Analyzing Income Inequality Trends in the Canada: Impacts of the Great Recession (2007-2009) and COVID-19 Pandemic (2020-2023)*

Insights from 2002 to 2023

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This paper examines income inequality in Canada from 2002 to 2023 using data from the World Inequality Database (WID) and Statistics Canada. The analysis explores trends in income inequality and inflation, assessing whether these disparities have increased or decreased over time. It also compares the impacts of the Great Recession (2007–2009) and the COVID-19 pandemic (2020–2023) on income disparities. Through data analysis and regression modeling, this study investigates these trends in depth. Understanding these patterns is crucial for policymakers and the government to develop effective strategies aimed at reducing inequalities within the country. This report ultimately seeks to contribute to efforts promoting social and economic equity in Canada.

1 Introduction

Income inequality is a significant issue both in Canada and all around the world. Income inequality refers to the difference in how income is distributed among the population, highlighting significant disparities in financial well-being. Unlike wealth inequality, which considers the value of assets such as homes, stocks, and other holdings, income inequality specifically examines earnings from sources like wages, salaries, savings interest, stock dividends, rental income, and profits from the sale of assets. This distinction is essential for understanding the multifaceted nature of economic disparities. Gaining a deeper understanding of income

*Code and data are available at: https://github.com/DJY1231/Exploring_Income_Inequality_in_Canada_During_Major_Reces

inequality can equip policymakers and researchers with valuable insights to develop strategies aimed at addressing this pervasive problem.

This paper focuses on the dynamics of income inequality in Canada, especially focusing on the period from Great Recession (2007–2009) and the COVID-19 pandemic (2020–2023). Using the dataset provided by World Inequality Database (WID), the paper will fully investigate income trends across the social class, top 1%, top 10% and bottom 50% of income inequality. Moreover, will be considering variables such as year and CPI to find out the correlation between income inequality and inflation.

To efficiently investigate remaining income inequality between individual firms and social classes who are living in Canada, this paper will focus on exploring datasets and multiple linear regression modeling to find out the full details (trends, patterns) about income inequality that is occurring in Canada.

The paper is structured as following: Section 2 introduces the data used for analysis and findings, including the variables of interest. Section 3 introduces the linear regression model to examine the correlation between time (year) and social class to investigate income inequality in Canada. Section 4 introduces the full analysis of the table which will include the summary. Section 5 may discuss about the findings that we investigated and also talk about the weaknesses of this paper and its next steps. Section 6 will discuss about the focus on an aspect of surveys, sampling or observational data, related to the paper.

1.1 Estimand

The goal of this paper is to explore the relationship between income inequality and time, measured in years, in Canada, with a focus on how changes over the years affect income inequality. Additionally, this paper examines whether the Great Recession (2007–2009) or the COVID-19 pandemic (2020–2023) caused greater income inequality among different social classes. The analysis uses data from the World Inequality Database (WID) to graph income inequality trends from 2002 to 2023, supplemented by data from Statistics Canada to examine the inflation rate for each year.

Thus this paper highlights the trend of income inequality between time, social class, and inflation within Canada.

2 Data

2.1 Data source

The data is gathered from World Inequality Database (WID) which introduces the pre tax income share by each social class over time: 2002 to 2023 in Canada. The second data is

gathered from Statistics Canada where the data illustrates the Consumer Price Index (CPI) to figure out the inflation rate within each year.

2.2 Data mearsurement

The WID dataset provides information that offers insights into the income inequality trends in Canada. The y-axis represents the income share, measured in dollars (%) while the x-axis corresponds to the years from 2002 to 2023, representing the share of pre tax total income for each year. For the Statistics Canada dataset, it provides the information of yearly Consumer Price Index (CPI). The y-axis represents the CPI, measured in index base period while the x-axis corresponds to the years from 2002 to 2023, representing the CPI for each year.

Data cleaning and analysis were conducted using the base statistical programming language R (R Core Team 2023), and the core components such as tidyverse (Wickham et al. 2019), lubridate (Garrett Grolemund and Hadley Wickham. 2011), janitor (Firke 2023), testthat (Wickham H. 2011), validator (Van der Loo and Mark 2022), knitr (Xie 2023), ggplot2 (Wickham 2016), and dplyr (Wickham et al. 2023).

2.3 Variables of Interest

Table 1: First 40 rows of Income Share by Social Class Over Time: 2002 to 2023 in Canada.

Country	Social_Class	Year	Share_of_total_income
Canada	Top 1% income	2002	0.1279
Canada	Top 1% income	2003	0.1306
Canada	Top 1% income	2004	0.1359
Canada	Top 1% income	2005	0.1402
Canada	Top 1% income	2006	0.1421
Canada	Top 1% income	2007	0.1421
Canada	Top 1% income	2008	0.1347
Canada	Top 1% income	2009	0.1186
Canada	Top 1% income	2010	0.1235
Canada	Top 1% income	2011	0.1228
Canada	Top 1% income	2012	0.1162
Canada	Top 1% income	2013	0.1161
Canada	Top 1% income	2014	0.1144
Canada	Top 1% income	2015	0.1149
Canada	Top 1% income	2016	0.0990
Canada	Top 1% income	2017	0.1053
Canada	Top 1% income	2018	0.1053
Canada	Top 1% income	2019	0.1039

Country	Social_Class	Year	Share_of_total_income
Canada	Top 1% income	2020	0.1059
Canada	Top 1% income	2021	0.1162
Canada	Top 1% income	2022	0.1162
Canada	Top 1% income	2023	0.1162
Canada	Top 10% income	2002	0.3660
Canada	Top 10% income	2003	0.3695
Canada	Top 10% income	2004	0.3756
Canada	Top 10% income	2005	0.3807
Canada	Top 10% income	2006	0.3838
Canada	Top 10% income	2007	0.3838
Canada	Top 10% income	2008	0.3758
Canada	Top 10% income	2009	0.3588
Canada	Top 10% income	2010	0.3652
Canada	Top 10% income	2011	0.3647
Canada	Top 10% income	2012	0.3582
Canada	Top 10% income	2013	0.3587
Canada	Top 10% income	2014	0.3565
Canada	Top 10% income	2015	0.3539
Canada	Top 10% income	2016	0.3413
Canada	Top 10% income	2017	0.3481
Canada	Top 10% income	2018	0.3460
Canada	Top 10% income	2019	0.3438

Table 1: The first 40 rows of Income Share by social class over time: 2002 to 2023 in Canada.

1. Location: The model uses all the dataset collected across Canada. This geographic coverage enables us to access different social class with different income level.

2. Social Class: The dataset contains information on income levels for each social class, including Top 1% income, Top 10% income and bottom 50% income. These income levels provide detailed insights into income distribution across different years and shares of total income in Canada.

3. Year: The dataset covers the years from 2002 to 2023, allowing for the exploration of long-term income inequality trends and changes over time. This period encompasses the time between two major recessions—the Great Recession and the COVID-19 pandemic—providing valuable insights into patterns and income distribution during these economic events.

4. Share of total income: The dataset likely represents the share of pre tax total income earned by specified social classes (e.g., "Top 1% income") in Canada for each year. For instance, a value of 0.1279 for "Top 1% income" in Canada in 2002 indicates that the

top 1% of earners received 12.79% of the total income generated in the country that year. This data is significant because it reveals trends in how the income shares of different social classes change over time.

2.4 Data Visualization

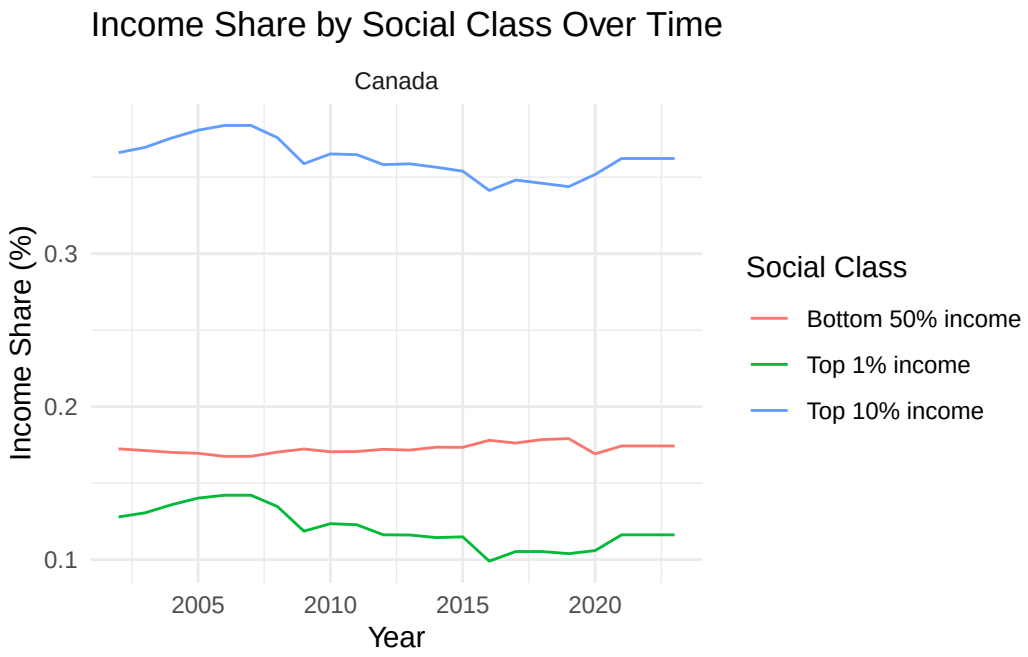

Figure 1: Income Share by Social Class Over Time: 2002 to 2023 in Canada.

Figure 1 displays the trend of income distribution across different social classes in Canada from 2002 to 2023. The data indicates a downward trend in the income share for the top 1% and top 10% of earners during the period from 2002 to 2016, suggesting that these groups lost a portion of their total income share during that time. However, between 2016 and 2023, the total income share for these groups increased. Conversely, the bottom 50% of earners experienced a slight increase in their total income share over the entire period, reflecting a modest improvement in their economic position. The decreasing trend in the income share for the top 1% and top 10%, alongside the increased share for the bottom 50%, suggests that income inequality in Canada gradually decreased during the period from 2002 to 2016, with the bottom 50% receiving a slightly larger share of overall economic growth. However, after 2016, the trend appears to reverse, indicating a rise in income inequality as the top income groups regained a larger share of total income.

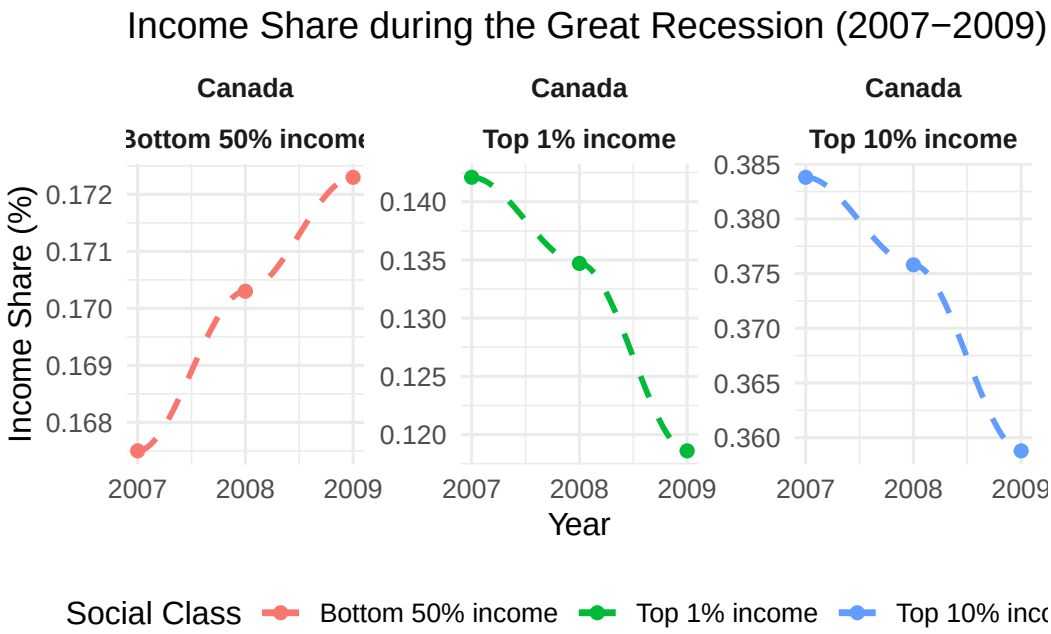

Figure 2: Income Share by Social Class during the Great Recession: 2007 to 2009 in Canada.

Figure 2 illustrates the trend of income distribution across different social classes in Canada from 2007 to 2009, during the Great Recession. One notable trend is the downward shift in the income share for the top 1% and top 10% of earners, alongside an upward trend in the income share for the bottom 50% of earners during this period. This trend suggests that the top 1% and top 10% groups lost a portion of their total income share during this time. Specifically, the income share of the top 1% decreased by 2.35 percentage points, from 14.21% to 11.86% of the total income pie. Similarly, the top 10% experienced a decrease of 2.5 percentage points, from 38.38% to 35.88%. This indicates that the top 10% group was economically affected more than the top 1%. In contrast, the bottom 50% showed an increase in income share, with their portion rising by 0.48 percentage points, from 16.75% to 17.23% of the total income pie.

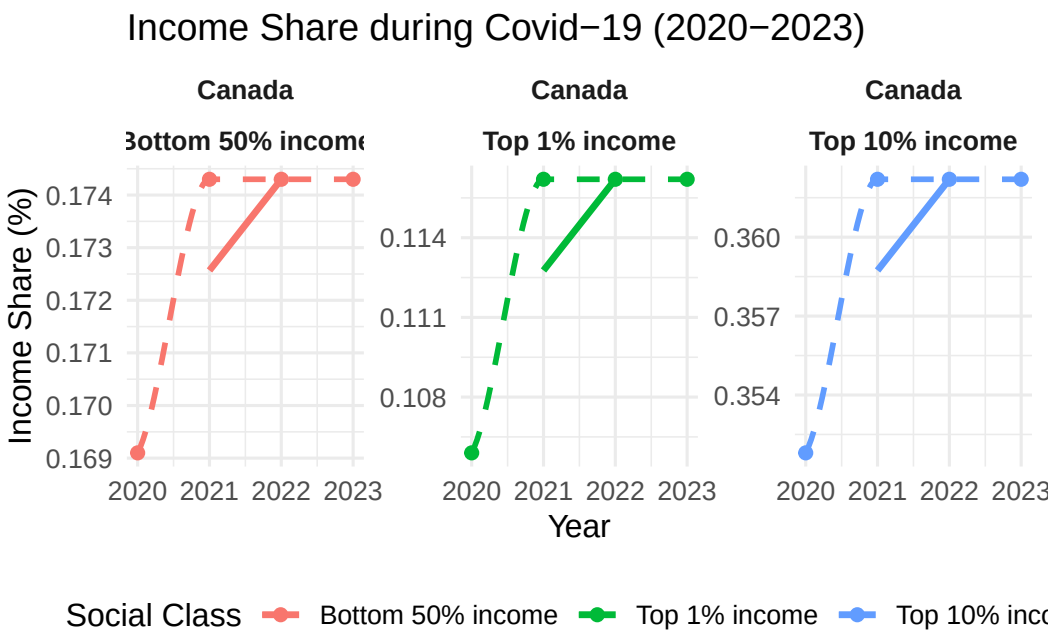

Figure 3: Income Share by Social Class during the Covid-19: 2020 to 2023 in Canada.

Figure 3 illustrates the trend of income distribution across different social classes in Canada from 2020 to 2023, during the COVID-19 pandemic. One noticeable trend is the upward shift in income share from 2020 to 2021, followed by a consistent income share for all social classes (top 1%, top 10%, and bottom 50% of earners) afterward. This trend suggests that all social classes benefited from an increase in total income share during this time. However, to determine who benefited the most and assess income inequality between the social classes, it is necessary to consider the percentage increases. Specifically, the income share of the top 1% increased by 1.03 percentage points, rising from 10.59% to 11.62% of the total income pie. Similarly, the income share of the top 10% increased by 1.04 percentage points, from 35.18% to 36.22%. This indicates that the top 10% group benefited slightly more than the top 1% by 0.01 percentage points. Meanwhile, the bottom 50% experienced an increase in income share of 0.52 percentage points, from 16.91% to 17.43%. Comparing the magnitude of these increases, the top 1% and top 10% benefited more than the bottom 50%, highlighting a persistent income inequality gap during the COVID-19 pandemic.

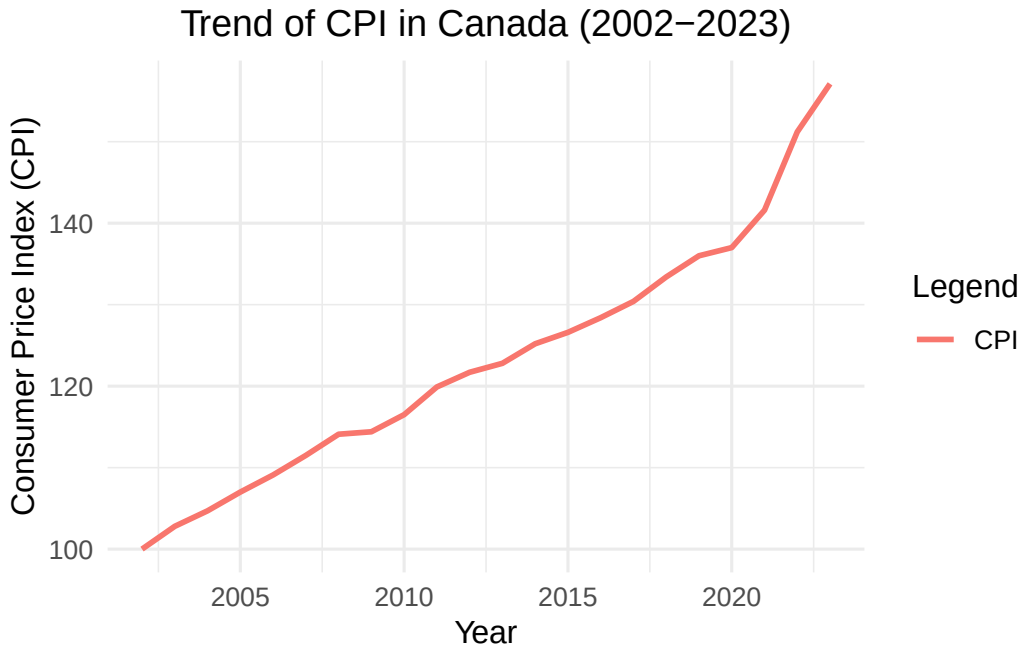

Figure 4: Consumer Price Index (CPI) over time: 2002 to 2023 in Canada.

Figure 4 illustrates the trend of the Consumer Price Index (CPI) in Canada from 2002 to 2023. The CPI shows a consistent upward trend over this period, indicating that consumer prices have steadily increased. This trend suggests that rising consumer prices are associated with an increase in the inflation rate. In other words, as the inflation rate rises, purchasing power, defined as the ability to buy products and services decreases.

3 Model

This section will discuss the multiple linear regression meodl that will be used for the paper analysis.

3.1 Model set-up

The multiple linear regression model is as follows:

$$\begin{aligned}\text{Share\_of\_total\_income}(Y) = \beta_0 &+ \beta_1 \cdot \text{Year} + \beta_2 \cdot \text{Social\_Class} \\ &+ \beta_3 \cdot \text{Period} + \beta_4 \cdot (\text{Year} \times \text{Social\_Class}) \\ &+ \beta_5 \cdot (\text{Social\_Class} \times \text{Period}) + \varepsilon\end{aligned}$$

3.1.1 Model justification

We aim to model the relationship between the response variable Y, which represents the share of income for each social class, using the following components:

- β_0: The overall intercept of the model.
- β_1: The trend of pre-tax total income share over time.
- β_2: The differences in pre-tax total income share across various social classes.
- β_3: The effect of the economic period on income share.
- β_4 and β_5: Interaction terms that account for the combined influence of time and economic periods on different social classes.
- ε: The error term, representing unaccounted variability in the model.

The selection of priors for the coefficients, β_0, β_1, β_3, β_4, and β_5 as Normal distributions with a mean of 0 and a standard deviation of 2.5 reflects a weakly informative prior. This approach signifies an absence of strong assumptions about the magnitude or direction of their effects.

4 Results

The regression results are as following:

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Please cite as:

 Hlavac, Marek (2022). stargazer: Well-Formatted Regression and Summary Statistics Tables.

 R package version 5.2.3. https://CRAN.R-project.org/package=stargazer


Regression Results: Income Inequality During Great Recession and COVID-19
================================================================
                                       Dependent variable:
                                   ---------------------------
                                      Share of Total Income
----------------------------------------------------------------
Year                                          0.001*
                                             (0.0003)

Top 1% Income                                5.194***
                                              (0.783)
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Top 10% Income	5.192***
	(0.783)
Bottom 50% Income	-0.001
	(0.004)
Great Recession	-0.005
	(0.004)
COVID-19	
Other Period	-0.002***
	(0.0004)
Year x Top 1% Income	-0.003***
	(0.0004)
Year x Top 10% Income	0.007
	(0.005)
Year x Bottom 50% Income	0.007
	(0.005)
Top 1% Income x Great Recession	0.025***
	(0.006)
Top 10% Income x Great Recession	0.021***
	(0.006)
Bottom 50% Income x Great Recession	
Top 1% Income x COVID-19	
Top 10% Income x COVID-19	-0.834
	(0.554)
Observations	66
R2	0.997
Adjusted R2	0.997

```
================================================================
Note:                                *p<0.1; **p<0.05; ***p<0.01
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Table 2: Summary results for the share of total income model

This table summarize the output of the multiple linear regression model that estimates the share of total income based on different predictors: year, social class (top 1% income, top 10% income, and bottom 50% income), periods (The Great recession and Covid-19 pandemic), and interaction terms between these predictors.

Social Class (top 1% income, top 10% income, and bottom 50% income): Both coefficients for top 1% income (5.194) and top 10% income (5.192) are positive. Meaning that these groups have a higher share of total income relative to the reference group (Bottom 50% Income, in this case). This indicates that the wealthiest groups (Top 1% and Top 10%) contribute significantly to income inequality, as they command a larger portion of the income pie. On the other hand, a negative coefficient for the Bottom 50% Income (-0.001) means that this group contributes a smaller share to the total income. This suggests that the lower-income group has limited access to the total economic growth or benefits from the overall income, which exacerbates income inequality.

Constant: The constant term is not displayed and is also not statistically significant, suggesting that the share of total income is not significantly different from zero.

5 Discussion

This paper examines income inequality in Canada from 2002 to 2023, with a primary focus on analyzing income disparities during two major recessions: the Great Recession (2007–2009) and the COVID-19 pandemic (2020–2023). Through data analysis and regression modeling, the findings suggest that income inequality has potentially increased over time, with the income gap between social classes widening.

In the discussion section, I will provide a detailed analysis of the results and explore how CPI rates may contribute to increasing or decreasing income inequality.

5.1 Comparing income inequality trends during two major recessions: the Great Recession (2007–2009) and the COVID-19 pandemic (2020–2023).

Based on Figure 2, which displays the trend of income distribution across different social classes in Canada from 2007 to 2009, the data indicates a downward trend in the income share for the top 1% and top 10% of earners during the period from 2007 to 2009, suggesting that these groups lost a portion of their total income share during the Great Recession. Specifically, the income share of the top 1% decreased by 2.35 percentage points, from 14.21% to 11.86% of the

total income pie. Similarly, the top 10% experienced a decrease of 2.5 percentage points, from 38.38% to 35.88%. During this period, many businesses and small retailers faced significant challenges, forcing them to reduce spending, cut investments, and, in some cases, declare bankruptcy due to low liquidity and limited access to credit. This resulted in widespread job losses, reduced incomes, and an overall economic downturn, ultimately contributing to a contraction in consumer spending and slowing economic recovery.

In contrast, the bottom 50% of earners experienced a slight increase in their total income share during this period. Where the bottom 50% showed an increase in income share, with their portion rising by 0.48 percentage points, from 16.75% to 17.23% of the total income pie. This trend could be attributed to a combination of factors, including government intervention through stimulus packages and unemployment benefits, which provided financial support to lower-income households. Additionally, the top 1% and top 10% earners were disproportionately affected due to their greater reliance on capital markets and asset-based income, which saw significant declines during the financial crisis. The stock market crash and falling real estate values directly impacted high-income groups who held substantial wealth in these asset classes, exacerbating the decline in their income share.

Moving on, the detailed analysis during the COVID-19 pandemic is shown in Figure 3: Income Share by Social Class During the COVID-19 Pandemic (2020 to 2023) in Canada. Figure 3 illustrates the trend of income distribution across different social classes in Canada during this period. Unlike the Great Recession, where the top 1% and top 10% earners lost a portion of their income share while the bottom 50% benefited, one noticeable trend during the COVID-19 pandemic is the upward shift in income share across all social classes (top 1%, top 10%, and bottom 50% earners). This trend suggests that all social classes benefited from an increase in total income share during this time.

To determine who benefited the most and assess income inequality between the social classes, it is necessary to consider the percentage increases. Specifically, the income share of the top 1% increased by 1.03 percentage points, rising from 10.59% to 11.62% of the total income pie. Similarly, the income share of the top 10% increased by 1.04 percentage points, from 35.18% to 36.22%. Meanwhile, the bottom 50% experienced an increase in income share of 0.52 percentage points, from 16.91% to 17.43%. Comparing the magnitude of these increases, the top 1% and top 10% benefited more than the bottom 50%, highlighting a persistent income inequality gap during the COVID-19 pandemic.

This trend can be explained by the unique economic characteristics of the pandemic period. While the top 1% and top 10% earners initially experienced losses due to a significant decline in capital markets and asset values during the early stages of the pandemic, the rapid recovery of the stock market and real estate values later in the period more than offset these losses. The extraordinary fiscal and monetary policies implemented during the pandemic, such as quantitative easing and low interest rates, disproportionately benefited asset holders, leading to a sharper recovery in wealth for higher-income groups. In contrast, while the bottom 50% saw some improvements due to direct government interventions like cash transfers, wage subsidies, and unemployment benefits, these gains were smaller in magnitude compared to the

recovery experienced by the wealthiest groups. This disparity underscores the role of asset ownership in shaping income inequality during economic crises and recoveries.

During the Great Recession (2007–2009) and the COVID-19 pandemic (2020–2023), income inequality in Canada exhibited contrasting patterns in terms of income share changes among different social classes. During the Great Recession, the income share of the top 1% decreased significantly by 2.35 percentage points (from 14.21% to 11.86%), and the top 10% saw a decline of 2.5 percentage points (from 38.38% to 35.88%). In contrast, the bottom 50% experienced a modest increase of 0.48 percentage points (from 16.75% to 17.23%). These changes indicate that the Great Recession had a redistributive effect, slightly reducing income inequality as higher-income earners bore the brunt of the economic downturn.

On the other hand, the COVID-19 pandemic saw an overall upward trend in income shares for all social classes. The top 1% increased their income share by 1.03 percentage points (from 10.59% to 11.62%), and the top 10% by 1.04 percentage points (from 35.18% to 36.22%). Meanwhile, the bottom 50% experienced a smaller increase of 0.52 percentage points (from 16.91% to 17.43%). While all groups benefited during the pandemic, the gains were disproportionately larger for higher-income earners, exacerbating income inequality.

When comparing the two recessions, the Great Recession had a more significant impact on narrowing income inequality, as the top earners lost a greater share of income while the bottom 50% slightly improved their position. In contrast, the COVID-19 pandemic widened the income gap due to the larger relative gains experienced by the top 1% and 10%, driven by the rapid recovery of asset values such as stocks and real estate. These findings underscore the differing economic dynamics of the two crises, with the Great Recession redistributing income downward and the COVID-19 pandemic reinforcing pre-existing inequalities.

5.2 How Consumer Price Index (CPI) rates may contribute to increasing or decreasing income inequality.

Figure 4 illustrates the trend of the Consumer Price Index (CPI) in Canada from 2002 to 2023. The CPI shows a consistent upward trend over this period, indicating that consumer prices have steadily increased. This trend suggests that rising consumer prices are associated with an increase in the inflation rate. In other words, as the inflation rate rises, purchasing power—defined as the ability to buy products and services—decreases. We measure inflation by the CPI annual growth rate, which directly reflects the increase in the cost of essential goods and services.

Rising inflation and its connection to income inequality is a significant concern. Income inequality is problematic because it concentrates wealth and power in the hands of the rich, reducing opportunities for social or economic mobility for large segments of the population. This can exacerbate the financial strain on lower-income households, particularly during periods of high inflation, as these groups typically spend a larger proportion of their income on necessities such as housing, food, and energy. The combination of rising prices and stagnant

wages can result in a higher cost of living, leading to increased hardship, diminished quality of life, and heightened financial insecurity for many. Moreover, high levels of income inequality are often associated with societal challenges, including increased crime rates, mental health issues, and social unrest, further emphasizing the need to address its root causes.

5.3 Weaknesses and Limitations

While the analysis provides valuable insights, several limitations remain. First, it relies on aggregated data that may mask important regional or demographic variations in income inequality trends. For example, certain provinces or industries in Canada may have experienced different degrees of impact during these recessions. Second, the analysis focuses on income share percentages but does not focuses into the absolute changes in wealth or income levels, which could provide a more comprehensive picture of inequality. Additionally, while the regression modeling captures general trends, it may not fully account for other confounding factors, such as shifts in taxation policies, labor market dynamics, or global economic conditions, which also influence income distribution. Lastly, the analysis does not explore the long-term implications of these recessions, such as their effects on intergenerational mobility or wealth accumulation.

5.4 Future Steps

To deepen our understanding of income inequality, future research should incorporate more data, such as regional or demographic-specific trends, to uncover disparities within sub populations. Additionally, examining absolute changes in wealth and income alongside percentage shifts would provide a more direct perspective on the economic impacts of recessions. Further studies should also explore the role of policy interventions, such as fiscal policy, taxation, and social safety nets, in shaping inequality trends and assess their effectiveness in mitigating disparities. Another important area of exploration is the long-term effects of income inequality on economic mobility, societal cohesion, and overall well-being. For example, investigating how recessions affect access to education, healthcare, and job opportunities for different income groups could shed light on structural barriers that perpetuate inequality. Finally, integrating measures of wealth inequality, such as asset ownership and debt levels, would complement the income-focused analysis and provide a broader understanding of economic disparities in Canada. Addressing these gaps would not only enhance our knowledge but also inform the development of more equitable economic policies in the future.

Appendix

5.5 Sketches

Data, graph, and analysis sketches can be found in the Github Repository.

5.6 Additional data details

World Inequality Database (WID): Data Description: The WID dataset provides detailed information on income distribution across social classes, including the top 1%, top 10%, and bottom 50% income earners in Canada. The dataset spans from 2002 to 2023, with annual observations. It includes pre-tax income shares expressed as a percentage of total income.

Geographic Coverage: The data is national in scope, representing Canada as a whole, without regional disaggregation.

Temporal Coverage: The dataset covers key economic events, such as the Great Recession (2007–2009) and the COVID-19 pandemic (2020–2023), allowing for trend analysis and comparative studies.

Statistics Canada (CPI Data): Data Description: The Consumer Price Index (CPI) dataset measures the annual cost of a fixed basket of goods and services over time, serving as an indicator of inflation. The dataset includes values from 2002 to 2023.

Geographic Coverage: The CPI data represent a national average but include price trends from various provinces and urban areas.

Temporal Granularity: The CPI data are reported monthly, but for consistency with the WID dataset, annual averages were calculated.

5.7 Posterior predictive check (PPC)

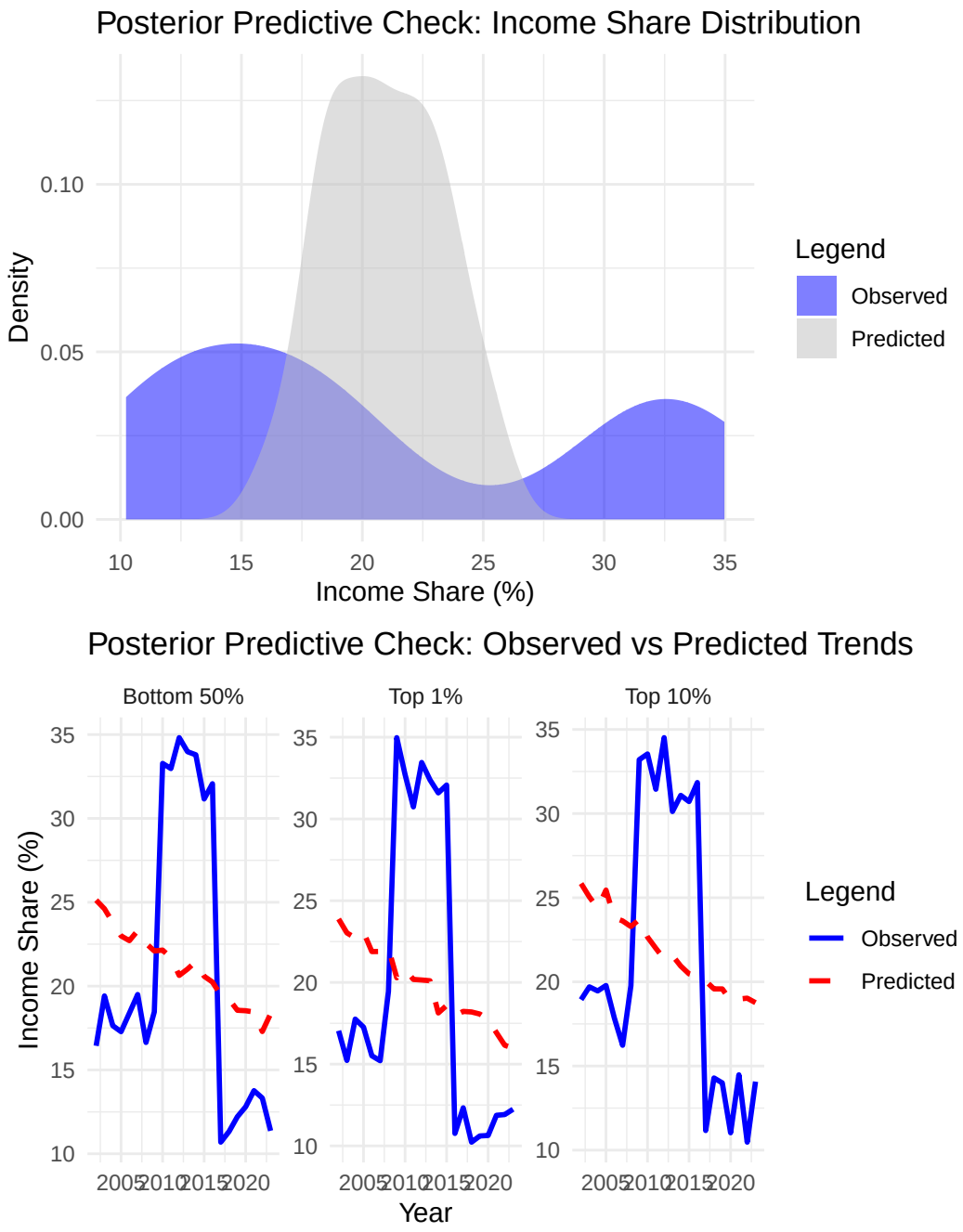

Figure 6: Posterior distribution for Income Inequality

Figure 6 visually displays how closely the predicted income shares generated by the model align with the observed income share. If the model is well-fitted, the predicted values will

closely match the observed values in both distribution and trends.

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