2016 Census One variable`, which contains data for all 25 wards (Ward 1, Ward 2, …, Ward 25). After cleaning, the data was saved in CSV and Parquet formats, with the following columns:

- `ward_id`: unique identifier for each ward,
- `ward`: ward name,
- `population`: total population,
- `income`: average household income.

The ward names were manually entered into the cleaned data and the `ward_id` was set as the row name. A sample of the data can be seen in Table 1. These variables were collected through methods including online responses, mailed questionnaires, the Census Help Line, and enumerators (Government of Canada 2023).

Table 1: Sample of Cleaned Toronto Ward Profile Data

Ward ID	Ward Name	Population	Average Household Income
1	Etobicoke North	115120	95200
2	Etobicoke Centre	117200	146600
3	Etobicoke-Lakeshore	139920	127200
4	Parkdale-High Park	104715	127200
5	York South-Weston	115675	88700

2.3 Capital Budget and Plan Details

The 2023-2032 Capital Budget and Plan Details dataset (Toronto 2024b), published by Financial Planning and updated on May 1, 2024, provides the 10-year capital budget for Toronto's wards. This data set covers allocations for fixed assets such as land, buildings, equipment, and new facility construction. We used it to analyze the distribution of capital budget allocations across various categories and wards. The 2023-2032 time frame was selected to align with Ward Profiles data and to reflect the planning relevance following the 2022 Municipal Elections.

Key columns include `Project Name`, yearly budget allocations from 2023 to 2032, `Ward Number`, `Ward`, `Category`, and `Total 10 Year` (Sum of Year 1 to 10), where the budget is in thousands of dollars (e.g., 10 = $10,000). However, Table 2 shows a sample of the cleaned data and our variables of interest:

- `Total 10-year capital budget` allocated to each ward

- Category of the Capital Budget, including fields like `Service Improvement and Enhancement`, `Growth Related`, and `State of Good Repair`.

Rows with `CW` (city-wide budget) were removed since they were applicable to all wards and to avoid large values, keeping only rows specific to each ward. The cleaned data was saved in CSV and Parquet formats for further analysis.

Table 2: Sample of Cleaned Toronto Capital Budget Data

Ward ID	Ward Name	Category	Total 10-Year Budget (in 000s)
1	Etobicoke North	Growth Related	65750.00
1	Etobicoke North	Service Improvement and Enhancement	5142.00
1	Etobicoke North	State of Good Repair	3271.47
2	Etobicoke Centre	Growth Related	89582.00
2	Etobicoke Centre	Service Improvement and Enhancement	37154.00

2.4 City Wards

The City Wards dataset (Toronto Open Data Portal 2024), published by the City Clerk's Office and last updated on July 22, 2024, contains geographical information about each ward, including the ward ID, ward name, and ward boundary. This dataset, effective January 1, 2024, was used to map the `ward_id` to the ward name in the cleaned data. Key columns include:

- `ward_id`: unique identifier for each ward,
- `ward`: ward name,
- `ward_boundary`: geographical boundary of the ward.

The ward names were mapped to the `ward_id` and integrated with the Ward Profiles Section 2.2 and Capital Budget data sets Section 2.3 to create the final data set for analysis. This dataset was not used directly in the analysis but was essential for mapping the ward names to the ward IDs in the cleaned data.
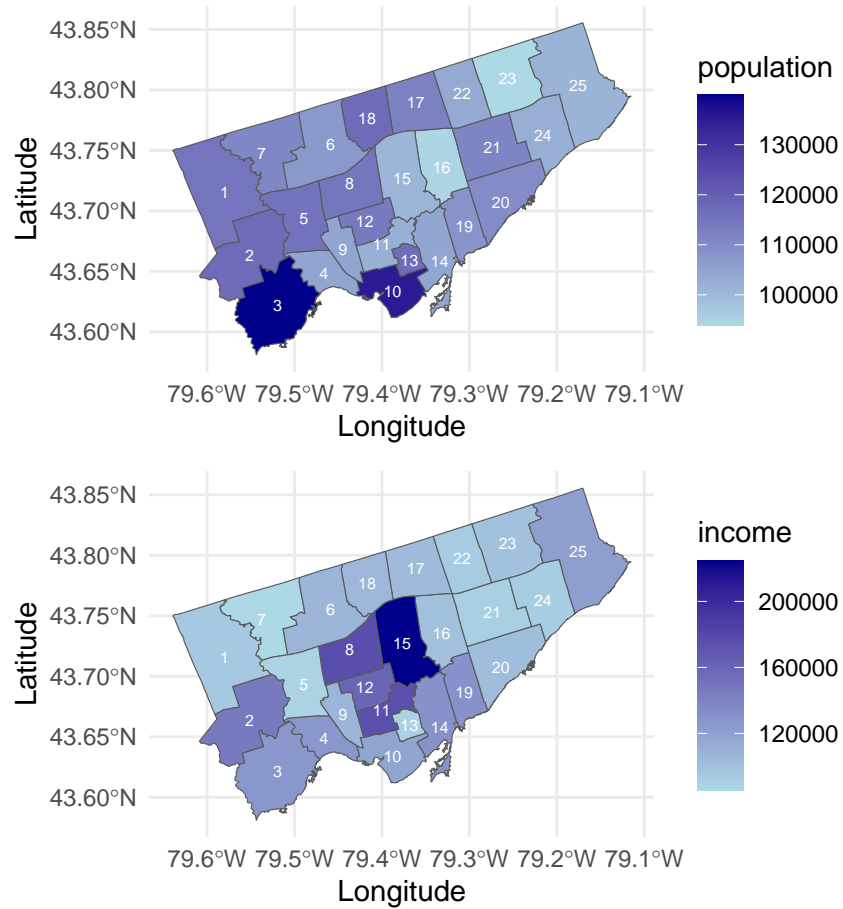
Figure 1: Map of Toronto highlighting the population by ward

2.5 Ward Profiles Results

The City of Toronto is divided into 25 wards, and the 2021 census data highlights significant disparities in population and average household income among them. As shown in Figure 1, Spadina-Fort York (Ward 10) and Etobicoke-Lakeshore (Ward 3) have the highest population densities, with 135,400 and 139,920 residents, respectively. In contrast, Don Valley West (Ward 15) has a lower population density of 101,025 but boasts the highest average household income at $224,800.

Population distribution reveals a concentration in the western part of the city and downtown areas. Notably, wards like Etobicoke Centre (Ward 2) and Etobicoke-Lakeshore (Ward 3), situated farther from downtown, have lower costs of living and correspondingly lower average household incomes, such as Etobicoke North (Ward 2) with $95,200.

An interesting pattern emerges around Don Valley West (Ward 15), which has the highest average household income. Wards such as University-Rosedale (Ward 11), Toronto-St. Paul's (Ward 12), and Eglinton-Lawrence (Ward 8) are clustered together, indicating a geographical correlation among high-income areas. Conversely, the wards with the highest population densities do not overlap with those that have the highest average household incomes, highlighting distinct socioeconomic patterns within the city.

This analysis will further explore the relationships between average household income, population, and budget allocations across various categories, with a focus on wards exhibiting higher average household incomes and population densities.

2.6 Relationship between Average Household Income & Population with Budget Allocation for Health and Safety
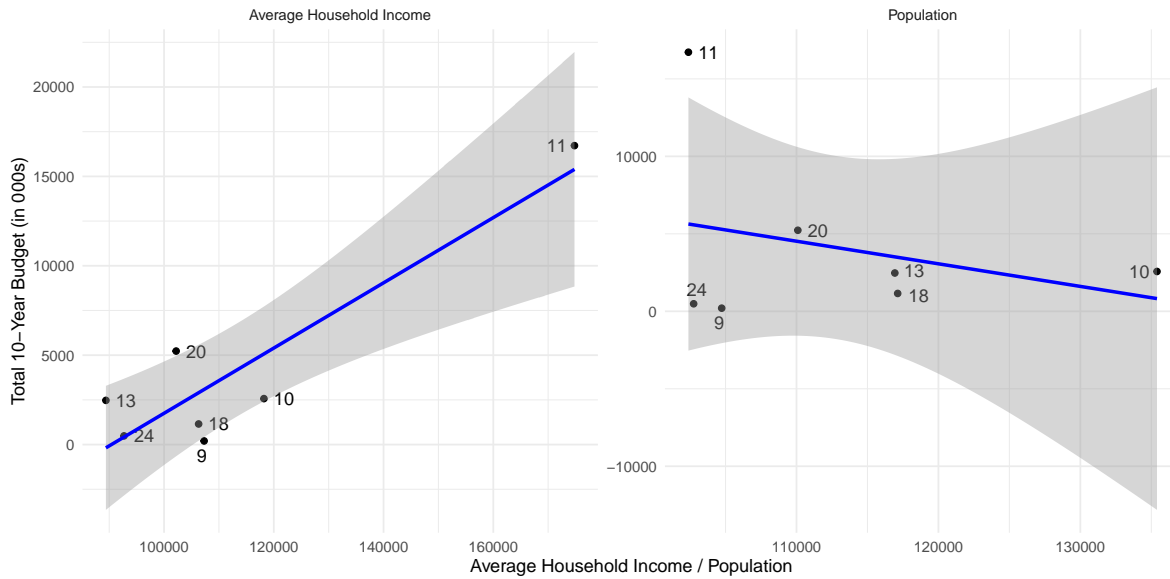

Figure 2: Health and Safety Budget by Ward

Figure 2 illustrates the relationship between average household income, population, and the total 10-year budget allocation for Health and Safety projects. The linear regression lines indicate a positive correlation, suggesting that higher average household incomes and larger populations are associated with increased budget allocations for Health and Safety.

As noted in Section 2.5, Ward 15 (Don Valley West) has the highest average household income, and surrounding wards also exhibit elevated incomes. This trend is reflected in the budget allocations, with Ward 11 receiving a higher budget for Health and Safety projects compared to other wards. This implies that areas with greater average household incomes tend to receive more funding for such initiatives.

Ward 10 (Spadina-Fort York), despite its high population density, ranks second in budget allocation. This indicates a prioritization of higher-income areas for funding, even though Ward 10 has a significant population. The lower budget allocation for Ward 10 compared to Ward 11 suggests a strategic focus on income levels rather than solely on population density.

It is important to note that some data points are missing in the plot for other wards, which may result from incomplete data or other factors. Further analysis is warranted to better understand the intricate relationships among average household income, population, and budget allocations for Health and Safety projects.

2.7 Relationship between Average Household Income & Population with Budget Allocation for Growth Related Projects
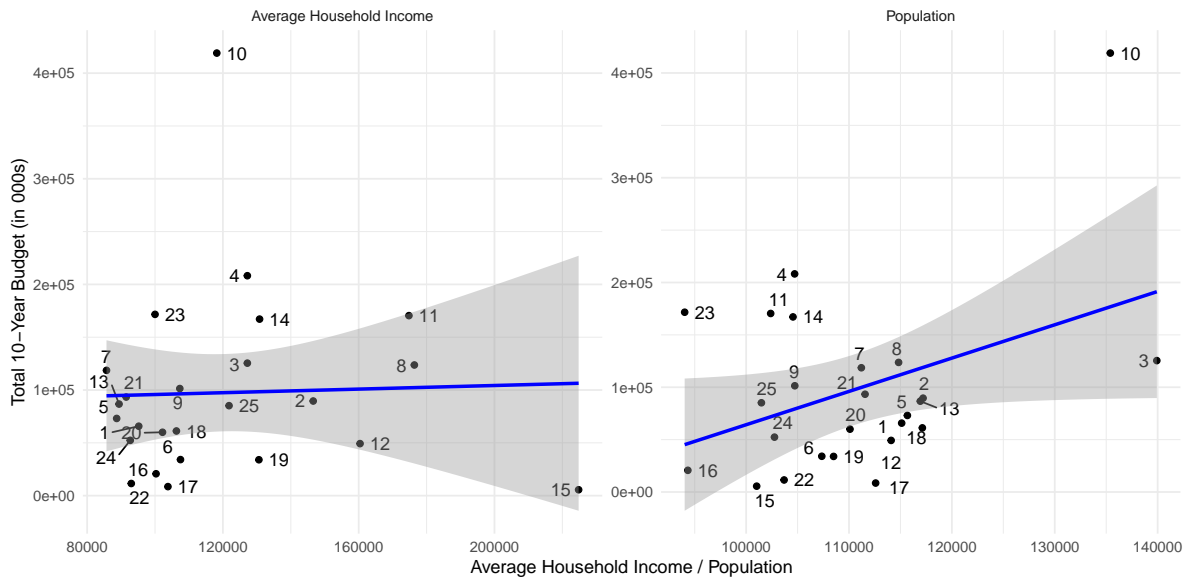

Figure 3: Growth Related Budget

Figure 3 presents the relationship between average household income, population, and the total 10-year budget allocation for Growth-Related projects. The linear regression line for average household income remains relatively flat, hovering around $100,000. This suggests that budget allocations for Growth-Related projects are not significantly influenced by the average household income. In other words, funds for these projects are distributed more uniformly across wards, regardless of their income levels. A similar pattern can be observed in Figure 4 where the budget allocation is not strongly correlated with average household income.

In contrast, the linear regression line for population tells a different story. It shows a positive correlation between population size and budget allocation for Growth-Related projects. Wards
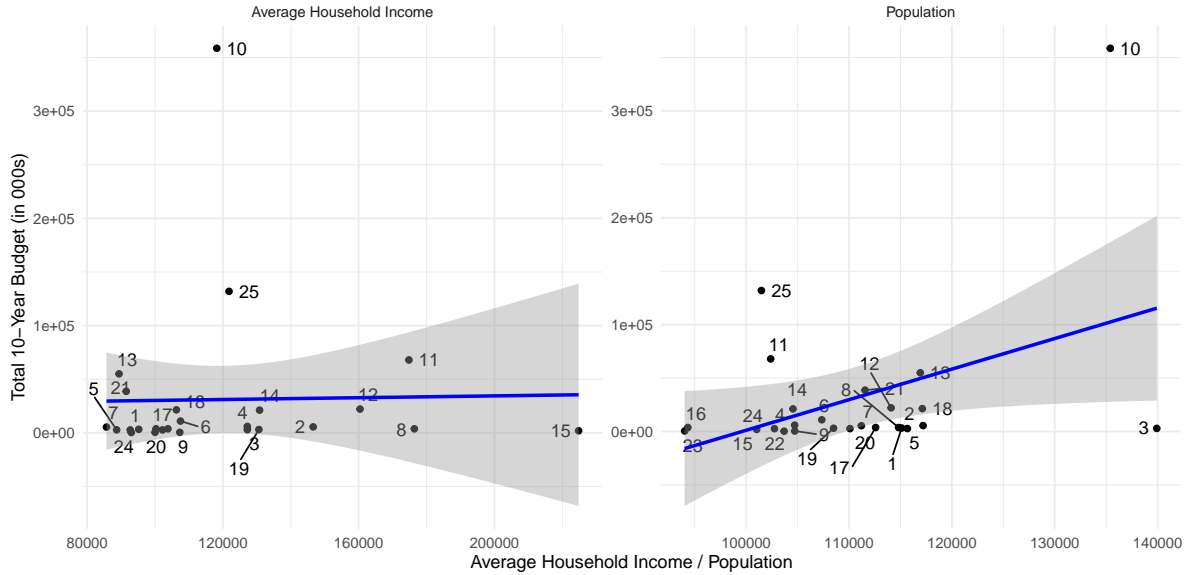
Figure 4: State of Good Repair Budget by Ward

with higher population densities, such as Ward 10 (Spadina-Fort York), Ward 13 (Toronto Centre), Ward 5 (York South-Weston), and Ward 2 (Etobicoke North), receive larger portions of the Growth-Related budget. This indicates that population density plays a key role in determining how much funding a ward receives for Growth-Related projects, with more populous wards receiving a greater share of the budget.

2.8 Relationship between Average Household Income & Population with Budget Allocation for Service Improvement and Enhancement

Figure 5 illustrates the relationship between average household income, population, and the total 10-year budget allocation for Service Improvement and Enhancement projects. These projects aim to enhance the quality of services provided to residents and improve the overall infrastructure of the city (Toronto 2018).

The relatively flat linear regression lines for both average household income and population suggest that these factors do not strongly influence the allocation of budgets for Service Improvement and Enhancement projects. This reflects the city's effort to ensure equitable distribution of services and infrastructure improvements across all wards, irrespective of their income levels or population densities.

However, some notable outliers are evident in the data. Ward 11 (University-Rosedale), for example, received the highest budget allocation for Service Improvement and Enhancement projects while also ranking as the second-highest in average household income. This may
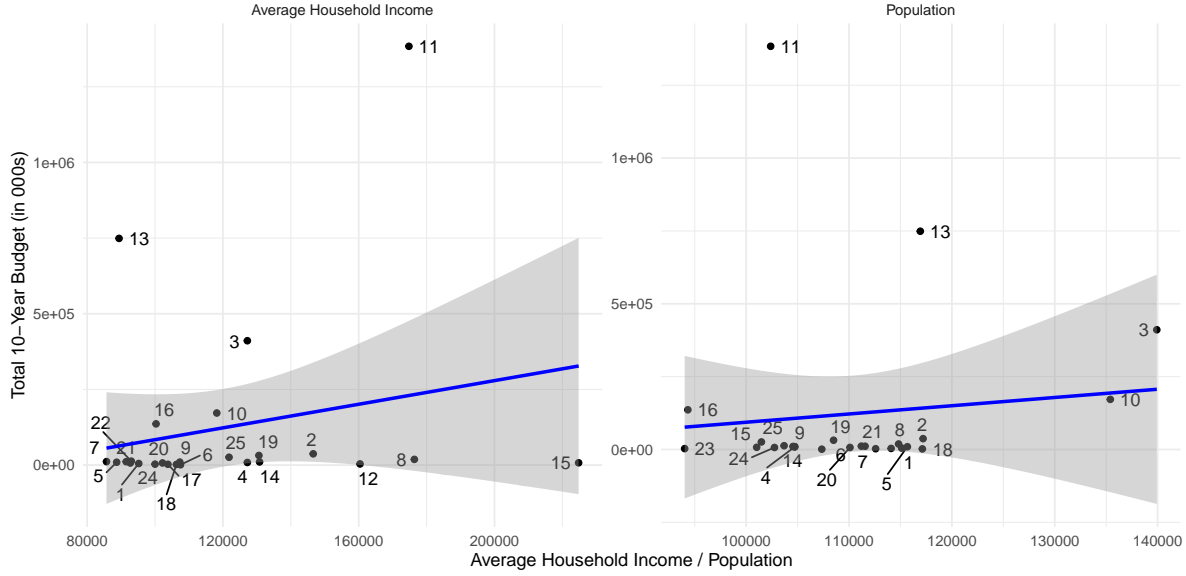
Figure 5: Service Improvement and Enhancement by Ward

indicate a more targeted approach to allocating funds in higher-income areas, though the specific reasons could be tied to pressing needs such as ongoing infrastructure upgrades or community development initiatives.

Other wards like Ward 3 (Etobicoke-Lakeshore) and Ward 10 (Spadina-Fort York), which have high population densities, also received significant budget allocations, suggesting that these areas are priorities for service improvements and infrastructure enhancement.

Despite these outliers, the majority of wards received similar budget allocations for Service Improvement and Enhancement projects, underscoring a city-wide strategy to enhance services uniformly for all residents.

3 Discussion

In this study, we expected that population density would be a major contributing factor for the budget allocation for most of the cateogries. However, we found that the relationship between population density and budget allocation varies across categories. For Growth-Related projects, population density plays a significant role in determining the budget allocation, with more populous wards receiving a larger share of the budget. This suggests that the city is prioritizing areas with higher population densities for growth-related initiatives, reflecting a focus on addressing the needs of more densely populated areas. In contrast, the relationship between average household income and budget allocation is less pronounced for Growth-Related

projects, indicating a more uniform distribution of funds across wards, regardless of their income levels. Wards with higher average household incomes tend to receive more funding for Health and Safety projects, reflecting a focus on addressing the needs of wealthier areas. While budget allocation for Service Improvement and Enhancement projects is relatively consistent across wards, some outliers suggest targeted investments in specific areas, potentially driven by unique needs or ongoing infrastructure projects. Overall, our findings highlight the complex interplay between demographic and economic factors in shaping budget allocations in Toronto's wards, with implications for urban governance and equitable resource distribution.

Some of the limitations of this study include the lack of detailed information on specific projects within each category, which could provide more insights into the rationale behind budget allocations. Additionally, the analysis focused on the relationship between population density, average household income, and budget allocation, but other factors such as infrastructure needs, community development priorities, and political considerations may also influence budget decisions. Future research could explore these factors in more detail to provide a comprehensive understanding of how municipal budgets are allocated and the impact of these decisions on residents' quality of life.

In conclusion, this study sheds light on the relationship between demographic and economic factors and budget allocations in Toronto's wards, offering valuable insights into the city's resource distribution strategies. By understanding how population density and average household income influence budget decisions, policymakers can make more informed choices that address the diverse needs of residents and promote equitable urban development. This research contributes to the growing body of literature on urban governance and fiscal policy, providing a data-driven approach to understanding the complexities of municipal budgeting and resource allocation.

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