Canadian Income Inequality and Redistribution post the Economic Expansion of 1995

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Major Paper presented to the

Department of Economics of the University of Ottawa

in partial fulfillment of the requirements of the M.A. Degree

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Ottawa, Ontario

April 8th, 2010

Abstract

Using microdata from the public-use files of the Survey of Labour and Income Dynamics (SLID), I investigate Canadian income inequality and redistribution for the years from 1996 to 2006, roughly the period after the economic expansion of 1995. During this period, numerous tax and transfer policy changes were implemented. The Atkinson indices A(1.0) and A(1.5), which in my belief reflect Canadian social preferences, indicate that after-tax income inequality has risen (with the rise being concentrated during 1996-1999) due a tax and transfer system that more than offset the decline in market income inequality. In this paper, I also examine relative income gaps in order to gain insight into movements at various parts of the distribution, as well as carry out subgroup decompositions by various family characteristics, namely age of oldest member, family composition, and main source of family income.

1. Introduction

Income inequality is a key determinant of a country's economic well-being given that citizens care about whether or not national income is distributed "fairly". The measurement of income inequality entails an important concept, that is, the dimension of income. Since what people care about is the amount of money they have to spend after receiving transfers and paying taxes, after-tax (and transfer) income best reflects their welfare.

After-tax income inequality depends on the income inequality generated by markets (market income inequality), in particular the labour market, as well as on the extent to which the tax and transfer system can redistribute market income between citizens (effect of redistribution). The standard approach to measuring the effect of redistribution is to take the difference between after-tax income inequality and market income inequality, which captures only the direct effect of redistribution and not any disincentive effects on the markets, such as the negative effect of social assistance on the labour force participation rate.

Previous studies show that in contrast to the slightly declining trend of the 1980s, Canadian after-tax income inequality has been rising steadily during the 1990s (Frenette et al., 2007; Heisz, 2007). Underlying this rising trend was a continuation of the widening market income distribution that began in since the early-1980s. During the 1980s, redistribution grew enough to undo this widening; however, in the 1990s it did not (ibid). More specifically, redistribution in the 1990s grew to some extent during the first half of the decade but as a result of the various tax and transfer policy changes introduced since the mid-1990s, it subsequently declined (Frenette et al., 2009).

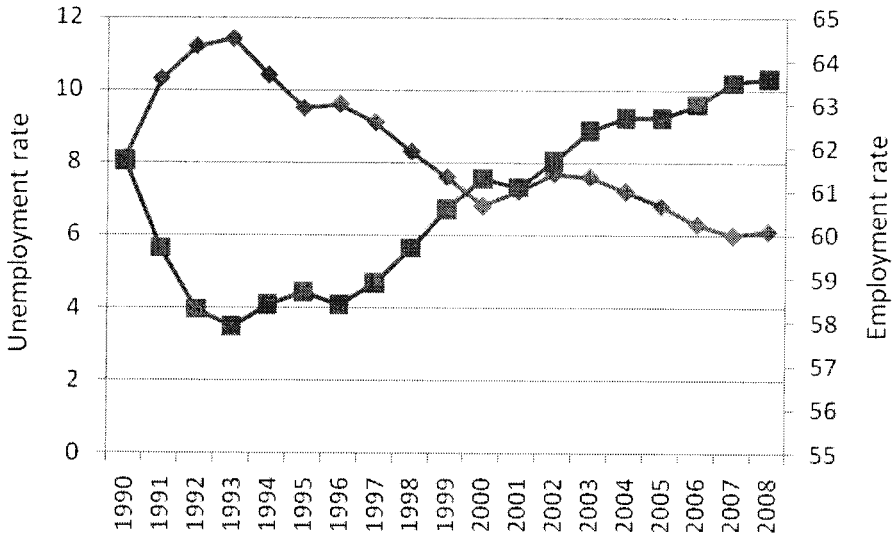
Focusing on the period since the mid-1990s, in this paper I investigate Canadian trends in income inequality and redistribution using microdata from the public-use files of the Survey of Labour and Income Dynamics (SLID), which are available from 1996 to 2006. In order to reflect Canadian social welfare, the inequality measures I have chosen are the Atkinson indices A(1.0) and A(1.5). To separate the (direct) effect of transfers from that of taxes, I include total income (after-transfer before-tax) inequality in addition to market income inequality and after-tax income inequality in my analysis. (The exact methodology will be given later in the paper).

Since the mid-1990s, the tax and transfer system has undergone extensive reform (as mentioned earlier). The three major changes in the transfer system were the transformation of the Unemployment Insurance (UI) into the Employment Insurance (EI) program in 1996, the expansion of the Child Tax Benefit program in 1998, and reforms in the Social Assistance (SA) program across provinces from the mid-1990s to the early-2000s. Both the EI program and the SA program featured benefit cuts and tighter eligibility rules. Major changes in the tax system include decreases in the provincial base tax-rate across provinces during the latter half of the 1990s and full indexation of the federal system in 2000.[1] Together this set of policy changes is expected to dampen the redistributive power of the welfare state, thereby putting upward pressures on after-tax income inequality. However, what actually happens to after-tax income inequality also depends on labour market conditions.

[1] Frenette et al. (2009) provide more details on the set of tax and transfer policy change in their study.

Inequality in market income tends to rise during recessionary periods and decline (to a much lesser extent) during the subsequent expansionary periods (Brzozowski et al., 2010). Workers at the bottom of the income distribution face greater chances of job loss

Figure 1: Labour Force Survey (LFS) estimates, 1990-2008 – unemployment rate and employment rate



Source: Statistics Canada CANSIM table 282-0002

during economic downturns and then job regain as employment prospects improve. Figure 1, which plots the unemployment rate along with the employment rate (on the right axis), indicates that, aside from the mild glitch in 2000 (brought on by the U.S. recession), the economy has been improving (declining unemployment rate and rising employment rate) since the economic slump of 1995-96. In 1996, the unemployment rate (employment rate) was 9.6% (58.4%), and by 2006, it had decreased (increased) to 6.3% (63.0%). In opposition to the impact of the tax and transfer policy changes, the improvement in the labour market conditions is expected to put downward pressures on after-tax income inequality through its effect on market income inequality.

My results indicate that Canadian after-tax income inequality has increased slightly from 1996 to 1999 and has since then stabilized; overall, it increased by 0.022 A(1.0) points. In consistency with expectations, this rise was entirely due to a weakening in the tax and transfer system, mostly the transfer system, as market income inequality decreased throughout the period. These trends are supported by both Atkinson indices. An examination across the market and after-tax income distributions reveals that most of the changes in market income inequality and redistribution occurred at the bottom (10^{th} percentile) of the distribution while the change in after-tax income inequality was driven by stronger movements at the top (90^{th} percentile) of the distribution.

In order to understand the effect of the redistributive system on the development of income inequality between families with different characteristics, I decompose the overall inequality into within-group inequality and between-group inequality according to family characteristics for both market income and after-tax income. My finding that the redistributive system has induced inequality between families who derive their income from different sources – labour income, government transfers, and other incomes, provides further evidence of a weakening in the transfer system. Since young families and lone-parents are more likely to fall at the bottom of the distribution and/or to rely on government assistance, it is not surprising that the redistributive system has also induced inequality between families of different age groups and between families of different composition. Furthermore, young families and lone-parents were the most perversely affected by the policy changes in terms of inequality movements within those groups.

The rest of the paper is organized as follows. In order to familiarize the reader with the quantification of income inequality, the next section provides a brief overview of

some common inequality measures. Section 3 describes the data source and the methodology employed in my study. Section 4 discusses recent income inequality and redistribution trends as indicated by earlier studies, both across the group of OECD countries and for Canada alone. The results of my study for Canada over the period 1996-2006 are contained in Section 5, which presents the overall patterns and trends in income inequality and redistribution, the development of relative income gaps, and the subgroup decomposition results. Section 6 compares my measured inequalities with those produced by the Luxembourg Income Study (LIS). Section 7 concludes.

2. Overview of Inequality Measures

Many measures of income inequality have been developed over the years, and each has its own merits and drawbacks. Nonetheless, there are some commonly postulated key axioms that any good measure should satisfy. These include: 1) *Pigou-Dalton Transfer Principle.* A transfer from a poorer to a richer person should register as a rise (or at least not a fall) in inequality; conversely, a transfer from a poorer to a richer person should register as a fall (or at least not a rise). 2) *Income Scale Independence.* Changing all incomes by the same proportion should not change inequality. 3) *Dalton's Principle of Population.* Replications of the population should not change inequality. And 4) *Anonymity.* Inequality should depend on only income and not any other characteristic of individuals (Litchfield, 1999; Chakravarty, 1999). Well-known measures such as the Gini coefficient, the Generalized Entropy (GE) class of indices, and the Atkinson class of indices all satisfy these properties (Chakravarty, 1999). The formulas for these indices are presented in Table 1.

Table 1: Well-known inequality indices*

Gini coefficient	$G = \frac{1}{2n^2\bar{y}}\sum_{i=1}^{n}\sum_{j=1}^{n}\lvert y_i - y_j\rvert$
Generalized Entropy class of indices	$GE(\alpha) = \begin{cases} \frac{1}{\alpha^2-\alpha}\left[\frac{1}{n}\sum_{i=1}^{n}\left(\frac{y_i}{\bar{y}}\right)^{\alpha} - 1\right] & if \ \propto \neq 0,1 \\ \frac{1}{n}\sum_{i=1}^{n}\log\frac{\bar{y}}{y_i} & if \ \propto = 0 \\ \frac{1}{n}\sum_{i=1}^{n}\frac{y_i}{\bar{y}}\log\frac{y_i}{\bar{y}} & if \ \propto = 1 \end{cases}$
Atkinson class of indices	$A(\varepsilon) = \begin{cases} 1 - \left[\frac{1}{n}\sum_{i=1}^{n}\left[\frac{y_i}{\bar{y}}\right]^{1-\varepsilon}\right]^{\frac{1}{1-\varepsilon}} & if \ \varepsilon \neq 1 \\ 1 - \frac{1}{n\bar{y}}\sum_{i=1}^{n}\log y_i & if \ \varepsilon = 1 \end{cases}$

* There are n individuals; y_i is the income of the i^{th} individual; and $\bar{y}$ is the mean income.

The Gini coefficient, the most widely used index in the empirical literature, is derived from the well-known Lorenz curve.[2] It takes on values between 0 and 1, with 0 indicating complete equality and 1 indicating complete inequality. The Gini coefficient has the merit of being defined over zero and negative values of income, which frequently occur in empirical data. On the downside, since it is sensitive to changes in the middle (and not the tails) of the income distribution, it is not an ideal choice for societies that place greater weight on inequality at the extremes, such as the lower end of the distribution.

Unlike the Gini coefficient, the GE indices have a parameter (α) that represents the weights attached to distances between incomes at different parts of the distribution. This parameter can take on any real value, and an index with a lower value of α is more bottom-sensitive while an index with a higher value of α is more top-sensitive. The

[2] A Lorenz curve is a graph where the horizontal axis represents the cumulative percentage of the population, ordered by income from lowest to highest, and the vertical axis represents the cumulative percentage of income held by that part of the population. For a discussion of the relationship between the Lorenz curve and the Gini coefficient, see Kesselman and Cheung (2004).

values of the GE index range from 0 to ∞, with higher values indicating higher levels of inequality. Popular sub-cases are the mean logarithmic deviation (α=0), the Theil index (α=1), and the half squared coefficient of variation (α=2). The main benefit of using these indices is that they can be additively decomposed into within-group inequality and between-group inequality. A caveat is that some forms of the index involve taking the natural logarithm and are thus not defined over zero and negative incomes. Also, the absence of an upper limit to the index value makes comparison across distributions rather difficult.

The Atkinson (1970) indices are derived from social welfare functions containing a parameter (ε) for inequality aversion, which allows normative judgements on society's valuation of equality. This parameter can take on any non-negative value between 0 and ∞, with higher values indicating higher inequality aversion, but the most common values are 0.5 and 1.0. Unlike the GE indices but like the Gini coefficient, the Atkinson indices have values ranging from 0 to 1 and are easy to compare across distributions; furthermore, they have intuitively appealing interpretations. For example, an Atkinson index of 0.30 means that if incomes are distributed equally, only 70% of the total national income would be needed to achieve the same level of social welfare, or equivalently, 30% can be saved. Atkinson indices share a common caveat with the GE indices, that is, some forms are not defined over zero and negative incomes. Atkinson indices can be subgroup decomposed non-additively using a method proposed by Blackorby et al. (1981).[3]

[3] The details of this decomposition method will be discussed in 3.1 of the next section on Data & Methodology.

Other widely-used inequality measures include various percentile ratios, such as P90/P10, P90/P50, and P50/P10. P90/P10, or the "decile ratio", is the income of a person at the 90th percentile over the income of a person at the 10th percentile, and thus captures inequality movements at the tails of the distribution. P90/P50, which is the 90th percentile over the median (50th percentile), captures movements in the top half of the distribution. And P50/P10, which is the median over the 10th percentile, captures movements in the bottom half of the distribution. Selected percentile ratios, or their logarithms, are sometimes reported alongside the Gini coefficient, for example in Smeeding (2005), Kenworthy and Pontusson (2005), and Frenette et al. (2007). These ratios are simple but do not make use of the entire distribution.

As there are advantages and disadvantages associated with any inequality measure, there is thus far no clear consensus among researchers regarding the best one to use. The choice is therefore left entirely up to the individual researcher.

3. Data and Methodology

3.1 The Atkinson Index and its Subgroup Decomposition

The inequality measures I have chosen for this study are the Atkinson indices with inequality aversion parameters 1.0 and 1.5 – A(1.0) and A(1.5). My motivations are that they not only allow normative judgements on inequality aversion (as previously mentioned) but also their ease of comparability across distributions facilitates the study of inequality trends over time. Keeping the fact that Canadians are likely to be somewhat less inequality averse than Europeans in mind, the choice of parameters are based on a finding of Ebert and Welsch (2009), which states that the parameter most representative

of the evaluation of inequality by European citizens falls between 1.0 and 1.5. (In order to examine income inequality at different parts of the distribution, the P90/P10, P90/P50, and P50/P10 ratios are also discussed). Subgroup decomposition is done for the A(1.0) index using the non-additive method of Blackorby et al. (1981).

When working with survey data, cross-sectional sample weights are applied to all estimates to ensure representativeness of the Canadian population. The formulas for the Atkinson index and its subgroup decomposition are as follows. Let n be the number of families in the sample, w_i be the sample weight of the i^{th} family, and y_i be the "equivalent" income of the i^{th} family.[4] Define $N = \sum_{i=1}^{n} w_i$ as the total population and $\bar{y} = \frac{\sum_{i=1}^{n} w_i y_i}{N}$ as the mean equivalent income.

The Atkinson index is given by $A(\varepsilon) = 1 - \frac{y_{EDE}(\varepsilon)}{\bar{y}}$, where y_{EDE} is the "equally distributed equivalent" income, i.e. the per person income that, if distributed equally, would give the same level of social welfare as the actual distribution (Atkinson, 1970). As in Jenkins (1999), y_{EDE} is defined by:

$$y_{EDE}(\varepsilon) = \begin{cases} \left[\sum_i \frac{1}{N} w_i {y_i}^{1-\varepsilon}\right]^{\frac{1}{1-\varepsilon}} & for\ \varepsilon = 1.5 \\ \sum_i \frac{1}{N} w_i \log y_i & for\ \varepsilon = 1.0 \end{cases}$$

The Atkinson index is the percentage of total income saved by moving from the actual distribution to a distribution in which everyone has the equally distributed equivalent income.

Suppose that the population is divided into K mutually exclusive subgroups. Let N_k and $y_{EDE,k}$ be respectively the population and the equally distributed equivalent

[4] The equivalent income is the per-person income which takes into account the economies of scale of family size. More on this will be given in the next subsection.

income of the k^{th} subgroup. Then $A = A_w + A_B - A_w \times A_B$, where A_w is the within-group inequality given by $A_w = 1 - \frac{\sum_{k=1}^{K} N_k y_{EDE,k}}{N\bar{y}}$ and A_B is the between-group inequality given by $A_B = 1 - \frac{N y_{EDE}}{\sum_{k=1}^{K} N_k y_{EDE,k}}$ (Blackorby et al., 1981; Jenkins, 1999). The within-group inequality is the percentage of total income saved by moving from the actual distribution (a) to a distribution in which everyone has the equally distributed equivalent income of his/her subgroup (b). Then the between-group inequality is the percentage of total income saved by moving from the latter distribution (b) to one in which everyone has the equally distributed equivalent income of the population (c); in other words, the inequality of subgroup equally distributed equivalent incomes.

3.2 Data Source and Treatment

The data used are from the public-use microdata files of the Study of Labour and Income Dynamics (SLID), which are available from 1996 to 2006. The SLID provides detailed annual data on income and labour market activity, as well as family characteristics, and has been Statistics Canada's official income data source since 1996. The household survey covers the population of the 10 provinces excluding Indian reserves, institutions, and military barracks. These exclusions account for less than 3% of the population. The public-use file is a randomly selected sample of the full SLID sample and consists of approximately 30311 observations (the average over my sample time period). The data are subject to top- and bottom-coding of very high and very low incomes (which are rare or unique), perturbation, and other confidentiality measures (Statistics Canada, 2006).

The data collected is at the economic family level, which in SLID consists of economic families as well as unattached individuals. Statistics Canada's definition of an

economic family is a group of two or more persons under the same dwelling who are related by blood, marriage, common-law, or adoption. An unattached individual is a person who is either living alone or with unrelated others, and is strictly speaking not part of an economic family. However, to reflect the overall level of economic well-being in the population, it is important to include unattached individuals as well as they make up more than ten percent of Canadians and may have very different incomes than the rest of the population (Skuterud et al., 2004).

For the purposes of this study, a few modifications are made to the original income data before generating results. First, in order to take into account economies of scale due to larger family sizes, all incomes are divided by the number of equivalent adults in order to arrive at measures of equivalent income. Many methods exist but a popular and computationally convenient way is dividing income by the square root of family size. For a family of 6 persons or less, this is near equivalent to counting the first person as 1, the second person as 0.4 if adult and 0.3 otherwise, and all other members as 0.3 (Skuterud et al., 2004). Second, observations with zero or negative after-tax income (accounting for 0.2% of the original sample) are dropped under the assumption that they are erroneous. Finally, incomes are bottom-coded to 0.1% of the mean equivalent income, thereby avoiding the problem of undefined inequality measures due to zero and negative incomes.[5]

[5] A similar procedure is used in Heisz (2007), which bottom-codes incomes to 1% of the mean equivalent income. Given that the sample size is small, I have chosen 0.1% instead in order to reduce the number of modified observations. This recodes the market incomes of 7.5% of the original sample. Total incomes and after-tax incomes are not affected (either zero or one change).

The unit of analysis is the individual.[6] All estimates are thus produced using person weights. Assuming an egalitarian distribution within the household, the person weight is equal to the cross-sectional family weight (given in SLID) times the family size. The measured inequality is then the inequality that would result if all individuals are assigned their respective family equivalent incomes.

Inequality is measured for three income dimensions: first market income, then total income, and lastly after-tax income. Their definitions in SLID are as follows. Market income includes earnings, investment income, retirement income, and other income. Total income is market income plus government transfers. Government transfers include Child Tax Benefits, Canada/Quebec Pension Plan benefits, Old Age Security and Guaranteed Income Supplement/Spousal Allowance, Employment Insurance Benefits, Social Assistance, Workers' Compensation Benefits, Goods and Services Tax Credit, and Provincial/Territorial Tax Credits. Other government transfers are counted as other income under market income. After-tax income is total income minus provincial and federal income taxes. The direct effect of transfers is the difference between total income inequality and market income inequality; the direct effect of taxes is the difference between after-tax income inequality and total income inequality; and the total effect of the redistributive system is the combined effect of taxes and transfers.

In order to investigate the roles of various family characteristics, market income inequality and after-tax income inequality are subgroup decomposed along three dimensions: age of the oldest member, family composition, and main source of family income. The subgroups defined by age of oldest member are young (aged 24 or under)

[6] Even though the level of family income matters most for economic well-being, the desirable unit of analysis is the individual. This is illustrated by an example in Skuterud et al. (2004).

families (6.3%), prime-aged (aged 25 to 64) families (69.8%), and senior (aged 65 or older) families (23.9%). The subgroups defined by family composition are unattached individuals (30.9%), couples with children (25.1%), couples with no children (27.4%), lone-parents (6.5%), and other families (10.1%). Finally, the subgroups defined by main source of income are families whose main source is labour income – wages & salaries and self-employment income (66.6%), families whose main source is government transfers (23.8%), and families whose main source is any other income including investment income and retirement pensions (9.6%).

Before presenting my results on Canadian income inequality and redistribution over the period 1996-2006, I first discuss the findings of some previous studies for the group of OECD countries as well as specifically for Canada over the 1980s and the 1990s.

4. Previous Studies on Income Inequality

4.1. Recent OECD Patterns and Trends

During the post-WWII period, income inequality for the group of affluent OECD countries has generally followed a U-shaped pattern. After decades of inequality decline, the trend reversed and inequality began to increase, starting with the United States (and others) in the late-1970s (Cornia, 1999). Evidence from the OECD's recent publication *Growing Unequal?* (2008) indicates that from the mid-1980s to the mid-2000s, household disposable income inequality (market income plus public transfers minus income taxes and employment social security contributions) has increased in about two-thirds of the OECD countries. The magnitude of the overall increase was moderate but

significant with an average of 2 Gini percentage points, ending at an average of 0.30 by the mid-2000s. The rising trend in disposable income inequality was more prevalent during the first decade (mid-1980s to mid-1990s) than during the second (since the mid-1990s); furthermore, the rise during the first decade mainly reflected rising market income inequality whereas the rise since the mid-1990s mainly reflected the effect of the tax and transfer system. An examination across the quintiles reveals that disposable income grew disproportionately with larger gains for persons in the top quintile than for those at the bottom.

Over the 1980s and 1990s, the U.S. has had the highest level of disposable income inequality among the rich OECD countries, as well as one of the fastest growth rates in inequality (Smeeding, 2005). Smeeding (2005) shows that at the turn of the century (2000), the U.S. had a decile ratio (P90/P10) of 5.45, which is much higher than the cross-country (excluding the U.S.) average of 4.1. The U.S. also had the largest absolute gap between a low-income person at the 10^{th} percentile and a high-income person at the 90^{th} percentile. He attributes the U.S. phenomenon to a combination of low wages and lack of social spending efforts directed towards low-income working families.

The causes of increasing income inequality are complex and cannot be easily disentangled. According to Cornia (1999), the increase in income inequality for the group of OECD countries is to a considerable extent explained by a rise in earnings inequality, which is mainly a consequence of skill-biased technical progress and trade liberalization (shifting demand away from unskilled labour to skilled labour), as well as the erosion of labour market institutions, such as the erosion of minimum wages and the decline of unionization, acting to undermine the country's ability to contain the upward pressures on

earnings inequality. Other factors include a rise in interest rates and in profit share, financial liberalization, and changes in tax and transfer policies. For example, globalization and de-unionization had adverse effects on Australian inequality during the period 1970-2001 while improved terms of trade and higher minimum wages tended to decrease it (Gaston and Rajaguru, 2009). New Zealand's rising income inequality during the period 1984-1996 was driven by rising unemployment, perhaps due to de-regulation and privatization of firms, and financial liberation, which jacked up interest rates (Podder and Chatterjee, 2002).

In a number of OECD countries, capital income and self-employment income have became increasingly important sources of rising income inequality, and in some cases even dominating the contribution of earnings. Quintano et al. (2009) have found for Italy that while the sharp inequality rise during the period 1991-93 was driven largely by wage differentials, income from financial assets has became the main source during 1993-2004 and self-employment income has been rising in importance since 2000. Breen et al. (2008) provide evidence for several other countries. For example, in the U.K., the contribution of self-employment income inequality to overall inequality has gone from 7% in 1979 to 30% in 1999. In Sweden, the contribution of capital income has gone from 3% in 1975 to 42% in 2000; and in Norway, it has gone from 3.3% to 48% over the same period. Breen et al. have also found that the contributions of earnings inequality relative to other income sources have varied widely across countries, from 22-45% in Italy to around 80% in Canada, and have been higher in the Anglo-Saxon countries (Canada, the U.S., and the U.K.), Sweden, and Germany than in France, Italy, and Norway.

Moving away from the income sources of rising inequality, Kenworthy (2008) carries out a cross-country comparative study of 12 OECD countries in order to examine the interaction between various factors that affect after-tax income inequality. He focuses on working-age households.[7] Using a series of scatterplots, he finds support for the roles of wages, employment, and household composition in market income inequality. The combination of the wage rate and the unemployment rate through its effect on the number of hours worked determine individual earnings, which is an important component of market income. The unemployment rate also affects the percentage of households with no earners, which is positively associated with market income inequality as shown by one of his scatterplots. Household composition determines the potential number of working adults – for example, single-adult households limit this number to one while multiple-adult households can potentially have multiple earners. Multiple-adult households may also engage in "marital homogamy" (the tendency for individuals with similar incomes to marry). His scatterplots show that both the percentage of single-adult households and the degree of homogamy are positively associated with market income inequality. The tax and transfer system affects after-tax income inequality through its ability to absorb market income inequality.

Kenworthy and Pontusson (2005) find further support for the role of employment and household structure; however, they choose to focus on employment and argue that employment and household structure are not competing but inter-related factors. They compare the trends in market income inequality among working-age households with

[7] Working-age households are usually defined as households with heads aged 25-59, as in this study.

those in individual earnings inequality among full-time workers for 11 OECD countries.[8] They claim that changes in employment have driven the observed diverging trends for countries such as Finland (slightly decreasing earnings inequality and increasing market income inequality) over the period 1980-2000 and the Netherlands (rising earnings inequality and stable market income inequality) over the period 1979-1999. A plot of changes in the Gini coefficient and changes in the employment rate shows a clear negative relationship between the two variables.

Kenworthy and Pontusson proceed to analyze the trends in redistribution and provide counter-evidence to the common notion of the declining welfare state. Their focus on working-age households excludes pensions from consideration. They find that despite the significant cutbacks that took place in many countries, redistribution as measured by the difference between market income inequality and disposable income inequality has actually increased over the 1980s and the 1990s in almost all of the countries in their sample, except the Netherlands, which saw large decreases. The authors attribute the increased redistribution to the "automatic compensatory response" of the welfare system. The Nordic and continental European welfare states are found to be more responsive to market income inequality than their American and British counterparts.

OECD (2008) shows that from the mid-1990s to the mid-2000s, trends in redistribution have varied across countries, with overall increases in Germany, Italy and the Czech Republic and decreases in Finland, Sweden, Norway, Ireland, Canada, and the U.S.. In 2005, taxes and transfers lowered market income inequality by around one-third

[8] Their group of countries include Germany, the UK, Sweden, Australia, Finland, Norway, Denmark, Canada, Switzerland, the US, and the Netherlands. Concentrating on full-time workers eliminates the role of employment in earnings inequality.

(or 0.15 Gini points), with the smallest reductions in Korea and the U.S. and the largest reductions in the Nordic countries (consistent with Kenworthy and Pontusson's finding). The report also provides evidence suggesting that Kenworthy and Pontusson's focus on employment over household structure is warranted. For most countries, shifts in age structure (aging population) and in household type (rise of single-adult families including lone-parents and elderly persons living alone) are found to have played only a partial role in the income inequality rise, with the latter being more important. Changes in employment seem to have been more influential as higher employment rates kept household earnings inequality fairly stable since the mid-1990s, on average and in most countries, despite widespread increases in individual earnings inequality. OECD (2008) also reports that both capital income and self-employment income have wider distributions than earnings – on average by a difference of a quarter Gini point, and that they have become increasingly so since 1995, driving the rise in market income inequality in several OECD countries.

Although many inequality patterns and trends, such as the rise in disposable income inequality, the importance of earnings inequality, the role of changing demographics, and the redistributive role of the welfare state, are common across the group of OECD countries, the specific patterns and trends vary from country to country; hence I now turn my focus specifically to Canada.

4.2. Canadian Trends over the 1980s and 1990s

Rashid (1998) shows that during the period 1970-1995, Canadian gross income inequality has increased by 2 Gini percentage points, from 0.352 to 0.373. Without transfers, this increase would have been 7 points, suggesting an important role for

government transfers in mitigating inequality. An interesting feature is that most of the inequality rise has followed the two recessions in the early-1980s and the early-1990s, as inequality changed little during periods of economic stability. During the period, dual-earner families and young families experienced significant increases in gross income inequality while female lone-parent families and elderly families experienced declines.

Brzozowski et al. (2010) have also observed the tendency for income inequality to revolve around recessions. They trace various dimensions of Canadian income inequality for working-age families over the period 1977-2005. Wage inequality, as measured by the variance of log wages, doubled over the period and its Gini coefficient increased by 9 percentage points. Family earnings inequality increased by 18 variance of log points and by 7 Gini points. Earnings inequality among household heads is substantially higher than earnings inequality among families, implying the presence of substantial "family insurance". Adding financial income to family earnings has virtually no impact on inequality and adding private transfers (the other source of market income) has a small disequalizing impact (but which has been increasing over time), suggesting that family earnings inequality is the main contributor to family market income inequality. What the authors find striking is the large reduction in inequality after adding taxes and transfers, suggesting a strong redistributive role played by the tax and transfer system. Despite the substantial rise in wage and earnings inequality, variance of log after-tax income has remained fairly stable up until 1989 and since then increased only moderately by 8 points.

Focusing on roughly the same period as Brzozowski et al., Lu et al. (2010)[9] have found that the changes in family earnings distribution were driven by changes in the wage structure, and more importantly, by changes in family structure such as the increasing likelihood of marital homogamy ("assortative mating" in their paper) and the rise of single-parent families and couples without children. Other family structural changes such as the rise in women's labour force participation and population aging have had strong equalizing impacts. According to Lu et al., all (or at least most) of the increase occurred before 1995, as the log of P90/P10 decreased somewhat (due to narrowing in the bottom half of the distribution) and the Gini coefficient increased only slightly since 1995.

Breaking down the period 1980-2000 into decades, Frenette et al. (2007) compare inequality trends between the 1980s and the 1990s, which roughly coincide with the two Canadian business cycles.[10] They find that market income inequality rose at similar paces during the two periods; however, the effect of redistribution was drastically different. During the 1980s, the tax and transfer system had more than offset the rise in market income inequality so that after-tax income inequality actually decreased slightly. As for the 1990s, the tax and transfer system had not fully offset the increase in market inequality, resulting in a rise in after-tax inequality. They describe the difference between the two decades as a "smoking gun pointing to a potential weakening of the effectiveness of redistributive policies" (p. 737). The policy changes of the 1990s had the most perverse effect on families with younger earners, particularly lone mothers and

[9] They restrict their sample to families in which the head(s) of the household is (are) aged 16 to 64 and are Canadian residents with no self-employment income.

[10] The data source is Census, which contains no income tax data. The authors remedied this problem by imputing taxes based on information from the administrative tax data.

unattached males, and no negative impact on the elderly and couples without children, as indicated in an earlier study by Frenette et al. (2004).[11]

By examining the extent to which the tax and transfer system reduced inequality over time, Heisz (2007) shows that the after-tax income inequality rise in the 1990s was solely a reflection of the rising market income inequality, as the redistributive system was as effective at reducing inequality in 2004 as it was in 1989. After-tax income inequality did not rise in the 1980s because redistribution grew by more than enough to offset the rise in market income inequality. In order to prevent after-tax income inequality from rising in the 1990s, redistribution would have needed to continue to grow at the same pace as or even faster than market income inequality into the 1990s; however, it did not grow by nearly as much. Frenette et al. (2009) arrive at a similar conclusion in their follow-up study to Frenette et al. (2007), focusing on the effect of the tax and transfer policy changes during the 1990s on the evolution of overall income inequality. More specifically, they find that the tax and transfer system became more redistributive to some extent during the first half of the 1990s but then reversed itself during the latter half.

Going back to Heisz, an examination of after-tax income across percentiles reveals that the distribution has widened from 1989 to 2004 due to a decline in income at the bottom (10^{th}) percentile (by 3%) combined with increases at the median (by 8%) and the top (90^{th}) percentile (by 15%), with most of the widening occurring after the economic expansion of 1995. Income polarization also grew during the period, as the

[11] Frenette et al. (2004) was carried out before the SCF/SLID 2003 revision of weights, which put more emphasis on the tails of the distribution. They compare three data sources and find that the (pre-revised) SCF/SLID data produces lower levels and growths of income inequality than Census and tax data, due to under-representation at the tails of the distribution.

middle class (persons with family income within 75% to 150% of the median) declined in size and moved towards the tails of the distribution.

A number of trends are suggested by the above mentioned Canadian studies for the period since the economic expansion of 1995, namely the possible decline in family earnings inequality among working-age households due to narrowing in the bottom half of the distribution (Lu et al., 2010); the widening in after-tax income distribution (Heisz, 2007); and the decline in government redistribution (Frenette et al., 2009). The trends as indicated by my study for the period 1996-2006 are presented in the next section.

5. Results

5.1 Overall Trends

Table 2 presents the levels of market income, total income, and after-tax income inequality (panels 1, 2, and 3 respectively), as well as the direct effects of transfers (panel 4), taxes (panel 5), and transfers and taxes combined (panel 6), for the years from 1996 to 2006 and for both Atkinson measures. A(1.5) produces higher values of income inequality than A(1.0) as it incorporates a higher degree of inequality aversion; and this is shown in the first three panels.

Not surprisingly, the level of market income inequality has been consistently higher than the level of after-tax income inequality, as the redistributive system through taxes and transfers acts to mitigate some of the market level inequality. Over the period, the level of reduction in inequality was impressive – by more than half of market inequality or an average of 0.315 A(1.0) points; furthermore, most (around 86% or 0.272 points) of this reduction came from transfers. Notice in both Figure 2a (plots A(1.0)) and

Table 2: Income inequality and redistribution, both Atkinson measures, 1996-2006

Year	Market Income (a)		Total Income (b)		After-tax Income (c)		Direct effect of transfers (b-a)		Direct effect of taxes (c-b)		Total effect of transfers and taxes (c-a)	
	A(1.0)	A(1.5)	A(1.0)	A(1.5)	A(1.0)	A(1.5)	A(1.0)	A(1.5)	A(1.0)	A(1.5)	A(1.0)	A(1.5)
1996	0.517	0.916	0.201	0.321	0.158	0.261	-0.315	-0.595	-0.043	-0.060	-0.359	-0.655
1997	0.516	0.916	0.205	0.326	0.162	0.267	-0.311	-0.590	-0.043	-0.059	-0.354	-0.649
1998	0.510	0.911	0.209	0.335	0.165	0.275	-0.301	-0.576	-0.044	-0.060	-0.345	-0.635
1999	0.500	0.902	0.219	0.358	0.175	0.300	-0.280	-0.544	-0.044	-0.058	-0.324	-0.602
2000	0.490	0.893	0.222	0.348	0.177	0.289	-0.268	-0.545	-0.045	-0.059	-0.313	-0.603
2001	0.488	0.891	0.219	0.343	0.177	0.293	-0.269	-0.547	-0.042	-0.050	-0.311	-0.598
2002	0.474	0.880	0.215	0.336	0.174	0.282	-0.259	-0.544	-0.041	-0.055	-0.300	-0.599
2003	0.475	0.881	0.216	0.336	0.175	0.281	-0.258	-0.545	-0.042	-0.055	-0.300	-0.599
2004	0.469	0.873	0.220	0.343	0.178	0.287	-0.250	-0.530	-0.042	-0.055	-0.292	-0.586
2005	0.468	0.875	0.221	0.348	0.179	0.293	-0.247	-0.527	-0.042	-0.055	-0.289	-0.582
2006	0.457	0.862	0.221	0.347	0.180	0.294	-0.236	-0.515	-0.041	-0.053	-0.277	-0.568
Average	0.488	0.891	0.215	0.340	0.173	0.284	-0.272	-0.551	-0.043	-0.056	-0.315	-0.607
Absolute growth	-0.060	-0.054	0.019	0.026	0.022	0.033	0.079	0.081	0.003	0.007	0.082	0.087
Relative growth	-11.7%	-5.9%	9.5%	8.2%	13.9%	12.7%	-25.2%	-13.5%	-6.4%	-11.5%	-22.9%	-13.3%

Figure 2a: Trends in market, total, and after-tax income inequality, 1996-2006 – A(1.0)

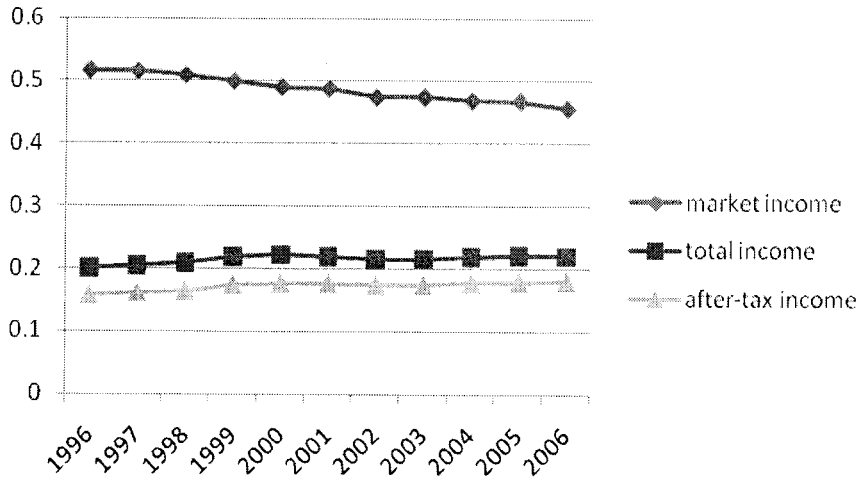
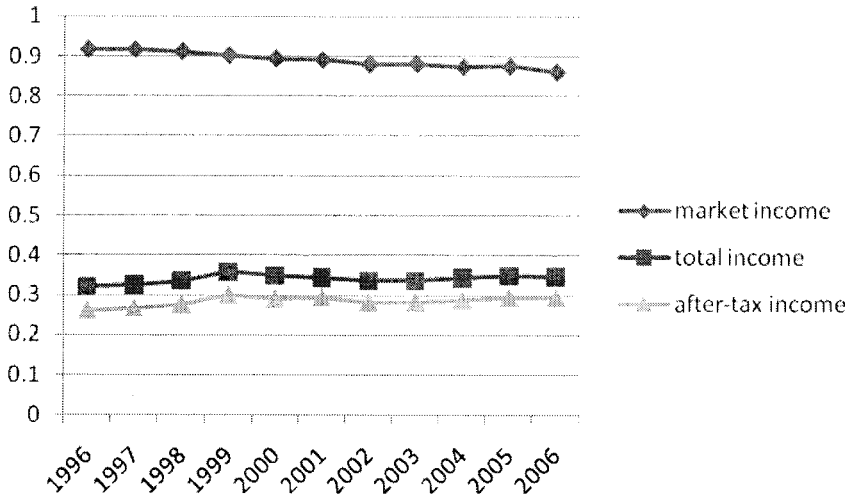


Figure 2b (plots A(1.5)) the much wider gap between the trend lines of market and total income inequality than between those of total and after-tax income inequality. The above evidence indicates that from 1996 to 2006, the redistributive system, mostly due to transfers, has been very effective at mitigating market income inequality.

Figure 2b: Trends in market, total, and after-tax income inequality, 1996-2006 – A(1.5)



To discuss the trends in income inequality and redistribution, I start with market income inequality in panel 1. Market income inequality has consistently declined from 1996 to 2006, as shown in Figure 2a and in Figure 2b. A(1.0) fell from 0.517 in 1996 to 0.457 in 2006, a decrease of 0.06 points or 11.6%; and A(1.5) fell from 0.916 to 0.862, a decrease of 0.054 points or 5.9%.

Moving on, panel 2 indicates that total income inequality increased by 0.019 points according to A(1.0) and by 0.026 points according to A(1.5). Both Figure 2a and Figure 2b show that virtually the entire rise occurred during the beginning of the period from 1996 to 1999, as total income inequality remained fairly stable after 1999. The fact that the rise in total income inequality occurred despite a fall in market income inequality points to a weakening in the redistributive power of the transfer system. Indeed, the level

of reduction, as measured by A(1.0), was 0.315 points in 1996 but only 0.236 points in 2006. The decreasing level of reduction due to transfers is illustrated in both figures by the narrowing gap between the trend lines of market income inequality and total income inequality.

What matters most to citizens is their after-tax income. Over the period, after-tax income inequality, according to A(1.0), increased by 0.022 points or 13.9%, from 0.158 in 1996 to 0.18 in 2006; and according to A(1.5), it increased by 0.033 points or 12.7%, from 0.261 to 0.294. As with total income inequality, almost the entire rise in after-tax income inequality occurred over the period 1996-1999. The magnitude of the rise in after-tax inequality was only slightly higher than that in total income inequality, suggesting that the tax system did not contribute much to the rise in after-tax inequality. Indeed, as shown in Table 2, the level of reduction due to taxes was roughly the same in 2006 as it was in 1996. In Figure 2a and Figure 2b, this is illustrated by the fairly constant gap between the total income inequality and after-tax income inequality trend lines.

A comparison of the after-tax inequality trend with the market inequality trend (thereby treating the tax and transfer system as a whole) indicates that the Canadian redistributive system, almost entirely from transfers, has turned a decline in market income inequality into an increase in after-tax income inequality. This means that it has more than just nullified improvements due to market forces, but has actually generated growing (after-tax) income inequality. After-tax inequality in 2006 was 0.082 A(1.0) points higher than it would have been if the level of redistribution had remained constant, meaning that the redistributive system has induced 0.082 points of inequality over the period 1996-2006. While the Canadian redistributive system was successful in mitigating

the levels of market income inequality, it did poorly in preserving the trend of declining market income inequality.

5.2 Relative Gaps as Indicated by Selected Percentile Ratios

The inequality trends discussed earlier are consistent with the trends found using the ratio of the 90th percentile to the 10th percentile, or P90/P10. (Recall that the P90/P10 ratio captures inequality movements in the tails of the distribution). The P90/P10 ratios in market income and in after-tax income are presented in Table 3 (the raw data is in the Appendix – Table 10a and Table 10b). In 1996, the P90/P10 ratio in market income was

Table 3: Market and after-tax percentile ratios, 1996-2006 – P90/P10, P90/P50, and P50/P10

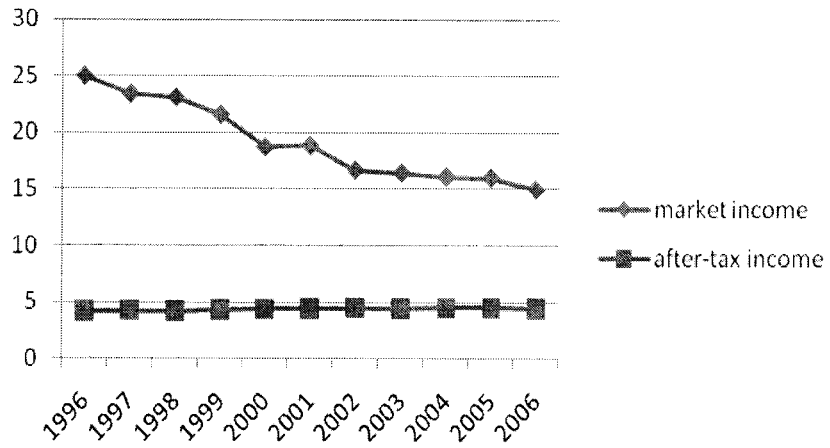
Year	Market Income			After-tax Income		
	P90/P10	P90/P50	P50/P10	P90/P10	P90/P50	P50/P10
1996	24.99	2.22	11.24	4.20	1.85	2.27
1997	23.42	2.22	10.53	4.24	1.87	2.26
1998	23.13	2.21	10.42	4.18	1.88	2.23
1999	21.62	2.24	9.62	4.30	1.90	2.27
2000	18.69	2.27	8.26	4.36	1.93	2.27
2001	18.84	2.26	8.33	4.39	1.91	2.30
2002	16.67	2.27	7.35	4.47	1.93	2.31
2003	16.41	2.28	7.19	4.42	1.92	2.30
2004	16.08	2.29	6.99	4.50	1.94	2.31
2005	15.99	2.33	6.85	4.50	1.93	2.33
2006	14.93	2.33	6.41	4.46	1.95	2.29
Absolute growth	-10.06	0.12	-4.83	0.26	0.10	0.02
Relative growth	-40.3%	5.3%	-42.9%	6.2%	5.3%	0.9%

24.99, meaning that a person at the 90th percentile had almost 25 times the market income of a person at the 10th percentile. By 2006, it was 14.93, a decline of 40.3%. The decreasing relative gap between a low-market income person and a high-market income person has driven the decline in market income inequality over the whole distribution. The P90/P10 ratio in after-tax income has increased by 6.2%, from 4.2 in 1996 to 4.46 in

2006. As with market income, the increasing gap between a low-after-tax income person and a high-after-tax income person has driven the rise in after-tax inequality.

The declining trend of market P90/P10 and the rising trend of after-tax P90/P10 are illustrated in Figure 3a. Over the period, the poor have fared better relative to the rich in terms of their market income, but have fared worse in terms of their after-tax income. Furthermore, the opposing trends in the P90/P10 ratios of the two incomes provide further evidence of the failure of the tax and transfer system to preserve the declining trend observed in market income, in this case, between the rich and the poor.

Figure 3a: Trends in market and after-tax percentile ratios, 1996-2006 – P90/P10



The decline in market income gap between the low-income person and the high-income person could be driven by either worsening at the top of the distribution or improvements at the bottom. Over the period, the P50/P10 ratio has decreased by a magnitude comparable to the decline in the P90/P10 ratio (42.9%) while the P90/P50 ratio has slightly increased (by 5.3%). This implies that the declining gap was due to improvements in the bottom half of the distribution. Underlying the decreasing income gap in the lower half of the distribution was a large market income growth of 145.8% at

the 10th percentile, compared to the much smaller growths at all other percentiles. The 20th percentile had the second largest growth of 58.5%; the 90th percentile had a growth of 46.8%; and the median (50th percentile) had the smallest growth of 39.4% (Appendix – Table 10a). Over the period, the growth at the 10th percentile greatly overpowered the growths at the 50th and at the 90th percentiles, driving the large declines in P50/P10 and P90/P10 respectively.

Over the period, after-tax P90/P50 has increased by 5.3% while after-tax P50/P10 has remained constant (an increase of less than 1%). Comparing the trends in market P90/P50 and market P50/P10 with the trends in, respectively, after-tax P90/P50 and after-tax P50/P10 suggests that the effect of the weakening redistributive system fell entirely upon the bottom half of the distribution. The matching slight upward trends in market P90/P50 and in after-tax P90/P50 shown in Figure 3b imply that the market inequality growth was fully translated into after-tax inequality growth, suggesting that the redistributive system had no impact on the development of inequality in the upper half of the distribution. On the contrary, the fact that the after-tax P50/P10 remained roughly

Figure 3b: Trends in market and after-tax percentile ratios, 1996-2006 – P90/P50

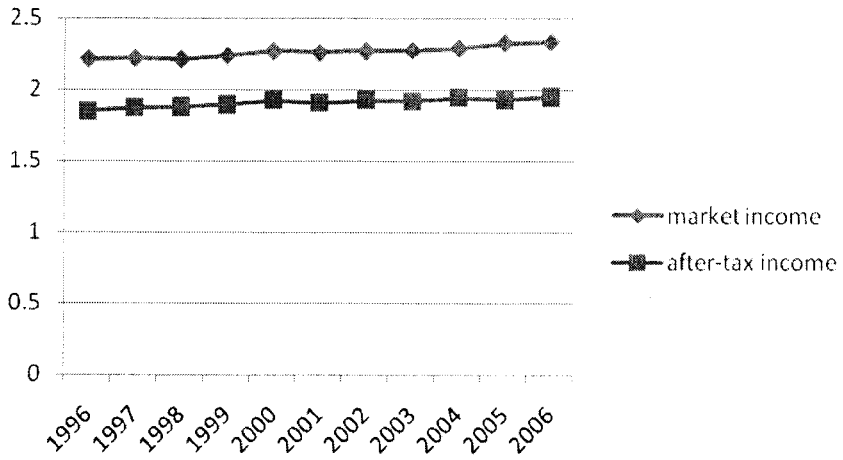
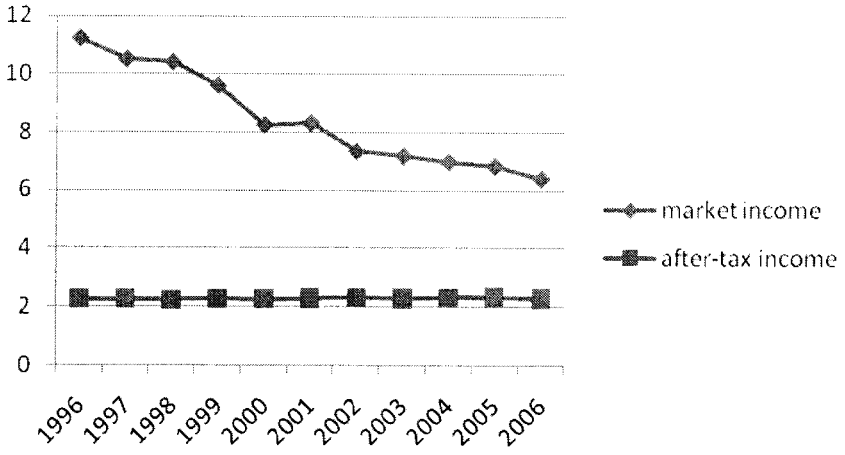


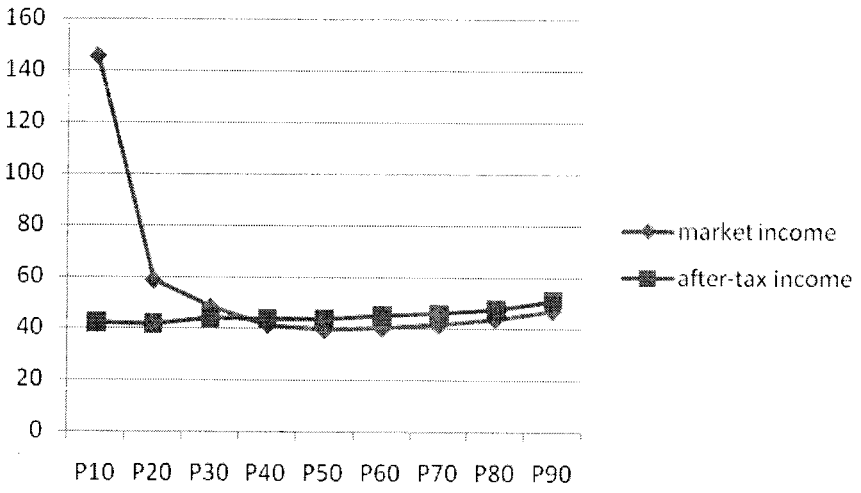
Figure 3c: Trends in market and after-tax percentile ratios, 1996-2006 – P50/P10



stable despite the strong decline in market P50/P10 (shown in Figure 3c) indicates that the redistributive system had fully offset the decline in market inequality in the bottom half of the distribution. Indeed, the large income gain experienced by the low-market income person (at the 10th percentile) was significantly reduced after adding in taxes and transfers so that after-tax income growth at the 10th percentile was only 42.1%. After-tax income grew by 43.4% at the median (50th percentile) and a slightly higher percentage of 50.9% at the 90th percentile (Appendix – Table 10b), driving the slightly increasing after-tax relative income gap between the rich and the poor. The percentage growths in market income and after income across the distribution are illustrated in Figure 4.

Looking across the percentiles of the income distribution, it is evident that the changes in market income inequality and redistribution observed for the period were mainly driven by movements at the10th percentile, so that movements at the 90th percentile drove the change in after-tax income inequality. The rest of this section investigates the contribution of various family characteristics to these changes, starting with the age structure.

Figure 4: Percentage income growth over 1996-2006 at percentiles across the distribution



5.3 Decomposition Results by Age of Oldest Member

In order to examine the role of the age structure on income inequality and the response of the redistributive system to any inequality generated by the age structure, market income and after-tax income are subgroup decomposed by age of oldest member. The population is partitioned into young (aged 24 and under) families, prime-aged (aged 25-64) families, and senior (aged 65 and over) families. The between-group inequality is the part that is explained by age structure while the within-group inequality is the unexplained part. As I am also interested in the evolutions of income inequality and redistribution for the different age groups and how they compare to that for the whole population, subgroup trends are also discussed.[12]

The first panel of Table 4 presents the decomposition results for market income inequality. Inside the brackets in column 2 and column 3 of the panel are respectively the

[12] As the unit of analysis is the individual, inequality within a subgroup specifically refers to inequality among individuals whose families belong to that subgroup.

between-group inequalities and the within-group inequalities expressed as percentages of overall inequality. Since the decomposition method used is non-additive but the tertiary term is small, these percentages can be used to roughly approximate the explanatory powers of between-group inequality and within-group inequality. Indeed, by additively decomposing the Theil index, Joanis and Rodriguez (2001) find that the age structure

Table 4: Decomposition results for market and after-tax income inequality by age of oldest member, 1996-2006 [13]

Year	Market income inequality			After-tax income inequality			Effect of redistribution on between-group inequality
	Overall	Between-group (% of overall)	Within-group (% of overall)	Overall	Between-group (% of overall)	Within-group (% of overall)	
1996	0.517	0.078 (15.1%)	0.476 (92.1%)	0.158	0.009 (5.7%)	0.151 (95.2%)	-0.069
1997	0.516	0.090 (17.4%)	0.468 (90.8%)	0.162	0.009 (5.3%)	0.154 (95.5%)	-0.081
1998	0.510	0.084 (16.6%)	0.464 (91.1%)	0.165	0.008 (4.8%)	0.158 (96.0%)	-0.077
1999	0.500	0.070 (14.0%)	0.462 (92.5%)	0.175	0.008 (4.3%)	0.169 (96.4%)	-0.062
2000	0.490	0.073 (14.8%)	0.450 (91.8%)	0.177	0.008 (4.4%)	0.171 (96.3%)	-0.065
2001	0.488	0.066 (13.6%)	0.451 (92.5%)	0.177	0.008 (4.5%)	0.171 (96.3%)	-0.059
2002	0.474	0.066 (13.9%)	0.437 (92.2%)	0.174	0.009 (5.2%)	0.167 (95.7%)	-0.057
2003	0.475	0.071 (15.0%)	0.434 (91.5%)	0.175	0.009 (4.9%)	0.168 (95.5%)	-0.063
2004	0.469	0.069 (14.7%)	0.430 (91.6%)	0.178	0.010 (5.4%)	0.170 (95.6%)	-0.060
2005	0.468	0.064 (13.7%)	0.432 (92.2%)	0.179	0.009 (4.8%)	0.172 (96.0%)	-0.055
2006	0.457	0.060 (13.2%)	0.422 (92.4%)	0.180	0.007 (4.0%)	0.174 (96.7%)	-0.053
Average	0.488	0.072 (14.7%)	0.448 (91.9%)	0.173	0.008 (4.8%)	0.166 (96.0%)	-0.064
Overall growth*	-0.060	-0.018 (30.1%)	-0.054 (89.6%)	0.022	-0.002 (-8.3%)	0.024 (107.8%)	0.016

* The brackets in this row contain the growths in between-/within-group inequality expressed as percentages of the growth in overall inequality.

explained 13.5% of Canadian market income inequality in 1996; and my results show that between-group inequality was 15.1% of overall market inequality, which seems like a reasonable (but overstated) approximation. Looking at the panel, it is apparent that most of the overall market income inequality is due to within-group inequality (the unexplained part); nonetheless, the explanatory power of between-group inequality (the

[13] Recall that the decomposition method used includes a tertiary term – the product of within-group inequality and between-group inequality – so that the within-group and between-group inequalities do not add up to the overall inequality.

explained part) is still quite high – close to 14.7% on average, suggesting that the age structure is a fairly significant source of market income inequality. The decline in market income inequality was mostly unexplained, but a small part was explained by inequality decline between age groups (down 0.018).

Turning to the second panel of Table 4, which presents the decomposition results for after-tax inequality, and comparing it with the results from the first panel, one sees that inequality between age groups explains after-tax income inequality (close to 4.8%) less well than it does market income inequality. This perhaps reflects the fact that some government transfer programs such as Old Age Security (OAS) and the income-tested Guaranteed Income Supplement (GIS) are targeted towards seniors, and thus act to mitigate some inequality between age groups. The fact that young families are more likely to use Social Assistance (confirmed by Finnie et al., 2005) may also be a factor. The last column of Table 4 indicates that the direct effect of redistribution on inequality between age groups is on average -0.064; however, this effect has increased by 0.016 (became less negative) over the period. The decrease in redistribution has cancelled any decrease in market income inequality between age groups, so that the after-tax income inequality between groups remained constant, consistent with Figure 5. As with overall income inequality for the whole population, the redistributive system was successful at mitigating the levels of inequality between age groups, but not at maintaining the inequality improvement (decline) made between age groups at the market level as it induced 0.016 points of inequality, a significant amount considering that the market income inequality between groups is on average 0.072 (Table 4 – first panel).

Figure 5: Trends in market and after-tax income inequality between age groups, 1996-2006

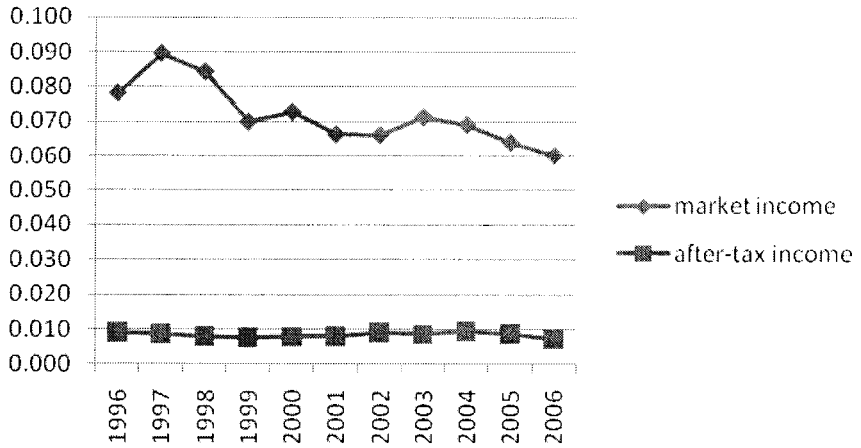


Table 5: Market and after-tax income inequality and redistribution for young, prime-aged, and senior families, 1996-2006

Year	Young families			Prime-aged families			Senior families		
	Market	After-tax	Effect of Red.	Market	After-tax	Effect of Red.	Market	After-tax	Effect of Red.
1996	0.665	0.259	-0.406	0.450	0.157	-0.293	0.672	0.107	-0.565
1997	0.671	0.256	-0.414	0.440	0.160	-0.279	0.691	0.113	-0.578
1998	0.636	0.257	-0.379	0.438	0.165	-0.273	0.675	0.112	-0.564
1999	0.584	0.261	-0.323	0.438	0.179	-0.259	0.651	0.108	-0.543
2000	0.575	0.261	-0.314	0.425	0.181	-0.245	0.646	0.110	-0.536
2001	0.556	0.268	-0.288	0.428	0.180	-0.248	0.629	0.112	-0.518
2002	0.560	0.290	-0.270	0.412	0.175	-0.237	0.625	0.113	-0.512
2003	0.539	0.275	-0.264	0.408	0.176	-0.232	0.636	0.115	-0.521
2004	0.535	0.300	-0.235	0.404	0.179	-0.225	0.623	0.113	-0.510
2005	0.507	0.281	-0.227	0.405	0.182	-0.223	0.619	0.116	-0.503
2006	0.476	0.260	-0.216	0.395	0.184	-0.211	0.611	0.119	-0.492
Absolute growth	-0.189	0.001	0.190	-0.055	0.027	0.082	-0.062	0.012	0.073

To discuss the income inequality and redistribution trends within each age group, I turn to Table 5. Figure 6a provides a visual representation of the subgroup trends (against the population trend) in market income inequality; and Figure 6b does the same for after-tax income inequality. During the period, all three age groups have experienced declining market inequality but the decline for young families was much more dramatic

(by 0.189). After-tax inequality among young families rose until 2004 and then subsequently declined sharply so that it was the same in 2006 as it was in 1996. Overall, the degree of inequality induced by the tax and transfer system for this group was more than twice that for the whole population (by 0.190). The inequality patterns for prime-aged families were very similar to those for the whole population. Compared to the

Figure 6a: Trends in market income inequality for young, prime-aged, senior, and all families, 1996-2006

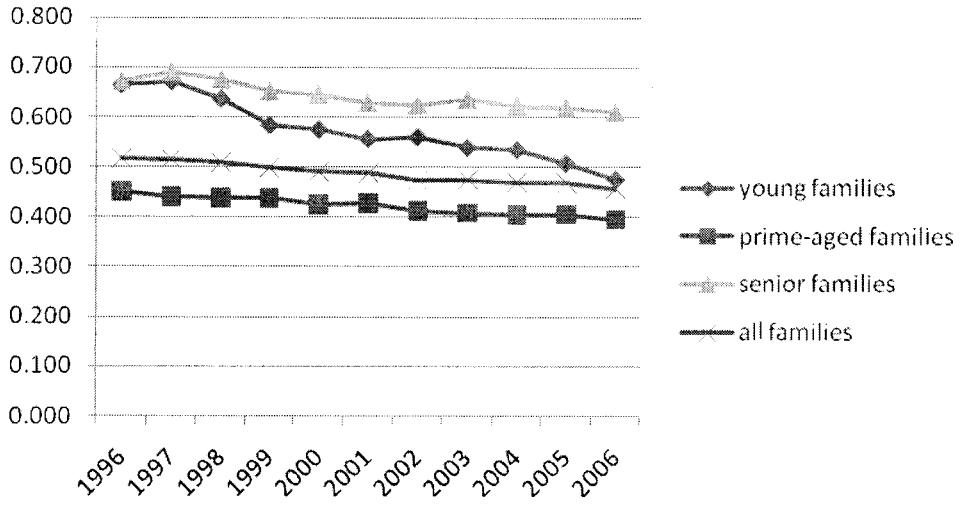
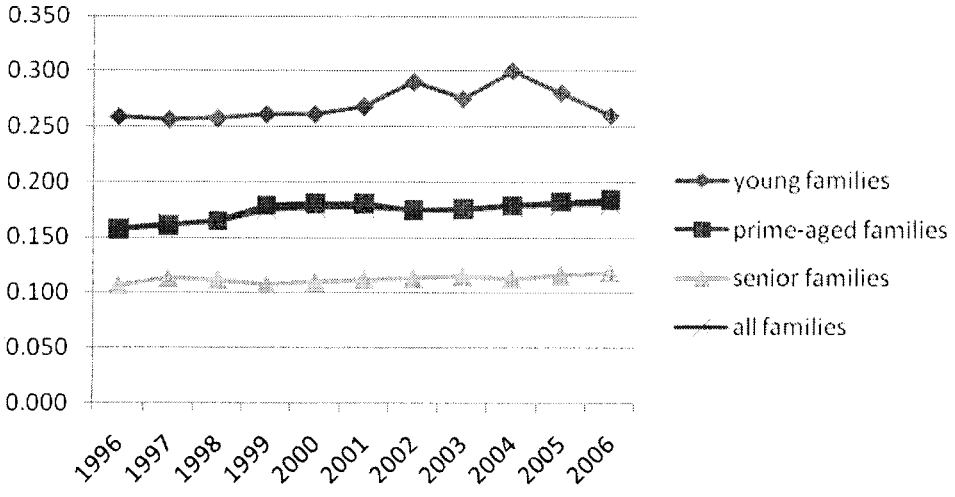


Figure 6b: Trends in after-tax inequality for young, prime-aged, senior, and all families, 1996-2006



population, senior families experienced a comparable decline in market income inequality but a slightly smaller rise in after-tax income inequality. Overall, the redistributive system had a slightly smaller inequality inducing effect for this group than for the whole population.

5.4 Decomposition Results by Family Composition

Subgroup decomposition results by family composition are interpreted in the same way as those by age of oldest member, and they are presented in Table 6. The family composition variable divides the population into unattached individuals, couples with no children, couples with children, lone-parents, and other families (catch-all category for any family which does not belong to one of the other four groups).

Table 6: Decomposition results for market and after-tax income inequality by family composition, 1996-2006

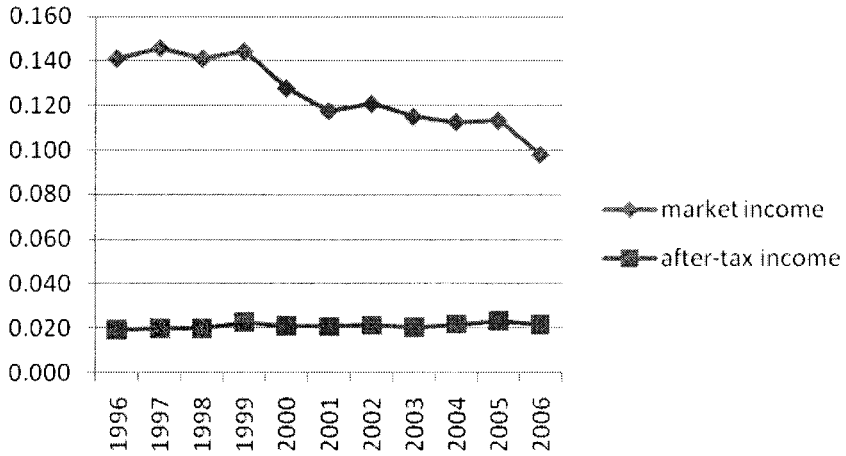
Year	Market income inequality			After-tax income inequality			Effect of redistribution on between-group inequality
	Overall	Between-group (% of overall)	Within-group (% of overall)	Overall	Between-group (% of overall)	Within-group (% of overall)	
1996	0.517	0.141 (27.3%)	0.438 (84.6%)	0.158	0.019 (12.1%)	0.142 (89.6%)	-0.122
1997	0.516	0.146 (28.3%)	0.433 (83.9%)	0.162	0.020 (12.2%)	0.145 (89.6%)	-0.126
1998	0.510	0.141 (27.7%)	0.429 (84.2%)	0.165	0.020 (12.1%)	0.148 (89.7%)	-0.121
1999	0.500	0.144 (28.9%)	0.415 (83.1%)	0.175	0.023 (13.0%)	0.156 (89.0%)	-0.122
2000	0.490	0.128 (26.1%)	0.416 (84.8%)	0.177	0.021 (11.9%)	0.159 (90.0%)	-0.107
2001	0.488	0.117 (24.1%)	0.420 (86.0%)	0.177	0.021 (11.7%)	0.160 (90.2%)	-0.097
2002	0.474	0.121 (25.5%)	0.402 (84.8%)	0.174	0.021 (12.2%)	0.156 (89.7%)	-0.099
2003	0.475	0.115 (24.2%)	0.406 (85.6%)	0.175	0.020 (11.7%)	0.157 (90.1%)	-0.095
2004	0.469	0.112 (24.0%)	0.402 (85.7%)	0.178	0.022 (12.3%)	0.159 (89.7%)	-0.091
2005	0.468	0.114 (24.3%)	0.400 (85.5%)	0.179	0.023 (12.9%)	0.160 (89.1%)	-0.090
2006	0.457	0.098 (21.4%)	0.398 (87.1%)	0.180	0.021 (11.9%)	0.162 (90.0%)	-0.076
Average	0.488	0.125 (25.6%)	0.414 (85.0%)	0.173	0.021 (12.2%)	0.155 (89.7%)	-0.104
Overall growth*	-0.060	-0.043 (71.8%)	-0.040 (66.1%)	0.022	0.002 (10.8%)	0.020 (92.8%)	0.046

* The brackets in this row contain the growths in between-/within-group inequality expressed as percentages of the growth in overall inequality.

The first panel of Table 6 shows that inequality between groups explains a large part of overall market income inequality; its explanatory power is close to 25.6% on

average. This percentage is much higher than the (close to) 14.7% found for age structure, indicating that family composition is a more important source of market income inequality than age structure. Family composition has also contributed more to the change in market income inequality than age structure, as the inequality between differently composed families declined by 0.043, compared to the smaller decline of 0.018 in inequality among age groups.

Figure 7: Trends in market and after-tax income inequality between families of different composition, 1996-2006



Between-group inequality among families of different composition explains overall after-tax income inequality (close to 12.2%, second panel of Table 6) less well than it does overall market income inequality. The redistributive system reduces the market income between-group inequality by an average of 0.104 points. One main reason is that lone-parents have a higher probability of using Social Assistance than any other group – 27.4% for lone-fathers and 50.4% for lone-mothers (Finnie et al., 2005). Despite the decline in between-group market inequality, after-tax inequality among differently composed families has remained fairly stable (as shown in Figure 7), reflecting the 0.046 points of inequality induced by the weakening redistributive system.

Table 7 contains the inequality and redistribution data for each of the subgroups.[14] During the period, both unattached individuals and couples with no children experienced a similar decline in market inequality – slightly smaller than the population market inequality decline, but the trends in their after-tax inequalities were very different. After-tax inequality among unattached individuals rose by twice the increase in population after-tax inequality (Figure 8b illustrates the difference). The inequality inducing effect of the redistributive system for this group was slightly larger overall than that for the whole population. On the other hand, after-tax inequality among couples with no children stayed constant, and the inequality induced for this group was somewhat smaller than that for the whole population. As for couples with children, the decline in their market inequality

Table 7: Market and after-tax income inequality and redistribution for unattached individuals, couples with no children, couples with children, and lone-parents, 1996-2006

Year	Unattached individuals			Couples w/ no children			Couples w/ children			Lone-parents		
	Market	After-tax	Effect of Red.	Market	After-tax	Effect of Red.	Market	After-tax	Effect of Red.	Market	After-tax	Effect of Red.
1996	0.773	0.234	-0.540	0.529	0.152	-0.377	0.323	0.123	-0.200	0.765	0.141	-0.624
1997	0.773	0.232	-0.541	0.537	0.160	-0.377	0.311	0.124	-0.187	0.757	0.147	-0.610
1998	0.759	0.228	-0.531	0.539	0.167	-0.372	0.305	0.125	-0.180	0.738	0.159	-0.580
1999	0.782	0.281	-0.501	0.525	0.166	-0.359	0.291	0.134	-0.157	0.685	0.146	-0.540
2000	0.765	0.262	-0.504	0.507	0.159	-0.348	0.309	0.148	-0.161	0.634	0.157	-0.477
2001	0.759	0.263	-0.496	0.502	0.160	-0.343	0.325	0.153	-0.172	0.616	0.148	-0.468
2002	0.745	0.253	-0.492	0.502	0.164	-0.338	0.287	0.139	-0.148	0.612	0.154	-0.458
2003	0.744	0.258	-0.486	0.502	0.158	-0.344	0.295	0.144	-0.151	0.599	0.162	-0.438
2004	0.739	0.267	-0.472	0.492	0.153	-0.339	0.290	0.145	-0.145	0.577	0.164	-0.413
2005	0.736	0.269	-0.466	0.500	0.164	-0.336	0.286	0.142	-0.144	0.608	0.181	-0.427
2006	0.721	0.279	-0.442	0.478	0.161	-0.317	0.285	0.143	-0.142	0.559	0.164	-0.395
Overall growth	-0.052	0.045	0.098	-0.050	0.009	0.059	-0.038	0.020	0.058	-0.206	0.023	0.229

[14] The data and discussion of "other families" is omitted since these families do not share any common characteristic and thus do not reveal any useful information.

Figure 8a: Trends in market income inequality for unattached individuals, couples with no children, couples with children, lone-parents, and all families, 1996-2006

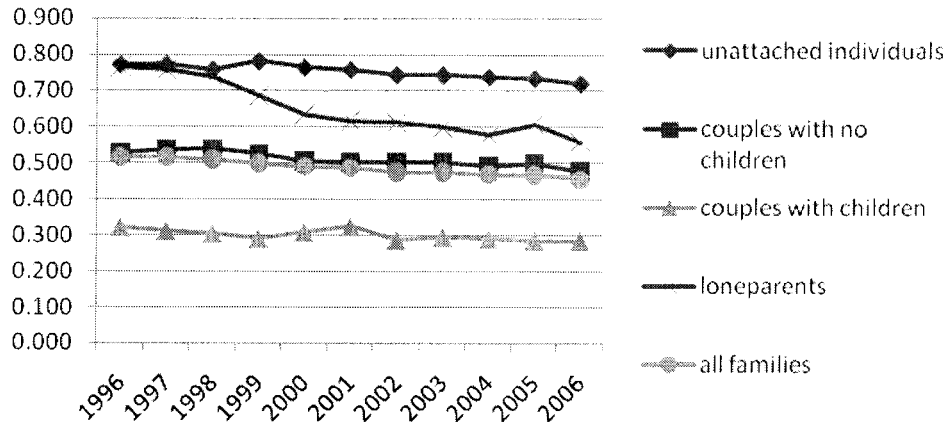
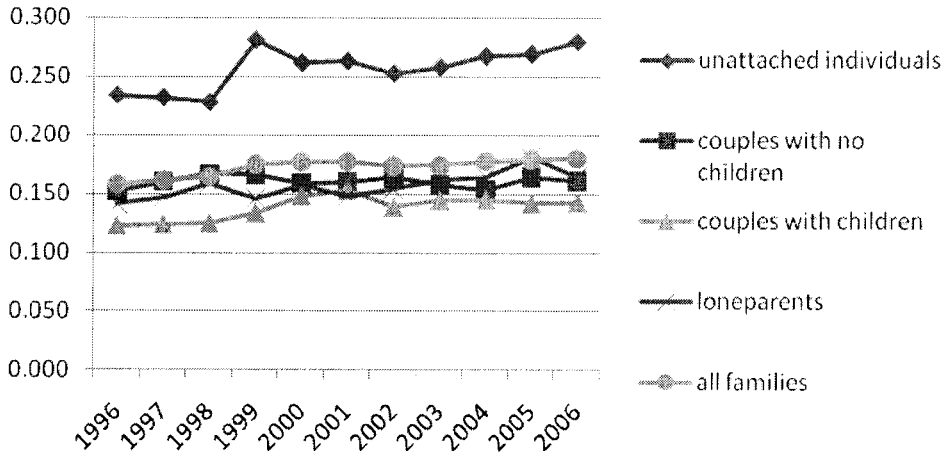


Figure 8b: Trends in after-tax income inequality for unattached individuals, couples with no children, couples with children, lone-parents, and all families, 1996-2006



was about two-thirds that for the whole population while the rise in their after-tax inequality had the same magnitude as the population rise. Overall, the effect of the tax and transfer system on couples with children was on a par with that on couples with no children. The most dramatic situation was for the group of lone-parents, who experienced a very sharp decline in market inequality (as shown in Figure 8a) – almost three and a half times the population market inequality decline. However, the after-tax inequality for

this group did not fall but instead rose by the same magnitude as that for the whole population. The redistributive system had a significantly more perverse impact on the group of lone-parents than on any other group as it induced 0.229 points of inequality for that group.

5.5 Decomposition Results by Main Source of Income

Subgroup decomposition by main source of income, in addition to identifying the role of main income source in income inequality, can potentially shed some light on the roles of different income sources.[15] The families are divided into those who derive their income mainly from labour, those who derive their income mainly from government transfers, and those who derive their income mainly from other sources such as investment income and retirement pensions. Table 8 presents the decomposition results.

Since families who rely on government transfers probably have lower market incomes than families who rely on labour income or other sources, the high levels of between-group market inequality seen in the first panel of Table 8 are consistent with expectation. In fact, most of the overall market income inequality is explained by inequality between groups (close to 70.6% on average). The explanatory power of main source of income is significantly higher than that of age structure and that of family composition. Also seen in the panel is that market income inequality between groups has declined by 0.094 points over the period; this most likely reflects the large market income gains found earlier (in section 5.2) for low-income individuals.

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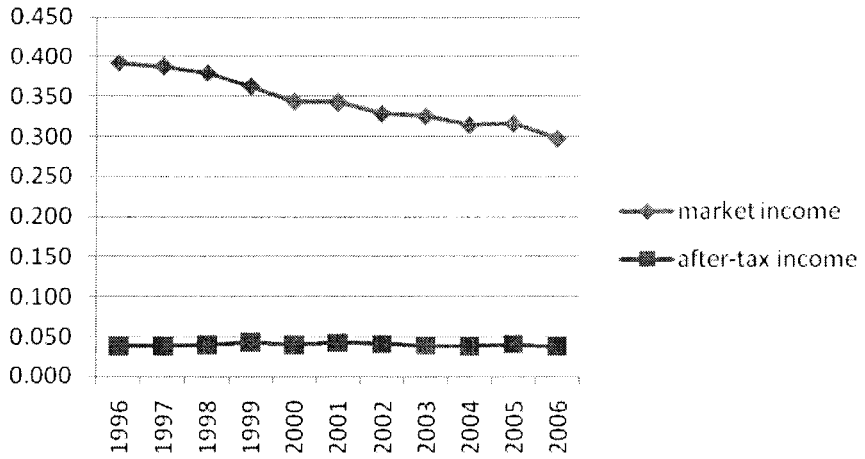
[15] Decomposition by income source is the usual method of investigating the roles of different income sources in income inequality; however, as far as I know, no such method has been developed for the Atkinson indices. Subgroup decomposition by main income source serves as a less desirable alternative but is nonetheless useful.

Table 8: Decomposition results for market and after-tax income inequality by main source of income, 1996-2006

Year	Market income inequality			After-tax income inequality			Effect of redistribution on between-group inequality
	Overall	Between-group (% of overall)	Within-group (% of overall)	Overall	Between-group (% of overall)	Within-group (% of overall)	
1996	0.517	0.392 (75.8%)	0.205 (39.7%)	0.158	0.038 (24.0%)	0.125 (79.0%)	-0.354
1997	0.516	0.388 (75.2%)	0.209 (40.5%)	0.162	0.038 (23.6%)	0.128 (79.4%)	-0.350
1998	0.510	0.380 (74.5%)	0.209 (41.1%)	0.165	0.040 (24.2%)	0.130 (79.0%)	-0.340
1999	0.500	0.363 (72.6%)	0.215 (43.0%)	0.175	0.043 (24.6%)	0.138 (78.8%)	-0.320
2000	0.490	0.344 (70.1%)	0.223 (45.5%)	0.177	0.040 (22.3%)	0.143 (80.9%)	-0.304
2001	0.488	0.343 (70.2%)	0.221 (45.3%)	0.177	0.042 (23.8%)	0.141 (79.5%)	-0.300
2002	0.474	0.329 (69.3%)	0.217 (45.7%)	0.174	0.041 (23.4%)	0.139 (79.8%)	-0.288
2003	0.475	0.325 (68.6%)	0.221 (46.6%)	0.175	0.039 (22.1%)	0.142 (81.0%)	-0.287
2004	0.469	0.314 (67.0%)	0.226 (48.1%)	0.178	0.038 (21.2%)	0.145 (81.9%)	-0.277
2005	0.468	0.316 (67.6%)	0.222 (47.4%)	0.179	0.040 (22.6%)	0.145 (80.7%)	-0.276
2006	0.457	0.298 (65.2%)	0.226 (49.5%)	0.180	0.037 (20.7%)	0.148 (82.4%)	-0.261
Average	0.488	0.345 (70.6%)	0.218 (44.8%)	0.173	0.040 (23.0%)	0.139 (80.2%)	-0.305
Overall growth*	-0.060	-0.094 (156.6%)	0.021 (-34.7%)	0.022	-0.001 (-3.4%)	0.024 (107.0%)	0.094

* The brackets in this row contain the growths in between-/within-group inequality expressed as percentages of the growth in overall inequality.

Figure 9: Trends in market and after-tax income inequality between families with different main income sources, 1996-2006



After adding transfers and taxes, inequality between families defined by their main income source explains less than 23% (on average) of the overall income inequality, as shown in the second panel of Table 8, compared to the (close to) 70.6% before. The

significantly lower explanatory power makes sense since the redistributive system, which includes transfer payments, is designed to mitigate some inequality at the market level. The level of reduction between the groups is 0.305 on average but has declined by 0.094 over the period, consistent with the weakening redistributive system. As illustrated by Figure 9, the tax and transfer system has fully offset the market income inequality decline that occurred between families with different main income sources so that after-tax income inequality between the groups remained constant.

Table 9 contains the data for the subgroups. Contrary to the decline in population market income inequality, market income inequality among labour income families rose (by 0.031) over the period, possibly pointing to a growth in earnings inequality for working families since workers who regain employment during expansionary periods tend to be lower-income earners. Most of the rise in market inequality was translated into after-tax inequality rise, indicating that the redistributive system had very little (direct) effect on the evolution of inequality among labour income families. Market inequality

Table 9: Market and after-tax income inequality and redistribution for labour income families, government transfer families, and other income families, 1996-2006

Year	Labour income families			Government transfer families			Other income families		
	Market	After-tax	Effect of red.	Market	After-tax	Effect of red.	Market	After-tax	Effect of red.
1996	0.183	0.117	-0.065	0.821	0.145	-0.676	0.267	0.178	-0.089
1997	0.189	0.123	-0.067	0.824	0.150	-0.674	0.249	0.168	-0.081
1998	0.189	0.122	-0.067	0.818	0.160	-0.659	0.262	0.178	-0.084
1999	0.197	0.132	-0.066	0.801	0.181	-0.619	0.234	0.155	-0.079
2000	0.210	0.141	-0.069	0.794	0.162	-0.633	0.224	0.154	-0.070
2001	0.209	0.139	-0.070	0.786	0.168	-0.618	0.192	0.131	-0.061
2002	0.204	0.137	-0.067	0.773	0.160	-0.613	0.209	0.141	-0.067
2003	0.207	0.139	-0.068	0.770	0.153	-0.618	0.218	0.153	-0.065
2004	0.212	0.143	-0.069	0.765	0.158	-0.607	0.228	0.155	-0.073
2005	0.208	0.140	-0.068	0.773	0.166	-0.607	0.240	0.171	-0.069
2006	0.213	0.146	-0.067	0.748	0.158	-0.590	0.230	0.163	-0.066
Overall growth	0.031	0.029	-0.002	-0.073	0.013	0.086	-0.038	-0.015	0.023

Figure 10a: Trends in market income inequality for labour income families, government transfer families, other families, and all families, 1996-2006

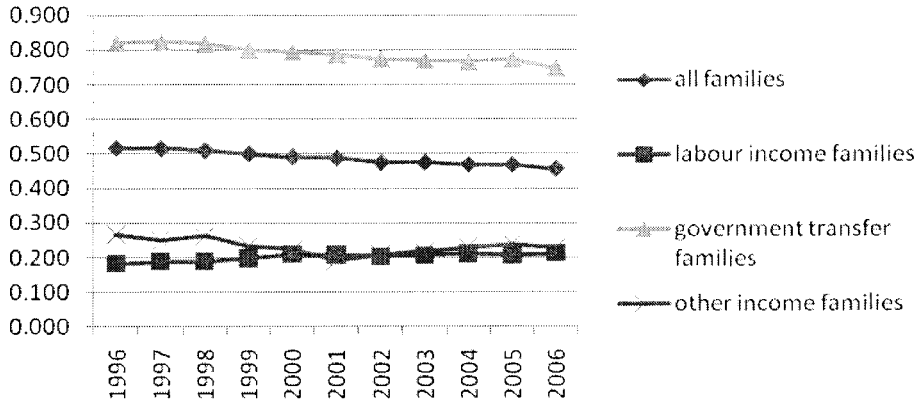
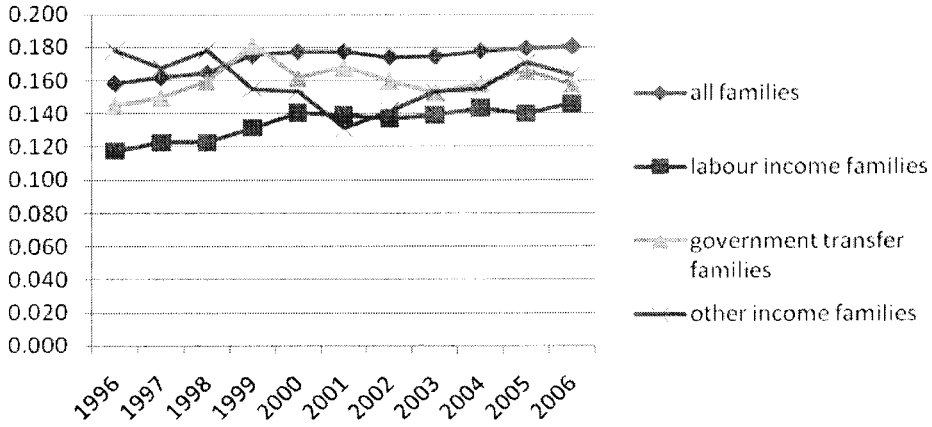


Figure 10b: Trends in after-tax income inequality for labour income families, government transfer families, other families, and all families, 1996-2006



among government transfer families has declined by a slightly larger magnitude than the population market inequality rise while their after-tax inequality has risen by a slightly smaller magnitude than the population after-tax inequality rise. Overall the inequality inducing effect of the redistributive system for this group was on a par with that for the whole population; this is consistent with the previous finding that the declining redistributive power of the tax and transfer system was mostly due to a weakening transfer system. The decline in market inequality among other income families was

somewhat smaller in magnitude than that for the whole population and the after-tax inequality for this group also declined but not by as much. Overall, the redistributive system had a much less perverse effect on this group than on the whole population.

6. Comparison with Luxembourg Income Study (LIS) Estimates

In order to verify the validity of my results, I compare my estimates of A(1.0) and P90/P10 with those from the LIS Inequality and Poverty Key Figures (Luxembourg Income Study (LIS) Key Figures, no date). Their data source and methodology are similar to mine except that the data for 1997 is from SCF; households with negative after-tax income are not deleted from the sample; and incomes are bottom-coded at 1% of equivalent mean income and top-coded at 10 times the median of non-equivalent income (whereas incomes are bottom-coded at 0.1% of equivalent mean income and not top-coded in my study). Within my sample time frame, their estimates are available only for the years 1997, 1998, 2000, and 2004, so I am restricted to a narrower time frame of 1997-2004 for the comparison.

LIS produces inequality estimates only for disposable income, which is after-tax income (as defined in my study) minus payroll taxes. Since payroll taxes are progressive for low to middle incomes and regressive for higher incomes (Kesselman and Cheung, 2004), their inclusion/exclusion are not likely to cause significant discrepancies between their estimates and mine.

Table 10 shows that my estimates for after-tax income are very close to the LIS estimates for disposable income for both A(1.0) and P90/P10 measures, with mine being slightly higher, most likely due to the absence of top-coding in my data. My estimates for

the growths in A(1.0) and in P90/P10 (for after-tax income) over 1997-2004 are lower than theirs (for disposable income) in both absolute and relative terms; however, this is probably just due to the time frame used. For example, a comparison of 1998 and 2004 yields opposing results. Hence, the inferences I draw from my inequality measures do reflect the actual trends in Canadian income inequality.

Table 10: Comparison of my estimates for after-tax income with LIS estimates for disposable income – A(1.0) and P90/P10

Year	My estimates for after-tax income		LIS estimates for disposable income	
	A(1.0)	P90/P10	A(1.0)	P90/P10
1997	0.162	4.242	0.150	4.005
1998	0.165	4.181	0.171	4.244
2000	0.177	4.363	0.172	4.189
2004	0.177	4.495	0.172	4.379
Absolute growth	0.015	0.253	0.022	0.374
Relative growth	9.6%	6.0%	14.7%	9.3%

7. Conclusions

Since the economic expansion of 1995, Canadian after-tax income inequality has increased. The overall magnitude from 1996 to 2006 was 0.022 A(1.0) points, with most of the increase being concentrated in the beginning of the period from 1996 to 1999. In 1996, after-tax income inequality was at 0.158 but by 2006, it had risen to 0.180; in other words, equal distribution could have saved 15.8% of national income in 1996 but 18% in 2006 while keeping the same level of social welfare as that generated by the actual distribution after transfers are paid and taxes are collected.

The rise in after-tax income inequality was a reflection of a decrease in the effect of redistribution (mostly of transfers), which arose as a consequence of the tax and

transfer policy changes. Market income inequality has declined throughout the period due to the large market income gain of a low-income person at the 10th percentile; this most likely reflects the decrease in family earnings inequality (as indicated by log of P90/P10) which was driven by a narrowing in the bottom half of the distribution (Lu et al., 2010).[16] During the period, the tax and transfer system has more than offset the inequality decline in market income and has induced 0.082 A(1.0) points of inequality over the entire distribution. More specifically, it has compromised the large income growth at the 10th percentile so that after-tax income inequality was driven by the larger income growth of a high-income person at the 90th percentile.

Subgroup decomposition results indicate that the tax and transfer system has induced 0.016 A(1.0) points of inequality between families of different age groups, 0.046 points between families of different composition, and 0.094 points between families of different main source of income. For all three decompositions, the declines in market income inequality between groups were not translated into declines in after-tax income inequality between groups, which remained stable instead. Since lone-parents, young families, and families who rely on government transfers are the most likely to end up at the lower end of the income distribution, these results are consistent with the finding that the policy changes had the most perverse effect on low-income persons. An examination of trends within subgroups indicates that young families and lone-parents were the most perversely affected by the policy changes while families who derive their income mainly from labour were not affected.

[16] The Gini coefficient indicates a small rise; however, it fails to capture changes at the bottom (or the top) of the distribution.

Although the tax and transfer system did become less redistributive, it does not necessarily mean that the government should re-expand its social welfare programs; after all, the cutbacks were carried out in response to the pressing fiscal issue. In order to combat the issue of rising income inequality, it is perhaps more feasible to adopt policies that inherently have more redistributive power.

Appendix

Table 10a: Market income at percentiles across the distribution, 1996-2006

Year	P10	P20	P30	P40	P50	P60	P70	P80	P90
1996	2136.20	8200.00	13625.00	19052.56	24087.50	29300.53	35019.46	42012.50	53386.56
1997	2367.14	8750.00	14425.00	19798.99	24975.00	30237.50	36142.13	43558.61	55437.50
1998	2525.00	9237.60	15411.37	20755.74	26384.91	31741.30	38000.00	45862.50	58407.02
1999	2742.41	9381.94	15440.05	21050.00	26450.00	32129.54	38549.81	46285.15	59277.65
2000	3398.67	10137.50	16546.30	22328.25	28000.00	33900.00	40703.20	49143.92	63525.00
2001	3464.82	10500.00	17025.00	22887.50	28875.00	35000.00	41719.30	50593.49	65275.00
2002	4041.45	11113.99	17675.00	23546.66	29698.48	35602.83	42779.96	52323.99	67372.16
2003	4214.66	11373.80	17942.51	24041.63	30410.53	36750.00	44000.00	53809.05	69175.00
2004	4474.46	11650.00	18335.76	25025.00	31371.05	38191.72	45590.71	55762.50	71937.50
2005	4755.29	12515.79	19475.00	26125.00	32620.29	39951.53	48053.10	58336.31	76013.98
2006	5250.00	13000.00	20187.90	26877.54	33587.57	41000.00	49475.00	60329.11	78382.79
absolute growth	3113.80	4800.00	6562.90	7824.98	9500.07	11699.47	14455.54	18316.61	24996.23
Relative growth	145.8%	58.5%	48.2%	41.1%	39.4%	39.9%	41.3%	43.6%	46.8%

Table 10b: After-tax income at percentiles across the distribution, 1996-2006

Year	P10	P20	P30	P40	P50	P60	P70	P80	P90
1996	10115.00	13785.36	16673.90	19813.13	22948.77	26197.50	30001.32	35013.41	42429.47
1997	10442.44	14185.00	17189.77	20371.80	23635.00	26942.50	30848.79	36045.41	44300.09
1998	11048.54	14796.21	17984.70	21325.00	24590.00	27995.57	32274.07	37330.00	46194.93
1999	10995.51	14912.34	18367.50	21697.57	24965.70	28726.39	32922.50	38389.63	47300.00
2000	11520.77	15664.74	19102.73	22585.00	26105.00	30030.39	34556.31	40645.00	50266.81
2001	12112.50	16728.71	20281.14	24060.00	27850.00	31877.38	36834.53	43214.67	53158.04
2002	12400.00	17111.98	21011.68	24745.20	28729.00	32837.50	37900.00	44543.97	55366.46
2003	12798.63	17398.45	21367.87	25325.03	29485.00	33722.50	38927.50	46025.91	56572.50
2004	13176.93	17953.44	22197.50	26322.05	30486.91	35285.15	40402.97	47410.00	59225.00
2005	13709.33	18809.04	23175.42	27537.50	31943.55	36880.00	42236.06	49571.39	61693.12
2006	14375.00	19525.00	24006.28	28427.50	32898.14	37998.31	43725.62	51577.50	64040.00
absolute growth	4260.00	5739.64	7332.38	8614.37	9949.37	11800.81	13724.30	16564.09	21610.53
Relative growth	42.1%	41.6%	44.0%	43.5%	43.4%	45.0%	45.7%	47.3%	50.9%

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