Essays on Public Economics

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Abstract

This thesis covers three self-contained chapters on topics in public economics concerning empirical evidence on the determinants of inequality, the gender difference in inequality dynamics and the spillover effects of corporate tax. All the empirical analyses are based on data from Canada.

Chapter 1 of this thesis analyzes the determinants of income inequality in Canada using micro-level data from Canada's censuses (1991, 1996, 2000, 2006, 2016). First, it is shown that market-income inequality is higher than inequality based on other types of income (annual wage, annual pre-tax income and annual income after-tax). Inequality is highly driven by the gap between the income shares held by the top 1% income group compared with other income percentiles. It is also explained by the large gap between income percentile of the top 25% income group and the bottom 75% income group. The top 30% income group held 60% of the population total income, while the bottom 30% income group held under 9% of the population total income. Inequality is different by province across Canada. From the findings, within-group inequality dominates between-group inequality, regardless of whether groups are defined by education, occupation, gender, age, language, marital status, or citizenship status. Second, analyzing the determinants of inequality, the results suggest that they vary significantly across income groups. The

results highlight the contribution of any explanatory factor to inequality and the proportion of inequality explained by all observable characteristics. The largest part (between 64% and 74%) of income inequality is not explained by individual observable characteristics. Third, these determinants are modified by redistributive policies such as taxes and transfers.

Based on the results from the first chapter of this thesis, and from the earlier empirical literature on income inequality, it appears that there are important wage and income gaps between males and females. Many studies investigate the factors that explain these income gaps between males and females. Few studies have examined how the determinants of inequality vary across the genders, a gap that the second chapter fills.

Chapter 2 brings further light on income inequality dynamics by gender and investigates its determinants from static and dynamic points of view. Using Canada income data, this research uses different measures of inequality to provide evidence on the changes in inequality by gender from 1991 to 2016. In this study, unconditional quantile regression based on the Re-entered Influence Function (RIF) is used to assess the impact of individual characteristics on income quantiles. The contribution of each relevant covariate on the Theil index by gender is documented by applying regression-based decomposition of inequality. Finally, RIF-Oaxaca-Blinder decomposition is used to investigate the composite and income structural effects on the changes in inequality measures by gender. Results show that, before 2001, inequality was higher among females than among males, and starting from 2001, the inverse process is observed. The changes in the interquantile differences are not homogeneous along the income distribution for both males and females. The pattern of the effects of covariates on quantiles along the income distribution is gender specific. The findings provide evidence

that, in most cases, the income structural effect explains the higher part of inequality dynamics by gender, even if the size of the impact differs by gender. Furthermore, the composite effect counterbalances the income structural effect most of the time, even if, in some cases, they contribute to the change in inequality measures in the same direction.

Chapter 3 investigates the spillover effects of corporate tax across the provinces using Canada's corporate provincial aggregate data from 1981 to 2019. A dynamic panel model is used to assess the incidence of tax competition within the country. The results show that an increase of statutory taxes in other provinces has a positive effect on the corporate taxable income of a specific province. The results provide the evidence of spillover effects of corporate tax across provinces in Canada. This chapter supports the recommendations proposed by Smart and Vaillancourt (2021) on formula allocation mechanism and by Boadway and Tremblay (2016) on the modernization of business taxation mechanism in Canada.

Declaration

All chapters of this thesis are self-containing research articles. I, acknowledge the contribution of Professor Roland Pongou, my supervisor for the research associated with this thesis. In all cases, his contribution is equal to my own, although the work in this thesis is in my own words.

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Dedicace

To the Lord for all his amazing graces in my life.

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General Introduction

Public economics is a field of study that examines government interventions to promote efficiency and equity in economic growth. This discipline encompasses a broad range of theoretical and empirical research on taxation, federal expenditures, and related fields that reveal the trade-offs between equity and efficiency. The equity and efficiency of the tax system can be evaluated from various perspectives, such as the income differences between individuals and the tax incidence on wages and capital. Over the past decade, extensive empirical research has supported the theoretical literature on the efficiency and equity of public policies.

The existing literature sheds light on the impact of personal income taxation and public interventions on individual well-being and inequality. Extensive research in economics has established a complex relationship between economic growth, inequality, and development. For instance, evidence shows that high levels of inequality can hinder economic growth (Causa et al. (2014)). Furthermore, given that inequality is a key determinant of insecurity, gender and income inequalities are crucial concerns for governments worldwide. In particular, the COVID-19 pandemic has heightened the importance of addressing these inequalities, as it has disproportionately affected vulnerable populations and exacerbated pre-existing disparities. Governments have often sought to address inequality through tax reform and income redistribution policies. However, to develop effective public policies

that promote both economic growth and social development, it is essential to gain a comprehensive understanding of inequality dynamics and the key drivers of these dynamics. This is particularly important in both developing and developed countries, where public policies play a critical role in ensuring equity and efficiency in the economy.

To achieve this, in-depth analyses of inequality, its dynamics over time, and the factors affecting these dynamics are necessary. Despite the growing interest in inequality issues, the existing literature has not adequately documented gender differences in inequality dynamics and the factors driving gender inequality, especially in developed countries such as Canada. Similarly, the efficiency of tax systems in the Canadian context, particularly the question of fiscal externalities on the behaviour of economic agents within the country, has been subject to limited empirical research. In this thesis, I address this gap in the literature by investigating income inequality and its dynamics, as well as the spillover effects of corporate tax on corporate taxable income, using Canadian data and econometric models.

The first chapter of the thesis focuses on the determinants of income inequality at different levels of the income distribution and the Theil index of inequality using Canada's census data. This chapter also contributes to the empirical literature on the redistributive impacts of government taxes and transfers across all parts of the income distribution. Using parametric and nonparametric approaches, I analyze the determinants of income inequality along the income distribution. Specifically, I estimate the percentile shares of individual annual pre-tax and transfer income of each percentile of income using data from the Canada censuses of 1991, 1996, 2001, 2006, and 2016. I find that market-income inequality is higher than inequality based on the other income types. Inequality is driven by the income gap between the top 1% income group and other income percentiles, as well as the large gap between income percentiles of the top 25% income group and the bottom 75% income group. The top 1% income group experienced a significant increase in their income share

over time, while the income share hold by other income percentiles remained relatively stable. The top 30% income group held 60% of the population total income, while the bottom 30% income group held under 9% of the population total income. Inequality is different by province across Canada. Alberta followed by Ontario, British Colombia and Newfoundland are the provinces that experienced the highest inequality whereas Prince Edward Irland experienced the lowest level of inequality. Moreover, within-group inequality dominates between-group inequality, regardless of whether groups are defined by education, occupation, gender, age, language, marital status, or citizenship status. Using regression-based decomposition of inequality and quantile regression, I show that individual observable characteristics do not drive the largest part (between 64% and 74%) of income inequality. Observable characteristics explained between 26% and 36% of individual annual income inequality regardless of the income type (annual wage, annual market-income, annual total pre-tax income, and annual after-tax income). Individual characteristics explained more inequality when considering wage as compared to the other income types. They also contribute more to explaining inequality in the top quartile level of individual annual income. I show that individual observable characteristics such as hours worked for pay or self-employment, education level, age, gender, English as mother tongue, and visible-minority status are the most important factors that explain income inequality between individuals and that their effects on income inequality vary across different income groups. The ways in which these factors affect income inequality differ across various income measures, namely wage, market income, pre-tax income, and after-tax income. The quantile regression analysis reveals that the effects of covariates on income vary across quantiles. Specifically, we found that education level, hours worked for paid and self-employment, visible-minority status, having one of Canada's official languages as mother tongue, citizenship, gender, and household type are significant factors that explain income inequality among individuals, as

determined by the quantile regressions.

The first chapter of this thesis highlights that the income gap within groups has a greater impact on overall income inequality than the income gap between groups. However, in the existing literature, there is a gap regarding income inequality within gender, despite the well-documented income gap between genders that contributes significantly to overall income inequality. While the literature on the income gap between genders provides valuable information on the factors driving the gender wage gap, less is known about differences in income inequality by gender and the factors contributing to inequality within each gender. This knowledge gap exists not only in the empirical literature in Canada but also in other industrialized countries. Therefore, the second chapter of this thesis aims to address this gap by examining the dynamics and determinants of within-gender income inequality.

The second chapter of this thesis examines inequality dynamics between 1991 and 2016 by gender using Canadian annual pre-tax income data from three sources: the individual files of the Canada Census (1991, 1996, 2001, 2006, and 2016), the Survey of Labour and Income Dynamics (SLID, 2008, 2009, 2010, and 2011), and the Canadian Income Survey (CIS, 2012, 2013, 2014, and 2015). Various inequality measures are employed to document the dynamics of inequality. To investigate the determinants of inequality by gender, regression-based decomposition (RBD) of inequality and the reentered influence function (RIF) decomposition are applied to income quantiles. Finally, changes in income inequality by gender over time are decomposed using the RIF-Oaxaca Blinder decomposition method. This method allows for the decomposition of inequality change over two time periods into coefficients/structural and covariates/composite effects for each factor. The application of this decomposition method sheds greater light on the factors responsible for changes in inequality by gender using data from the Canada Census (2001 and 2006).

In light of the literature gap in corporate taxable income, the third chapter of this thesis

investigates the spillover effects of corporate tax across provinces using Canada's corporate provincial aggregate data from 1981 to 2019. Through the implementation of a dynamic panel model, the results of this chapter demonstrate that an increase in statutory taxes in other provinces has a positive effect on the corporate taxable income of a specific province. This provides evidence of the spillover effects of corporate tax across provinces in Canada. Chapter 3 makes an important contribution to the empirical literature on the effect of corporate tax on corporate taxable income using data from Canada. To the best of my knowledge, this analysis is the first to analyze corporate tax spillovers across Canada's provinces using provincial aggregate data.

Chapter 1

Determinants of Income Inequality: Evidence from Canada's Census Data

1.1 Introduction

Income inequality has profound social and economic implications that affect individuals across the income distribution spectrum. These adverse consequences underscore the importance of examining income inequality and identifying its underlying drivers. Recent economic literature has highlighted the increasing trend of income inequality over the past two centuries, with intragroup inequality emerging as a significant factor. Piketty (2015) seminal work has shown that the rate of return on capital has exceeded economic growth over the past 250 years, contributing to the widening income gap between capital holders and other social groups. However, the role of intergroup inequality in this trend remains understudied. Therefore, there is a need for further research to understand the contribution of intergroup inequality to the overall trend of increasing global inequality. In general, research on this topic has covered three aspects: the methodological debate on how to measure inequality the quantification of income inequality and its trend across different

regions/countries and periods, and the identification of the determinants of inequality.

The implications of income inequality have significant social and economic impacts, affecting individuals across the entire income distribution spectrum. As such, it is vital to explore the topic and understand its underlying causes. Recent economic literature has identified a growing trend in income inequality over the past two centuries, with intra-group inequality emerging as a significant contributing factor. Piketty (2015) seminal work has highlighted the rate of return on capital exceeding economic growth over the last 250 years, which has resulted in a widening income gap between capital holders and other social groups. However, research regarding intergroup inequality's contribution to this trend remains limited. Furthermore, the COVID-19 pandemics widespread impact on well-being worldwide has intensified the focus on understanding the inequality dynamics in order to build strong policies that impact development. From the literature, there are limited studies on income inequality using individual files. The most recent research on income inequality at national level using individual level data were published in November 2022 in the Quantitative Economics, Volume 13, issue 4. This publication focused on global income dynamics where different type of individual annual incomes (earning, market income [1], disposable income) are used. For instance, Bowlus et al. (2022) examines four decades of Canadian earnings inequality and dynamics across workers and firms. To date, research in this area has encompassed three core aspects: methodological debates around how to measure inequality, quantifying income inequality across various regions/countries and periods, and identifying the determinants of inequality.

The aim of this paper is to contribute to the research agenda on income inequality. The paper has two goals. Firstly, it utilizes micro data from Canada's censuses conducted between 1991 and 2016 (1991, 1996, 2001, 2006, 2016) to examine the key features of in-

[1]Refers to annual pre-tax income that covers all formal income sources, excluding government transfer payments.

dividual annual wage/earning, market income, pre-tax and post transfers income, and after-tax and post transfers income distribution. This analysis allows for the examination of the dynamics of the share of income earned by each income percentile and how this changes over time. The initial analysis demonstrates the significance of the share of income owned by the top-income group, which has increased over time compared to other percentiles of the income distribution. Inequality is highly driven by the large-income gap and the dynamics of income between the bottom 75%-income group and the top 25%-income group Income percentiles. The top 1% income group experienced a significant increase in their income share over time, while the income share hold by other income percentiles remained relatively stable. The top 30% income group held 60% of the population total income, while the bottom 30% income group held under 9% of the population total income. It also reveals that income inequality has generally risen during the study period, with a particularly high variation between 2001 and 2006. The findings indicate that Alberta followed by Ontario, British Colombia and Newfoundland are the provinces that experienced the highest inequality whereas Prince Edward Ireland experienced the lowest level of inequality. Total pre-tax and post transfer income inequality is lower than market-income inequality. Government tax and transfers help to mitigate inequality. Additionally, like other studies, this research shows that within-group inequality dominates between-group inequality, regardless of the definition of the groups. Secondly, the paper explores the contribution of individual observable characteristics to inequality, which has been a neglected theme in the large literature on income inequality. It investigates the impact of individual observable characteristics on annual wage/earning inequality, annual market-income inequality, annual pre-tax and post-transfer income inequality, and annual after-tax and post-transfer income inequality.

Traditional approaches to evaluating income inequality follow two main approaches.

The first approach is the decomposition of inequality by income sources, as introduced by Shorrocks (1982), or by subgroups, as demonstrated by Shorrocks (1984). These methods help determine the exact contribution of each component to the overall inequality when total income is disaggregated into various components. Another set of decomposition approaches are primarily used to analyze the dispersion in income distribution. These include the percentile-share approach, introduced by Jann (2016), conditional-quantile regression (Koenker and Bassett Jr (1978); Koenker and Ng (2005)), unconditional-quantile regression with Recentered Influence Function (RIF), as used by (Firpo et al. (2009); Fournier and Koske (2012); Su and Heshmati (2013)), as well as the Oaxaca-Blinder approach (Blinder (1973); Su and Heshmati (2013)). Quantile regression has been used to analyze wage increases and changes in wage distribution (Gosling et al. (2000); Machado and Mata (2005); Melly (2005)), wage gaps between racial groups (Chay and Honore (1998)), wage gaps between genders (Fortin and Lemieux (1998)), and the determinants of earning inequality (Fournier and Koske (2013); Su and Heshmati (2013)). The Oaxaca-Blinder approach is used to study mean wage differences between groups, where the wage differential is decomposed into two components: the first component is explained by group differences in observed characteristics while the second refers to the difference that cannot be explained. The benefit of the quantile regression approach is its link to the Lorenz curve, as demonstrated by various studies.

This paper uses both parametric and nonparametric approaches to analyze income inequality along the income distribution in Canada. The percentile shares of individual annual wage/earning, market income, income pre-tax and post transfer, and income after tax and port transfer were estimated using data from the Canada censuses of 1991, 1996, 2001, 2006 and 2016. The results show heterogeneity in percentile shares along the income distribution and the dynamic of income share by percentile from 1991 to 2016. The tradi-

tional nonparametric approach proposed by Shorrocks (1984) was then used to decompose the generalized-entropy index of income inequality into within-group and between-group inequality. Finally, determinants of income inequality were studied using parametric approaches such as the regression-based inequality decomposition (Fields (2003); Cowell and Fiorio (2011)) at different levels of income distribution, and quantile regression.

The focus on Canada is due to the availability of data and the fact that it is an interesting case study. Between the mid-1990s and mid-2000s, Canada experienced the second-largest increase in income inequality among all OECD member countries, according to two reports issued by the OECD in 2008 and 2011. These reports also suggest that social program transfers reduced inequality less in Canada than in most OECD countries, and Canada spent less on cash benefits than most other OECD countries. These findings are consistent with some of the findings from other authors in "The Income Inequality: The Canadian Story, Volume V, the Art of State" series published in 2016.

Recent research has extensively investigated income inequality in Canada, with several notable contributions such as (Brown and Das (2022); Card et al. (2020); Scrimger (2020); Heisz and Murphy (2016); Fortin and Lemieux (2016); Fortin et al. (2016); Banting and Myles (2016); Heisz and Murphy (2016); Green and Sand (2015); Lemieux and Riddell (2015); Rajotte (2013)). This research has examined various aspects of income inequality, including trends, and driving forces, policy implications, the characteristics of top-income groups, the factors influencing middle-class earnings, the role of human capital and taxes and transfers in reducing inequality (Heisz and Murphy (2016)). Despite the insights provided by this literature, there is still much to learn about the contribution of individual observable characteristics to individual-level income inequality, and how tax and transfer policies affect inequality across the income distribution. As shown in the figure 1.11, when considering inequality measure like gini index trend, even if this provides information on

inequality dynamics over time, it does not give more details on what is going on along the income distribution in terms of inequality between income groups and the key factors that impact inequality. Also less is known about the contribution of individual characteristics on inequality and the impact of tax and transfers on inequality over all parts of individual income distribution. This study provides valuable insights into the determinants of income inequality in Canada. The analysis reveals that employment status, education, gender, age, citizenship, marital status, visible-minority status, and native language are among the most significant determinants of income inequality. It also highlights the heterogeneity in the way that each factor contributes to income inequality along the income distribution. The quantile regression method proves to be particularly useful in identifying how these factors impact income dispersion along the income distribution. However, the regression-based inequality decomposition method provides more information on the proportion of income inequality explained by individual observable characteristics (between 6% and 26% of income inequality). Results from the regression-based decomposition method indicate that individual characteristics contribute more to explaining inequality in the top quartile level of annual wage, annual market income, annual total pre-tax and-post-transfers income, and annual total after-tax and post-transfers income. Additionally, the analysis shows the largest discrepancies between different quartiles of income distribution. While individual characteristics explain about 14% of income inequality in the top 25%-income group, only between 7% and 5% of income market income or income after tax) inequality in the bottom 25%-income group (First income quartile) can be explained by individual characteristics. Overall, the study provides valuable insights into the determinants of income inequality in Canada, and its findings have important implications for policymakers seeking to reduce income inequality.

Quantile regression provides a more detailed understanding of how individual charac-

teristics impact both the distribution and dispersion of income. It reveals inequality both between and within income groups, and highlights the significance of various factors, such as employment status, education, gender, age, mother tongue, citizenship status, visible-minority status, household type, and size.

This study is the first to examine individual characteristics that explain annual income inequality at the individual level, utilizing various approaches to provide a nuanced understanding of the effect of observable characteristics on income distribution. Unlike other studies, this research provides insights into the specific characteristics that affect income at each level of the income distribution, accounting for the heterogeneity of inequality across the distribution. The use of census data yields more accurate estimates of inequality than household-based analyses (Picot and Hou (2014)), and the study also contributes to the literature on the redistributive effects of government taxes and transfers across the income distribution. Furthermore, census data at individual level allows accurate exploration of income inequality, in contrast to household data where inequality measures are based on income per capita.

The rest of the chapter is organized as follows. Section 1.2 situates this study within the existing literature. Section 1.3 describes the conceptual framework and presents our empirical strategies. Section 1.4 and Section 1.5 respectively present the data and the empirical results. Section 1.6 presents the conclusion with the policy implication.

1.2 Literature Review

Since Kuznets (1955), economists and other social scientists have tried to understand the income inequality by using regression models or decomposition approaches of inequality index. A number of empirical studies have explained income distribution or inequality from

a macro point of view. An important empirical literature, using data from different countries, has documented that inequality is positively correlated with unemployment (Metcalf (1969); Blinder and Esaki (1978); Mocan (1999); Cardoso and Urani (1995); Castaneda et al. (1998)). For example, Mocan (1999) investigates the effects of unemployment and inflation on income distribution in the United States. In agreement with previous studies, inflation is found to have a progressive impact on income inequality. The decomposition of inflation into two components showed that anticipated inflation has no impact on income inequality whereas unexpected inflation has redistributive impact on income from the highest quintile to the bottom three quintiles. López (2003) assesses the impact of some policies on inequality. He finds that the policy such as the reduction of inflation levels; the improvements in infrastructure and education would make change in growth and progressive distribution.

Many studies on the determinants of inequality at micro level using household survey data have also been conducted. These studies use various methodologies such as, descriptive analysis of inequality index, decomposition of inequality index by population group, decomposition of inequality by income sources (Mookherjee and Shorrocks (1982); Cowell (1984); Bourguignon and Morrisson (1985)), regression-based inequality decomposition, conditional and unconditional-quantile regression approach (Koenker and Ng (2005); Lemieux (2006); Fournier and Koske (2012); Su and Heshmati (2013)) and Oaxaca-blinder approach (Su and Heshmati (2013)). The approaches that are less used to explore determinants of income inequality and income distribution are regression-based inequality decomposition, quantile regression and Oaxaca-Blinder decomposition.

Decomposition of inequality by population subgroups and by component factors is the oldest (traditional) approach for quantifying how various factors affect inequality overall. Shorrocks (1982) and Shorrocks (1984)) showed that when income is disaggregated into

various components, the exact contribution of each component to the overall inequality can be determined. This approach is mainly used in studies such as Silber (1989); Jenkins (1995); Cowell and Jenkins (1995). Shorrocks (1983) uses data of family net incomes distribution in the United States between 1968 and 1977. In that study, the author calculated the proportion of total income inequality imputable to various income sources.

Fields (2003) proposes regression-based inequality decomposition analysis. Unlike the traditional inequality decomposition methods, regression-based approache allows the measurement of the contribution of any explanatory factor to inequality. Regression-based method is able to highlight the factors that have important contribution in the observed income inequality. Cowell and Fiorio (2011) show how regression-based inequality decomposition approach suggested by Fields (2003) can be reconciled with classic source-decomposition and subgroup-decomposition inequality methods to identify differences in determinants of inequality. Their results suggest that this method is fairly robust and provides an improvement of the traditional methods of decomposition. However, they find consistent results with these traditional decomposition methods. With regard to regression-based decomposition approach, no study in previous literature explores the heterogeneity of the determinants of inequality at different levels of income distribution.

Conditional-quantile regression is introduced by Koenker and Bassett Jr (1978) and is a natural extension of the linear-regression model. The purpose of the conditional quantile regression is to estimate the quantile of the conditional distribution of income and thus provide information for the most refined data. Given the heterogeneity of households, such an approach is more appropriate than a simple linear regression. Many studies have also used a quantile regression approach to analyze increases in wages, and to additional topics such as changes in wage distribution, wage distributions within specific industries, wage gaps between Caucasians and minorities, as well as between men and women, educa-

tional attainment, wage inequality and the intergenerational transfers of earnings (Eide and Showalter (1999)). Fournier and Koske (2013) used unconditional and conditional-quantile regressions to study the determinants of inequality in overall labour earnings. Their results suggest that, in general, a rise in the share of workers with secondary or post-secondary non-tertiary degrees and a rise in the share of workers on permanent contracts are associated with a narrowing of the earnings distribution. The use of unconditional-quantile regression based on the Re-entered Influence Function (RIF) and Oaxaca decomposition is relatively new. This new decomposition technical of inequality is strong in terms of analyzing inequality dynamics linked to the changes in the distribution of individual characteristics (Firpo et al. (2009); Lemieux (2006)).

Another approach used in previous empirical literature is Oaxaca-Blinder (1973). This approach aims at decomposing the difference in the mean of an outcome variable between two groups A and Blinder (1973) was interested in wage inequality between males and females. The Oaxaca technique has been widely used in the decomposition literature since DiNardo et al. (1996). Bourguignon et al. (2007) applied Oaxaca–Blinder to analyze the differences between the Brazilian income distribution and those of the United States and Mexico, and find that most of Brazil's excess income inequality is due to underlying inequalities in the distribution of two key factors such as access to education and to non-labour income; namely pensions. Su and Heshmati (2013) analyzed the determinants of income and income gap between urban and rural China with OLS conditional quantile regression and Oaxaca- Blinder decomposition methods on household data. They find that income gap can be largely explained by the individual's attributes, especially by the level of education and the type of occupation. The effects of these two factors are heterogeneous at different percentiles of the income distribution.

From the literature review it is evident that many studies have tried to address income

inequality by studying income gap between socio economic groups or the change in income distribution at the household level or wage distribution at the individual level. However, few have explored the determinants of individual-level income inequality. From the literature review, there are few studies that explore the determinants of inequality within income group and the dynamic of the inequality at different levels of the income distribution. Most studies that analyze income inequality do not differentiate between annual wage, annual market-income, annual total pre-tax income and annual income after-tax .

Moreover, when it comes to Canada, most of the research focuses on the analysis of the profile of income inequality. Recently, there has been abundant research on income inequality in Canada and from the most recent, it is clear that inequality has increased and especially regarding market-income. Income inequality has been relatively stable since the 2000s due to the increase in demand of an unskilled and a semi-skilled labour force. Income share held by the very top-income group has substantially increased whereas the share held by the middle and the bottom income classes has declined. There is strong and positive relationship between having a university degree and family income. Heisz and Murphy (2016) and other authors have found that the cumulative increase in market inequality was offset by the tax-and-transfer system even if the size of the effect varies from one period to another. Market-income inequality remained higher than tax-and-transfers-income inequality over the period afterward from 1976 to 2011. Bolton and Breau (2012) examined the level of employment-income inequality among income earners within each of Canada's Census Metropolitan Areas. The authors find that larger cities have more unequal distributions of employment income, than do cities in decline or than stagnant regions with higher unemployment. However, de-industrialization, as well as immigration and an aging population are the factors that best explain the rising inequality of earnings in Canada's cities since the mid-1990s. It was also found that the increased participation of females in

the labour force reduced inequality. Other studies on income distribution, using Canadian data, focused on the profiles of low and high income groups. These studies suggest that the high-risk groups in which occurrences of low-income situations most often observed are: single parents, people with activity limitations and recent immigrants especially those who belong to visible-minority groups (Zhang (2011)). Green et al. (2016) concluded that one of the policies to reduce the impact of the increase of income share of the top-income group compared to other income groups should be the review of taxation of top-income group and new corporate governance.

From the studies on income inequality in Canada, less is known about the contribution of individual observable characteristics to individual annual income inequality. Less is also known about the effect of individual characteristics to inequality over all parts of individual income distribution. Less is known about the impact of tax and transfers on inequality over all parts of the income distribution. In data on Canada, there is no study that analyzes the determinants of inequality of individual income in order to provide the contribution of observable characteristics to overall inequality and at each part of the income distribution.

This paper fills the gap that exists in the literature on individual income inequality studies in general, and specifically on the income inequality issues that are pertinent to Canada.

1.3 Methodology

Based on the objective of this research, the descriptive analysis of individual annual income over the income distribution from 1991 to 2016 has been presented by using the estimation of the share of income by income percentile over time. The analysis focuses on individuals who are between 25 and 64 years old. The descriptive analysis also covers the

decomposition of inequality by individual socio economic characteristics.

The Census data have been used to compute Gini and Theil indexes of inequality. Based on the data, we decompose the Theil index of inequality and estimate the contribution of observable characteristics to the individual annual incomes inequality. In the second part of the methodology, the determinants of income inequality have been study by using inequality index decomposition approaches, the regression-based inequality decomposition approach (Cowell and Fiorio (2011)) and the quantile regression models on annual wage, annual market-income, annual pre tax income, and annual income after tax.

The same explanatory variables (individual socio-demographic characteristics) and the same endogenous variables (annual wage, annual market-income, annual total pre-tax and post-transfers income and annual total after-tax and post-transfers income) have been used to analyze the determinants of income inequality with regression-based inequality decomposition, and quantile regression.

Moreover, the Lorenz curve and the density curve of endogenous variables depicted the impact of government policies (tax and transfers) on individual level income inequality.

1.3.1 Inequality Decomposition by Population Subgroups

Generalized entropy index (Theil index) of inequality and the inequality decomposition by population subgroups following Shorrocks (1984) approach have been used in this study. The Generalized Entropy (E) class is:

$$E(y,\alpha) = \frac{1}{\alpha^2 - \alpha}\left[\frac{1}{n}\sum_{i=1}^{n}\left(\frac{y_i}{\mu_y}\right)^{\alpha} - 1\right] \tag{1.1}$$

where y is the income, y_i is the individual i income, α is the type of generalized entropy index, is the population average income and n is the population size.

- **Theil-L**

$$E(0) = \frac{1}{n}\sum_{i=1}^{n} log\frac{\overline{y}}{y_i} \tag{1.2}$$

where $\overline{y}$ is the average individual income

- **Theil-T**

$$E(1) = \frac{1}{n}\sum_{i=1}^{n} \frac{y_i}{\overline{y}} log\frac{y_i}{\overline{y}} \tag{1.3}$$

Let the population be divided into j subgroups (indexed by j). Then if we define:

$$E_B(y;\alpha) = \frac{1}{\alpha^2 - \alpha}\left[\sum_{i=1}^{n} f_j \left(\frac{\mu_j}{\mu_y}\right)^{\alpha} - 1\right] \tag{1.4}$$

where f_i is the income frequency of each subgroup j and , the income average of subgroup j.

$$E_W(y;\alpha) = \sum_{k}^{j=1} w_j I_j(y;\alpha) \tag{1.5}$$

where $I_j(y;\alpha)$ is the Generalized Entropy (E) class of inequality index of each subgroup j.

$E_W(y;\alpha) = \sum_{k}^{j=1} w_j I_j(y;\alpha)$

where $w_j = v_j^{\alpha} f_j^{1-\alpha}$, $v_j = \frac{n_j \mu_j}{n\mu}$ and $f_j = \frac{n_j}{n}$

Following inequality decomposition into within and between inequalities, one can demonstrate that the total inequality is equal to :

$$E = E_B(\text{Within component}) + E_W(\text{Between component}) \tag{1.6}$$

Empirically, Theil-T index of inequality that is equivalent to General Entropy index where α is equal to 1 has been computed.

1.3.2 Regression-based Inequality Decomposition (RBD) Approach

Regression-based inequality decomposition approach is an extension of Shorrock decomposition approach of inequality. It was extended by Morduch and Sicular (2002), and Fields (2003).

This approach expressed income as a function of a vector of factors X which is the matrix of explanatory variables (Individual characteristics in the case of this research):

$$\ln Y = X\beta + \epsilon \tag{1.7}$$

β is a vector of coefficients associated to X and ϵ is the residuals.

From $Y = X\beta + e$, the share of inequality attributed to factor X_i is giving by:

$$S_m = \frac{b \sum_i a_i(y) x_{i,m}}{I(y)} \tag{1.8}$$

where $a_i(y)$ is the weight of each factor.

In this research, four models of RBD have been estimated. The difference between these three models is on the endogenous variable: log of annual wage, annual market-income, annual post-transfers and pre-tax, and annual income after-tax. Only incomes of individuals who are at between 25 and 64 years old have been considered. The regression-based decomposition is applied to 2016 Census data. The regression investigates a contribution of individual observable characteristics, such as age, work status (full-time or part-time worker), annual number of weeks hours worked, his level of education, gender, visible-minority and citizenship status, marital status, household type and size, self-

employed or paid worker status and the presence of kids or not in his household. The individual province of residence, the census metropolitan area (CMA) status of his city of residence, and his sector of activity have been used as control variables.

1.3.3 Quantile Regression Approach

In order to understand how the quantile regression allows for the study of determinants of income inequality, this sub section will present the Lorenz curve and its significance in terms of income inequality, and the close link between this curve and the Gini index. The relationship between the slope of the Lorenz curve and the quantile will be presented.

The Lorenz Curve provides a wealth of information on the entire distribution of income as a proportion of the average. Mathematically, the Lorenz curve is defined as follow:

$$L_p = \frac{1}{\mu} \int_0^p Q_p dq \tag{1.9}$$

$Q_(p)$, the quantile of order p of y is defined by $Q_(p) = \inf\{t : F_y(t) \geq p\}$ where $F_Y(t)$ is the CDF of Y. $\mu = \int_0^1 Q_p dq$ represents the average income of the population and $\mu_p = \frac{1}{p} \int_0^p Q_p dq$ represents the average income held by the cumulative proportion p of the population.

$$L_p = \frac{1}{\mu} \int_0^p Q_p dq = \frac{P\mu_p}{\mu} \tag{1.10}$$

The Lorenz curve has several interesting properties. It is between 0 (when $p = 0$) and 1 (when $p = 1$). It is increasing in p as income accumulates. It can also be seen from the value of the first derivative.

$$\frac{dL_p}{dp} = \frac{Q_p}{\mu} \tag{1.11}$$

The above equation shows that the order p quantile is the first derivative of Lorenz curve.The Lorenz curve is convex in p.

The Gini Index is one of the most used in the empirical evaluation of income inequality measures. It is defined in the continuous format:

$$G = 1 - \int_0^1 L_p dp \tag{1.12}$$

We can see clearly that the Gini index is the ratio of the area between the 45 degree line and the Lorenz curve: the higher the ratio, the greater the inequality.

The quantile method is justified in the context of the analysis of the determinants of income inequality because the Lorenz curve has the following interesting property: $\mu L_p^{'} = Q_p \geq 0$. $Q(p)$ is the quantile of order p.

This property is exploited to study the determinants of inequalities in analyzing the quantile of order p, using a quantile regression defined as:

$$y_p = X\beta_p + \epsilon \tag{1.13}$$

X represents the matrix of explanatory variables including characteristics of the individual and his household.

$p \in [0; 1]$ and $y_p = Q(p) = F_y^{-1}(p)$

For any fixed p the estimator $\hat{\beta}_p$ of β_p is such that:

$$\hat{\beta}_p = Arg \min_{\beta} \sum_{i=1}^{N} \left(1_{y_i - X\beta_g < 0} - p\right)(y_i - X\beta_p) \tag{1.14}$$

Quantile used in the regressions of this research are deciles.

$$y_p = (Q(p)) = \text{Decile}_p(\log(\text{ Revenu/ } X)) \tag{1.15}$$

Quantile regression allows the estimation of the effect of potential individual characteristics that have an impact on all parts of the income distribution. It provides more answers to the questions about the drivers of income inequality than the least squares methods, which only estimate the effects on average income.

The interpretation of the conditional-quantile regression on income distribution is quite straightforward. Considering the sex of the individual for instance, where the variable sex is equal to 1 when the individual is male and 0 when female, female individuals are said to be reference individuals. The coefficient estimate from conditional-quantile regression gives the benefit in income earnings associated with being male, assuming that the position of the individual among all individuals with the same characteristics does not change. For instance, if the individual had median income earnings among all individuals in the income distribution before the explanatory variable changed, he would have median earnings after the explanatory variable changes, so his income would rise by the estimated coefficient. The constant obtained from the regression provides the quantile of the reference individual.

The conditional-quantile regression results can also be used to analyze the dispersion of income within subgroups of individuals. When the coefficient of the dummy variable increases along the income distribution for sex, it reflects that income is more dispersed among males than among females. Even if conclusions about the dispersion of income among subgroups could be derived from the variance (for instance), conditional-quantile regression has the advantage of controlling for other individual observable characteristics.

The variables used in the regression-based decomposition models are the same in the four quantile regression models where quantiles used are deciles. The comparison between

these models provide robustness in the results on the determinants of income inequality.

1.4 Data

Micro data from Canada's Censuses from 1991 to 2016 were used to assess income inequality and to analyze income distribution over time [2]. The 2016 Census data is the recent census that has micro-level data on individual income. The 2011 Census data does not have micro-level data on individual income. All the incomes are converted into the 2015 year consumer prices index. As part of the study, we consider only individuals who are between 25 and 64 years old to select active individuals. Only 2006 Census data is used to decompose the Theil index of inequality into within-and-between group-inequality components. Furthermore, only 2016 census data is used to perform both quantile regression and regression-based decomposition of income inequality.

The tables 1.8 and 1.10 in the appendix present respectively the frequency and the descriptive statistics of the variables used by census.

The endogenous variables used in the regression-based decomposition and quantile regression models are the logarithms of the individual: annual wage, annual market income, annual total pre-tax and post-transfers, and annual income after-tax and post-transfers.

For estimation purpose, an additional restriction has been made. The outliers were removed from the original data; this includes individuals with annual incomes that are lower or equal to 0 dollars and those whose incomes are missing in the dataset. Those outliers were removed while performing the regression based decomposition and the quantile regression. Also, as we compare the results of four different income types, only individuals that have all the four types of income greater than 0 dollar are selected for the regression

[2]Data refers to individual public use files and we acknowledge the top coding issue in the data. However, as we make some restrictions in the data used in the regression part of the analysis, the top coding possible issue in the public use files is neglected.

part of the analysis.

The same explanatory variables are used for the regression-based inequality decomposition approach and quantile regression models for the robustness check.

Taking into account the results of previous empirical studies on the profile of low-income households and on inequality, the following socio-demographic characteristics were chosen to be part of the set of explanatory variables: gender, individual marital status, age, household-size, household type, individual visible-minority status, aboriginal status, the individual's residence status in Canada (Canada citizen or non Canadian) [3], education, mother tongue (Canada official languages as mother tongue or others), work type status, work time status. Individual age and its squared value are included to account for life-cycle effects. Moreover, "the highest certificate, diploma or degree" is a continuous variable and has been defined so that it takes a high value for those who have a higher level of education and a small value for those with lower level of education.

For household type, single individual are considered as reference in the regressions. Gender is defined as an explanatory variable and the reference individual is female.

The citizenship of the individual was taken into account and the reference individual in all the three models is that of 'Canadian citizens by birth '. Hence, variables such as Canadian citizens by naturalization and non-Canadian citizens are defined in the models as dichotomous variables.

Mother tongue was chosen as an explanatory variable and the reference individuals have English as mother tongue. The "number of weeks worked hours for pay or as self-employment" variable was chosen to assess the impact of activity on the labour market on income inequality. This variable is a continuous one. Also, household size is a continuous variable in the models.

[3] We do not use the variable "year since immigration" in the regression since we are not analyzing inequality only among immigrants people.

The control variables in the models are the individual province of residence, the census metropolitan area (CMA) status of his city of residence, and his sector of activity. Provinces are chosen as control variables in the model to take into account the fact that in Canada, income tax and socio economic policies are province specifics.

1.5 Empirical findings

1.5.1 Descriptive analysis of individual income distribution

From figure 1.1, one can notice that the income percentile of the top 25%-income group is higher than that of the bottom 50% income group and the value is almost stable over time for the bottom-income group, whereas there is a large increase for the top 25%-income group and even more for the top 1%-income group. The trend is almost the same when one considers annual wage over the study period as shown in the figure 1.2 below. From this result, one can conclude that inequality is highly driven by the large-income gap and the dynamics of income between the bottom 75%-income group and the top 25%-income group.

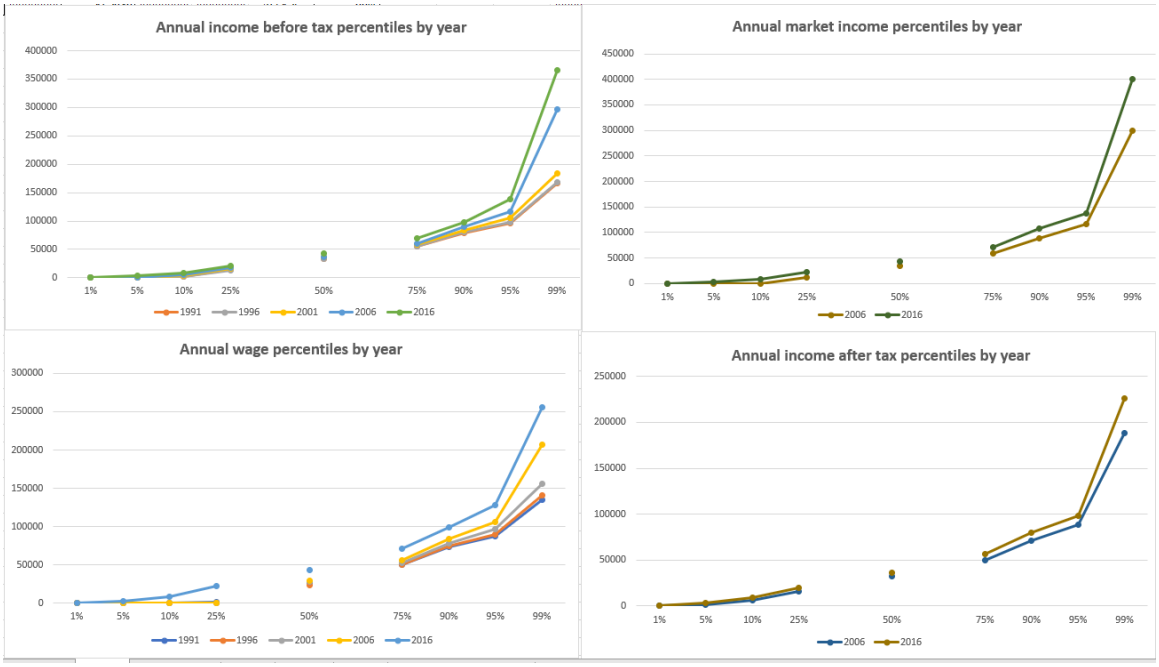


Figure 1.1: Annual Total Income Percentiles by Year and by Income type

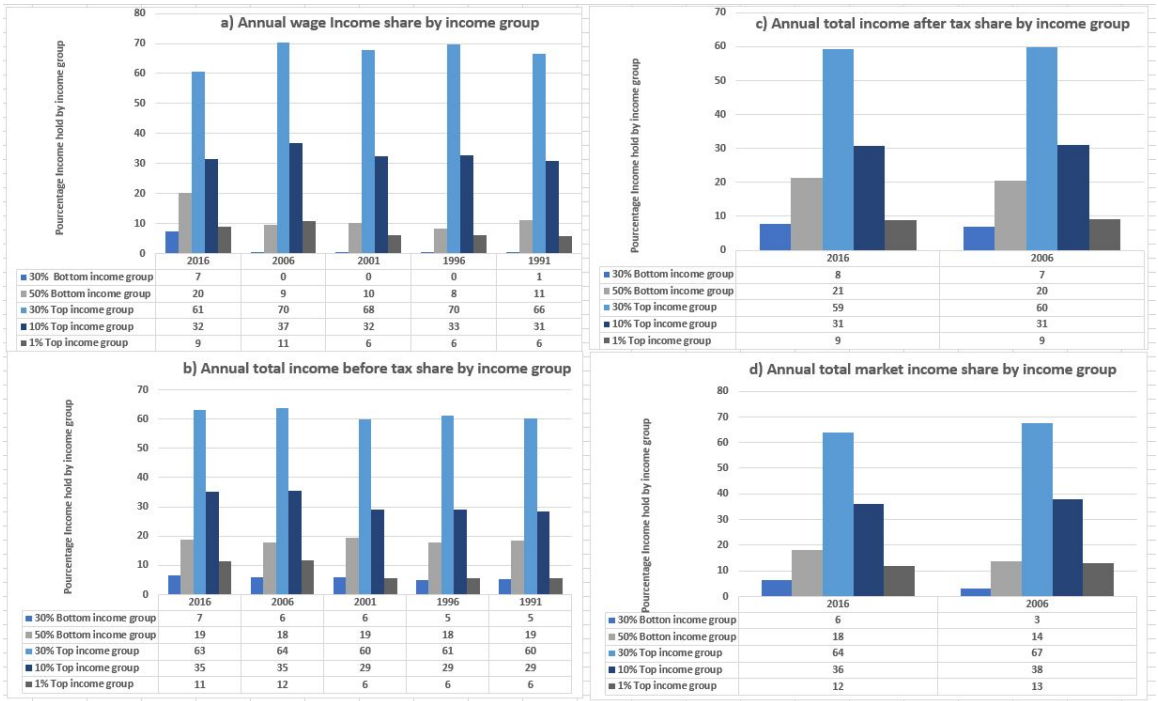


Figure 1.2: Annual Income Share Held by Income Group by Year

Figure 1.2 above presents the income share earned by income group based on annual

wage, annual market income, annual pre tax, and annual income after tax. It clearly shows the income share held by the bottom income group is insignificant compared with the share held by the top income group. This is the same for the four income type study in this chapter. The income share held by the top 1%-income group had a high increase over time whereas the income share held by the other income percentiles changed only very slightly over time. It can be concluded that this inequality is strongly due to the big gap in the dynamic of the share held by the top 1%-income group and the remaining income group. Furthermore, for all the four income types, the 30%- top income group held more than 60% of the income from the study population, and the 30%- bottom income group held less than 9% of the annual income from the study population.

Table 1.11 in the appendix provides the average annual income by income type and over the period of 1991 to 2016.

Table 1.12 in the appendix clearly shows that inequality has increased from 1992 to 2006 when one considers all the four types of income: annual wage, annual market income, annual pre-tax income and annual income after-tax. The results indicate a decrease of inequality between 2006 and 2016. This result is in the same line with the one found by other authors.

From figure 1.3, it appears that there is a big difference between the density curves of the annual wage, the market income, the annual pre-tax income and annual after-tax income. The comparison of the four density curves shows that the density curve changes after government implements its redistribution policies through tax and transfers. One can see that after tax and government transfers, the income density curve seems to account more for equity than income density curve without government policies. Also, the market-income density curve seems to be concentrated more to the left than the other incomes density curves. The income density functions highlight the social classes that pay for the

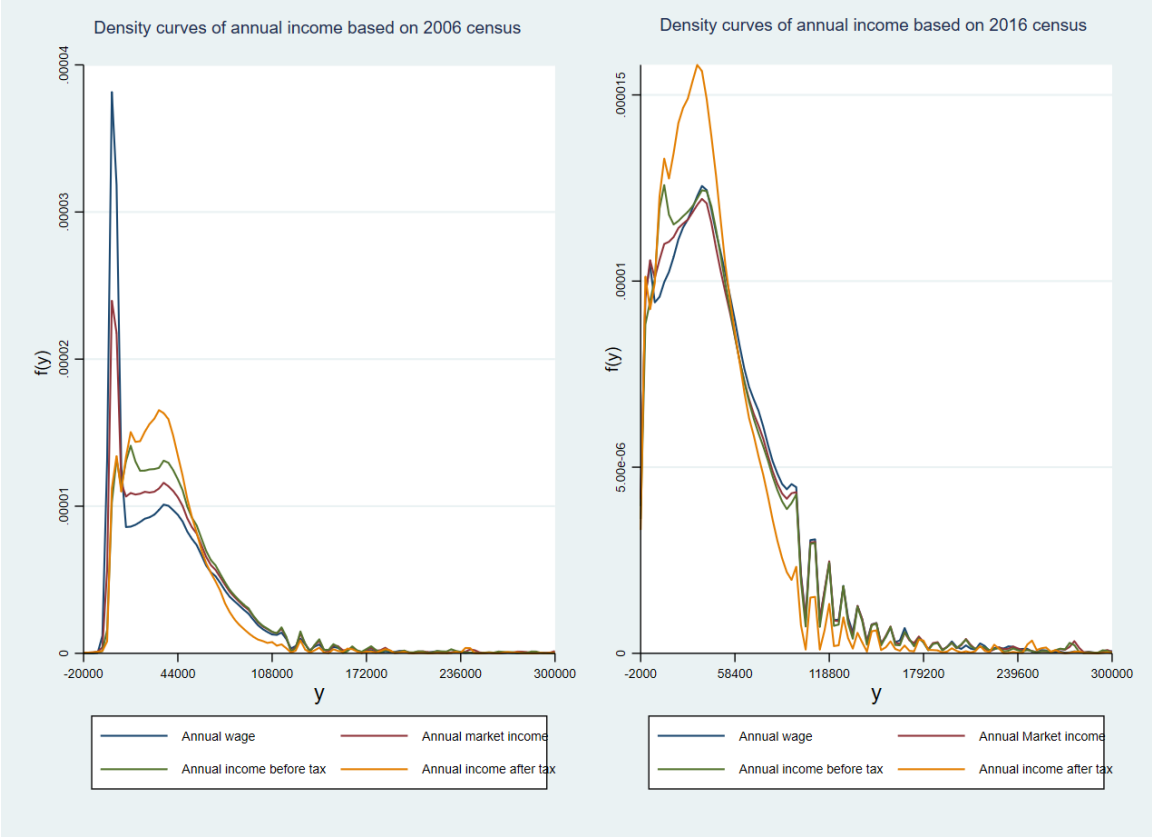


Figure 1.3: Density Curves of Individual Annual Incomes

social equity.

The analysis of the Lorenz curve of the four types of annual income shows that government policies reduce income inequality. Also, from figure 1.4, one can conclude that market income inequality is higher than annual pre-tax and income inequality.

From the table 1.12 and figure 1.4, one can notice that government redistribution policy reduce inequality overall. The results reveal higher inequality in the case of market-income as compared to after-tax income. Furthermore, inequality is driven by between-group inequalities

From table 1.14, in 2016, Alberta followed by Ontario, British Colombia, Newfoundland, Manitoba, and Saskatchewan are the provinces that experienced the highest inequality whereas Prince Edward Ireland experienced the lowest level of inequality.

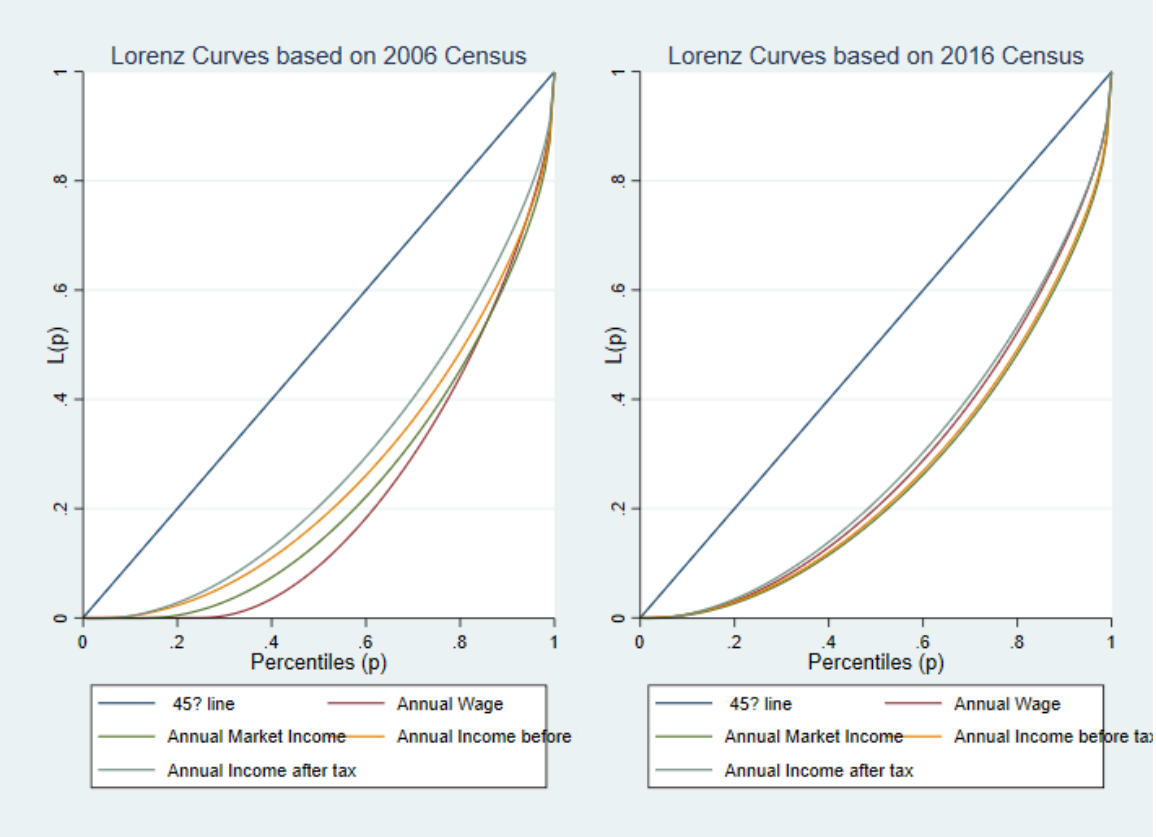


Figure 1.4: Lorenz Curves of Annual Incomes from 2006 and 2016 Census

From table 1.13, one can conclude that within-group inequality dominates between-group inequality, regardless of whether groups are defined by individual observable characteristics or not.

1.5.2 Results of the Regression-based Inequality Decomposition Approach

We use regression-based decomposition approach to see which factors drive inequality when we consider annual wage, annual market income, annual pre-tax and post-transfers income, and annual after-tax and post-transfers income. The estimation has been done for all income and by income quartile to check the homogeneity in the determinants of inequality over the income distribution.

The table 1.1 display the results of the regressions-based decomposition of inequality for individual annual wage, annual market income, annual pre-tax income and annual after-tax income. Table 1.2, and Table 1.3 display the results of the regressions-based decomposition of inequality respectively to annual market income, and annual after-tax income. They show the important of each individual characteristic in accounting (statistically significant) for the estimate levels of inequality. In the tables 1.2, and 1.3), the columns named "total" refer to the results of the regression-based decomposition model where we consider total income (annual market income, and annual after-tax income respectively). Columns Quartile 1, Quartile 2, Quartile 3, Quartile 4 indicate the regressions-based decomposition of inequality where the incomes considered are respectively the incomes of the 1^{st}, 2^{st}, 3^{st}, and 4^{st} quartiles. The use of quartile in the regression-based decomposition of inequality offers a useful tool for studying the factors that affect income inequality along the income distribution.

These results show similarity in the factors that drive income inequality when we consider different income groups even if the size of the contribution varies by income type. In each model, the values reported in the tables represent the contribution of each factor of the model to Theil index of inequality estimate by income type and income group. In other word, the tables report the percentage contributions of each factor to the explained inequality level. Overall, based on results from table 1.1, the largest (between 64.17% and 74.44%) part of the inequality is not driven by individual observable characteristics tested in the estimations. However, they do contribute more to explain inequality in the case of wage as compared to other income type. Furthermore, individual observable characteristics contribute more to explain inequality in the top quartile level of individual annual income (refer to tables 1.2, and 1.3). Overall, when one considers the four types of individual annual income, the large part of inequality is attributed to the residual term, which means

that a large portion of inequality is not explained by the variables included in the analysis. From results presented in table 1.1, the key factors that contribute to inequality by order of importance are: hours worked, part time/full time work status, education level, gender, age, self employment status, citizenship status, marital status, and visible minority status.

When we consider overall market income, a large part (64.85%) of inequality is attributed to the residual term, which means that a large portion of inequality is not explained by the variables included among the income determinants. After the residual, hours worked for pay or self-employment are the most important variable (10% as weight of contribution to inequality) followed by part time work status (7.9%). Other variables with sizeable shares are education level (3.7%), gender (2.58%), age and age squared (1.66%), Self employment status (1.54%), citizenship status (0.94%), marital status (0.61%). From this decomposition, it appears that inequality is more prevalent in the group with higher hours paid or self-employment work and those with the highest level of education. There exists a significant nonlinear relationship between individual age and inequality. The ways that these factors affects inequality of market income differs from those of wage, pre-tax income and after-tax income.

Table 1.1: Regression-based Decomposition of Inequality Based on Different Annual Income

Factors that contribute to inequality	Wage	Market income	Income pre tax	Income after tax
Residual	**64.1711*** **	**64.8555*** **	72.1250***	74.4436***
Age	5.0510***	5.1965***	3.4348***	2.7181***
Age Square	-3.6228***	-3.5323	-2.2881***	-1.7966***
Male	1.9375***	2.5789	1.2942***	1.0168***
Education (Ref: High school graduation)				
Other trades certification	-0.012***	-0.033***	-0.0086***	-0.0148***
College, CEGEP or other	-0.012***	-0.063***	-0.0214***	-0.0084***
University certification	0.015***	0.015***	0.0125***	0.0120***
Bachelor's degree	1.079***	1.533***	1.3799***	1.2821***
University certification	0.172***	0.230***	0.2442***	0.2203***
Degree in medicine, d	0.050***	0.633***	0.5650***	0.5194***
Master's degree	0.646***	1.092***	1.0015***	0.9208***
Earned doctorate degree	0.19***	0.34***	0.3342***	0.320***
Marital Status (Ref: Single)				
Legally married and not separated	0.488***	0.646***	1.3179***	1.1208***
Separated, but still married	-0.008***	-0.019***	-0.0165***	-0.0079***
Divorced	-0.004***	-0.012***	0.0050***	0.0181***
Widowed	-0.005***	-0.008***	-0.0017***	0.0026***
Self employment	2.485***	1.537***	2.2280***	2.1571***
Mother tongue (Ref: English as)				
French as mother tongue	-0.0198***	-0.0135***	0.0139***	0.0057***
No official language as Mother Tongue	0.1701***	0.3016***	0.4132***	0.3278***
Citizenship (Ref: Canadian By birth)				
Canada, by naturalization	0.013***	0.127***	0.1436***	0.0951***
None Canadian	0.515***	0.808***	1.1159***	0.9817***
Not a Visible minority	0.300***	0.564***	0.7113***	0.5922***
Not aboriginal	0.052***	0.085***	0.0831***	0.0615***
Part time worker	9.052***	7.686***	6.3691***	5.8922***
Annual weeks hours work	12.5071***	9.9904***	4.9986***	4.9114***
Attending school	0.190***	0.115***	0.1086***	0.0838***
Household type (Ref: Married-couple)				
Lone parent	0.009***	0.012***	-0.0135***	-0.0122***
Other Family	0.053***	0.074***	-0.0976***	-0.1044***
Household size	0.0024***	0.0268***	0.0016	0.0091***
Presence of kids	0.0132***	-0.0205***	0.0683***	0.1082***
Province, CMA and sector of activity contrôle	YES	YES	YES	YES
Number of obs	284,362	311,293	314,988	314,988
F stats	1959.54	2082.00	1502.54	1334.65
Prob > F	0.0000	0.0000	0.0000	0.0000
R-squared	0.3583	0.3514	0.2787	0.2556
Adj R-squared	0.3581	0.3513	0.2786	0.2554
Root MSE	1.0055	.93882	.91244	.87163

Source: Author's calculus from Canada Census Micro data 2016 *** p<$0.01, ** p<$0.05, * p<$0.1

Table 1.2: Regression-based Decomposition of Individual Annual Market-income Inequality

Factors that contribute to inequality	Income groups based on Annual market income				
	Total	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Residual	**64.8555*** **	92.7294***	**92.0202*** **	**95.1666*** **	82.7928***
Age	5.1965***	-0.0200**	0.8138***	0.5428***	7.0194***
Age Square	-3.5323	0.0242**	-0.6046***	-0.3297***	-4.6921***
Male	2.5789	0.0195***	0.3948***	0.8633***	0.9845
Education (Ref: High school graduation)					
Other trades certification	-0.033***	0.0075	0.0266***	-0.0032***	0.0040***
College, CEGEP or other	-0.063***	-0.0022	0.2229***	-0.1049***	-0.2789***
University certification	0.015***	0.0014	0.0032***	0.0387***	-0.0563***
Bachelor's degree	1.533***	-0.0054***	0.0452***	0.8201***	0.6086***
University certification	0.230***	0.0079	-0.0037***	0.1126***	0.0938***
Degree in medicine, d	0.633***	0.0194***	-0.0007	0.0747***	2.5110***
Master's degree	1.092***	-0.0073**	-0.0117***	0.3456***	1.2956***
Earned doctorate degree	0.34***	0.0202***	-0.000*	0.0513***	0.7706***
Marital Status (Ref: Single)					
Legally married and not separated	0.646***	0.0038	0.1274***	0.2575***	0.0687**
Separated, but still married	-0.019***	-0.0003	-0.0028**	-0.0079	-0.0158***
Divorced	-0.012***	0.0171***	0.0039***	-0.0182***	-0.0247***
Widowed	-0.008***	0.0014	-0.0011***	-0.0009***	-0.0020
Self employment	**1.537*** **	**0.8385*** **	**0.4965*** **	**0.0292*** **	**1.2995*** **
Mother tongue (Ref: English as)					
French as mother tongue	-0.0135***	0.1295**	0.0189*	0.0003	0.1768***
No official language as Mother Tongue	0.3016***	-0.0026**	0.1339***	0.0646***	0.1156***
Citizenship (Ref: Canadian By birth)					
Canada, by naturalization	0.127***	0.0002	0.0070	0.0794***	0.0578***
None Canadian	0.808***	0.0487***	0.2207***	0.1138***	-0.0043***
Not a Visible minority	**0.564*** **	**-0.0028** **	**0.0762*** **	**0.1724*** **	**0.2716*** **
Not aboriginal	**0.085*** **	**0.0388*** **	**0.0153*** **	**0.0061*** **	**0.0276*** **
Part time worker	7.686***	1.0323***	1.9890***	0.1476***	0.0087
Annual weeks hours work	9.9904***	4.7024***	1.4726***	0.1000***	0.1391***
Attending school	0.115***	-0.0072***	0.0767***	0.0010	0.0457***
Household type (Ref: Married-couple)					
Lone parent	0.012***	0.0006	0.0066	0.0038	0.0177***
Other Family	0.074***	0.0018	0.0181	0.0039	0.1045***
Household size	**0.0268*** **	**0.0320*** **	**0.0890*** **	**0.0010** **	**0.1537*** **
Presence of kids	**-0.0205*** **	**0.0303*** **	**0.0077**	**-0.0014*** **	**0.0142**
Province, CMA and sector of activity contrôle	YES	YES	**YES**		
Number of obs	311,293	63,505	80,405	79,246	88,137
F stats	2082.00	61.39	85.99	49.64	225.94
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000
R-squared	0.3514	0.0727	0.0798	0.0483	0.1721
Adj R-squared	0.3513	0.0715	0.0789	0.0474	0.1713
Root MSE	.93882	1.4058	.18501	.1364	.45338

Source: Author's calculus from Canada Census Micro data 2016 *** p<$0.01, ** p<$0.05, * p<$0.1

Table 1.3: Regression-based Decomposition of Individual Annual pre-tax and post-transfers Income Inequality

Factors that contribute to inequality	Income groups based on Annual Income after tax				
	Total	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Residual	74.4436***	95.7210***	91.7913***	94.6951***	82.1867***
Age	2.7181***	0.2832***	0.1634***	0.9531***	7.9510***
Age Square	-1.7966***	-0.2244***	-0.0505***	-0.6732***	-5.3751***
Male	1.0168***	0.4329**	0.1746***	0.6740***	1.2489
Education (Ref: High school graduation)					
Other trades certification	-0.0148***	0.0188	0.0592***	-0.0290***	-0.0086***
College, CEGEP or other	-0.0084***	-0.0006*	0.1828***	-0.0883***	-0.3283***
University certification	0.0120***	0.0056***	-0.0001***	0.0534***	-0.0600***
Bachelor's degree	1.2821***	0.0317*	0.0834***	0.9428***	0.7109***
University certification	0.2203***	0.0069***	0.0038***	0.1363***	0.1193****
Degree in medicine, d	0.5194***	0.0879***	0.0014*	0.0467***	2.4549***
Master's degree	0.9208***	0.0354***	-0.0051***	0.3746***	1.4441***
Earned doctorate degree	0.320***	0.0193***	0.0007*	0.0592***	0.7695***
Marital Status (Ref: Single)					
Legally married and not separated	1.1208***	0.2349***	0.1654***	0.1905***	0.0585
Separated, but still married	-0.0079***	-0.0050	0.0092***	-0.0085***	-0.0172***
Divorced	0.0181***	0.0092***	0.0223***	-0.0134***	-0.0252***
Widowed	0.0026***	0.0144***	0.0029***	-0.0025***	-0.0032
Self employment	2.1571***	1.0078***	0.7225***	0.0412***	1.3067***
Mother tongue (Ref: English as)					
French as mother tongue	0.0057***	0.1688***	0.0538***	-0.0139	0.2080***
No official language as Mother Tongue	0.3278***	-0.0203***	0.1526***	0.0663***	0.0953***
Citizenship (Ref: Canadian By birth)					
Canada, by naturalization	0.0951***	0.0154***	-0.0091	0.0505***	0.0532***
None Canadian	0.9817***	0.0968***	0.2213***	0.1463***	-0.0050***
Not a Visible minority	0.5922***	-0.0026	0.1411***	0.1670***	0.2475
Not aboriginal	0.0615***	0.0559***	0.0105***	0.0001	0.0163***
Part time worker	5.8922***	0.0137***	2.4473***	0.1507***	-0.0022*
Annual weeks hours work	4.9114***	0.7463***	1.2538***	0.2155***	0.0565
Attending school	0.0838***	0.0251***	0.0343***	0.0008	0.0481***
Household type (Ref: Married-couple)					
Lone parent	-0.0122***	0.0006	-0.0018***	-0.0045	0.0162***
Other Family	-0.1044***	-0.0084*	-0.0335***	-0.0261*	0.1199***
Household size	0.0091***	0.0017	0.0090	0.0040***	0.1217***
Presence of kids	0.1082***	0.0253***	-0.0031***	-0.0009	0.0113**
Province, CMA and sector of activity contrôle	YES	YES	YES	YES	YES
Number of obs	314,988	50,835	82,566	87,015	94,572
F stats	1334.65	28.01	91.07	60.12	252.84
Prob > F	0.0000	0.0000	0.0000	0.0000	0.0000
R-squared	0.2556	0.0428	0.0821	0.0530	0.1781
Adj R-squared	0.2554	0.0413	0.0812	0.0522	0.1774
Root MSE	.87163	1.5053	.15763	.11609	.38162
Source: Author's calculus from Canada Census Micro data 2016			*** p<$0.01, ** p<$0.05, * p<$0.1		

1.5.3 Quantile Regression Results

From the quantile-regression analysis, it is clear that the effect of covariates on income varies from one quantile to another, and by income type (wage, market income, pre tax income and after tax income). One can also see that government policies reduce the effect of those covariates on the dispersion of income distribution.

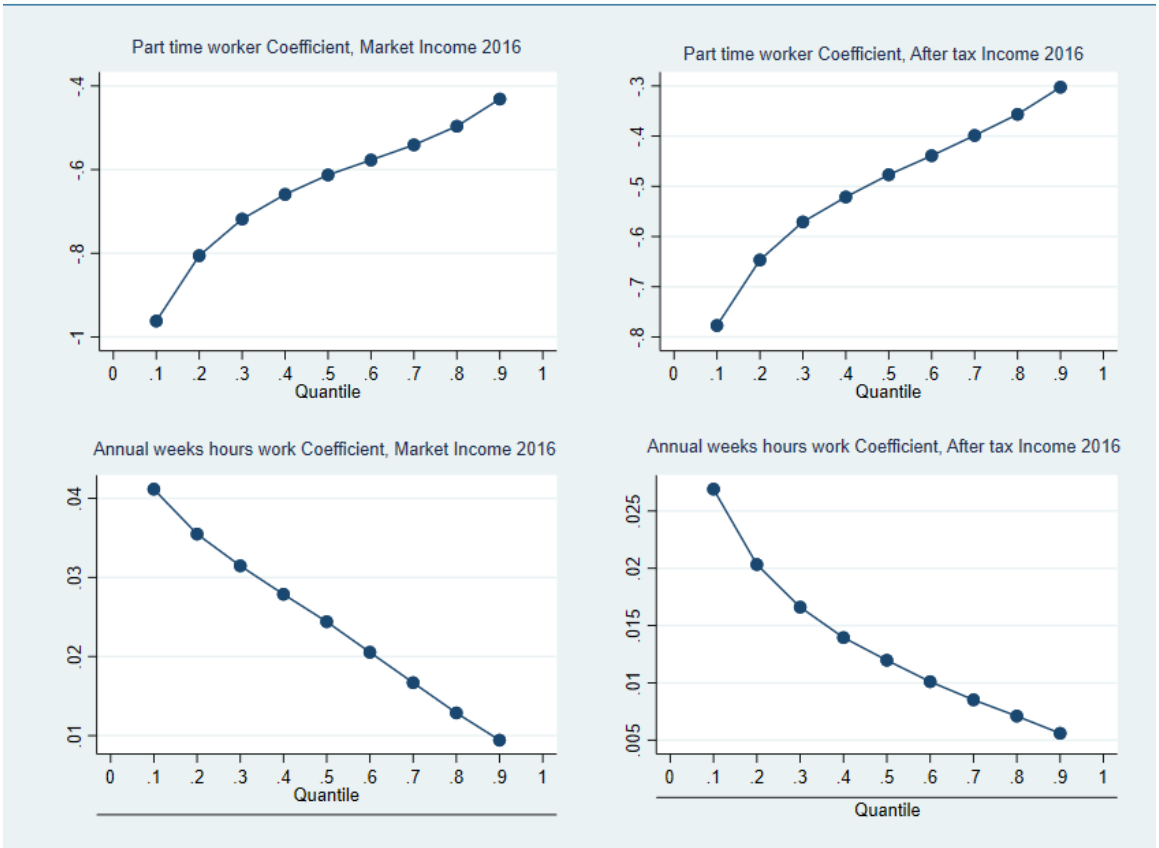


Figure 1.5: Annual Work Hours and Part Time Work Coefficients from Quantile Regression Estimate (Census 2016)

The hours worked for paid and self-employment effect on quantile is positive and decreasing along the income distribution for the four models of quantile regression. The size of the effect is high in the case of those who are at the bottom of the income distribution than those who are at the top of the distribution. As depicted by figure 1.5, the effect is higher on market income than on after-tax income. This means that the dispersion between

individuals in the same quantile level is reduced by the government policy.

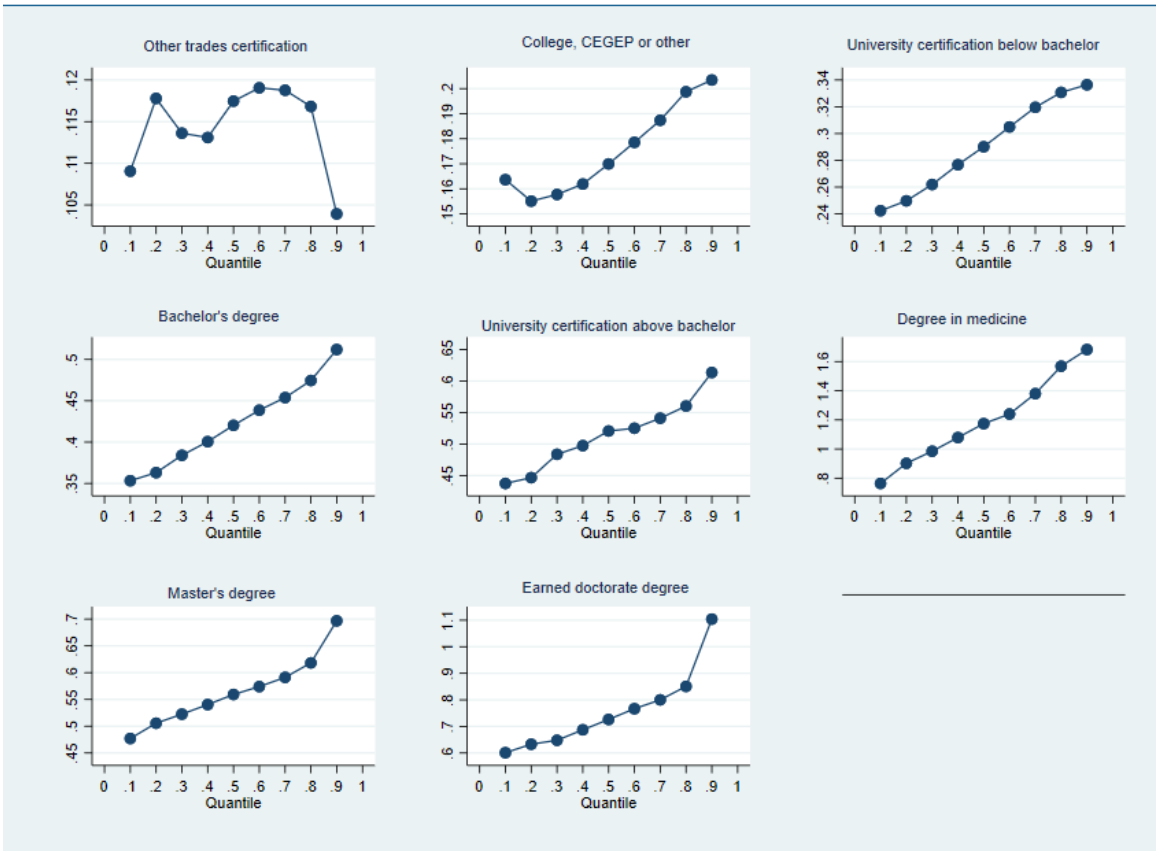


Figure 1.6: High level of Education's Coefficients from Quantile Regression Estimate(Census 2016, Market Income)

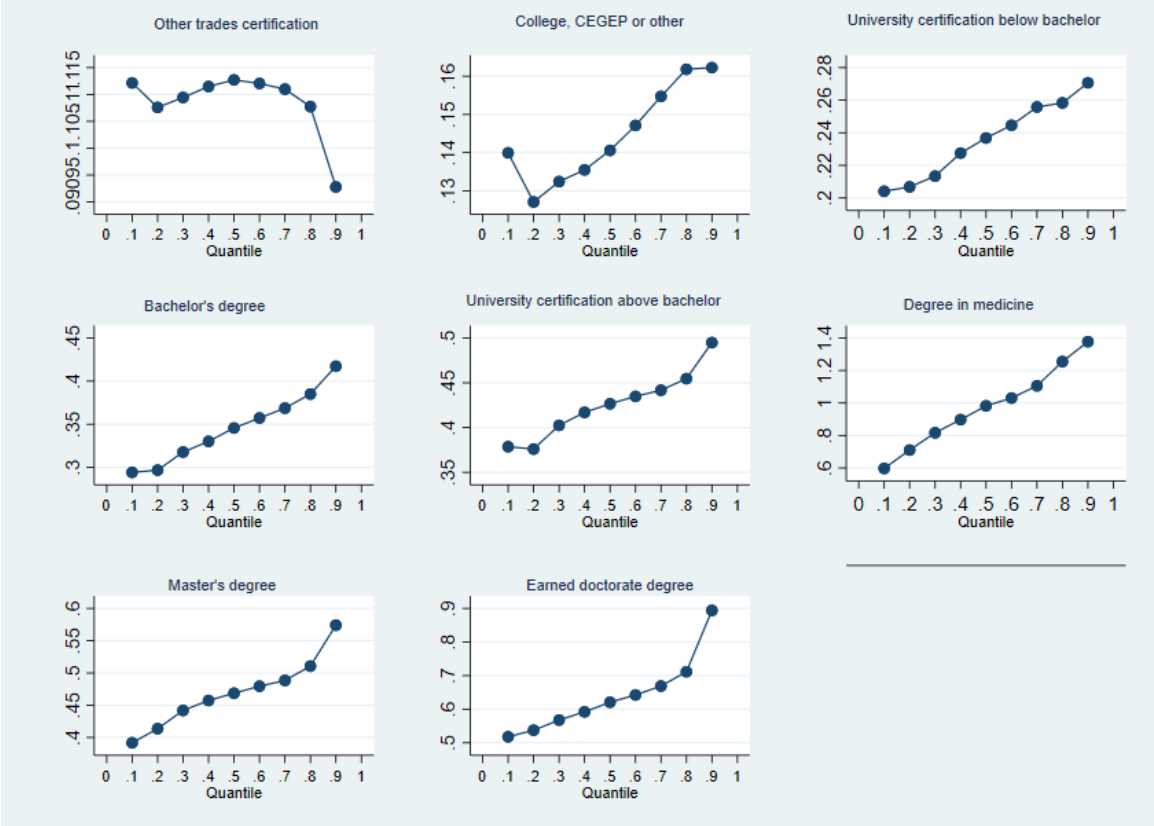


Figure 1.7: High Level of Education's Coefficients from Quantile Regression Estimate (Census 2016, After-tax Income)

From figures 1.6 and 1.7, The quantile regressions show that the higher the academic level, the higher the return to income along the income distribution. From the first decile to the top decile, this impact is increasing for most of high level school degrees when one considers both market income and after-tax income. However, the impact is lower in the case of after-tax income as compared to market income over the income distribution. This shows how government redistribution policies have impacted the return to education.

Figure 1.8: Men's Coefficients from quantile regression Estimate (Census 2016)

Compared to female, being male has a positive effect on income and the effect is increasing along the income distribution. The effect is higher for those who are at the top level of the income distribution and negligible for those who are at the bottom level of the distribution. Along the income distribution, it can be said that, at each level, men have an income that is relatively higher than that of women. From figure 1.8, the effect is higher with market income than after-tax income.

From the quantile regression results, it clearly appears that there is a non-linear relation between quantile and age. However, this non-linear relation is dominated by the age variable. This variable has a huge positive impact on income of each quantile. The effect of age variable is important in the case of market-income as compared to after-tax income.

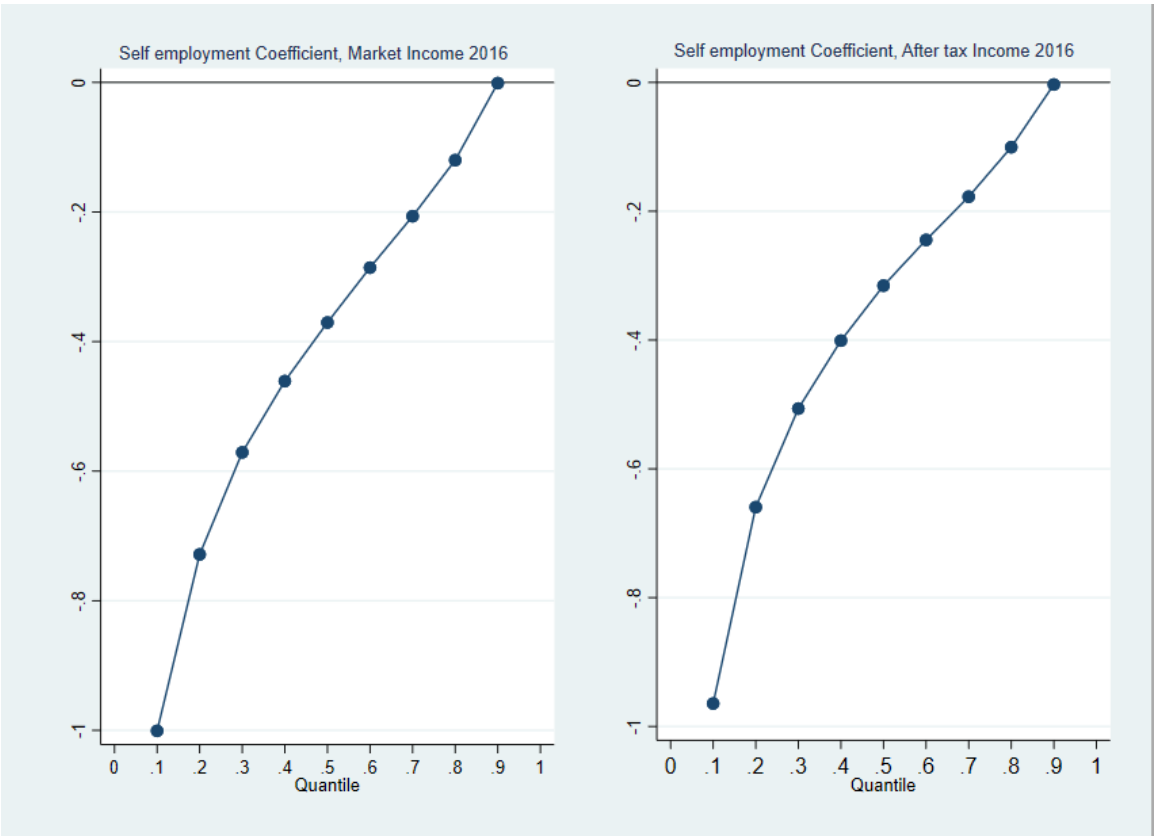


Figure 1.9: Self Employment's Coefficients from Quantile Regression Estimate (Census 2016)

Becoming self-employed has negative impact on income along the income distribution (1.9). The absolute value of this effect decreases from the bottom to the top of the income distribution. This increases inequality between income groups along the income distribution. Compared to those who are at the top of the income distribution, becoming self-employed generates a large inequality for individuals who are at the bottom of the income distribution. We do not see any impact of government policies on the effect when comparing the results from market income and those from after-tax income.

Compared to Canadians, being a non citizen of Canada, has an increasingly negative effect on the income distribution. The effect is higher for those who are at the bottom of the income distribution and negligible for those who are at the top. This effect on income

distribution is reduced with government policies.

Being non visible-minority has positif effect on income along the income distribution and the effect is increasing. It is lower for those who are at the bottom of the income distribution and higher for those who are at the top.

Household size has a negligible negative and decreasing (in absolute value) effect on market income along the income distribution. This factor decrease income and the effect if higher for those who are in the bottom income than for the top income group.

As compared to English, having french or non Canada's official languages as a mother tongue decrease income along the income distribution.

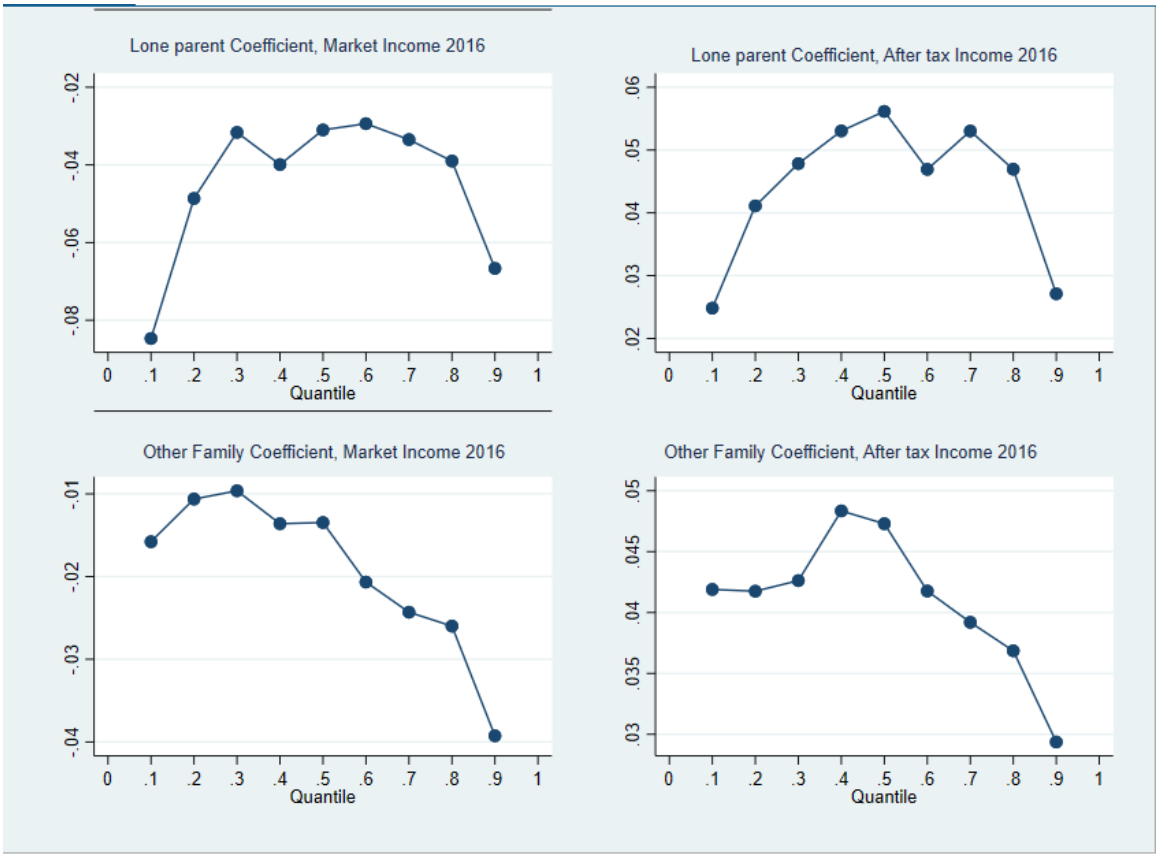


Figure 1.10: Household Family Type's Coefficients from Quantile Regression Estimate (Census 2016)

As compared to married type of household, being a lone parent has negative effect on

income along the income distribution in case of wage and market income. The effects become positifs along the income distribution when one considers both after-tax income and before tax-income. This results show the positive impact of government redistribution policies on lone parent family type.

Table 1.4: Quantile regression results with annual wage

Variables	Q10	Q20	Q30	Q40	Q50	Q60	Q70	Q80	Q90	Q100
Age	0.0667***	0.0597***	0.0587***	0.0591***	0.0598***	0.0606***	0.0613***	0.0627***	0.0651***	0.142***
	(0.00203)	(0.00138)	(0.00116)	(0.00110)	(0.00106)	(0.00105)	(0.00112)	(0.00116)	(0.00151)	(0.0387)
Age Square	-0.000688***	-0.000605***	-0.000589***	-0.000588***	-0.000592***	-0.000595***	-0.000595***	-0.000603***	-0.000613***	-0.00152***
	(2.28e-05)	(1.57e-05)	(1.32e-05)	(1.24e-05)	(1.20e-05)	(1.20e-05)	(1.27e-05)	(1.32e-05)	(1.72e-05)	(0.000424)
Male	0.249***	0.253***	0.259***	0.260***	0.263***	0.268***	0.276***	0.285***	0.304***	0.152**
	(0.00468)	(0.00325)	(0.00273)	(0.00264)	(0.00255)	(0.00257)	(0.00274)	(0.00309)	(0.00419)	(0.0746)
Education (Ref: High school graduation)										
Other trades certification	0.0968***	0.113***	0.117***	0.119***	0.118***	0.119***	0.120***	0.120***	0.114***	-0.192
	(0.00757)	(0.00539)	(0.00432)	(0.00416)	(0.00412)	(0.00397)	(0.00425)	(0.00454)	(0.00603)	(0.293)
College, CEGEP or other	0.147***	0.143***	0.149***	0.155***	0.159***	0.169***	0.177***	0.190***	0.200***	0.313***
	(0.00562)	(0.00394)	(0.00350)	(0.00334)	(0.00318)	(0.00324)	(0.00339)	(0.00364)	(0.00481)	(0.0972)
University certification below bachelor	0.203***	0.232***	0.250***	0.263***	0.278***	0.294***	0.309***	0.324***	0.335***	0.0751
	(0.0153)	(0.00817)	(0.00720)	(0.00784)	(0.00750)	(0.00714)	(0.00715)	(0.00799)	(0.00986)	(0.227)
Bachelor's degree	0.306***	0.332***	0.358***	0.379***	0.398***	0.414***	0.429***	0.449***	0.482***	0.301***
	(0.00718)	(0.00473)	(0.00405)	(0.00382)	(0.00358)	(0.00361)	(0.00378)	(0.00421)	(0.00541)	(0.100)
University certification above bachelor	0.384***	0.403***	0.454***	0.473***	0.488***	0.499***	0.509***	0.525***	0.564***	0.507**
	(0.0152)	(0.0108)	(0.0106)	(0.00927)	(0.00777)	(0.00766)	(0.00811)	(0.00840)	(0.0122)	(0.246)
Degree in medicine	0.0801	0.297***	0.529***	0.608***	0.682***	0.774***	0.825***	0.913***	1.145***	-0.508*
	(0.0556)	(0.0365)	(0.0431)	(0.0280)	(0.0338)	(0.0294)	(0.0308)	(0.0288)	(0.0363)	(0.280)
Master's degree	0.390***	0.447***	0.481***	0.505***	0.521***	0.536***	0.551***	0.574***	0.636***	0.162
	(0.0124)	(0.00796)	(0.00617)	(0.00556)	(0.00552)	(0.00517)	(0.00537)	(0.00616)	(0.00883)	(0.196)
Earned doctorate degree	0.385***	0.532***	0.566***	0.609***	0.652***	0.700***	0.733***	0.776***	0.897***	-0.0859
	(0.0410)	(0.0190)	(0.0145)	(0.0177)	(0.0142)	(0.0147)	(0.0133)	(0.0172)	(0.0241)	(0.429)
Marital status (Ref: Single)										
Legally married and not separated	0.191***	0.177***	0.170***	0.162***	0.158***	0.159***	0.156***	0.150***	0.132***	0.340
	(0.0115)	(0.00679)	(0.00621)	(0.00587)	(0.00560)	(0.00536)	(0.00593)	(0.00616)	(0.00770)	(0.214)
Separated, but still married	0.127***	0.114***	0.0985***	0.103***	0.106***	0.103***	0.101***	0.0969***	0.0759***	-0.392
	(0.0181)	(0.0118)	(0.0117)	(0.0102)	(0.00937)	(0.00905)	(0.0109)	(0.0115)	(0.0121)	(0.392)
Divorced	0.168***	0.146***	0.140***	0.131***	0.133***	0.136***	0.133***	0.122***	0.107***	0.339
	(0.0153)	(0.0116)	(0.00893)	(0.00928)	(0.00826)	(0.00842)	(0.00816)	(0.00837)	(0.0105)	(0.223)
Widowed	0.124***	0.110***	0.106***	0.114***	0.0884***	0.0812***	0.0732***	0.0731***	0.0498*	1.000***
	(0.0395)	(0.0198)	(0.0188)	(0.0173)	(0.0156)	(0.0146)	(0.0198)	(0.0179)	(0.0260)	(0.248)
Self employment	-2.102***	-1.260***	-0.835***	-0.598***	-0.436***	-0.313***	-0.212***	-0.125***	-0.0118	-7.228***
	(0.0370)	(0.0204)	(0.0176)	(0.0127)	(0.0105)	(0.00955)	(0.00920)	(0.00855)	(0.0113)	(0.647)
Mother tongue (Ref: English)										
French as mother tongue	0.0466***	0.0362***	0.0289***	0.0236***	0.0198***	0.0131***	-0.00175	-0.0139***	-0.0272***	0.139
	(0.00858)	(0.00644)	(0.00526)	(0.00484)	(0.00484)	(0.00440)	(0.00501)	(0.00515)	(0.00649)	(0.218)
No official language as MT	-0.0897***	-0.0788***	-0.0758***	-0.0757***	-0.0775***	-0.0799***	-0.0864***	-0.0884***	-0.101***	-0.110
	(0.0102)	(0.00598)	(0.00500)	(0.00469)	(0.00455)	(0.00436)	(0.00454)	(0.00462)	(0.00598)	(0.0922)
Citizenship (Ref: Canadian by birth)										
Canada, by naturalization	-0.0592***	-0.0611***	-0.0588***	-0.0603***	-0.0631***	-0.0656***	-0.0649***	-0.0673***	-0.0693***	
	(0.0104)	(0.00676)	(0.00560)	(0.00528)	(0.00498)	(0.00494)	(0.00496)	(0.00517)	(0.00665)	
None Canadian	-0.295***	-0.278***	-0.276***	-0.271***	-0.265***	-0.257***	-0.247***	-0.241***	-0.233***	-0.337***
	(0.0149)	(0.00926)	(0.00787)	(0.00761)	(0.00671)	(0.00704)	(0.00651)	(0.00679)	(0.00854)	(0.0992)
Not a Visible minority	0.116***	0.126***	0.130***	0.131***	0.130***	0.130***	0.131***	0.135***	0.152***	-0.00319
	(0.00970)	(0.00615)	(0.00537)	(0.00490)	(0.00454)	(0.00458)	(0.00455)	(0.00467)	(0.00604)	(0.111)
Not aboriginal	0.180***	0.131***	0.103***	0.0895***	0.0799***	0.0716***	0.0606***	0.0552***	0.0534***	0.299
	(0.0166)	(0.00949)	(0.00775)	(0.00680)	(0.00641)	(0.00615)	(0.00701)	(0.00717)	(0.00908)	(0.314)
Part time worker	-1.134***	-0.939***	-0.838***	-0.769***	-0.714***	-0.668***	-0.633***	-0.598***	-0.539***	-1.884***
	(0.0118)	(0.00809)	(0.00629)	(0.00556)	(0.00523)	(0.00505)	(0.00472)	(0.00506)	(0.00599)	(0.326)
Annual weeks hours work	0.0461***	0.0400***	0.0361***	0.0329***	0.0298***	0.0264***	0.0223***	0.0178***	0.0134***	0.157***
	(0.000333)	(0.000254)	(0.000182)	(0.000192)	(0.000195)	(0.000193)	(0.000212)	(0.000207)	(0.000248)	(0.00722)
Attending school	-0.120***	-0.0941***	-0.0866***	-0.0797***	-0.0760***	-0.0710***	-0.0628***	-0.0573***	-0.0504***	-0.401*
	(0.0105)	(0.00677)	(0.00577)	(0.00557)	(0.00484)	(0.00502)	(0.00473)	(0.00502)	(0.00613)	(0.205)
Household type (Ref: Married-couple)										
Lone parent	-0.0648***	-0.0340*	-0.0234*	-0.0332***	-0.0298***	-0.0234*	-0.0215*	-0.0311***	-0.0635***	-0.00965
	(0.0246)	(0.0180)	(0.0132)	(0.0121)	(0.0108)	(0.0125)	(0.0123)	(0.0113)	(0.0142)	(0.339)
Other Family	-0.0130	-0.0119*	-0.0124**	-0.0135**	-0.0170***	-0.0190***	-0.0225***	-0.0232***	-0.0319***	-0.123
	(0.0100)	(0.00662)	(0.00577)	(0.00548)	(0.00516)	(0.00512)	(0.00537)	(0.00584)	(0.00740)	(0.158)
Household size	-0.0233***	-0.0135***	-0.00968***	-0.00787***	-0.00731***	-0.00640***	-0.00516***	-0.00428***	-0.000372	-0.0781**
	(0.00287)	(0.00172)	(0.00156)	(0.00147)	(0.00138)	(0.00136)	(0.00140)	(0.00158)	(0.00198)	(0.0353)
Presence of kids	0.0412***	0.0407***	0.0426***	0.0440***	0.0464***	0.0469***	0.0463***	0.0450***	0.0425***	0.0201
	(0.00695)	(0.00453)	(0.00401)	(0.00379)	(0.00359)	(0.00362)	(0.00364)	(0.00408)	(0.00536)	(0.106)
Constant	5.485***	6.323***	6.744***	7.037***	7.279***	7.530***	7.823***	8.180***	8.497***	-0.349
	(0.0608)	(0.0426)	(0.0337)	(0.0324)	(0.0299)	(0.0301)	(0.0318)	(0.0339)	(0.0445)	(1.434)
Observations	284,362	284,362	284,362	284,362	284,362	284,362	284,362	284,362	284,362	67,283
R-squared	0.326	0.350	0.356	0.355	0.351	0.344	0.333	0.316	0.282	0.245
Province, CMA and Industry sectors Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Standard errors in parentheses - *** p<0.01, ** p<0.05, * p<0.1

Source :Author's calculus from Canada Census Micro data 2016.

Table 1.5: Quantile regression results with annual market income

Variables	Q10	Q20	Q30	Q40	Q50	Q60	Q70	Q80	Q90	Q100
Age	0.0532***	0.0499***	0.0496***	0.0492***	0.0501***	0.0509***	0.0510***	0.0529***	0.0545***	0.0935***
	(0.00202)	(0.00136)	(0.00116)	(0.00109)	(0.00104)	(0.00105)	(0.00109)	(0.00123)	(0.00161)	(0.0162)
Age Square	-0.000517***	-0.000476***	-0.000467***	-0.000456***	-0.000459***	-0.000459***	-0.000451***	-0.000460***	-0.000458***	-0.000954***
	(2.27e-05)	(1.54e-05)	(1.32e-05)	(1.25e-05)	(1.19e-05)	(1.20e-05)	(1.24e-05)	(1.41e-05)	(1.85e-05)	(0.000179)
Male	0.270***	0.265***	0.271***	0.274***	0.277***	0.281***	0.289***	0.299***	0.313***	0.457***
	(0.00475)	(0.00323)	(0.00274)	(0.00260)	(0.00254)	(0.00264)	(0.00275)	(0.00314)	(0.00428)	(0.0400)
Education (Ref: High school graduation)										
Other trades certification	0.109***	0.118***	0.114***	0.113***	0.117***	0.119***	0.119***	0.117***	0.104***	0.218***
	(0.00790)	(0.00515)	(0.00438)	(0.00416)	(0.00390)	(0.00403)	(0.00420)	(0.00457)	(0.00613)	(0.0610)
College, CEGEP or other	0.164***	0.155***	0.158***	0.162***	0.170***	0.179***	0.187***	0.199***	0.203***	0.264***
	(0.00602)	(0.00407)	(0.00354)	(0.00331)	(0.00316)	(0.00321)	(0.00337)	(0.00371)	(0.00471)	(0.0528)
University certification above bachelor	0.242***	0.250***	0.262***	0.277***	0.290***	0.305***	0.320***	0.331***	0.336***	0.342**
	(0.0141)	(0.00856)	(0.00791)	(0.00765)	(0.00721)	(0.00697)	(0.00691)	(0.00722)	(0.0102)	(0.172)
Bachelor's degree	0.353***	0.363***	0.384***	0.401***	0.420***	0.439***	0.454***	0.475***	0.512***	0.517***
	(0.00684)	(0.00470)	(0.00407)	(0.00370)	(0.00359)	(0.00363)	(0.00377)	(0.00424)	(0.00572)	(0.0481)
University certification belo bachelor	0.437***	0.447***	0.484***	0.497***	0.521***	0.525***	0.541***	0.560***	0.614***	0.511***
	(0.0157)	(0.0131)	(0.00935)	(0.00966)	(0.00826)	(0.00856)	(0.00789)	(0.00919)	(0.0142)	(0.117)
Degree in medicine	0.764***	0.902***	0.985***	1.079***	1.174***	1.240***	1.380***	1.569***	1.683***	1.064***
	(0.0494)	(0.0268)	(0.0319)	(0.0289)	(0.0306)	(0.0268)	(0.0416)	(0.0223)	(0.0391)	(0.119)
Master's degree	0.477***	0.506***	0.523***	0.540***	0.559***	0.574***	0.591***	0.618***	0.697***	0.576***
	(0.0117)	(0.00699)	(0.00616)	(0.00537)	(0.00552)	(0.00536)	(0.00521)	(0.00637)	(0.0116)	(0.0722)
Earned doctorate degree	0.601***	0.633***	0.648***	0.687***	0.726***	0.767***	0.800***	0.851***	1.104***	0.398**
	(0.0289)	(0.0150)	(0.0155)	(0.0136)	(0.0117)	(0.0136)	(0.0124)	(0.0161)	(0.0385)	(0.202)
Marital status (Ref: Single)										
Legally married and not separated	0.203***	0.180***	0.175***	0.169***	0.171***	0.168***	0.164***	0.156***	0.148***	0.463***
	(0.0120)	(0.00713)	(0.00603)	(0.00554)	(0.00558)	(0.00538)	(0.00556)	(0.00581)	(0.00783)	(0.0851)
Separated, but still married	0.163***	0.126***	0.114***	0.113***	0.115***	0.113***	0.112***	0.105***	0.0972***	0.211
	(0.0231)	(0.0127)	(0.0126)	(0.0101)	(0.0103)	(0.00975)	(0.0104)	(0.0120)	(0.0113)	(0.220)
Divorced	0.193***	0.169***	0.153***	0.151***	0.149***	0.154***	0.143***	0.132***	0.130***	0.396***
	(0.0159)	(0.0109)	(0.00876)	(0.00888)	(0.00806)	(0.00828)	(0.00831)	(0.00901)	(0.0122)	(0.123)
Widowed	0.175***	0.140***	0.140***	0.122***	0.114***	0.0981***	0.101***	0.0942***	0.114***	0.452
	(0.0310)	(0.0199)	(0.0182)	(0.0144)	(0.0164)	(0.0170)	(0.0176)	(0.0183)	(0.0217)	(0.861)
Self employment	-1.001***	-0.728***	-0.571***	-0.461***	-0.371***	-0.286***	-0.207***	-0.120***	-0.00107	-2.621***
	(0.0139)	(0.00865)	(0.00749)	(0.00703)	(0.00656)	(0.00624)	(0.00638)	(0.00665)	(0.00891)	(0.137)
Mother tongue (Ref: English)										
French as mother tongue	0.0596***	0.0380***	0.0334***	0.0226***	0.0190***	0.0104**	-0.000684	-0.0116**	-0.0322***	0.217***
	(0.00902)	(0.00596)	(0.00508)	(0.00496)	(0.00461)	(0.00473)	(0.00484)	(0.00539)	(0.00642)	(0.0572)
No official language as MT	-0.0952***	-0.0915***	-0.0825***	-0.0842***	-0.0835***	-0.0894***	-0.0929***	-0.0973***	-0.107***	-0.0448
	(0.0103)	(0.00624)	(0.00566)	(0.00481)	(0.00429)	(0.00450)	(0.00440)	(0.00470)	(0.00620)	(0.0710)
Citizenship (Ref: Canadian by birth)										
Canada, by naturalization	-0.104***	-0.0974***	-0.0929***	-0.0888***	-0.0922***	-0.0889***	-0.0891***	-0.0911***	-0.0934***	-0.279***
	(0.0116)	(0.00707)	(0.00599)	(0.00533)	(0.00497)	(0.00482)	(0.00472)	(0.00524)	(0.00692)	(0.0709)
None Canadian	-0.342***	-0.323***	-0.309***	-0.301***	-0.296***	-0.283***	-0.272***	-0.274***	-0.260***	-1.110***
	(0.0148)	(0.00863)	(0.00843)	(0.00718)	(0.00649)	(0.00714)	(0.00658)	(0.00707)	(0.00958)	(0.159)
Not a Visible minority	0.129***	0.130***	0.135***	0.139***	0.140***	0.142***	0.144***	0.149***	0.175***	0.116
	(0.0102)	(0.00627)	(0.00555)	(0.00475)	(0.00457)	(0.00447)	(0.00444)	(0.00484)	(0.00624)	(0.0832)
Not aboriginal	0.199***	0.143***	0.117***	0.100***	0.0931***	0.0878***	0.0767***	0.0689***	0.0696***	0.522***
	(0.0148)	(0.00957)	(0.00812)	(0.00703)	(0.00614)	(0.00677)	(0.00705)	(0.00667)	(0.00909)	(0.102)
Part time worker	-0.962***	-0.806***	-0.718***	-0.659***	-0.613***	-0.577***	-0.541***	-0.496***	-0.431***	-2.133***
	(0.0100)	(0.00680)	(0.00567)	(0.00532)	(0.00478)	(0.00485)	(0.00474)	(0.00517)	(0.00617)	(0.148)
Annual weeks hours work	0.0412***	0.0355***	0.0315***	0.0279***	0.0244***	0.0205***	0.0167***	0.0129***	0.00942***	0.148***
	(0.000370)	(0.000219)	(0.000198)	(0.000203)	(0.000202)	(0.000200)	(0.000188)	(0.000188)	(0.000213)	(0.00416)
Attending school	-0.0728***	-0.0593***	-0.0593***	-0.0561***	-0.0589***	-0.0559***	-0.0521***	-0.0553***	-0.0541***	-0.0856
	(0.0102)	(0.00635)	(0.00546)	(0.00492)	(0.00499)	(0.00475)	(0.00475)	(0.00510)	(0.00592)	(0.0731)
Household type (Ref: Married-couple)										
Lone parent	-0.0847***	-0.0486***	-0.0316***	-0.0399***	-0.0310***	-0.0294**	-0.0335***	-0.0390***	-0.0666***	0.104
	(0.0304)	(0.0166)	(0.0119)	(0.0122)	(0.0120)	(0.0131)	(0.0125)	(0.0115)	(0.0146)	(0.369)
Other Family	-0.0158	-0.0106	-0.00963*	-0.0136***	-0.0135***	-0.0207***	-0.0243***	-0.0260***	-0.0393***	0.0615
	(0.0111)	(0.00682)	(0.00580)	(0.00522)	(0.00513)	(0.00503)	(0.00532)	(0.00568)	(0.00741)	(0.0845)
Household size	-0.0243***	-0.0147***	-0.0128***	-0.0100***	-0.00873***	-0.00627***	-0.00524***	-0.00284*	0.00290	-0.0894***
	(0.00288)	(0.00183)	(0.00153)	(0.00143)	(0.00139)	(0.00136)	(0.00137)	(0.00155)	(0.00205)	(0.0229)
Presence of kids	0.0337***	0.0348***	0.0389***	0.0391***	0.0408***	0.0392***	0.0378***	0.0339***	0.0343***	-0.00595
	(0.00704)	(0.00465)	(0.00394)	(0.00376)	(0.00355)	(0.00364)	(0.00371)	(0.00417)	(0.00544)	(0.0526)
Constant	6.097***	6.786***	7.162***	7.485***	7.734***	8.010***	8.320***	8.582***	8.817***	-2.571***
	(0.0591)	(0.0386)	(0.0340)	(0.0322)	(0.0296)	(0.0312)	(0.0319)	(0.0330)	(0.0431)	(0.498)
Observations	311,293	311,293	311,293	311,293	311,293	311,293	311,293	311,293	311,293	311,293
R-squared	0.324	0.338	0.345	0.349	0.350	0.346	0.337	0.318	0.282	0.273
Province, CMA and Industry sectors Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Standard errors in parentheses - *** p<0.01, ** p<0.05, * p<0.1

Source :Author's calculus from Canada Census Micro data 2016.

Table 1.6: Quantile regression results with annual income before tax

Variables	Q20	Q20	Q30	Q40	Q50	Q60	Q70	Q80	Q90	Q100
Age	0.0367***	0.0381***	0.0403***	0.0413***	0.0425***	0.0436***	0.0435***	0.0444***	0.0484***	0.0249**
	(0.00187)	(0.00124)	(0.00108)	(0.00100)	(0.000946)	(0.000934)	(0.000995)	(0.00109)	(0.00145)	(0.0123)
Age Square	-0.000371***	-0.000374***	-0.000389***	-0.000393***	-0.000398***	-0.000400***	-0.000390***	-0.000386***	-0.000406***	-0.000303**
	(2.12e-05)	(1.43e-05)	(1.24e-05)	(1.15e-05)	(1.08e-05)	(1.06e-05)	(1.13e-05)	(1.24e-05)	(1.67e-05)	(0.000146)
Male	0.169***	0.185***	0.195***	0.202***	0.209***	0.215***	0.229***	0.243***	0.268***	0.0244
	(0.00433)	(0.00288)	(0.00261)	(0.00242)	(0.00235)	(0.00237)	(0.00252)	(0.00288)	(0.00400)	(0.0280)
Education (Ref: High school graduation)										
Other trades certification	0.123***	0.117***	0.119***	0.121***	0.125***	0.122***	0.121***	0.118***	0.107***	0.241***
	(0.00692)	(0.00455)	(0.00421)	(0.00373)	(0.00371)	(0.00370)	(0.00380)	(0.00436)	(0.00542)	(0.0446)
College, CEGEP or other	0.155***	0.146***	0.146***	0.151***	0.158***	0.166***	0.172***	0.185***	0.188***	0.321***
	(0.00558)	(0.00358)	(0.00326)	(0.00302)	(0.00298)	(0.00295)	(0.00313)	(0.00344)	(0.00426)	(0.0441)
University certification below bachelor	0.220***	0.232***	0.241***	0.252***	0.265***	0.280***	0.289***	0.298***	0.313***	0.248***
	(0.0129)	(0.00815)	(0.00711)	(0.00774)	(0.00642)	(0.00636)	(0.00702)	(0.00724)	(0.00979)	(0.0841)
Bachelor's degree	0.322***	0.327***	0.350***	0.368***	0.386***	0.404***	0.420***	0.441***	0.480***	0.470***
	(0.00642)	(0.00441)	(0.00374)	(0.00345)	(0.00339)	(0.00331)	(0.00348)	(0.00385)	(0.00552)	(0.0480)
University certification above bachelor	0.413***	0.419***	0.450***	0.465***	0.480***	0.493***	0.501***	0.523***	0.579***	0.649***
	(0.0152)	(0.00999)	(0.00963)	(0.00778)	(0.00813)	(0.00730)	(0.00771)	(0.00753)	(0.0143)	(0.0781)
Degree in medicine	0.618***	0.774***	0.896***	0.990***	1.097***	1.177***	1.284***	1.470***	1.618***	0.556***
	(0.0472)	(0.0260)	(0.0244)	(0.0289)	(0.0208)	(0.0229)	(0.0385)	(0.0317)	(0.0321)	(0.204)
Master's degree	0.427***	0.454***	0.484***	0.503***	0.522***	0.536***	0.554***	0.581***	0.662***	0.515***
	(0.0105)	(0.00697)	(0.00599)	(0.00522)	(0.00470)	(0.00490)	(0.00499)	(0.00580)	(0.00968)	(0.0671)
Earned doctorate degree	0.557***	0.581***	0.616***	0.654***	0.686***	0.732***	0.762***	0.819***	1.044***	0.330
	(0.0212)	(0.0142)	(0.0121)	(0.0144)	(0.0121)	(0.0112)	(0.0111)	(0.0154)	(0.0316)	(0.306)
Marital status (Ref: Single)										
Legally married and not separated	0.306***	0.251***	0.230***	0.221***	0.211***	0.197***	0.189***	0.181***	0.161***	2.491***
	(0.0103)	(0.00646)	(0.00565)	(0.00530)	(0.00520)	(0.00471)	(0.00524)	(0.00554)	(0.00749)	(0.301)
Separated, but still married	0.269***	0.215***	0.192***	0.178***	0.154***	0.143***	0.130***	0.120***	0.0991***	2.165***
	(0.0164)	(0.0120)	(0.0102)	(0.00935)	(0.00778)	(0.00817)	(0.00853)	(0.0101)	(0.0134)	(0.377)
Divorced	0.297***	0.224***	0.204***	0.187***	0.170***	0.160***	0.143***	0.130***	0.113***	2.240***
	(0.0149)	(0.0105)	(0.00816)	(0.00728)	(0.00778)	(0.00689)	(0.00731)	(0.00830)	(0.00974)	(0.345)
Widowed	0.407***	0.306***	0.269***	0.240***	0.208***	0.202***	0.173***	0.180***	0.137***	2.337***
	(0.0215)	(0.0187)	(0.0134)	(0.0129)	(0.0146)	(0.0139)	(0.0145)	(0.0192)	(0.0198)	(0.383)
Self employment	-1.022***	-0.725***	-0.573***	-0.465***	-0.375***	-0.297***	-0.217***	-0.129***	-0.0236***	-5.212***
	(0.0162)	(0.00856)	(0.00715)	(0.00621)	(0.00578)	(0.00552)	(0.00560)	(0.00616)	(0.00806)	(0.557)
Mother tongue (Ref: English)										
French as mother tongue	0.0563***	0.0381***	0.0249***	0.0184***	0.0137***	0.00392	-0.00743*	-0.0193***	-0.0373***	0.172***
	(0.00713)	(0.00556)	(0.00503)	(0.00424)	(0.00425)	(0.00419)	(0.00437)	(0.00477)	(0.00597)	(0.0588)
No official language as MT	-0.0991***	-0.0899***	-0.0853***	-0.0870***	-0.0911***	-0.0920***	-0.0921***	-0.0948***	-0.106***	-0.171*
	(0.00976)	(0.00585)	(0.00511)	(0.00467)	(0.00436)	(0.00413)	(0.00402)	(0.00428)	(0.00566)	(0.0919)
Citizenship (Ref: Canadian by birth)										
Canada, by naturalization	-0.0826***	-0.0823***	-0.0803***	-0.0796***	-0.0809***	-0.0809***	-0.0811***	-0.0837***	-0.0857***	-0.197**
	(0.0106)	(0.00638)	(0.00544)	(0.00510)	(0.00481)	(0.00442)	(0.00444)	(0.00464)	(0.00611)	(0.0858)
None Canadian	-0.425***	-0.352***	-0.331***	-0.315***	-0.296***	-0.278***	-0.262***	-0.254***	-0.247***	-2.440***
	(0.0156)	(0.00924)	(0.00799)	(0.00701)	(0.00673)	(0.00622)	(0.00616)	(0.00654)	(0.00845)	(0.198)
Not a Visible minority	0.123***	0.128***	0.136***	0.139***	0.139***	0.137***	0.142***	0.148***	0.172***	0.198**
	(0.00912)	(0.00594)	(0.00481)	(0.00442)	(0.00429)	(0.00412)	(0.00428)	(0.00429)	(0.00552)	(0.0934)
Not aboriginal	0.178***	0.123***	0.0971***	0.0840***	0.0801***	0.0637***	0.0533***	0.0501***	0.0517***	1.124**
	(0.0132)	(0.00832)	(0.00762)	(0.00649)	(0.00616)	(0.00630)	(0.00581)	(0.00622)	(0.00852)	(0.445)
Part time worker	-0.811***	-0.698***	-0.627***	-0.577***	-0.535***	-0.498***	-0.457***	-0.420***	-0.364***	-1.369***
	(0.00982)	(0.00600)	(0.00508)	(0.00447)	(0.00430)	(0.00400)	(0.00417)	(0.00443)	(0.00561)	(0.122)
Annual weeks hours work	0.0281***	0.0220***	0.0183***	0.0155***	0.0134***	0.0115***	0.00980***	0.00818***	0.00671***	0.0533***
	(0.000309)	(0.000215)	(0.000175)	(0.000158)	(0.000141)	(0.000130)	(0.000135)	(0.000137)	(0.000178)	(0.00354)
Attending school	-0.0769***	-0.0825***	-0.0808***	-0.0750***	-0.0691***	-0.0631***	-0.0612***	-0.0559***	-0.0523***	-0.00956
	(0.00952)	(0.00598)	(0.00490)	(0.00480)	(0.00446)	(0.00435)	(0.00432)	(0.00484)	(0.00543)	(0.0509)
Household type (Ref: Married-couple)										
Lone parent	-0.00620	0.0457***	0.0495***	0.0468***	0.0452***	0.0402***	0.0341***	0.0219**	0.00983	-0.0880
	(0.0252)	(0.0140)	(0.0132)	(0.0113)	(0.0102)	(0.0115)	(0.0108)	(0.0110)	(0.0149)	(0.268)
Other Family	0.0400***	0.0428***	0.0421***	0.0444***	0.0440***	0.0321***	0.0287***	0.0240***	0.0103	0.114
	(0.00962)	(0.00587)	(0.00542)	(0.00502)	(0.00485)	(0.00435)	(0.00492)	(0.00534)	(0.00705)	(0.0885)
Household size	-0.00577**	-0.000603	0.000226	0.00154	0.00250**	0.00403***	0.00497***	0.00691***	0.0129***	-0.0201
	(0.00236)	(0.00158)	(0.00139)	(0.00131)	(0.00124)	(0.00121)	(0.00131)	(0.00140)	(0.00172)	(0.0198)
Presence of kids	0.0995***	0.0911***	0.0855***	0.0793***	0.0746***	0.0698***	0.0646***	0.0594***	0.0467***	0.292***
	(0.00605)	(0.00415)	(0.00368)	(0.00343)	(0.00330)	(0.00328)	(0.00355)	(0.00386)	(0.00494)	(0.0460)
Constant	7.210***	7.813***	8.107***	8.347***	8.532***	8.711***	8.887***	9.043***	9.126***	1.266*
	(0.0551)	(0.0340)	(0.0319)	(0.0300)	(0.0275)	(0.0265)	(0.0282)	(0.0304)	(0.0425)	(0.736)
Observations	314,988	314,988	314,988	314,988	314,988	314,988	314,988	314,988	314,988	314,988
R-squared	0.251	0.266	0.273	0.275	0.274	0.269	0.260	0.244	0.214	0.151
Province, CMA and Industry sectors Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Standard errors in parentheses - *** p<0.01, ** p<0.05, * p<0.1

Source :Author's calculus from Canada Census Micro data 2016.

Table 1.7: Quantile regression results with annual total income after tax

Variables	Q20	Q20	Q30	Q40	Q50	Q60	Q70	Q80	Q90	Q100
Age	0.0316***	0.0345***	0.0356***	0.0370***	0.0374***	0.0381***	0.0384***	0.0384***	0.0410***	0.0175
	(0.00168)	(0.00113)	(0.000964)	(0.000880)	(0.000840)	(0.000833)	(0.000905)	(0.000941)	(0.00124)	(0.0120)
Age Square	-0.000326***	-0.000344***	-0.000347***	-0.000356***	-0.000353***	-0.000352***	-0.000346***	-0.000334***	-0.000342***	-0.000239*
	(1.91e-05)	(1.29e-05)	(1.10e-05)	(1.01e-05)	(9.66e-06)	(9.53e-06)	(1.04e-05)	(1.08e-05)	(1.43e-05)	(0.000140)
Male	0.148***	0.156***	0.164***	0.169***	0.172***	0.178***	0.186***	0.198***	0.222***	0.0239
	(0.00381)	(0.00270)	(0.00232)	(0.00211)	(0.00207)	(0.00206)	(0.00225)	(0.00254)	(0.00354)	(0.0262)
Education (Ref: High school graduation)										
Other trades certification	0.112***	0.108***	0.109***	0.111***	0.113***	0.112***	0.111***	0.108***	0.0928***	0.238***
	(0.00606)	(0.00420)	(0.00359)	(0.00325)	(0.00330)	(0.00325)	(0.00343)	(0.00370)	(0.00474)	(0.0425)
College, CEGEP or other	0.140***	0.127***	0.132***	0.135***	0.141***	0.147***	0.155***	0.162***	0.162***	0.313***
	(0.00486)	(0.00337)	(0.00290)	(0.00266)	(0.00264)	(0.00260)	(0.00276)	(0.00306)	(0.00376)	(0.0398)
University certification below bachelor	0.204***	0.207***	0.213***	0.228***	0.237***	0.245***	0.256***	0.258***	0.271***	0.214***
	(0.0123)	(0.00797)	(0.00618)	(0.00612)	(0.00569)	(0.00568)	(0.00574)	(0.00605)	(0.00856)	(0.0766)
Bachelor's degree	0.294***	0.297***	0.318***	0.330***	0.346***	0.357***	0.369***	0.385***	0.417***	0.448***
	(0.00565)	(0.00404)	(0.00344)	(0.00305)	(0.00294)	(0.00287)	(0.00298)	(0.00342)	(0.00478)	(0.0438)
University certification above bachelor	0.379***	0.376***	0.402***	0.417***	0.427***	0.435***	0.442***	0.455***	0.495***	0.598***
	(0.0154)	(0.00939)	(0.00745)	(0.00710)	(0.00691)	(0.00589)	(0.00658)	(0.00711)	(0.0149)	(0.0641)
Degree in medicine	0.597***	0.711***	0.817***	0.898***	0.982***	1.031***	1.106***	1.255***	1.377***	0.316
	(0.0669)	(0.0247)	(0.0168)	(0.0210)	(0.0243)	(0.0186)	(0.0276)	(0.0318)	(0.0248)	(0.345)
Master's degree	0.392***	0.414***	0.442***	0.457***	0.469***	0.479***	0.488***	0.511***	0.574***	0.499***
	(0.0102)	(0.00635)	(0.00514)	(0.00429)	(0.00428)	(0.00405)	(0.00447)	(0.00511)	(0.00887)	(0.0595)
Earned doctorate degree	0.518***	0.537***	0.568***	0.592***	0.621***	0.642***	0.669***	0.712***	0.894***	0.511***
	(0.0166)	(0.0146)	(0.0111)	(0.0113)	(0.0104)	(0.00916)	(0.0120)	(0.0120)	(0.0367)	(0.178)
Marital status (Ref: Single)										
Legally married and not separated	0.272***	0.219***	0.205***	0.192***	0.184***	0.173***	0.166***	0.155***	0.137***	2.347***
	(0.0101)	(0.00598)	(0.00515)	(0.00456)	(0.00434)	(0.00432)	(0.00463)	(0.00523)	(0.00654)	(0.271)
Separated, but still married	0.260***	0.212***	0.194***	0.173***	0.152***	0.141***	0.128***	0.109***	0.101***	1.679***
	(0.0157)	(0.0102)	(0.00921)	(0.00738)	(0.00726)	(0.00789)	(0.00744)	(0.00767)	(0.00951)	(0.420)
Divorced	0.281***	0.215***	0.199***	0.175***	0.157***	0.147***	0.131***	0.119***	0.108***	2.092***
	(0.0135)	(0.00905)	(0.00759)	(0.00705)	(0.00676)	(0.00606)	(0.00599)	(0.00766)	(0.00897)	(0.324)
Widowed	0.366***	0.269***	0.246***	0.217***	0.190***	0.174***	0.160***	0.148***	0.116***	2.087***
	(0.0182)	(0.0171)	(0.0140)	(0.0123)	(0.0137)	(0.0153)	(0.0130)	(0.0142)	(0.0185)	(0.295)
Self employment	-0.964***	-0.659***	-0.506***	-0.401***	-0.316***	-0.245***	-0.177***	-0.101***	-0.00324	-5.472***
	(0.0145)	(0.00762)	(0.00645)	(0.00561)	(0.00521)	(0.00502)	(0.00507)	(0.00521)	(0.00715)	(0.475)
Mother tongue (Ref: English)										
French as mother tongue	0.0388***	0.0248***	0.0174***	0.0136***	0.00584	-0.00361	-0.00956**	-0.0189***	-0.0379***	0.175***
	(0.00681)	(0.00502)	(0.00430)	(0.00381)	(0.00363)	(0.00363)	(0.00373)	(0.00435)	(0.00535)	(0.0440)
No official language as MT	-0.0873***	-0.0766***	-0.0741***	-0.0749***	-0.0773***	-0.0760***	-0.0777***	-0.0805***	-0.0886***	-0.108
	(0.00846)	(0.00568)	(0.00454)	(0.00398)	(0.00370)	(0.00357)	(0.00354)	(0.00392)	(0.00494)	(0.0856)
Citizenship (Ref: Canadian by birth)										
Canada, by naturalization	-0.0650***	-0.0709***	-0.0652***	-0.0687***	-0.0664***	-0.0667***	-0.0702***	-0.0704***	-0.0726***	-0.151*
	(0.00938)	(0.00635)	(0.00501)	(0.00443)	(0.00408)	(0.00388)	(0.00393)	(0.00415)	(0.00556)	(0.0773)
None Canadian	-0.388***	-0.315***	-0.292***	-0.279***	-0.258***	-0.241***	-0.229***	-0.219***	-0.212***	-2.330***
	(0.0151)	(0.00940)	(0.00701)	(0.00626)	(0.00575)	(0.00538)	(0.00545)	(0.00533)	(0.00682)	(0.168)
Not a Visible minority	0.109***	0.110***	0.117***	0.118***	0.119***	0.119***	0.117***	0.123***	0.144***	0.201**
	(0.00847)	(0.00568)	(0.00470)	(0.00389)	(0.00379)	(0.00356)	(0.00365)	(0.00390)	(0.00523)	(0.0827)
Not aboriginal	0.147***	0.0900***	0.0703***	0.0628***	0.0543***	0.0459***	0.0330***	0.0281***	0.0157**	1.037***
	(0.0133)	(0.00781)	(0.00625)	(0.00572)	(0.00501)	(0.00514)	(0.00541)	(0.00553)	(0.00735)	(0.301)
Part time worker	-0.777***	-0.647***	-0.571***	-0.521***	-0.477***	-0.439***	-0.399***	-0.357***	-0.303***	-1.348***
	(0.0101)	(0.00586)	(0.00500)	(0.00409)	(0.00409)	(0.00369)	(0.00388)	(0.00388)	(0.00460)	(0.129)
Annual weeks hours work	0.0269***	0.0203***	0.0166***	0.0140***	0.0120***	0.0101***	0.00852***	0.00710***	0.00560***	0.0550***
	(0.000326)	(0.000215)	(0.000164)	(0.000137)	(0.000129)	(0.000118)	(0.000125)	(0.000117)	(0.000146)	(0.00642)
Attending school	-0.0533***	-0.0601***	-0.0583***	-0.0575***	-0.0523***	-0.0471***	-0.0428***	-0.0407***	-0.0387***	-0.0173
	(0.00819)	(0.00552)	(0.00440)	(0.00391)	(0.00401)	(0.00374)	(0.00367)	(0.00407)	(0.00460)	(0.0523)
Household type (Ref: Married-couple)										
Lone parent	0.0248	0.0411***	0.0478***	0.0530***	0.0562***	0.0469***	0.0530***	0.0470***	0.0271**	-0.527
	(0.0217)	(0.0125)	(0.0107)	(0.0109)	(0.0101)	(0.00948)	(0.00921)	(0.0106)	(0.0122)	(0.603)
Other Family	0.0419***	0.0418***	0.0426***	0.0483***	0.0473***	0.0418***	0.0392***	0.0369***	0.0294***	0.129
	(0.00888)	(0.00578)	(0.00495)	(0.00446)	(0.00414)	(0.00413)	(0.00443)	(0.00525)	(0.00648)	(0.0807)
Household size	-0.00117	0.00348**	0.00376***	0.00567***	0.00635***	0.00705***	0.00861***	0.0107***	0.0173***	-0.0254
	(0.00233)	(0.00151)	(0.00133)	(0.00114)	(0.00109)	(0.00109)	(0.00116)	(0.00126)	(0.00163)	(0.0189)
Presence of kids	0.0964***	0.0856***	0.0823***	0.0768***	0.0736***	0.0690***	0.0635***	0.0565***	0.0440***	0.276***
	(0.00559)	(0.00391)	(0.00340)	(0.00302)	(0.00293)	(0.00292)	(0.00317)	(0.00336)	(0.00449)	(0.0416)
Constant	7.379***	7.949***	8.251***	8.460***	8.644***	8.814***	8.971***	9.127***	9.238***	1.465**
	(0.0538)	(0.0331)	(0.0280)	(0.0255)	(0.0242)	(0.0234)	(0.0247)	(0.0264)	(0.0365)	(0.739)
Observations	314,988	314,988	314,988	314,988	314,988	314,988	314,988	314,988	314,988	314,988
R-squared	0.231	0.245	0.251	0.252	0.250	0.244	0.235	0.218	0.188	0.135
Province, CMA and Industry sectors Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Standard errors in parentheses - *** p<0.01, ** p<0.05, * p<0.1

Source :Author's calculus from Canada Census Micro data 2016.

1.6 Conclusion

The overall goal of the article is to study the determinants of income inequality in order to understand deeply the key inequality driving factors along the income distribution in order to help policy makers design policies that will improve the population's well-being and reduce income inequality.

With micro data from Canada Censuses of 1991, 1996, 2001, 2006 and 2016, the percentile shares of individual annual pre tax and transfer income of each percentile of income were estimated. The results suggested heterogeneity in the percentile share along the income distribution. The income percentile of the top 25% income group is higher than that of the bottom 50% income group and the value is almost stable over time for the bottom income group, whereas there is a large increase for the top 25% income group and even more for the top 1% income group. The top 30% income group held 60% of the population total income, while the bottom 30% income group held under 9% of the population total income. Inequality is different by province across Canada. Alberta followed by Ontario, British Colombia and Newfoundland are the provinces that experienced the highest inequality whereas Prince Edward Irland experienced the lowest level of inequality. After the decomposition of inequality into within-groups and between-groups inequalities, an analysis of determinants of income inequality was performed using the regression-based decomposition of inequality at different levels of the income distribution and the quantile regression.

From the traditional non-parametrical approach of inequality decomposition (Shorrocks (1984)), it appears that both absolute and relative decomposition of inequality are mainly explained by within group inequality components.

From the regression-based decomposition approach of inequality, overall, the largest

(between 64.17% and 74.44%) part of the annual income inequality is not driven by individual observable characteristics present in the model. However, they do contribute more to explain inequality in the top quartile level of individual annual income (wage, market-income, annual pre tax income, and after tax income). The largest part of inequality is attributed to the residual term. This unexplained part (residual term) may, for instance, account for national economic conditions such as, economic growth, unemployment level, social policies. After the residual, hours worked for pay or self-employment, education level, gender, age, English as mother tongue, visible-minority are the most important factors that explained income inequality between individual. The ways that factors affect inequality of annual wage, annual market income, annual income pre-tax, and annual income after-tax differs.

From the quantile regression analysis, it is clear that the effect of the covariates on income varies from one quantile to another. The quantile regressions show that education level, hours worked for paid and self-employment, visible-minority status, having one of the Canada's official languages as a mother tongue, citizenship, gender, household type were important factors that explained income inequality between individual. The factors that affect quantile along the income distribution are consistent when one considers the four types of income, even if the magnitude differs by income type.

In regard with the findings of this chapter, we provide policy suggestions that intend to narrow income inequality. The redistribution policies should be improved by concentrating more efforts in the reduction of inequality in the top and bottom income quartiles or deciles of the income distribution. Furthermore, ensuring a high level of education of good quality to all citizens must continue to be a high priority for governments at both federal and provincial levels in order to curb inequality. From the findings, important part of inequality is not explained by individual characteristics. The dynamics of the difference in income

share held by income group should be considered by governments to reduce income disparity. The results from this research support that government at different level review the taxation of top-income group in order to reduce the impact of the increase of income share of the top-income group compared to other income groups (Green et al. (2016)). Furthermore, governments should continue to build and implement the following policies:

- spend more cash benefits on the lower income and middle-income groups;
- set personal income tax to be progressive for income after 75 income percentile level;
- promote and facilitate labor market access for recent immigrants;
- promote and facilitate labor market access for all visible minority groups;
- develop projects that support the participation of low and middle income groups to the labor market.

1.7 Appendix

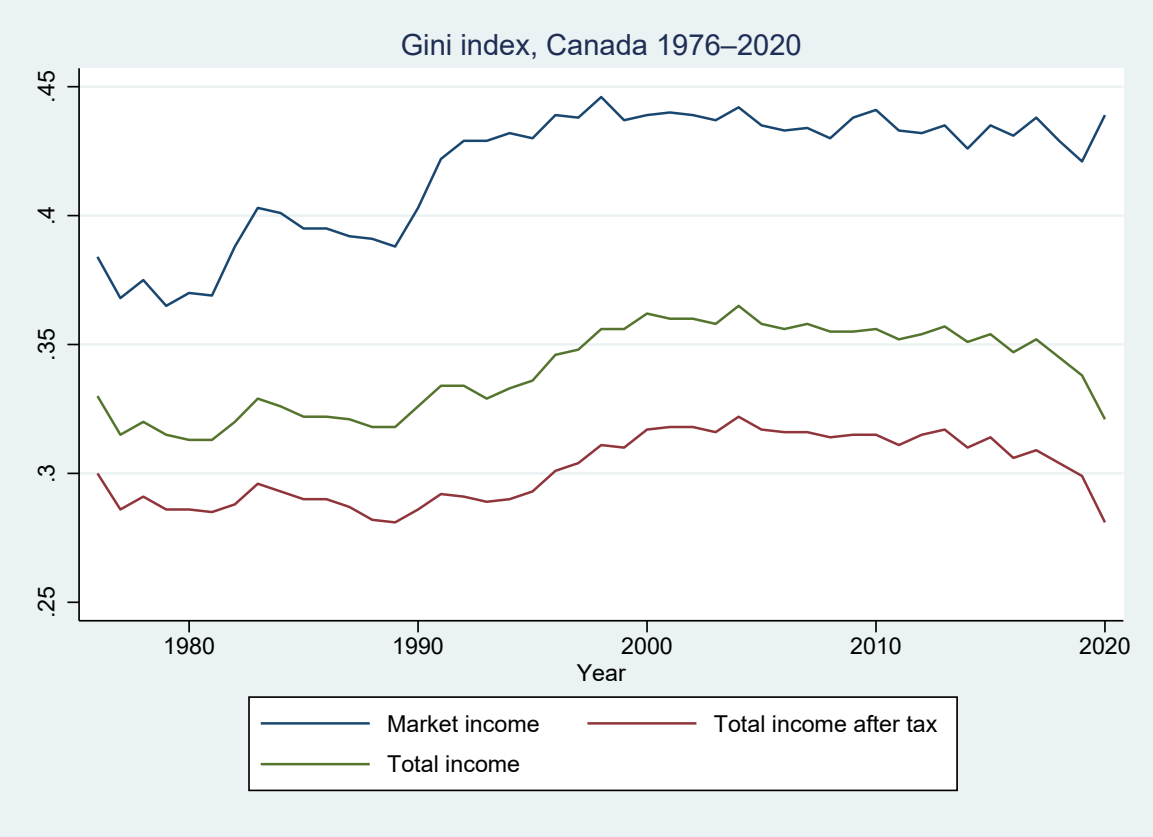


Figure 1.11: Gini index of equivalent income inequality by income type, Canada 19762020
Data source: Table 11-10-0134-01 (formerly CANSIM 206-0033)

Table 1.8: Profile of individual characteristics by data (1991-2016)

Individual Characteristics Frequency	(Pourcentage)				
	1991	1996	2001	2006	2016
Marital status					
Single	19.17	21.86	24.4	26.87	20.69
Legally married /Common low	66.97	62.69	59.81	57.28	68.46
Separated	3.55	3.85	3.93	3.92	2.96
Divorced	7.93	9.51	9.93	10.12	6.49
Widowed	2.38	2.09	1.92	1.81	1.4
Province					
Newfoundland	1.97	1.9	1.75	1.68	1.51
Prince Edward Island	0.42	0.45	0.43	0.41	0.38
Nova Scotia	3.2	3.14	3.05	2.92	2.59
New Brunswick	2.58	2.53	2.45	2.37	2.09
Quebec	26.16	25.47	24.58	24.4	23.18
Ontario	37.19	37.26	37.97	38.15	38.22
Manitoba	3.75	3.61	3.52	3.41	3.43
Saskatchewan	3.24	3.05	2.88	2.8	2.95
Alberta	9.17	9.27	9.89	10.39	11.98
British Columbia	12.04	13.01	13.18	13.15	13.36
Yukon/Northwest Terr	0.29	0.32	0.29	0.31	0.29
Household size					
One persone	9.17	10.06	11.17	11.89	12.73
2 persons	27.45	28.14	29.53	30.69	30.69
3 persons	21.85	21.48	21.02	20.87	20.82
4 persons	24.93	24.22	22.97	22.1	21.37
5 persons	10.9	10.41	9.89	9.34	8.81
6 persons	3.76	3.7	3.68	3.12	3.26
7 persons and more	1.94	1.99	1.75	1.99	2.34
House hold type					
Married-Couple	76.48	74.29	72.78	71.63	68.97
Lone parent	7.48	8.12	8.62	8.82	1.86
Other Familly	16.04	17.59	18.6	19.55	29.17
Gender					
Female	50.53	50.74	50.87	51.02	51.05
Male	49.47	49.26	49.13	48.98	48.95
Visible Minority status					
Visible Minority	9.15	11.21	13.13	15.36	21.19
Not a Visible minority	90.85	88.79	86.87	84.64	78.81

Table 1.9: Profile of individual characteristics by data (1991-2016)

Individual Characteristics Frequency	(Percentage)				
	1991	1996	2001	2006	2016
Age					
25 to 29 years	16.12	12.91	11.58	11.36	11.96
30 to 34 years	16.98	15.8	12.8	11.62	12.26
35 to 39 years	15.74	16.36	15.37	12.66	11.99
40 to 44 years	14.26	14.94	15.74	14.99	11.77
45 to 49 years	11.32	13.56	14.32	14.9	12.32
50 to 54 years	9.11	10.47	12.67	13.49	14.11
55 to 59 years	8.42	8.31	9.76	11.91	13.77
60 to 64 years	8.04	7.65	7.76	9.08	11.83
High degree of education					
Sec. school grad. Certificate	56.1	51.05	46.73	39.52	35.58
Trades certificate	13.24	12.65	13	12.44	10.71
Other non-univ. cert	13.77	16.87	18	20.39	22.4
Univ. cert/diploma	2.38	2.61	3	4.94	2.94
Bachelor degree(s)	9.37	10.95	13	14.65	19.2
Univ. cert/diploma	1.61	1.76	2	2.34	1.76
Deg. in med/dent/vet/	0.53	0.58	1	0.55	0.7
Masters degree(s)	2.53	2.95	4	4.47	5.9
Earned doctorate	0.47	0.58	1	0.71	0.82
Attending school					
Not attending school	90.47	90.82	91.71	90.2	91.99
Attending school	9.53	9.18	8.29	9.8	8.01
Language					
English	56.96	57.07	56.67	56.06	56.47
French	25.48	24.32	23.55	23.11	21.37
Non Official Language	17.56	18.61	19.78	20.82	22.16
Citizenship					
Canadian by birth	78.83	77.87	77.06	77.17	72.62
Canadian by naturalization	14.47	15.82	16.76	17.36	19
Other country(ies)	6.7	6.31	6.18	5.46	8.39
Immigrant					
Non Immigrant	78.83	77.87	77.07	0.89	72.85
Immigrant	20.28	21.55	22.24	75.71	25.7
Non Permanent	0.89	0.57	0.68	23.4	1.45
Full time vs. part time job					
Full time	86.08	83.31	84.88	85.15	84.51
Part time	13.92	16.69	15.12	14.85	15.49
PKID					
None				41.02	31.74
One or more				58.98	68.26
Aboriginal vs. non aboriginal					
Aboriginal				3.22	4.25
Non Aboriginal				96.78	95.75
Total	435,040	430,307	440,585	469,532	507,222

Source:Author calculus based on Census data.

Table 1.10: Descriptive Statistics of individual Characteristics from Canada Census data

Census 2016

Individual Characteristics	Obs	Mean	Std.Dev.	Min	Max
Age	507,222	44.83921	11.38309	27	62
Gender	507,222	1.489482	.4998899	1	2
High degree of education	501,051	4.019886	2.090019	2	10
Marital status	507,222	1.99447	.7885673	1	5
Mother Tongue	500,585	1.656855	.8176718	1	3
Immigration Status	505,595	1.286008	.4828866	1	3
Years since immigration	128,349	20.26659	13.38837	1	44
Visible Minority status	494,673	1.788054	.4086873	1	2
Aborigine	507,222	1.957451	.2018392	1	2
Household type	507,222	1.602034	.907226	1	3
Household size	505,093	3.019565	1.431229	1	7
Presence of Kids in the household	409,372	.6826236	.4654558	0	1
Full time and part time work	415,316	1.154923	.3618317	1	2
Total weeks of work	424,869	42.95383	13.25091	0	50.5
School attendance	504,501	1.080119	.2714773	1	2
Province	507,222	36.49096	12.9898	10	60
Annual wage	388,409	55156.94	63921.69	.9840259	1216852
Annual market Income	451,773	58160.08	84337.54	-49201.29	1584057
Annual total Income before tax	495,673	56191.25	78052.34	-49201.29	1561466
Annual total Income after tax	495,98	44883.08	50646.79	-49201.29	1039730

Census 2006

Individual Characteristics	Obs	Mean	Std.Dev.	Min	Max
Age	469,532	44.19575	10.76293	27	62
Gender	469,532	1.489764	.4998958	1	2
High degree of education	467,438	3.78579	1.991511	2	10
Marital status	469,532	2.027084	.9352674	1	5
Mother Tongue	469,532	1.647602	.8029228	1	3
Immigration Status	469,532	2.225045	.4384851	1	3
Years since immigration	95,392	18.71016	10.03077	1	34
Visible Minority status	466,418	1.846365	.3605986	1	2
Aborigine	469,532	1.967764	.1766274	1	2
Household type	467,654	1.479228	.8003899	1	3
Household size	467,654	3.036258	1.405306	1	7
Presence of Kids in the household	467,654	.5898463	.4918619	0	1
Full time and part time work	387,247	1.14845	.3555464	1	2
Total weeks of work	395,713	43.71401	12.84982	0	50.5
School attendance	469,532	1.098034	.2973606	1	2
Province	469,532	35.90115	13.11187	10	60
Annual wage	468,948	38223.39	57582.86	0	1422631
Annual market Income	468,948	46356.21	73840.31	-57996.03	1536364
Annual total Income before tax	469,097	48814.74	70095.97	-57996.03	1491178
Annual total Income after tax	468,948	39249.79	45886.77	-57996.03	1022451

Source:Author calculus based on Canada's Census data.

Table 1.11: Average annual income by income type

Income type	Average				
	2016	2006	2001	1996	1991
Annual total Wage	55156.94	38223.39	34355.44	30954.58	31886.18
Annual Market income	58160.08	46356.21			
Annual total pre tax income	56191.25	48814.74	42620.17	39227.97	39684.75
Annual total income after tax	44883.08	39249.79			

Source: Authors estimation based on Canada's census data (1991-2016)

Table 1.12: Income inequality indexes from 1991 to 2016 by income type

Theil Index computed based on population that are 25 years old and more				
Year	Wage	Annual tot inc. bef. tax	Annual tot. inc. af. tax	Annual Market income
1991	0.329491	0.342170		
1996	0.353686	0.371088		
2001	0.348846	0.367943		
2006	0.486079	0.523947	0.406033	0.607335
2016	0.489847	0.517808	0.398418	0.603699
Theil Index computed based on population that are between 25 years and 64 years old				
	Wage	Annual tot inc. bef. tax	Annual tot. inc. af. tax	Annual Market income
1991	0.252492	0.281313		
1996	0.271080	0.315066		
2001	0.266186	0.315714		
2006	0.391819	0.468356	0.363917	0.489624
2016	0.386173	0.462162	0.356135	0.487155
Gini Index computed based on population that are 25 years old and more				
	Wage	Annual tot inc. bef. tax	Annual tot. inc. af. tax	Annual Market income
1991	0.4381251	0.4457241		
1996	0.4539084	0.4641579		
2001	0.4502260	0.4622225		
2006	0.5006542	0.5064919	0.4545282	0.5446547
2016	0.5069921	0.5038101	0.4515642	0.5430460
Gini Index computed based on population that are between 25 years and 64 years old				
	Wage	Annual tot inc. bef. tax	Annual tot. inc. af. tax	Annual Market income
1991	0.3825243	0.4025537		
1996	0.3966654	0.4265451		
2001	0.3925926	0.4270474		
2006	0.4438918	0.4774791	0.4279370	0.4846140
2016	0.4460562	0.4754095	0.4248162	0.4848094

Source: Authors estimation based on Canada's census data (1991-2016)

Table 1.13: Decomposition of individual annual total pre tax income inequality into within and between components (by sub-group).

Decomposition of individual annual total pre tax and transfers income inequality by subgroup	**GE(1)**	**Absolute contribution**	**Relative contribution**
Gender			
Female	0.327	0.126	0.288
Male	0.466	0.286	0.648
Within		0.412	0.936
Between		0.028	0.063
Population		0.441	1
Education level			
Within		0.392	0.890
Between		0.044	0.100
Population		0.441	1
Visible-minority status			
Within		0.437	0.99
Between		0.003	0.007
Household type			
Within		0.434	0.985
Between		0.006	0.013
Population		0.441	1

Source: Authors estimation based on Canada's Census data (2006)

Table 1.14: Theil index computed based on population that are between 25 years and 64 years old by Province of Residence

Theil Index of Inequality by Province between 2006 and 2016								
Province	Annual wage		Market Income		Before tax Income		After tax income	
	2006	2016	2006	2016	2006	2016	2006	2016
1: Newfoundland	**0.387342**	**0.395195**	**0.434594**	**0.426865**	**0.373301**	**0.380155**	**0.291618**	**0.296212**
2: Prince Edward Island	0.323406	0.267134	0.371867	0.310109	0.301129	0.264238	0.241024	0.208488
3: Nova Scotia	0.321558	0.344705	0.376365	0.378510	0.355230	0.364068	0.279985	0.279180
4: New Brunswick	0.320587	0.292706	0.364835	0.311906	0.331959	0.289362	0.264066	0.231220
5: Quebec	**0.314154**	**0.325271**	**0.407121**	**0.408117**	**0.375894**	**0.367003**	**0.281402**	**0.274449**
6: Ontario	**0.397115**	**0.401718**	**0.505797**	**0.504606**	**0.493077**	**0.484140**	**0.379549**	**0.363393**
7: Manitoba	**0.336723**	**0.321698**	**0.405164**	**0.394360**	**0.382987**	**0.383899**	**0.299781**	**0.297960**
8: Saskatchewan	0.335741	0.312352	0.391514	0.371064	0.371519	0.362747	0.299794	0.284441
9: Alberta	**0.488967**	**0.433087**	**0.603938**	**0.586641**	**0.586032**	**0.573933**	**0.468979**	**0.459528**
10: British Columbia	**0.386973**	**0.365312**	**0.475096**	**0.456071**	**0.463871**	**0.441908**	**0.369757**	**0.352546**
11: Yukon/Northwest Terr	0.295039	0.271452	0.349268	0.296680	0.352675	0.301755	0.301286	0.256716
Canada	**0.391819**	**0.386173**	**0.489624**	**0.487155**	**0.468356**	**0.462162**	**0.363917**	**0.356135**

Chapter 2

Within-Gender Income Inequality: Dynamics, Composite and Income Structural Effects

2.1 Introduction

The phenomenon of income inequality has become a growing concern in most industrialized countries over the past three decades (Breau (2015)), a trend exacerbated by the COVID-19 pandemic. Canada has also experienced a similar trend, with income inequality steadily rising since the mid-1990s. [1] To better understand this process, several studies have been conducted on the topic. The Institute for Research on Public Policy has published numerous essays on the subject, compiling them under the title 'Income Inequality: The Canadian Story'. This collection provides an overview of the factors contributing to the growing income gap in Canada. The Canadian Centre for Policy Alternatives (CCPA)

[1] Procyk (2014); Fong (2017); http://behindthenumbers.ca/2017/10/27/population-changing-income-inequality-remains/

has also published several studies on the topic, examining its causes and consequences and proposing policy solutions to address the issue.

The income gap between genders has attracted significant attention in the empirical literature on income distribution and inequality in Canada and other industrialized countries. While many studies have investigated the determinants of the wage or earning gap between men and women, there is a notable lack of research on differences in income inequality within gender. This knowledge gap is particularly relevant given the large income gap between men and women, which highlights the need to investigate how this gap can affect overall income inequality. Moreover, overall income inequality is largely driven by within-group and less by between-group inequality. [2] Still, when considering gender as a group, less is known about within gender income inequality, the most relevant component of overall income inequality. Although some studies have explored changes in income distribution and inequality over time, such as (Piketty (2014); Gabaix et al. (2016); Alvaredo et al. (2017)), less is known about inequality dynamics by gender and the factors that explain changes in inequality within gender. Therefore, more research is needed to shed light on this important issue.

The existing literature on income inequality has paid limited attention to differences in income inequality within genders. To address this gap in this research, I investigates the dynamics of income inequality by gender and the determinants of income inequality from both static and dynamic perspectives. This research sheds light on the difference in income inequality by gender and provides insights into the causes of inequality at different levels of income distribution, as well as changes in income inequality over time. Previous studies have mostly estimated inequality indices based on market income, total annual income before tax, or total annual income after tax (Sarah Burkinshaw (2022); Chen et al.

[2] e.g. Cowell and Fiorio (2011), http://stateofworkingamerica.org/chart/swa-wages-table-4-20-contribution-group/

(2021); Frenette et al. (2009), etc.). However, these approaches may not capture the full extent of income inequality, particularly for those with non-salaried income. Focusing solely on wages as a measure of income inequality can be limiting, as it excludes individuals with non-salaried income. This group represents a significant portion of the labor force in Canada and should not be neglected when analyzing income inequality. Following Lemieux and Riddell (2015) approach of using annual market income to study the top income group with Canadian census data, our analysis focuses mainly on individual annual total income as the key variable for studying income inequality by gender. We will also conduct robustness tests using individual annual wages to validate our findings.

In this paper, we aim to document the dynamics of income inequality by gender in Canada from 1991 to 2016 using different measures of inequality, such as the Gini index, Theil index, income variance, and income interquantile differences. To achieve this, we utilize Canadian annual pre-tax income data from three sources: the individual files of the Canada Census (1991, 1996, 2001, 2006), the Survey of Labour and Income Dynamics (SLID, 2008, 2009, 2010, 2011), and the Canadian Income Survey (CIS, 2012, 2013, 2014, 2015). [3] and the Canadian Income Survey (CIS, 2012, 2013, 2014, 2015)[4]. Furthermore, we investigate the determinants of income inequality by gender using two different methods: unconditional quantile regression based on the re-entered influence function (RIF) decomposition by (Firpo et al. (2009)) and regression-based decomposition (RBD) of inequality. Finally, we use the inequality decomposition method developed by Firpo et al. (2018) (FFL or RIF-Oaxaca Blinder) to decompose the changes/dynamics in income inequality by gender over time. This method enables us to split the change in inequality between two periods into composition effects (explained component) and structure effects (unexplained component) for each factor. Overall, this study contributes to the extensive

[3]https://www150.statcan.gc.ca/n1/pub/75f0011x/75f0011x2013001-eng.htm
[4]https://www150.statcan.gc.ca/n1/pub/75-513-x/75-513-x2014001-eng.htm

literature on income inequality by bringing further light on the dynamics of income inequality by gender in Canada. By utilizing different measures of inequality and various data sources, we provide details on the differences in income inequality by gender and the factors responsible for changes in inequality at different levels of income distribution. Our analysis is conducted using Canada census data (2001 and 2006).

According to the empirical literature on inequality in Canada, this paper is a unique study that examines and documents gender differences in the dynamics of inequality while considering the factors that impact inequality by gender. The paper uses a decomposition approach to document the factors that impacted the dynamics of inequality by gender. To focus on the labor force, individuals between the ages of 25 and 64 years old were included in the sample, while citizens under the age of 25 were excluded to avoid underestimating the inequality that exists between people Fortin et al. (2017).

The results show that prior to 2001, inequality was higher among females than males, and starting from 2001, the inverse process was observed. Females were less represented at the top of the income distribution and represented a higher proportion of the bottom income group. However, the proportion of females in the top income group has improved over time. The changes in the interquantile differences are not homogeneous along the income distribution for both males and females. The pattern of the effects of covariates on quantiles along the income distribution is gender-specific, and the return of each covariate varies by time period. The dynamics of inequality is not identical for males and females. From the regression-based decomposition, overall, the proportion of inequality explained by individual characteristics is less than 50% depending on the year, data source, and gender. The explained proportion of inequality is higher for females than males. The key observable characteristics that contribute to inequality within-females and within-males are annual hours of work, level of education, immigrant status, age, marital status, and house-

hold size. For most of the inequality measures used in the study, the income structure effect dominates the composition effect for both males and females. However, there are some specific interquantile differences where the composition effect has a greater impact. Moreover, the composition effect generally counterbalances the income structure effect, although in some cases, they contribute to the change in inequality measures in the same direction. The factors that affect the dynamics of each inequality measure are gender-specific, and education, age, citizenship, job participation status, and household size are significant in increasing or decreasing inequality measures in most cases. Visible minority status and marital status usually counterbalance the effect of the former factors.

The paper is structured as follows. Section 2.2 presents a summary of the key findings in the empirical literature relative to the gender difference in income and in inequality and factors that account for the income accumulation process. Section 2.3 describes the data and presents descriptive statistics. Section 2.4 provides the analysis of gender differences in the determinants of income inequality by presenting the methodology and the results from the unconditional quantile regression and regression-based decomposition. Section 2.5 presents the methodology and the results of the decomposition of the dynamics of income inequality by gender. Finally, Section 2.6 presents the discussion of the results and concludes.

2.2 Literature Review

This paper seeks to analyze gender income inequality from both static and dynamic perspectives while providing evidence on the determinants of inequality at different levels of the income distribution and on the changes in income inequality in two points of time. In addition, in order to ensure the consistency of the results, this paper analyses the determi-

nants of wage inequalities within gender.

Over the recent years, a number of studies have focused on the determinants of wage inequality without paying more attention to issues of income inequality, which should receive a particular attention in developed countries such as Canada (Cowell and Fiorio (2011); Piketty (2014); Fortin (2019a)). Wage is a share of income and by focusing only on wage, we exclude a non-negligible share of people with non-salaried income. The fundamental interest of this study in highlighting the determinants of income inequality by gender to the detriment of wage inequality is that this analysis does not exclude people with non-employment income, which constitutes a huge share (more than 30%) of the active population in Canada.

Based on the literature on gender and inequality, this section mainly emphasizes key findings on the factors that drive inequality. First of all, this literature will review findings on gender inequality by providing a summary of the key findings on the gender difference in wage and the several factors that play an important role in the income accumulation process, in the change in income or wage structure. Thereafter, we will focus on inequalities in relation to the change in income structures, the change in inequality in general, and some differences by gender. Finally, the paper will highlight the gaps in the empirical literature to which this paper intends to respond. Studies on earnings gap between gender have generated considerable interest in the empirical literature on wage distribution and inequality in most of the industrialized countries including in Canada (Mills and Zandvakili (2004); Boll and Lagemann (2018)). These studies, which have looked at the determinants of the wage or earning gap by gender, have shown that female make up the majority of part-time workers while pointing to a considerable income gap between men and women in the European Union. Specifically, this particular gap lies between 6.1% and 30%. According to European Commission research published in 2014, some of the most important causes of

the gender income gap are discrimination in the workplace, job difference, and the industry difference. Previous research that has investigated the wage gap between males and females has shown the impact of some individual observable characteristics in the explanation of gender wage or earning gap. Among others, gender differences in educational attainment (O'Neill and Polachek (1993); Blau and Kahn (1997); Brown and Corcoran (1997); Delaney et al. (2010)), and in character traits including personality, risk preferences and social preferences (Nyhus and Pons (2005); Mueller and Plug (2006); Semykina and Linz (2007); Croson and Gneezy (2009); Borghans et al. (2009)) have been found to impact the gender pay gap.

In their research published in 2007, Semykina and Linz (2007) proved that, in addition to the age, the education level and position occupied by agents in the firm, the personal traits of the agents, including their personal beliefs (beliefs that events in life are either the result of personal control and effort), affect gender wage inequalities. For example, when the score that capture the fact that life events are a result of personal control and effort increases by one unit compared to the sample average, women's wages increases by 6.4%. In the meantime, the effect observed for males is smaller: 4.6%. Similarly, Boll and Lagemann (2018) used data from EU countries to provide evidence that education, work hours, and the type of contract that agents have with companies (temporary vs. permanent contract) contribute to gender differences in earnings. In addition to that, the authors identified the size of the firms in which women work as one of the determinants of gender income inequality. Fortin and Lemieux (2016) studied occupations' effect on the change in the wage structure. One of their key findings is that a task that is linked to technological change and offshoring can explain most of the variation in specific wage percentile. They found that some jobs tend to display a decline in task prices. These results are in line with the work carried out by Acemoglu et al. (2015) on the same issue. In their paper entitled "Robots

And Jobs: Evidence From Us Labor Markets", they studied the effect of technology use on the US labor market over the period 1990 to 2007. Analysis derived from the estimates indicate that the use of robot technology significantly reduces employment and worker wages. Specifically, the authors found that one additional robot per 1000 workers reduces the employment and wage ratio of workers by 0.2 and 0.42 percentage points respectively. A large body of literature has documented the link between income and immigration status. For example, Aydemir and Skuterud (2005) nd in Canada that, the earnings of immigrants who arrived in the 1990s is 30 percent less than Canadian-born workers earning. From Boudarbat and Lemieux (2014), along the wage distribution, there is heterogeneity in the decline of the relative wages of immigrants in Canada. They used unconditional quantile and standard OLS regressions to show that factors such as experience, education, and country of origin of immigrants explain both the changes in the mean wage gap and in the gap at different quantiles of the income distribution. The authors concluded that the wage gap changes much in the case of male compared to female workers. They also emphasized that most of the increase in the wage gap between immigrants and the Canadian-born happens at the lower end of the distribution. Despite the persistence of gender wage inequalities observed over the last decades, it should be noted that these gender wage gaps have decreased over the time while other forms of inequality (household income for example) have either increased or remained stable Pelletier et al. (2019).

In addition to examining gender wage inequality, the literature has also addressed the determinants of gender income inequality. For example, Fortin et al. (2017) not only investigated Canadian patterns in income inequality but they also investigated the top 1% income group and underlined the role of the gender wage gap in income inequality, especially in terms of differences in income distribution between men and women. Governments in many countries including in Canada have implemented many policies in order to reinforce

female participation in the labour market, and to reduce the wage gap between males and females for the same job which require equal skills.

The change in the gender wage gap would have been impacted by those wage and labour market participation equalization policies. For example in Canada, among the policies that aim to reduce the gender income gap, we can mention policies improving female participation in the labour market (maternity leave, child daycare support, etc.), pay for work involving equal skills and effort, responsibility, and working conditions. A number of such studies provide evidence of the positive impact of these policies on the gender income gap (Fortin et al. (2012); Fortin (2019a)). In addition, another stream of literature addressing these issues has shown that these policies could lead to perverse effects on gender inequalities. For example, (Bailey et al. (2019)) showed that California's 2004 Paid Family Leave Act (PFLA) on women's careers program reduces the employment and annual income of new mothers after childbirth. Although these policies tend to reduce the earning gap between male and female, there is more to be done. Even though, many gap-reducing policies used in Canada have resulted in a shrinking gender pay gap signicant improvements are still needed. Females are more likely to work in unpaid work and to deal with invisible barriers in the labour market. Empirically, it was shown that males and females differed in the investment choice and behavior (Hinz et al. (1997); Bajtelsmit and VanDerhei (1997); Sunden and Surette (1998); Jianakoplos and Bernasek (1998); Finucane et al. (2000); Bernasek and Shwiff (2001); Charness and Gneezy (2007). From these findings, there is strong correlation between gender and portfolio risk profile. Females favor lower risk than males in terms of investment. Charness and Gneezy (2007) provided strong evidence of the differences in the risk-taking process between males and females. Using an experimental approach, the authors found strong evidence of the fact that females are more risk-averse and invest less than males.

Inequality at the individual level is mostly investigated in terms of the difference in wages or earning gap according to the following groups: gender, recent immigrant and non-immigrant, indigenous and non-indigenous people. From their findings, there is signi-cant growth in the real wage, and this increases more at the bottom than at the top of the income distribution. Also, some of the studies investigated the difference in inequality by geographic area in Canada. Bolton and Breau (2012) examined income inequality among income earners within each of Canada's Census Metropolitan Areas (CMA). The authors found that larger cities have greater unequal distribution of employment income than do smaller cities where unemployment rates are higher. Since the mid-1990s, the increase of the participation of female to labour force has been found to reduce inequality. However, during that period, the factors that explain the best rising in earnings inequality in Canadian cities are de-industrialization, immigration, and the aging population. There is research focused on the decomposition of inequality and gender, and these studies can be classified into two different groups. The most important group covers numbers of studies that investigate the income gap between males and females and the factors that impact the improvement observed in the gap in the recent years, especially in most of the developed countries. This group of research focused on between gender income inequality. Several studies, such as Goldin (2014) highlight the difficulties females to simultaneously manage professional and family life. That is one of the reasons why female are less represented among high income people. Fortin et al. (2017) show that the under-representation of females in the top income group leads to slow the progress in the gender pay ratio in the case where the top income group experiences increase in inequality. The author show that glass ceiling effect seems to be increasing only for females in the top 0.1%. A glass ceiling is a metaphor that referred to an invisible barrier in a labour market, above which it is difcult for women to be promoted or to get a better salary or further opportunities.

Fortin et al. (2012) documented that, in Canada, there is a decline in the wage disparity between males and females. This decline explains why inequality within males and females has increased more than inequality for the whole population. They show that unions status in the labour market raises female wages more than male wages even if the way that union raises the wage by gender is almost constant along the income distribution.

Several studies have also investigated the direct effect of unionization on income inequality (Card et al. (2004); Fortin et al. (2012)). For example, Card et al. (2004) provide the evidence of the effect of a decline in unionization on the rise of inequality in Canada during the 1980s and 1990s. Mussida and Picchio (2014) show that the gender wage gap affects less educated women and this nding supports the presence of a sticky floor, which is the evidence of discrimination in the job market that keeps females at the bottom of the job scale. Arulampalam et al. (2007) provide evidence of the gender wage gap in eleven Europe countries from 1994 to 2001. They find a glass ceiling effect with a prevalence of female characteristics, particularly at the top of the wage distribution. Most of the studies find evidence of gender wage gap mostly at the lower quantiles and top quantiles. Furno (2016) use data from Italy and investigate wage differential between genders by quantile. They apply Oaxaca decomposition, and decompose gender and regional wage differences across quantile into covariate and coefficient effects at various quantiles and come to the conclusion that gender and region are the main causes of inequality. Theirs research shows that there is evidence of gender and regional composition effects which can be interpreted to be a glass ceiling. This effect decreases across quantiles. Furthermore, there is decrease of the unexplained wage difference across quantiles due to gender and region (greater at lower wages) which suggests a sticky floor effect.

The second group of research on gender and income inequality paid attention on income dynamics or income change (Brewer et al. (2009); Brewer and Wren-Lewis (2016)).

In fact, there are growing interest in the change in income and the factors that account for changes in income distribution and income inequality over time (Piketty (2014); Piketty (2014); Gabaix et al. (2016); Alvaredo et al. (2017)). Among others, increased in wage dispersion caused by technology change, redistribution policies, and changes in population structure have been found to impact income inequality. Furthermore, the change in household profile toward the bottom to the top of the income groups contribute to equalize income distribution. Brewer et al. (2009) use Britain income data and investigate the change in earning inequality by decomposing inequality by income source, by population subgroup, and by factor with regression-based decomposition. Income used is income measured after taxes and benefits. They found divergence in the dynamics of the different measures of earning inequality used, such as the Gini coefficient, the mean log deviation, and the 90/10 ratio over the study period. The results show that changes in within-group inequality are the components which contribute more to overall inequality changes than changes between groups. Khanna et al. (2016) investigate the change in real earnings of rural India between 2004/05 and 2011/12. They show that the change in workers characteristics had an increasing effect on inequality. Using RIF de composition, they show that along the earnings distribution, both the composition effect and the structure effect increased earnings, except at the top of the distribution. From the findings, the impact of the change in structure effect on the change in inequality is greater than the impact of the change in the composition effect. More specifically, while both the composition effect (due to the changes in the distribution of covariates) and the structure effect (due to the changes in returns to characteristics/covariates) increase wages, the impact of the change in the structure effect is more substantial in increasing wages than the impact of the change in the composition effect. The increase in inequality was attributable to increase in the education levels, while the decline in inequality is linked to the fact that lower quantiles

workers experienced higher improvements in returns to their characteristics than the top quantiles workers.

Hoover and Yaya (2010) examine the relationship between inequality and growth by gender within immigrant groups in the United States. From their findings for females, there is an inverted 'U 'relationship between inequality and growth whereas the opposite is observed for males. This observed difference by gender is mainly linked to the difference in the participation in the labour market, while considering the two groups. They also find that inequality is higher within new immigrants compared to other immigrants. During the study period, they found that inequality is higher within female immigrants compared to male immigrants. Recent research on inequality that used Canadian data has more insight on the analysis of the change in the earnings inequality in Canada (Green and Sand (2015); Fortin and Lemieux (2015); Veall (2012)). For instance, Fortin and Lemieux (2015) studied the difference in the change in earning by province and the economic factors that influenced the observed patterns. The authors provided an analysis on the wage change at each ventil of the wage distribution by gender from 2000 to 2010 using the Canada labour force survey. From their analysis, the change in log wage was higher for females than males during the period of 2000 to 2010. At all percentiles, women experienced increase in wage than men during the study period, and this reflects the decline in the gender wage gap. For each gender, the wage at the top end increased gradually between 2000 and 2005 and more modestly between 2005 and 2010. In Canada, less has been done on income mobility, and the little research that has been done on this subject does not provide evidence of gender differences in income mobility.

Despite the contribution of the literature over the recent years on issues related to gender inequality, most of the research on inequality have mainly investigated inequality trends, inequality at the household level, and in the top income group. The literature has focused

more on wage inequality (which excludes people with non-wage incomes), whereas research of income inequality could reveal some evidence that could help to improve policies that also affect people with non-wage incomes. Most of the work on income inequality has focused either on the determinants of income inequality or on the determinants of income inequality between gender without paying particular attention to income inequalities within gender, where inequalities are much more pronounced Cowell and Fiorio (2011). This gap, observed in the empirical literature, is even more glaring in Canada, where, to the best of our knowledge, our study is one of the first to look at the determinants of inequalities within gender while showing the dynamics of inequalities by gender and by year.

2.3 Inequality within Gender

2.3.1 Data Sources and Variables

This study analyses the dynamics of annual pre-tax income inequality by gender using three data sources. It covers the period from 1991 to 2015 and is based on data from Canada's census individual files data (1991, 1996, 2001, 2006, 2016), personal files from the Survey of Labour and Income Dynamics (SLID, 2008 , 2009, 2010, 2011) and Canadian Income Survey (CIS, 2012, 2013, 2014, 2015) .

The first data source is from individual files in Canada census (1991, 1996, 2001, 2006 and 2016). In fact, Census data has the best information on income for the analysis of income inequality (Foley and Green (2017), Boudarbat et al. (2006)). It is the most representative cross-sectional data on Canada's population and provides information on annual income and socio-economic characteristics of Canadian residents and households. However, there are drawbacks in Canada's census for the analysis of individual annual income inequality. First, only Canada's census of 1991, 1996, 2001, 2006 and 2016 have individual

files while considering the study period. Second, in 2006, substantial changes were made in the way that the information on income was collected. In 2006, it was possible to collect information from individuals or census family tax forms with the consent of individual or household. This collection approach affects income inequality measures as mentioned in Brochu et al. (2014) research on inequality using Canada census.

In order to capture income inequality by gender in Canada in recent years, two national surveys that contain individual annual income and some observable characteristics such as age, education, and labour market participation were used.

The second data source used in this study is the personal files of the Survey of Labour and Income Dynamics (SLID, 2008, 2009, 2010, and 2011). SLID is used since it contains almost the same variables as in the individual files of Canada Census. However, SLID has the advantage of providing information on labour market participation. In addition to individual characteristics observed in the census, SLID provides information on job positions (Manager, nurse, etc.), the sectors of activity in the labour market (Private or public sector), and whether individuals work in a sector that is unionized and has a collective agreement. This is one advantage of SLID compared to Canada Census. One drawback of SLID is that the last version of its individual files is from 2011. Starting from 2012, the annual Canadian Income Survey was launched and is the third data source used in this study with the versions from 2012 to 2015.

The use of three data sources in this study is also justified for three other reasons. The first reason is that it helps to capture the dynamics of income inequality by gender over a long period from 1991 to 2016. The second reason is that, in line with the objective of this paper, it provides robustness check and sensitivity analysis of the factors that drive income inequality by gender while using different years and data sources to investigate their impact on income inequality by gender. The last reason is that, since this study explores

the composition and structure effects of the change / dynamics of income inequality by gender, the use of different data sources provides data sensitivity analysis, omitted variable sensitivity analysis and year robustness check on the results.

All three data sources contain individual annual pre-tax income (i.e. individual income before taxes or market income) as well as some observable characteristics including, education level, age, province of residence, immigration status, marital status, and household size. Moreover, for work status, the observable variable in the census is the average weekly work hours, whereas in SLID and CIS it is the total annual work hours. In addition to these variables, SLID and CIS contains individual job positions. Also, SLID has the advantage of two additional aspects on individual job profiles: unionization status and sectors of activity (Public and private sector). In the census, it is also possible to observe individual race in the 1996 and 2001 versions.

As part of the study, and as we mention in the introduction, a restriction has been made on the databases. Following many other studies (eg. Fortin (2019b)), and as we mentioned in the introduction, only individuals between the ages of 25 and 64 are considered in the analysis. In order to make the income value comparable from 1991 to 2016, all income values have been converted into the year 2015 consumer price index from the Conference Board of Canada e-data source downloaded in January 2018.

The tables 2.1 and 2.3 in the appendix present respectively females' characteristics descriptive statistics and frequency table from Canada's census data (1991, 1996, 2001, 2006, 2016). In the same vein, the tables 2.2 and 2.5 present respectively males' characteristics descriptive statistics and frequency table from the census data (1991, 1996, 2001, 2006, 2016).

2.3.2 The Dynamics of Income Inequality by Gender

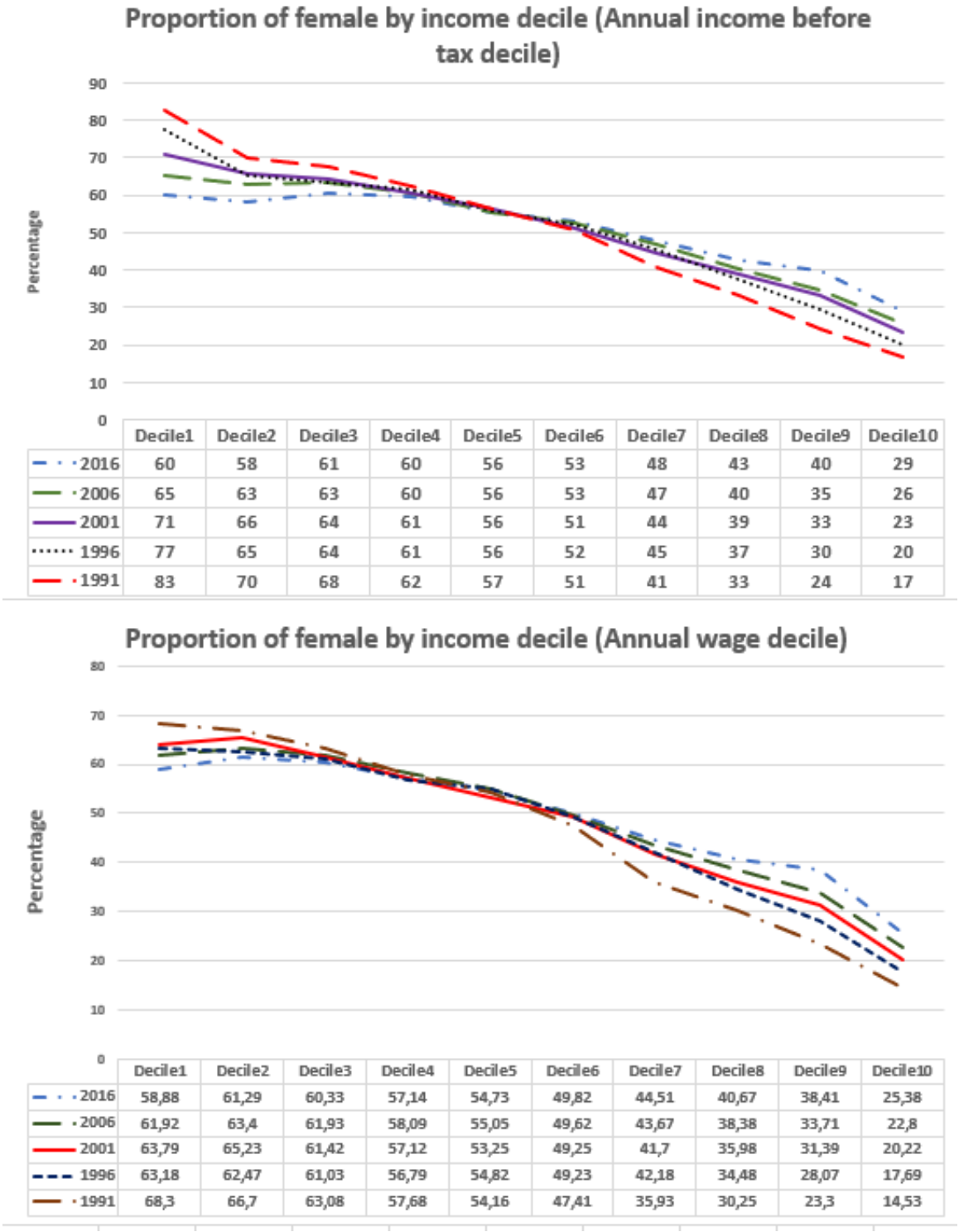
I used the total income before taxes and this is from the three databases. This total income includes investment income, self-employment income, and also unemployment insurance benefits. Furthermore, it should be noted that pensioners are not included in the analysis due to the drastic drop in their income. Annual pre-tax income is used to compute some inequality measures retained in this study. This income includes investment income, self-employment income, and also unemployment insurance benefits. As measures of inequality, this study uses Theil and Gini indexes of inequality, income variance, income share hold by income groups from the bottom to the top of the income distribution and the interquantile differences such as D90-10, D90-50, D50-10, D99-90 etc.[5] For instance the interquantile difference D90-10 stands for the difference between decile 90 and decile 10. Income variance, Gini, and Theil indexes provide overall inequality without details on the way that it behaves between income group along the income distribution. However, the interquantile differences have the advantage of providing more information on inequality between income groups across the income distribution. However, it should be noted that pensioners are not included in the analysis due to the drastic drop in their income.

Table 2.7, displays Theil index by income decile within males, females, and all the population. It also presents inequality by income decile by gender during the study period. Before 2001, inequality was higher within females than within male. Since 2001, income inequality is higher within males than within females. A big jump in inequality can be observed from 2001 to 2006 within both genders, whereas the Theil and the Gini indexes are almost stable after 2006. In 2006 there is high peak in inequality measures which is probably due to the change in the way that income data was collected during the 2006 Census (Brochu et al. (2014)). From 1991 to 2006, there is an increased in within gender

[5]Referred to Litchfield (1999) for the conceptual definition of Gini and Theil indexes

income inequality. Between 2009 and 2011, within gender income inequality decreased slightly. From 2013 to 2015, income inequality increases within males, while it decreases within females. Figure 2.7 depicts all inequality measures used in this study by gender during the study period. It is important to mention that in order to facilitate comparison between years, we have adjusted for inflation by converting the income values for each year (1991 to 2016) to the 2015 years consumer price index from the Conference Board of Canada e-data source downloaded in January 2018.

By analyzing inequality within gender by income decile, results show that for both males and females, inequality is higher for the first decile followed by decile 10 and decile 2. Inequality in the other income group is stable and is negligible. Tables 2.8 and 2.9 display other income inequality measures for males and females respectively.



	Decile1	Decile2	Decile3	Decile4	Decile5	Decile6	Decile7	Decile8	Decile9	Decile10
2016	60	58	61	60	56	53	48	43	40	29
2006	65	63	63	60	56	53	47	40	35	26
2001	71	66	64	61	56	51	44	39	33	23
1996	77	65	64	61	56	52	45	37	30	20
1991	83	70	68	62	57	51	41	33	24	17

	Decile1	Decile2	Decile3	Decile4	Decile5	Decile6	Decile7	Decile8	Decile9	Decile10
2016	58,88	61,29	60,33	57,14	54,73	49,82	44,51	40,67	38,41	25,38
2006	61,92	63,4	61,93	58,09	55,05	49,62	43,67	38,38	33,71	22,8
2001	63,79	65,23	61,42	57,12	53,25	49,25	41,7	35,98	31,39	20,22
1996	63,18	62,47	61,03	56,79	54,82	49,23	42,18	34,48	28,07	17,69
1991	68,3	66,7	63,08	57,68	54,16	47,41	35,93	30,25	23,3	14,53

Figure 2.1: Proportion of Females by Annual Pre-tax Income Decile and Annual Wage decile (Census data)

Figure 2.1 displays the dynamics of the proportion of females by annual pre-tax income

decile and annual wage decile. It shows that females are highly represented at the bottom of the income distribution and less represented at the top of the income distribution. This is in line with the glass ceiling phenomenon found in the empirical literature on the gender income gap (Pena-Boquete et al. (2010)). Therefore, females contribute to inequality more at the bottom of the income distribution, while males contribute more to inequality at the top of the income distribution. The graph also shows that the proportion of females at the bottom of the income distribution decreases over time, whereas it increases at the top of the income distribution during the study period. This finding is consistent with the literature on the representation of females in the top income group in Canada (Fortin (2019b)). While analyzing the representation of gender by income group from the bottom to the top of the income distribution, females represent more than 50% of the first five deciles of the income distribution, and males represent more than 50% of the five top income deciles. The proportion of females in the bottom 20% income group is higher than 65% of the total population and has a decreasing trend over the sample period whereas, the proportion of females in the top income groups rises during the same period. This describes gender mobility along the income distribution over time. It shows that even if females are less represented at the top of the income distribution and more represented at the bottom of the income distribution, females mobility from the bottom to the top of the income distribution is significant during the study period. This is in line with some findings from previous literature (Fortin (2019b)).

When considering other inequality measures such as the Gini index, income variance, and annual income interquantile differences, one can notice the differences in inequality by gender and the dynamics along the income distribution. During the study period, interquantile differences are higher within males than females. For both genders, considering all the interquantile differences, the D99-75 is the highest one, followed by D90-10. This

shows that, for both genders, inequality between the top 25% income group is higher than inequality in the bottom 90% income group. Table 2.8 presents income percentile and inequality measures for females from 1991 to 2001, while table 2.9 presents the correspondent measures of inequality for males. Figure 2.8 displays income share hold by income group by gender. Within both males and females, the income share hold by the top 30% income group is higher than 76% of the total income of each group. Income share hold by the top 30% income group in the case of females is higher than the income share hold by the same income group in the case of males. Within females, the income shares hold by the top 30% income group decreases from 83% in 1991 to 79% in 2008 and become somehow stable. Within males, it increases from 77% in 1991 to 81% in 2006, then decreases and become almost stable until 2014, and then increases slightly in 2015 to 78%.

2.4 Gender Difference in the Determinants of Income Inequality

2.4.1 Unconditional Quantile Regression-Methodology and Results

Unconditional quantile regression based on the Re-centered Influence Function (RIF) is used to assess inequality over the income distribution (Firpo et al. (2009), Firpo et al. (2018), Töpfer (2017)). The empirical results from the unconditional quantile regression based on RIF provide evidence of the differences in the returns to observable characteristics on income at different levels of the income distribution by gender.

Recentered Influence Function (RIF)-Regression Model: Methodology

Let define Y as individual income and X as explanatory variables which are individual observable characteristics. We are interested in the change in the τth quantile denoted q_τ of the unconditional distribution $F_Y(y)$ of Y. Let define F as a class of distribution functions of Y. The Influence Function (IF) studies how a change in the distribution of covariates affects distributional statistics (F). It provides the direct effect of the changes in the proportion of X on q_τ. The following equation is the q_τ influence function $IF(Y, q_\tau, F_y)$:

$$IF(Y, q_\tau, F_y) = \frac{\tau - 1\{y \leq q_\tau\}}{f_Y(q_\tau)} \tag{2.1}$$

$f_Y(q_\tau)$ is the density at the quantile estimated by Kernel density estimator, and $1\{y \leq q_\tau\}$ is a variable which indicate whether the observation value lies under or above the quantile q_τ.

One of the property of the influence function is that:

$$E[IF(Y, q_\tau, F_y)] = 0 \tag{2.2}$$

Based on the influence function (IF) and its property, the Recentered Influence Function (RIF)-regression model has been developed by Firpo et al. (2009) in order to evaluate the marginal impact of the changes in the distribution of the covariates on the quantiles of the marginal distribution of the dependent variable (Y). RIF function is given by equations below:

$$RIF(Y, q_\tau, F_y) = q_\tau + IF(Y, q_\tau, F_y) \tag{2.3}$$

$$RIF(Y, q_\tau, F_y) = q_\tau + \frac{\tau - 1\{y \leq q_\tau\}}{f_Y(q_\tau)} \tag{2.4}$$

After the estimation of the density of Y ($f_Y(q_\tau)$) using the Kernel density estimator, $\hat{q_\tau}$ of the τth quantile of the unconditional distribution of Y is estimate as well as the RIF of each quantile of order τ.

Once the RIF function of each quantile of order τ is estimated based on Y distribution, we adopt an ordinary least square (OLS) regression model for the recentered influence function. We regress RIF estimate of each q_τ on the set of explanatory variables X as specified in the following equation. Empirically, X refers to the individual observable characteristics.

$$RIF^q = X\beta + \epsilon \tag{2.5}$$

where ϵ is the error term, identically distributed with a 0 mean. $\hat{\beta}$ is the estimated vector of the coefficients, and

$$E[RIF(Y, q_\tau, F_y)] = X\hat{\beta} \tag{2.6}$$

RIF-Regression Model: Empirical Results

In this study, the unconditional quantile regression based on the Re-entered Influence Function (RIF) is used to assess inequality over the income distribution by gender. The RIF-OLS estimated coefficients of the log of annual pre-tax income deciles. The coefficients of the regression referred to the impact of changes in the distribution of individual observable characteristics on quantiles of the unconditional distribution of annual pre-tax income. It captures the marginal effect of a change in the covariate distribution on the unconditional quantile of log of annual pre-tax income by gender. The empirical results from the unconditional quantile regression based on RIF provide evidence of the effect of the difference in the returns to observable characteristics at a different level of the income distribution by

gender. The general finding by gender is consistent over time even if the magnitude varies by year, this to account for income and inequality dynamics over time. The results are also consistent when different data sources are used in the analysis.

Tables 2.10 and 2.14 report the RIF-regression estimates using census data in 2016 for females and males respectively. For testing and sensitivity analysis purposes, we perform RIF regression on annual wage of males and females using 2016 census data. The tables 2.11 and 2.15 report the estimation of RIF regression on annual wage respectively for females and males. Age has a significant effect on income at each level of the income distribution with evidence of non-linearity. The effect of age on inequality is higher for males compared to females across quantiles. For the first two deciles, the effect is negative on the male income, whereas it is negative on the female income for the first three deciles. Overall, the effect of age on quantiles for both males and females increases from the bottom to the top of the income distribution.

In the 2006 and 2016 census, the variable education is not continuous and is a categorical variable. Considering 'Education with secondary school degree 'as a reference in the estimates, for all other levels of education lower than a bachelor's degree, the return to education is positive and present an inverted U-shape curve from the bottom to the top of the income distribution for both males and females. For those levels of education, the return on education is higher for males compared to females. The return to education for both genders with more than a bachelor's degree (except for those who earn degrees in medicine), follows two opposite V-shape curves with a lower return at the bottom of the income distribution and the highest return at the top of the income distribution. In contrast, the return to education for those who hold degrees in medicine increases with quantiles from the bottom to the top of the income distribution for both males and females. Marital status in 2006 and 2016 census is a categorical variable. Overall, marital status has a sig-

nificant effect on income at all levels of the income distribution except 'separated 'marital status which has a significant effect only on deciles 2, 4, 5, 8 of male's income and for deciles 1, 2, 5, 6, 7, 8 of female's income. 'Separated'marital status has positive effect on males income whereas the effect on females income is positive starting from the decile 5. 'Legally married 'marital status has a negative effect on female income at all levels of the income distribution, whereas its effect is positive on male's income at all levels of the income distribution. Never legally married marital status has a negative impact on both male's and female's income at all levels of the income distribution and the effect is higher on male's income compared to female. 'Widowed'marital status effect on income is positive at each quantile for both genders. The effect decreases from the bottom to the top for males and displays two opposite V-shape curves in the case of female's income.

For both males and females, average weekly work hours and not belonging to a visible minority have a significant positive effect by quantile, and the effect decreases from the bottom to the top of the income distribution. All citizenship status over than Canadian born has a negative effect at all level of the income distribution in both gender's income. Household size has a significant negative effect on female income, whereas the effect is negative only for the first five deciles of male's income. The effects have different pattern across quantiles and is in line with the findings from Ndoye (2015)).

Tables 2.12 and 2.16 report the RIF-regression estimates using 2011 SLID for females and males respectively whereas tables 2.13 and 2.17 display the RIF-regression from 2015 Canadian Income Survey for females and males respectively. Education and Marital status are categorical variables and have the same modalities in both SLID and CIS. Age and annual hours work are continuous variables in both CIS and SLID. Education is a continuous variable in SLID and categorical variable in CIS. Other differences between the RIF estimate from SLID 2011 and RIF estimate from CIS 2015 is that SLID estimates control

for two additional work profiles: unionization status and the sector of activity (Private and public sector).

From estimate that used SLID, in line with the findings from Ndoye (2015), age has a significant effect on income at each level of income distribution with the evidence of non-linearity. For most of the quantile, the effect of age on inequality is higher for males compared to females, and this is consistent with the results from the 2016 Census. For the first two deciles, the effect is negative one male's income whereas it is negative on female's income for the first three deciles. Overall, the effect of age on income for both males and females is increasing from the bottom to the top of the income distribution. In line with finding from the unconditional quantile regression using SLID and Census, with CIS 2015, age has a significant effect on income at each level of the income distribution, except at the first quantile with the evidence of non-linearity. Based on RIF estimated with 2015 version of CIS, from decile 2 to decile 5, the effect of age on income is higher for males compared to females but starting from decile 6; the effect is higher for females.

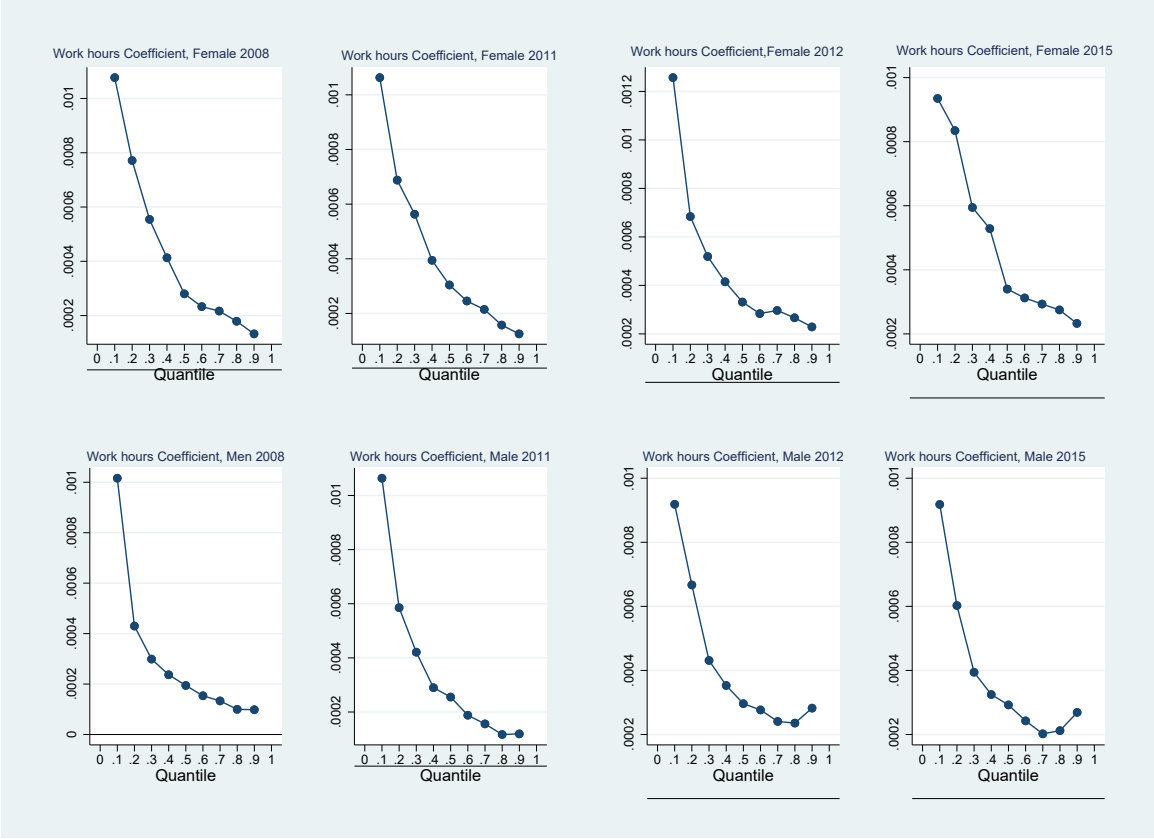


Figure 2.2: Annual Work Hours Coefficient from RIF Estimate, SLID (2008 2011) and CIS (2012 2015)

Figure 2.2 depicts annual work hour effect on quantile from the unconditional quantile regression using CIS (2012,2015) and SLID (2008, 2011) for both males and females. Even if RIF estimate from SLID has the advantage of controlling for the sector of activity and unionization status of the work type, one can conclude that annual work hour effect has the same pattern across quantile for both males and females. As in the case of RIF results from 2016 Census, the annual work hours has a positive effect on each quantile and the effect decrease over the income distribution for both genders even while comparing estimate from the same data source (SLID or CIS) in two different years (2015 and 2012 for CIS, and 2008 and 2011 for SLID). While comparing the effect of annual work hours on males incomes from the same data source in two different years, one can conclude that the effect changes

by quantile and capture indeed the change in annual work hours distribution from one year to another year and the change in income distribution by gender in two different periods. Considering the female income, the effect of annual work hours by quantile along the income distribution follows the same pattern in 2008, 2011 and 2015 even if the magnitude differs by quantile and by year due to the change in the covariate distribution, and in the income distribution. For those three years, for female income, the effect of being single on quantile is negative and decrease in absolute value from the bottom to the top of the income distribution. However, for females in 2012, the effect of being single on quantile has opposite pattern even if it still negative and increase in absolute value from the bottom to the top income group.

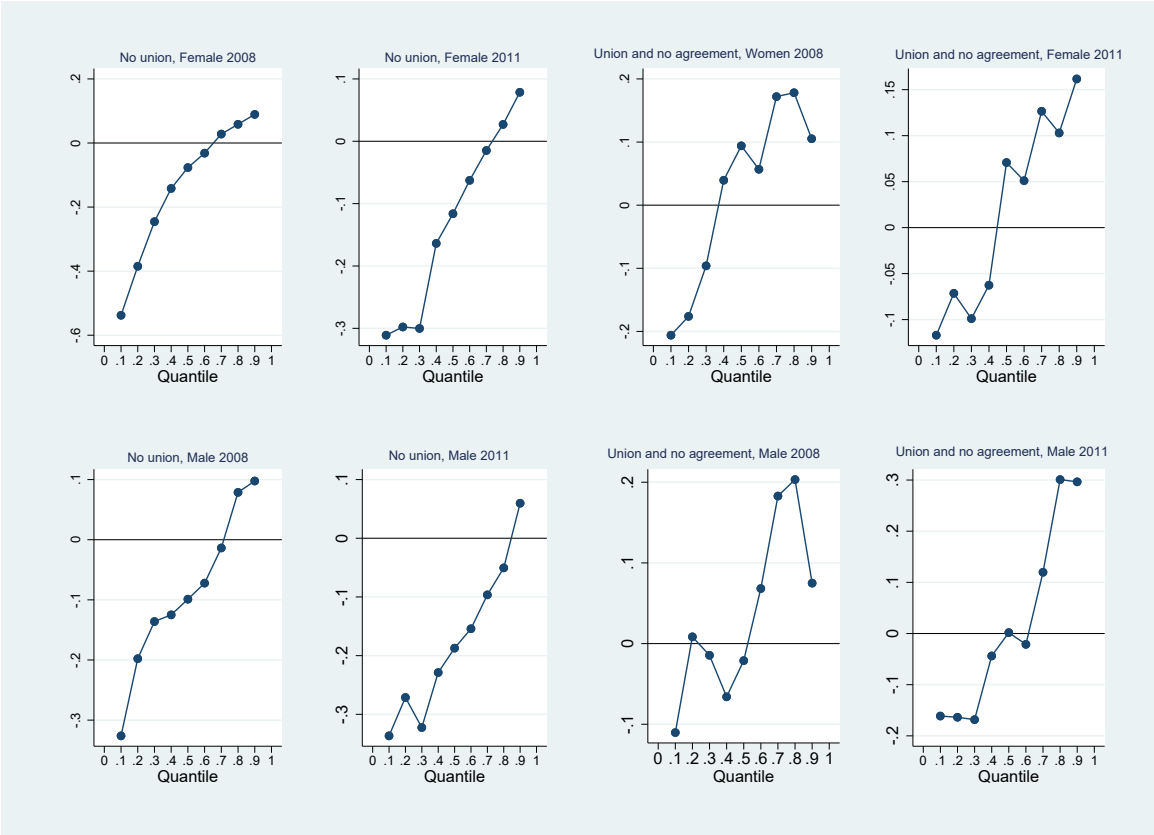


Figure 2.3: Union Membership Coefficients from RIF Estimate, SLID (2008 2011)

In RIF estimate from SLID 2008 and 2011, unionization status is categorical variable,

and the reference variable in the estimate is the presence of union and agreement. From the estimate, the union and no agreement status has a significant effect only on one quantile for female income, and the effect is significant for deciles 2, 3, 7, 8 and 9 on males income. These effects are negatives for the bottom income groups and positives for the top income groups. However, no union and non-agreement status have a significant effect on all quantiles from the bottom to the top of both male's and female's incomes, as depicted in figure 2.3. The effect is higher for males compared to females and is different from one period to another for both females and males. The effect is negative for the bottom income groups and positive for the top income groups for both males and females.

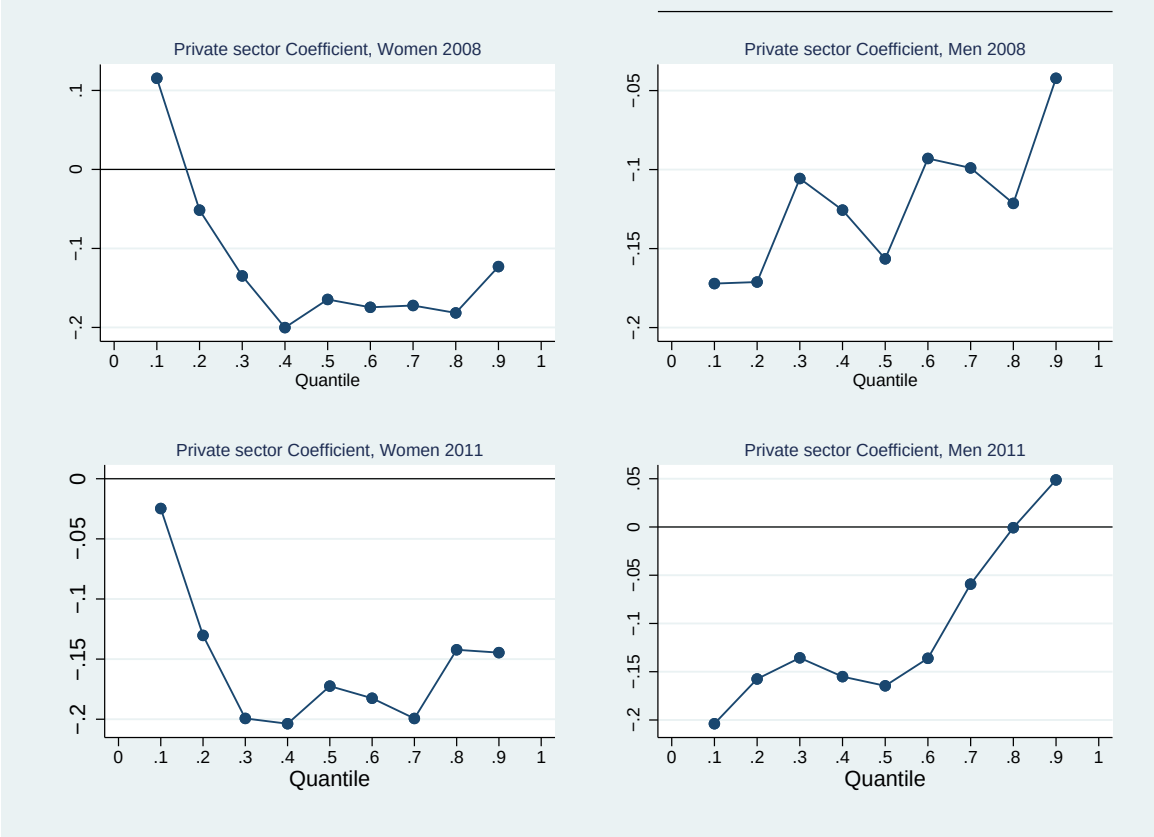


Figure 2.4: Private Sector Coefficients from RIF Estimate, SLID (2008 2011)

Considering the sector of activity in RIF estimate with SLID 2008 and 2011, working in private sector have significant and negative effect on quantile along the income distribu-

tion for both males and females (Figure 2.4). Nevertheless, the effect has v shape with low absolute value at the bottom and higher absolute value at the top income group for females. The effect decreases in absolute value from the bottom to the top of male's income distribution. There is difference in the effect of the sector of activity by quantile for both males and females while considering two different years.

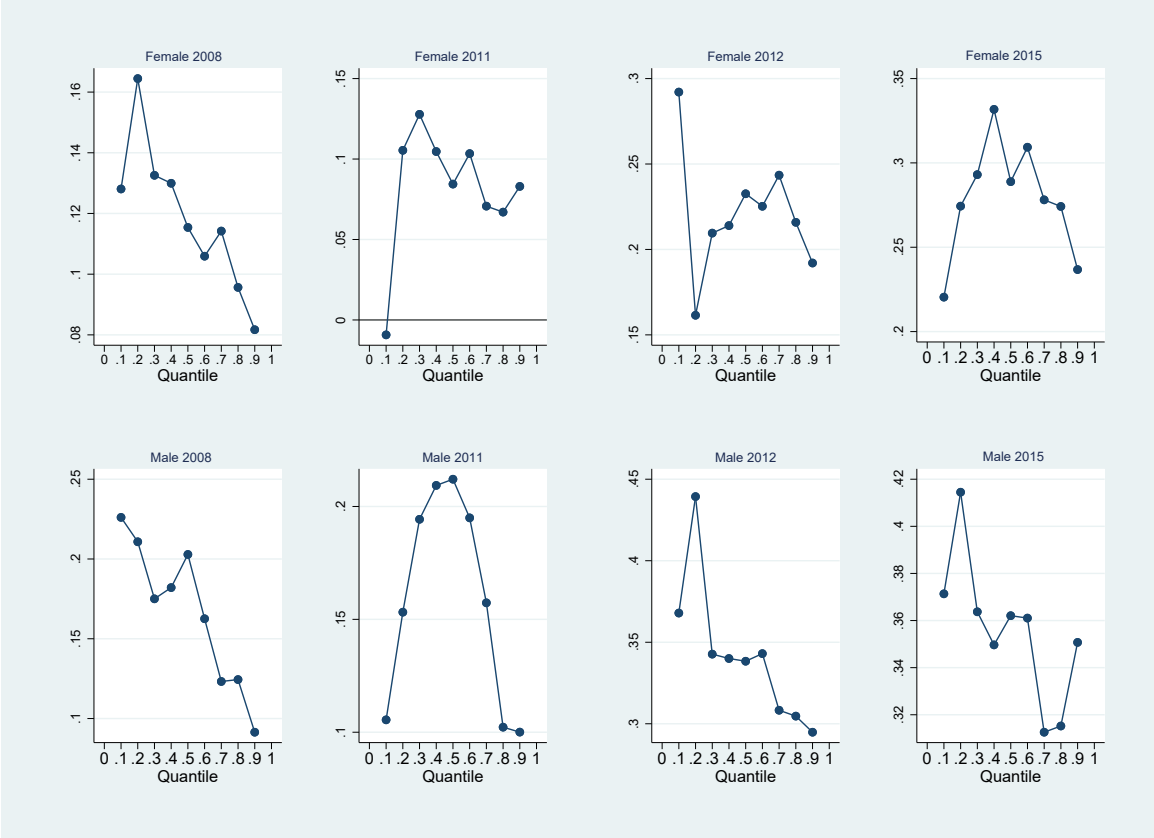


Figure 2.5: Non Immigrant Status Coefficients from RIF Estimate, SLID (2008 2011) and CIS (2012 2015)

Figure 2.5 presents immigration status effect on quantile by gender for four years (2008, 2011, 2012, 2015). Being non-immigrant has a positive and significant effect on quantile by gender for all years along the income distribution. The effect on male's income quantile follows almost the same pattern while comparing results using CIS 2012 and CIS 2015, but for the same data source and years, the pattern of the effect on female's quantile are

different. There are big difference in the pattern of the effect on quantiles for both males and female while considering estimates from 2008 and 2011 versions of SLID.

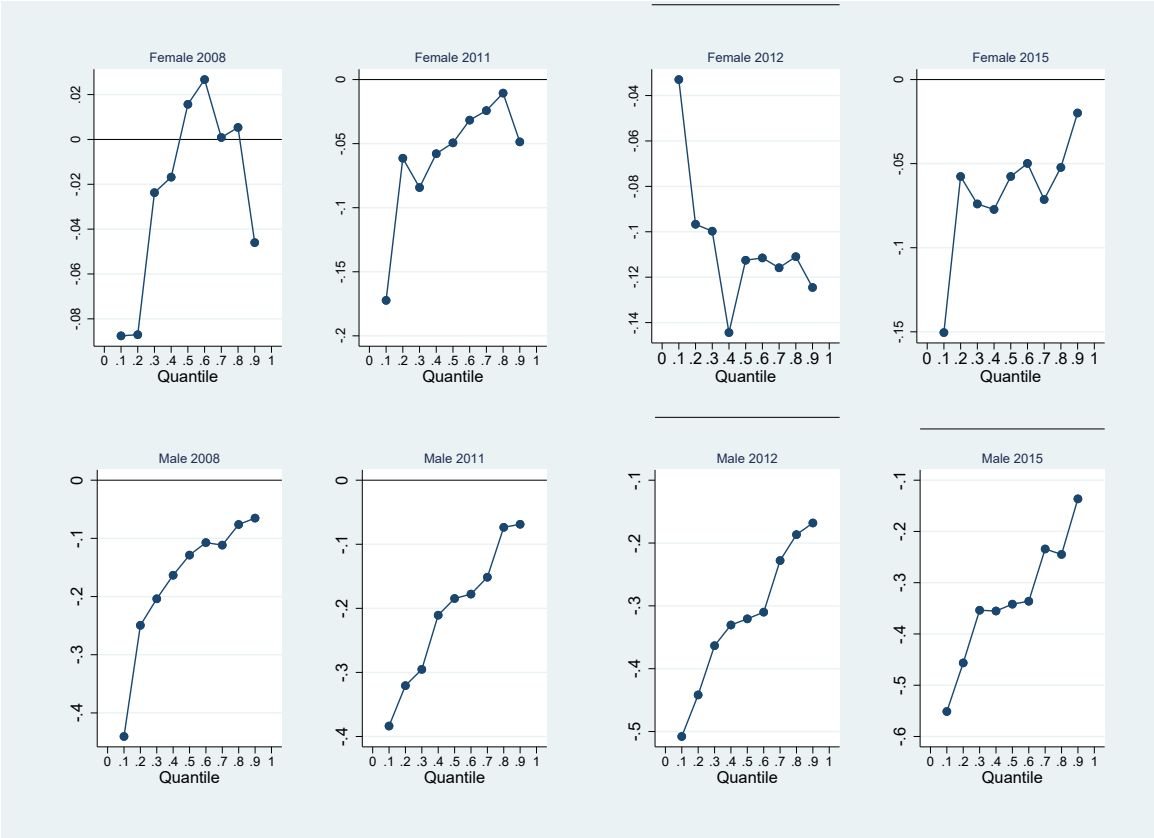


Figure 2.6: Single Marital Status Coefficients from RIF Estimate, SLID (2008 2011) and CIS (2012 2015)

When considering marital status in RIF estimate from both SLID and CIS, most of the marginal effects are not significant for males and females. Single marital status is the only one modality for which the effects are significant across quantile for males and female in the different year by the data source (SLID and CIS). These results are displayed in figure 2.6, which present a single marital status coefficient from RIF using both SLID (2008 and 2011) and CIS (2012 and 2015) for males and females. From both SLID (2008 and 2011) and CIS (2012 and 2015) being single has negative effect by quantile and the effect increases in absolute value from the bottom to the top of the income distribution. The absolute value

of the effect is higher in 2011 than in 2008 for SLID data source and higher in 2015 than in 2012 for CIS.

2.4.2 Regression-Based Decomposition: Methodology and Results

Regression-Based Decomposition: Methodology

Regression-based inequality decomposition (RBD) approach (Cowell and Fiorio (2011)) is used to investigate the factors that drive income inequality within genders. This approach is used to analyze individual characteristics that contribute to annual pre-tax income inequality within males and females to see if there is differences in the determinants of income inequality by gender since both groups have experienced difference in their income distribution and inequality. The regression-based decomposition approach is applied on pre-tax annual income. The contribution of each factor to inequality within males and within females is computed and compared to see if there is any difference.

Extended by Morduch and Sicular (2002) and Fields (2003) from Shorrocks (1984) approach, regression-based inequality decomposition (RBD) method expressed income as a function of a vector of factors X which is the set of explanatory variables such as individual characteristics. The income function is expressed as following:

$$\ln Y = X\beta + \epsilon \tag{2.7}$$

where Y is income, β is a vector of coefficients associated to the vector of individual characteristics X and ϵ is the residuals.

Considering the estimated coefficients b, the share of inequality attributed to factor X_i is giving by:

$$S_i = b_i \frac{\sum_{j=1}^{N} a_j(y) X_{j,i}}{I(y)} \tag{2.8}$$

where N stands for the population size, I for inequality and a_j for the share of population total income earned by individual j.

In this paper, Y is the pre-tax annual income. The regression-based decomposition is applied to investigate the contribution of individual observable characteristics to Theil index by gender.[6].

Regression-Based Decomposition: Results

Tables 2.18, 2.19 and 2.20 display the results of regression-based decomposition of income inequality by gender using the Census (2001, 2006), SLID (2008, 2011) and CIS (2012, 2015) data sources respectively.

Table 2.18 presents inequality decomposition by gender using the census for two different years (2001, 2006). This table compares the results of the regression-based decomposition of income inequality by gender using two different years (2001, 2006) and the same individual characteristics to provide robustness checks of the results by the data source (Census). In tables 2.19 and 2.20, one can see the same analysis of inequality. The main difference is that table 2.19 uses data from SLID (2008, 2011) and table 2.20 presents inequality decomposition by gender using CIS (2012 and 2015). The comparison of the results of the three tables by gender provides the sensitivity analysis of the results considering data sources and the effect of omitted variables.

The results from the same data source in two different periods and the same individual

[6]Regression-based decomposition of inequality is computed by using the stata package ineqrbd developed by Fiorio and Jenkins (2021), Cowell and Fiorio (2011)

characteristics show that the proportion of inequality (Theil index) explained by individual characteristics varies by year and is different for females and males.

Considering the decomposition using Census data from 2001 (Refers to table 2.18), individual characteristics explained only 25% of inequality within females and 22% of inequality within males in 2001. For the 2006 Census, individual characteristics explained 15% of inequality within females and 13% of inequality within males. The results show that individual characteristics contributed more to explaining inequality within females than within males. However, in terms of ranking, factors that have been identified as having the most impact on individual income inequality are the same for males and females. Work status (Average weekly work hours) has a higher effect on inequality among females than among males. Next, come the level of education, marital status, citizenship status, and visible minority status on the list of the factors that drive inequality among both males and females. Marital status contributes more to inequality within males compared to the inequality within females. However, the contribution of marital status to inequality was higher in 2001 than in 2006 for both genders. Citizenship status contributes more to inequality within males compare with the inequality within females even if the contribution was higher in 2001 than in 2006 for both males and females. As compared to income inequality among females, visible minority status has more effect on inequality among male even if the effect was higher in 2001 than in 2006 for both males and females. Finally, household size had a negative effect on inequality within males in 2001 and 2006, while it reduced income inequality among females in 2006 and had a positive contribution to inequality in 2001.

Table 2.19 displays the results of the regression-based decomposition of inequality within both males and females using SLID data in 2008 and 2011. From the results, in 2008, 50% and 40% of inequality within females and within males respectively was ex-

plained by individual characteristics. In 2011, individual observable characteristics explained 45% and 44.63% of income inequality within females and males, respectively. As conclude from census data results, from SLID, the results show that the proportion of within female income inequality explained by observable characteristics is higher than the one of males. As mentioned earlier, the SLID data source has the advantage of three more variables compared to the census and the CIS data sources. In addition to the variable used in the regression-based decomposition with census data, in the same regression with SLID, the Job position (Manager, health, home support worker, etc...) the sectors of activity (Private and public sectors) and the job unionization status are observed and used. In terms of ranking, factors that have been identified to have the most impact on income inequality for the population aged 25 years old and more are the same for males and females: work status (Total annual work hours), job position, education (years of schooling), job unionization status, sector of activity (Private and public sectors), age, immigration status, marital status and household size. Work hours contributes more to inequality within females than within males, but the contribution is higher in 2008 than in 2011 for females while it is higher in 2011 than in 2008 for males. After work hours, job position is the second factor that contributes highly to inequality within gender. Education contributes more to inequality within females than males, and the contribution is higher in 2011 than in 2008. The contribution of unionization status is higher within females than males, and the contribution is higher in 2008 within females than in 2011 while it was higher in 2011 within males than in 2008. The sector of activity (Private sector) contribution to inequality is higher within females than males, and the contribution is higher in 2011 than 2008 for females while it is higher in 2008 than in 2011 for man. The contribution of age and immigration status to inequality is higher within males than females, and the contribution is higher in 2008 than 2011 for both genders.

Table 2.20 displays the results of RBD of inequality within gender using the version 2012 and 2015 of CIS. From the results, 33% and 32% of inequality within females are explained by observable characteristics in 2012 and 2015, respectively. Considering inequality within males, 30% and 28% is explained by observable characteristics in 2012 and 2015 respectively. This result is consistent with the ones obtained from SLID and Census data where the proportion of inequality explained by observable characteristics is higher for females than males. While ranking the contribution of each factor to inequality, the hierarchical list of the factors that have the most impact on income inequality is different for males and female with CIS data in 2012 and 2015. In fact, the factors that contribute to inequality in 2012 for females are the following in order of importance: annual hours of work, level of education, self-employment status, age, immigrant status, marital status, and household size. In 2015 within females, the factors that contribute to inequality in order of importance are the following: annual hours of work, level of education, immigrant status, age, self-employment status, marital status, and household size. Within males, the factors that contribute to inequality in 2012 are annual hours of work, level of education, self-employment status, marital status, age, immigrant status, and household size, and in 2015 the factors are: annual hours of work, self-employment status, level of education, immigrant status, marital status, age, and household size.

Overall, considering all data source with the sensibility analysis of some omitted variables and over time one can conclude that the part of inequality explained by individual characteristics is less than 50% depending on the year, the data source and gender. The explained proportion of inequality is higher for females than males. The remaining proportion of inequality is not explained by the factors specified in the RBD model. This part is likely to be related to factors such as individual non-observables skill (risk aversion, income structure effect etc.), individual experience in the labour market, social network, non-

observable discrimination in the job market at some hierarchical level or position and the unemployment rate even if overall women experimented higher unemployment rate than men. The key observable characteristics that contribute to inequality within females and within males are annual hours of work, level of education, immigrant status, age, marital status, and household size. The importance of the contribution of each factor to inequality varies by year and data source even if they remain in the list.

2.5 Decomposition of the Dynamics of Inequality by Gender

2.5.1 Decomposition of the Dynamics of Inequality by Gender: Methodology

The following question helps to well understand the decomposition procedure of the changes in inequality measures. Did income inequality change because of individual specific characteristics distribution change over time (explained part or composition effect) or because the returns to these individual specific characteristics change over time (the income structure effect or unexplained part)? Income structure effects are due to group differences in the income determination functions, whereas the composition effects are linked to the differences in the covariates.

Following the literature on the decomposition of the change in inequality or income distribution, there exist different approaches (eg.: DFL procedure (DiNardo et al. (1996)), MM decomposition (Machado and Mata (2005)), FFL decomposition (Firpo et al. (2018))). Among these decomposition approaches, one can distinguish the aggregate decomposition, the counterfactual decomposition of the change in income distributions with quantile re-

gression(Machado and Mata (2005)), the decomposition of the change using unconditional quantile regression developed by Firpo et al. (2018). Each of these decomposition technicals has some limitations and advantages.

The decomposition of the change in income distribution using quantile regression does not provide the detail on the contribution of each covariate to the change due to the composition effect. The FFL decomposition approach developed by Firpo et al. (2018) has the advantage of providing the information on the effect of every single covariate to the change linked to the composition and structure effects. The most performing decomposition method of the change in inequality measure that provides details in the contribution of each covariate to the composition effect is FFL procedure. In order to decompose the change in inequality measures into composition and income structure effects, one applies the FFL (Firpo et al. (2018)) procedure. The FFL procedure combines re-entered influence function, Oaxaca-Blinder (Jann (2008)) decomposition, and reweighting approach in the computation of the counterfactual.

In our analysis, we are interested in the decomposition of the change of inequality measures (such as Gini index, Interquantile differences, and income variance) between two periods (for instance, where comparing inequality measure between year $t_0 = 2001$ and year $t_1 = 2006$).

In order to well understand the procedure, the two following sub-sections 2.5.1 and 2.5.1 are developed. The sub-section 2.5.1 summarizes the standard Oaxaca-Blinder decomposition approach and its shortcoming in the case of the inequality decomposition literature. Sub-section 2.5.1 summarizes (Firpo et al. (2018)) procedure applied for the decomposition of the changes in inequality measures in this paper.

Standard Oaxaca-Blinder (OB) Decomposition

This section aims to summarize Oaxaca-Blinder decomposition, which feats with the decomposition of the difference in mean wage or income while comparing two groups A and B. In general, the two groups referred to gender, race, or other observable characteristics. However, the two groups can also be referred to periods 0 and 1. It emphasizes how the OB decomposition provides a way to appraise the contribution of each covariate/observable characteristic in the composition and the income structure effects. Let consider in this session, group A and B as period 0 and 1. The standard Oaxaca-Blinder decomposition assumes a linear functional form between the outcome variable and the covariates as specified below:

$$Y_{ti} = X_{ti}\beta_{ti} + \epsilon_{ti},\ E(\epsilon_{ti}) = 0,\ t \in \{0, 1\} \tag{2.9}$$

Where Y_{ti} represents individual *i* income during the period t and X_{ti}, the explanatory variables which are individual *i* observable characteristics during the period t. β refers to the regression coefficients.

Let define Y_t as income observed during period $t = 0, 1$, F_t as a class of distribution functions of Y_t, and I as the conditional join distribution of (Y_0, Y_1). Let define Y_C as the counterfactual distribution of Y_0 but with the distribution of observed and unobserved characteristics at $t = 1$. One is interested in the analysis of the difference in the income distribution between $t = 0$ and $t = 1$. The overall difference in I between $t = 0$ and $t = 1$ is:

$$\delta_O^I = I(F_1) - I(F_0) = I_1 - I_0 \tag{2.10}$$

$$\delta_O^I = \underbrace{(I_1 - I_C)}_{\delta_S^I} + \underbrace{(I_C - I_0)}_{\delta_X^I} = \delta_S^I + \delta_X^I \tag{2.11}$$

δ_S^I represents the effect of the difference in the distribution of income structure function, whereas δ_X^I refers to the effect of the difference in the distribution of X. δ_S^I totally reflects the change in the distribution of income structure function only if the counterfactual distribution I_C is evaluated from the distribution of X at $t = 1$ as the distribution of X at $t = 0$. The evaluation of the counterfactual distribution assumes two main assumptions: ignorability and overlapping support. Ignorability assumption refers to the fact that, while considering a joint distribution (X, T, ϵ), for all x in X, error term is independent to T given $X = x$. The Overlapping support assumption implies an overlap in observable covariates in period $t = 0$ and $t = 1$ such that all values in X is observed among individuals in time $t = 0$ and $t = 1$.The standard OB decomposition is easy to compute in the case of mean. However, it provides consistent estimates of the income structure and composition effect only under the assumption that the conditional expectation is linear. In the case of the decomposition of the mean, $I_C = \mu_C$ and under the linearity assumption, the counterfactual mean of Y_0 given $T = 1$ is:

$$\mu_C = E[Y_0|T = 1]^{'}\beta_0 = E[X|T = 1]^{'}\beta_0 \tag{2.12}$$

Beyond the decomposition of the difference in income mean, RIF regression is used in the decomposition procedure of the change in inequality measures (Firpo et al. (2018)).

Summary of the RIF Oaxaca-Blinder decomposition

This section summarizes detail regarding the decomposition procedure developed by Firpo et al. (2018) (FFL procedure or RIF Oaxaca-Blinder decomposition), applying an extension of Oaxaca-Blinder decomposition that relies on RIF to provide the composition and income structure effects of covariates on the changes in inequality measures. The Oaxaca-Blinder method can be used to decompose the difference in inequality measure between two periods. It can be used to decompose the difference in inequality measures such as Gini index, income variance, and interquantile ranges, into a composition effect and a wage structure effect linked to differences in the return to these covariates between the two groups.

FFL decomposition procedure consists of two stages estimation. During the first stage, one applies a reweighing procedure in the construction of the counterfactual distribution of inequality measures evaluated from the distribution at year t_1 as the distribution observed at t_0. In the second stage of the decomposition procedure, RIF regression is applied, and the estimates are used in the Oaxaca-Blinder type decomposition. This decomposition allows insights into the income distribution based on coefficients and covariates effects. The change in inequality measure is split into unexplained and explained effects. The unexplained effect is due to the difference in estimated coefficients, and the explained effect (composition effect) is related to the different characteristics. In other words, unconditional quantile regressions estimate at various quantiles provide the coefficients to compute the decomposition of the changes in two periods (t_0 and t_1). Oaxaca - Blinder decomposition is implemented after applying the reweighing procedure in the construction of the counterfactual distribution of inequality measure evaluated at year t_1 as the distribution observed at t_0.

For the construction of the counterfractuel distribution, let consider the following probability and weighting functions: $p(x) = Pr(T = 1|X = x)$, $w_0(T) \equiv \frac{1-T}{1-p}$, $w_1(T) \equiv \frac{T}{p}$,

and $w_C(T,X) \equiv \frac{p(x)}{1-p(x)}\frac{1-T}{p}$. The reweighting function $w_t(T)$ represents the conditional distribution of Y_t given T, whereas the $w_C(T,X)$ represents the conditional distribution of Y_1 given $t = 0$. FFL procedure applied the recentered influence function regression with Oaxaca-Blinder type decomposition with the reweighing procedure in the construction of the counterfactual distribution F_C. The recentered influence function of $(y; I_t, F_t)$ and $(y; I_C, F_C)$ are respectively:

$$\widehat{RIF}(y; I_t, F_t) = I_t + \widehat{IF}(y; I_t, F_t) \tag{2.13}$$

$$\widehat{RIF}(y; I_C, F_C) = I_C + \widehat{IF}(y; I_C, F_C) \tag{2.14}$$

$$E[I(F)] = E[IF(y; I, F)] = 0 \tag{2.15}$$

$$I(F) = \int E[RIF(y; I, F)|X = x].dF_X(x) \tag{2.16}$$

Let λ_t^I and λ_C^I be the RIF regression coefficients of $RIF(y; I_t, F_t)$ and $RIF(y; I_C, F_C)$ respectively with linear regression. From the decomposition, the income structure effect, as well as the composition effect in terms of the contribution of each covariate, are respectively:

$$\delta_S^I = E[X|T = 1]^{'}(\lambda_1^I - \lambda_C^I). \tag{2.17}$$

$$\widehat{\delta}_S^I = (\Sigma_{i=1}^N \widehat{w}_1^*(T_i)X_i)^{'}(\widehat{\lambda}_1^I - \widehat{\lambda}_C^I). \tag{2.18}$$

$$\delta_X^I = \Sigma_{l=1}^L (E[X^l|T = 1] - E[X^l|T = 0])\lambda_{0,l}^I + E[X|T = 1]^{'}(\lambda_C^I - \lambda_0^I). \tag{2.19}$$

$$\widehat{\delta}_X^I = (\Sigma_{i=1}^N \widehat{w}_1^*(T_i)X_i)^{'}\widehat{\lambda}_C^I - (\Sigma_{i=1}^N \widehat{w}_0^*(T_i)X_i)^{'}\widehat{\lambda}_0^I. \tag{2.20}$$

Where l refers to the covariates, and i to the individual observed in the RIF regression.

Empirically, in this paper, one decomposes the change in the interquantile ranges, the variance, and the Gini index between two periods ($t = 0, 1$).[7]

2.5.2 Decomposition of Inequality dynamics by Gender: Results

Tables 2.21 presents the results of the decomposition of inequality dynamics within males based on Census (2001, 2006) data sources respectively. In the same vein table 2.22 is the corresponding results of RIF-Oaxaca decomposition of inequality dynamics within females.

The estimated change in inequality presents in these tables refers to inequality estimated in the period t0 minus the inequality estimated in period t1. For instance, in case of the decomposition made using the census data, the change in inequality is inequality in 2001 minus inequality estimated in 2006. Since the log function is used in the computation of the estimated value of the change by inequality measure, for the Gini index and the variance, when the value of the change is negative, this means that inequality increase from t0 to t1. However, for the change of the differences interquantile (e.g., D90-80, D90-10) when the estimated change of the inequality measure has a positive value, this means that inequality decrease from 2001 to 2006.

Results of the Decomposition of the Dynamics of Inequality Within Males: Income Structure and Composition Effects

Table 2.21 presents the results of the decomposition of the changes in inequality measures between 2001 and 2006 when considering inequality within males. From the results, Gini index, the variance followed by the difference interquantile D90-80, D90-10, D90-

[7] Firpo et al. (2018) provides more details on the decomposition of these three distribution statistics into income structure and composition effects.

50 increased from 2001 to 2006, whereas the difference interquantile D50-30 and D20-10 decreased. For most of the inequality measures, income structure effect dominates the composition effect excepted the case of the differences interquantile D50-10 and D20-10 where composition effect dominates income structure effect. The composition effect counterbalance, income structure effect in the decomposition of the changes of the difference interquantile D90-80, D90-10, D50-30, and of Gini index. The composition effect contributes to reduce Gini index and the differences interquantile D90-80, D90-10, whereas it contributes to increase D50-30. The remaining analysis will only focus on the contribution of the covariates to the change of inequality induce by the composition effect for each inequality measure presented in the table 2.21.

The composition effect reduces Gini index, and all the observable covariates contribute to reducing the Gini index from 2001 to 2006. In order of importance of the factors that affect the most the variation of Gini index are: visible minority followed by education, age, marital status, citizenship, household size, and work hours. The composition effect increases the variance due to age, followed by education, citizenship, household size, average work hours. However, visible minority status and marital status counterbalance these effects. Considering the dynamics of D90-80 from 2001 to 2006, education followed by citizenship status, Household size and average work contribute to decreasing inequality, whereas age, visible minority status and marital status contribute to increasing the difference interquantile by counterbalancing the effect of the former covariates.

The composition effect reduces the difference interquantile D90-10 from 2001 to 2006 based on age followed by education, citizenship status, household size, and average work hours. However, visible minority status and marital status contribute to increasing D90-10. The composition effect increases the difference interquantile D90-50 due to visible minority status, age, and marital status whereas education followed by citizenship, household

size, and the average work hours affect the change in the opposite way. Age, education, citizenship, average work hour, and household size reduce the difference interquantile D50-10 between 2001 and 2006, whereas the covariates which contribute to increasing the difference are visible minority status followed by marital status. visible minority status, marital status followed by age increase the difference interquantile D50-30 from 2001 to 2006. However, education followed by household size, citizenship status, and average work hour reduce the difference interquantile. For the change of D20-10 from 2001 to 2006, age, followed by education, citizenship status and average work hours contribute to decreasing the difference interquantile D10-10 whereas visible minority followed by marital status counterbalance these effects.

Results of the Decomposition of the Dynamics of Inequality Within Females: Income Structure and Composition Effects

Considering Females, based on the decomposition of the changes in inequality measure between 2001 and 2006 and presented in table, Gini index and the variance increased from 2001 to 2006, whereas the interquantile differences decreased.

In general, structure effect contribute highly to the change in inequality when considering all inequality measures except for the interquantile difference D90-80 where composition effect is the one that has a higher effect on inequality. Furthermore, the composition effect counterbalances the income structure effect in the decomposition of the changes of Gini index, the variance, D50-30, D90-80. The composition effect contributes to decreasing inequality in both Gini and variance cases, and the income structure effect counterbalances the composition effect by increasing inequality. The contribution of structure effect to inequality is higher than the contribution of the composition effect when one considers the variation of all inequality measures presented in the table 2.22. In order to highlight

the covariate effect on the change in inequality, the remaining analysis will only focus on the contribution of the observable characteristics to the changes relative to the composition effect.

In the case of the change of Gini index and the variance, age, education and average work hours are the covariates which contribute to the composition effect where these effects where counterbalance by the effect of a visible minority, marital status, and household size. For D90-80, education followed by work hours, marital status, and citizenship status are the covariates which contribute to decrease the income differences between D90 and D80. However, age and visible minority status counterbalance the effect of these factors by increasing the difference from 2001 to 2006. For the change of the interquantile difference D90-10 from 2001 to 2006, age, education, average work hour, are the covariates which contribute to decrease the change in the difference whereas visible minority status contributes to increasing the change by highly counterbalancing the effect of the formers covariates. Considering the dynamics of D90-50 from 2001 to 2006, education, average work hour, citizenship status followed by marital status contribute to decreasing inequality whereas visible minority status and age contribute to increasing the difference by counterbalancing the effect of the formers covariates highly. Between 2001 and 2006, age followed by the average work hour contribute to decreasing the interquantile difference D50-10, whereas visible minority status followed by education counterbalance these effects. The decrease of the interquantile difference D50-30 from 2001 to 2006, was counterbalanced by education followed by visible minority status and household whereas age contributes to decreasing the difference. For the change of D20-10 from 2001 to 2006, age, followed by average work hour and education, contribute to increasing the change in the difference whereas visible minority counterbalance these effects.

2.6 Conclusion

The literature on the genders income gap documents factors that drive this gap, but little is known about income inequality within gender and how the determinants of inequality differ between genders. Therefore, the purpose of this study is to bring further light on the dynamics of income inequality by gender and to investigate the determinants of income inequality by gender in static and dynamic points of view. In this paper, different inequality measures are used to document inequality dynamics from 1991 to 2016 by gender using Canadian annual pre-tax income from three data sources (The individual files of Canada Census (1991, 1996, 2001, 2006 and 2016), the Survey of Labour and Income Dynamics (SLID, 2008 , 2009, 2010, 2011) and the Canadian Income Survey (CIS, 2012, 2013, 2014, 2015)). The determinant of inequality by gender is investigated by applying unconditional quantile regression based on the re-entered influence function (RIF) decomposition and regression-based decomposition (RBD) of inequality. Finally the factors that affect the dynamics of income inequality by gender have been documented by using RIF-Oaxaca Blinder decomposition approach.

From the unconditional quantile regression, overall, age has an overall significant effect on income at each level of income distribution with the evidence of non-linearity. For most of the quantile, the effect of age on income is higher for males compared to females, and this is consistent with different data sources. Overall, the effect of age on income for both males and females increases from the bottom to the top of the income distribution. The annual work hours effect has the same pattern across quantile for both males and females, with the effect decreasing over the income distribution for both males and females and the results is consistent in a comparison between two different data sources. However,

the size of the effect changes by quantile from one year to another and certainly captures the change in annual work hours distribution and the change in income distribution by gender in two different periods. From the estimate, no union and non-agreement, and job status have a significant effect on all quantiles from the bottom to the top of both male and female incomes. The effect is higher for males compared to females and is different from one period to another for both females and males. Further, the effect is negative for the bottom income groups and positive for the top income groups for both males and females. Considering the sector of activity, working in the private sector has a significant and negative effect on quantile along the income distribution for both males and females. There is a difference in the effect of the sector of activity by quantile for both males and females when considering two different years. Being non-immigrant has a positive and significant effect on quantile by gender for all years along the income distribution. There is a significant difference in the pattern of the effect on quantiles for both males and female. Considering marital status, being single has a significant and negative effect by quantile and the effect if increases in absolute value from the bottom to the top of the income distribution. The absolute value of the effect varies by year. Household size has a negative effect on female income, whereas the effect is negative only for the first five deciles of male income. The effects have different patterns across quantiles and are significant only with census data. This finding is in line with finding from Ndoye (2015).

The contribution of each covariate/individual observable characteristic to the Theil index has been documented within gender by applying regression-based decomposition to the annual pre-tax income by gender. Overall, the part of inequality explained by individual characteristics is less than 50% depending on the year, the data source and gender. The explained proportion of inequality is higher for females than males. The

remaining proportion of inequality is not explained by the factors specified in the RBD model. This part is likely to be related to factors such as individual non-observables skills. The key observable characteristics that contribute to inequality within females and within males are annual hours of work, level of education, immigrant status, age, marital status, and household size. The importance of the contribution of each factor to inequality varies by year and data source and gender. Work hours contributes more to inequality within females than within males. Education contributes more to inequality within females than within males. The contribution of unionization status is higher within females than within males. The sector of activity (Private sector) contribution to inequality is higher within females than within males. The contribution of age and immigration status to inequality is higher within males than within females.

From FFL decomposition of the dynamics of inequality measures by gender, one concludes that the dynamics of inequality is not identical for males and females. However, in both cases, for most of the inequality measures used in the study, the income structure effect dominates the composition effect except for the change observed for some specifics interquantiles differences. Furthermore, the composition effect counterbalances income structure effect most of the time, even if in some cases, they contribute to the change in inequality measures in the same direction. In addition to that, the covariates that contribute to the composition effect, counterbalance each other effect by either increasing or reducing the inequality measures. The factors that affect each inequality measure are gender specific. In most of the cases, education, age citizenship, job participation status, and household size have a high effect in increasing or decreasing the inequality measure. Visible minority status and marital status counterbalance most of the time the effect of the former factors.

2.7 Appendix

Table 2.1: Descriptive Statistics of Females' Characteristics from Canada Census data

Census 2016					
Individual Characteristics	Obs	Mean	Std.Dev.	Min	Max
Age	258,946	44.89211	11.36294	27	62
High degree of education	4.150959	2.08056	2	10	
Marital status	2.070192	.8394173	1	5	
Mother Tongue	1.672132	.8252912	1	3	
Immigration Status	258,1	1.294173	.4853087	1	3
Years since immigration	67,914	20.06569	13.3419	1	44
Visible Minority status	252,575	1.77942	.4146386	1	2
Aborigine	258,946	1.9554	.2064244	1	2
Household type	258,946	1.61307	.9103597	1	3
Household size	257,851	3.037599	1.418314	1	7
Presence of Kids in the household	215,07	.6832427	.465213	0	1
Full time and part time work	201,219	1.227359	.4191275	1	2
Total weeks of work	206,544	42.22201	13.94178	0	50.5
School attendance	257,649	1.088267	.2836839	1	2
Province	258,946	36.48707	13.00096	10	60
Annual wage	191,327	43942.79	38364.55	.9840259	407697.7
Annual market Income	224,957	45550.53	49744.71	-29520.78	556918.3
Annual total Income before tax	251,647	45102.7	46128.72	-29520.78	516065.5
Annual total Income after tax	251,822	37489.28	32042.79	-29520.78	365789
Census 2006					
Age	239,572	44.17788	10.75253	27	62
High degree of education	238,661	3.81413	1.95541	2	10
Marital status	239,572	2.114567	.9859757	1	5
Mother Tongue	239,572	1.65526	.8069834	1	3
Immigration Status	239,572	2.229931	.4410343	1	3
Years since immigration	49,854	18.51135	10.04907	1	34
Visible Minority status	238,011	1.841696	.3650262	1	2
Aborigine	239,572	1.966545	.1798231	1	2
Household type	238,88	1.475126	.7805639	1	3
Household size	238,88	3.045429	1.393208	1	7
Presence of Kids in the household	238,88	.6039225	.4890819	0	1
Full time and part time work	185,431	1.230026	.4208505	1	2
Total weeks of work	190,447	42.6778	13.83412	0	50.5
School attendance	239,572	1.107179	.3093409	1	2
Province	239,572	35.89239	13.12043	10	60
Annual wage	239,295	28189.91	33671.02	0	355023.8
Annual market Income	239,295	33544.47	40540.32	-34797.62	39 0661.3
Annual total Income before tax	239,369	36784.65	37996.4	-34797.62	373196.3
Annual total Income after tax	239,295	31074.16	27389.99	-34797.62	266388.5

Source:Author calculus based on Canada's Census data.

Table 2.2: Descriptive Statistics of Males' Characteristics from Canada Census data

Census 2016

Individual Characteristics	Obs	Mean	Std.Dev.	Min	Max
Age	248,276	44.78404	11.40383	27	62
High degree of education	245,313	3.883243	2.09111	2	10
Marital status	248,276	1.915493	.7233827	1	5
Mother Tongue	245,031	1.640923	.8093433	1	3
Immigration Status	247,495	1.277492	.4802009	1	3
Years since immigration	60,435	20.49235	13.43693	1	44
Visible Minority status	242,098	1.797062	.4021879	1	2
Aborigine	248,276	1.959589	.1969208	1	2
Household type	248,276	1.590524	.9038043	1	3
Household size	247,242	3.000756	1.444339	1	7
Presence of Kids in the household	194,302	.6819384	.4657247	0	1
Full time and part time work	214,097	1.086844	.2816067	1	2
Total weeks of work	218,325	43.64616	12.52312	0	50.5
School attendance	246,852	1.071614	.2578478	1	2
Province	248,276	36.49501	12.97817	10	60
Annual wage	197,082	66043.63	79894.96	.9840259	1216852
Annual market Income	226,816	70666.28	106766.2	-49201.29	1584057
Annual total Income before tax	244,026	67626.1	99613.04	-49201.29	1561466
Annual total Income after tax	244,158	52508.96	63539.08	-49201.29	1039730

Census 2006

Individual Characteristics	Obs	Mean	Std.Dev.	Min	Max
Age	229,96	44.21436	10.77375	27	62
High degree of education	228,777	3.756225	2.028069	2	10
Marital status	229,96	1.935945	.8700313	1	5
Mother Tongue	229,96	1.639624	.7985941	1	3
Immigration Status	229,96	2.219956	.4357563	1	3
Years since immigration	45,538	18.92782	10.00628	1	34
Visible Minority status	228,407	1.85123	.3558619	1	2
Aboriginal	229,96	1.969034	.1732267	1	2
Household type	228,774	1.483512	.8205604	1	3
Household size	228,774	3.026681	1.417768	1	7
Presence of Kids in the household	228,774	.5751484	.4943215	0	1
Full time and part time work	201,816	1.073498	.2609522	1	2
Total weeks of work	205,266	44.67542	11.78258	0	50.5
School attendance	229,96	1.088507	.284031	1	2
Province	229,96	35.91027	13.10298	10	60
Annual wage	229,653	48678.13	73316.18	0	1422631
Annual market Income	229,653	59705.85	95246.83	-57996.03	1536364
Annual total Income before tax	229,728	61349.69	90669.05	-57996.03	1491178
Annual total Income after tax	229,653	47768.69	58100.57	996.03	1022451

Source:Author calculus based on Canada's Census data.

Table 2.3: Frequency table of Females' Characteristics from Canada Census data

Individual Characteristics Frequency	(Percentage)				
	1991	1996	2001	2006	2016
Marital status					
Single	16.44	18.89	21.37	23.87	18.01
Legally married /Common low	66.9	62.89	60.16	57.67	68.82
Separated	3.87	4.26	4.37	4.38	3.41
Divorced	8.95	10.65	11.08	11.29	7.65
Widowed	3.84	3.31	3.02	2.79	2.1
Province					
Newfoundland	1.96	1.9	1.77	1.7	1.53
Prince Edward Island	0.42	0.45	0.43	0.42	0.39
Nova Scotia	3.21	3.16	3.08	2.97	2.64
New Brunswick	2.58	2.53	2.45	2.36	2.11
Quebec	26.33	25.44	24.49	24.22	22.89
Ontario	37.35	37.52	38.21	38.45	38.64
Manitoba	3.71	3.58	3.49	3.39	3.42
Saskatchewan	3.21	3.02	2.85	2.81	2.9
Alberta	8.98	9.11	9.7	10.14	11.72
British Columbia	11.97	12.99	13.25	13.25	13.49
Yukon/Northwest Terr	0.27	0.3	0.28	0.3	0.28
Household size					
One persone	8.75	9.16	10.12	10.81	11.33
2 persons	28.23	29.32	30.62	31.75	31.86
3 persons	21.92	21.67	21.16	21.11	21.05
4 persons	24.63	23.93	22.9	21.9	21.26
5 persons	10.81	10.26	9.83	9.28	8.83
6 persons	3.72	3.68	3.63	3.14	3.32
7 persons and more	1.94	1.97	1.73	2	2.35
House hold type					
Married-Couple	74.86	72.87	71.57	70.48	68.27
Lone parent	10.21	11.13	11.43	11.52	2.15
Other Familly	14.93	15.99	17	17.99	29.58
Visible Minority status					
Visible Minority	9.26	11.46	13.49	15.83	22.06
Not a Visible minority	90.74	88.54	86.51	84.17	77.94

Table 2.4: Frequency table of Females' Characteristics from Canada Census

Individual Characteristics Frequency	(Percentage)				
	1991	1996	2001	2006	2016
Age					
25 to 29 years	16.12	12.96	11.65	11.35	11.7
30 to 34 years	17.08	15.84	12.84	11.64	12.26
35 to 39 years	15.71	16.4	15.32	12.75	12.09
40 to 44 years	14.23	15	15.75	14.94	11.86
45 to 49 years	11.17	13.48	14.38	14.91	12.29
50 to 54 years	9.02	10.36	12.54	13.56	14.11
55 to 59 years	8.45	8.25	9.73	11.84	13.77
60 to 64 years	8.21	7.7	7.79	9.02	11.93
High degree of education					
Sec. school grad. Certificate	59.15	52.85	47.32	39.6	33.68
Trades certificate	9.12	8.87	9.34	9	6.72
Other non-univ. cert	16.06	19.51	20.67	22.72	25.47
Univ. cert/diploma below bachelor	2.88	3.04	3.39	5.56	3.41
Bachelor degree(s)	8.89	10.86	13.1	15.47	21.24
Univ. cert/diploma above bachelor	1.54	1.82	2.18	2.57	2.02
Deg. in med/dent/vet/	0.29	0.36	0.47	0.47	0.68
Masters degree(s)	1.9	2.42	3.14	4.15	6.14
Earned doctorate	0.17	0.27	0.38	0.46	0.63
Attending school					
Not attending school	89.3	89.72	90.75	89.28	91.17
Attending school	10.7	10.28	9.25	10.72	8.83
Language					
English	56.96	57	56.43	55.74	55.82
French	25.8	24.41	23.57	22.99	21.14
Non Official Language	17.24	18.58	20.01	21.27	23.04
Citizenship					
Canadian by birth	78.94	77.74	76.67	76.7	71.75
Canadian by naturalization	14.1	15.59	16.93	17.51	19.59
Other country(ies)	6.96	6.67	6.41	5.79	8.66
Immigrant					
Non Immigrant	78.94	77.74	76.68	0.87	71.98
Immigrant	20.17	21.7	22.66	75.26	26.63
Non Permanent	0.89	0.56	0.66	23.87	1.39
Full time vs. part time job					
Full time	75.58	72.93	75.87	77	77.26
Part time	24.42	27.07	24.13	23	22.74
Presence of kids					
None				39.61	31.68
One or more				60.39	68.32
Aboriginal vs. non aboriginal					
Aboriginal				3.35	4.46
Non Aboriginal				96.65	95.54
Total	219,885	218,358	224,126	239,572	258,946

Source:Author calculus based on Censuses data.

Table 2.5: Frequency table of Males' Characteristics from Canada Census data

Individual Characteristics Frequency	(Percentage)				
	1991	1996	2001	2006	2016
Marital status					
Single	21.97	24.91	27.54	30	23.49
Legally married /Common low	67.04	62.48	59.45	56.88	68.08
Separated	3.21	3.44	3.47	3.43	2.5
Divorced	6.9	8.34	8.75	8.91	5.28
Widowed	0.88	0.83	0.79	0.78	0.66
Province					
Newfoundland	1.97	1.9	1.74	1.66	1.49
Prince Edward Island	0.41	0.45	0.43	0.41	0.37
Nova Scotia	3.18	3.11	3.02	2.88	2.55
New Brunswick	2.57	2.53	2.46	2.37	2.08
Quebec	25.99	25.5	24.67	24.58	23.48
Ontario	37.01	37	37.72	37.85	37.78
Manitoba	3.79	3.65	3.56	3.44	3.45
Saskatchewan	3.27	3.08	2.91	2.8	3.02
Alberta	9.37	9.42	10.09	10.64	12.26
British Columbia	12.12	13.02	13.11	13.05	13.23
Yukon/Northwest Terr	0.31	0.33	0.31	0.32	0.29
Household size					
One persone	9.61	10.99	12.25	13.02	14.18
2 persons	26.66	26.91	28.39	29.59	29.46
3 persons	21.77	21.29	20.88	20.61	20.59
4 persons	25.24	24.51	23.04	22.3	21.48
5 persons	10.99	10.56	9.94	9.39	8.78
6 persons	3.79	3.71	3.73	3.1	3.19
7 persons and more	1.94	2.02	1.77	1.98	2.32
House hold type					
Married-Couple	78.14	75.76	74.03	72.83	69.7
Lone parent	4.68	5	5.7	5.99	1.55
Other Familly	17.18	19.24	20.27	21.18	28.75
Visible Minority status					
Visible Minority	9.05	10.95	12.75	14.88	20.29
Not a Visible minority	90.95	89.05	87.25	85.12	79.71

Table 2.6: Frequency table of Males' Characteristics from Canada Census

Individual Characteristics Frequency	(Percentage)				
	1991	1996	2001	2006	2016
Age					
25 to 29 years	16.11	12.85	11.52	11.38	12.23
30 to 34 years	16.88	15.76	12.76	11.6	12.26
35 to 39 years	15.77	16.33	15.41	12.56	11.88
40 to 44 years	14.28	14.87	15.73	15.05	11.68
45 to 49 years	11.48	13.63	14.25	14.88	12.35
50 to 54 years	9.21	10.58	12.8	13.42	14.12
55 to 59 years	8.4	8.38	9.8	11.97	13.76
60 to 64 years	7.87	7.6	7.73	9.14	11.72
High degree of education					
Sec. school grad. Certificate	52.98	49.2	46.12	39.43	37.55
Trades certificate	17.46	16.54	16.46	16.04	14.86
Other non-univ. cert	11.42	14.16	14.87	17.95	19.19
Univ. cert/diploma below bachelor	1.87	2.16	2.36	4.29	2.45
Bachelor degree(s)	9.86	11.04	12.45	13.78	17.07
Univ. cert/diploma above bachelor	1.68	1.7	1.88	2.11	1.48
Deg. in med/dent/vet/	0.78	0.81	0.79	0.63	0.72
Masters degree(s)	3.17	3.5	4.08	4.8	5.66
Earned doctorate	0.78	0.91	1	0.97	1.02
Attending school					
Not attending school	91.67	91.94	92.71	91.15	92.84
Attending school	8.33	8.06	7.29	8.85	7.16
Language					
English	56.97	57.14	56.92	56.4	57.15
French	25.15	24.22	23.53	23.24	21.6
Non Official Language	17.88	18.64	19.54	20.36	21.24
Citizenship					
Canadian by birth	78.71	78.01	77.47	77.66	73.53
Canadian by naturalization	14.84	16.05	16.59	17.21	18.38
Other country(ies)	6.44	5.93	5.94	5.12	8.1
Immigrant					
Non Immigrant	78.71	78.01	77.48	0.92	73.76
Immigrant	20.39	21.4	21.81	76.17	24.74
Non Permanent	0.9	0.59	0.7	22.91	1.51
Full time vs. part time job					
Full time	94.8	92.23	92.94	92.65	91.32
Part time	5.2	7.77	7.06	7.35	8.68
Presence of kids					
None				42.49	31.81
One or more				57.51	68.19
Aboriginal vs. non aboriginal					
Aboriginal				3.1	4.04
Non Aboriginal				96.9	95.96
Total	215,205	211,949	216,459	229,960	248,276

Source:Author calculus based on Censuses data.

Table 2.7: Theil Index by Income Decile within Males and Females

Income Group	Theil Index by income decile (Male and Female)												
	1991	1996	2001	2006	2008	2009	2010	2011	2012	2013	2014	2015	2016
Decile1	0,228	0,265	0,292	0,353	0,230	0,230	0,226	0,212	0,232	0,240	0,233	0,226	0,288
Decile2	0,048	0,051	0,023	0,015	0,011	0,011	0,011	0,010	0,012	0,012	0,011	0,011	0,010
Decile3	0,005	0,006	0,005	0,004	0,003	0,003	0,003	0,003	0,003	0,003	0,003	0,003	0,003
Decile4	0,004	0,003	0,003	0,003	0,003	0,003	0,003	0,003	0,003	0,003	0,003	0,003	0,003
Decile5	0,004	0,004	0,003	0,002	0,002	0,002	0,002	0,002	0,002	0,002	0,002	0,002	0,003
Decile6	0,002	0,003	0,002	0,002	0,002	0,002	0,002	0,002	0,001	0,001	0,001	0,002	0,001
Decile7	0,002	0,002	0,002	0,002	0,002	0,002	0,001	0,002	0,002	0,002	0,002	0,002	0,002
Decile8	0,002	0,002	0,002	0,002	0,002	0,002	0,002	0,002	0,002	0,002	0,002	0,002	0,002
Decile9	0,003	0,003	0,003	0,004	0,003	0,003	0,003	0,004	0,003	0,004	0,003	0,003	0,004
Decile10	0,067	0,061	0,058	0,273	0,145	0,117	0,120	0,100	0,093	0,079	0,102	0,103	0,266
Population	0,294	0,317	0,315	0,477	0,331	0,319	0,321	0,308	0,309	0,303	0,312	0,323	0,477
Male Theil Index by income decile													
Income Group	1991	1996	2001	2006	2008	2009	2010	2011	2012	2013	2014	2015	2016
Decile1	0,219	0,264	0,313	0,491	0,260	0,275	0,275	0,244	0,277	0,261	0,266	0,265	0,295
Decile2	0,047	0,051	0,023	0,015	0,011	0,011	0,010	0,010	0,012	0,011	0,011	0,010	0,010
Decile3	0,005	0,006	0,005	0,004	0,003	0,003	0,003	0,003	0,003	0,003	0,003	0,003	0,004
Decile4	0,004	0,003	0,003	0,003	0,003	0,003	0,003	0,003	0,003	0,003	0,003	0,003	0,003
Decile5	0,004	0,003	0,003	0,002	0,002	0,002	0,002	0,002	0,002	0,002	0,002	0,002	0,002
Decile6	0,002	0,003	0,002	0,002	0,002	0,002	0,002	0,001	0,001	0,001	0,001	0,002	0,002
Decile7	0,002	0,002	0,002	0,002	0,002	0,002	0,001	0,002	0,002	0,002	0,002	0,002	0,002
Decile8	0,002	0,002	0,002	0,002	0,002	0,002	0,002	0,002	0,002	0,002	0,002	0,002	0,002
Decile9	0,003	0,003	0,003	0,004	0,003	0,003	0,004	0,004	0,003	0,004	0,003	0,003	0,004
Decile10	0,073	0,067	0,066	0,319	0,163	0,130	0,132	0,114	0,105	0,085	0,116	0,109	0,301
Population	0,241	0,278	0,280	0,501	0,313	0,301	0,307	0,293	0,289	0,283	0,301	0,307	0,514
Female Theil Index by income decile													
Income Group	1991	1996	2001	2006	2008	2009	2010	2011	2012	2013	2014	2015	2016
Decile1	0,232	0,263	0,280	0,279	0,219	0,210	0,206	0,199	0,212	0,231	0,217	0,207	0,273
Decile2	0,048	0,051	0,023	0,015	0,011	0,011	0,011	0,010	0,012	0,012	0,011	0,011	0,009
Decile3	0,005	0,006	0,004	0,004	0,003	0,003	0,003	0,003	0,003	0,003	0,003	0,003	0,003
Decile4	0,004	0,004	0,003	0,004	0,003	0,003	0,003	0,003	0,003	0,003	0,003	0,003	0,002
Decile5	0,004	0,004	0,003	0,002	0,002	0,002	0,002	0,002	0,002	0,002	0,002	0,002	0,002
Decile6	0,002	0,003	0,002	0,002	0,002	0,002	0,002	0,002	0,001	0,002	0,001	0,002	0,002
Decile7	0,002	0,002	0,002	0,002	0,002	0,002	0,001	0,001	0,002	0,002	0,002	0,002	0,002
Decile8	0,002	0,002	0,002	0,002	0,002	0,002	0,002	0,002	0,002	0,002	0,002	0,002	0,002
Decile9	0,003	0,003	0,003	0,003	0,003	0,003	0,003	0,003	0,003	0,003	0,003	0,003	0,004
Decile10	0,036	0,030	0,024	0,111	0,074	0,074	0,074	0,049	0,047	0,051	0,044	0,085	0,135
Population	0,283	0,302	0,300	0,362	0,289	0,291	0,285	0,275	0,282	0,279	0,274	0,299	0,370

Table 2.8: Income Inequality Measure for Females

Income percentile	Female Annual Pre- tax Income Inequality												
	1991	1996	2001	2006	2008	2009	2010	2011	2012	2013	2014	2015	2016
p_5	0	283	1287	1160	2662	2765	2825	3221	2575	2293	3034	3300	3936
p_10	3181	3128	6124	4640	7433	7770	7906	8395	7776	7961	8469	8625	8856
p_25	14680	14357	15998	13919	16085	16438	16572	17107	16981	17107	17292	17500	16728
p_50	30584	29740	32639	26678	28843	29282	29396	30359	30166	30916	31576	31825	31489
p_75	52949	52477	54557	45237	48783	49688	49989	50555	49930	51527	51776	52600	53137
p_90	76460	77080	81137	69595	72745	74685	75038	74974	76481	77316	78372	79825	81674
p_95	93926	94905	103549	86994	89968	92409	92371	92714	94372	96200	96069	97725	98403
p_99	163436	163679	174738	204378	137919	144890	141274	147836	149425	146980	146632	164950	266056
Inequality measures	**1991**	**1996**	**2001**	**2006**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Gini index	0,413	0,429	0,429	0,446	0,409	0,41	0,406	0,402	0,407	0,405	0,403	0,413	0,448
Variance	1,2E+09	1,2E+09	1,3E+09	1,4E+09	1E+09	1,1E+09	1,1E+09	9,7E+08	1E+09	1E+09	1E+09	1,3E+09	1,98E+09
D9010	73279	73952	75013	64956	65313	66915	67132	66579	68705	69355	69903	71200	72818
D9050	45876	47340	48498	42917	43902	45403	45642	44615	46315	46400	46796	48000	50185
D5010	27403	26611	26515	22038	21410	21512	21490	21964	22390	22955	23107	23200	22633
D9975	110488	111202	120181	159141	89136	95202	91284	97281	99495	95453	94855	112350	212919
D7550	22365	22737	21919	18559	19940	20406	20593	20195	19764	20611	20200	20775	21649
D5025	15904	15383	16640	12759	12757	12844	12823	13252	13185	13809	14284	14325	14760

Table 2.9: Income Inequality Measure for Males

Income percentile	Male Annual Pre- tax Income Inequality												
	1991	1996	2001	2006	2008	2009	2010	2011	2012	2013	2014	2015	2016
p_5	5490	3059	4271	3480	8736	7438	7933	8501	7645	8012	7938	7650	5904
p_10	11994	9426	10856	10439	14810	14130	14182	14493	13991	14659	14613	13950	11808
p_25	24131	21248	22777	22038	27151	26047	26000	26452	27019	26974	26798	26400	23617
p_50	44347	41814	42714	42917	46814	45347	45995	46727	47147	47405	47529	47700	45265
p_75	65756	64972	66367	68435	73147	71892	72539	73918	75415	76105	75844	77500	73802
p_90	90987	90278	96017	100913	107606	105156	106689	106970	109247	113359	111238	114750	108243
p_95	112922	112754	123611	127591	134230	132724	135840	137514	140427	144275	141601	145050	147604
p_99	207321	206378	247999	475066	244860	253557	261438	252403	239429	249904	263962	272225	559226
Inequality measures	**1991**	**1996**	**2001**	**2006**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Gini index	0,372	0,401	0,403	0,48	0,403	0,403	0,407	0,401	0,4	0,401	0,407	0,413	0,489
Variance	1,5E+09	1,5E+09	1,7E+09	8,1E+09	4,2E+09	3,1E+09	3,3E+09	3E+09	2,9E+09	2,7E+09	3,21E+09	3,2E+09	9,65E+09
D9010	78994	80852	85161	90474	92796	91026	92507	92476	95257	98699	96625	100800	96435
D9050	46641	48465	53303	57996	60792	59809	60693	60243	62100	65954	63709	67050	62978
D5010	32353	32387	31858	32478	32005	31218	31814	32233	33156	32745	32916	33750	33457
D9975	141566	141406	181632	406631	171712	181665	188899	178485	164014	173799	188118	194725	485424
D7550	21409	23158	23653	25518	26333	26545	26543	27191	28268	28700	28315	29800	28537
D5025	20216	20565	19937	20879	19663	19300	19996	20275	20128	20430	20731	21300	21649

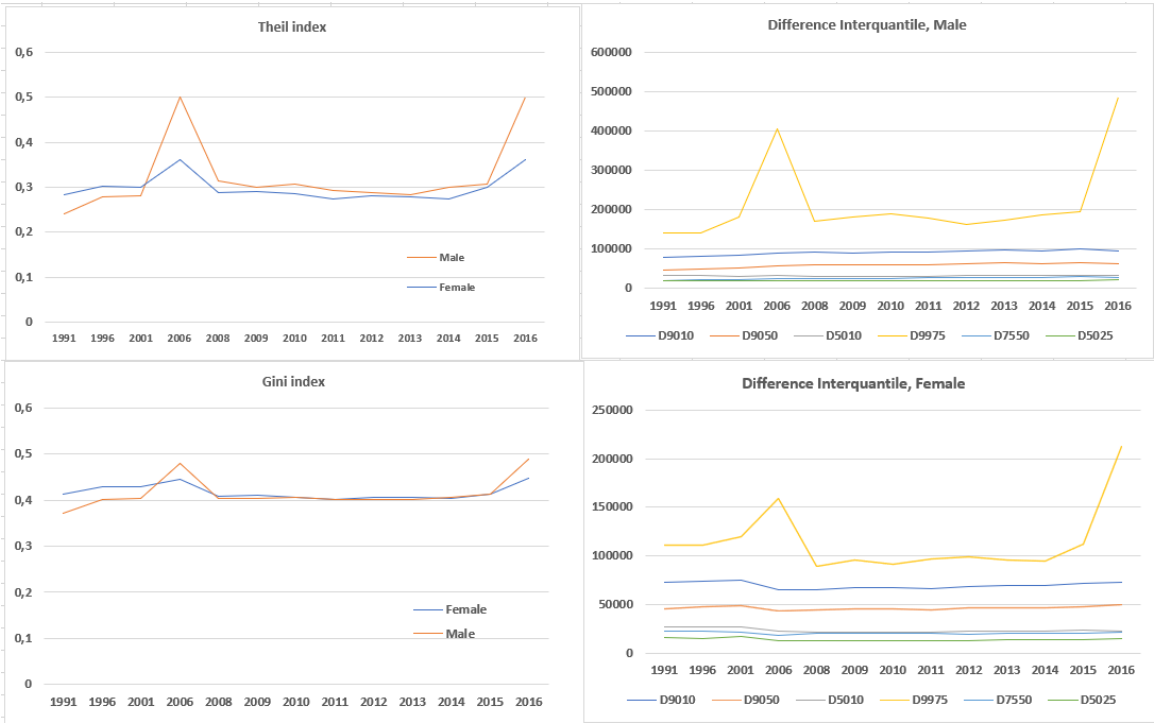


Figure 2.7: Inequality Dynamic within Males and Females from 1991 to 2016

Figure 2.8: Income Share Hold by Income Group by Gender from 1991 to 2016

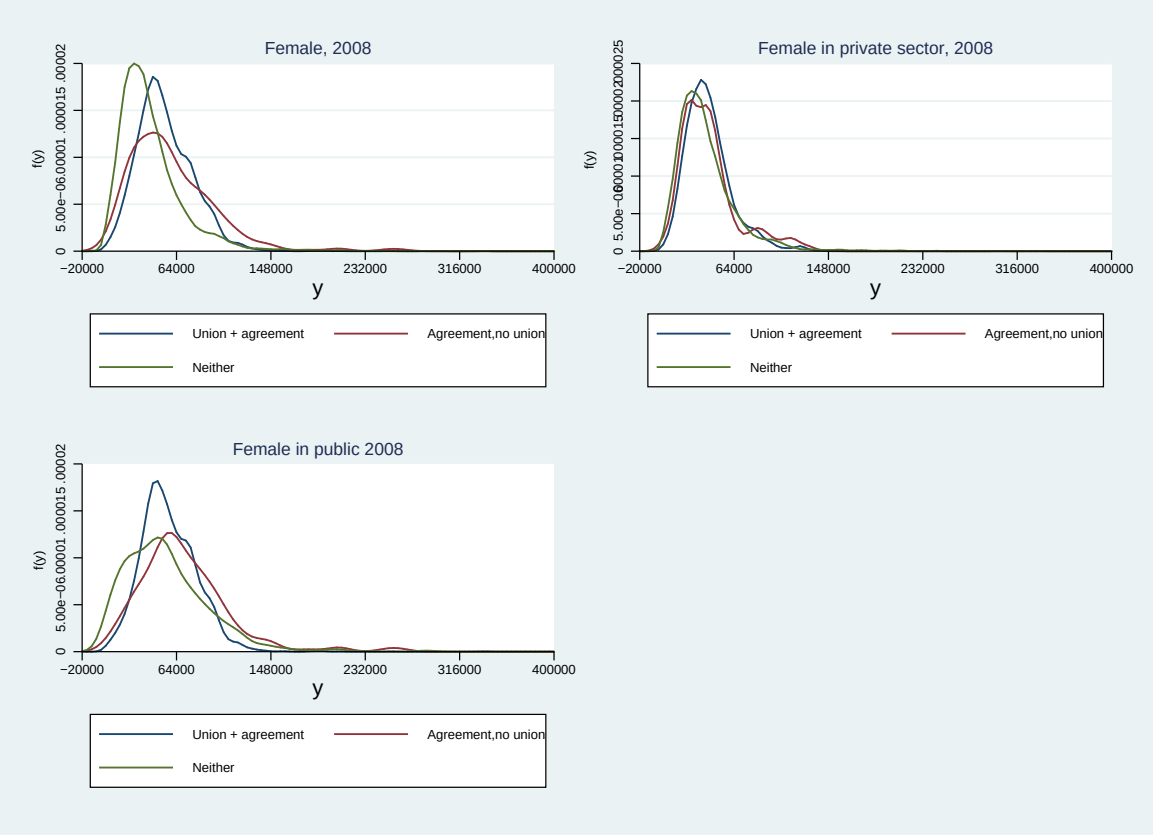


Figure 2.9: Female Annual Pre-tax Density Curve, SLID (2008)

Figure 2.10: University Degree Coefficient from RIF Estimate, CIS (2012 and 2015)

Unconditional Quantile Regression Results

Table 2.10: Unconditional Quantile Regression Results, Female Annual Pre-tax Income(Census 2016)

Variables	rif_10	rif_20	rif_30	rif_40	rif_50	rif_60	rif_70	rif_80	rif_90
Age	0.00775*	0.0239***	0.0328***	0.0394***	0.0426***	0.0472***	0.0577***	0.0638***	0.0455***
	(0.00430)	(0.00260)	(0.00198)	(0.00163)	(0.00146)	(0.00144)	(0.00157)	(0.00167)	(0.00164)
Age Square	-0.000108**	-0.000260***	-0.000341***	-0.000392***	-0.000415***	-0.000450***	-0.000542***	-0.000589***	-0.000392***
	(4.89e-05)	(2.95e-05)	(2.24e-05)	(1.85e-05)	(1.66e-05)	(1.64e-05)	(1.79e-05)	(1.92e-05)	(1.91e-05)
Education (Ref: High school graduation)									
Other trades certification	0.00934	-0.00762	-0.000878	-0.0135	-0.0370***	-0.0587***	-0.0616***	-0.0247***	0.0280***
	(0.0221)	(0.0136)	(0.0104)	(0.00845)	(0.00740)	(0.00684)	(0.00666)	(0.00624)	(0.00539)
College, CEGEP or other	0.0860***	0.105***	0.129***	0.124***	0.116***	0.105***	0.0962***	0.0761***	0.0546***
	(0.0135)	(0.00818)	(0.00625)	(0.00520)	(0.00469)	(0.00460)	(0.00486)	(0.00489)	(0.00448)
University certification below bachelor	0.124***	0.138***	0.180***	0.199***	0.233***	0.257***	0.272***	0.258***	0.176***
	(0.0249)	(0.0152)	(0.0117)	(0.00997)	(0.00920)	(0.00953)	(0.0109)	(0.0118)	(0.0113)
Bachelor's degree	0.140***	0.172***	0.235***	0.286***	0.324***	0.384***	0.476***	0.500***	0.362***
	(0.0147)	(0.00880)	(0.00668)	(0.00555)	(0.00505)	(0.00508)	(0.00572)	(0.00631)	(0.00639)
University certification above bachelor	0.218***	0.230***	0.283***	0.336***	0.393***	0.485***	0.604***	0.676***	0.514***
	(0.0286)	(0.0170)	(0.0131)	(0.0112)	(0.0105)	(0.0111)	(0.0138)	(0.0169)	(0.0188)
Degree in medicine	0.346***	0.354***	0.403***	0.441***	0.506***	0.623***	0.842***	1.075***	1.299***
	(0.0510)	(0.0288)	(0.0223)	(0.0192)	(0.0183)	(0.0195)	(0.0246)	(0.0312)	(0.0414)
Master's degree	0.200***	0.214***	0.288***	0.344***	0.406***	0.500***	0.638***	0.728***	0.623***
	(0.0203)	(0.0120)	(0.00904)	(0.00756)	(0.00695)	(0.00723)	(0.00876)	(0.0106)	(0.0123)
Earned doctorate degree	0.337***	0.331***	0.390***	0.442***	0.516***	0.645***	0.854***	1.071***	1.222***
	(0.0425)	(0.0250)	(0.0195)	(0.0168)	(0.0158)	(0.0173)	(0.0226)	(0.0300)	(0.0414)
Marital status (Ref: Single)									
Legally married and not separated	0.219***	0.182***	0.120***	0.0962***	0.0839***	0.0909***	0.0896***	0.0684***	0.0331***
	(0.0255)	(0.0149)	(0.0111)	(0.00901)	(0.00796)	(0.00762)	(0.00802)	(0.00818)	(0.00721)
Separated, but still married	0.198***	0.153***	0.121***	0.112***	0.0961***	0.0819***	0.0392***	0.0408***	0.0294**
	(0.0302)	(0.0199)	(0.0156)	(0.0133)	(0.0121)	(0.0122)	(0.0130)	(0.0138)	(0.0134)
Divorced	0.244***	0.164***	0.144***	0.139***	0.116***	0.111***	0.102***	0.0914***	0.0558***
	(0.0245)	(0.0164)	(0.0129)	(0.0109)	(0.0101)	(0.0101)	(0.0112)	(0.0120)	(0.0119)
Widowed	0.279***	0.213***	0.190***	0.176***	0.155***	0.152***	0.145***	0.124***	0.0699***
	(0.0473)	(0.0313)	(0.0247)	(0.0208)	(0.0190)	(0.0192)	(0.0217)	(0.0236)	(0.0238)
Self employment	-1.041***	-0.664***	-0.473***	-0.347***	-0.260***	-0.205***	-0.165***	-0.113***	-0.0396***
	(0.0255)	(0.0139)	(0.00963)	(0.00734)	(0.00623)	(0.00594)	(0.00648)	(0.00710)	(0.00752)
Mother tongue (Ref: English)									
French as mother tongue	0.0503***	0.0377***	0.0348***	0.0348***	0.0234***	0.0165**	0.00902	-0.0121	-0.0309***
	(0.0182)	(0.0112)	(0.00869)	(0.00726)	(0.00668)	(0.00674)	(0.00755)	(0.00825)	(0.00820)
No official language as MT	-0.0752***	-0.0649***	-0.0790***	-0.0784***	-0.0758***	-0.0754***	-0.0764***	-0.0722***	-0.0565***
	(0.0169)	(0.0101)	(0.00772)	(0.00652)	(0.00600)	(0.00609)	(0.00689)	(0.00759)	(0.00790)
Citizenship (Ref: Canadian by birth)									
Canada, by naturalization	-0.0310*	-0.0440***	-0.0420***	-0.0556***	-0.0708***	-0.0969***	-0.133***	-0.144***	-0.115***
	(0.0188)	(0.0111)	(0.00840)	(0.00712)	(0.00660)	(0.00677)	(0.00773)	(0.00865)	(0.00906)
None Canadian	-0.417***	-0.343***	-0.304***	-0.273***	-0.251***	-0.252***	-0.257***	-0.231***	-0.160***
	(0.0281)	(0.0162)	(0.0119)	(0.00950)	(0.00844)	(0.00824)	(0.00908)	(0.00988)	(0.00994)
Not a Visible minority	0.00687	0.0491***	0.0688***	0.0785***	0.0852***	0.0872***	0.109***	0.115***	0.110***
	(0.0178)	(0.0105)	(0.00795)	(0.00666)	(0.00610)	(0.00617)	(0.00693)	(0.00770)	(0.00784)
Not aboriginal	0.0610**	0.0782***	0.0632***	0.0542***	0.0456***	0.0342***	0.0336***	0.0374***	0.0310***
	(0.0253)	(0.0155)	(0.0118)	(0.00987)	(0.00881)	(0.00868)	(0.00936)	(0.00981)	(0.00926)
Part time worker	-0.996***	-0.855***	-0.676***	-0.519***	-0.410***	-0.334***	-0.292***	-0.248***	-0.137***
	(0.0156)	(0.00920)	(0.00642)	(0.00486)	(0.00408)	(0.00382)	(0.00400)	(0.00410)	(0.00384)
Annual weeks hours work	0.0328***	0.0204***	0.0149***	0.0113***	0.00929***	0.00788***	0.00689***	0.00566***	0.00315***
	(0.000559)	(0.000305)	(0.000212)	(0.000162)	(0.000137)	(0.000129)	(0.000137)	(0.000141)	(0.000132)
Attending school	-0.171***	-0.147***	-0.108***	-0.0765***	-0.0584***	-0.0336***	-0.0362***	-0.0440***	-0.0296***
	(0.0189)	(0.0110)	(0.00810)	(0.00658)	(0.00593)	(0.00596)	(0.00669)	(0.00723)	(0.00694)
Household type (Ref: Married-couple)									
Lone parent	0.218***	0.141***	0.0758***	0.0333**	0.0236	-0.00572	-0.0259*	-0.0544***	-0.0551***
	(0.0413)	(0.0264)	(0.0200)	(0.0165)	(0.0148)	(0.0143)	(0.0148)	(0.0148)	(0.0137)
Other Family	0.210***	0.151***	0.0821***	0.0448***	0.0344***	0.0310***	0.0192***	0.00209	-0.0110
	(0.0229)	(0.0136)	(0.0102)	(0.00826)	(0.00727)	(0.00699)	(0.00740)	(0.00759)	(0.00689)
Household size	0.00351	0.00297	0.00369	0.00624***	0.00699***	0.00755***	0.00907***	0.0106***	0.0156***
	(0.00570)	(0.00344)	(0.00259)	(0.00211)	(0.00188)	(0.00185)	(0.00201)	(0.00213)	(0.00208)
Presence of kids	0.135***	0.0937***	0.0604***	0.0353***	0.0305***	0.0255***	0.0267***	0.0336***	0.0259***
	(0.0150)	(0.00895)	(0.00680)	(0.00563)	(0.00508)	(0.00506)	(0.00558)	(0.00602)	(0.00595)
Constant	7.922***	8.316***	8.500***	8.709***	8.877***	8.978***	8.924***	9.084***	9.911***
	(0.131)	(0.0802)	(0.0604)	(0.0494)	(0.0438)	(0.0430)	(0.0466)	(0.0499)	(0.0494)
Province, CMA and Industry sectors Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	155,956	155,956	155,956	155,956	155,956	155,956	155,956	155,956	155,956
R-squared	0.196	0.295	0.344	0.358	0.349	0.333	0.309	0.272	0.189

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Unconditional Quantile Regression Results

Table 2.11: Unconditional Quantile Regression Results, Female Annual Wage (Census 2016)

Variables	rif_10	rif_20	rif_30	rif_40	rif_50	rif_60	rif_70	rif_80	rif_90
Age	0.0494***	0.0657***	0.0680***	0.0679***	0.0651***	0.0664***	0.0730***	0.0781***	0.0532***
	(0.00646)	(0.00346)	(0.00253)	(0.00205)	(0.00169)	(0.00165)	(0.00170)	(0.00183)	(0.00172)
Age Square	-0.000493***	-0.000662***	-0.000685***	-0.000684***	-0.000647***	-0.000653***	-0.000715***	-0.000750***	-0.000479***
	(7.30e-05)	(3.91e-05)	(2.86e-05)	(2.32e-05)	(1.92e-05)	(1.89e-05)	(1.94e-05)	(2.10e-05)	(2.00e-05)
Education (Ref: High school graduation)									
Other trades certification	-0.0811**	-0.0412**	-0.0355***	-0.0331***	-0.0690***	-0.0875***	-0.0754***	-0.0260***	0.0331***
	(0.0335)	(0.0182)	(0.0135)	(0.0109)	(0.00875)	(0.00795)	(0.00728)	(0.00695)	(0.00559)
College, CEGEP or other	0.0503**	0.0929***	0.117***	0.132***	0.114***	0.108***	0.0917***	0.0822***	0.0592***
	(0.0197)	(0.0106)	(0.00786)	(0.00649)	(0.00544)	(0.00532)	(0.00529)	(0.00538)	(0.00467)
University certification below bachelor	0.0856**	0.151***	0.174***	0.219***	0.228***	0.271***	0.281***	0.270***	0.185***
	(0.0376)	(0.0204)	(0.0151)	(0.0125)	(0.0107)	(0.0109)	(0.0117)	(0.0129)	(0.0119)
Bachelor's degree	0.192***	0.199***	0.246***	0.296***	0.326***	0.399***	0.469***	0.517***	0.371***
	(0.0215)	(0.0115)	(0.00850)	(0.00699)	(0.00587)	(0.00587)	(0.00619)	(0.00691)	(0.00668)
University certification above bachelor	0.251***	0.266***	0.306***	0.340***	0.414***	0.504***	0.606***	0.695***	0.521***
	(0.0428)	(0.0228)	(0.0168)	(0.0142)	(0.0121)	(0.0128)	(0.0148)	(0.0184)	(0.0196)
Degree in medicine	-0.0158	0.0511	0.147***	0.185***	0.236***	0.388***	0.533***	0.671***	0.719***
	(0.121)	(0.0612)	(0.0430)	(0.0351)	(0.0294)	(0.0296)	(0.0334)	(0.0405)	(0.0457)
Master's degree	0.188***	0.196***	0.254***	0.325***	0.381***	0.493***	0.606***	0.736***	0.627***
	(0.0303)	(0.0159)	(0.0116)	(0.00958)	(0.00815)	(0.00840)	(0.00951)	(0.0117)	(0.0129)
Earned doctorate degree	0.0154	0.140***	0.262***	0.365***	0.458***	0.608***	0.788***	1.045***	1.141***
	(0.0768)	(0.0386)	(0.0281)	(0.0232)	(0.0198)	(0.0211)	(0.0255)	(0.0337)	(0.0438)
Marital status (Ref: Single)									
Legally married and not separated	-0.00995	0.0190	0.0106	0.0271**	0.0282***	0.0523***	0.0486***	0.0420***	0.0239***
	(0.0354)	(0.0191)	(0.0139)	(0.0112)	(0.00922)	(0.00882)	(0.00880)	(0.00904)	(0.00761)
Separated, but still married	-0.0129	0.0146	-0.00707	-0.00370	-0.00360	0.0111	-0.0112	0.000909	0.0174
	(0.0486)	(0.0262)	(0.0200)	(0.0166)	(0.0140)	(0.0137)	(0.0141)	(0.0152)	(0.0142)
Divorced	0.0615	0.0504**	0.0535***	0.0718***	0.0535***	0.0618***	0.0482***	0.0598***	0.0406***
	(0.0396)	(0.0219)	(0.0165)	(0.0137)	(0.0117)	(0.0116)	(0.0121)	(0.0133)	(0.0126)
Widowed	-0.108	-0.0231	-0.00277	0.0208	-0.00298	-0.00289	0.0122	0.0136	-0.0135
	(0.0802)	(0.0434)	(0.0321)	(0.0262)	(0.0223)	(0.0217)	(0.0224)	(0.0243)	(0.0225)
Self employment	-2.077***	-1.054***	-0.677***	-0.469***	-0.320***	-0.255***	-0.210***	-0.164***	-0.0944***
	(0.0610)	(0.0284)	(0.0189)	(0.0142)	(0.0110)	(0.0103)	(0.0104)	(0.0114)	(0.0112)
Mother tongue (Ref: English)									
French as mother tongue	0.136***	0.0646***	0.0468***	0.0412***	0.0203***	0.0113	-0.00320	-0.00901	-0.0243***
	(0.0272)	(0.0149)	(0.0111)	(0.00915)	(0.00776)	(0.00778)	(0.00820)	(0.00913)	(0.00867)
No official language as MT	0.0274	-0.0269**	-0.0546***	-0.0732***	-0.0704***	-0.0762***	-0.0758***	-0.0672***	-0.0443***
	(0.0241)	(0.0132)	(0.00979)	(0.00817)	(0.00700)	(0.00705)	(0.00751)	(0.00839)	(0.00837)
Citizenship (Ref: Canadian by birth)									
Canada, by naturalization	-0.00471	-0.0284**	-0.0330***	-0.0501***	-0.0656***	-0.0959***	-0.126***	-0.138***	-0.113***
	(0.0267)	(0.0145)	(0.0108)	(0.00897)	(0.00774)	(0.00787)	(0.00848)	(0.00959)	(0.00954)
None Canadian	-0.363***	-0.261***	-0.265***	-0.265***	-0.242***	-0.251***	-0.233***	-0.219***	-0.153***
	(0.0398)	(0.0208)	(0.0152)	(0.0121)	(0.00999)	(0.00968)	(0.0100)	(0.0110)	(0.0105)
Not a Visible minority	-0.0266	0.0337**	0.0600***	0.0669***	0.0798***	0.0833***	0.0984***	0.109***	0.101***
	(0.0253)	(0.0138)	(0.0102)	(0.00843)	(0.00719)	(0.00723)	(0.00766)	(0.00861)	(0.00835)
Not aboriginal	0.148***	0.119***	0.0850***	0.0566***	0.0476***	0.0374***	0.0248**	0.0258**	0.0214**
	(0.0383)	(0.0204)	(0.0148)	(0.0122)	(0.0102)	(0.00984)	(0.0101)	(0.0108)	(0.00983)
Part time worker	-1.394***	-1.231***	-0.965***	-0.735***	-0.531***	-0.427***	-0.349***	-0.300***	-0.178***
	(0.0243)	(0.0129)	(0.00852)	(0.00622)	(0.00469)	(0.00430)	(0.00416)	(0.00425)	(0.00358)
Annual weeks hours work	0.0871***	0.0520***	0.0338***	0.0233***	0.0160***	0.0131***	0.0104***	0.00822***	0.00441***
	(0.000950)	(0.000423)	(0.000275)	(0.000204)	(0.000157)	(0.000145)	(0.000142)	(0.000148)	(0.000129)
Attending school	-0.267***	-0.207***	-0.135***	-0.0795***	-0.0414***	-0.0193***	-0.0163**	-0.0240***	-0.0187***
	(0.0292)	(0.0147)	(0.0102)	(0.00819)	(0.00680)	(0.00679)	(0.00717)	(0.00792)	(0.00722)
Household type (Ref: Married-couple)									
Lone parent	-0.0534	-0.0531	-0.0668***	-0.0541***	-0.0508***	-0.0268	-0.0395**	-0.0454***	-0.0580***
	(0.0618)	(0.0345)	(0.0256)	(0.0207)	(0.0170)	(0.0163)	(0.0161)	(0.0166)	(0.0145)
Other Family	-0.0792**	-0.0279	-0.0289**	-0.0245**	-0.0185**	-0.00357	0.000169	0.00239	-0.0122*
	(0.0319)	(0.0172)	(0.0127)	(0.0103)	(0.00845)	(0.00809)	(0.00810)	(0.00840)	(0.00724)
Household size	-0.0431***	-0.0284***	-0.0280***	-0.0251***	-0.0158***	-0.0134***	-0.00950***	-0.00313	0.00548**
	(0.00852)	(0.00456)	(0.00332)	(0.00268)	(0.00219)	(0.00213)	(0.00218)	(0.00234)	(0.00217)
Presence of kids	0.00787	-0.0202*	-0.0218**	-0.0168**	-0.0223***	-0.0102*	-0.000224	0.0106	0.0224***
	(0.0214)	(0.0116)	(0.00862)	(0.00706)	(0.00590)	(0.00584)	(0.00608)	(0.00664)	(0.00626)
Constant	3.912***	5.648***	6.814***	7.541***	8.190***	8.438***	8.582***	8.787***	9.780***
	(0.212)	(0.111)	(0.0807)	(0.0648)	(0.0529)	(0.0507)	(0.0511)	(0.0551)	(0.0491)
Province, CMA and Industry sectors Control	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	141,881	141,881	141,881	141,881	141,881	141,881	141,881	141,881	141,881
R-squared	0.271	0.393	0.416	0.406	0.380	0.355	0.322	0.281	0.198

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 2.12: Unconditional Quantile Regression Results, Female Annual Pre-tax Income (SLID 2011)

Individual Characteristics	rif_10	rif_20	rif_30	rif_40	rif_50	rif_60	rif_70	rif_80	rif_90
Age	-0.0589***	-0.00580	0.0190*	0.0248***	0.0224***	0.0307***	0.0289***	0.0305***	0.0218**
	(0.0182)	(0.0123)	(0.0104)	(0.00776)	(0.00715)	(0.00701)	(0.00751)	(0.00828)	(0.00944)
Age Square	0.000748***	0.000149	-0.000141	-0.000221**	-0.000186**	-0.000271***	-0.000232***	-0.000214**	-0.000112
	(0.000204)	(0.000138)	(0.000117)	(8.75e-05)	(8.03e-05)	(7.89e-05)	(8.47e-05)	(9.42e-05)	(0.000108)
Year of schooling	0.0102	0.0297***	0.0358***	0.0352***	0.0420***	0.0437***	0.0518***	0.0511***	0.0483***
	(0.0107)	(0.00705)	(0.00574)	(0.00453)	(0.00395)	(0.00394)	(0.00438)	(0.00486)	(0.00582)
Common-law	0.0788	0.0572	-0.00966	-0.0170	-0.0193	-0.0202	0.0180	0.0504	-0.0156
	(0.0813)	(0.0540)	(0.0452)	(0.0356)	(0.0340)	(0.0334)	(0.0356)	(0.0397)	(0.0448)
Separated	0.249**	0.0227	0.00877	0.0450	0.00669	-0.0252	0.0207	0.0295	-0.0250
	(0.101)	(0.0809)	(0.0716)	(0.0568)	(0.0525)	(0.0523)	(0.0565)	(0.0631)	(0.0716)
Divorced	0.159**	0.0766	0.0851*	0.0304	0.0201	0.0144	-0.00246	0.0443	0.0175
	(0.0811)	(0.0594)	(0.0500)	(0.0403)	(0.0393)	(0.0394)	(0.0436)	(0.0486)	(0.0569)
Widowed	0.338**	0.293**	0.221**	0.111	0.0510	0.0561	0.0269	0.0407	-0.0412
	(0.146)	(0.116)	(0.103)	(0.0806)	(0.0748)	(0.0722)	(0.0760)	(0.0873)	(0.0986)
Single never married	-0.172**	-0.0614	-0.0843**	-0.0579*	-0.0494*	-0.0317	-0.0242	-0.0106	-0.0486
	(0.0733)	(0.0461)	(0.0392)	(0.0298)	(0.0275)	(0.0274)	(0.0299)	(0.0333)	(0.0384)
Non immigrant	-0.00926	0.105***	0.128***	0.105***	0.0844***	0.103***	0.0707***	0.0670**	0.0830***
	(0.0591)	(0.0385)	(0.0323)	(0.0249)	(0.0231)	(0.0225)	(0.0244)	(0.0273)	(0.0317)
Annual work hours	0.00106***	0.000688***	0.000563***	0.000394***	0.000304***	0.000246***	0.000215***	0.000158***	0.000125***
	(6.29e-05)	(3.50e-05)	(2.60e-05)	(1.84e-05)	(1.66e-05)	(1.58e-05)	(1.70e-05)	(1.85e-05)	(2.17e-05)
Unionization Status(Ref: Union-agreement)									
Union, no agreement	-0.117	-0.0714	-0.0990	-0.0626	0.0708	0.0511	0.127*	0.103	0.162
	(0.136)	(0.103)	(0.0823)	(0.0672)	(0.0629)	(0.0686)	(0.0753)	(0.0866)	(0.118)
No union, no agreement	-0.311***	-0.298***	-0.300***	-0.164***	-0.116***	-0.0626**	-0.0147	0.0271	0.0786**
	(0.0638)	(0.0458)	(0.0398)	(0.0315)	(0.0293)	(0.0286)	(0.0307)	(0.0335)	(0.0374)
Private sector	-0.0247	-0.130***	-0.199***	-0.204***	-0.172***	-0.183***	-0.199***	-0.142***	-0.145***
	(0.0612)	(0.0425)	(0.0378)	(0.0316)	(0.0301)	(0.0303)	(0.0328)	(0.0363)	(0.0417)
Household Size	0.0133	0.0111	-0.00345	-0.00930	-0.0158*	-0.00806	-0.0176*	-0.00378	-0.00672
	(0.0222)	(0.0144)	(0.0118)	(0.00915)	(0.00833)	(0.00820)	(0.00905)	(0.00983)	(0.0110)
Constant	9.291***	8.697***	8.710***	9.111***	9.317***	9.390***	9.732***	10.18***	11.24***
	(0.461)	(0.395)	(0.316)	(0.234)	(0.211)	(0.207)	(0.232)	(0.270)	(0.410)
Job position Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Prov Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,077	3,077	3,077	3,077	3,077	3,077	3,077	3,077	3,077
R-squared	0.276	0.354	0.392	0.394	0.373	0.338	0.309	0.257	0.185

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 2.13: Unconditional Quantile Regression Results, Female Annual Pre-tax Income (Canadian Income Survey,2015)

Individual characteristics	rif_10	rif_20	rif_30	rif_40	rif_50	rif_60	rif_70	rif_80	rif_90
Age	-0.00924	0.0297**	0.0168*	0.0335***	0.0315***	0.0404***	0.0371***	0.0409***	0.0375***
	(0.0173)	(0.0129)	(0.00903)	(0.00863)	(0.00626)	(0.00684)	(0.00730)	(0.00783)	(0.00821)
Age square	0.000217	-0.000155	-2.82e-05	-0.000204**	-0.000224***	-0.000320***	-0.000278***	-0.000318***	-0.000289***
	(0.000190)	(0.000141)	(9.77e-05)	(9.31e-05)	(6.73e-05)	(7.39e-05)	(7.93e-05)	(8.56e-05)	(9.04e-05)
Education (Ref: Less than high school)									
Graduated high school	0.121	0.267**	0.194**	0.213***	0.0712	0.0791	0.0920**	0.00105	0.0259
	(0.156)	(0.114)	(0.0757)	(0.0683)	(0.0474)	(0.0481)	(0.0466)	(0.0473)	(0.0428)
Non-university certificate	0.317**	0.515***	0.426***	0.461***	0.249***	0.221***	0.239***	0.144***	0.114***
	(0.152)	(0.111)	(0.0732)	(0.0662)	(0.0462)	(0.0471)	(0.0460)	(0.0475)	(0.0438)
University degree	0.389***	0.660***	0.615***	0.710***	0.486***	0.534***	0.643***	0.560***	0.461***
	(0.151)	(0.110)	(0.0718)	(0.0644)	(0.0448)	(0.0459)	(0.0457)	(0.0486)	(0.0474)
Not stated	0	0	0	0	0	0	0	0	0
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Common-law	0.0124	0.0221	0.0765*	0.0322	0.0590*	0.0466	0.0155	-0.0239	-0.00104
	(0.0769)	(0.0600)	(0.0439)	(0.0441)	(0.0341)	(0.0378)	(0.0409)	(0.0426)	(0.0479)
Separated	-0.0762	0.252***	0.210***	0.0613	0.0452	0.0879	0.0846	0.118	0.117
	(0.148)	(0.0953)	(0.0721)	(0.0759)	(0.0593)	(0.0664)	(0.0733)	(0.0795)	(0.0949)
Divorced	0.0600	0.0456	0.0159	0.0802	0.0313	0.000351	0.0554	0.0755	-0.0379
	(0.0844)	(0.0712)	(0.0553)	(0.0545)	(0.0424)	(0.0472)	(0.0519)	(0.0584)	(0.0638)
Widowed	0.170	0.177	0.0499	0.00960	0.0314	0.110	0.132	0.117	-0.0491
	(0.148)	(0.115)	(0.0956)	(0.0946)	(0.0700)	(0.0807)	(0.0898)	(0.103)	(0.103)
Single	-0.150*	-0.0576	-0.0740*	-0.0772*	-0.0576*	-0.0498	-0.0713**	-0.0522	-0.0199
	(0.0785)	(0.0575)	(0.0423)	(0.0408)	(0.0302)	(0.0323)	(0.0344)	(0.0368)	(0.0393)
Non immigrant	0.220***	0.274***	0.293***	0.332***	0.289***	0.309***	0.278***	0.274***	0.237***
	(0.0577)	(0.0433)	(0.0309)	(0.0297)	(0.0219)	(0.0236)	(0.0256)	(0.0273)	(0.0295)
Annual worked hours	0.000935***	0.000835***	0.000595***	0.000528***	0.000340***	0.000312***	0.000293***	0.000275***	0.000233***
	(6.10e-05)	(3.98e-05)	(2.50e-05)	(2.18e-05)	(1.48e-05)	(1.60e-05)	(1.70e-05)	(1.82e-05)	(2.09e-05)
Household size	-0.0229	-0.00818	-0.00215	-0.0132	-0.0170*	-0.0163*	-0.0149	-0.0147	-0.00604
	(0.0231)	(0.0176)	(0.0126)	(0.0122)	(0.00897)	(0.00960)	(0.0102)	(0.0107)	(0.0115)
Non self employed	0.871***	0.752***	0.507***	0.453***	0.266***	0.205***	0.126***	0.0516	-0.0797
	(0.108)	(0.0750)	(0.0492)	(0.0448)	(0.0316)	(0.0342)	(0.0371)	(0.0411)	(0.0497)
Constant	7.082***	6.497***	7.701***	7.651***	8.624***	8.639***	8.853***	9.174***	9.763***
	(0.413)	(0.308)	(0.216)	(0.205)	(0.150)	(0.162)	(0.175)	(0.190)	(0.205)
Province control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,706	3,706	3,706	3,706	3,706	3,706	3,706	3,706	3,706
R-squared	0.191	0.264	0.278	0.274	0.257	0.231	0.215	0.188	0.119

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2.14: Unconditional Quantile Regression Results, Male Annual Pre-tax Income (Census 2016)

Variables	rif_10	rif_30	rif_40	rif_50	rif_60	rif_70	rif_80	rif_90
Age	0.0191***	0.0408***	0.0458***	0.0471***	0.0490***	0.0484***	0.0398***	0.0397***
	(0.00456)	(0.00201)	(0.00177)	(0.00162)	(0.00154)	(0.00150)	(0.00155)	(0.00224)
Age Square	-0.000130**	-0.000376***	-0.000429***	-0.000440***	-0.000451***	-0.000440***	-0.000340***	-0.000304***
	(5.10e-05)	(2.24e-05)	(1.98e-05)	(1.81e-05)	(1.73e-05)	(1.69e-05)	(1.76e-05)	(2.57e-05)
Education (Ref: High school graduation)								
Other trades certification	0.187***	0.174***	0.177***	0.174***	0.166***	0.140***	0.115***	0.0998***
	(0.0148)	(0.00711)	(0.00640)	(0.00592)	(0.00562)	(0.00542)	(0.00545)	(0.00751)
College, CEGEP or other	0.112***	0.146***	0.165***	0.161***	0.162***	0.148***	0.121***	0.106***
	(0.0141)	(0.00634)	(0.00572)	(0.00534)	(0.00514)	(0.00507)	(0.00521)	(0.00735)
University certification below bachelor	0.131***	0.167***	0.212***	0.221***	0.218***	0.205***	0.184***	0.190***
	(0.0322)	(0.0139)	(0.0124)	(0.0118)	(0.0117)	(0.0118)	(0.0125)	(0.0184)
Bachelor's degree	0.131***	0.202***	0.253***	0.285***	0.315***	0.320***	0.315***	0.382***
	(0.0162)	(0.00691)	(0.00617)	(0.00579)	(0.00569)	(0.00579)	(0.00627)	(0.00948)
University certification above bachelor	0.194***	0.244***	0.303***	0.343***	0.380***	0.385***	0.366***	0.456***
	(0.0379)	(0.0161)	(0.0146)	(0.0141)	(0.0145)	(0.0154)	(0.0173)	(0.0270)
Degree in medicine	0.418***	0.497***	0.618***	0.702***	0.764***	0.831***	1.049***	1.712***
	(0.0627)	(0.0261)	(0.0238)	(0.0230)	(0.0238)	(0.0257)	(0.0305)	(0.0548)
Master's degree	0.144***	0.227***	0.304***	0.365***	0.427***	0.455***	0.477***	0.623***
	(0.0232)	(0.00948)	(0.00850)	(0.00817)	(0.00831)	(0.00883)	(0.0101)	(0.0164)
Earned doctorate degree	0.144***	0.276***	0.377***	0.452***	0.548***	0.649***	0.796***	1.149***
	(0.0416)	(0.0174)	(0.0160)	(0.0160)	(0.0170)	(0.0192)	(0.0240)	(0.0418)
Marital status (Ref: Single)								
Legally married and not separated	0.627***	0.413***	0.356***	0.291***	0.219***	0.159***	0.112***	0.0832***
	(0.0273)	(0.0108)	(0.00892)	(0.00768)	(0.00688)	(0.00636)	(0.00616)	(0.00813)
Separated, but still married	0.512***	0.315***	0.262***	0.209***	0.153***	0.103***	0.0634***	0.0264
	(0.0583)	(0.0254)	(0.0230)	(0.0213)	(0.0202)	(0.0198)	(0.0204)	(0.0283)
Divorced	0.441***	0.295***	0.239***	0.179***	0.121***	0.0681***	0.0287*	0.0141
	(0.0532)	(0.0224)	(0.0196)	(0.0177)	(0.0166)	(0.0160)	(0.0161)	(0.0231)
Widowed	0.756***	0.468***	0.394***	0.293***	0.214***	0.171***	0.122***	-0.00817
	(0.101)	(0.0455)	(0.0417)	(0.0392)	(0.0369)	(0.0366)	(0.0405)	(0.0530)
Self employment	-1.134***	-0.549***	-0.436***	-0.348***	-0.271***	-0.218***	-0.167***	-0.134***
	(0.0209)	(0.00760)	(0.00636)	(0.00567)	(0.00535)	(0.00527)	(0.00560)	(0.00865)
Mother tongue (Ref: English)								
French as mother tongue	0.154***	0.0660***	0.0377***	0.0153**	-0.00480	-0.0325***	-0.0507***	-0.0952***
	(0.0200)	(0.00904)	(0.00808)	(0.00753)	(0.00727)	(0.00724)	(0.00758)	(0.0111)
No official language as MT	-0.114***	-0.0914***	-0.0966***	-0.0878***	-0.0855***	-0.0907***	-0.0983***	-0.144***
	(0.0198)	(0.00810)	(0.00716)	(0.00662)	(0.00640)	(0.00642)	(0.00685)	(0.0102)
Citizenship (Ref: Canadian by birth)								
Canada, by naturalization	-0.0545***	-0.0892***	-0.0925***	-0.0977***	-0.0996***	-0.103***	-0.103***	-0.138***
	(0.0209)	(0.00865)	(0.00774)	(0.00727)	(0.00716)	(0.00729)	(0.00787)	(0.0121)
None Canadian	-0.578***	-0.378***	-0.340***	-0.288***	-0.246***	-0.214***	-0.187***	-0.196***
	(0.0299)	(0.0115)	(0.00983)	(0.00886)	(0.00843)	(0.00839)	(0.00880)	(0.0133)
Not a Visible minority	0.159***	0.166***	0.177***	0.194***	0.194***	0.177***	0.166***	0.214***
	(0.0200)	(0.00811)	(0.00713)	(0.00659)	(0.00637)	(0.00636)	(0.00672)	(0.00998)
Not aboriginal	0.289***	0.161***	0.123***	0.102***	0.0850***	0.0658***	0.0562***	0.0865***
	(0.0303)	(0.0128)	(0.0113)	(0.0104)	(0.00990)	(0.00974)	(0.0101)	(0.0135)
Part time worker	-1.726***	-0.573***	-0.388***	-0.275***	-0.210***	-0.161***	-0.115***	-0.111***
	(0.0330)	(0.00968)	(0.00762)	(0.00640)	(0.00569)	(0.00525)	(0.00523)	(0.00732)
Annual weeks hours work	0.0381***	0.0170***	0.0130***	0.00998***	0.00758***	0.00558***	0.00372***	0.00301***
	(0.000725)	(0.000247)	(0.000201)	(0.000174)	(0.000159)	(0.000152)	(0.000155)	(0.000223)
Attending school	-0.208***	-0.110***	-0.0840***	-0.0695***	-0.0638***	-0.0666***	-0.0625***	-0.0670***
	(0.0240)	(0.00918)	(0.00799)	(0.00730)	(0.00703)	(0.00687)	(0.00697)	(0.00988)
Household type (Ref: Married-couple)								
Lone parent	-0.232***	-0.0502	-0.0420	-0.0434**	-0.0264	-0.0321*	-0.0531***	-0.0499**
	(0.0881)	(0.0315)	(0.0256)	(0.0216)	(0.0198)	(0.0179)	(0.0165)	(0.0216)
Other Family	-0.0472*	-0.00878	-0.0115	-0.00877	-0.0126*	-0.0197***	-0.0123**	-0.0299***
	(0.0266)	(0.0103)	(0.00859)	(0.00746)	(0.00673)	(0.00630)	(0.00624)	(0.00840)
Household size	-0.0226***	-0.0178***	-0.0106***	-0.00151	0.00633***	0.0123***	0.0162***	0.0285***
	(0.00635)	(0.00256)	(0.00221)	(0.00199)	(0.00189)	(0.00186)	(0.00194)	(0.00279)
Presence of kids	0.0622***	0.0822***	0.0838***	0.0835***	0.0816***	0.0791***	0.0732***	0.0754***
	(0.0158)	(0.00685)	(0.00607)	(0.00561)	(0.00539)	(0.00534)	(0.00556)	(0.00802)
Constant	6.863***	8.186***	8.490***	8.759***	9.031***	9.419***	10.02***	10.21***
	(0.133)	(0.0601)	(0.0529)	(0.0484)	(0.0459)	(0.0445)	(0.0462)	(0.0660)
Province, CMA and Industry sectors Controls	YES	YES	YES	YES	YES	YES	YES	YES
Observations	159,905	159,905	159,905	159,905	159,905	159,905	159,905	159,905
R-squared	0.221	0.309	0.310	0.305	0.293	0.271	0.235	0.182

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 2.15: Unconditional Quantile Regression Results, Male Annual Wage (Census 2016)

Variables	rif_10	rif_30	rif_40	rif_50	rif_60	rif_70	rif_80	rif_90
Age	0.0675***	0.0702***	0.0663***	0.0651***	0.0637***	0.0589***	0.0465***	0.0450***
	(0.00628)	(0.00229)	(0.00193)	(0.00172)	(0.00162)	(0.00155)	(0.00154)	(0.00230)
Age Square	-0.000718***	-0.000736***	-0.000686***	-0.000664***	-0.000637***	-0.000575***	-0.000435***	-0.000379***
	(7.07e-05)	(2.56e-05)	(2.16e-05)	(1.93e-05)	(1.82e-05)	(1.75e-05)	(1.75e-05)	(2.64e-05)
Education (Ref: High school graduation)								
Other trades certification	0.204***	0.172***	0.168***	0.172***	0.171***	0.146***	0.117***	0.105***
	(0.0210)	(0.00805)	(0.00690)	(0.00623)	(0.00588)	(0.00556)	(0.00539)	(0.00766)
College, CEGEP or other	0.109***	0.158***	0.171***	0.172***	0.172***	0.156***	0.122***	0.110***
	(0.0190)	(0.00712)	(0.00618)	(0.00566)	(0.00541)	(0.00524)	(0.00518)	(0.00753)
University certification below bachelor	0.164***	0.186***	0.215***	0.231***	0.224***	0.206***	0.190***	0.191***
	(0.0440)	(0.0157)	(0.0134)	(0.0126)	(0.0123)	(0.0121)	(0.0125)	(0.0189)
Bachelor's degree	0.0728***	0.199***	0.243***	0.291***	0.319***	0.326***	0.303***	0.378***
	(0.0217)	(0.00775)	(0.00669)	(0.00616)	(0.00601)	(0.00603)	(0.00630)	(0.00989)
University certification above bachelor	0.163***	0.246***	0.282***	0.337***	0.381***	0.385***	0.332***	0.417***
	(0.0522)	(0.0180)	(0.0159)	(0.0151)	(0.0153)	(0.0161)	(0.0171)	(0.0275)
Degree in medicine	-0.0140	0.323***	0.456***	0.529***	0.565***	0.622***	0.767***	1.428***
	(0.120)	(0.0379)	(0.0321)	(0.0298)	(0.0295)	(0.0304)	(0.0337)	(0.0623)
Master's degree	-0.00189	0.213***	0.292***	0.366***	0.423***	0.462***	0.465***	0.598***
	(0.0312)	(0.0105)	(0.00910)	(0.00866)	(0.00871)	(0.00916)	(0.0102)	(0.0171)
Earned doctorate degree	-0.0667	0.228***	0.337***	0.436***	0.532***	0.641***	0.757***	1.180***
	(0.0615)	(0.0202)	(0.0177)	(0.0172)	(0.0179)	(0.0201)	(0.0239)	(0.0440)
Marital status (Ref: Single)								
Legally married and not separated	0.439***	0.376***	0.337***	0.270***	0.204***	0.146***	0.102***	0.0743***
	(0.0360)	(0.0121)	(0.00967)	(0.00816)	(0.00730)	(0.00657)	(0.00613)	(0.00824)
Separated, but still married	0.364***	0.290***	0.241***	0.198***	0.157***	0.109***	0.0619***	0.0188
	(0.0778)	(0.0284)	(0.0248)	(0.0228)	(0.0214)	(0.0206)	(0.0204)	(0.0291)
Divorced	0.271***	0.271***	0.218***	0.171***	0.133***	0.0676***	0.0305*	0.0182
	(0.0713)	(0.0255)	(0.0212)	(0.0190)	(0.0179)	(0.0169)	(0.0164)	(0.0245)
Widowed	0.734***	0.314***	0.267***	0.216***	0.143***	0.120***	0.0417	-0.140***
	(0.128)	(0.0554)	(0.0472)	(0.0411)	(0.0391)	(0.0383)	(0.0383)	(0.0402)
Self employment	-1.815***	-0.625***	-0.470***	-0.386***	-0.324***	-0.262***	-0.201***	-0.180***
	(0.0396)	(0.0111)	(0.00878)	(0.00759)	(0.00706)	(0.00680)	(0.00699)	(0.0113)
Mother tongue (Ref: English)								
French as mother tongue	0.162***	0.0470***	0.0305***	0.00592	-0.0122	-0.0299***	-0.0495***	-0.0879***
	(0.0281)	(0.0102)	(0.00874)	(0.00798)	(0.00762)	(0.00746)	(0.00752)	(0.0113)
No official language as MT	-0.134***	-0.0914***	-0.0903***	-0.0763***	-0.0783***	-0.0821***	-0.0961***	-0.136***
	(0.0254)	(0.00911)	(0.00784)	(0.00715)	(0.00691)	(0.00682)	(0.00702)	(0.0109)
Citizenship (Ref: Canadian by birth)								
Canada, by naturalization	0.0833***	-0.0381***	-0.0562***	-0.0801***	-0.0799***	-0.0857***	-0.0771***	-0.115***
	(0.0270)	(0.00969)	(0.00844)	(0.00784)	(0.00768)	(0.00771)	(0.00803)	(0.0127)
None Canadian	-0.390***	-0.326***	-0.299***	-0.263***	-0.224***	-0.190***	-0.152***	-0.168***
	(0.0381)	(0.0130)	(0.0108)	(0.00958)	(0.00910)	(0.00892)	(0.00905)	(0.0140)
Not a Visible minority	0.0476*	0.159***	0.181***	0.196***	0.194***	0.178***	0.160***	0.204***
	(0.0258)	(0.00917)	(0.00786)	(0.00718)	(0.00690)	(0.00679)	(0.00694)	(0.0107)
Not aboriginal	0.255***	0.130***	0.112***	0.0894***	0.0758***	0.0537***	0.0437***	0.0611***
	(0.0415)	(0.0143)	(0.0120)	(0.0108)	(0.0103)	(0.00999)	(0.00995)	(0.0139)
Part time worker	-2.938***	-0.767***	-0.493***	-0.325***	-0.231***	-0.152***	-0.0935***	-0.0786***
	(0.0517)	(0.0111)	(0.00824)	(0.00675)	(0.00599)	(0.00542)	(0.00510)	(0.00700)
Annual weeks hours work	0.0853***	0.0275***	0.0191***	0.0139***	0.0106***	0.00744***	0.00497***	0.00415***
	(0.00111)	(0.000279)	(0.000216)	(0.000181)	(0.000164)	(0.000153)	(0.000150)	(0.000218)
Attending school	-0.388***	-0.122***	-0.0844***	-0.0605***	-0.0607***	-0.0589***	-0.0553***	-0.0500***
	(0.0335)	(0.0103)	(0.00856)	(0.00764)	(0.00730)	(0.00698)	(0.00683)	(0.01000)
Household type (Ref: Married-couple)								
Lone parent	-0.282**	-0.0619*	-0.0325	-0.0335	-0.0298	-0.0473**	-0.0673***	-0.0537**
	(0.115)	(0.0366)	(0.0288)	(0.0238)	(0.0216)	(0.0189)	(0.0162)	(0.0217)
Other Family	-0.0561	-0.0195*	-0.0118	-0.0107	-0.0184**	-0.0218***	-0.0111*	-0.0217**
	(0.0350)	(0.0117)	(0.00941)	(0.00802)	(0.00723)	(0.00660)	(0.00632)	(0.00876)
Household size	-0.0405***	-0.0201***	-0.0132***	-0.00158	0.00795***	0.0141***	0.0176***	0.0303***
	(0.00850)	(0.00291)	(0.00242)	(0.00214)	(0.00202)	(0.00195)	(0.00197)	(0.00294)
Presence of kids	0.0782***	0.0802***	0.0919***	0.0831***	0.0767***	0.0778***	0.0709***	0.0769***
	(0.0212)	(0.00770)	(0.00658)	(0.00596)	(0.00570)	(0.00553)	(0.00555)	(0.00825)
Constant	3.460***	7.053***	7.708***	8.182***	8.565***	9.102***	9.788***	10.10***
	(0.184)	(0.0642)	(0.0545)	(0.0491)	(0.0468)	(0.0454)	(0.0454)	(0.0666)
Province, CMA and Industry sectors Controls	YES	YES	YES	YES	YES	YES	YES	YES
Observations	142,940	142,940	142,940	142,940	142,940	142,940	142,940	142,940
R-squared	0.285	0.343	0.331	0.321	0.306	0.280	0.242	0.180

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 2.16: Unconditional Quantile Regression Results, Male Annual Pre-tax Income (SLID 2011)

Individual Characteristics	rif_10	rif_20	rif_30	rif_40	rif_50	rif_60	rif_70	rif_80	rif_90
Age	0.0449*	0.0528***	0.0302***	0.0318***	0.0382***	0.0414***	0.0333***	0.0250***	0.0237**
	(0.0233)	(0.0132)	(0.0103)	(0.00845)	(0.00833)	(0.00789)	(0.00790)	(0.00798)	(0.0116)
Age Square	-0.000400	-0.000510***	-0.000279**	-0.000293***	-0.000346***	-0.000369***	-0.000272***	-0.000168*	-0.000137
	(0.000261)	(0.000147)	(0.000114)	(9.38e-05)	(9.25e-05)	(8.78e-05)	(8.83e-05)	(9.05e-05)	(0.000134)
Year of schooling	0.0102	0.0232***	0.0270***	0.0289***	0.0350***	0.0406***	0.0418***	0.0400***	0.0513***
	(0.0112)	(0.00700)	(0.00553)	(0.00444)	(0.00447)	(0.00416)	(0.00424)	(0.00427)	(0.00643)
Marital Status(Ref:Married)									
Common-law	0.0929	0.0448	0.0320	0.0112	-0.0111	-0.0371	-0.0146	-0.0315	-0.135***
	(0.0735)	(0.0479)	(0.0421)	(0.0371)	(0.0394)	(0.0382)	(0.0388)	(0.0391)	(0.0498)
Separated	0.0998	0.00854	-0.00943	-0.151**	-0.0921	-0.0907	-0.104*	-0.0817	-0.175**
	(0.144)	(0.0822)	(0.0764)	(0.0706)	(0.0703)	(0.0630)	(0.0586)	(0.0609)	(0.0813)
Divorced	-0.230*	-0.207**	-0.0860	-0.0923*	-0.0554	-0.0787	-0.132**	-0.212***	-0.138*
	(0.139)	(0.0813)	(0.0627)	(0.0547)	(0.0555)	(0.0531)	(0.0549)	(0.0460)	(0.0734)
Widowed	-1.076*	-0.304	-0.296	-0.237	-0.225	-0.221	-0.278	-0.106	0.266
	(0.637)	(0.294)	(0.185)	(0.187)	(0.231)	(0.244)	(0.182)	(0.199)	(0.383)
Single never married	-0.384***	-0.321***	-0.295***	-0.211***	-0.185***	-0.178***	-0.151***	-0.0736**	-0.0688*
	(0.0870)	(0.0502)	(0.0409)	(0.0335)	(0.0333)	(0.0311)	(0.0304)	(0.0292)	(0.0407)
Non immigrant	0.105	0.153***	0.194***	0.209***	0.212***	0.195***	0.157***	0.102***	0.100**
	(0.0672)	(0.0399)	(0.0326)	(0.0266)	(0.0260)	(0.0246)	(0.0250)	(0.0265)	(0.0407)
Annual work hours	0.00106***	0.000585***	0.000421***	0.000290***	0.000255***	0.000188***	0.000156***	0.000117***	0.000119***
	(7.37e-05)	(3.56e-05)	(2.54e-05)	(2.06e-05)	(1.99e-05)	(1.81e-05)	(1.78e-05)	(1.78e-05)	(2.70e-05)
Unionization Status(Ref: Union-agreement)									
Union, no agreement	-0.161	-0.164*	-0.168**	-0.0439	0.00181	-0.0212	0.120*	0.301***	0.297**
	(0.140)	(0.0851)	(0.0722)	(0.0624)	(0.0649)	(0.0648)	(0.0698)	(0.0831)	(0.142)
No union, no agreement	-0.337***	-0.271***	-0.322***	-0.229***	-0.187***	-0.154***	-0.0964***	-0.0505*	0.0597
	(0.0699)	(0.0430)	(0.0351)	(0.0296)	(0.0310)	(0.0292)	(0.0293)	(0.0290)	(0.0382)
Private sector	-0.204***	-0.158***	-0.136***	-0.155***	-0.165***	-0.136***	-0.0592*	-0.000708	0.0488
	(0.0753)	(0.0459)	(0.0375)	(0.0318)	(0.0345)	(0.0337)	(0.0347)	(0.0358)	(0.0531)
Household Size	-0.0403*	-0.0335**	-0.0141	-0.000620	0.0156*	0.0145*	0.0125	0.0125	0.0148
	(0.0232)	(0.0133)	(0.0111)	(0.00904)	(0.00911)	(0.00862)	(0.00855)	(0.00873)	(0.0125)
Constant	7.662***	8.217***	9.267***	9.482***	9.445***	9.595***	9.884***	10.34***	10.34***
	(0.579)	(0.374)	(0.283)	(0.223)	(0.220)	(0.211)	(0.263)	(0.303)	(0.531)
Job position Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Prov Control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,997	2,997	2,997	2,997	2,997	2,997	2,997	2,997	2,997
R-squared	0.270	0.325	0.350	0.345	0.335	0.328	0.286	0.239	0.159

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 2.17: Unconditional Quantile Regression Results, Male Annual Pre-tax Income (Canadian Income Survey, 2015)

Individual Characteristics	rif_10	rif_20	rif_30	rif_40	rif_50	rif_60	rif_70	rif_80	rif_90
Age	0.0121	0.0420***	0.0396***	0.0342***	0.0339***	0.0327***	0.0340***	0.0260***	0.0314***
	(0.0228)	(0.0129)	(0.00859)	(0.00755)	(0.00748)	(0.00701)	(0.00636)	(0.00707)	(0.0103)
Age square	5.79e-05	-0.000321**	-0.000325***	-0.000282***	-0.000286***	-0.000273***	-0.000291***	-0.000199***	-0.000180
	(0.000241)	(0.000137)	(9.06e-05)	(7.96e-05)	(7.91e-05)	(7.40e-05)	(6.75e-05)	(7.50e-05)	(0.000112)
Education (Ref: Less than high school)									
Graduated high school	0.659***	0.380***	0.263***	0.263***	0.218***	0.227***	0.155***	0.130***	0.175***
	(0.186)	(0.101)	(0.0651)	(0.0546)	(0.0499)	(0.0439)	(0.0362)	(0.0358)	(0.0435)
Non-university certificate	0.832***	0.624***	0.423***	0.405***	0.393***	0.394***	0.294***	0.260***	0.236***
	(0.179)	(0.0959)	(0.0627)	(0.0527)	(0.0483)	(0.0426)	(0.0359)	(0.0362)	(0.0430)
University degree	0.741***	0.651***	0.527***	0.571***	0.595***	0.640***	0.576***	0.581***	0.680***
	(0.180)	(0.0954)	(0.0613)	(0.0511)	(0.0467)	(0.0413)	(0.0356)	(0.0374)	(0.0495)
Not stated	0	0	0	0	0	0	0	0	0
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Common-law	0.0148	0.0460	-0.0328	-0.0542	-0.103**	-0.170***	-0.128***	-0.137***	-0.122**
	(0.107)	(0.0632)	(0.0467)	(0.0422)	(0.0427)	(0.0422)	(0.0383)	(0.0434)	(0.0613)
Separated	-0.584**	-0.207	-0.155	-0.108	-0.156*	-0.0656	-0.0363	-0.0649	-0.201*
	(0.298)	(0.155)	(0.106)	(0.0879)	(0.0860)	(0.0861)	(0.0789)	(0.0865)	(0.103)
Divorced	-0.120	0.0368	-0.0553	-0.0820	-0.0195	-0.0301	0.00436	-0.0771	-0.168*
	(0.175)	(0.0999)	(0.0788)	(0.0713)	(0.0720)	(0.0719)	(0.0667)	(0.0730)	(0.0974)
Widowed	0.539***	0.154	0.296*	0.0969	-0.0479	-0.184	-0.0880	-0.0474	-0.228
	(0.202)	(0.264)	(0.152)	(0.191)	(0.225)	(0.192)	(0.184)	(0.219)	(0.254)
Single	-0.551***	-0.456***	-0.354***	-0.355***	-0.342***	-0.336***	-0.234***	-0.245***	-0.136***
	(0.112)	(0.0647)	(0.0438)	(0.0390)	(0.0379)	(0.0352)	(0.0311)	(0.0339)	(0.0468)
Non immigrant	0.371***	0.414***	0.364***	0.350***	0.362***	0.361***	0.313***	0.315***	0.351***
	(0.0786)	(0.0469)	(0.0318)	(0.0281)	(0.0279)	(0.0268)	(0.0247)	(0.0286)	(0.0421)
Annual worked hours	0.000918***	0.000603***	0.000394***	0.000325***	0.000292***	0.000243***	0.000202***	0.000212***	0.000269***
	(9.17e-05)	(4.59e-05)	(2.69e-05)	(2.47e-05)	(2.27e-05)	(2.00e-05)	(1.74e-05)	(1.99e-05)	(3.12e-05)
Household size	-0.0452	-0.0485***	-0.0331***	-0.0247**	-0.0294***	-0.0124	0.000144	0.00822	0.0257*
	(0.0317)	(0.0185)	(0.0124)	(0.0109)	(0.0106)	(0.0102)	(0.00924)	(0.0105)	(0.0151)
Non self employed	1.479***	1.006***	0.602***	0.483***	0.371***	0.280***	0.191***	0.137***	0.0482
	(0.121)	(0.0641)	(0.0400)	(0.0339)	(0.0325)	(0.0310)	(0.0282)	(0.0327)	(0.0499)
Constant	5.526***	6.456***	7.713***	8.278***	8.615***	8.927***	9.233***	9.584***	9.422***
	(0.573)	(0.321)	(0.212)	(0.188)	(0.185)	(0.175)	(0.159)	(0.177)	(0.259)
Observations	3,880	3,880	3,880	3,880	3,880	3,880	3,880	3,880	3,880
R-squared	0.152	0.221	0.228	0.228	0.219	0.209	0.196	0.163	0.115
Province, CMA and Industry sectors Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Regression-Based Decomposition Results

Table 2.18: Regression-Based Decomposition Results by Gender Pre-tax Annual Income (Census,2001 & 2006)

Individual Characteristics	Male						Female					
	2001			2006			2001			2006		
	Coef	Std	Cont	Coef	Std	Cont	Coef	Std	Cont	Coef	Std	Cont
Residual			75.19			84.61			77.41			87,2044
Age	-0.011***	0,001	0,505	-0.018***	0,001	0,482	0.012***	0,001	-0,288	0.004***	0,001	0,094
Age Square	0.0002***	0.00001	-1,166	0.0003***	0,0000109	-0,841	-0.00003***	0,00001	0,166	0.00007***	0.00001	0,108
Education (Ref: Secondary without degree or less)			5,999			3,674			5,796			2,82
High school graduation	0.22***	0,006	-0,282	0.252***	0,008	-0,335	0.231***	0,005	-0,145	0.261***	0,009	-0,262
Other trades certification	0.221***	0,008	-0,088	0.216***	0,011	-0,12	0.288***	0,006	0,254	0.336***	0,01	0,068
College, CEGEP or other	0.437***	0,006	1,251	0.478***	0,009	0,728	0.412***	0,006	0,893	0.464***	0,01	0,422
University certification	0.537***	0,011	0,364	0.568***	0,013	0,263	0.405***	0,013	0,105	0.476***	0,016	0,048
Bachelor's degree	0.688***	0,007	2,597	0.75***	0,01	1,681	0.615***	0,007	2,107	0.732***	0,011	1,126
University certification	0.749***	0,014	0,621	0.813***	0,019	0,386	0.611***	0,014	0,367	0.71***	0,022	0,184
Degree in medicine, d	0.918***	0,03	0,221	1.101***	0,041	0,156	0.993***	0,021	0,635	1.292***	0,037	0,352
Master's degree	0.839***	0,012	1,094	0.891***	0,015	0,762	0.728***	0,01	1,13	0.825***	0,016	0,573
Earned doctorate degree	0.973***	0,033	0,221	0.837***	0,032	0,153	0.858***	0,019	0,45	0.964***	0,026	0,309
Marital status (Ref: Divorced)			0,601			0,274			3,087			2,099
Legally married and not separated	-0.151***	0,007	0,523	-0.118***	0,009	0,197	0.221***	0,007	1,828	0.276***	0,011	1,167
Separated, but still married	0.024**	0,011	0,009	-0.006	0,015	-0,001	0.064***	0,012	-0,006	0.018	0,019	-0,002
Never legally married	-0.119***	0,008	-0,114	-0.14***	0,01	-0,05	-0.188***	0,008	1,341	-0.242***	0,012	0,938
Widowed	0.211***	0,009	0,183	0.247***	0,013	0,128	0.219***	0,014	-0,076	0.283***	0,021	-0,004
Citizenship (Ref: Canadian by birth)			0,873			0,778			1,324			1,007
Canada, by naturalization	-0.07***	0,005	0,02	-0.028***	0,008	0,016	-0.178***	0,005	0,121	-0.114***	0,009	0,072
None Canadian	-0.45***	0,009	0,853	-0.522***	0,014	0,762	-0.57***	0,009	1,203	-0.714***	0,016	0,935
Not a Visible minority	0.126***	0,011	0,072	0.259***	0,01	0,479	0.32***	0,011	0,374	0.427***	0,011	0,973
Household size	-0.014***	0,002	0,116	0	0,002	-0,001	-0.012***	0,002	-0,098	-0.021***	0,002	-0,033
Average weekly work hours	0.025***	0	17,386	0.025***	0	10,388	0.016***	0	11,667	0.017***	0	5,477
Province controle			0,428			0,16			0,557			0,251
Constant	8.971***	0,031		8.933***	0,04		8.745***	0,03		8.647***	0,045	
Number of obs	268315			283946			256745			268168		
F stats	2951,35			1721,92			2497,86			1311,47		
Prob > F	0			0			0			0		
R-squared	0,2481			0,1539			0,2259			0,128		
Adj R-squared	0,2481			0,1538			0,2259			0,1279		
Root MSE	0,98409			1,3756			0,92782			1,5136		

Standard errors in parentheses

* p<0.1, ** p<0.05, *** p<0.01

Regression-Based Decomposition Results

Table 2.19: Regression-Based Decomposition Results by Gender Pre-tax Annual Income (Slide, 2008 & 2011)

Individual Characteristics	Female						Male					
	2008			2011			2008			2011		
	Coef	Std	Cont	Coef	Std	Cont	Coef	Std	Cont	Coef	Std	Cont
Residual			50.2288			54.903			60.009			55.374
Age	0.022***	0.007	2.885	0.006	0.007	0.77	0.048***	0.007	13.769	0.033***	0.007	8.381
Age Square	-0.0002***	0.00008	-1.618	0.00003	0.00008	0.296	0.0004***	0.00008	-9.601	-0.0003***	0.00008	-5.148
Gender(Ref: Male)												
Education (Years of Schooling)	0.034***	0.004	3.966	0.038***	0.004	4.028	0.018***	0.004	1.687	0.03***	0.004	2.882
Marital status(Ref:Married)												
Common-law	-0.047	0.032	0.035	0.004	0.033	-0.003	-0.035	0.033	0.018	-0.012	0.032	-0.018
Separated	0.033	0.047	0.027	0.046	0.05	0.034	-0.045	0.062	-0.021	-0.063	0.057	-0.006
Divorced	0.067**	0.035	0.162	0.043	0.038	0.072	-0.102**	0.048	0.012	-0.137***	0.048	0.072
Widowed	0.206**	0.071	0.08	0.165**	0.071	0.082	0.207	0.186	0.039	-0.384**	0.173	0.039
Single-never married	-0.027	0.027	0.029	-0.054**	0.028	0.129	-0.173***	0.028	2.451	-0.211***	0.028	3.259
Non immigrant	0.112***	0.022	0.852	0.067***	0.023	0.423	0.182***	0.024	1.269	0.144***	0.023	0.889
Annual work hours	0.001***	0.00002	22.602	0.0005***	0.00002	19.502	0.0004***	0.00002	12.354	0.0004***	0.00002	15.252
Unionization(Ref:Union and agreement)												
Agreement, no union	-0.015	0.059	-0.004	0.001	0.071	0.001	0.029	0.061	0.039	0.04	0.064	0.066
No Union and no Agreement	-0.171***	0.027	2.37	-0.154***	0.028	2.163	-0.103***	0.025	0.455	-0.184***	0.026	1.507
Private sector	-0.083***	0.028	1.32	-0.125***	0.029	2.223	-0.114***	0.03	1.046	-0.099***	0.03	0.84
Household size	-0.003	0.008	0.074	0.003	0.009	-0.045	-0.008	0.008	-0.036	-0.009	0.008	-0.04
Job position(Ref:Manager)												
Other Management	-0.034	0.138	-0.235	-0.276**	0.151	-1.732	-0.222**	0.105	-2.25	-0.06	0.166	-0.568
Prof in Business..	-0.088	0.141	-0.278	-0.359**	0.154	-0.968	-0.273**	0.113	-0.641	-0.155	0.171	-0.388
Financial,Secretary..	-0.289**	0.137	-0.823	-0.514***	0.151	-0.86	-0.441***	0.119	-0.28	-0.294*	0.173	-0.364
Clerical Occupation	-0.414***	0.136	0.385	-0.601***	0.15	0.372	-0.653***	0.108	1.56	-0.702***	0.167	3.831
Natural Applied Sc	-0.034	0.142	-0.127	-0.299**	0.154	-0.956	-0.285***	0.104	-2.094	-0.245	0.165	-1.873
Health,Nurses	-0.115	0.14	-0.556	-0.335**	0.153	-1.61	-0.315**	0.139	-0.256	-0.186	0.196	-0.162
Tech,Assist health	-0.389***	0.139	0.098	-0.693***	0.153	0.367	-0.72***	0.158	0.124	-0.718***	0.182	0.481
Social Sc,Govt	-0.425***	0.139	0.152	-0.622***	0.151	-0.115	-0.524***	0.115	-0.233	-0.409**	0.172	-0.218
Teacher and Professor	-0.374***	0.138	-1.308	-0.536***	0.152	-2.341	-0.72***	0.112	0.293	-0.672***	0.169	-0.309
Art,Culture,Recreatn	-0.293**	0.144	-0.157	-0.643***	0.157	0.093	-0.566***	0.122	0.228	-0.581***	0.175	0.674
Wholesale,Tech..	-0.197	0.147	-0.185	-0.507***	0.158	-0.068	-0.371***	0.114	-0.55	-0.26	0.17	-0.34
Retail Salespersons	-0.781***	0.141	4.789	-1.013***	0.154	7.954	-0.727***	0.115	1.647	-0.677***	0.173	1.491
Chefs and Cooks,Food..	-0.642***	0.146	1.569	-0.904***	0.163	1.821	-1.05***	0.125	2.999	-0.882***	0.177	2.514
Protective Services	-0.43***	0.168	-0.032	-0.536***	0.18	-0.164	-0.639***	0.115	-0.19	-0.529***	0.171	-0.182
Home Support workers	-0.926***	0.144	3.597	-1.13***	0.161	3.215	-1.289***	0.32	0.309	-1.164***	0.266	0.437
Sales, Service,nec	-0.802***	0.139	7.738	-0.93***	0.153	7.096	-1.028***	0.11	6.379	-0.84***	0.168	5.879
Supervisor:trades	0	0	0	-0.289	0.339	-0.029	-0.414***	0.12	-0.389	-0.34**	0.176	-0.34
Construction Trades	0	0	0	-0.637	0.55	0.006	-0.566***	0.116	0.589	-0.367**	0.173	0.01
Other Trades	-0.408**	0.179	0.064	-1.042***	0.199	0.597	-0.527***	0.106	0.099	-0.376**	0.167	-0.596
Transport operators	-0.594***	0.178	0.204	-0.929***	0.214	0.246	-0.714***	0.11	1.442	-0.701***	0.168	1.442
Trades Helpers	-0.618***	0.188	0.3	-0.793***	0.197	0.322	-0.801***	0.115	2.656	-0.726***	0.171	2.094
Unique-Primary Ind	-0.817***	0.203	0.381	-1.54***	0.224	0.852	-0.911***	0.126	1.157	-0.796***	0.183	0.737
Machine Operators	-0.608***	0.147	0.888	-0.764***	0.166	0.614	-0.631***	0.108	1.509	-0.517***	0.169	0.634
Labourer in Proces..	-0.645***	0.174	0.287	-0.949***	0.225	0.255	-0.73***	0.142	0.477	-0.64***	0.193	0.422
Constant	9.163***	0.213		9.617***	0.229		9.418***	0.202		9.315***	0.238	
Province Control	Yes		0.242	Yes		0.455	Yes		1.927	Yes		1.344
Number of obs	3147			3077			3020			2997		
F stats	76.94			59.34			47.24			56.68		
Prob> F	0			0			0			0		
R-squared	0.4977			0.451			0.3999			0.4463		
Adj R-squared	0.4912			0.4434			0.3914			0.4384		
Root MSE	0.49921			0.52775			0.52156			0.51074		

Regression-Based Decomposition Results

Table 2.20: Regression-Based Decomposition Results by Gender Pre-tax Annual Income (CIS,2012 & 2015)

Individual Characteristics	Women						Men					
	2012			2015			2012			2015		
	Coef	Std	Cont	Coef	Std	Cont	Coef	Std	Cont	Coef	Std	Cont
Residual			67.9			66.971			69.849			71.37
Age	0.021***	0.01	3.261	0.027***	0.01	4.263	0.019***	0.007	3.941	0.025***	0.007	4.348
Age Square	-9.4E-05	0	-1.169	-0.00015**	0	-1.872	-5.93E-05	7.7E-05	-1.036	-0.0001**	7.4E-05	-2.03
Education (Ref: Less than high school)			4.497			4.695			3.968			3.827
Graduated high school	0.14***	0.05	-0.755	0.1**	0.06	-0.644	0.109**	0.049	-0.672	0.29***	0.052	-1.364
Non-university certification	0.239***	0.05	-0.618	0.288***	0.06	-0.67	0.241***	0.048	0.071	0.414***	0.051	0.34
University degree	0.544***	0.05	5.971	0.534***	0.05	6.01	0.486***	0.047	4.46	0.615***	0.05	4.85
Note stated	0.216**	0.12	-0.102				-0.132	0.118	0.11			
Marital Status (Ref: Married)												
Common-law	0.017	0.04	0.017	0.023	0.04	0.025	-0.122***	0.039	0.056	-0.08**	0.041	-0.034
Separated	0.078	0.07	0.035	0.104	0.07	0.067	-0.177**	0.084	-0.024	-0.252***	0.085	0.096
Divorced	0.129***	0.05	0.409	0.039	0.05	0.095	-0.182***	0.063	0.006	-0.082	0.066	-0.045
Widowed	0.086	0.09	0.042	0.109	0.08	0.052	-0.014	0.18	-0.001	0.074	0.187	0.006
Single-never married	-0.102***	0.04	0.348	-0.075**	0.03	0.21	-0.324***	0.038	2.995	-0.319***	0.037	2.774
Non immigrant	0.212***	0.03	1.277	0.282***	0.02	2.481	0.369***	0.027	2.745	0.372***	0.027	3.226
Annual work hours	0.001***	0.0000	19.711	0.001***	0.0000	19.594	0.0005***	0.00002	12.233	0.0004***	0.00002	10.24
Household size	-0.002	0.01	0.025	-0.007	0.01	0.082	-0.011	0.01	-0.021	-0.011	0.01	-0.031
Non self employed	0.466***	0.04	2.929	0.381***	0.033	2.347	0.508***	0.03	3.762	0.534***	0.031	4.288
Constant	8.136***	0.18		8.059***	0.17		8.258***	0.178		8.145***	0.18	
Province Controle			0.718			0.99			1.526			1.966
Number of obs	3667			3706			3848			3880		
F stats	90.74			101.02			86.97			86.03		
Prob > F	0			0			0			0		
R-squared	0.321			0.3303			0.3015			0.2863		
Adj R-squared	0.3175			0.327			0.298			0.2829		
Root MSE	0.68452			0.66353			0.73063			0.73922		

Decomposition of the Dynamics of Inequality by Gender

Table 2.21: FFL Decomposition of the Change in Inequality within Males (Annual Pre-tax Income, Census 2001 and 2006).

Inequality measure based on Male annual pre-tax income	**90-80**	**90-10**	**90-50**	**50-10**	**50-30**	**20-10**	**Gini**	**Variance**
Estimated changes (2001-2006)	-0.0267	-0.0254	-0.0457	0.0202	0.0137	0.0151	-0.0124	-1.5146
Total Composition effect	0.0006	0.0120	-0.0061	0.0181	-0.0071	0.0248	0.0000	-0.0014
Total income effect	-0.0273	-0.0375	-0.0396	0.0021	0.0208	-0.0097	-0.0124	-1.5131
Composition effects attributable to								
Age	-0.0019	0.0328	-0.0068	0.0396	-0.0008	0.0331	0.0006	0.0294
Education	0.0034	0.0235	0.0096	0.0139	0.0095	0.0109	0.0008	0.0241
Marital Status	-0.0006	-0.0118	-0.0026	-0.0092	-0.0035	-0.0058	0.0003	-0.0126
Citizenship	0.0007	0.0060	0.0016	0.0043	0.0011	0.0030	0.0001	0.0047
Visible minority	-0.0012	-0.0430	-0.0098	-0.0332	-0.0154	-0.0170	0.0013	-0.0512
Household size	0.0002	0.0027	0.0016	0.0011	0.0014	-0.0003	0.0001	0.0025
Average Weekly work hours	0.0000	0.0016	0.0002	0.0014	0.0004	0.0008	0.0000	0.0015
Province	0.0000	0.0002	0.0000	0.0001	0.0001	0.0001	0.0000	0.0002
Total	0.0006	0.0120	-0.0061	0.0181	-0.0071	0.0248	0.0000	-0.0014
Income structural effects attributable to								
Age	-0.1377	0.1893	-0.2098	0.3991	-0.1479	0.6328	0.0227	-2.4121
Education	0.0004	-0.1498	0.0275	-0.1773	-0.0126	-0.1520	0.0014	0.3075
African Status								
Marital Status	0.0044	-0.0473	0.0090	-0.0563	-0.0091	-0.0534	0.0018	0.2679
Citizenship	-0.0002	0.0179	-0.0036	0.0215	0.0062	0.0163	0.0004	-0.0662
Visible minority	-0.0064	-0.2325	-0.0439	-0.1886	-0.0359	-0.1818	0.0010	0.2213
Household size	-0.0103	-0.1029	-0.0315	-0.0714	-0.0293	-0.0299	0.0055	-0.3361
Average Weekly work hours	-0.0017	-0.3446	-0.0142	-0.3304	-0.0457	-0.2843	0.0047	1.0194
Province	-0.0059	-0.0709	0.0194	-0.0904	-0.0573	-0.0375	0.0034	-0.3763
Constant	0.1302	0.7033	0.2074	0.4959	0.3525	0.0801	0.0126	-0.1385
Total	-0.0273	-0.0375	-0.0396	0.0021	0.0208	-0.0097	-0.0124	-1.5131

Table 2.22: FFL Decomposition of the Change in Inequality within Females (Annual Pre-tax Income, Census 2001 and 2006).

Inequality measure based on Female annual pre-tax income	90-80	90-10	90-50	50-10	50-30	20-10	Gini	Variance
Estimated changes (2001-2006)	0.0032	0.2431	0.0334	0.2097	0.0186	0.1702	-0.0047	-0.9484
Total Composition effect	0.0032	0.0406	0.0119	0.0288	-0.0145	0.0234	0.0005	0.0044
Total income effect	-0.0001	0.2024	0.0215	0.1809	0.0332	0.1468	-0.0052	-0.9527
Composition effects attributable to								
Age	-0.0014	0.0404	-0.0039	0.0444	0.0045	0.0275	0.0006	0.0224
Education	0.0031	0.0074	0.0151	-0.0076	-0.0158	0.0044	0.0005	0.0089
Marital Status	0.0011	0.0031	0.0014	0.0017	-0.0001	0.0015	-0.0001	-0.0024
Citizenship	0.0008	0.0049	0.0018	0.0031	0.0002	0.0019	0.0001	0.0036
Visible minority	-0.0022	-0.0337	-0.0098	-0.0239	-0.0020	-0.0202	-0.0008	-0.0313
Household size	0.0001	-0.0001	0.0006	-0.0007	-0.0009	0.0001	0.0000	-0.0007
Average Weekly work hours	0.0016	0.0200	0.0067	0.0133	0.0000	0.0091	0.0001	0.0047
Province	0.0000	-0.0014	0.0000	-0.0014	-0.0003	-0.0009	0.0000	-0.0008
Total	0.0032	0.0406	0.0119	0.0288	-0.0145	0.0234	0.0005	0.0044
Income structural effects attributable to								
Age	0.0429	-0.0407	-0.0389	-0.0018	-0.0148	0.1313	-0.0352	-4.2699
Education	0.0199	-0.1065	0.0608	-0.1674	0.0004	-0.1123	0.0003	0.1510
African Status								
Marital Status	0.0039	-0.0657	-0.0192	-0.0465	0.0190	-0.0493	-0.0008	-0.0106
Citizenship	-0.0031	0.0131	-0.0028	0.0159	0.0020	0.0083	0.0003	0.0045
Visible minority	-0.0110	-0.1308	-0.0299	-0.1008	-0.0012	-0.0682	0.0033	0.5714
Household size	-0.0006	-0.0152	-0.0069	-0.0084	-0.0161	-0.0345	0.0021	0.2882
Average Weekly work hours	-0.0201	-0.2803	-0.0730	-0.2074	0.0147	-0.1226	0.0027	0.7234
Province	0.0190	-0.1907	0.0480	-0.2387	-0.0658	-0.1774	-0.0036	-0.2346
Constant	-0.0511	1.0193	0.0833	0.9359	0.0949	0.5715	0.0257	1.8238
Total	-0.0001	0.2024	0.0215	0.1809	0.0332	0.1468	-0.0052	-0.9527

Chapter 3

Corporate Tax Spillovers: Evidence from Canada Corporate Tax System

3.1 Introduction

Tax collection is an essential instrument that enables governments to obtain resources to finance their economies. Income taxes are among the most important types of taxes and have been considered one of the most significant innovations of the last two centuries (Aidt and Jensen (2009)). This is mainly due to the critical role played by individuals and firms in creating the wealth that underpins development.

In this regard, tax systems are regarded as policy instruments that can help achieve public policy goals such as increased economic growth, productivity, investment, and competitiveness. For example, if a country seeks to achieve a development goal based on certain constraints, it may increase or decrease tax rates accordingly.

Tax competition is becoming increasingly common at various levels, including between countries, provinces in a country, and municipalities in a province. The objective of this competition is to encourage economic growth by attracting investors and taxpay-

ers. However, tax policies must be set within certain constraints. For example, a country (or province/municipality) may decide to increase the supply of goods and services to its population by marginally increasing the tax rate, which could lead to higher revenue.

While some authors argue that raising taxes to a certain level may result in costs to both taxpayers and the economy due to the loss of revenue resulting from higher tax rates (Ferede and Dahlby (2016)), an increase in a domestic tax rate could lead to a decrease in tax rates of other countries, provinces, or municipalities. These countries, provinces, or municipalities may reduce their tax rates to attract investment and/or taxpayers, including firms, to declare their taxable income in another country with relatively lower tax rates (Aidt and Jensen (2009)).

Therefore, countries, provinces, and municipalities must balance increasing tax rates to generate revenue and reducing tax rates to attract investment and taxpayers.

In a setting of tax competition, several authors have shown that an increase in tax rates in one country can harm the tax revenues of other countries (Devereux et al. (2008); Devereux et al. (2008); Riedl and Rocha-Akis (2012); Riedl and Rocha-Akis (2012); Naitram (2019); Azémar et al. (2020)). On the other hand, reducing tax rates may not always benefit a country when its neighboring country increases its taxes (Redoano (2014)). The role of taxes in economic growth and development has been widely studied in the literature, particularly the impact of corporate income tax on economic indicators (Chetty and Saez (2005); Piotrowska et al. (2008); Devereux et al. (2014); Hassett and Mathur (2015); McKenzie and Ferede (2017); Ferede and Dahlby (2019)). Effective tax rates can influence investment decisions regarding industry, location, and asset mix and distort organizational form, financial structure, and dividend policy choices. Hassett et al. (2006) found that the corporate tax rate has a negative effect on wages using data from several countries. This analysis is confirmed by Ebrahimi and Vaillancourt (2016) and McKenzie and Ferede (2017), where

the latter explains the negative effect of the corporate tax rate on wages through its effect on the capital-labor ratio. Another stream of literature focuses on the externalities that corporate income tax rates could have on outcomes such as the corporate income tax base, GDP, and investments (Devereux et al. (2008); Riedl and Rocha-Akis (2012); Gravelle (2014); Keen et al. (2014); Crivelli et al. (2016); Brun and Coulibaly (2019)). For example, Brun and Coulibaly (2019) provide evidence that the corporate income tax base decreases in a domestic country when other countries marginally decrease their corporate income tax rates. While the existing literature on this topic has focused on the direct impact of the corporate income tax rate, it has also examined its spillovers or externalities. However, most of these analyses have been conducted in an international context, where tax competition and tax externalities are investigated between countries (e.g., Devereux et al. (2008); Riedl and Rocha-Akis (2012); Crivelli et al. (2016); Naitram (2019); Brun and Coulibaly (2019); Azémar et al. (2020)). Furthermore, most studies that have addressed the spillover effect of corporate tax rates at the international level have focused on European countries, OECD countries, and the US. Although tax policies vary at the micro-level within countries, only a few studies have investigated tax competition and tax externalities within a country at the provincial or municipality level (e.g., Besley and Rosen (1998); Buettner (2003); Devereux et al. (2007); Isen (2014); Parchet (2019)).

Moreover, while some studies have analyzed the spillover effects of the tax rates of other jurisdictions (provinces or municipalities) on the tax rate of a specific jurisdiction (Parchet (2019)), there is a gap in the empirical literature on the spillover effect of corporate tax on corporate taxable income (corporate tax base) at the national level, which determines the externality of the tax policy on tax revenue and economic growth (Besley and Rosen (1998); Hayashi and Boadway (2001); Devereux et al. (2007); Parchet (2019)).

The limited evidence addressing corporate income tax rate spillovers at a more micro-

level (within a country) has shown mixed results. For instance, Isen (2014) showed that tax rates in neighboring municipalities in the US state of Ohio have either no or insignificant effect on tax revenue, tax rate, and total expenditure. However, in the German context, Buettner (2003) showed that when small jurisdictions reduce their tax rates, it negatively affects their tax base (taxable income).

Canada has a unique tax system where the tax rates vary across provinces. As a result, studying corporate tax externalities or spillovers at the national level is crucial to enrich the empirical literature on corporate taxation. However, the existing evidence on tax competition and fiscal externalities in the Canadian context is limited. While Hayashi and Hayashi and Boadway (2001) have provided evidence of tax competition between provinces, little is known about the significance of corporate tax externalities within Canadian jurisdictions. Furthermore, no study has investigated corporate tax externalities on corporate taxable income using Canadian provincial-level data.

This study aims to address this gap in the literature by investigating the spillover effects of corporate income tax rates on Canada's corporate income tax base, using Canadian provincial corporate data from 1981 to 2019. This paper is the first study of this kind in the context of taxable income in Canada. The objective is to guide public policy in setting tax rates that promote economic efficiency and respect the neutrality principle of business taxation as proposed by (Mintz et al. (2001)). Based on this principle, the tax system should not distort business decisions.

The empirical analysis in this study uses Canadian provincial corporate data from 1981 to 2019. It applies a Dynamic panel model to estimate the spillover effects of corporate tax rates on the corporate tax base. Two identification strategies are employed to address potential endogeneity and measurement error issues. The results suggest that an increase in corporate statutory tax rates in other provinces has a positive effect on the corporate taxable

income of a specific province, indicating the presence of spillover effects of corporate tax across provinces in Canada.

The chapter is organized as follows. Section 3.2 presents the literature review, and section 3.3, the background of the Canadian corporate tax system. Section 3.4 describes the methodology and the identification strategies applied to the estimation of corporate tax spillovers on Canada's corporate tax base. Section 3.5 presents the data used and the empirical results. Section 3.6 concludes and suggests policy implication.

3.2 Literature Review

Over the past few decades, fiscal and business taxation has received significant attention in both the empirical and theoretical literature. This literature review will focus on issues related to tax competition and corporate tax externalities at both the national and international level.

Several authors have examined the empirical evidence of tax competition by analyzing the impact of the tax rate in other jurisdictions on the tax rate of a specific jurisdiction. Notably, Devereux et al. (2008), Riedl and Rocha-Akis (2012), and Azémar et al. (2020) have conducted extensive research in this area. Using panel data from 21 countries of the Organization for Economic Co-operation and Development (OECD) from 1982 to 1999, Devereux et al. (2008) found that the statutory tax rate of a given country is negatively affected by the tax rate of other countries. They applied the instrumental variables approach and determined that a one percent increase in the statutory tax rate of other countries can decrease the statutory tax rate of the selected country by between 0.34 and 0.67 percentage points. This highlights the impact of tax competition on tax policies within a country and emphasizes the importance of considering the tax policies of other countries when making

decisions about tax rates.

The findings of Riedl and Rocha-Akis (2012) are consistent with those of Devereux et al. (2008). Both studies utilize data from OECD countries between 1982 and 2005 to demonstrate that a 1% reduction in corporate income tax rates in neighboring countries results in a significant decrease in aggregate corporate profits of firms. The authors employ various techniques, including the instrumental variables approach and the Least Square Dummy Variable (LSDV) method, to analyze 17 OECD countries and produce robust results. Notably, their research indicates that a 1% reduction in the corporate income tax rates of three neighboring countries results in a 38% decline in the corporate income tax base in the long term. Furthermore, one of the study's outcomes suggests that a 1% increase in a country's corporate income tax rate leads to an 86% decrease in the country's corporate income tax base.

Similarly, Azémar et al. (2020) offer a new perspective on tax competition by examining 114 countries, including those in the EU and OECD, from 1995 to 2014. They utilize a spatial autoregressive (SAR) model, which incorporates the corporate statutory tax rate's lag, the spatial lag of tax rates in other countries, and the spatial lag of GDP and other control variables. Their findings provide evidence of tax competition among governments, indicating that a decrease in the corporate tax rate can increase the attractiveness of foreign direct investment (FDI) from other countries.

In a study by Redoano (2014), panel data from European Union (EU) countries spanning 1970 to 1990 show that a 1% reduction in the statutory rate of corporate tax in other EU member countries reduces the country's tax rate by 0.71 percentage points. However, the effect is smaller and statistically insignificant when non-EU countries reduce their statutory corporate tax rate by 1%. These findings suggest that tax competition is more prevalent between countries within the same union than those outside.

Another branch of literature has focused on the direct effect of corporate tax rates on the incidence of taxes. For instance, McKenzie and Ferede (2017) analyze the Canadian context by utilizing data from 10 provinces over 33 years (1981 to 2014) to investigate the impact of the corporate income tax rate on wages and capital. By regressing wages on the corporate income tax rate while controlling for other factors, the authors find a negative correlatin between the two factors, indicating that an increase in the corporate income tax rate substantially reduces wages. The mechanism underlying this result is that the corporate income tax rate affects the capital/labor ratio, which, in turn, influences wages.

Ferede and Dahlby (2019) conducted a similar analysis and examined the effect of the corporate income tax rate on economic growth using Canadian provincial data from 1981 to 2016. Using the Pooled Mean Group (PMG) estimation approach, Ferede and Dahlby (2019) concludes that one effective way to boost economic growth is to reduce the corporate income tax rate. In particular, a reduction of the corporate income tax rate by 1% increases economic growth by 0.12% points and GDP per capita by 1.2% in the long run. The same authors use the estimators from their 2019 joint publication to simulate the impact of the Alberta government's 2019 corporate income tax rate reduction policy on economic growth and employment. The results show that this policy will contribute to increasing economic growth and employment.

The effect of the corporate income tax rate on economic growth was also studied by (Ferede and Dahlby (2019)). They examined Canadian provincial data from 1981 to 2016 and used the Pooled Mean Group (PMG) estimation approach. The study concluded that reducing the corporate income tax rate is an effective way to boost economic growth. Specifically, a reduction of the corporate income tax rate by 1% leads to an increase of 0.12 1% points in economic growth and a 1.2% rise in GDP per capita in the long run. In another study, (Dahlby and Ferede (2019)) used their estimators from the 2019 joint publication to

simulate the impact of the Alberta government's 2019 corporate income tax rate reduction policy on economic growth and employment. The simulation results suggest that the policy will increase economic growth and jobs.

Gravelle (2014) examined the effect of lower corporate tax rates in the US on revenue, job creation, and economic growth. According to her findings, lower corporate tax rates in the US resulted in increased revenue, job creation, and better economic growth, even though it is not necessarily the optimal tax policy. She also argued that if other countries were to reduce their corporate tax rates relative to the US, creating investment competition, the gains would not offset the revenue loss due to the reduced corporate tax rates. Gravelle (2014) emphasized that while the statutory tax rate is important for increased revenue through profit shifting, effective rates are essential for investments.

Moreover, Crivelli et al. (2016) investigated the effect of a reduction in the corporate income tax rate in other countries on the corporate income tax base in OECD countries. Their findings indicate that a 1% decrease in the corporate income tax rate in other countries reduces the domestic country's corporate income tax base by 6.4%. Crivelli et al. (2016) also argued that efforts aimed at addressing international corporate tax spillover effects have not been successful. They showed that some of the most recommended solutions, such as unitary taxation (Formula Apportionment), do not seem to benefit developing countries. These countries tend to implement higher corporate tax regimes for aggressive revenue generation and enjoy the spillover effects of international corporate taxation.

Similarly, Brun and Coulibaly (2019) examined the spillover effect of the corporate income tax rate in 34 African countries. Their findings are consistent with those of previous studies by Riedl and Rocha-Akis (2012) and Crivelli et al. (2016) which suggest that a domestic country's corporate income tax rate is negatively correlated with its corporate income tax base. Brun and Coulibaly (2019)'s study also indicates that a decrease in cor-

porate tax rates in other countries, including neighboring countries, considerably reduces the corporate income tax base in the domestic country.

Naitram (2019) investigated the extent to which the corporate income tax rate in one country affects the tax of other countries, using data from 76 countries between 1984 and 2015. This study uses a foreign direct investment severity model and found that when the corporate income tax rate of other countries decreases by 1%, it negatively affects the corporate income tax rate of the country in question. These results hold even when different control variables or other identification strategies, including Heckman's two-step method, are used; suggesting that capital account openness and trade openness may explain this result.

In contrast to the research studies mentioned above that focus on tax competition between countries and the direct effect of corporate tax rates on macroeconomic indicators, there is less literature that examines the spillover effects of corporate tax rates within countries or jurisdictions.

The paper by Brett and Pinkse (2000) examines the effect of property tax rate reductions in neighboring municipalities on the property income of municipalities in the province of British Columbia, Canada, using data from 1987 and 1991. The authors find that such reductions do not affect the property tax in the municipalities, which they attribute to the fact that the incidence of the policies may take time to have an effect. In a similar analysis, (Isen (2014)) investigates the causal impact of a municipality's tax rate on various economic indicators of neighboring provinces in the US state of Ohio, using regression discontinuity design. The results suggest that the tax rate has little or no effect on the outcome variables, consistent with the findings of Brett and Pinkse (2000). Another study by Buettner (2003) examines the effect of tax rate externalities on the tax base in 996 jurisdictions in Germany, using provinces as units of analysis. The author finds that reducing tax rates in neighbor-

ing jurisdictions has no effect on the tax base, but small jurisdictions are more sensitive to the tax decisions of competing jurisdictions, resulting in a negative effect on the tax base. Similarly, Devereux et al. (2007) analyzes tax rate spillovers within the US using an instrumental variable approach, focusing on the effects of cigarette and gasoline tax rates in neighboring states on the state under study. The results show that an increase in cigarette tax rates in neighboring states increases the state's tax rates in the long term, but there is no effect of gasoline tax rates in neighboring states on those in the state under study.

Hayashi and Boadway (2001) consider Canadian data and study the effect of corporate tax on governmental and provincial jurisdictions. The authors argue that most provincial jurisdictions react negatively to governmental tax rates by reducing their statutory tax rates when the government increases its corporate tax rate. On the other hand, some provinces respond positively by increasing their corporate tax rate due to an increase in the rate of one of its counterparts.

The research by Devereux et al. (2007) on tax rate spillovers within the US builds on the work of Besley and Rosen (1998), one of the first papers to address the issue of tax externalities. Using US data collected between 1975 and 1989, Besley and Rosen (1998) finds that increasing federal tax rates on gasoline and cigarettes raises the state tax rate. However, Devereux et al. (2007) criticizes these findings for not accounting for the lagged dependent variable, which explains the tax rate at period t.

In the Swiss context Parchet (2019) examines the externality that one municipality's personal income tax rate might have on another municipality's tax rate. The author uses panel data from 1983 to 2012, and shows that an increase in tax rates in one municipality leads to a decrease in the tax rate of neighboring municipalities. Specifically, it was shown that a ten (10) percentage point increase in the average tax rates in neighboring municipalities is accompanied by a 5 percentage point decrease in the municipality's tax rate. The

author used different specifications to show the robustness of the results. These results confirm the theory of tax competition where governments can manipulate tax rates according to those of neighboring municipalities or countries to attract investors.

In the Swiss context, Parchet (2019) examines the externality of one municipality's personal income tax rate on another municipality's tax rate. Using panel data from 1983 to 2012, the author shows that an increase in tax rates in one municipality leads to a decrease in the tax rate of neighboring municipalities. Specifically, a 10-percentage point increase in the average tax rates in neighboring municipalities is accompanied by a 5-percentage point decrease in the municipality's tax rate. The author employs different specifications to demonstrate the robustness of the results. These findings confirm the theory of tax competition, which suggests that governments may manipulate tax rates to attract investors based on those of neighboring municipalities or countries. Table 3.7 in the appendix summarizes the key studies on Canada's corporate tax incidence and spillovers.

Based on the literature review, there is growing empirical evidence of tax competition between countries, such as the OECD, EU, and non-EU countries, where changes in corporate tax rates in other countries affect the tax rate, taxable income, or other macroeconomic indicators in the domestic country. However, there are limited studies on the spillover effects of corporate taxation within a country, where changes in tax rates in other jurisdictions within the country affect the tax rate or macroeconomic indicators of a specific jurisdiction. While there is a growing interest in analyzing the spillover effects of corporate tax on macroeconomic indicators, this chapter is unique in its investigation of corporate tax spillovers on the corporate tax base using Canadian data.

3.3 Overview of Canadian Corporate Tax System

This section summarises Canada's corporate tax system and key findings on its performance. Corporate taxation occurs at two levels in Canada: federal and provincial. In addition, generally, at the provincial and territorial levels, there are two corporate tax rates: the lower rate and the higher rate. Corporations that meet the federal small business deduction requirements are granted a lower tax rate. It refers to corporations with a business limit lower than or equal to $500,000 in most provinces. Other provinces establish their own business limit. The higher rate is applied to all corporations that have more than $500 000 Canadian dollars as a business limitation.

In the mid-1950s, the corporate tax rate was estimated at 40 percent (Taxation (1998)). In the 1970s, it decreased to 35 percent. Between the 1970s and 1980s, the corporate tax rate remained high and high rates were observed in the late 1970s. A consequence was the financing of debt during that period and, thus, a low level of corporate profits. This continued till the 1990s when recessions caused corporate tax rates to reach their maximum. Afterwards, low tax rates and broad-based policies were adopted and contributed to decrease tax rates in 1994 and 1995. The following year, the complexity of the system received an unsatisfactory review. At the same time, the government noticed that countries with a relatively low corporate tax rate were experiencing growth and attracting foreign direct investment. Therefore, the government adopted a "Five Year Reduction Plan" in 2000 to keep the tax system competitive and followed by the provinces' decision to do the same. Consequently, the federal corporate tax income decreased from 28 percent in 1999 to 15 percent in 2012 (Yilmaz et al. (2019)). This made the combined federal-provincial corporate tax rate decrease from an average of 43 percent in 2000 to an average of 26 percent in 2012. Figure 3.1 below depicts Canada's corporate statutory tax rate trend from 2000 to

2020. This summarizes several rounds of corporate tax reform undertaken by Canada's federal and provincial governments over the past 20 years for a more competitive tax regime.

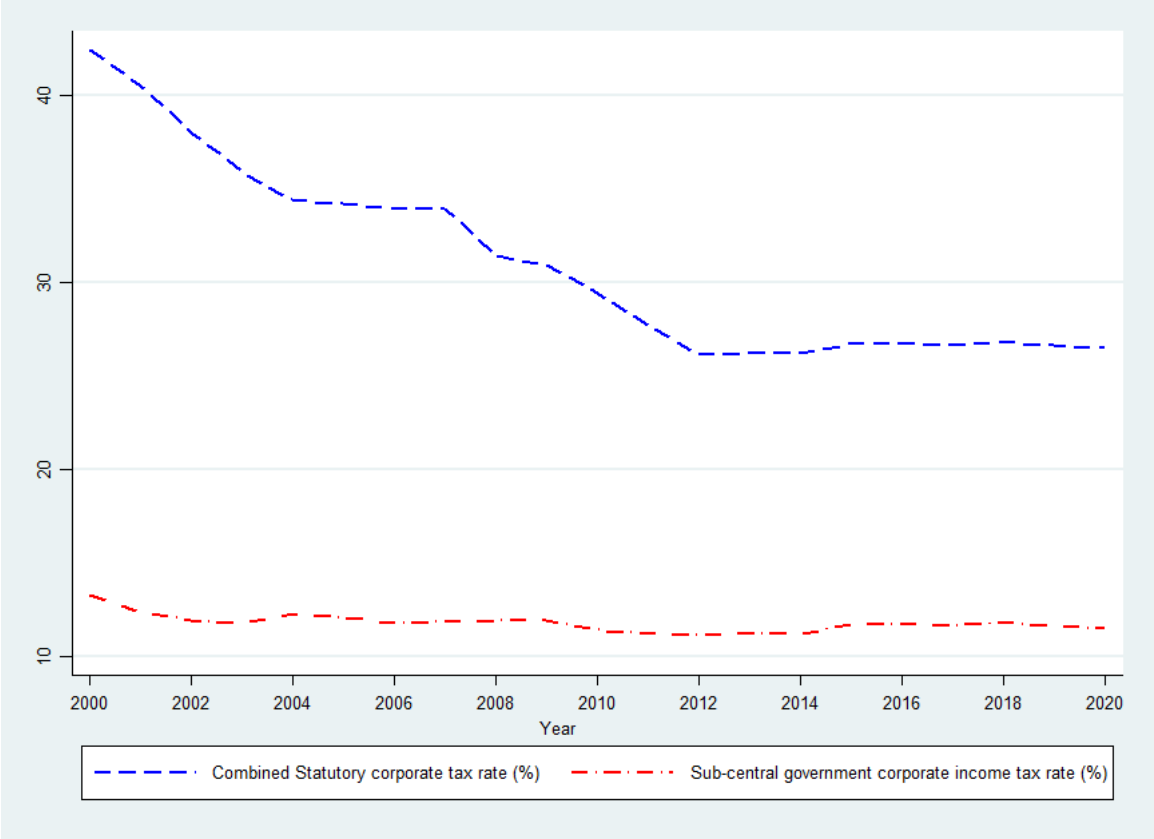


Figure 3.1: Canada's Corporate Statutory Tax Rate - Manufacture Sector (Federal Tax Rate Combined Provincial and Federal Tax Rate). Source: https://stats.oecd.org/

The reduction plan is different from one province to another. This is the case of the cancellation of taxation on financial services businesses by Alberta and British Columbia. All these changes have effectively increased the competitiveness of Canada's tax. The marginal effective tax rate has varied (increased and decreased) over time, influenced by provincial tax decisions, though it's still competitive among G7 and OECD countries. Indeed, in 2014, three provinces, namely British Columbia (BC), Manitoba (MA), and Saskatchewan (SAS), had respectively 27.5, 26.2, and 24.3 percent (highest rates in Canada) as the marginal effective tax rate. This means that an extra Canadian dollar in corporation investment is taxed

at the aforementioned rates. This is explained by the fact that those provinces still rely on retail sales taxes. It is important to indicate that those rates are higher than the average in G7 countries, influencing the overall tax rate in Canada. Specifically, it is lower than the US marginal effective tax rate, allowing Canada to stay the course. The rate is higher than that used in Mexico, another contestant to Canada on the international market. The corporate tax as a share of government expenditures has stayed relatively high compared to the share of corporate tax in the GDP. Over time, government expenditures have been increasing, and the government has started raising other taxes, like personal income taxes, to finance those expenditures. Ultimately, personal income taxes grew two and a half times between 1950 and 1990.

Figure 3.2 displays Canada's corporate tax revenue as a percentage of both GDP and total collected tax revenue.

From the Global Competitiveness Report, based on the 2019 international tax competitiveness index (Klauss (2019)), Canada ranks 23rd out of 34 regarding its corporate taxes. Based on 2022 international tax competitiveness index (Bunn (2022)), Canada ranks 27th out of 38 countries regarding its corporate taxes. This indicates that Canada still has to improve the competitiveness of its taxation system.

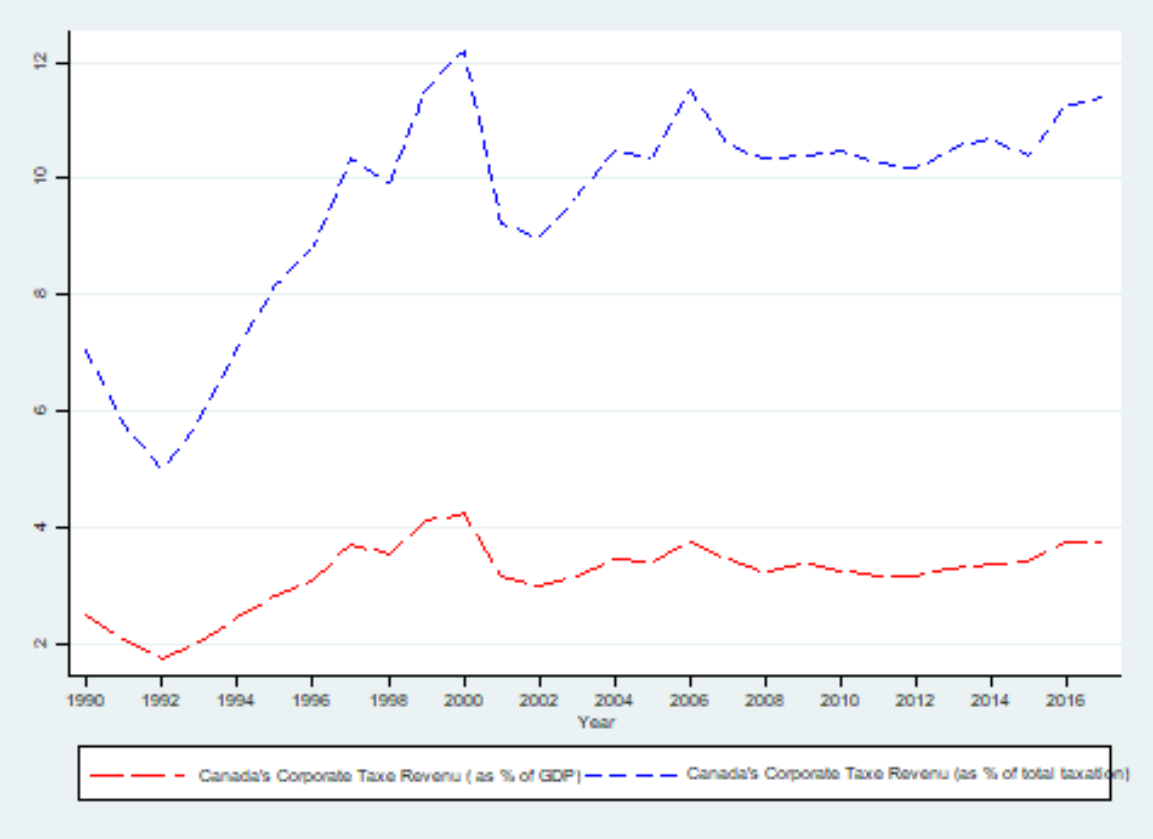


Figure 3.2: Canada's Corporate Tax Revenu (Source: https://stats.oecd.org/).

3.4 Estimation of Corporate Tax Spillovers on Corporate Tax Base: Model and Identification Strategies

Corporate Tax Spillovers can have macro-relevant effects through several channels. One province's corporate tax decisions may affect other provinces across Canada by their impact on the corporate tax base (Corporate taxable income). This paper explores the spillover effects of Canada's corporate tax system where taxes are province specific. It assesses the effects of other provincial tax practices on a province's i corporate taxable income.

3.4.1 Model Specification

Similarly to the models used in the empirical literature on international fiscal externalities (e.g., Buettner (2003); Riedl and Rocha-Akis (2012); Keen et al. (2014); Crivelli et al. (2016)), this paper investigates for the Canadian tax system, the corporate tax spillover effects on corporate taxable income by estimating the following dynamic panel equation:

$$lnB_{it} = \alpha_i + \delta lnB_{it-1} + \beta ln\tau_{it} + \gamma ln\overline{\tau}_{it} + \rho' X_{it} + \mu_t + \epsilon_{it} \tag{3.1}$$

and

$$\overline{\tau}_{it} = W_{-i}\tau_{-it} \tag{3.2}$$

Where B_{it}, is the corporate income tax (CIT) base (corporate taxable income) in province $i = 1, 2, ...10$ at time $t = 1, 2, ...T$, τ_{it} is the province $i = 1, 2, ...10$ corporate statutory tax rate evaluated in percentage at period t. The product $W_{-i}\tau_{-it}$ represents the weighted average of the statutory tax rates in provinces $k \neq i$. Furthermore, the details in the way that the weighted average corporate income tax rate of provinces $k \neq i$ is constructed are presented in the section 1.5. X_{it} is a vector of control variables that can affect the corporate tax base and that vary by province and over time.These control variables are chosen from the macroeconomic indicators following the empirical literature on corporate tax competition and spillovers, and the list is presented in the section 1.5.

In this specification, the lagged dependent variable (LDV) allows for the response of the tax base of the province i to the change in its own tax rate.

The coefficient δ represents the short run marginal impact of a province's own corporate taxable income at time $t-1$ on its taxable income at time $t-1$. The coefficient β represents the short run marginal impact of a province's own corporate income tax rate on its corporate taxable income while its long run impact is represented by $\theta(\beta) \equiv \beta/(1-\delta)$. From the

literature, these two effects are expected to be negative.

γ and $\theta(\gamma) \equiv \gamma/(1-\delta)$ are respectively the short and the long run base spillover effects of the tax rates set by other provinces on a corporate taxable income of the province i. These two effects are expected to be positive.

From the literature, the way that each control variable is expected to impact corporate tax base varies (Ebrahimi and Vaillancourt (2016)).

From different data sources, provincial panel data that covers the period from 1981 to 2019 and Canada's 10 provinces is constructed. This leads to the estimation of the parameter of a dynamic panel model with small N (Number of provinces) and large T (Time period).

To deal with dynamic panel model challenges (e.g., over-identification) with large T, two transformed databases are generated from the original panel data. The first transformed panel data is based on "five years time period" and all the variables used in the estimation of the equation 3.1 are based on the average values over the "five years period". This transformed "five years time period" data is a panel of 10 provinces and 8 "five years time period". For sensibility analysis purpose, a second transformed panel data based on "four years time period" is generated and refers to a panel of 10 provinces and 10 "four years time period". These data transformation processes are also justified by the fact that taxes do not change significantly on yearly basis. Adequate identification strategies are applied to each of these three panel data to investigate properly the spillover effect of Canadian corporate tax system on corporate taxable income.

3.4.2 Identification Strategies: Estimation Approaches

We are interested in estimating the coefficients δ , β and γ of equation 3.1 using panel data with small N and small T such that $N \geq T$. In this identification strategies, one considers

the "five years time period" and the "four years time period" panel data.

From the econometric literature on the dynamic panel model, the estimation of the model represented by equation 3.1 is not straightforward for the reason of endogeneity generated by the presence of the lagged dependent variable (B_{it-1}). B_{it-1} is then correlated with the unobserved time variable error (Nickell and Moses (1981)). Beside that, in tax competition statement, the change in corporate tax policy in the province i could potentially affect the change in corporate tax policy in other provinces $k \neq i$.

In order to overcome endogeneity issues in a dynamic panel model, optimal GMM estimators were developed in the literature (Arellano and Bond (1991); Arellano and Bond (1991); Arellano and Bover (1995); Ahn et al. (1995); Blundell et al. (2001)). GMM estimators are widely used when estimating dynamic panel models with large N, small T and $N \geq T$. GMM estimators use endogenous and predetermined lagged of dependant variables as instruments to deal with endogeneity and get consistent estimators. However, this estimator is supposed to behave poorly when the panel sample is small. In order to assess the robustness of the estimates obtained from the GMM estimators, alternative robust estimators can be used for the cases of: large N and small T, small or moderate N and Large T, small T and small N.

As results, to address the endogeneity challenges in the equation 3.1, with the panel dynamic model where $N \geq T$, the system GMM for dynamic panel model (Blundell et al. (2001)) is used. Since N is not large, the robustness of the GMM estimators is performed with the quasi-maximum likelihood estimation of linear dynamic short-T panel data model (Kripfganz (2016)), and Moral-Benito et al. (2019). These estimators are valuable to assess the robustness of estimates obtained with the system GMM method. The section below presents a short description of each estimation method used.

System GMM Estimator for Dynamic Panel Models

In the literature, there are various GMM estimators for dynamic panel data models: Arellano and Bond (1991) GMM estimator (Arellano and Bond (1991)), Arellano and Bond (1995) GMM estimator (Arellano and Bover (1995)), Ahn and Schmidt (1995) GMM estimator (Ahn et al. (1995)), and Blundell and Bond (2000) system GMM estimator (Blundell et al. (2001)). Among these four methods, the system GMM estimator aims to tackle the weak instrument in dynamic panel model. Recently, there is a new development of GMM estimator for a dynamic panel model that integrates the system GMM estimator and is more efficient (Kripfganz and Schwarz (2019)). The stata command that implements this methods is xtdpdgmm (Kripfganz (2019)).

Quasi-Maximum Likelihood Estimation of Linear Dynamic Short-T Panel Data Model

The quasi-maximum likelihood estimation of linear dynamic short-T panel data model developed by Kripfganz (2016) and Moral-Benito et al. (2019) is an alternative to the GMM estimators for panel dynamics model with potential efficiency gains. The stata command that implements this method is xtdpdqml (Kripfganz (2015)) which is based on Bhargava and Sargan (1983) random-effects QML estimator and Hsiao et al. (2002) fixed-effects QML estimator for linear dynamic panel data models.

3.5 Data Descriptive Analysis and Empirical Results

3.5.1 Data Descriptive Analysis and Data Transformation

Canada's provinces panel data from 1981 to 2019 is used to assess the spillover effects of Canada's corporate tax system. In this study, we use annual panel data of the ten Canadian provinces. The data covered the period from 1981 to 2019. The set of data used in the empirical analysis contains the following variables for each of the Canadian ten provinces: annual corporate taxable income, GDP, unemployment rate, annual consumer price index by province, GDP deflator, the annual exportation from province i to other provinces $(-i)$ in Canada, and provincial annual statutory CIT rates. Ideally, sensibility analysis of spillover effects can be done based on corporate marginal effective tax rate. However, in this study, only the corporate statutory tax rate is used because it is the one that is available in the study period by province. Most of the data come from the Conference Board of Canada's e-data sources. The annual statutory CIT rates by Canadian provinces were collected from various sources. The series of the statutory CIT rates by province from 1980 to 2005 were collected from Cahill (2007). The remaining time series were collected from www.taxtips.ca and www2.deloitte.com.

Table 3.8 presents the data sources of each variable used in the empirical analysis. Table 3.9 provides the definition of our key variables of interest used in the estimations.

Figures 3.4, 3.5, 3.6 and 3.7 present the yearly panel of the key variables of interest in this study. Each yearly graph represents the variable values in the ten provinces . Province ID in the figures 3.4, 3.5, 3.6 and 3.7 are the following: ALB(1), BC(2), Manitoba(3), NB(4, NF(5), NS(6), ON(7), PEI(8), QUE(9), SAS(10).

Since the statutory CIT rate does not change substantially in a yearly basis by province, I use five and four year periods panel dynamic data generated with the average values as

explained earlier. Table 3.10, 3.11 and 3.14 present the descriptive statistics of variables in the year panel data, "five years period" panel data, and "four years period" panel data respectively. These tables shed some light on the variation of the average value of these key variables within the period of the study use in the estimation of the dynamic panel model.

Dependent Variable: Corporate Profit by Province and by Year

It is important to mention that, at the province level, Corporate Profit is not available from statistics Canada public use data sources. Furthermore, firm-level corporate taxable income and data by province are not easy to get and are very costly. As a result, for this study, only aggregate provincial level corporate profit (corporate taxable income) is used.

From the Conference Board of Canada e-data, at the provincial level, the corporate profit (or corporate taxable income) refers to the operating surplus of corporations. In order to estimate the dynamic panel model described in equation 3.1, one generates the corporate taxable income in percentage of GDP by province and period t. This transformed variable is used as B_{it} in equation 3.1.

Key Independent Variables:

From equation 3.1, the three key independent variables of the main dynamic panel model are one-time period lag of the corporate profit of province i (B_{it-1}), the corporate statutory tax rate of province i (τ_{it}), the weighted average of the corporate statutory tax rate of all other provinces $(-i)$ excepted province i ($\overline{\tau}_{it}$).

Corporate Statutory Tax Rate by Province and by Year: τ_{it}

Corporate statutory tax rate by province and by year is one of the key variables of the study. The corporate statutory tax rate used is the combined federal and provincial corporate statutory tax rates of the manufacturer and processors sector by province and

year. This variable is referred to as τ_{it} in equation (1).

Weighted Average Tax Rate of other Provinces: $\overline{\tau}_{it}$

The weighted average tax rate of other provinces is equal to $W_{-i}\tau_{-it}$. In the formula, the weight variable (w_{-i}) of a province (i) used to generate the weighted average tax rate of other provinces is computed in four different ways for sensitivity analysis purposes. The choice of those four types of weighted average of the corporate tax rate of other provinces is based on the empirical literature on fiscal externalities. We generate for each province and each period: i) a weight computed based on the GDP of each province (GDP_Weight), ii) a weight computed based on province population size ($Population\_Weight$); iii) a weight computed based on corporate taxable income of each province ($Profit\_Weight$) , and iv) contiguity-based spacial weight ($Spatial\_Weight$).

i) GDP-based Weight: (GDP_Weight**)**

$$W_{jtgdp} = \frac{GDP_{jt}}{\sum_{s=1} GDP_{st}} \tag{3.3}$$

$$\overline{\tau}_{it} = \Sigma^{9}_{j \neq i} W_{jtgdp}\tau_{jt} \tag{3.4}$$

ii) Population-based Weight: ($Population\_Weight$**)**

$$W_{jtPopulation} = \frac{Population_{jt}}{\sum_{s=1} Population_{st}} \tag{3.5}$$

$$\overline{\tau}_{it} = \Sigma^{9}_{j \neq i} W_{jtPopulation}\tau_{jt} \tag{3.6}$$

iii) Corporate taxable income-based Weight: ($Profit\_Weight$**)**

$$W_{jtProfit} = \frac{Profit_{jt}}{\sum_{s=1} Profit_{st}} \tag{3.7}$$

$$\overline{\tau}_{it} = \Sigma^{9}_{j \neq i} W_{jtProfit} \tau_{jt} \tag{3.8}$$

iv) Contiguity-based Spatial Weight: ($Spatial\_Weight$**)**

Contiguity-based weight refers to the weight matrix generated by considering only nearest neighboring provinces. In particular, province j is assigned a value of 1 if it shares borders with province i and 0 if it does not share a border with i. Therefore, if the number of all provinces that share bothers with the province i is n_i, then the weight assigned to province j is the following:

$$W_{j,i} = \begin{cases} \frac{1}{n_i} & \text{If province j shares border with the province i} \\ 0 & \text{Otherwise.} \end{cases}$$

Figure 3.3 presents Canada's province MAP used to computed the spatial weight matrix.

The weighted average tax rate by province and year is computed based on the following formula:

$$\overline{\tau}_{it} = w_{-i}\tau_{-it} = \Sigma^{9}_{j \neq i} W_{j,i} \tau_{jt} \tag{3.9}$$

Where τ_{jt} refers to the corporate statutory tax rate of the province j and at time t.

Control Variables:

In order to properly isolate the effect of corporate tax externalities, the key drivers of the change in corporate taxable income are used as control variables. From the empirical liter-

Figure 3.3: Canada's Provinces MAP

ature, the following control variables are used in the panel dynamic model represented by equation 3.1: exportation from province i to other provinces in Canada, GDP per capita, total population (a proxy of the size of the province), unemployment rate, the provincial level of the consumer price index and the GDP deflator by province. The exportation from province i to other Canadian provinces is a proxy of the trade openness of the province. The province's total population is a proxy of the size of the province and the GDP per capita is an indicator of the province-level of development.

The tables 3.8 and 3.9 in the appendix describe in detail each variable used in the estimate of equation 3.1.

3.5.2 Empirical Strategies and Estimation Results

In this session, the results from each estimation method are presented. These results include all sensitivity analyses performed based on the panel data (”Five years period” data or ”Four years period” data) used and control variables. Tables report the robust standard errors.

System GMM Estimator: Results

Table 3.1 displays results from the estimation of equation 3.1 with two-step system GMM estimator using four different average weighted statutory tax rates. Table 3.3 presents the estimation of equation 3.1 with two-step system GMM estimator using the weighted average tax rate computed with corporate tax base ($Profit\_Weight$) whereas table 3.4 presents the same estimator of equation 3.1 using GDP-based weight version of the weighted average tax rate in other provinces (GDP_Weight. Multiple specifications with control variables are tested and tables 3.3 and 3.4 present only the summary of those that do not produce significant coefficients and those that show the evidence of spillover effect of corporate tax on corporate taxable base as a percentage of GDP. The p-values show that there is no second-order serial correlation in the residual of the estimation reported in the tables. From the Hansen test, the null hypothesis of the absence of correlation between the instruments and the error term is not rejected. Considering the two first columns of tables 3.1 and 3.3, the difference in the specification is only based on the difference in the lag variables used to control for endogeneity issues.

From the results of the two first models in table 3.1 and 3.3, there is clear evidence that, when controlling for trade openness (ln exportation) and inflation (ln consumer price index (CPI)), an increase in the province i’s tax rate reduces the corporate tax base as expected even if this effect is not significant. However, the results suggest that a reduction in the weighted average tax rate of other provinces is likely to reduce the host province i’s

corporate tax base. This spillover effect is significant when controlling for trade openness of the host province and its inflation level. Based on models 1 and 2 in table 3.1, a one percentage reduction in the weighted average corporate tax rate (GDP_Weight) is likely to reduce province i's corporate taxable profit in percentage of GDP by 2.99% or 2.85% (table 3.1 columns 1 and 2) in the short run while the spillover effects in the long run is 5.36% or 5.34%. Both the short and the long run effects are significant. Table 3.1 also provides the sensitivity analysis of the estimates presented in columns 1 and 2 by using the three other weighted average corporate tax rates ($Population\_Weight$; $Profit\_Weight$, and $Spatial\_Weight$). From the sensitivity analysis, there is consistency in the spillover effects obtained by using different weighted average corporate tax rates to estimate equation 3.1. Even if both long run and short run effects of corporate tax spillover vary in values by using different weighted average tax rates they are significant and consistent.

Table 3.1: System GMM Estimator Results based on "Five Years Period" Panel Data and where four Average Weighted Statutory Tax Rates are used for sensitivity analysis purpose

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	lcorp_gdp	lcorp_gdp	lcorp_gdp	lcorp_gdp	lcorp_gdp	lcorp_gdp	lcorp_gdp	lcorp_gdp
L1 ln Corporate Profit in percent of GDP (lcorp_gdp)	0.442***	0.426***	0.375***	0.364***	0.443***	0.467***	0.276**	0.286*
	(5.33)	(4.49)	(4.14)	(3.62)	(4.51)	(4.26)	(2.46)	(2.08)
ln CIT rate	-0.106	-0.132	-0.0150	-0.0794	-0.136	-0.250	-0.641	-0.624
	(-0.11)	(-0.14)	(-0.02)	(-0.08)	(-0.14)	(-0.27)	(-1.04)	(-1.02)
ln GDP_Weight	2.538*	2.666*						
	(2.03)	(2.09)						
ln Population_Weight			2.855*	2.992*				
			(2.14)	(2.26)				
ln Profit_Weight					2.987*	2.847**		
					(2.12)	(2.27)		
ln Spatial_Weight							2.871*	2.983*
							(2.14)	(1.87)
ln Consumer Price Index (CPI)	1.440*	1.472*	1.919**	1.893**	1.870**	1.623*	1.180	1.306
	(2.23)	(2.17)	(2.64)	(2.50)	(2.35)	(2.25)	(0.92)	(0.82)
ln exportation	0.405	0.429	0.419	0.447*	0.448	0.431*		
	(1.77)	(1.82)	(1.74)	(1.84)	(1.75)	(1.85)		
ln unemployment rate							-0.941*	-0.888
							(-2.23)	(-1.70)
Constant	-10.68**	-11.22**	-12.02**	-12.50**	-12.46*	-11.49*	-4.081	-4.662
	(-2.31)	(-2.34)	(-2.36)	(-2.43)	(-2.18)	(-2.21)	(-0.66)	(-0.61)
Observations	70	70	70	70	70	70	70	70
$\theta(\gamma)$	4.549*	4.647*	4.571*	4.70*	5.364*	5.346*	3.963*	4.178*
F	17.70	10.89	9.333	6.164	8.263	7.469	49.75	45.12
M1 (p value)	0.049	0.050	0.059	0.062	0.069	0.70	0.569	0.582
M2 (p value)	0.309	0.346	0.235	0.230	0.306	0.239	0.179	0.180
Overidentification								
Hansen (p value) 0.15	0.151	0.163	0.165	0.181	0.173	0.593	0.567	
Number of intruments	12	12	12	12	12	12	12	12
Exogeneity test instrument								
GMM Hansen (p value)	0.05	0.05	0.054	0.054	0.065	0.061	0.250	0.235
IV (p value)	0.05	0.03	0.057	0.025	0.082	0.036	0.2	0.223

Robust Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The difference in the specification of columns 1 (3, 5, 7) and 2 (respectively 4, 6,8) is only based on the difference in the lags variables used as instruments to deal with the endogeneity issues when using Xtabond2 command is stata. The first column includes in the list of instruments the lags of ln CIT rate whereas the column 2 includes the lags of GDP_Weight.

Table 3.2: System GMM Estimator Results based on "Four Years Period" Panel Data and where four Average Weighted Statutory Tax Rates are used for sensitivity analysis purpose

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	lcorp_gdp	lcorp_gdp	lcorp_gdp	lcorp_gdp	lcorp_gdp	lcorp_gdp	lcorp_gdp	lcorp_gdp
L.lcorp_gdp	0.478**	0.490**	0.369*	0.373*	0.448**	0.470**	0.454**	0.456**
	(2.86)	(3.12)	(1.98)	(2.06)	(2.67)	(2.87)	(3.05)	(2.82)
ln CIT rate	-0.498	-0.408	-0.298	-0.252	-0.447	-0.329	-0.789	-0.852
	(-0.50)	(-0.45)	(-0.29)	(-0.26)	(-0.44)	(-0.34)	(-0.80)	(-1.40)
ln GDP_Weight	2.597*	2.485*						
	(2.03)	(2.21)						
ln population_Weight			3.251*	3.213*				
			(2.03)	(2.17)				
ln profit_Weight					3.826**	3.412**		
					(2.42)	(2.32)		
ln spatial_Weight							1.734	1.773
							(1.37)	(1.25)
ln CPI	0.938*	0.974*	1.796**	1.814**	1.979**	1.882**	0.518	0.485
	(1.87)	(2.06)	(2.98)	(3.02)	(2.30)	(2.41)	(0.46)	(0.44)
ln exportation	0.427	0.399	0.475	0.469	0.572	0.504		
	(1.42)	(1.57)	(1.43)	(1.53)	(1.58)	(1.61)		
ln unemployment rate							-0.564	-0.557
							(-1.47)	(-1.35)
Constant	-9.803*	-9.496**	-12.90*	-12.88**	-15.39*	-13.81*	-0.745	-0.680
	(-2.16)	(-2.28)	(-2.16)	(-2.30)	(-2.19)	(-2.17)	(-0.15)	(-0.14)
Observations	90	90	90	90	90	90	90	90
$\theta(\gamma)$	4.975*	4.869*	5.150*	5.122*	6.926**	6.444*	3.178	3.26
F	11.90	10.54	6.092	5.893	4.089	5.309	14.67	14.70
M1 (p value)	0.016	0.014	0.015	0.015	0.020	0.018	0.020	0.019
M2 (p value)	0.286	0.270	0.248	0.245	0.291	0.245	0.239	0.258
Overidentification								
Hansen (p value) 0.327	0.321	0.311	0.311	0.342	0.329	0.339	0.339	
Number of intruments	14	14	14	14	14	14	14	14
Exogeneity test instrument								
GMM Hansen (p value)	0.163	0.160	0.153	0.153	0.174	0.165	0.173	0.171
IV (p value)	0.139	0.207	0.138	0.188	0.183	0.204	0.124	0.111

Robust Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The difference in the specification of columns 1 (3, 5, 7) and 2 (respectively 4, 6,8) is only based on the difference in the lags variables used as instruments to deal with the endogeneity issues when using Xtabond2 command is stata. The first column includes in the list of instruments the lags of ln CIT rate whereas the column 2 includes the lags of GDP_Weight.

Table 3.3: System GMM Estimator's Results based on "Five Years Period" Panel Data and where the Average Weighted Statutory Tax Rate is Computed with GDP (GDP_Weight)

	(1) lcorp_gdp	(2) lcorp_gdp	(3) lcorp_gdp	(4) lcorp_gdp
L.lcorp_gdp	0.442***	0.426***	-0.0409	0.239
	(5.33)	(4.49)	(-0.23)	(1.67)
ln CIT Rate	-0.106	-0.132	-0.597	-0.121
	(-0.11)	(-0.14)	(-0.32)	(-0.20)
ln GDP_Weight	2.538*	2.666*	1.810	0.759
	(2.03)	(2.09)	(1.42)	(1.21)
ln CPI	1.440*	1.472*	-3.499	-0.0477
	(2.23)	(2.17)	(-1.42)	(-0.09)
ln exportation	0.405	0.429	0.128	
	(1.77)	(1.82)	(0.55)	
ln GDP			2.827**	
			(2.43)	
ln unemployment rate				-1.120***
				(-3.43)
Constant	-10.68**	-11.22**	-32.15***	2.053
	(-2.31)	(-2.34)	(-3.26)	(0.90)
Observations	70	70	70	70
$\theta(\gamma)$	4.550*	4.647*		
	(2.55)	(2.53)		
F	17.70	10.89	29.49	11.56
M1 (p value)	0.049	0.05	0.956	0.7
M2 (p value)	0.309	0.346	0.461	0.237
Overidentification				
Hansen (p value)	0.15	0.151	0.624	0.935
Number of Intruments	12	12	12	12
Endogeneity test				
IV (p value)	0.622	0.87	0.912	1

Robust Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The difference in the specification of columns 1 and 2 is only based on the difference in the lags variables used as instruments to deal with the endogeneity issues when using Xtabond2 command is stata. The first column includes in the list of instruments the lags of lcit whereas the column 2 includes the lags of ln GDP_Weight.

Table 3.4: System GMM Estimator Results based on "Five Years Period" Panel Data and where the Average Weighted Statutory Tax Rate is Computed with Corporate Tax Base ($Profit\_Weight$)

	(1) lcorp_gdp	(2) lcorp_gdp	(3) lcorp_gdp	(4) lcorp_gdp	(5) lcorp_gdp
L1 Ln corporate profit in percent of GDP	0.443***	0.467***	-0.0395	0.283**	0.272*
	(4.51)	(4.26)	(-0.16)	(2.50)	(1.87)
Ln CIT rate	-0.136	-0.250	-0.995	-0.523	-0.484
	(-0.14)	(-0.27)	(-0.58)	(-0.69)	(-0.54)
Ln Profit_Weight	2.987*	2.847**	1.690*	0.981	0.736
	(2.12)	(2.27)	(2.01)	(1.47)	(0.61)
Ln CPI	1.870**	1.623*	-4.003	-0.0998	-0.272
	(2.35)	(2.25)	(-1.31)	(-0.15)	(-0.35)
Ln exportation	0.448	0.431*	0.101		-0.0622
	(1.75)	(1.85)	(0.56)		(-0.26)
Ln GDP			2.979*		
			(2.03)		
Ln unemployment rate				-1.319***	-1.412**
				(-3.32)	(-2.94)
Constant	-12.46*	-11.49*	-31.70**	3.029	4.533
	(-2.18)	(-2.21)	(-2.68)	(1.10)	(0.87)
Observations	70	70	70	70	70
$\theta(\gamma)$	5.363*	5.345*			
	(3.05)	(2.92)			
F	8.263	7.469	25.90	29.14	53.81
M1 (p value)	0.069	0.07	0.672	0.884	0.775
M2 (p value)	0.306	0.239	0.204	0.188	0.203
Overidentification					
Hansen (p value)	0.181	0.173	0.751	0.901	0.456
Number of Intruments	12	12	12	12	12
Endogeneity test					
IV (p value)	1	0.54	0.927	1	1

Robust Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The difference in the specification of columns 1 and 2 is only based on the difference in the lags variables used as instruments to deal with the endogeneity issues when using Xtabond2 command is stata. The first column includes in the list of instruments the lags of ln CIT rate whereas the column 2 includes the lags of ln of $Profit\_Weight$.

Quasi-Maximum Likelihood (QML) Estimator: Results

For robustness check of the results obtained from the system GMM estimator, QLM estimator is used to estimate equation 3.1. Tables 3.6, 3.15, and 3.5 present the results of the specifications tested. Tables 3.6 and 3.5 use the weighted average corporate tax rate computed with the corporate tax base. Besides that, table 3.5 uses the ”Four years period” panel data whereas tables 3.6 and 3.15 present the results of estimations that use ”Five years period” panel data.

Table 3.5: Quasi-Maximum Likelihood Estimator's Results based on "Four Years Period" Panel Data and where the Average Weighted Statutory Tax Rate is Computed with Corporate Tax Base ($Profit\_Weight$)

	(1) lcorp_gdp	(2) lcorp_gdp	(3) lcorp_gdp	(4) lcorp_gdp	(5) lcorp_gdp	(6) lcorp_gdp
L.lcorp_gdp	0.673	0.760	0.415***	0.264	0.327***	0.275***
	(.)	(.)	(5.10)	(.)	(3.63)	(3.20)
ln CIT rate	-0.337	-0.318	-0.252	-0.113	-0.794	-0.627
	(-0.37)	(-0.27)	(-0.43)	(-0.22)	(-1.18)	(-1.02)
ln Profit_Weight	2.273	1.751***	1.904	1.224***	2.272*	1.963***
	(.)	(2.70)	(.)	(2.67)	(1.69)	(2.76)
ln unemployment rate	-0.0231		-0.0130	-0.0901	-0.103	-0.250***
	(-0.06)		(-0.13)	(-0.49)	(-0.29)	(-2.59)
ln exportation	0.512**	0.544**	0.455***	1.153***		
	(2.21)	(2.41)	(3.12)	(5.14)		
ln GDP	0.463		1.459***	0.958***	2.144***	2.129***
	(0.85)		(7.42)	(11.09)	(2.66)	(3.13)
ln CPI		0.341	-1.719**	-1.496	-2.517**	-2.483**
		(0.55)	(-2.49)	(.)	(-2.05)	(-2.33)
ln population				-1.299***		-0.489**
				(-5.29)		(-2.25)
Constant	-15.36**	-9.305	-23.65	-13.24	-25.37**	-20.71***
	(-2.03)	(.)	(.)	(.)	(-2.27)	(-2.81)
N	100	100	100	100	100	100

Robust Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3.6: Quasi-Maximum Likelihood Estimator Results based on "Five Years Period" Panel Data and where the Average Weighted Statutory Tax Rate is Computed with Corporate Tax Base ($Profit\_Weight$)

	(1) lcorp_gdp	(2) lcorp_gdp	(3) lcorp_gdp	(4) lcorp_gdp	(5) lcorp_gdp	(6) lcorp_gdp
L1.lcorp_gdp	0.762	0.747	0.378***	0.272	0.195	0.0827
	(.)	(.)	(3.83)	(.)	(1.28)	(0.66)
ln CIT rate	-0.641	-0.185	-0.523	-0.699	-0.730	-0.465
	(-0.24)	(-0.17)	(-0.48)	(.)	(-1.31)	(-0.93)
ln Profit_Weight	2.080	1.160**	1.686	0.912***	1.724*	1.322***
	(1.17)	(2.21)	(.)	(2.82)	(1.70)	(2.83)
ln unemployment rate	-0.474		-0.296**	-0.193	-0.373	-0.362*
	(-0.71)		(-2.41)	(-1.06)	(-0.92)	(-1.70)
ln exportation	0.604	0.750**	0.466	1.178***		
	(1.60)	(2.52)	(1.48)	(6.16)		
ln GDP	0.00358		1.487***	1.069***	2.369*	2.464**
	(0.00)		(5.86)	(5.13)	(1.82)	(2.37)
ln CPI		-0.234	-2.276*	-2.388***	-3.309**	-3.115**
		(-0.27)	(-1.95)	(-4.73)	(-2.21)	(-2.00)
ln population				-1.353***		-1.052**
				(-6.60)		(-2.51)
Constant	-8.944	-9.681	-21.65	-10.99	-25.18	-17.74
	(-0.77)	(.)	(.)	(.)	(-1.58)	(-1.60)
N	80	80	80	80	80	80

Robust Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Based on the results, when using different control variables, the specifications 4, 5 and 6 display consistently spillover effects of a one percent increase in the weighted average corporate tax rate of other provinces. The effects are significant and positives. This shows

a clear evidence of spillover effects of the weighted average corporate tax rate of other provinces on the host province's corporate tax base as a percentage of GDP. One percent increase in the weighted average corporate tax rate of other provinces has on the corporate tax base (as a percent of GDP) a short run spillover effect that lies between 0.9% and 2.22% based on different sensitivity analyses (performed with different control variables, "Four years period" and "Five years period"panel data).

3.6 Conclusion

Although a large body of theoretical literature has studied the reasons why fiscal externalities occur from tax policies, less is known, from the empirical literature, on the significance of fiscal externalities. Despite the importance of corporate tax incidence in the policy designment process, the empirical evidence of tax spillovers is scarce in general and particularly when one considers business and corporate taxation.

To fill this gap in the empirical literature on corporate tax incidence, in this paper, we investigate empirical evidence of fiscal externalities on corporate taxable income in an open economy where tax varies by province within the country. Analyzing variation within one country has the advantage of controlling for country specific factors that studies based on multiple countries may not be able to account for. In fact, We investigate empirical evidence of corporate tax spillover on corporate taxable income using Canadian data where corporate tax varies by province. To this end, we use Canadian provincial corporate data from 1981 to 2019 and apply a dynamic panel model. Using two identification strategies, the results show that an increase of statutory taxes in other provinces has a positive effect on the corporate taxable income of a specific province. This shows an evidence of spillover effects in Canadian corporate tax system.

Canada corporate tax system is based on the intra-country formula allocation (FA). This means that, when a business operates in several provinces, provincial governments split the corporate taxable income using the FA mechanism. The findings of this chapter of the thesis support the fact that, even in the presence of equalization policy, Canada federal government needs to review the formula allocation mechanism and implement reforms in the business taxation. This chapter supports the recommendations proposed by Smart

and Vaillancourt (2021) on formula allocation mechanism and by Boadway and Tremblay (2016) on the modernization of business taxation mechanism in Canada.

3.7 Appendix

Appendix A: Data Description and Descriptive Statistics

Table 3.7: Key Empirical Studies on Corporate Taxation Incidence in Canada

Authors	Data	Identification strategies	Key results
Ferede and Dahlby (2019)	To estimate the effect of the corporate income tax on GDP growth, the authors use panel data from 35 periods (from 1981 to 2016) in the 10 provinces.	Pooled mean group (PMG).	Using the estimation method based on the Pooled mean group (PMG), this paper investigated the effect of the corporate income tax on GDP growth. The results suggest that a 1% reduction in the statutory income tax rate of the provinces increases (in the long run), the GDP per capita by 1.2%.
?	This research examines the factors that determine the increase or the reduction of the tax rate by provincial governments in Canada by using a multinomial logit model on provincial data in Canada from 1973 to 2010. Different variables were used in the analyses including Corporate income tax rate (CIT), Top personal income marginal tax rate (PIT), Sales tax rate, Other provinces' CIT, Other provinces' PIT	Multinomial logit model	The results indicate that left-wing provincial governments are more likely to increase rather than decrease not only their personal income tax (PIT) rate but also their general sales tax (PST). The authors suggest that when provinces reduce either their (PIT) or their corporate income tax (CIT), neighboring provinces do the same.
Ferede and Dahlby (2016)	This paper computes for each province, the Marginal Cost of Public Fund (MCF) (it measures here the loss incurred by each province by increasing tax revenues by one dollar) for each province in Canada using estimated values of the long-term elasticity for the following variables:corporate income tax (CIT), personal income tax (PIT) and provincial general sales tax (PST). To do this, the authors use provincial data for 38 periods, from 1972 to 2010.	Dynamic Ordinary Least Square (DOLS) estimation method proposed by Stock and Watson	The results suggest that the Marginal Cost of Public Fund (MCF) generated by CIT and PIT is higher than that generated by PST.
?	This paper estimates the effect of tax rates on the taxable income of firms within provinces in Canada. In other words, this research looks at the income shifting by firms as a result of marginal changes in tax rates. The empirical analyses use provincial data (in Canada) on statutory tax rates and firm taxable income for 11 periods (from 1986 to 1999).	Difference in Difference estimator with firm type, province and industry interaction fixed effects.	Evidence indicates that a reduction in the tax rate leads to an increase in taxable income per capita and these results are consistent regardless of the type of firm: large firms or small firms. The authors argued that lowering the statutory tax rate of one tax jurisdiction could lead to the creation of a tax haven under that statutory authority thereby attracting financial investment on the one hand.
?	This paper examines the effect that the tax reforms that took place from 2010 (in Canada) could have on capital investment and the cost of doing business. To this end, the authors use corporate income tax rates from 2006 to 2010.	Simulation	The paper stressed the importance of long-term economic growth and aggressive revenue generation as a key priority of every government. They argued that to attain improved economic growth governments and statutory authorities should reduce corporate and personal taxes on investment and savings.
?	In this paper, the authors estimate the effect of the corporate income tax rate on corporate income tax using data from 27 OECD countries including Canada from 2001 to 2005.	Ordinary Least Square with year fixed effects	Based on the results, the authors argued that Canada risk driving away resources from more productive investment toward more politically favored economic investment by adapting and maintaining temporary measures targeting specific business preferences. The report further argues that by reducing the current corporate tax rate, Canada would see minimal cost being shifted out while minimal profit would be shifted in leading to an increase in corporate tax revenue.

Table 3.8: Variables and Data Sources

Variable names	Definition	Sources
corpprofit	Corporate Income tax (CIT) base (in million) in province i in period t.	Conference Board of Canada
corp_gdp	Corporate Income tax (CIT) base in percentage of GDP with one period lag (Province i)	Conference Board of Canada
cit	Combined provincial and federal corporate statutory tax (Manufacture sector)	1) From Corporate tax from 1981 to 2005, referred to Cahill (2007). 2) Corporate tax from 2006 to 2019, referred to www.taxtips.ca and www2.deloitte.com
witi_gdpfinal	Weighted average of the statutory tax rates from all other provinces excepted the province i. Use GDP in the generation of the Weighted average	Computed based on GDP and statutory tax rate as presented in the section 5
witi	The weighted average of the statutory tax rates from all other provinces excepted the province i. Use corporate income tax (CIT) base in the computation of the Weighted average	Computed based on corporate taxable income and statutory tax rate as presented in the section 5
uprpct	Unemployment rate (in $\%$) in province i in period t	Conference Board of Canada
gdp	GDP of province i in period t	Conference Board of Canada
gdp_capita	GDP per capita of province i in period t	Conference Board of Canada
ipc2	Consumption price index in province i in period t	Conference Board of Canada
gdp_deflator	GDP deflator in province i in period t	Conference Board of Canada
expotherprov	Exportation from province i to other provinces in Canada in period t	Conference Board of Canada
popula	Population in province i in period t	Conference Board of Canada

Table 3.9: Description of the Variables Used in the Estimation

Variable names	Definition	Type of variable in the model
lcorp_gdp	Logarithm of the Corporate Income tax (CIT) base in percentage of GDP in province i in period t.	B_{it}
L.lcorp_gdp	Logarithm of the Corporate Income tax (CIT) base in percentage of GDP with one period lag (Province i)	B_{it-1}
lcit	Log of province i corporate statutory tax rate in period t	τ_{it}
lwiti_gdpfinal	Logarithm of the weighted average of the statutory tax rates in provinces i. Use GDP in the generation of the Weighted average	Equal to $W_{-i}\tau_{-it}$ and $w_i = \frac{GDP_i}{\sum_{s=1} GDP_s}$
lwiti	Logarithm of the weighted average of the statutory tax rates in provinces i. Use Corporate Income tax (CIT) base in the computation of the Weighted average	Equal to $W_{-i}\tau_{-it}$ and $w_i = \frac{B_i}{\sum_{s=1} B_s}$
lupr	Log of unemployment rate in province i in period t	Control variable.
lgdp	Log of the GDP per capita of province i in period t	Control variable
lipc2	Log of consumption price index in province i in period t	Control variable
lgdp_deflator	Log of GDP deflator in province i in period t	Control variable
lexp	Log of the exportation from province i to other provinces in Canada in period t	Control variable
lpopula	Log of the population in province i in period t	Control variable

Table 3.10: Descriptive Statistics of Collected and Transformed Variables: Year Basis Time Period

	n	min	mean	sd	max	p25	p50	p75
year		1981.0	2000.00	11.27	2019	1990.00	2000.00	2010.00
ipc2002		0.5	0.97	0.24	1	0.79	0.95	1.17
gdp_deflator		0.4	0.79	0.20	1	0.65	0.79	0.96
expotherprov		737.0	27373.31	31348.80	132770	7279.00	11844.48	41322.25
corpprofit		53.0	15499.72	21745.08	114682	1873.11	5094.93	21249.72
corp_gdp		0.6	12.63	6.78	45	8.83	11.82	14.12
witi		14.3	30.73	6.56	44	25.49	31.24	35.03
witi_gdpfinal		16.3	31.09	6.57	45	26.04	31.57	35.02
uprpct		3.4	9.42	3.64	20	6.59	8.73	11.94
cit		24.5	35.25	6.71	49	29.60	35.11	39.80
popula		123.4	3068.71	3608.51	14538	749.35	1097.21	4152.34
gdp_capita		8674.0	34702.92	17077.15	92611	21040.04	31290.70	45194.94
gdp		1070.5	118198.80	164178.75	890966	18221.98	38683.56	158026.75
lcorp		4.0	8.53	1.76	12	7.54	8.54	9.96
lgdp		9.1	10.33	0.51	11	9.95	10.35	10.72
lexp		6.6	9.51	1.31	12	8.89	9.38	10.63
lupr		1.2	2.17	0.39	3	1.88	2.17	2.48
lwiti		2.7	3.40	0.22	4	3.24	3.44	3.56
lcit		3.2	3.54	0.19	4	3.39	3.56	3.68
lipc		-0.7	-0.07	0.27	0	-0.24	-0.05	0.16
lwiti_gdpfinal		2.8	3.41	0.22	4	3.26	3.45	3.56
lcorp_gdp		-0.6	2.39	0.58	4	2.18	2.47	2.65
lgdp_deflator		-0.9	-0.27	0.27	0	-0.43	-0.24	-0.05
lpopula		4.8	7.32	1.26	10	6.62	7.00	8.33
N	390							

Table 3.11: Descriptive Statistics of Collected and Transformed Variables: Four Years Time Period

	n	min	mean	sd	max	p25	p50	p75
period4		1.0	5.50	2.89	10	3.00	5.50	8.00
popula		124.5	3084.19	3642.61	14293	749.86	1099.68	4187.41
lpopula		4.8	7.32	1.27	10	6.62	7.00	8.34
corpprofit		79.6	15822.20	21935.93	113454	2063.09	5678.89	20702.56
cit		24.8	35.06	6.69	48	29.31	34.44	39.31
uprpct		3.6	9.37	3.51	19	6.71	8.56	12.04
gdp_capita		9876.1	35277.74	17222.33	82601	21500.75	32096.17	46169.23
expotherprov		801.5	27633.96	31707.59	130868	7249.50	11921.39	42395.50
ipc2002		0.5	0.98	0.25	1	0.80	0.98	1.19
witi		16.1	30.55	6.55	43	25.51	30.93	34.93
gdp_deflator		0.4	0.80	0.20	1	0.65	0.80	0.97
corp_gdp		1.7	12.62	6.37	40	9.34	11.99	13.85
witi_gdpfinal		16.5	30.96	6.53	43	26.96	31.61	35.00
lgdp		9.2	10.35	0.51	11	9.97	10.38	10.74
lexp		6.7	9.52	1.32	12	8.88	9.38	10.65
lupr		1.3	2.16	0.37	3	1.89	2.14	2.47
lwiti		2.8	3.39	0.22	4	3.24	3.43	3.55
lcit		3.2	3.54	0.19	4	3.38	3.54	3.67
lipc		-0.6	-0.06	0.27	0	-0.22	-0.02	0.17
lcorp_gdp		0.4	2.39	0.55	4	2.22	2.47	2.62
lgdp_deflator		-0.8	-0.26	0.27	0	-0.43	-0.22	-0.03
lwiti_gdpfinal		2.8	3.41	0.22	4	3.29	3.45	3.56
N	100							

Table 3.12: Descriptive Statistics of Collected and Transformed Variables: Four Years Time Period

	n	min	mean	sd	max	p25	p50	p75
period4		1.0	5.50	2.89	10	3.00	5.50	8.00
ipc2002		0.5	0.99	0.25	1	0.83	0.99	1.21
gdp_deflator		0.4	0.81	0.20	1	0.67	0.82	0.99
expotherprovmillion		814.5	28070.51	32117.04	131546	7422.51	12787.38	42913.91
corpprofitmillion		79.6	16359.96	22600.74	113737	2201.74	5615.81	21569.64
corp_gdp		1.3	12.64	6.34	38	9.48	12.00	14.04
uprpct		4.3	9.27	3.50	19	6.64	8.61	11.85
cit		24.9	34.67	6.55	47	29.51	33.88	39.02
popula		124.5	3111.75	3679.19	14413	749.71	1102.41	4238.01
gdp_capita		9876.1	36269.96	17475.31	80627	22244.28	33122.43	46659.07
gdp		1231.0	125054.85	173654.68	874176	19073.47	40669.91	172012.72
corporateprofit_weigth		15.7	30.20	6.49	43	25.31	30.00	34.58
gdp_weigth		16.7	30.68	6.41	43	26.16	31.14	34.83
population_weight		16.5	30.45	6.45	43	26.08	31.39	34.54
spatial_weight		25.4	34.05	5.75	46	29.52	33.57	37.69
lipc2		-0.6	-0.04	0.27	0	-0.19	-0.01	0.19
lgdp_deflator		-0.8	-0.24	0.27	0	-0.40	-0.20	-0.01
lexp		6.7	9.53	1.32	12	8.91	9.45	10.67
lcorp		4.3	8.59	1.75	12	7.67	8.62	9.97
lcorp_gdp		0.1	2.40	0.55	4	2.22	2.48	2.64
lupr		1.4	2.15	0.37	3	1.87	2.15	2.46
lcit		3.2	3.53	0.19	4	3.38	3.52	3.66
lpopula		4.8	7.33	1.27	10	6.62	7.01	8.35
lgdpcapita		9.2	10.38	0.51	11	10.01	10.41	10.75
lgdp		7.1	10.80	1.50	14	9.85	10.61	12.05
lwiti_profit		2.7	3.38	0.22	4	3.23	3.40	3.54
lwiti_gdp		2.8	3.40	0.22	4	3.26	3.44	3.55
lwiti_pop		2.8	3.39	0.22	4	3.26	3.45	3.54
lwiti_spatial		3.2	3.51	0.17	4	3.38	3.51	3.63
prov_id		1.0	5.50	2.89	10	3.00	5.50	8.00
N	100							

Table 3.13: Descriptive Statistics of Collected and Transformed Variables: Five Years Time Period

	n	min	mean	sd	max	p25	p50	p75
period5		1.0	4.50	2.31	8	2.50	4.50	6.50
ipc2002		0.6	0.98	0.25	1	0.78	0.98	1.19
gdp_deflator		0.5	0.80	0.20	1	0.65	0.80	0.98
expotherprovmillion		810.2	27619.18	31714.58	129184	7600.39	11580.32	42017.32
corpprofitmillion		83.4	15790.92	21886.36	112303	2041.02	5768.33	22120.94
corp_gdp		1.7	12.62	6.28	37	9.27	11.67	14.04
uprpct		4.5	9.38	3.51	19	6.70	8.65	11.79
cit		24.9	35.06	6.56	47	30.27	34.21	39.33
popula		125.1	3083.60	3645.81	14183	748.73	1097.06	4199.04
gdp_capita		10156.0	35256.59	17213.85	83527	21252.62	31544.02	45874.48
gdp		1272.5	120647.43	168053.51	841511	18519.40	39160.62	164077.25
corporateprofit_weigth		15.6	30.55	6.51	43	25.45	30.81	34.99
gdp_weigth		16.6	30.95	6.50	43	26.27	31.10	35.01
population_weight		16.4	30.78	6.49	43	25.82	31.26	34.70
spatial_weight		25.5	34.42	5.74	46	30.00	33.89	38.22
lipc2		-0.6	-0.06	0.27	0	-0.25	-0.02	0.17
lgdp_deflator		-0.8	-0.26	0.27	0	-0.44	-0.22	-0.02
lexp		6.7	9.52	1.32	12	8.93	9.35	10.64
lcorp		4.4	8.55	1.75	12	7.57	8.60	9.97
lcorp_gdp		0.4	2.39	0.54	4	2.21	2.45	2.63
lupr		1.5	2.16	0.37	3	1.90	2.15	2.45
lcit		3.2	3.54	0.19	4	3.41	3.53	3.67
lpopula		4.8	7.32	1.27	10	6.62	7.00	8.34
lgdpcapita		9.2	10.35	0.51	11	9.96	10.36	10.73
lgdp		7.1	10.76	1.50	14	9.82	10.57	12.00
lwiti_profit		2.7	3.39	0.22	4	3.24	3.43	3.56
lwiti_gdp		2.8	3.41	0.22	4	3.27	3.44	3.56
lwiti_pop		2.8	3.40	0.22	4	3.25	3.44	3.55
lwiti_spatial		3.2	3.52	0.17	4	3.40	3.52	3.64
prov_id		1.0	5.50	2.89	10	3.00	5.50	8.00
N	80							

Table 3.14: Descriptive Statistics of Collected and Transformed Variables: Five Years Time Period

	n	min	mean	sd	max	p25	p50	p75
period5		1.0	4.50	2.31	8	2.50	4.50	6.50
popula		125.1	3083.60	3645.81	14183	748.73	1097.06	4199.04
lpopula		4.8	7.32	1.27	10	6.62	7.00	8.34
corpprofit		83.4	15790.92	21886.36	112303	2041.02	5768.33	22120.94
cit		24.9	35.06	6.56	47	30.27	34.21	39.33
uprpct		4.5	9.38	3.51	19	6.70	8.65	11.79
gdp_capita		10156.0	35256.59	17213.85	83527	21252.62	31544.02	45874.48
expotherprov		810.2	27619.18	31714.58	129184	7600.39	11580.32	42017.32
ipc2002		0.6	0.98	0.25	1	0.78	0.98	1.19
witi_other		15.6	30.55	6.51	43	25.45	30.81	34.99
gdp_deflator		0.5	0.80	0.20	1	0.65	0.80	0.98
corp_gdp		1.7	12.62	6.28	37	9.27	11.67	14.04
witi_gdpfinal		16.6	30.95	6.50	43	26.27	31.10	35.01
lgdp		9.2	10.35	0.51	11	9.96	10.36	10.73
lexp		6.7	9.52	1.32	12	8.93	9.35	10.64
lupr		1.5	2.16	0.37	3	1.90	2.15	2.45
lwiti		2.7	3.39	0.22	4	3.24	3.43	3.56
lcit		3.2	3.54	0.19	4	3.41	3.53	3.67
lipc		-0.6	-0.06	0.27	0	-0.25	-0.02	0.17
lcorp_gdp		0.4	2.39	0.54	4	2.21	2.45	2.63
lgdp_deflator		-0.8	-0.26	0.27	0	-0.44	-0.22	-0.02
lwiti_gdpfinal		2.8	3.41	0.22	4	3.27	3.44	3.56
N	80							

Figure 3.4: Corporate Statutory Tax Rate (Federal tax rate Combined provincial and federal tax) by province and year from 1981 to 2019. Sources: Computed as described in table 3.8 and table 3.9

Figure 3.5: Corporate Taxable Profit in Percentage of GDP by province and year from 1981 to 2019.Sources: Author computation based on data from Conference Board of Canada

Figure 3.6: Corporate Taxable Profit(in million of Canadian's $) by Province and Year from 1981 to 2019. Sources: Conference Board of Canada

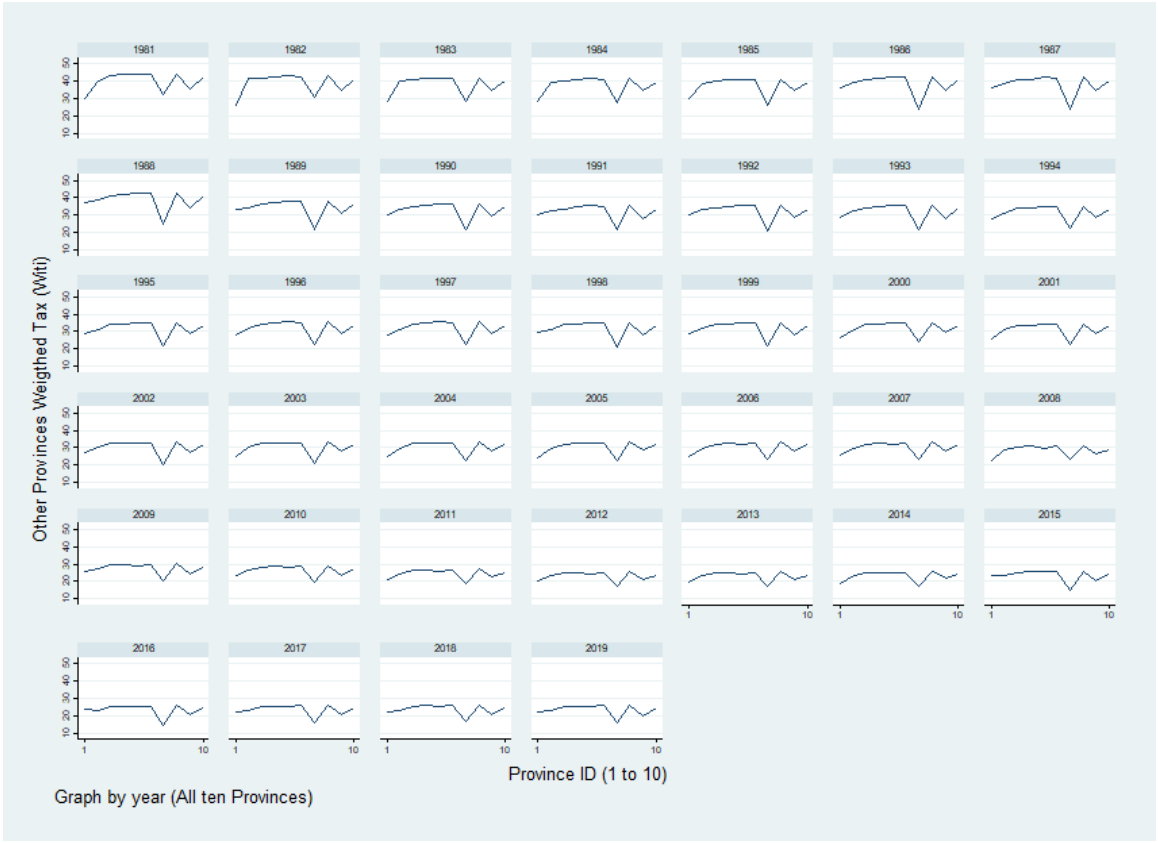


Figure 3.7: Weighted Corporate Statutory Tax Rate of Other Province (Witi in %)

Appendix B: Quasi-Maximum Likelihood Estimator Results

Table 3.15: Quasi-Maximum Likelihood Estimator's Results based on "Five Years Period" Panel Data and where the Average Weighted Tax is Computed with GDP ($lwiti_{gdp}$)

	(1) lcorp_gdp	(2) lcorp_gdp	(3) lcorp_gdp	(4) lcorp_gdp	(5) lcorp_gdp	(6) lcorp_gdp
L.lcorp_gdp	0.558	0.671	0.314	0.278	0.152	0.0551
	(0.27)	(.)	(1.12)	(.)	(0.95)	(0.41)
lcit	-0.405	-0.243	-0.347	-0.654	-0.553	-0.347
	(-0.07)	(-0.16)	(-0.46)	(.)	(-1.08)	(-0.76)
lwiti_gdpfinal	2.541	1.656	1.994	1.204	1.838*	1.419***
	(0.34)	(1.04)	(0.93)	(.)	(1.66)	(2.95)
lupr	-0.311		-0.142	-0.120	-0.191	-0.253
	(-0.88)		(-0.67)	(-0.64)	(-0.46)	(-1.05)
lexp	0.695***	0.777	0.592*	1.226***		
	(2.64)	(0.80)	(1.69)	(6.85)		
lgdp	0.313		1.534**	1.048***	2.544*	2.554**
	(0.41)		(2.57)	(6.11)	(1.95)	(2.44)
lipc		0.0315	-2.114	-2.186***	-3.366**	-3.114*
		(0.01)	(-0.82)	(-6.48)	(-2.22)	(-1.94)
lpopula				-1.406***		-1.029**
				(-6.86)		(-2.35)
_cons	-15.32	-11.23	-25.21	-12.14	-28.34*	-19.81*
	(.)	(.)	(.)	(.)	(-1.75)	(-1.77)
N	80	80	80	80	80	80

Robust Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

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