Income Inequality and Housing Access in Canada

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ABSTRACT

Income inequality can have negative consequences on countries' economy, cultural quality and politics. At the same time, housing access has become a vital problem for countries' development and growth. In many countries, income inequality is considered as a major problem. The association between income inequality and housing access has become an important issue in recent years. In this paper, I analyze how income inequality influences housing access in Canada. At first, I observe the GINI coefficient of each Canadian province along with the housing access problem in a fixed effect model without controlling for any categorical variables, then I analyze the result with controls for categorical variables. The results show that income inequality increases housing cost burden for low-income households and decreases housing quantity during 2000-2004.

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1. Introduction

In a country’s development, policymakers are not only interested in the economic wealth of the country, but also in the distribution of the wealth to less fortunate citizens. In the 1970s, one of the most common ways to describe the economic growth of countries was "growth with equity". Income distribution provides challenges to policymakers in both political and economic contexts. An individual's disposable income determines her purchasing power (Määttänen, & Terviö, 2014). Those with higher disposable incomes are associated with more purchasing power than those with lower levels of disposable income. Income inequality is the extent to which there is an unequal distribution of income in a society. It also provides a measurement of the degree to which there is an unfair distribution of a country's economic wealth (Schiller, 2007).

Recent economic studies are of the opinion that the global financial crisis could have occurred due to income inequality. The reasoning behind this argument is straightforward: inequality is always associated with financial crises because as the level of inequality goes up, people with little income borrow more in order to close the gap with the ones at the top (Beddoes, 2010). Secondly, large income differences shrink economic growth due to the high social tension that is created between various classes of citizens, especially if the country lacks social cohesion (Zhang, 2015). Also, social instability could lower foreign investments (Beddoes, 2010).

People use their earnings mainly to purchase goods and services that they need. Since the ability to purchase depends on income, those individuals with more disposable income tend to have more purchasing power. As a result, they are able to meet the majority of their wishes, while the others with little disposable income have less purchasing power and are unable to satisfy their basic requirements. Individual needs can be divided in two categories. The first category is basic needs that include food, shelter, and clothing. The requirements in this category are necessary for every individual to survive. It is not possible for a person to lack any of the three and still lead a normal life. The other category is secondary needs, which are still vital but which people may survive without. Items in this category include education, cars, computers and phones (Hulchanski, 1997).

If not contained, income inequality could cause a serious crisis to the Canadian economy and social stability in the future. One of the most serious results of income inequality is that members of the middle and lower classes may not have access to quality housing. If the poor in Canada have lower housing accessibility and affordability levels, then Canada might end up

facing both economic and social disruptions. Currently, there is enough evidence to suggest that huge income differences have negative effects on housing accessibility, especially to those with lower income levels. There are three following consequences: (i) a rising income inequality increases housing affordability problem for low income people; (ii) higher income inequality is related with more crowded living space; (iii) income inequality is negatively related to housing quality (Dewilde & Lancee, 2013). Therefore, nations such as Canada should focus on limiting the negative effects of income inequality in relation to housing affordability.

Previous research has shown that income inequality could affect housing access. Matlack and Vigdor (2008) investigated how income inequality affects the housing affordability of low-income families based on U.S. data. Zhang (2015) also analyzed how income inequality influences access to housing for low-income families based on Chinese data. Similarly, this paper will examine the relationship between income inequality and housing access based on Canadian statistics. Although Canada was more effective at controlling income inequality and maintaining stable housing prices than the U.S., income inequality in Canada has nevertheless seen a rise over the last two decades. This rise comes after an initial decline was experienced in the period after World War II to the 1970s (Yalnizyan, 2010). More recently, an increasing number of people cannot afford to buy a house (Cox & He, 2016). This research aims to establish the extent to which income inequality affects Canadian housing access.

Analyzing this topic is very important. Growing income inequality could result in more homicides (Braithwaite, 2013). The homicide rate reflects the severity of competing limited social resources among people. These deaths frequently occur in low-income populations because they feel they have nothing to lose by participating in illegal activities (Daly et al.,

2001). Furthermore, housing access is a minimum requirement for people to live with dignity. Homeless people could commit crimes which would be bad for social stability and solidarity (Hagan & McCarthy, 1998). Thus, we must research the relationship between income inequality and housing access and find some effective ways to improve the well-being of the whole society.

The rest of this paper is constructed as follows. Section 2 is the literature review that summarizes previous studies about the relationship between income inequality and housing access. Section 3 describes data, variables and models, and section 4 presents the empirical results and interpretations. The last section is the conclusion.

2. Literature Review

In this section, I will first review previous articles about the way in which income inequality and poverty affect housing access and mention the role that income inequality plays in both social and economic dimensions. Next, I will introduce the concepts of absolute income and relative income. Then, I will briefly review the measurement of income inequality. Finally, I will examine the literature on the impact of both absolute income inequality and relative income inequality on the housing access problem.

2.1 Income Inequality, Poverty and Housing Access

Income inequality has an important role to play in the welfare of individuals in a society. Extreme income inequality results in a poorer state of well-being of individuals. Therefore, decreasing income inequality is essential for the realization of better, more successful and healthier societies (Wilkinson & Pickett, 2006). As per Tunstall et al. (2013), there is more

evidence that poverty affects housing accessibility than housing accessibility affects poverty. In a recent study by Norris and Winston (2012), housing accessibility is defined in terms of affordability (cost of housing), quality of housing (problems associated with housing) and quantity of housing (crowding in housing). When households face problems of housing affordability, they often respond by decreasing their housing consumption and accepting little space with lower quality housing standards (Matlack & Vigdor, 2008).

In addition, decent and quality housing in an appealing job market contributes in raising disposable income, maintaining of incentives for work and preventing deprivation of material resources (Andrews & Sánchez, 2011). There is also proof that deplorable housing condition has negative influence on childhood development and health of adults (Wilkinson, 1992). The problems associated with good housing conditions are directly proportional to poverty (Wilkinson, & Pickett, 2009). As stated before, the size of disposable income determines the purchasing power of households. It follows that those households or individuals with higher levels of disposable income are in a better position to access and purchase decent housing than the ones with little disposable income. High levels of income inequality indicate that such a society has households/individuals with very high-income levels while others have quite low levels of income. This obviously portends a serious threat to the social and economic development of any society. Income inequality should get sufficient attention if any country or society intends to remain stable in the path of social and economic development (Fahey & Norris, 2011).

2.2 Income Hypotheses

Economists put forward a number of hypotheses and systems for explanations of income inequality. One such system put forward by Laporte (2002) was the Absolute Income Hypothesis, which asserted that if a unit of income was taken from the high-income earners and transferred to the low-income earners, it would enhance general economic well-being. The hypothesis agrees that higher income levels have the potential to guarantee individuals healthier states of living. As per the hypothesis, the absolute income level of individuals predicts consumption (Albrecht & Van Hoofstat, 2011).

The second hypothesis by Wilkinson (1996) is the Relative Income Hypothesis, which hypothesizes that in a given range, people's level of income is static but their well-being changes instantly when the average income changes. This means that the effect of inequality is hugely reliant on the state of the low-income earners and the high-income earners (Mayer & Sarin, 2005). People tend to compare their income status with their immediate neighbor, and as a result, the very poor end up working extra hard to join the middle class while the middle class will be mildly satisfied with their status.

2.3 The Measurement of Income Inequality

There are several ways to compute income inequality. On the one hand, the range and range ratio are used to calculate absolute income inequality. On the other hand, the computation of relative inequality is based on two representative methods: coefficient of variation and GINI coefficient.

The range is an inequality measure that takes a summary of the differences between the highest income and the lowest income in a population. However, this method of inequality has one fundamental limitation, as it only takes into account the measures of values in the whole dataset.

Range ratio inequality is computed through dividing a value at a specific percentile by the corresponding value at a lower percentile. The shortcoming of range ratio is similar with range in that it uses only two observations while ignoring a large section of the provided information. This is the reason why these two measures are the least used in the calculation of inequality.

The coefficient of variation is the standard deviation divided by the mean. The coefficient of variation is quite easy to calculate and it also takes into consideration all the observations in the population. The only major drawback of this measure is that it can take values from zero to infinity.

The next measure of inequality that we look at is the GINI coefficient. The calculation of the GINI coefficient is based on the Lorenz Curve. The plotting of this curve is done by ranking individual/household observations in an ascending order as per the variable we are interested in. In this case, the variable is income, as we want to calculate income inequality. Once the Lorenz Curve is plotted, we then plot the cumulative proportions of the income variable and the population on the vertical and horizontal axis respectively. The GINI coefficient is then equal to twice the area between the Lorenz Curve and the equality diagonal. The value ranges from zero to one where zero represents perfect equality and one is perfect inequality. If the GINI coefficient is one, then it implies that in the entire society only one person holds all the resources of the society (Kemeny, 1995).

2.4 Absolute Income Inequality and Housing Access

Many previous economists developed models to analyze the relationship between absolute income inequality and housing prices. Although these economists used different theories, there are three common things among these models: individuals are not identical, the housing supply is very inelastic, and the existence of an entry barrier reduces access to the housing market. Here we regard the housing price as an indicator of housing access because the increase of housing prices acts as a kind of powerful obstruction for people to access certain types of housing.

The model in the theory put forth by Gyourko et al. (2013) has two types of houses in the market. House A is built on elastic supply land and the rent of the land can be regarded as zero. House B, which is established on inelastic supply land, has fixed capacity for households. One of the assumptions in this model is that most families that exist in this economy prefer house B to house A under the same conditions. In addition, the workers are divided into two categories: high productivity workers with high wages and low productivity workers with low wages. In this model, a house is defined as a consumption good. Thus, if the wage of the high productivity worker increases, the price of house B will increase because more households will have enough purchasing power to buy the desirable living location. However, the price increase in house B will also promote the price growth of the whole housing market, which leads to a quantitative adjustment that occurs in house A.

The next model was described by Määttänen and Terviö (2014). This model regards the house as a normal good that people will increase spending on when they become wealthier. However, unlike in the model of Gyourko et al., the difference between households is

determined by income and house quality rather than by productivity. It assumes that households live in a one-period economy and consume only the house and a composite good. The endowment of households is one house and an income used to buy a composite good. When absolute income inequality increases, wealthier people will pursue the high-quality house and poor people will become the backbone of the low-quality housing market. This results in a decline in price in the low-quality housing market and an increase in price in the high-quality housing market. Therefore, we do not know whether the growing income inequality makes the overall housing price go up or down in this model.

The previous two theories were derived through considering housing as consumption goods. However, housing might also be considered to be an asset. Nakajima (2005) created a life-cycle general equilibrium model, and argued that a house could become one asset in a portfolio because extra houses can generate rent. In this model, there are some important assumptions. Assumption 1: the non-housing assets in the portfolio are of decreasing marginal productivity. Assumption 2: all the agents in this economy prefer saving to consumption after receiving their income. This also assumes that people can always save a part of their income to be used for investment. If these investments flow into the housing market in the first place, the housing prices will inevitably increase. There is also the possibility that people might prefer to invest in non-housing capital. But this is unlikely to happen because an increase in demand of these assets along with decreases in returns (first assumption) will cause people to put money back into the housing market.

2.5 Relative Income Inequality and Housing Access: Empirical Evidence

The most common way to measure relative income inequality is the GINI coefficient. Economists always set it as the independent variable in a regression model to research the correlation between housing access and income inequality. Zhang (2015) made an empirical analysis to study income inequality and housing access in China.

Although China has become the second largest economy in recent years, its 1.4 billion-person population nevertheless means it is still a developing country. However, 30 years of reform and opening up has led to the improvement of the Chinese economy and has allowed some people to get rich. The government pins its hope on a "trickle-down" effect in order to improve the economy in poor areas. However, in fact, high economic growth has not increased the living standards of poor people; rather, it has increased income inequality.

This phenomenon is obvious in the real estate market. Nowadays the price of housing is rising much faster than wages are increasing in the middle and lower classes in China. Many low-income households are only able to afford small living spaces and end up living in "city ants". City ants are places where people only reside in confined dwellings. In contrast, at the same time some wealthy households have a dozen decent houses. Therefore, Zhang (2015) undertook an empirical analysis to investigate how income inequality affects housing access for low-income households in China.

The partial equilibrium framework was introduced at the beginning of Zhang's paper. He divided the population into two groups: high-income and low-income households. Figures 1 and 2 describe the housing demands of low-income households and high-income households respectively, and Figure 3 shows both the supply curve and the demand of the overall housing

market. The initial income is fixed for these two groups, and then he assumed that the disposable income of high-income households increased. This means that income inequality has widened, which led to both the demand curve of high income-households and the whole market to shift up. This caused the equilibrium price of the housing market to rise. As a result, low-income households would face higher housing pricing and would be able to buy fewer houses.

The main drawback of this model is clear. Firstly, heterogeneous households exist in the market and the living space of each housing is diverse in the real world. However, this model assumes households are homogeneous and all the housing area is the same. For example, if high-income households mainly consume large-sized apartment and low-income households principally purchase small-sized apartment, an increase in income for high-income households may simultaneously promote the demand for big houses and reduce the demand for small houses (note that the total housing stock is not fixed). Therefore, the price of small-sized apartments would decrease. Furthermore, the Chinese government implements home-purchase restrictions on rich households in reality. But this model assumes people can buy unlimited numbers of houses within their budget set. Since the partial equilibrium model does not apply to the real world, Zhang (2015) did an empirical test for evaluating whether income inequality has negative impact on housing access in China.

Figure 1

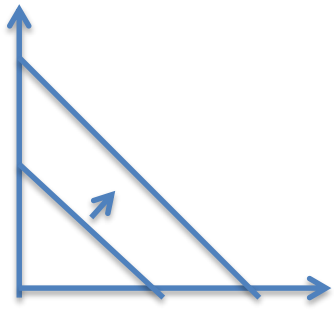


Figure 2

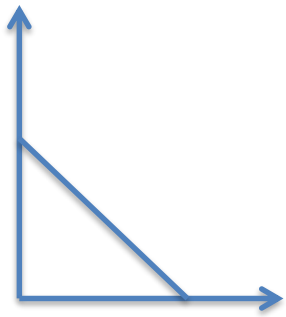
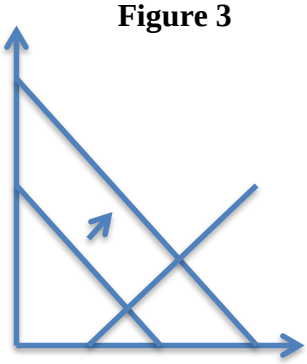


Figure 3



	High-income households	Low-income households	Overall market

Source: Zhang (2015)

Zhang (2015) chose different cities' GINI coefficient as the independent variable; housing quantity, housing quality and housing affordability are three different dependent variables. The per capita living space represents housing quantity. Housing quality depends on whether the house has a bathroom or not, as there are many living spaces without indoor bathrooms that were built before China's wealth increased in the last decade. The residual income (total disposable income minus total rent) can be set as the housing affordability. The rent here for people who do not need to rent houses in the market can be considered as an opportunity cost. The object of study in Zhang's paper is the bottom 20% of households and bottom 30% of households in China.

After Zhang conducted his empirical analysis, he found that for both the bottom 20% of households and the bottom 30% of households, the residual income decreased significantly when the GINI coefficient increased by one standard deviation. The conclusion did not change when the researcher added the fixed effect into the OLS regression. Although the living space per capita decreased because of the increased GINI coefficient, the bottom 20% and 30% was not influenced greatly after the GINI coefficient increased by one standard deviation. Moreover, the higher the income inequality, the lower the likelihood that low-income households would have an indoor bathroom whether fixed effect is considered or not. In summary, the above result is consistent with the partial equilibrium model that income inequality has huge negative effect on the housing access of low-income households in China.

3. Data, Summary Statistics and the Model

This section introduces the data sources and regression model, shows various variables needed in my econometric model and summarizes statistics for all variables.

3.1 Data from ODESI

This paper mainly uses the Ontario Data Documentation, Extraction Service and Infrastructure Initiative (ODESI) database for the years 2000 to 2004. The ODESI provides the survey of household spending where most variables in this paper come from. The survey of household spending offers information about expenditure of individuals or households drawn from Canadian residents, excluding institutional residents, people who live in military camps and Indian reserve inhabitants. I concentrate on persons and households living in the ten provinces, namely Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, Alberta and British Columbia. Although sometimes terminology and labels of variables vary over these years, the meaning and definition are the same for all years.

3.2 Data from CANSIM

I collected the GINI coefficient index for each province from Statistics Canada's CANSIM database that can be calculated from three different sets of income data: adjusted[1] market

[1] The source of GINI coefficients of adjusted market, total and after-tax income is Canadian Income Survey which is a sub-sample of the Labour Force Survey sample. A complex random sampling plan in LFS means that each household represents a number of other households in the population. "Estimates for a given characteristic are obtained by multiplying the survey weight by the corresponding value of this characteristic. The initial weights are the LFS subweights, which are then adjusted to account for the fact that the CIS is a sub-sample of the LFS sample" (Statistics Canada, 2018).

income, adjusted total income and adjusted after-tax income. Market income is obtained by subtracting government's subsidies from total income before tax. The government transfers is a kind of means used by the government to reduce income inequality. I use the adjusted after-tax income to compute the GINI coefficient. The low-income population in each country has the most severe housing access problem. In CANSIM, there are three ways to define low-income lines: Low Income Cut-Offs (LICOs), Market Based Measure (MBM) and Low Income Measure (LIM). Although "Low income cut-offs (LICOs) are established using data from the Survey of Household Spending" (Statistics Canada, 2010) that is matched up with the data source I used from ODESI, it is divided by community size, not by province. Furthermore, MBM also focuses on community size and it has a strong subjectivity because MBM is based on a certain basket of goods and services. Finally, "The low-income measure (LIM) is a fixed percentage (50%) of median adjusted family income, where 'adjusted' indicates that family needs are taken into account" (Giles, 2004, p. 13). The advantage of LIM is that it does not include any geographic elements, it applies to every area in Canada. Thus, I downloaded LIM from CANSIM, which is a perfect fit for my model. From Table 1, I set the income source as after-tax income because the GINI coefficient in my model is calculated based on after-tax income. Then I can define different LIM from different household sizes from 2000 to 2004.

Table 1 Low Income Measures by Income Source and Household Size in 2016 Constant Dollars

	Canada
	2016 Constant Dollars
	After-tax Income

Household Size	2000	2001	2002	2003	2004
1 person	17,979	18,604	18,781	18,777	19,021
2 persons	25,426	26,309	26,561	26,554	26,899
3 persons	31,140	32,222	32,530	32,522	32,945
4 persons	35,957	37,207	37,562	37,553	38,042
5 persons	40,201	41,599	41,996	41,986	42,531

Source: CANSIM

3.3 The Model

In order to obtain the impact of income inequality in different provinces and years in Canada on housing access, I use the same model as Zhang (2015). Thus, the model is:

$$H_{ijt} = \alpha + \beta\ GINI_{jt} + \lambda\ X_{ijt} + P_j + Y_t + U_{ijt}$$

H_{ijt} is the dependent variable we are interested in, which includes the logarithm of residual income, persons per bedroom and shelter cost-to-income ratio. $GINI_{jt}$ refers to province j's GINI coefficient in t^{th} year. X_{ijt} represents a group of housing characteristic categorical variables including i^{th} householder's age, marital status and sex. Since the model is used for panel data regression, we chose the fixed effect model to estimate the association between income inequality and housing access in the period from 2000 to 2004 among Canadian provinces. "Under the fixed-effect model we assume that there is one true effect size that underlies all the studies in the analysis, and that all differences in observed effects are due to sampling error" (Borenstein et al., 2010, p. 97). P_j and Y_t represent province fixed effect and

year fixed effect, respectively. Regardless of what the dependent variable is, the year fixed effect and province fixed effect will be added to the model. U_{ijt} is the error term.

3.4 Variables

In this section, I present the dependent variables, independent variables and category variables.

3.4.1 Dependent Variable

The housing access in this paper is a dependent variable and I analyze it on two sides: housing affordability and housing quantity. The ratio of shelter cost to income and logarithm of residual income determine housing affordability. The Persons-per-bedroom represents housing quantity.

3.4.1.1 The Ratio of Shelter Cost to Income (STIR)

In Canada Mortgage and Housing Corporation (CMHC) as well as provincial housing authorities' view, STIRs are the most reliable indicator of housing affordability because they come from accessible data and make few assumptions about shelter and non-shelter consumption patterns of each household (Croll, 2015). The Canadian government considers a household to be experiencing a housing affordability problem when STIR is more than 30 percent. Thus, STIR is an excellent dependent variable for our model because it measures a housing cost burden that is highly correlated with housing access. In addition, "they are intuitive and easy to calculate, making them especially easy to explain to non-experts" (Croll, 2015, p. 22).

However, there are two problems that occur during STIR computation. First, sometimes the household income is not positive, which means that the STIR is negative. Furthermore, STIR is meaningless when the household has no income. It is much easier for people to understand STIR across different regions and time series if these outliers are excluded from the sample (Bogdon and Can, 1997). So I remove the households with STIR that is negative or insignificant[2].

3.4.1.2 The Residual Income (RI)

Residual income is another way for economists to measure housing affordability. Residual Income (RI) equals a total household's income minus their shelter cost (Croll, 2015). Residual Income is considered to be qualified if a household can buy a basket of non-shelter goods in minimum criteria. If the household has no ability to reach the lowest standard of this basket after spending on shelter, it is regarded as housing unaffordable. In addition, the existence of RI makes up for the limitation of STIR. First, since RI shows shelter cost and non-shelter cost directly, it is a better guide to the well-being of the household. Also, RI is a more precise indictor to measure housing affordability when the household type is different. That is, RI can be adjusted for different household sizes, areas, tenures and ethnic groups. RI also has its negatives. The first limitation is that different people have different opinions about the minimum standards of a basket of non-shelter goods. Additionally, compared to STIR, the target population has more difficulties in comprehending RI. Fortunately, these two main drawbacks have no effect on my model. As such, RI is the perfect counterpart to STIR.

[2] One limitation of this approach is that it excludes from the sample some households with acute housing access problems.

3.4.1.3 Persons-Per-Bedroom (PPB)

Both RI and STIR are not concerned with housing quantity (crowding). Sometimes the increase in shelter cost is due to higher quality and larger size of space. From this perspective, housing quantity is closer to reality than housing affordability. RI and STIR do not represent real situations when too many bodies share a single small space.[3] As a result, I chose persons-per-bedroom (PPB) as another dependent variable to investigate how income inequality influences housing quantity. PPB measures quantity of people per bedroom in one household, which identifies whether this household is overcrowded or not. In my sample, I divided household size by the number of bedrooms, and got the PPB. Nevertheless, a household greater than 5 people and a number of bedrooms exceeding 4 were dropped from my sample data. The reason is that from the survey of household spending in ODESI, all these households comprised 6 or more people are thought as 6 people, and all the houses made up of 5 or more bedrooms are considered as 5 bedrooms.

3.4.2 Independent Variables

3.4.2.1 GINI Coefficient

I used the GINI coefficient as the main independent variable. As explained above, the GINI coefficient measures income inequality and the value is in the interval [0,1]. The single GINI coefficient was meaningless in my case. I needed to compare it over time or among different

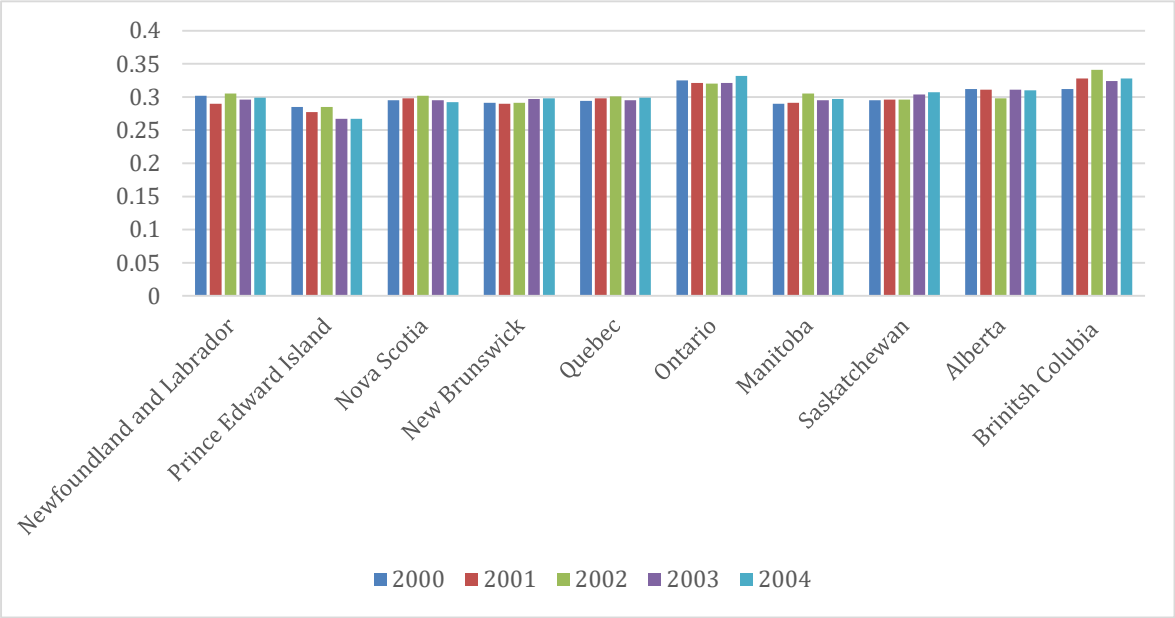
[3] Overcrowding makes total household income increase because a large number of people live in one unit.

places. Figure 4 shows the GINI coefficient, by adjusted after-tax income in the ten Canadian provinces from 2000-2004. The provinces show no major overall change in the GINI coefficient during this period. Compared to other provinces, however, the most severe income inequality (high GINI coefficient) is in Ontario and British Columbia. The lowest GINI coefficient is in Prince Edward Island each year.

3.4.3 Categorical Variables

Categorical variables are variables that can be divided into two or more groups, but there is no rank between these categories. In this paper, the age group, sex and marital status are the three categorical variables. The age group can be divided into 5 groups: less than 30 years old, 30-39 years old, 40-49 years old, 50-59 years old and 60 years old and over. Sex can be grouped into two categories: male and female. Marital status can be categorized into two groups: Married/ common law and never married.

Figure 4: GINI coefficient in the ten Canadian provinces from 2000 to 2004



Source: CANSIM

3.5 Descriptive Statistics

3.5.1 Summary of Variables

Table 2 Descriptive Statistics

Variable	Mean	Standard deviation
Household total income (Canadian dollars)	22463	9561
Household after-tax income (Canadian dollars)	19214	8183
Household size (minimum=1, maximum=5)	2.466275	1.130671
Shelter cost-to-income (STIR)	0.2923831	0.1627837
Residual income (RI)	16498	8561
Persons per room (PPB)	1.084358	0.5127673
Sex	0.4906056	0.4999286

(0=male; 1=female)		
Householder age group (less than 30 years old=1, others=0)	0.2281022	
Householder age group (60 years old and over =1, others=0)	0.3187348	
Marital status (Married/common law=0, never married=1)	32% never married 68% married	
GINI coefficient	0.301767	0.0134136

Source: ODESI

There are 14,796 households in the sample. These households are grouped into Low-Income Measures (LIMs). Thus, of course, households in this category tend to be low-income. Table 2 shows the mean and standard deviation of the dependent variables and the independent variable. The sample average of RI is just over 16,000 dollars, but the standard deviation is very large, approaching $8,600. The mean of STIR is about 29%, the average PPB is approximately 1 and the average value of the GINI coefficient is around 0.3. Furthermore, the average household total income is 22463 dollars[4] and the mean after-tax income is 19214 dollars. Less than one third are never married householders, and slightly less than half are headed by female householders. About one-third of individuals are 60 years old and over[5].

[4] The currency used in this paper is the Canadian dollar.

[5] This high share of senior suggests the fact that the sample is limited to low income households.

4. Empirical Analysis and results

Since we have determined the regression model and gotten reliable data, we can get the final coefficient estimates we want by using Ordinary least squares (OLS). Thus, in this part, we will analyze the results gradually so as to achieve an effective conclusion.

4.1 The Total Impact of Inequality on Housing affordability

Table 3 Income Inequality and Housing affordability Among Low-Income Households

Dependent Variable: Ln (Residual income)

Independent variable		
GINI coefficient	-2.143159 (2.11)	-1.358989 (1.872)

Female householder		0.0843506*** (0.017)
Never married householder		-0.7763525*** (0.0239)
Householder over 60		-0.0714001*** (0.02)
Householder less than 30		-0.149152*** (0.03)
Year fixed effect	Yes	Yes
Province fixed effect	Yes	Yes
N	14,796	14,796
Adjusted R^2	0.012	0.25

Dependent Variable: Shelter Cost-to-Income Ratio

Independent variable		
GINI coefficient	0.3147648 (0.46)	0.1621024 (0.445)
Female householder		0.0020419 (0.004458)
Never married householder		0.0906904*** (0.0052727)
Householder over 60		-0.0286569*** (0.0050672)
Householder less than 30		-0.0017124 (0.0063845)
Year fixed effect	Yes	Yes
Province fixed effect	Yes	Yes
N	14,796	14,796
Adjusted R^2	0.03	0.1171

Source: Survey of household spending from ODESI, 2000-2004

Note：The detailed explanation of each variable is in Table 2. Both year fixed effect and province fixed effect are captured by a set of categorical variables

Robust standard errors in parentheses

*** P<0.01

Table 3 shows the relationship between income inequality and housing affordability. In this paper, I use residual income to measure housing cost burden. At the same time, I also set shelter cost-to-income as another measurement indicator in order to ensure the result is reliable. It reflects that the GINI coefficient increases one standard deviation (0.0134136), leading the residual income of low-income householders to decrease 0.0287% when the characteristics of householders are not controlled. The p value for the estimated coefficient on the GINI is greater than 0.05, which means the result is statistically insignificant. However, if I add some family characteristic variables into the regression model, the result is totally different. The householder who was female, never married, young or aged had a tendency to have insufficient income after the shelter cost was deducted. Therefore, I controlled these variables to offset the rising income inequality that increased one standard deviation in the GINI coefficient, which rendered a residual income decline of 0.0182%. Similarly, the p value for the estimated coefficient on the GINI is greater than 0.05 in this case.

Moreover, table 3 shows the situation if the dependent variable is shelter cost-to-income ratio. In terms of common sense, the household's characteristics predict that a lower residual income would also generate higher shelter cost-to-income ratios. In my regression model, the estimator seems to fit this principle. The result showed one standard deviation increase in the

GINI coefficient, which drives a STIR increase of 0.422 percentage points for low-income households, if the characteristic of households is not kept constraint. In addition, controlling the characteristic of households makes STIR increase just 0.217 percentage points. Note, the p value for the estimated GINI coefficient is greater than 0.05 in both specifications which suggests these two results are not statistically significant.

4.2 The Total Impact of Inequality on Housing Quantity

Table 4 Income Inequality and Housing Crowding Among Low-Income Households

Dependent variable: Persons per Bedroom (PPB)

Independent variable		
GINI coefficient	1.713778 (1.432527)	0.7572301 (1.274109)
Female householder		0.0444507*** (0.0140012)
Never married householder		-0.3709661*** (0.0151334)
Householder over 60		-0.361940*** (0.0155084)

Householder less than 30		0.1188564*** (0.0182005)
Year fixed effect	Yes	Yes
Province fixed effect	Yes	Yes
N	14,796	14,796
Adjusted R^2	0.012	0.2041

Source: Survey of household spending from ODESI, 2000-2004

Note：The detailed explanation of each variable is in Table 2. Both year fixed effect and province fixed effect are captured by dummy variables

Robust standard errors in parentheses

*** P<0.01

The regression reported in Table 4 sets Persons-Per-Bedroom as the dependent variable. This specification presents the positive correlation between income inequality and crowding for low-income households. There is a one standard deviation increase in the GINI coefficient, and an 0.01 person increase in PPB when categorical variables are controlled. After the household characteristics are added into the regression, I found households headed by young people (less than 30 years) are more crowded, both as married individuals and female householders.

Compared with the previous findings, the rise of GINI index makes less crowded living condition for low income households in Canada. Matlack and Vigdor (2006) indicated when all categorical variables are in the specification, an 0.10 person increase in PPB is related with a one standard deviation increase in GINI coefficient in America, which is nearly ten times

compared to Canada. In my opinion, the reason for this big difference is that I dropped a part of the data for both household size and number of bedrooms because of sample imperfections. This process ignored the larger households in my sample, which may have caused the model to be unable to efficiently estimate the relationship between PPB and the GINI coefficient.

5. Conclusion

In the last decade, income inequality has had a huge effect on housing access. Many previous studies have analyzed how income inequality affects housing access. Matlack and Vigdor (2006) stated that increasing income inequality makes poor families experience major crowding and increased housing cost does not leave as much income for their other necessities. Zhang (2015) emphasized that the higher the GINI coefficient, the more the housing cost burden for low-income households, the more crowded their living conditions and the poorer their housing quality. Thus, we cannot neglect this topic and the government should examine ways to solve it.

In this paper, I used the same model designed by Zhang (2015) to research the connection between income inequality and the housing access problem for low-income households in

Canada from 2000 to 2004. My results and conclusions are similar to previous studies. The regression model indicates that increasing income inequality leads to a decline in housing affordability of the poor in Canada, and to an increase in household crowding. To be more specific, the rise in income inequality causes the housing cost burden to become heavier and does increase low income households crowding. In conclusion, compared with other countries (U.S., China), the Canadian government is better at dealing with the relationship between income inequality and housing access. Essentially, income inequality does not bring huge harm to the poor in the housing access problem in Canada.

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Statistics Canada. Table 11-10-0134-01 Gini coefficients of adjusted market, total and after-tax income.

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