

An Analysis of Income Inequality across Age Groups in Canada

By
Jingsong Yu
3689994

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Department of Economics of the University of Ottawa
Supervisor: Professor David Gray

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Abstract

I use the Theil Index to examine the trends of income inequality in Canada and to compare the degrees of income inequality across age groups. What I mainly discuss is the impact of various income components on income inequality within different age groups. I decompose individual's total incomes into employment income, public pension income, and other income. Using the Microdata files on individuals provided by the censuses of Canada from 1981 to 2001, I discover that public pension benefits reduce the degree of income inequality, especially for those within the age group of 66 and over. The main finding in this paper is that the composition of the income among various sources is a key factor in determining the overall degree of income inequality.

Keywords: income inequality, primary income source, pension

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1. Introduction

There has been much recent attention paid to the problem of income inequality in many industrialized countries. Among the Canadian population, the degree of income inequality has continued to increase with a few fluctuations during the past two decades. High levels of income inequality may affect the social cohesion of the country. Therefore, understanding the determinants of the degree of income inequality is essential. Not surprisingly, this has become the focus of numerous papers. In particular, authors have examined particular elements thought to be able to shed light on the problem. For example, Gray, Mills, and Zandvakili (2003a) paid particular attention to education, age, and marital status. Age is an interesting element that can shed light on the income inequality problem. Brown and Prus (2006) presented an interesting conclusion: There is a strong negative correlation between age and the degree of income equality. In other words, the older individuals become, the more equal the income distribution within that age group is. Older people, especially those who are retired, have more equal income distribution. Why does this phenomenon occur? The answer to this question lies in the primary sources of income among different age groups.

There are four hypotheses that will be examined in this paper, which are:

1. The trend of adult's income inequality in Canada is increasing over time.
2. The degree of income inequality among the active population is higher than that among the retired population.
3. The public pension system in Canada has a progressive impact on the distribution of income among retired Canadians.
4. The main finding: The composition of income, in other words, the primary source and its weight, for each age group is a key factor in determining the overall degree of income inequality.

To examine these four hypotheses, I divide individuals who are in the 18 and over year-old group into three subgroups according to their degrees of labour force attachment: the active group (age 18 to 60), the retired group (age 66 and over), and the half-active-half-retired group (age 61 to 65).¹ These three groups differ according to their primary source of income. I examine the degrees of income inequality across those groups in Canada over the period of 1980 to 2000. I also divide income into three sources: employment income, public pension income, and other income. By doing this, I can examine how the public pension system affects the degree of income inequality and determines the relationship between the primary income source and the degree of income inequality. To reach this goal, a suitable inequality measure is needed. The Generalized Entropy class is employed because these measures have some desirable properties. I choose the Census data as the data set.² Its advantages include its large sample size, its representativeness, a rich set of covariates, and the fact that it covers a long time period. Although the Census data are only available quinquennially, that is enough to study long term trends.

This paper proceeds in six sections. The following section contains a review of the literature. The description of the merits of the available data sources comes after that. Next, I describe procedures in income measurement, income inequality measurement, and the method used to decompose inequality by age subgroups. Then, I analyze what has happened to income inequality in Canada based on the Census data, and I compare the degree of income inequality across age groups (between active population and retired population). I also examine the impact of different income components on the level of income inequality within three age groups in this section. The study concludes with a summary.

1. I am not going to discuss teenagers' income distribution. Their main income source is their parents, which means teenagers are not financially independent. Usually, people living in Canada first enter the labour force at age 18 or later.

2. The other possible data sets are the longitudinal Administrative Database and SCF/SLID.

2. Literature review

The review of literature is composed of three parts: recent research on income inequality in Canada, the analysis of income inequality, and the primary topic for this paper, namely income inequality in the later stages of the life cycle.

2.1 Recent research on income inequality in Canada

Since the 1990s, several surveys of major issues regarding income inequality in Canada have been published. Beach and Slotsve (1996) indicated the existence of a trend towards increased inequality and polarization in the distribution of earned income of men, combined with stagnation of average real male income since the mid 1970's. The sharp rise in average hourly real wages occurring in the early 1970s was followed by a twenty year period of stagnation. Smith and Arthur (1997) pointed out that this development was initially noted by the Economic Council of Canada in 1991. The rising differentials in income between younger and older workers, and the absolute decline in the average real income of young workers have also been noted by the Economic Council.

The key points of all the discussions on income distribution are the degree and the trends in inequality in before-tax income, after-tax income, and transfer income. The comparisons are useful in considering the role of government income redistribution policy. Wolfson and Murphy (1998) have suggested that the degree of after-tax family income inequality changed very little, while pre-tax income inequality rose, from the 1980s to early 1990s. Canada's tax and transfer system played an important role in reducing the degree of income inequality. To update the study of the after-tax family income inequality patterns in the 1990s and to compare them with the patterns from the 1980s, Frenette, Green and Picot (2004) estimated inequality trends at the family

level over the 1990s from three distinct data sources: survey data, tax data and the Census data.³ By using tools such as the Gini coefficient, the coefficient of variation, and by comparing the distribution of family income among the three data sources, they found that according to all three types of data sources, the degree of income inequality was increasing substantially over the decade. They used tax data to determine that the degree of family market income inequality rose in the past 10 years, but the tax and transfer system worked to offset this trend, resulting in no significant change in the level of after-tax income inequality. They also pointed out that the increase in the degree of market income inequality was driven both by the rise in income at the top of the distribution and by the very substantial fall in income at the bottom.⁴

Gray, Mills and Zandvakili (2003a) also demonstrated that the degree of inequality for the overall distribution of income among economic families in Canada was rising in the early 1990s, a period during which the economy was recovering from recession. They selected Statistics Canada's Survey of Consumer Finances as the data set, and the class of Generalized Entropy measures as the measurement tools because of the property of decomposability. There are two important findings in their article: First, because of some secular factors, such as skill-biased technological change and rising inequality in the distribution of working income, the degree of overall family income inequality increased over the period of 1991 to 1997. The other contribution of this article was that they found that, although the degree of inequality within groups of population was much greater than the degree of inequality between them, the change in "between-group" inequality was significant for the groups identified by education, age, and marital status.

Frenette, Green and Picot (2004) indicated the existence of an increased trend of the

³ They define the after-tax family income as:

after-tax income = paid income + net self-employment income + other employment income + other market income + transfer income – income taxes.

⁴ One point of departure between their article and most of the existing literature is that they include in their sample those individuals with zero income rather than restricting it only to those with positive income.

after-tax family income inequality in the 1990s. As an update and as the most recent article on income inequality in Canada, Frenette, Green and Milligan (2006) presented new evidence on the levels and trends of after-tax income inequality during the period of 1980 to 2000. Since many of the changes in income distribution are situated in the tails, they argued that existing data sources, such as the Survey of Consumer Finance and the Survey of Labour and Income Dynamics (SCF/SLID) and T1 family file (T1FF), might miss changes in the tails of the pre-tax income distribution because these subjects have a 20% under-response rate relative to Census data set. They selected the Census data because of its continuity, mandatory response and larger sample size.

However, the main disadvantage of using the Census data is that the information on the amount of taxes paid, which is necessary for the examination of disposable income, is not included in them. These authors used a reduced-form approach in which they estimated a regression of taxes paid on family characteristics by using the T1FF data, and then used the estimated coefficients from those regressions to predict taxes paid in the Census. By importing this information into the Census data, they examined the differences in the levels and trends in after-tax inequality between the newly constructed the Census data (After-tax Census data) and the survey datasets. Their results demonstrated that after-tax inequality levels based on the new data were substantially higher than those based on the old data, primarily because the income levels at the bottom of the distribution are lower than those in survey data. They also found that the reconstructed Census data showed larger long-term increases in the level of after-tax income inequality and far more variability over the macroeconomics cycle.

2.2 The methods employed to research income inequality

2.2.1 Persistent and Transitory inequality

To point out the extent to which Canada's increasing inequality reflects greater year-to-year income fluctuations as opposed to a wider dispersion in permanent income, Baker and Solon (2003) decomposed the growth rate in individual Canadians' incomes into persistent and transitory components. The other contribution they made in this literature on income dynamics and inequality trends was that they used a rich data set, the T-4 supplementary Tax File maintained by Revenue Canada, to achieve some methodological advances. Almost all of the articles in the existing literature have simple representation of the time series properties of earnings and relatively small scale datasets that imposed lots of restrictions, such as the assumptions of no life-cycle variation in the variance of transitory income shocks, no permanent shocks, and no persistent heterogeneity among individuals in their rates of human capital investment.

These authors estimated an elaborate empirical model of the stochastic processes that generated growth in income based on a version of the canonical variance-components models of income dynamics. The model they designed had more complicated structure than others before them had done. Growth in the degree of income inequality was decomposed into two parts: a persistent component and a transitory component. By analyzing the variance and the covariance for the cohorts born in 1926-27, 1942-43, and 1958-59, they found out that upward trends in both components contribute to the rise in inequality, but the persistent component seems to be playing a larger role than the transitory component.

Katz and Autor (1999) carried out a similar analysis based on US data. These authors also did decomposition into a transitory and a permanent component. Unlike Baker and Solon, they concluded that the increased inequality in the 1980s was mostly attributable to a large increase in the returns to the education, which has not taken place in Canada, and to other persistent worker attributes.

2.2.2 Income inequality and the business cycle

A recession is typically characterized by negative or slow growth in GDP, high unemployment and a low inflation rate. The discussion about the relationship between income inequality and the business cycle focuses on how inflation and unemployment affect income distribution. Do these variables have a positive effect, a negative effect, or perhaps no impact at all?

Inflation and inequality

Early work of this sort was carried out by Palmer and Barth (1977). According to their paper, inflation may mainly affect inequality via tax and income sources. Keeping real wage fixed, these authors calculated the effects of a ten percent increase in nominal income in order to match an increase in the cost of living. Under a progressive income tax regime and a system of tax expenditure, the tax burden rose for all income groups, but poor earners bore the greatest proportional increase in the tax burden. In other words, low income earners face relatively higher tax rates than rich earners, which contributes to a higher degree of income inequality. That is because the tax brackets are not indexed for inflation, so that raises in nominal income but not in real income pushed low and middle income earners into higher tax brackets. To analyze the income sources effects on the level of income inequality, Palmer and Barth focused on transfers and pensions, noting that adverse distributional effects on the degree of

income inequality would result if they were not fully indexed against inflation. More generally, inflation redistributes income from those whose income rises relatively slowly in response to inflation to those whose incomes rise more rapidly. However, how such adjustments vary by income level is unknown.

Although the effects of inflation on inequality are not signed in their paper, some evidence suggests that a modest inverse relationship exists. Williamson and Lindert (1980) confirmed this conclusion in their article where little negative correlation was found between inflation and U.S. inequality over two decades up to 1970. By empirical data analysis, Johnson and Shipp (1997) also concluded that inflation had a progressive influence, i.e., an increase in inflation was associated with a decrease in inequality.

Unemployment and inequality

Mendershausen (1946) discussed several reasons why unemployment might work to raise income inequality based on weak theoretical foundations. First, higher unemployment would increase the period during which workers received zero or low incomes. Second, every worker does not have identical chances of being laid off: The less skilled and lower paid workers are more vulnerable. Third, unemployment puts downward pressure on the wages of the lower paid workers. Unemployment may also destroy opportunities for gaining job experience and on-the-job training and reduce job quality. However, many recent theoretical works have shown that a positive relationship between inequality and unemployment is not always valid. Parker (1996) presented a supply and demand theory of income distribution in which lower paid workers may have lower willingness to take poor paying jobs. This phenomenon may result in a higher level of income inequality, but in higher unemployment. Empirical time series evidence does not support a positive relationship between them either. The level of income inequality grew steadily while unemployment declined over the 1980s in U.S. Johnson and Shipp's 1997 paper also suggested that unemployment did not

significantly affect the inequality measures.

Many of the above conclusions are mainly based on data from a period where inequality was increasing over time. And most of the recent works on changes in income disparities over the business cycle are disconnected from changes in long-run inequality. The research challenge is to disentangle empirically the effect of the business cycle on inequality from secular trends in inequality. It is necessary to examine the connection between long-run trends and cyclical variations in income inequality. Barlevy and Tsiddon (2006) have developed a theoretical model in which cyclical and trend inequality are related. They showed how fluctuations in the degree of income inequality interacted with the forces that drive long-run inequality. According to their results, recessions should contribute more to raising inequality when permanent inequality is rising in the long run than when it is falling in the long run. The empirical evidence from the first half of the 20th century supports their contention that the effect of business cycle on income inequality is not always constant, but depends on the direction of trend inequality. The other important conclusion is that secular inequality trends can influence the degree of cyclical sensitivity of income inequality, which has important implications for using evidence on the cyclicity of income inequality in resolving various macroeconomic puzzles.

2.3 The later stages of the life cycle

Because of an aging population (especially the aging of the “baby boom” generation) and the common event of retirement, the academic interest and research on the later stages of the life cycle have grown over the last few years. So, it is very sensible to make a distinction between the population of those of retired age and the population of those of active age in the inequality studies. In the following section, I will discuss the approach to research the late stages of the life cycle in the context of retirement.

2.3.1 General discussion

Most of the research examining the degree of income inequality over the later stages of the life cycle is applied to the two public policy issues: criteria for an effective national retirement system and the relationship between income inequality and the adequacy of public pension benefits. Knox and Cornish (1997) established four criteria which a suitable retirement income system should satisfy:

1. An adequate minimum income should be provided for all retirees.
2. Higher contributions over the working life should lead to higher benefits.
3. There should be some degree of redistribution in order to reduce the degree of income inequality.
4. Horizontal equity, meaning that similar benefits should be provided to individuals in similar circumstances

These four criteria have been widely used in the research and evaluation on public pension systems (Brown and Prus, 2004).

In my literature review, I will focus on the other important issue: the relationship between income inequality and the adequacy of public pension benefits. The most common hypothesis on this issue is that there is an inverse relationship between the adequacy of public pension benefits and the degree of income inequality among the retired population. In other words, countries with comprehensive, universal, and generous public pension systems will tend to exhibit more equal distributions of income among the retired populations. To support this proposition, Prus and Brown (2004) used the Luxembourg Income Study (LIS) data to investigate the relationship across 10 industrialized nations with modern social pension systems. By summing the adjusted household incomes of all households from all the income sources, the data in table 1 show the composition of seniors' household gross incomes by source.⁵

⁵ Based on Rainwater's (1974) research, the denominator of adjusted household income equals 1.0 for a

Generally speaking, in the countries with low degrees of income inequality, such as Sweden and Denmark, private income constitutes a relatively small share of total household income. On the contrary, in the countries with relatively high degrees of income inequality, such as Israel and Australia, private income plays a very important role in total household income.

By plotting the Gini coefficient for adjusted household income and the proportion of total income accounted for by government transfers, figure 1 supports the hypothesis that the adequacy of public pension benefits plays an important role in equalizing the retired age income inequality across countries. Although this is not an exact relationship, these data suggest that cross-national variations in income inequality are partly explained by the differences in the percentage of public pension transfers in the composition of household income.

Brown and Prus (2006) also did a similar research among the older populations by comparing seven OECD Countries in 2006. Two hypotheses are tested in the paper: First, levels of income inequality decline during the last stage of the life cycle because public pension benefits are more equally distributed than work income. Second, because of the progressive redistributive nature of government benefits, countries with more generous public income security programs are better able to reduce income inequalities among their old populations. They arrived at two main conclusions: First, the benefit level of retirement income provided by public pension systems and the degree of post-retirement income inequality have a negative correlation. Second, levels of income inequality decline between the active stage and the retirement stage of the life cycle. It appears as though their evidence supports their conjectures.

one-person household, $\sqrt{2} = 1.414$ for a two-person household and so on.

2.3.2 Discussions about the effects of pensions

It is well known that public pension benefits are one of the most important income sources for the population aged 66 years or older. The incomes of the population aged 66 years or older are composed of employment income, public pension income, and other income. Veall (2006) provided some evidence about the very unequal distribution of employment income in the absence of pension benefits. The share of employment income received by the top 1% of earners within the 66 and over age group had increased from 30% in 1982 to more than 60% in 2002. Figure 2 shows that the labour market income in Ontario comprises a very small share of total income received by seniors, and that what is received from labour market is concentrated among a tiny minority.

The issue of how public pension systems affect income inequality has also received much attention in many countries. There are many hypotheses about the effect of public pension policy on the distribution of income among the retired populations. They have led to three approaches for analyzing this issue.

The first model is the “rising tide” (Crystal and Shea 1990) or transfer redistribution (Pampel and Hardy 1994) model. It claimed that the public pension systems transfer income from the rich to the poor and from the employed to the retired (e.g., GIS in Canada and Supplemental Security Income in U.S.). Therefore, public pension benefits are more equally distributed than the income generated from the labour market. The equal distribution of public pension benefits results from the political process. All citizens are compelled to ensure the well-being, because each of them has an equal weight in the democratic process. Hurd and Shoven (1985) showed some evidence in order to support this model.

The second model is the status maintenance model (Henretta and Campbell 1976). By

using 1962 Occupational Changes in a Generation (OCG) Survey dataset and the combined 1973, 1974 and 1975 NORC General Social Survey dataset, these authors compared status attainment for a cohort before and after most of its members have retired. They found that an effect of the public pension system was to reinforce pre-retirement inequalities by favoring those who made higher contributions over the course of the working life (e.g., C/QPP and Social Security). In other words, the public pension systems have the effect of maintaining, not changing, economics status and inequality in retirement.

The third model of income inequality and the later life course is the cumulative advantage/disadvantage (Crystal and Shea 1990) or status divergence (Pampel and Hardy 1994) model. Note that approach one and approach three have the same reference, because these authors mentioned both of approaches in their papers. Through the study on recent U.S.A Census data, these authors concluded that inequality was greatest among elderly population. The least well-off one-fifth of the retired population receives 5.5% of the elderly total wealth, while the best-off one-fifth receives 46%. This model implies that, although the goal of public pension plan is to make income distribution more equal, the existing retirement income system produces a higher degree of income inequality than the labor market does because economic advantages and disadvantages accumulate over the life course. In other words, individuals with high status attainment as a result of high parental socio-economic status and human capital investment, such as education, are financially well off during the active and retired years. This is because higher status attainment usually translates into a good job and a good health status. Therefore, those individuals are less likely to be forced to retire because of bad health or unemployment, and more likely have higher lifetime saving, investments, pension credits and other assets. The opposite is also true. Those with status background disadvantages are more likely forced to retire because of bad health or poor working conditions, and experience a loss of labour income. *“They tend to rely almost exclusively on government benefits that operate at the margins”* (Prus 1999). Because

public pension benefits have only a limited portion of pre-retirement earnings, therefore, the accumulation of economic resources for some individuals leads an expanding overall degree of income inequality within the retired population.

Ample empirical evidence has been found to support all of the three models. Which model is supported by empirical evidence in Canada? Using data from the 1976 Survey of Consumer Finance, Myles (1981) found some support for the first model in Canada. He observed that the public pension system had an equalizing effect on the rate of absolute and relative income inequality across socio-economic groups of older individuals. The empirical work carried out by Prus (1999) also demonstrated the importance of universal and high minimum-level public pension benefits for reducing the level of income inequality among the retired population. Cohorts entering old age today in Canada experience a drop in the overall level of income inequality partly because of the relatively important role played by public pensions, such as GIS, which are distributed more equally than labour income. Therefore, compared to the status maintenance model and the cumulative advantage/disadvantage model, the rising tide/transfer redistribution model is supported by most of the research on income inequality in Canada.

3. Data source

The combination of the Survey of Consumer Finance and the Survey of Labour and Income Dynamics (SCF/SLID) on the one hand, and the Census data on the other hand, are two main data sources that are available to examine the pattern of income inequality in Canada.^{6 7} Each of these sources has its own advantages and disadvantages, which are shown in table 2. Frenette, Green and Milligan (2006)

⁶ SCF and SLID are two separate data files, but SLID followed the SCF after 1996.

⁷ Another possible data set is the Longitudinal Administrative Database. The advantage of administrative data is that it is reported accurately, at least on an annual basis, and the coverage is very broad. It is not necessarily representative of the population, however. Some low income people do not like to file a return, and are not sampled. It also lacks useful information such as the education level. Administrative data usually do not reveal many individual traits.

argued that the Census data has several appealing characteristics in measuring inequality compared to SCF/SLID. First, it has better coverage. Response to the Census is mandatory by law, therefore, the coverage of the population is almost complete. The response to the SCF/SLID is voluntary, and about 20% of selected household decline to respond. This contributes to an error on the two tails of the pre-tax income distribution, which was demonstrated by Frenette, Green and Picot (2004).⁸ The much larger sample size, which permits more reliable measures of percentiles in both tails of the distribution of the individual income, is the other advantage of the Census data coming with the better coverage. Second, it has no break over the period that I am interested in. In contrast, the SCF was replaced by the SLID in 1997. The disadvantage of the Census data is also evident: the Census data are only available quinquennially. Therefore, higher frequency movements in income may not be captured. There is no remedy for this problem. However, for studying long term trends, the quinquennial data are sufficient. The 1980, 1990 and 2000 Censuses were all taken at times when the business cycle was near its peak. Consequently, consistent comparisons across time are meaningful.

The Public Use Microdata file on individuals provided by the census of Canada is selected as the data base for this paper. The file contains a wide range of statistical data for Canada, the provinces and territories, as well as for the selected Census metropolitan areas. These data are based on a sample representing between 1–3% of the population. Lots of information about demographic and economics traits is provided. It contains information regarding income, age, schooling, and ethno-cultural characteristics. This microdata file is a powerful research tool, as it allows users to use basis variables of the Census, such as age, gender, education, etc, which enables them to select the groups of data which suit their own requirements.

⁸ Response to the SCF/SLID is voluntary, and about 20% of selected households choose not to do so. This may create a potential for response bias that is related to income. The SCF/SLID datasets include weights calculated so that key sample characteristic mimic those of the population as a whole, but income is not one of the characteristics. Thus, to the extent that response bias is related to income, even after controlling for observables that are directly addressed by the weights, the weighted income distribution obtained from the SCF/SLID may still not correspond to that for the whole population. (Frenette, Green and Milligan 2006)

4. Research Method

4.1 Income Measurement

Comparisons of income inequality between the groups of the population of different ages are always made in terms of money income. The Census data set always report the annual cash income. Analysis based on the individual and household levels is feasible using the Census as well as other income surveys. In this paper, as opposed to family income, individual income is selected for the following reasons: First, an individual's public pension income is the primary concern of this paper.⁹ Second, the variance in income distribution between the young and the old is a part of the central thrust of this paper. Obviously, individual income is better suited for this question. The data in this paper, such as wages and salaries, investment income and Old Age Security Pension, are reported at the individual level in the Census.

One of the primary objectives of this paper is to measure the impact of public pension income on income distribution among the retired population. Public pension income is comprised of income from both Old Age Security (OAS) program and Quebec Pension Plan /Canada Pension Plan (CPP/QPP). The problem arising here is that in 1986, there were no entries for OAS and CPP/QPP incomes appearing on the list of the Public Used Microdata file. To address this issue, I note that individual's total income is composed of wages and salaries, self-employment income, investment income, Old Age Security Pension and Guaranteed Income Supplement, CPP/QPP benefits, annuities besides the pension income from OAS and CPP/QPP, and other money income. There are two measures that I use to evaluate the public pension benefits:

⁹ Those observations for which there are negative values are excluded, just as was done in most of the existing literature.

$$\text{PENSION}_1 = \text{OASGIP} + \text{CQPPBP}$$

$$\text{PENSION}_2 = \text{TOTINCP} - \text{WAGESP} - \text{SELFIP} - \text{INVSTP} - \text{RETIRP} - \text{OTINCP}^{10}$$

PENSION₂ is defined by residual approach. According to the construction of PENSION₁ and PENSION₂, they should be the same. However, they are not identical in practice, because of some complicated reasons such as reporting error. If there is a stable mathematical relationship between PENSION₁ and PENSION₂ over the time period, PENSION₂ can be used to develop a proxy for PENSION₁ for 1986. Define PPENSION = MPENSION₁/MPENSION₂ where MPENSION₁ and MPENSION₂ represent the mean of PENSION₁ and PENSION₂ in each year. If the value of PPENSION is relatively constant over the Census files, it can be used to calculate missing values of PENSION₁ in 1986 by extrapolation. As shown in table 4, the standard deviation during the census years is relatively small compared to the mean, which means PPENSION is almost constant from 1981 to 2001. Although this assertion is only based on 4 observations, it is probably a sufficient indicator for the long term relationship between PENSION₁ and PENSION₂. It is clear from table 5 that PPENSION has been fluctuating in stable fashion around 1.11 in this period. Therefore, instead of PENSION₁, we can use PENSION₂ divided by 1.11 to measure the public pension income in 1986. In summary, the data series for public pension income is formed as follows:

$$\text{PENSION} = \text{PENSION}_2 / 1.11 \text{ in } 1986$$

$$\text{PENSION} = \text{PENSION}_1 \text{ in } 1981, 1991, 1996 \text{ and } 2001$$

4.2 Income inequality measurement

The degree of income inequality can be calculated by several methods, so it is important to select an appropriate measure. The choice of inequality measure

¹⁰ The definition of variables is shown in table 3.

represents an important aspect in computing short-run inequality, long-run inequality, and the income stability profile. There are five desirable properties for a suitable inequality measure: Mean independence (Income Homogeneity), Anonymity (Symmetry), the Pigou-Dalton Principle of Transfer, the Principle of Population and Decomposability.¹¹

There are two broad types of income inequality measures: conventional measures with no explicit reference to the concept of social welfare, and other measures that are based on some social welfare function. Unfortunately, most of the popular conventional measures, including the Variance, the Coefficient of Variation, the Standard Deviation of Logarithm, and the Gini Coefficient violate some of the properties mentioned above. The Variance measure violates the mean independence property because it is not defined relevant to the mean. As far as the Coefficient of Variation is concerned, transfers from rich people to poor people always reduce its value, which is contrary to the property 1. The Standard Deviation of Logarithms is more sensitive to the transfers in the lower income brackets than to the transfers among the higher income brackets. The Gini Coefficient has the same problem as the Coefficient of Variation, and in addition, it is not additively decomposable.

According to the analysis above, in order to link the statistical summary measures of income inequality to social welfare issues, it is preferable to analyze them within a social welfare function framework rather than relying on implicit value measures. In other words, it implies that there are some other measures which are better than conventional measures. Are there income inequality measures which are homogeneous, symmetric, decomposable, and satisfy Pigou-Dalton Principle of Transfer? The answer is yes, and they are labeled as the class of Generalized Entropy measures. They are equivalent to Atkinson indices of inequality (Atkinson, 1970) and contain Theil's two information measures (Theil, 1967). Theil Index 1 is selected as

¹¹ See appendix 1

the measurement of income inequality in this paper.¹²

After calculating the income inequality measures, the next step is to examine how different income components influence the degree of income inequality in different age groups. To achieve this goal, I divide the population into three groups according to their degrees of labour force attachment and age: the active group (age 18 to 60), the retired group (age 66 and over), and the half-active-half-retired group (age 61 to 65), and examine the shares of their income that are attributed to income versus pension income. As shown in tables 6 and 7, the primary income source for the population aged 18 to 60 is employment income; the share of employment income in total income is always above 60% within this age group in table 7. The people who are older than 65 obtain their income mainly from public pension system; the share of public pension income in total income is above 64% within this age group in table 6. The primary income source for the population aged 61 to 65 is the mixture of employment income and public pension income.

There are four points relevant to the analysis presented in the above two tables:

1. According to tables 6 and 7, the share of public pension income in total income gets higher as people become older. On the contrary, the share of employment income in total income gets lower while people become older. Additionally, for all age groups, the average share of public pension income in total income has exhibited an increasing trend from 1981 to 2001, while the average share of employment income in total income has exhibited a decreasing trend over the period.
2. The public pension income for the population aged between 18 and 50 is not zero. This phenomenon may be caused by the disability subsidy provided by the government as a part of the public pension system or some reporting error.
3. The population aged between 61 to 65 will be excluded in the most the analyses in the rest of this paper due to their complicated income sources.

¹² See Appendix 2

4. There is still another component of individual's income other than employment income and public pension income. Those incomes are defined as other income, and are calculated as following: $OINCOME = INVSTP + RETIRP + OTINCP$.

5. The analysis of income inequality in Canada across age groups

5.1 The trend of adult's income inequality in Canada¹³

The existing literature in Canada generally finds a rising trend in total income inequality in recent decades, with some fluctuations occurring in the early 1980s, the late 1980s and the early 1990s. This view is also supported by my result: I calculate the overall Theil Index for adult's total income across the period 1980 to 2000 by using the s18 and over age group's total income at the individual level in the Census Microdata set.¹⁴ The values are 0.3412 (1981), 0.3427 (1986), 0.32267 (1991), 0.35351 (1996) and 0.34866 (2001). According to the values, figure 3 shows that the overall degree of total income inequality in Canada was slightly increasing from 1980 to 2000, despite registering two declines in the period of 1985 to 1990, and 1995 to 2000. One of the possible interpretations to this phenomenon is that these two deviations from a possible trend toward higher inequality might have something to do with the recovery periods that occurred in the late 1980s and the late 1990s. It is well known that the recession affected Canada's economy in the periods of 1982 to 1983 and 1991 to 1992. Consequently, the increasing trend of the Theil Index from 1981 to 1985 and 1991 to 1995 might reflect the recession, and the decreasing trend of the Theil Index from 1986 to 1990 and 1996 to 2000 might reflect the recovery.¹⁵

¹³ Adults are defined as those whose age is 18 or over

¹⁴ As the 1981 Census data just contain the population's 1980 information, Census data can only indicate population's previous-year status.

¹⁵ Beach, Finnie and Gray (2005) demonstrated that, in Canada, the degree of the income inequality would

5.2 Adult's income distribution across age groups

Adults can be divided into three subgroups that differ according to their primary income source and age: first, there is 18 to 60 age group, whose primary income source is employment income. Then, there is 66 and over age group, whose primary income source is public pension income. Finally, there is 61 to 65 year old group, whose primary income source varies. Combining the information from tables 6 and 7, the total shares of employment income and public pension income in the total income are above 70% for the population aged between 61 and 65.

5.2.1 Active individuals—the 18 to 60 year old group

The population within this age group can be further divided into three subgroups: the 18 to 30 year old group, whose members recently entered the labour force, the 31 to 50 year old group, whose members tend to have stable jobs and income, and the 51 to 60 year old group, whose members are about to retire. Table 6 shows that the primary source of income is employment income for all three groups; however, there are some differences among them. Figure 4 shows the Theil Index for all three subgroups. Four points are evident from this figure:

1. The degree of income inequality within the 31 to 50 year-old group is always lower than the one in the other two subgroups during the period of 1980 to 2000.
2. The level of income inequality within the 18 to 30 year-old group is lower than the one within the 51 to 60 year-old group until 1996.
3. All subgroups except the 31 to 50 year-old group show a similar increasing trend in income inequality, much like the 18 to 60 year old group.
4. Compared to figure 3, one can see that adult and the three groups of the active population have very similar patterns of the change in income inequality over time,

decrease in the recovery period and increase in the recession period.

including the dip in 1990 and the slight dip in 2000.

The results from the decomposition of Theil Index by age groups are shown in table 8. The between-group Theil Index is relatively low, while the within-group Theil Index is dramatically high. It suggests that the main factor generating overall income inequality is the inequality within each age group for total income. The variation between them, which corresponds to the differences in the mean levels, is very low. This fact indicates that, among the active population, age is not a key factor in affecting the degree of income inequality.

5.2.2 Retired individuals—the group aged 66 or older

It is not necessary to divide the population into different subgroups within this age group. One interesting aspect is the trend of inequality. Only a few articles in the existing literature mention the trend of seniors' income inequality over time. Thus, I calculate the Theil Index for the population aged 66 and over using the Census data. The values for this index are 0.30065 (1981), 0.28347 (1986), 0.29003 (1991), 0.25671 (1996) and 0.2459 (2001). It is observed that the degree of overall income inequality is decreasing (figure 5). Table 6 and figure 5 also suggest that, among the retired population, the declining trend of income inequality and the increasing trend of the share of income received from public pension benefits occurred simultaneously. This is not too surprising, as the public pension benefits are designed to be progressive in their redistributive impact on total income. I will explain how this occurs in the next section.

5.2.3 The relationship of income inequality between the active population and the retired population

The degree of income inequality among the retired age population (66 and over) is always significantly lower than that among the active age population (18 to 60) in Canada. As shown in figure 6, from 1980 to 2000, the level of income inequality always follows this pattern. And, in table 9, note that the values for the between-group Theil Index are close to 0, which means there is no major difference in mean income between these two subgroups.

Why is the income distribution of the retired population always more equal than that of the active population? This is partially due to the Canadian public pension system, which has the impact of flattening the income inequality. In Canada, public pension benefits are tied relatively loosely to prior wages, in contrast to the private pension schemes whose benefit levels are directly tied to prior wages and contributions. As one of the two major pillars of Canada's public pension system, OAS program provides a pension which is a flat benefit available to all those age 66 and over with at least 10 years of residence. OAS benefits are totally means tested, so they have a very progressive redistributive impact on the total income. The other pillar, CPP/QPP benefits, is subjected to a floor as well as to a ceiling. The benefit amount is restricted to that range no matter how little or how much other income is received, and irrespective of the prior level of income. As a result, public pension benefits have succeeded in decreasing poverty among the elderly by the institution of a series of targeted, flat-rate benefits which redistribute income to pensioners. Therefore, for these and other reasons, public pension benefits have been more equally distributed than employment income. This is one of the most important reasons why the retired population, whose primary income source is public pension benefits, have lower values of the Theil Index than the active population, whose primary income source is employment income.

5.2.4 How public pension benefits affect income inequality of retirees

The literature has raised the question of whether the distribution of the income could be more equal in the absence of a public pension system. In such a scenario, the existing retirement income system would produce more income inequality than the labour market because economic advantages, such as high status attainment as a result of high parental socio-economic status and human capital investment, accumulate over the life course (Pampel and Hardy 1994). In other words, pension benefit levels would be closely tied to wages, thus reinforcing the inequalities that prevailed during the active years. Does this kind of retirement system apply to Canada? The answer is no. The counterfactual exercise shown in figure 7 indicates that, excluding income from public pensions, the income distribution of the retired population would be very unequal— the values of the Theil Index would be above 0.6. Some articles in the literature support this view. For example, Veall (2006) indicated that, within the 66 and over year-old group, the percentage of labor market income received by the top 1% earners is more than 60% of the total income earned by the entire group in 2002. The figures for the provinces of PEI, Quebec, Ontario, NSNB and Newfoundland are 55%, 61%, 63%, 65%, 70% and 80%, respectively.

Canada's public pension system has a positive impact on reducing the inequality. It is becoming more and more effective in this respect: in 1980, the receipt of public pension benefits reduced the value of Theil Index of retired Canadians from 0.65501 to 0.30065 (with a decrease of 54.1%), in 1986, from 0.65737 to 0.28347 (with a decrease of 56.88%), in 1991, from 0.62871 to 0.29003 (with a decrease of 53.87%), in 1996, from 0.64103 to 0.25671 (with a decrease of 59.95%), in 2001, from 0.61584 to 0.2459 (with a decrease of 60.07%). The effect of public pension benefits on the Theil coefficient becomes greater over the course of the interval.

5.3.5 Relationship between inequality and income source

For retired people, their primary source of income is from Canada's public pension system shown in Table 6. Among the population whose income mainly comes from employment, there is an increasing trend on income inequality. By contrast, for the population whose income mainly stems from public pension plan, the distribution of income exhibits a decreasing trend of inequality. Is it just a coincidence, or, is there some relationship between income source and income inequality?

Figure 8 indicates the changes in the share of public pension income in total income for the 66 and over year-old group from 1980 to 2000. The share is always over 60% for the entire interval, which suggests that public pension benefits are the main income source for the retired population. By comparing figure 5 with figure 8, there is a strictly negative relationship between the degree of income inequality and the share of public pension income for the population aged 66 and over age population.

Figure 9 shows the changes in the share of employment income in total income within the 18 to 60 year-old group from 1980 to 2000. This share is always above 70%, which implies that employment income is the active population's primary income source. The comparison between figure 6 and figure 9 indicates that the degree of income inequality and the share of employment income for the population within the 18 to 60 year-old group also have an inverse relationship, although not for every year.¹⁶ In other words, an increase in the degree of income inequality and a decrease in the share of employment income for the population of active age occurred simultaneously.

Figures 10 and 11 show that, compared to total income, primary income has a more equal distribution, although the difference is very slight in figure 10. As mentioned

¹⁶ The exception of this relationship occurs in 2000.

before, total income is equal to employment income plus public pension income and other income. Employment income is the primary source of income for the 18 to 60 year-old group.

For the active population, the Theil Index for employment income is always slightly lower than that of total income, while the Theil Index for public pension income and other income is always higher than that of total income. There are two facts contributing to this phenomenon. First, as I mentioned before, the public pension benefits received by active individuals are mainly from the disability subsidies. Obviously, there is only a small portion of individuals among the active population that gets these subsidies. Second, other income is distributed very unequally among the active population. Therefore, within this age group, the higher the portion of employment income (the primary income source) in total income is, the higher the share of income component with a relatively low level of income inequality is. When the share of the income component with a relatively low level of income inequality gets higher, the total degree of income inequality goes down. In other words, as the share of employment income (primary income) increases, the level of inequality of total income falls.

Figure 11 suggests that the hypothesis that the primary income source has more equal distribution than total income is still applicable to the retired population. It is not surprising that the public pension income of the retired population has a more equal distribution than their total income. However, it is worth noting that the Theil Index for public pension income is quite low. This implies that, for the retired population, the degree of inequality for the distribution of public pension income is much more equalitarian than the distribution of their income earned from other sources.

6. Conclusion

In this paper, I first demonstrate the degrees and the trends of income inequality during the period of 1980 to 2000 for Canada across age groups by using the Census data. I argue that Canada's overall trend for the degree of income inequality has been increasing during the past two decades, and provide a possible explanation for the turning points. I demonstrate that the retired population has lower degree of income inequality than the active population does by comparing the trends over time in the values of their Theil Indices.

I also indicate the positive effect of public pension benefits on reducing the degree of income inequality among the retired population in Canada. This positive effect is demonstrated by comparing the values of the retired population's income inequality Theil Index with and without public pension income.

The main finding in this paper is that the composition of income among the various sources for either age group (active age group and retired age group) is a key factor in determining the overall degree of income inequality within this cohort in Canada. There are three conclusions based on this finding: First, individual's primary income source has a more equal distribution than their total income for both the active age group and the retired age group. Second, because employment income, which is the primary income source for the active individuals, has a higher level of inequality than public pension benefits, which is the primary income source for the retired individuals, the active population has higher degree of income inequality than the retired population. Third, by testing for the compositional effect of primary source income, I discover that the degree of total income inequality decreases while the portion of primary source income in total income increases, all other factors held constant.

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Appendix 1

The Generalized Entropy Classes

Zandvakili (2000) claims that a suitable inequality measure must satisfy five properties:

1. **Mean independence (Income Homogeneity):** The inequality measure will be insensitive to proportional changes in all incomes.
2. **Anonymity (Symmetry):** The inequality measure must be independent of labels assigned to income shares of the population.
3. **Pigou-Dalton Principle of Transfer:** Inequality must be reduced by a transfer from a rich person to a poor person. The reverse is also true.
4. **Principle of Population:** Compared to absolute densities of income, the inequality measurement depends on relative densities of income.
5. **Decomposability:** In an inequality measure, the total inequality in the distribution of income of a population can be broken down into a weighted average of the inequality existing within subgroups of the population and the inequality between the groups.

One of the most useful properties of an inequality measure is decomposability, but not all decomposable measures are suitable inequality measures. Some of the decomposable measures violate some of those requirements. The inequality measures that are homogeneous, symmetric, decomposable, and satisfy the Pigou-Dalton condition of transfer are called the class of Generalized Entropy measures. The Generalized Entropy measures are equivalent to Atkinson indices of inequality (Atkinson 1970), and contain Theil's two information measures. Compared to Atkinson indices of inequality, Theil's two information measures are more widely used. They are made up of two components: within-group Theil Index and between-group Theil Index.

Gray, Mills and Zandvakili (2003) define Theil's two information measures in more detail:

$$\text{Theil 1: } T1 = -\sum_{i=1}^N w_i s_i \log(ns_i)$$

$$\text{Between-Theil 1: } BT1 = \sum_{j=1}^w s_j^* \log\left(\frac{ns_j^*}{n_j}\right)$$

$$\text{Within-Theil 1: } WT1 = \sum_{j=1}^w s_j^* T1_j$$

$$\text{Theil 2: } T2 = \sum_{i=1}^N \frac{w_i}{n} \log\left(\frac{1}{ns_i}\right)$$

$$\text{Between-Theil 2: } BT2 = \sum_{j=1}^w \frac{n_j}{n} \log\left(\frac{ns_j^*}{n_j}\right)$$

$$\text{Within-Theil 2: } WT2 = \sum_{j=1}^w \frac{n_j}{n} T2_j$$

where y_i is income of i^{th} individual, N_j is number of observations in j^{th} group, $N = \sum_j N_j$, w_i is population weight for i^{th} observation j . w_i^j is population weight for i^{th} observation in group j , n_j is sum of population weights for j^{th} group, n is total population, weighted income share $s_i = \frac{y_i}{\sum_{i=1}^N w_i y_i}$, $s_i^j = s_i$ for the j^{th} group, s_j^* is weighted income share of the j^{th} group, $T1_j$ is the Theil 1 for the j^{th} group, and $T2_j$ is the Theil 2 for the j^{th} group.

Appendix 2

The Theil Index

Consider a population of persons (or households ...), $i = 1, \dots, n$, with income y_i , and weight w_i . Let $f_i = \frac{w_i}{N}$, where $N = \sum w_i$. (In what follows all sums are over all values of whatever is subscripted). When the data are unweighted, $w_i = 1$ and $N = n$. Arithmetic mean income is m . Suppose there is an exhaustive partition of the population into mutually-exclusive subgroups $k = 1, \dots, K$. The Generalized Entropy class of inequality indices is given by

$$GE(a) = \left[\frac{1}{(a(a-1))} \right] \left\{ \left[\sum \left(f_i \left(\frac{y_i}{N} \right)^a \right) \right] - 1 \right\}, \quad a \neq 0 \text{ and } a \neq 1,$$

$$GE(a) = \sum f_i \left(\frac{y_i}{m} \right)^a \log \left(\frac{y_i}{m} \right),$$

$$GE(0) = \sum f_i \log \left(\frac{m}{y_i} \right).$$

The inequality indices differ in their sensitivities to income differences in different parts of the distribution. The more positive “a” is, the more sensitive GE (a) is to income differences at the top of the distribution; the more negative a is, the more sensitive it is to differences at the bottom of the distribution. GE (1) is the Theil Index.

$$GE(a) = GE_W(a) + GE_B(a)$$

where $GE_W(a)$ is Within-group Inequality and $GE_B(a)$ is Between-Group Inequality and

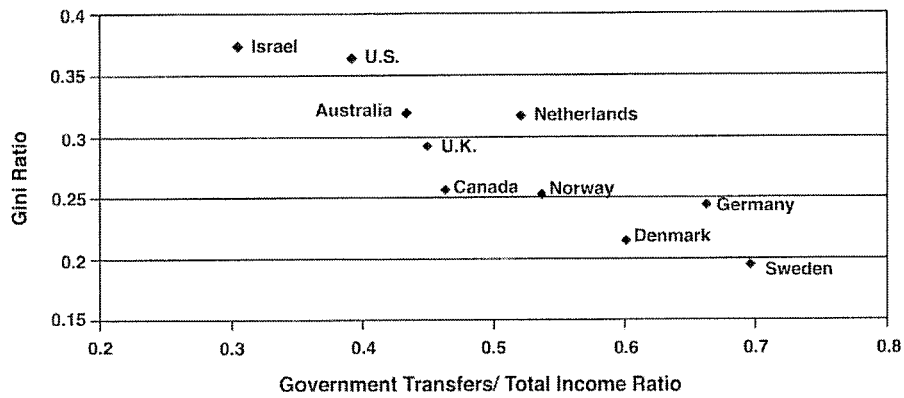
$$GE_W(a) = \sum [v_k^{1-a} * s_k^a * GE_k(a)]$$

where $v_k = \frac{N_k}{N}$ is the number of persons in subgroup k divided by the total number of persons (subgroup population share), and s_k is the share of total income held by k's members (subgroup income share). Strictly speaking, v_k is the sum of the weights in subgroup k divided by the sum of the weights for the full estimation sample. $GE_k(a)$, inequality for subgroup k, is calculated as if the subgroup were a separate population, and $GE_B(a)$ is derived assuming every person within a given subgroup k received k's mean income m_k .

Figures

Figure 1

Percentage of Household Income from Government Transfers by Gini Coefficient Selected Countries, Household Heads Aged 65+

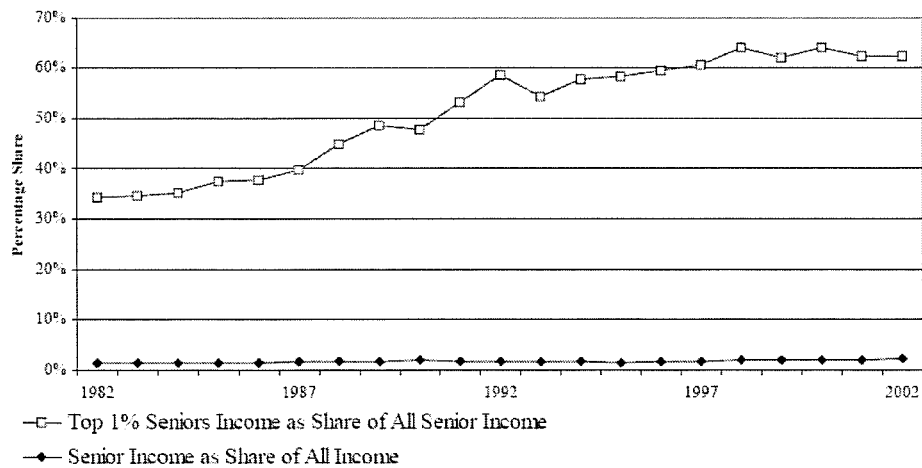


Source: Luxembourg Income Study, Household Files, Wave IV.

This figure is reprinted from Brown and Prus : "Social Transfers and Income Inequality in Old Age: A Multinational Perspective" 2004.

Figure 2

Figure A1.6 Ontario, Senior Employment Income, 1982 - 2002



This figure is reprinted from Michael R. Veall: "The Top Shares of Older Earners in Canada." 2006

Figure 3 Quinquennial values of the Theil Index for the 18 years and older year-old group

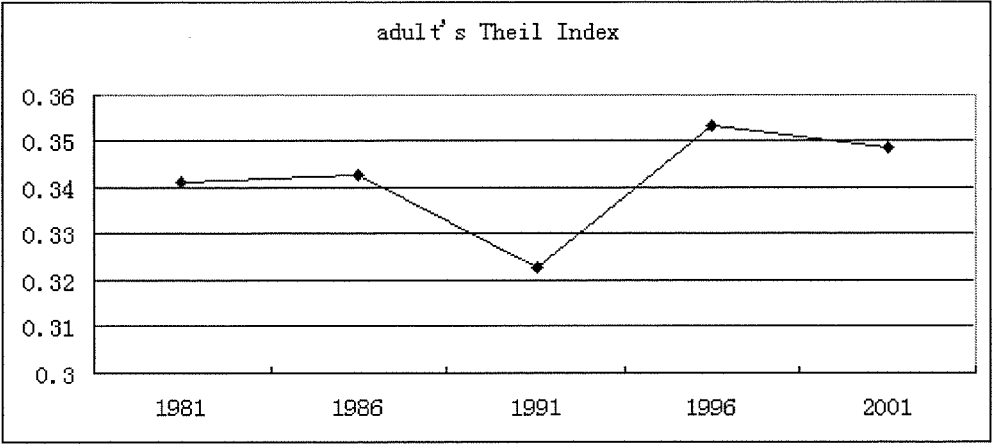


Figure 4 Quinquennial values of the Theil Index for the 18 to 60 year-old group

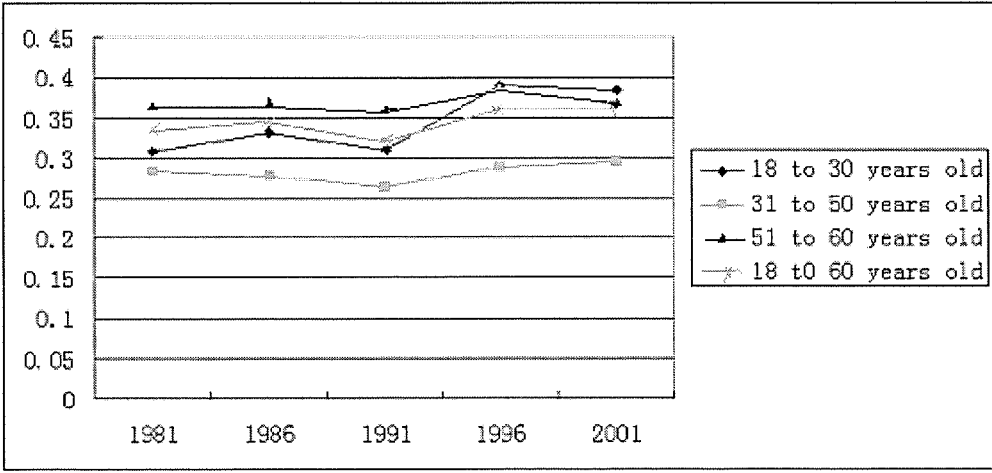


Figure 5 Quinquennial values of the Theil Index for the 66 years and older year-old group

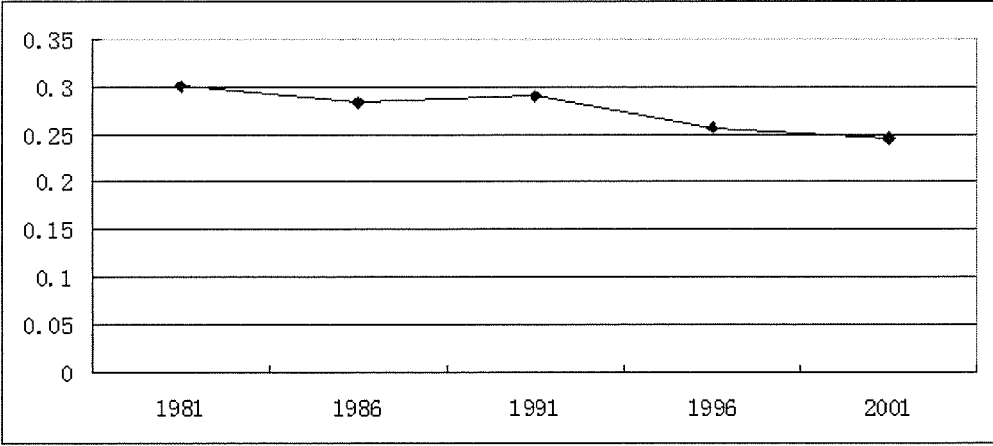


Figure 6 Quinquennial values of the Theil Index for the active and retired people

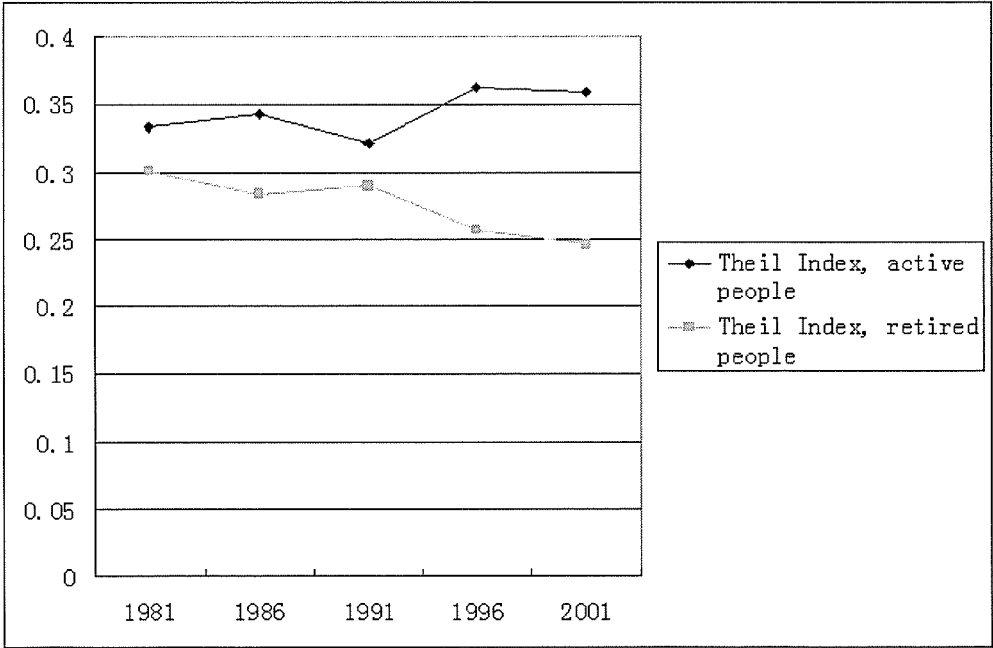


Figure 7 Counterfactual exercise on the income with and without public pension benefits

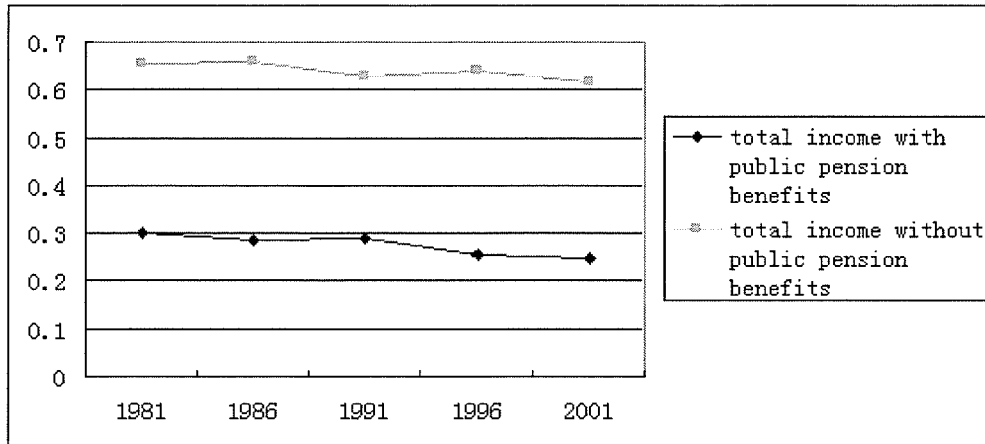


Figure 8 The share of public pension income in total income, the 66 and over year-old group

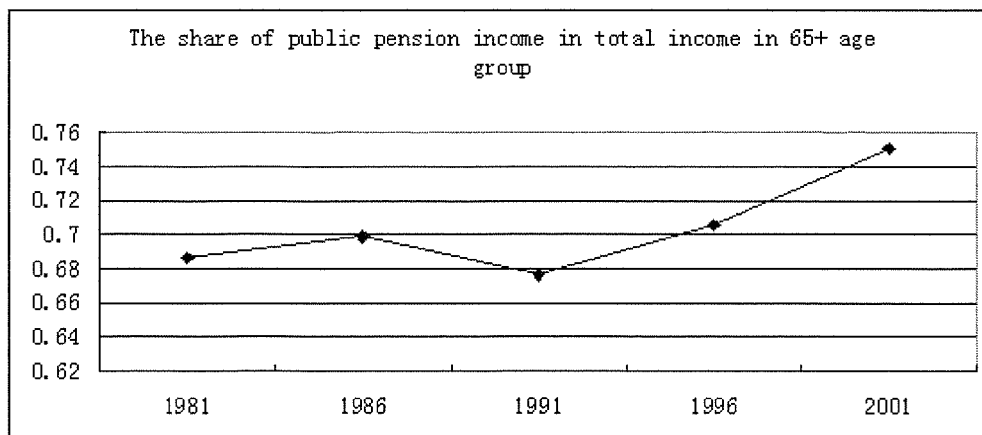


Figure 9 The share of employment income in total income, the 18 to 60 year-old group

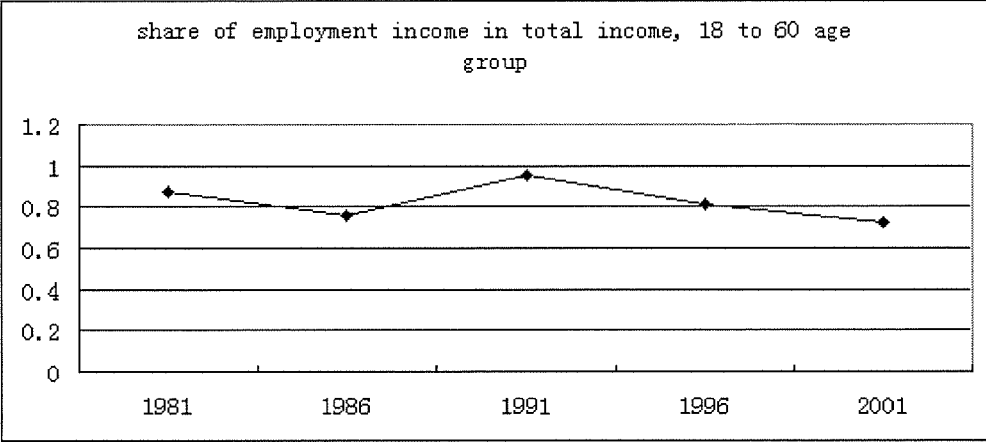


Figure 10 Quinquennial values of the Theil Index for the 18 to 60 year-old group

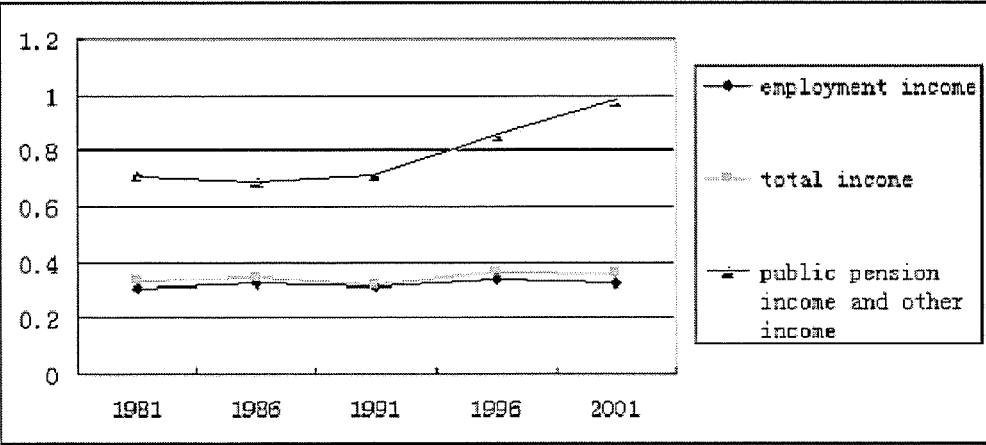
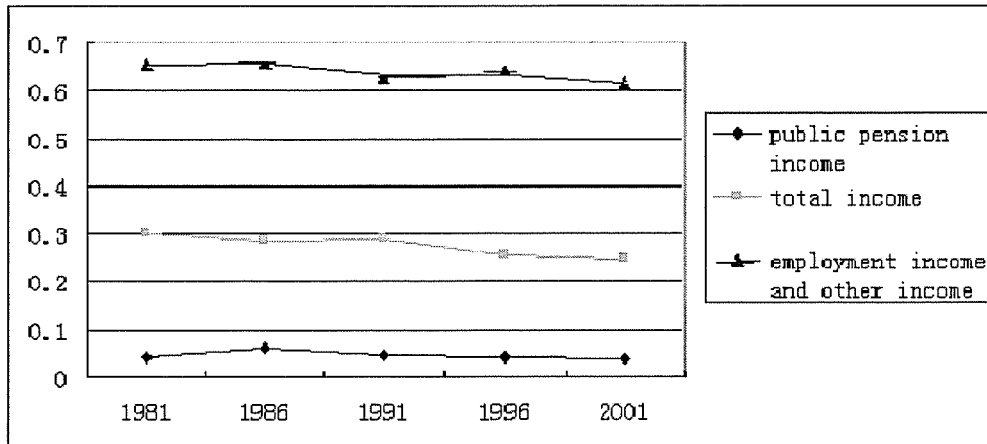


Figure 11 Quinquennial values of the Theil Index for the 66 and over year-old group



Tables

Table 1

**Percentage Distribution of Adjusted Household Income by Source
Selected Countries, Household Heads Aged 65+**

Source	Country									
	Sweden	Denmark	Germany	Norway	Canada	U.K.	Netherlands	Australia	U.S.	Israel
Earnings ^a	7.2	11.0	14.9	20.9	19.6	15.9	8.6	29.3	28.2	32.8
Investments ^b	7.2	8.7	4.9	10.1	14.0	14.1	9.4	16.8	15.8	9.5
Pensions ^c	16.0	20.1	13.9	15.3	20.0	25.1	29.9	10.7	17.0	27.2
Government transfers	69.6	60.2	66.3	53.7	46.3	44.9	52.1	43.3	39.1	30.5

Note: Percentages are based on before-tax household income adjusted for household size and may not total exactly to 100% due to rounding.

^aIncludes self-employment income.

^bIncludes other income from private sources.

^cPrivate (occupational) pension income.

Source: Luxembourg Income Study, Household files, Wave IV.

This table is reprinted from Brown and Prus : "Social Transfers and Income Inequality in Old Age: A Multinational Perspective" 2004

Table 2 Characters of income data sources

	SCF/SLID	Census
Continuity	Break in 1996	No break
Coverage	80% response rate	Mandatory response
Sample size	Small	Large
Frequency	Annual	Every 5 years

Table 3 Variables' definition

TOTINCP	Total Income
WAGESP	Wages And Salaries
SELFIP	Self-Employment Income
INVSTP	Investment Income
OASGIP	Old Age Security Pension And Guaranteed Income Supplement
CQPPBP	Canada Or Quebec Pension Plan Benefits
RETIRP	Retirement Pensions, Superannuation And Annuities, Including Those From Rrsps And Rrifs
OTINCP	Other Money Income

Table 4

Variable	Obs	Mean	Std. Dev.	Min	Max
ppension	4	1.109731	.0040118	1.105377	1.113457

The 4 observations of PPENSION are based on 1981, 1991, 1996, and 2001. The Standard Derivative is relatively small comparing to the Mean. It implies that PPENSION is approximately constant to 1.11 during the period of 1981 to 2001.

Table 5

YEAR	MPENSION1	MPENSION2	PPENSION
1981	3788.879	3421.781	1.107283
1991	9011.523	8098.021	1.112806
1996	10874.74	9766.647	1.113457
2001	12139.44	10982.17	1.105377

Table 6 Share of public pension income in total income

Age range	1981	1986	1991	1996	2001
18 to 30	.0910127	.1295205	.2092032	.2056096	.1744277
31 to 50	.0926987	.2047415	.1197218	.17532	.2323
51 to 60	.127903	.1487421	.1457969	.2050015	.1754767
61 to 65	.2952461	.3261409	.3552992	.3796595	.4207838
66 to 70	.6492449	.6665067	.6570706	.6933013	.700982
71 to 75	.6901014	.6955288	.6693105	.6818014	.6870639
76 to 80	.7184822	.7301969	.6897149	.7250401	.7073723
Older than 80	.741323	.7519457	.7168949	.7510457	.7328295
Average	.1845815	.2487332	.2410588	.2988134	.3008079

Table 7 Share of employment income in total income

Age range	1981	1986	1991	1996	2001
18 to 30	.8726359	.8289333	.7492943	.7534742	.7889774
31 to 50	.830926	.7262392	.84928	.8975556	.7136548
51 to 60	.7003539	.6723116	.7583492	.6267918	.6727496
61 to 65	.4274179	.3633246	.3421287	.3153669	.2999148
66 to 70	.0891521	.0741978	.0714118	.0595165	0.5467413
71 to 75	.0393117	.0393568	.0436524	.0528549	.0355519
76 to 80	.0214073	.0181437	.0254106	.0191973	.0195574
Older than 80	.0153371	.012437	.0232408	.0142911	.013008
Average	.8709949	.6378678	.7893395	.6456506	.5773998

Table 8 Within-group and between-group Theil Index for active people based on three age subgroups.

Year	1981	1986	1991	1996	2001
GE(1)_W	0.31787	0.30342	0.28538	0.32052	0.32152
GE(1)_B	0.02333	0.03495	0.02982	0.03772	0.03353

GE(1)_W represents within-group Theil Index.. GE(1)_B represents between-group Theil Index.

Table 9 Within-group and between-group Theil Index for active population and retired population.

Year	1981	1986	1991	1996	2001
GE(1)_W	0.32020	0.32270	0.30267	0.33351	0.32866
GE(1)_B	0.02122	0.01978	0.01792	0.02033	0.02131