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How the Federal Tax and Transfer System Interacts with Income Inequality

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The mandate of the Parliamentary Budget Officer is to provide independent analysis to Parliament on the state of the nation's finances, the government's estimates and trends in the Canadian economy; and upon request from a committee or parliamentarian, to estimate the financial cost of any proposal for matters over which Parliament has jurisdiction.

The analysis presented here is based upon a static micro-simulation model. Other than consumption assumptions derived from household spending surveys, no behavioural assumptions have been applied.

This analysis is based on Statistics Canada's Social Policy Simulation Database and Model. The assumptions and calculations underlying the simulation results were prepared by the PBO and the responsibility for the use and interpretation of these data is entirely that of the author.

Prepared by: Duncan MacDonald*

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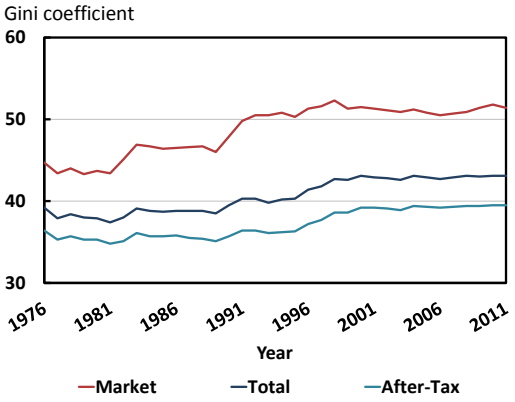
* The author would like to thank Jason Jacques, Jean-François Nadeau, and Trevor Shaw for their input. All errors are the responsibility of the author. Please contact Mostafa Askari (Mostafa.askari@parl.gc.ca) for further information.

Executive Summary

Income inequality, as measured by the Gini coefficient, has been increasing in Canada since at least the 1970s (Figure E1).[1] The Canadian tax and transfer system has historically served to reduce market income inequality. Over time, as inequality has increased, and as various tax and transfers have been added or removed, their impact on inequality has also changed.

Figure E1

Income Inequality in Canada



Source: Statistics Canada CANSIM Table 202-0705.

Note: The Gini coefficient shown above is unadjusted for all family units.

This report examines both the impact of income inequality on taxes and transfers (henceforth the federal fiscal balance), and the impact of the tax and transfer system on income inequality.

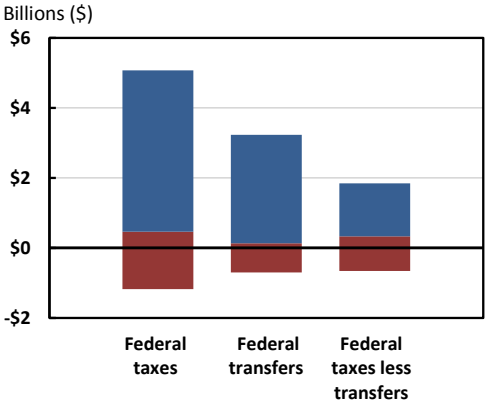
The results indicate that the current Canadian tax and transfer system automatically responds to increases in market inequality by further reducing after-tax inequality at a rate of 0.4 per unit increase in the market Gini coefficient. This is achieved mainly through the transfer system.

[1] The Gini coefficient is a measure of the spread of incomes in a society. It varies between 0 and 100, with 0 representing a society where everybody earns the same amount of income, and 100 representing a society where one person earns all of the income.

The size of the fiscal impact of inequality is determined by the tax and transfer system. With rising inequality, more taxes are collected, and more transfers are disbursed. These two effects act in opposite directions, reducing the overall size of fiscal changes (Figure E2).

Figure E2

Inequality Based Fiscal Impacts



Sources: SPSD/M, Parliamentary Budget Officer.

Note: The blue shading represents simulated changes over the span of inequality examined, while the red shading represents changes over the approximate historical range of the Gini coefficient.

PBO estimated the impacts on the fiscal balance of a range of Gini coefficients below and above the current Gini coefficient of 52. The fiscal impact ranged from a negative impact of $650 million to a positive impact of $1.8 billion. Over the historical range of the Gini coefficient (red bars), the fiscal impact of income inequality varies by $1 billion.

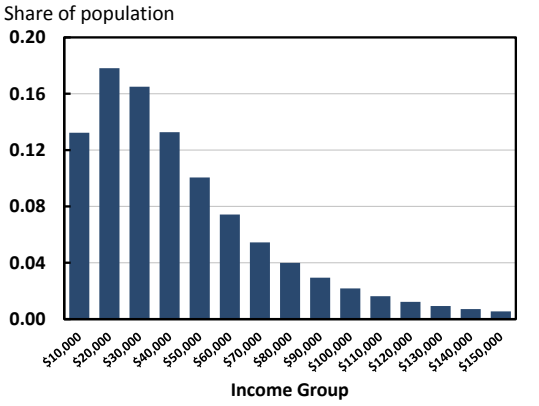
This suggests that, currently, the federal fiscal balance does not materially change in response to either an increase or decrease in equality. In the event of any future changes to the current tax and transfer system, the impact of income inequality on the fiscal balance may change.

Context

Income inequality is a measure of the gap between the rich and the poor in a society. As with most countries, income in Canada is distributed unequally across the population (Figure 1). This distribution of income has implications for both tax revenues and transfer payments.

Figure 1

Canada Income Distribution: 2011



Sources: Statistics Canada Survey of Labour and Income Dynamics, Parliamentary Budget Officer.

The nature of how income is distributed affects how much the government collects in direct tax revenue, and also how much is spent in transfer programs to households (for example, the Guaranteed Income Supplement), as a number of transfers are means tested.[2]

This suggests that there will be an impact on the federal fiscal balance with either an increase or a decrease in inequality.[3] An increase in inequality will likely consist of an income distribution with more high earners, allowing for more tax revenues because of the progressiveness of the federal tax system. These revenues could be offset by higher direct transfer payments to the larger number of earners below the average. Lowered inequality, will have the opposite effect.

Canadian Inequality

Statistics Canada provides a measurement of inequality using the Gini coefficient (see Box 1). In general, there has been an upward trend in all of the various measurements of the Gini, characterised by an upward shift of the market Gini coefficient in the early 1980s and early 1990s, indicating an increase in income inequality (Figure 2).[4] Since the beginning of the century it has increased less measurably.[5]

The House of Commons Standing Committee of Finance examined income inequality in Canada in 2013.[6] The report reviewed various aspects of the impacts of income inequality, including health, education and employment. The report did not address the ability of the current tax and transfer system to react to changes in inequality, or decompose the equalizing effect attributable to each system.[7]

[2] Service Canada - Guaranteed Income Supplement. Accessed November 2014.

[3] Federal fiscal balance here is considered in the context of the tax and transfer system. That is, the federal fiscal balance is taxes minus transfers.

[4] Fortin et al (2012) attributed these jumps to recessions during those time periods. Recessions tend to affect low income earners disproportionally and so have a negative effect on equality. See Fortin, N., Green, D., Lemieux, T, Milligan, K., and Riddell, W. C. (2012). Canadian inequality: Recent developments and policy options. Canadian Public Policy – Analyse de Politiques. 38(2).

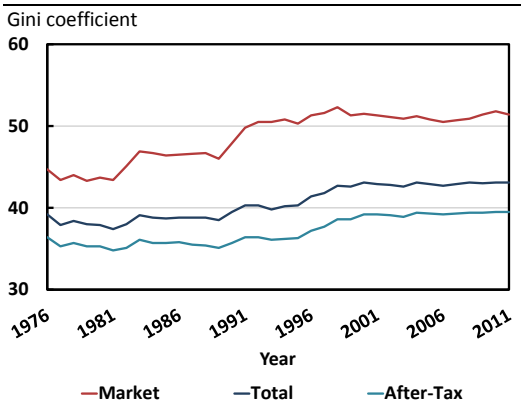
[5] Analysis has shown that a more recent trend is the rising proportion of income going to the very top groups of income earners. Shifts such as these, that include a small number of individuals, are not always captured by the Gini coefficient.

[6] Canada. Parliament. House of Commons. Standing Committee of Finance. (2013, December). Income Inequality in Canada: An Overview. Third report. 41st Parliament, 2nd session.

[7] By current tax and transfer system, the PBO refers to the tax and transfer system in 2009. The report also examined tax and transfer systems for 2006 and 2014 in comparison with 2009 populations and characteristics.

Figure 2

Income Inequality in Canada



Source: Statistics Canada CANSIM Table 202-0705.

Note: The Gini coefficient shown above is unadjusted for all family units.

This report examines how federal finances change when the underlying income distribution changes. This examination highlights how the structure of the tax and transfer system allows it to react to changes in inequality. It also examines how the tax and transfer system acts to reduce inequality through the progressivity of direct taxes and redistribution through the transfer system.

Methodology

Annex A provides an in-depth explanation of the methodology used in this report.

The PBO examined individual market income of Canadians for the 2009 tax year. Before making any changes, important characteristics of the population were determined and held broadly constant throughout the analysis. This approach allowed the PBO to maintain a consistent portrait of the Canadian economy. The key control variables are presented in Table 3.

Box 1

Gini Coefficient

The Gini coefficient (Gini) measures the extent to which the distribution of income among individuals or households within an economy deviates from a perfectly equal distribution.

A larger Gini implies larger income inequality. At the extremes, a Gini of zero represents perfect equality and 100, perfect inequality. For example, the OECD lists the United States as having an equivalized Gini of 50.7, while Canada had one of 43.8 in 2011.

The Gini can be calculated on various types of income, including market income (wages and salaries), total income (market income plus individual transfers from government), and after-tax income (total income less direct taxes, such as income taxes).

The Gini coefficient can be calculated using different methods. This report calculated the Gini coefficient using the cumulative probability distribution.

Sources: Organization for Economic Co-Operation and Development, World Bank.

Table 3

Demographic Controls

Target	Categorized By
Average Market Income	Province
Population Totals	Province Sex Age Group
Employment to Population Ratio	Province Sex Age Group

Source: Parliamentay Budget Officer.

While holding these control parameters broadly constant, the PBO altered the underlying income distribution. The impact of this different distribution on the tax and transfer system was then examined using a micro-simulation model developed by Statistics Canada.[8]

A useful way to estimate and alter the underlying distribution is with a probability distribution that provides a good fit to income data.[9,10] The Gini coefficient was calculated from the distribution parameters, and distributions covering a range of Gini coefficients were examined.

The estimated Gini coefficient for the 2009 tax year was 52 and the range of Gini coefficients examined covered a span from 40 to 65.[11]

For each level of market income inequality, the Gini for income after taxes and transfers was also calculated. The difference in the three Gini coefficients provided a measure of the ability of the tax and transfer system to reduce inequality.

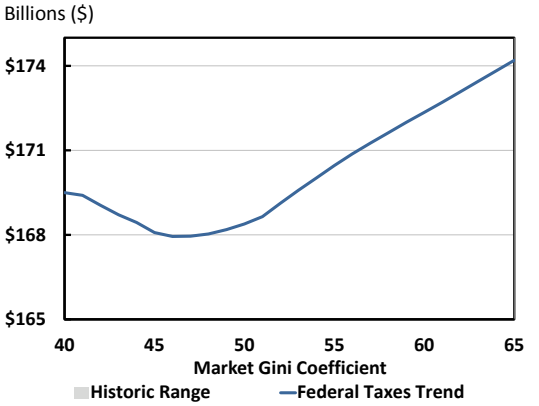
The PBO also examined how the tax and transfer system has changed over time. The analysis was repeated for two other fiscal years, 2006 and 2014, and the redistributive effect on income inequality was compared to that of 2009.[12]

Results: Federal Taxes and CPP/QPP

As expected, when market inequality increases from the baseline level of 52, federal taxes also increase (Figure 4). This is driven by the increased number of high income individuals, paying high marginal tax rates.

Figure 4

Federal Taxes at Various Gini Coefficients



Sources: SPSD/M, Parliamentary Budget Officer.

Note: The Historic range depicts the observed range of the Canadian Gini coefficient of 43 to 52.

While these increases in inequality also include an increase in the number of individuals earning less than the average income, the marginal tax rate of these individuals is less than that of the rich.[13]

A decrease in inequality is characterised by an initial decrease in tax revenues, followed with a leveling off. A lower Gini represents a coalescing of earners around the income average, so a higher proportion of individuals will earn incomes closer to the average wage, while there will be fewer individuals with very high incomes or very low incomes. Figure 5 shows this result graphically.

[8] The PBO used version 21.0 of Statistics Canada's Social Policy Simulation Database and Model (SPSD/M). This model allows for a static analysis of changes to the Canadian tax and transfer system, as well as an implicit analysis of changes to various demographic inputs.

[9] The PBO used the Double Pareto Lognormal Distribution following Reed, W. J., & Jorgensen, M. (2005). The double Pareto-lognormal distribution – a new parametric model for size distribution. *Communications in Statistics (34),* 1733-1753.

[10] Annex A discusses the DPLN distribution and Gini coefficient calculations in greater detail.

[11] The Gini coefficient was calculated on individual market income.

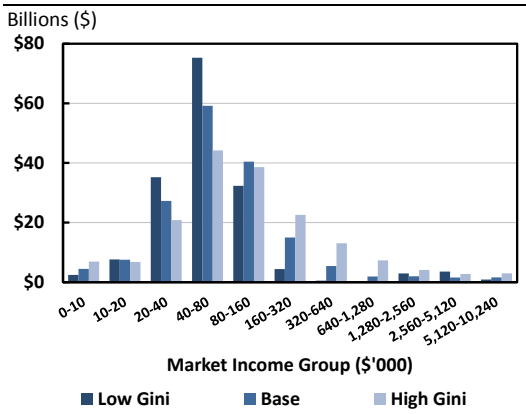
[12] In the comparison to other years, the 2006 and 2014 tax and transfer systems were applied to 2009 populations and incomes. This allowed for a direct comparison.

[13] The average individual income modelled is approximately $38,000 in 2009 dollars. See Annex A for more details.

With a low Gini, there is an increase in federal taxes paid by those earning between twenty and eighty thousand dollars, driven by the increase in individuals in those categories. There is a decrease in taxes paid by other earners, but this decrease is partially offset by additional taxes paid by these middle income earners.

Figure 5

Total Federal Taxes Paid by Market Income



Sources: SPSD/M, Parliamentary Budget Officer.

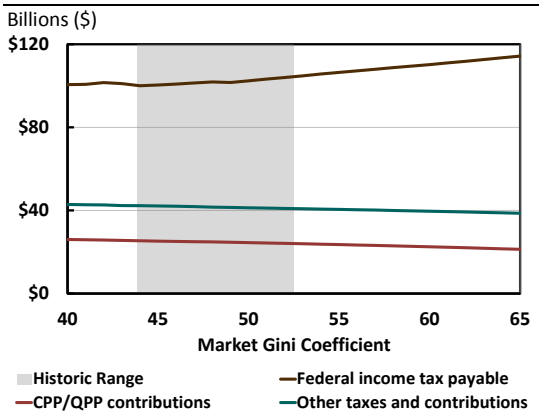
Note: Low Gini, Baseline, and High Gini correspond with values of 40, 52, and 65 respectively.

Some government revenues other than income taxes are included in the Federal taxes category. Figure 6 provides a decomposition of Federal taxes into income taxes, CPP/QPP contributions, and other taxes and contributions, which include commodity taxes, and EI contributions.

While income taxes broadly increase with inequality (approximately $530 million per point of the Gini coefficient), both CPP/QPP and EI contributions decrease ($182 and $62 million per point of Gini respectively). These decreases are driven by the caps on contributions for each program.[14,15] Beyond a certain threshold, individuals earning higher incomes will not experience an increase in EI or CPP contributions.

Figure 6

Federal Taxes Decomposition



Sources: SPSD/M, Parliamentary Budget Officer.

Note: The Historic range depicts the observed range of the Canadian Gini coefficient of 43 to 52.

With an increase in inequality, there are both more high income earners and low income earners. The high earners will not have higher contributions, while low earners will have lower contributions.

Results: Federal Transfers and CPP/QPP

The transfer system consists of a series of programs intended to redistribute income across society. Some examples of federal transfer programs include:

- Old Age Security (OAS)
- The Goods and Services Tax Credit
- The Guaranteed Income Supplement (GIS)

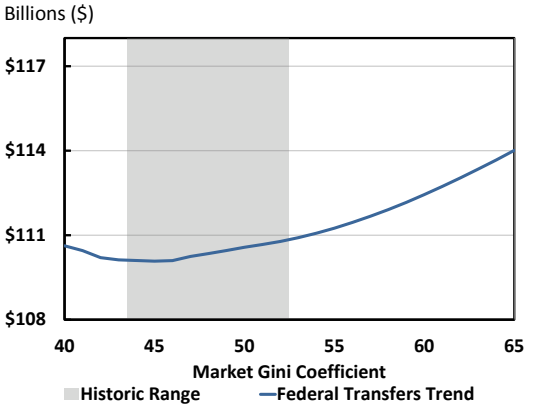
As inequality shifts, the amount transferred through these programs will also shift. Figure 7 depicts the change in total transfer programs as inequality increases or decreases.

As inequality increases, federal transfers also increase. As inequality decreases, there is a dip and then an increase in the amount of transfers. As Figure 8 shows, the U-shape found in Figure 7 is mostly attributable to an increase in CPP/QPP payments as the Gini coefficient decreases.

[14] Canada Revenue Agency – EI Premium Rates and Maximums. Accessed November 2014.
[15] Canada Revenue Agency – CPP contribution rates, maximums and exemptions. Accessed November 2014.

Figure 7

Federal Transfers at Various Gini Coefficients



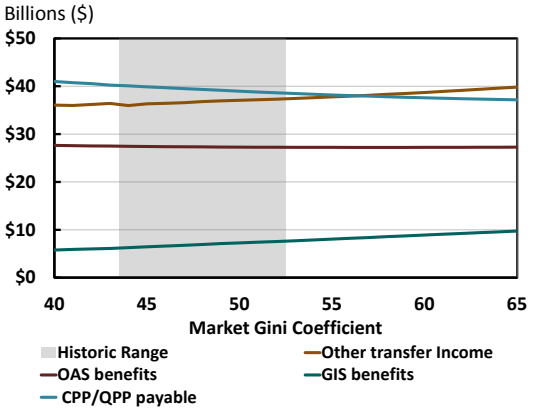
Sources: SPSD/M, Parliamentary Budget Officer.

Note: The Historic range depicts the observed range of the Canadian Gini coefficient of 43 to 52.

Other than CPP/QPP payments, transfer programs react as expected. Payments through GIS increase with increased inequality, while OAS benefits and EI payments (included in Other Transfers) remain constant as demographic and employment trends were held constant.

Figure 8

Federal Transfers Decomposition



Sources: SPSD/M, Parliamentary Budget Officer.

Note: The Historic range depicts the observed range of the Canadian Gini coefficient of 43 to 52.

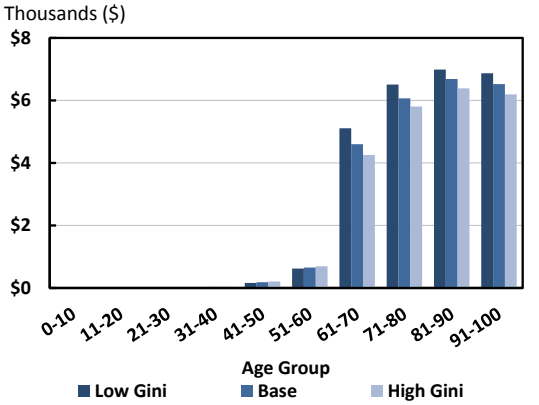
CPP/QPP benefits are calculated differently from most other benefits, in that CPP/QPP benefits are largely dependent on an individual's income throughout their working life.[16]

With low inequality, there are more retirees that have earned higher wages during their working life, when compared to the baseline. Based on their work history, these individuals are eligible for higher CPP/QPP payments. The result is that there are higher total CCP/QPP payments in low inequality scenarios.[17]

In higher inequality scenarios, a larger proportion of individuals earn higher incomes. But these incomes are higher than in the low income scenario, and CPP/QPP benefits are capped. Thus, CPP/QPP payments do not increase in tandem. In conjunction with a higher proportion of lower income earners (who contribute less to pension plans), this results in lower CPP/QPP benefits paid out in high inequality scenarios (Figure 9).

Figure 9

Average CPP/QPP Benefits Paid



Sources: SPSD/M, Parliamentary Budget Officer.

[16] Service Canada – Contributions to the Canada Pension Plan. Accessed November 2014.

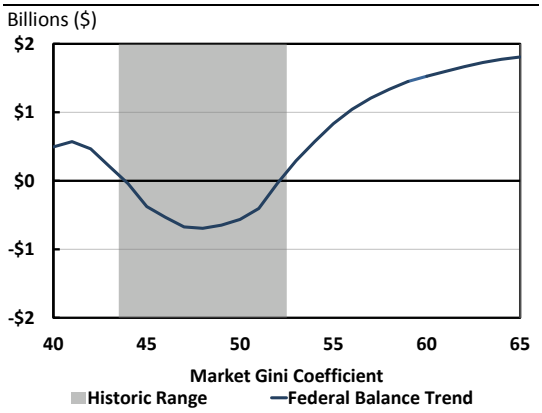
[17] Implicit in this approach is that the question being examined is less one of "What would government finances look like if *inequality decreases/increases*?" and more one of "What would government finances look like if *Canada existed in a world of lower or higher inequality*?" The difference between these two questions is that one considers a change from one state of inequality to another while the other considers the state of existing for a period of time at a given level of inequality.

Results: Federal Fiscal Balance

As inequality changes, there are changes to both taxes and transfers at the federal level. How these two variables change in tandem is depicted in Figure 10. Over the range of inequality examined, the federal fiscal balance decreases by at most $0.7 billion, and increases by a maximum of $1.8 billion (1.1 and 3.2 per cent of the balance respectively).

Figure 10

Change in the Balance: Taxes Less Transfers



Sources: SPSD/M, Parliamentary Budget Officer.

Note: The Historic range depicts the observed range of the Canadian Gini coefficient of 43 to 52.

With an increase in the Gini from the 2009 baseline (52) there is a slight increase in the balance. In general, however, the increase in taxes is mostly offset by an increase in transfers. The disbursement of transfers tends to marginally increase as inequality increases, while the increase in direct taxes appears to increase constantly with inequality. The average increase in the federal fiscal balance for levels of inequality above the reference line is $1.3 billion, or 2.3 per cent.

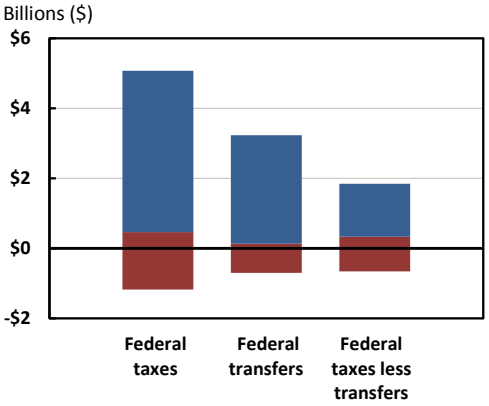
As inequality decreases relative to the 2009 baseline, both federal taxes and transfers fall and then rebound slightly. However, the rate of change is different. The net effect of these two trends is an average decrease in the federal fiscal balance by approximately $180 million, or a reduction of 0.3 per cent.

Since 1974, the Canadian market Gini coefficient has been observed to vary over a range of 43 to 52. As such, it is worth noting that, under this historical range, the federal fiscal balance will vary across a range of $1 billion, or 1.7 per cent of the baseline balance.[18]

Figure 11 depicts the range of fiscal impacts predicted under a larger range of inequality scenarios, relative to the observed baseline. There is a small potential for a decrease in either taxes or transfers as a result of income inequality, while there is a larger potential for an increase. However, over the historical range of inequality, the impact on the federal fiscal balance is small.

Figure 11

Inequality Based Fiscal Impacts



Sources: SPSD/M, Parliamentary Budget Officer.

Note: The blue shading represents simulated changes over the span of inequality examined, while the red shading represents changes over the approximate historical range of the Gini coefficient.

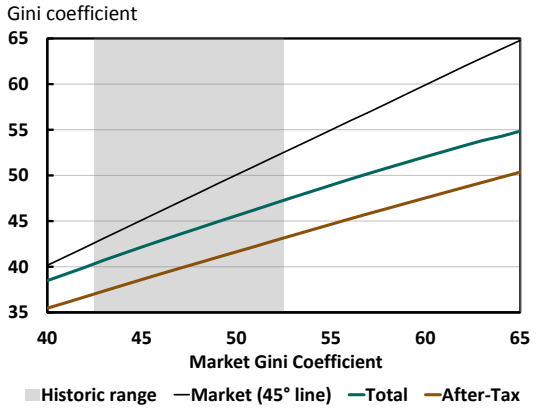
[18] The historic market Gini coefficient covers a period from 1976 to 2011 as reported by Statistics Canada. This inequality measure is calculated differently than the PBO's Gini coefficient, and is applied to a different dataset, and so direct comparability is generally not advised. The numbers are reported here only to provide a sense of the historic spread of the Gini coefficient. Statistics Canada CANSIM Table 202-0705. Accessed November 2014.

Results: Gini After Taxes and Transfers

A benefit of employing the micro-simulation method used by the PBO is that it allows for a decomposition of the effect on inequality of taxes and of transfers separately. The income inequality measures for both total and after-tax income inequality measures were obtained by analysing the incomes of the simulated populations. The inequality reduction attributable to each system is shown in Figure 12, while the overall results are presented in Figure 13.[19,20,21]

Figure 12

Gini Coefficient for Total and After-Tax Income



Sources: SPSD/M, Parliamentary Budget Officer.

Within Figure 12, the black line represents a 45 degree line indicating market income inequality (which the PBO controlled during simulations). The Total and After-Tax lines lie below the 45 degree line and indicate the shift down in the Gini once transfers have been disbursed (the Total line) and direct taxes applied (the After-Tax line).

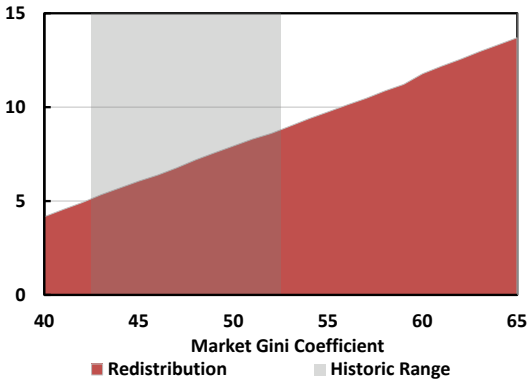
The chart shows the effect of both taxes and transfers on income inequality for a given level of market income inequality.[22]

Redistribution through the transfer system (which affects total income) increases as inequality increases, while the tax system shifts inequality down, regardless of the original market inequality. This is true at all levels of inequality examined.

On average, an increase in market income inequality induces the tax and transfer system to reduce inequality by a further 0.4 Gini coefficient units. This increase occurs mostly through transfers.

Figure 13

Equalizing Effect of the Tax and Transfer System



Sources: SPSD/M, Parliamentary Budget Officer.

Note: The Historic range depicts the observed range of the Canadian Gini coefficient of 43 to 52.

These results intuitively make sense, as the transfer system is at least partially driven by the needs of recipients, for example the GST/HST tax credit.[23] As inequality increases, the number of individuals on low or modest incomes will increase in conjunction with the increase in high

[19] Total income refers to individual market income after transfers, and after-tax income refers to total income after the application of direct taxes. Both federal and provincial direct taxes and transfers are included.

[20] Annex B re-presents Figure 12, the Gini coefficient for consumption income (income after indirect taxes such as GST) included. As commodity taxes are not progressive, their impact is to slightly increase the Gini coefficient. However, this difference was not significantly different from the after-tax line.

[21] Figure 13 depicts the change in the Gini coefficient in the transition from market income to consumption income. That is, including commodity taxes such as GST.

[22] Rather than examine the observed distributional effects of specific tax or transfer measures, this analysis examines the system as a whole and its flexibility in impacting hypothetical (but plausible) income distributions.

[23] Canada Revenue Agency – Goods and services tax/Harmonized sales tax (GST/HST) credit. Accessed November 2014.

incomes individuals.[24] The direct tax system, however, being mostly comprised of income taxes, does not drastically change its progressivity with inequality.

As a result of the increased proportion of high income earners, there is a slight increase in progressivity through direct taxation as the Gini increases. This trend is a reflection of the shift of the proportion of individuals in each tax bracket. However, this increase is relatively small.

Results: Comparison to Other Years

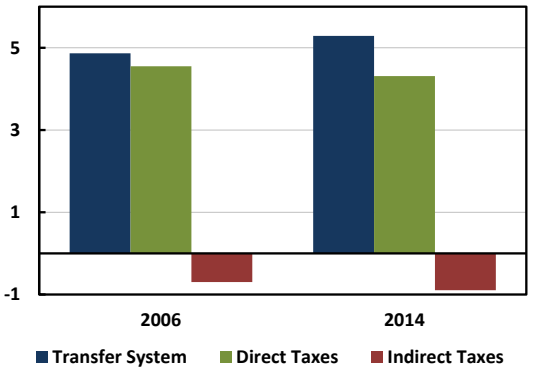
Each year there are many changes to the federal tax and transfer system. A previous PBO report explored individual details of major changes to the federal tax system implemented between 2005 and 2013.[25] This report supplements that analysis by examining the overall ability of the direct tax and transfer system to mitigate changes in market income inequality over the span of 2006 to 2014.[26]

Figure 14 depicts the average reduction in the Gini coefficient over the range of income distributions, for the years 2006 and 2014, while Figure 15 depicts the change in reduction over the time period. Shown is the reduction in the Gini from market income to consumption income (that is, after the application of transfers, direct taxes, and indirect taxes). Overall, there has been no change in the overall ability of the tax and transfer system to reduce market inequality over the period.

Figure 14

Average Inequality Reduction Through the Tax and Transfer System: Selected Years

Gini coefficient units



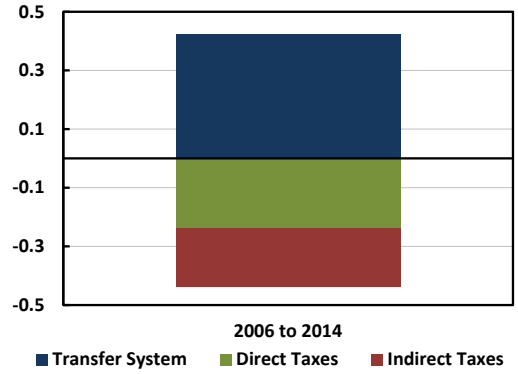
Sources: SPSD/M, IMF, Parliamentary Budget Officer.

However, since 2006 there has been a small increase in the ability of the transfer system to reduce market inequality. These changes occurred between 2007 and 2009. Since 2009 the ability of the transfer system to reduce inequality has remained approximately constant.[27]

Figure 15

Change in Average Inequality Reduction: 2006 to 2014

Gini coefficient units



Sources: SPSD/M, IMF, Parliamentary Budget Officer.

[24] As average income remains constant, changes in inequality in this analysis can be thought of as either a hollowing out (increase in inequality) or a rounding out (decrease in inequality) of middle income individuals.

[25] PBO (2014). Revenue and Distribution Analysis of Federal Tax Changes: 2005-2013. Accessed January 2015.

[26] There are some difference in methodology between the previous report and the current one. Two differences worth mentioning are the following: 1) the earlier analysis examined the span 2005 to 2013 while this report examines 2006 to 2014; and 2) the measure of inequality used in the current analysis uses a slightly different methodology from the previous analysis.

[27] The previous PBO report indicates that the two major progressive transfers implemented between 2007 and 2009 were the Working Income Tax Benefit (WITB, announced in Budget 2007), implemented in 2007, and an increase to the National Child Benefit Supplement (NCB) threshold in 2009.

These changes to the transfer system have been offset by changes in the tax system. Relative to the transfer system, the ability of the direct taxation to reduce inequality has varied over the period examined. These shifts have served to both increase and decrease the progressiveness of direct taxation.[28] The net effect of these changes is a small decrease in the ability of both direct and indirect taxes to offset changes in inequality over the period examined.[29,30]

Conclusion

While changes in inequality do have impacts on both taxes and transfers, in balance these effects broadly cancel out. The current system of taxes and transfers serves to increasingly equalize income as inequality increases. In the event of any future changes to the current tax and transfer system, the impact of income inequality on the federal fiscal balance, and the size of equalizing effect on incomes, may change.

The PBO also examined how the equalizing effect of the tax and transfer system has changed in recent history. Although there have been changes to both transfers and taxes, these changes have been both positive and negative. Over the period from 2006 to 2014 the transfer system has become slightly more redistributive, while taxes have become slightly less progressive.

[28] Implicitly bundled into these calculations are changes to provincial taxation systems.

[29] The previous PBO report listed four major changes to the direct tax system over the 2007 to 2009 period as the following: 1) implementation of Pension Income Splitting in 2007; 2) an increase of the two lowest personal income tax amounts by 7.5 per cent in 2009; 3) the introduction of a non-refundable Child Tax Credit in 2007; 4) an increase of the Basic Personal Amount (BPA) by 9 per cent in 2007 and by 8 per cent in 2009. Of these four measures, only the increase in the BPA was progressive, with the remaining three measures being regressive. Over the period of 2010 to 2014 the only major tax change was a decrease in the Dividend Tax Credit (DTC) for both large and small corporations (relative to a 2006 baseline). Both of these reductions are progressive for households.

[30] The previous PBO report concluded that the DTC for large corporations was regressive in nature. The difference in conclusions between the previous report and the current one is the selection of a baseline year, 2005 versus 2006.

Annex A
Detailed Methodology

Methodology: Data Inputs

There are various potential sources of information on income distributions in Canada. Statistics Canada provides two prominent sources, the Census (more recently the National Household Survey) and the discontinued Survey of Labour and Income Dynamics (SLID).[31,32] Other data sources include the T1 Family file, which is an estimate of the annual income derived from the tax returns submitted to the Canada Revenue Agency (CRA), and the soon to be released Canadian Income Survey (CIS), and the Longitudinal and International Study of Adults (LISA).[33,34,35]

Due to the sampling process, the SLID (and its predecessor the Survey of Consumer Finances) has the potential to underestimate the extreme tails of an income distribution, as the tails are sparsely populated and thus more sensitive to survey non-response.[36] The Census achieves a higher response rate than does SLID, but it is conducted every five years and lacks tax information.[37]

The dataset used in this analysis is an imputed one, extracted from Statistics Canada's Social Policy Simulation Database and Model (SPSD/M).[38] This micro-simulation uses a sample of households from the SLID as a base dataset, and augments it with information on high income earners using synthetic information derived from personal income tax returns. This augmentation allows for an investigation into high income earners, a required ability when considering income inequality. The households in this dataset are then weighted to achieve desired control totals.

A limitation of using the SPSD/M extracted dataset is that the coverage of the model does not include the territories, individuals on reservations, individuals in collective dwellings (for example, prison) or armed forces personnel residing in barracks.[39,40]

This analysis used the most recent version of SPSD/M (version 21.0), which had 2009 as the base year of analysis. More recent analysis years are available, but are obtained in the model by re-weighting the 2009 base year. This re-weighting did not guarantee that target value would mirror control totals and so the 2009 base year was considered.

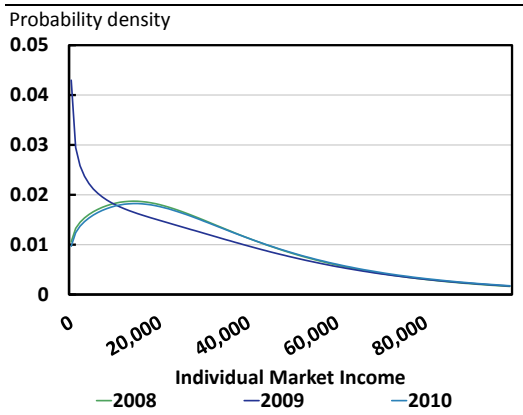
The 2009 base year is a point of minor concern, as it corresponds to a tax year associated to the financial crisis, and the shape of SLID incomes from that year do not match the year before or the year after (Figure A1). The problem is offset, however, as the aim of the analysis is to alter the income distribution, and so the shape of the base distribution matters only as a reference point.

[31] Statistics Canada – National Household Survey. Accessed November 2014.
[32] Statistics Canada – Survey of Labour and Income Dynamics (SLID). Accessed November 2014.
[33] Statistics Canada – Annual Income Estimates for Census Families and Individuals (T1 Family File). Accessed November 2014.
[34] Statistics Canada – Canadian Income Survey (CIS). Accessed November 2014.
[35] Statistics Canada – Longitudinal and International Study of Adults (LISA). Accessed November 2014.
[36] Frenette, M., Green, D.A., and Milligan, K.(2007). The tale of the tails: Canadian income inequality in the 1980s and 1990s. Canadian Journal of Economics, 40(3), 734-764.
[37] Milligan, K. (2013). Income inequality and income taxation in Canada: Trends in the census 1980-2005. University of Calgary School of Public Policy SPP Research Papers 6(24).
[38] Statistics Canada – The Social Policy Simulation Database and Model (SPSD/M). Accessed November 2014.

[39] Statistics Canada – SPSD/M Product Description. Accessed November 2014.
[40] These limitations are limitations inherited from SLID. The Census includes the territories, and individuals on native reserves, but also does not include people in collective residences. To partially correct for this, SPSD/M adds institutionalized elderly people, as they constitute an important tax category.

Figure A1

SLID Income Distributions: 2008-2010



Source: Statistics Canada Survey of Labour and Income Dynamics, Parliamentary Budget Officer.

Income data was extracted from SPSD/M as individual counts in $10,000 bins of market income, up to $5 million.[41] Within the baseline model, annual market incomes below $5 million accounted for 99 per cent of all market income. Simulations affecting incomes above $5 million were controlled by holding constant the average market income by province (Table A2).[42]

Methodology: DPLN Distribution

The extracted dataset was fitted to a double Pareto-lognormal distribution (DPLN) proposed by Reed as a good fit for income data.[43,44] The distribution is defined as being equal in distribution to the product of a lognormal distribution and the ratio of two Pareto distributions, and motivated by Brownian motion and an evolution of incomes based on the age profile of the population in question.[45,46]

Table A2

SPSD/M Simulated Income Distribution

$ millions

Income Group (Millions)	Employment income	Investment income	Market income	Taxes
0-2	$749,000	$67,000	$916,000	$279,000
2-5	$7,000	$4,000	$11,000	$4,000
5-10	$3,000	$3,000	$5,000	$2,000
10-25	$2,000	$1,000	$4,000	$1,000

Income Group (Millions)	Employment income	Investment income	Market income	Taxes
0-2	98.50%	90.15%	97.90%	97.66%
2-5	0.88%	4.86%	1.15%	1.32%
5-10	0.34%	3.36%	0.57%	0.61%
10-25	0.27%	1.62%	0.38%	0.42%

Source: SPSD/M.

The cumulative distribution is defined as:

$$F(x) = \Phi\left(\frac{\log x - \nu}{\tau}\right) - \frac{1}{\alpha+\beta}\left[\beta x^{-\alpha} A(\alpha,\nu,\tau)\Phi\left(\frac{\log x - \nu - \alpha\tau^2}{\tau}\right) - \alpha x^{\beta} A(-\beta,\upsilon,\tau)\Phi^{c}\left(\frac{\log x - \nu + \beta\tau^2}{\tau}\right)\right]$$

Here α, β, τ and ν are parameters of the distribution while Φ and Φ^c are the cumulative distribution and complement of the standard normal distribution, respectively. The function $A(\cdot)$ is defined as:

$$A(\theta,\nu,\tau) = exp\left(\theta\nu + {}^{\theta^2\tau^2}/_{2}\right)$$

When $\alpha > 1$, the expected value of the distribution is given as:

[41] Market income refers to income collected in a given year from earnings, investments, pensions, superannuation, and annuities. It does not include government transfers. Note that, as the National System of Accounts treats Registered Retirement Savings Plans as dis-saving, they are not included in this definition of market income.

[42] The choice of $5 million as a cut-off was a technical one, as the process of re-weighting the base distribution was limited to 512 bins. It is possible to increase the size of the bins from $10,000 to reach a higher cut-off, but at the loss of detail at lower income levels.

[43] Reed, W.J. (2003). The Pareto law of incomes – an explanation and an extension. *Physica A, (319)* pp. 579-597.

[44] Reed, W. J., & Jorgensen, M. (2005). The double Pareto-lognormal distribution – a new parametric model for size distribution. *Communications in Statistics (34),* 1733-1753.

[45] Graham, Robb and Poe (2012) provide some small changes to Reed's presentation of the DPLN in an Annex. These changes greatly help the applicability of the distribution. See next footnote.

[46] Graham, J. H., Robb, D. T., Poe, A. R. (2012). Random Phenotypic Variation of Yeast (Saccharomyces cerevisiae) Single-Gene Knockout Fits a Double Pareto-Lognormal Distribution. *PloS one 7*(11)

$$E(X) = \frac{\alpha\beta}{(\alpha-1)(\beta+1)} e^{\nu+\tau^2/2}$$

The distribution provides a good fit to income data, superior to that of either that Lognormal or Pareto distribution, two distributions commonly used with income data. Table A3 shows a comparison of fits between three distributions for the extracted dataset.

Table A3

DLPN, Pareto, and Lognormal Distributions

Distribution	Negative Log-likelihood
Lognormal	303.78
Pareto	246.87
DPLN	2.32

Source: Parliamentary Budget Officer.

Note: The fits displayed above correspond to the observed income distribution with a Gini coefficient of 52.0.

The base dataset was fit in *R* using the function *mle2* from the package *bbmle*.[47,48] Table A4 shows the estimated parameters associated with the 2009 SPSD/M income data.

Methodology: Gini Coefficient

Income distributions can take many shapes and sizes, which added to the difficulty in obtaining a tractable framework for analysis. The Gini coefficient provides a ready and familiar measure of inequality to describe an income distribution (See Box A1).

Table A4

Baseline DPLN Fitted Parameters

Parameter	Value
Alpha (α)	2.558
Beta (β)	0.691
Nu (ν)	10.896
Tau (τ)	0.313
Absolute Square Error	0.0005
Gini Coefficient	52.0

Source: Parliamentary Budget Officer.

There are many limitations to the Gini coefficient as a means of analysis, one being that there are at least a dozen ways to calculate the coefficient, and another being that multiple income distributions can have the same Gini (Figure A5).[49] With these limitations considered, the Gini coefficient still provides an adequate reference point with which to guide analysis.

Box A1

Gini Index

The Gini index measures the extent to which the distribution of income among individuals or households within an economy deviates from a perfectly equal distribution.

A larger Gini index implies larger income inequality. At the extremes, a Gini index of zero represents perfect equality and 100, perfect inequality.

Sources: Organization for Economic Co-Operation and Development, World Bank.

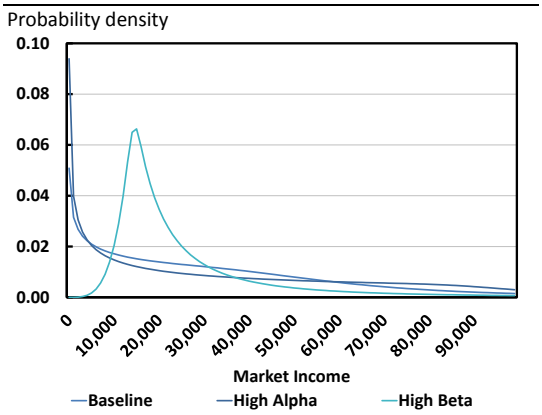
[47] R is a free statistical computing package. See The R Project for Statistical Computing.

[48] The mle2 function provides maximum likelihood estimation using a variety of numerical optimization techniques.

[49] Yitzhaki, S., & Schechtman, E. (2012). The Gini Methodology: A primer on a statistical methodology (Vol. 272). Springer.

Figure A5

Different Distributions with Same Gini



Source: Parliamentary Budget Officer.

Of the various possible methods of calculating the Gini coefficient, we use the formula based on the integrals of the cumulative distribution. The calculation for the Gini was presented by Griffiths and Hajargasht (2012)[50]. The calculation is as follows:

$$Gini = -1 + 2[\Phi\left(\frac{\tau}{\sqrt{2}}\right) + \frac{\beta(1+\beta)e^{\alpha(\alpha-1)\tau^2}}{(\alpha+\beta)(2\alpha-1)(1-\alpha+\beta)}\Phi\left(\frac{(1-2\alpha)\tau}{\sqrt{2}}\right) - \frac{\alpha(\alpha-1)e^{\beta(\beta+1)\tau^2}}{(\alpha+\beta)(1+2\beta)(1-\alpha+\beta)}\Phi\left(\frac{(-1-2\beta)\tau}{\sqrt{2}}\right)]$$

Using this calculation the PBO calculated that the Gini coefficient for the 2009 base dataset is 52.0.[51]

From these original parameters, alternate income distributions were obtained, spanning a range of Gini coefficients. To maintain a level of consistency in the parameters, attempts were made to limit the parameter changes to that of α and β. Annex C list the parameter values associated with each level of the Gini. Parameters were altered while holding the expected value of the distribution constant.

Methodology: Iterative Weight Estimation

The SPSD/M process of approximating the Canadian population consists of sampling households from the SLID and T1 files, and applying weights to approximate the population. A household contains a group of individuals, all likely earning different amounts of income, as well as other characteristics (for example, age and sex). Changing the household weights to achieve a given target risks diverging from other desired targets. To account for this Statistics Canada provided an iterative weight calculator that allowed for multiple targets to be achieved simultaneously.[52]

The targets set in this analysis aimed to keep basic demographic totals constant as well as the employment rate. Both margins were set according to age, province, and sex.[53] In addition, the desired income distribution was included as a weight. As the income distribution could only be specified directly for a specified range of incomes, the average income by province was also included as a target (Table A6). This approach allowed for the indirect reweighting of high incomes that were not directly controlled.

The iterative re-weighting program output included a new weight file that could then be input into SPSD/M to obtain simulated results that were analysed.

[50] Griffiths, W. and Hajargasht, G. (2012). Pareto-Lognormal Income Distributions: Inequality and Poverty Measures, Estimation and Performance. University of Melbourne Department of Economics Working Paper Series.1149.

[51] Note that this differs slightly from the Gini estimated by the PBO in a previous report of 54.13. A difference in estimation methodology explains this difference.

[52] These targets are generally achieved within a provided error tolerance.

[53] For the employment rate, ages were split into the following age groups: 15-20, 21-25, 26-45, over 45. For demographic totals, ages were split into the following groups: 0-5, 6-11, 12-17, 18-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70 and above.

Table A6

Demographic Controls

Target	Categorized By
Average Market Income	Province
Population Totals	Province Sex Age Group
Employment to Population Ratio	Province Sex Age Group

Source: Parliamentay Budget Officer.

Gini coefficients considered a range from 40 to 65. This range both covered observed values of the Gini coefficient and spanned a reasonable range of plausible values.

Methodology: Post Tax and Transfer Gini

When performing simulations, a desired output was the income distribution after transfers (total income) as well as after direct taxes (after-tax income) and indirect taxes (consumption income). The output distributions were also fit with the DPLN distribution and the Gini coefficient was obtained. By examining the difference between the Gini coefficients of the various incomes, a measure of the redistributive effect of both taxes and transfers was obtained.

Methodology: Multiyear Comparisons

The micro-simulation model used by the PBO allowed for examination of multiple tax years. To facilitate comparisons between the three years examined (2006, 2009 and 2014) the analysis was performed using 2009 prices and incomes. Only the tax and transfer system was altered. To maintain accuracy, 2006 and 2014 threshold values in the tax and transfer systems were inflated and deflated to 2009 levels, respectively. Under these additional scenarios the analysis was rerun and the resulting Gini coefficients compared.

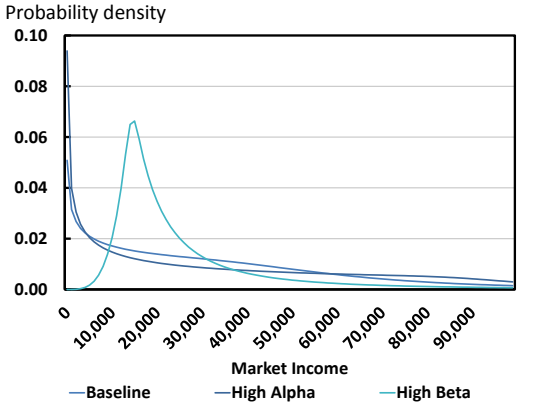
Annex B
Results Comparisons and Sensitivity Results

Sensitivity: Same Gini

One problem with using the Gini coefficient to measure inequality is that it consists on only one value. By definition, attempting to represent a four parameter distribution (the DPLN) with a single value cannot be accomplished using a one-to-one mapping. Thus, one single Gini coefficient could potentially represent many various underlying distributions. This issue is prevalent in any situation where a simplifying metric is used to describe the distribution (for example, attempting to describe the distribution using decile or quartile ranges). However, as the Gini coefficient is a widely recognizable measure of inequality, it was chosen to ease interpretation and provide narrative.

Figure B1

Different Distributions with Same Gini



Source: Parliamentary Budget Officer.

To control for the multiple Gini problem in this report, the PBO refrained from altering two of the parameters (ν and τ) once they were fitted, and restricted changes to the other two parameters (α and β). Further, the PBO held to the restriction of a constant expected value, allowing for a set of unique Gini coefficients to be analyzed.

The PBO also examined a subset of Gini coefficients that have differing underlying distributions (Figure B1). The baseline distribution was considered, as well as a distribution with a high alpha parameter, and one with a high beta parameter. Table B2 depicts some summary totals. Further details are presented in Table B3.

Table B2

Same Gini Coefficient - Parameter Values

Scenario	Baseline	High Alpha	High Beta
Alpha	2.558	5.000	1.483
Beta	0.691	0.496	4.850
Nu	10.896	11.421	9.610
Tau	0.313	0.100	0.050
Expected Value	$38,009	$38,009	$38,009
Gini Coefficient	52.0	52.0	52.0

Source: Parliamentary Budget Officer.

Table B3

Same Gini Coefficient – Simulation Results

Billions ($)

	Baseline	High Alpha	High Beta
Market Income	$931	$937	$884
Federal Transfers	$138	$137	$148
OAS	$27	$27	$28
GIS	$8	$9	$3
EI Benefits	$21	$20	$25
CPP/QPP	$39	$38	$44
GST Credit	$4	$4	$5
Other Transfers	$13	$13	$16
Provincial Transfers	$27	$28	$27
Total Income	$1,069	$1,074	$1,032
Federal Taxes	$169	$171	$158
Provincial Taxes	$114	$115	$110
Disposable Income	$861	$865	$837
Consumable Income	$786	$788	$764

Source: SPSD/M, Parliamentary Budget Officer.

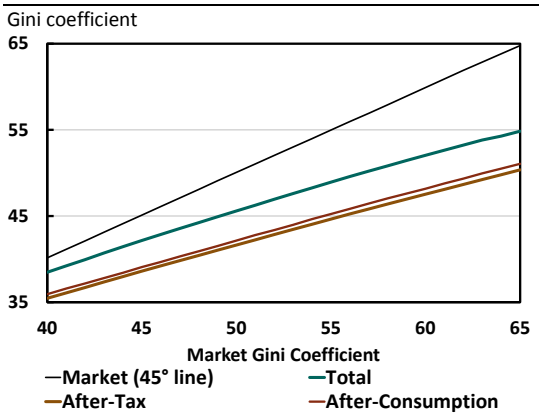
While there are differences in the aggregate totals, these differences are limited when the distribution is similar in shape to the Baseline. When attempting to examine extreme distributions (those deviating from the observed distribution greatly, such as the High Beta), the differences can be more pronounced. However, attempts to model distributions such as these result in practical and technical difficulties. Additionally, distributions such as the High Beta scenario are unlikely to be observed in practice.

Comparison: Disposable and Consumption Income

The after-tax Gini coefficients presented in Figure 12 of the report presents disposable income (market income after direct taxes such as income tax). It does not include indirect taxes, such as GST/HST and excise taxes. Income after taking these indirect taxes into consideration is referred to as consumption income. Figure12 is presented again in Figure B4 with the fitted Gini coefficients after commodity taxation is considered. The figure shows that there is a small, regressive, change in the Gini coefficient after indirect taxes are considered.

Figure B4

Gini Coefficient for Total, Disposable, and Consumption Income



Sources: SPSD/M, Parliamentary Budget Officer.

A small caveat in this conclusion is that the analysis is based on current spending and savings habits. A society with a lower Gini would have a greater proportion of lower and middle income individuals, and proportionally fewer high income earners. Different income distributions could be a result of a different social mix, and so assumptions on spending habits could be misleading. The spending habits of those individuals are reflected in commodity tax aggregates (Table B5).

Table B5

Simulated Commodity Taxation

Millions ($)

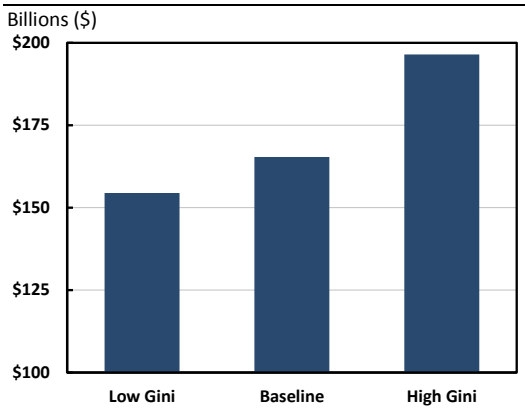
Indirect Taxes	Low Gini	Baseline	High Gini
GST	$23,900	$22,700	$20,800
Excise taxes	$4,200	$3,900	$3,500
Excise duties	$4,000	$3,600	$3,400
Custom import duties	$2,800	$2,600	$2,400
Federal indirect taxes	$34,900	$32,900	$30,100
Carbon tax	$600	$600	$500
Tobacco tax	$4,700	$4,100	$4,000
Retail sales tax	$28,500	$26,900	$24,300
Profits on liquor commissions	$5,300	$4,800	$4,200
Liquor gallonage taxes	$700	$600	$600
Gasoline tax	$5,400	$5,100	$4,500
Amusement tax	$600	$500	$500
Provincial indirect taxes	$45,800	$42,600	$38,700

Sources: SPSD/M, Parliamentary Budget Officer.

One effect driving the results and the different savings rate between high and low income individuals (Figure B6). Higher savings implies less consumption, and thus a greater sampling of high income individuals in the High Gini scenario drives the indirect taxes result. Figures B7, B8 and B9 depict income distributions shifts for the Baseline, Low Gini, and High Gini scenarios. The effect of income related differences in spending patterns are apparent in the shift from disposable to consumable income.

Figure B6

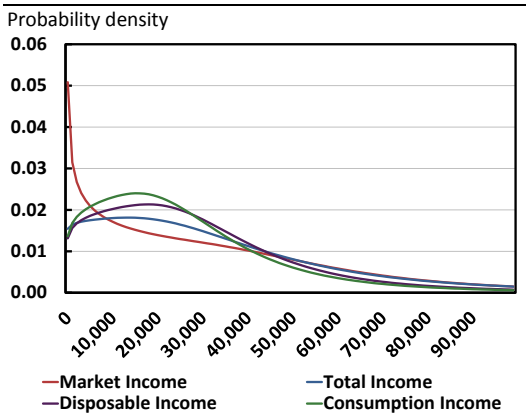
Simulated Household Savings



Sources: SPSD/M, Parliamentary Budget Officer.

Figure B7

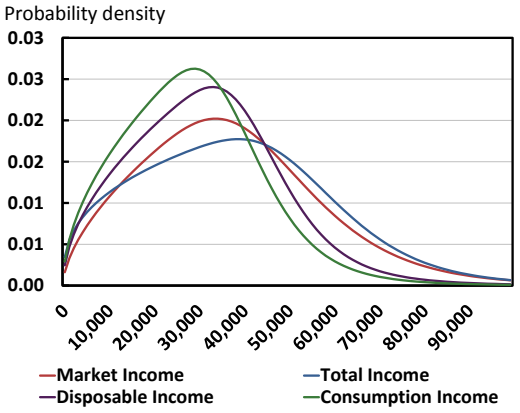
Baseline Income Distributions



Sources: SPSD/M, Parliamentary Budget Officer.

Figure B8

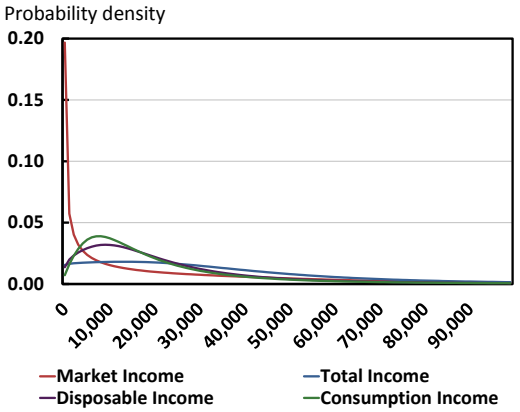
Low Gini Income Distributions



Sources: SPSD/M, Parliamentary Budget Officer.

Figure B9

High Gini Income Distributions



Sources: SPSD/M, Parliamentary Budget Officer.

Box B1

Income distributions

Figures B7, B8, and B9 depict the fitted income distributions for the Low, Baseline, and High Gini coefficient scenarios.

The figures can be interpreted as the shift in income distribution after the application of transfers, direct taxes, and indirect taxes.

The distributions shift from market income (red line) to total income (blue line) after the disbursement of transfers; and from total income to disposable income (purple line) once direct taxes are applied. Finally, based on evidence of consumer purchases, the income distribution shifts from disposable income to consumption income (green line) once indirect taxes are applied.

The three figures show the changing effect of tax and transfer system under various income distributions.

Source: Parliamentary Budget Officer.

Comparison: Micro-Simulation Totals

The SPSD/M Growth and Validation Guide presents comparison totals between observed and simulated variables from various official sources, as well as surveys. Some of those tables are reproduced here.[54]

Category	Difference		Source of Estimate								
			A	B	C	D	E	F	G	H	I
	%	$	SLID	SPSM	SNA	T4	HRSDC	Admin	CRA Income Statistics	T1 Historical File	T1, T4, or T5007
Market Income											
Wages and Salaries	100.1	791	690,847	702,526		701,735			683,800	683,089	
Self-employment Income	115.9	8,007	58,646	58,273					49,429	50,266	
Total Earnings	103.8	27,570	749,493	760,799					733,230	733,355	
Investment Income	94.5	-4,303	57,039	74,373					84,191	78,675	
Transfer Income											
Government Transfers to Persons			122,788	137,825							
Worker's Compensation	106.5	386	6,146	6,328	5,942				5,425		
OAS, GIS and SPA	101.1	393	32,317	35,316	34,923		35,380				
Social Assistance	105.6	603	10,262	11,459	13,118			13,118	9,967		10,856
Federal Transfers											
Child Tax Benefit	94.4	-511	8,368	8,629	9,670						9,139
UCCB	102	50	2,587	2,556					2,506		
OAS	100.4	119		27,268			27,149		25,378		
GIS	97.6	-188		7,520			7,708				
SPA	100.9	4		528			523				
EI Benefits + QPIP	111.7	2,346	21,501	22,372	18,660			19,494	20,046		20,026
QPIP	102.9	48		1,732				1,684			1,546
CPP/QPP Income	98.5	-569	35,756	38,653	39,222		39,706	38,644	37,581		
Sales Tax Credit	108.2	278	3,367	3,655	3,931						3,377
Provincial Transfers											
Family Programs			2,887	2,902							
Elderly Programs				509							
Federal Income Taxes											
Total Income assessed	104	37,571		978,527					947,137	940,957	
Total Deductions	105.2	4,269		85,894					87,417	81,625	
Taxable Income	104.8	40,612		893,178					858,732	852,566	
Basic Federal Tax	104.7	4,899		109,213					104,313		
Federal Income Tax	105.7	5,871		108,676	106,879				103,379	102,805	
Number of Filers ('000)	94.9	-1,295		24,301					25,596	25,298	
Number of Taxable Filers ('000)	104.6	772		17,703					16,931	16,487	
Provincial Income Taxes											
Québec provincial income taxes	100.5	100		21,111	21,036				21,011		
Provincial income tax, excl. Québec	99.5	-256		46,268	48,075				46,524	46,290	
Payroll Taxes											
EI Contributions	109.4	665		7,703	6,963				6,841	7,039	
CPP/QPP Contributions	103.4	788		24,121	23,333				21,486	22,403	

A - The SLID figures are from the 2009 Survey of Labour and Income Dynamics.
B - The SPSM figures are for the SPSD/M version 21.0 Release.
C - Provincial Economic Accounts.
D - Special tabulation of T4 file.
E - Social Assistance, Child Tax Benefit and Provincial Transfers come from the Strategic Policy and Research Directorate.
The remaining figures are from Statistics Related to Income Security Programs in Canada.
F - Official Quebec Statistics, Government of Quebec
G - Income Statistics publication, Canada Revenue Agency.
H - Special tabulation of Final T1 file, 5 years after the reference year.
I - Special tabulation of T5007, T4 files and T1 files.

[54] The SPSD/M Growth and Validation Guide can be obtained from the SPSD/M v21.0 documentation. Accessed November 2014.

Annex C
Tables

Table C1: Parameters and Fitted Gini Coefficients for Market Income using the Double-Pareto Lognormal Distribution.

Market Income

Market Income Gini Coefficient	Parameters				Absolute Square Error	Gini Coefficient of Fit
	Alpha (α)	Beta (β)	Nu (ν)	Tau (τ)		
30	6.660	1.609	10.831	0.273	0.0242	30.17
31	6.510	1.523	10.848	0.278	0.0227	31.17
32	6.352	1.444	10.864	0.285	0.0222	32.24
33	6.027	1.373	10.873	0.289	0.0215	33.29
34	6.043	1.335	10.878	0.307	0.0119	34.23
35	5.330	1.263	10.880	0.295	0.0125	35.22
36	5.016	1.210	10.884	0.297	0.0118	36.23
37	4.730	1.162	10.887	0.299	0.0114	37.23
38	4.475	1.118	10.889	0.301	0.0112	38.19
39	4.233	1.074	10.891	0.302	0.0110	39.22
40	4.004	1.043	10.887	0.304	0.0037	40.09
41	3.802	1.004	10.888	0.305	0.0032	41.13
42	3.630	0.969	10.888	0.305	0.0030	42.10
43	3.471	0.933	10.889	0.306	0.0026	43.13
44	3.330	0.902	10.890	0.307	0.0023	44.11
45	3.196	0.870	10.891	0.307	0.0020	45.14
46	3.087	0.843	10.891	0.308	0.0018	46.05
47	2.975	0.814	10.892	0.309	0.0016	47.07
48	2.871	0.787	10.892	0.309	0.0015	48.10
49	2.783	0.761	10.893	0.310	0.0011	49.09
50	2.695	0.736	10.893	0.311	0.0011	50.09
51	2.613	0.712	10.894	0.311	0.0010	51.09
52	2.558	0.691	10.896	0.313	0.0005	51.96
53	2.475	0.670	10.894	0.312	0.0010	52.97
54	2.405	0.647	10.895	0.313	0.0010	54.03
55	2.346	0.627	10.895	0.314	0.0011	54.99
56	2.289	0.608	10.895	0.315	0.0014	55.96
57	2.234	0.590	10.896	0.316	0.0018	56.92
58	2.185	0.570	10.896	0.317	0.0022	57.91
59	2.141	0.554	10.897	0.318	0.0027	58.82
60	2.067	0.537	10.892	0.312	0.0032	59.95
61	2.023	0.519	10.893	0.313	0.0036	60.96
62	1.984	0.504	10.893	0.314	0.0040	61.89
63	1.944	0.487	10.893	0.315	0.0046	62.90
64	1.908	0.473	10.894	0.317	0.0054	63.83
65	1.874	0.458	10.894	0.318	0.0063	64.76
66	1.840	0.444	10.894	0.319	0.0075	65.73
67	1.808	0.430	10.894	0.321	0.0087	66.67
68	1.779	0.418	10.894	0.322	0.0100	67.54
69	1.732	0.404	10.890	0.318	0.0113	68.68
70	1.720	0.391	10.894	0.326	0.0133	69.43
71	1.693	0.379	10.894	0.327	0.0151	70.33
72	1.666	0.367	10.894	0.329	0.0171	71.25
73	1.652	0.359	10.887	0.319	0.0240	71.74
74	1.629	0.348	10.887	0.321	0.0263	72.62
75	1.607	0.336	10.887	0.323	0.0289	73.49

Table C2: Parameters and Fitted Gini Coefficients for Total Income using the Double-Pareto Lognormal Distribution.

Total Income (Market Income plus transfers)

Market Income Gini Coefficient	Parameters				Absolute Square Error	Gini Coefficient of Fit
	Alpha (α)	Beta (β)	Nu (ν)	Tau (τ)		
30	6.994	1.370	10.945	0.218	0.0753	31.13
31	6.608	1.328	10.947	0.221	0.0689	31.88
32	6.451	1.276	10.957	0.229	0.0626	32.80
33	6.081	1.244	10.956	0.235	0.0571	33.56
34	5.760	1.224	10.948	0.245	0.0602	34.25
35	5.954	1.200	10.955	0.267	0.0558	35.00
36	5.113	1.175	10.936	0.258	0.0551	35.72
37	5.984	1.162	10.960	0.298	0.0512	36.31
38	5.969	1.180	10.944	0.335	0.0483	37.04
39	4.366	1.119	10.911	0.281	0.0492	37.86
40	5.955	1.143	10.942	0.362	0.0502	38.31
41	3.964	1.095	10.885	0.300	0.0492	39.24
42	3.822	1.086	10.872	0.314	0.0459	39.95
43	3.625	1.059	10.866	0.311	0.0371	40.71
44	3.484	1.040	10.858	0.317	0.0398	41.48
45	3.373	1.035	10.842	0.333	0.0414	42.20
46	3.284	1.030	10.827	0.348	0.0432	42.85
47	3.193	1.029	10.809	0.366	0.0447	43.56
48	3.113	1.037	10.786	0.388	0.0475	44.22
49	3.045	1.039	10.766	0.408	0.0486	44.90
50	2.967	1.040	10.745	0.426	0.0491	45.60
51	2.892	1.043	10.723	0.444	0.0492	46.29
52	2.827	1.047	10.701	0.460	0.0488	46.92
53	2.760	1.053	10.677	0.478	0.0483	47.58
54	2.690	1.061	10.649	0.497	0.0472	48.30
55	2.629	1.070	10.623	0.514	0.0460	48.94
56	2.570	1.081	10.594	0.532	0.0445	49.58
57	2.508	1.094	10.565	0.549	0.0428	50.23
58	2.455	1.110	10.532	0.567	0.0408	50.86
59	2.405	1.127	10.501	0.583	0.0388	51.44
60	2.354	1.147	10.468	0.600	0.0365	52.03
61	2.301	1.173	10.429	0.617	0.0340	52.66
62	2.254	1.200	10.392	0.634	0.0316	53.23
63	2.205	1.235	10.349	0.652	0.0290	53.84
64	2.162	1.274	10.307	0.669	0.0267	54.40
65	2.119	1.321	10.262	0.687	0.0244	54.95
66	2.268	1.788	10.110	0.798	0.0285	54.95
67	2.037	1.453	10.158	0.724	0.0201	56.07
68	2.002	1.539	10.104	0.742	0.0200	56.56
69	1.965	1.661	10.039	0.763	0.0205	57.09
70	1.929	1.842	9.964	0.786	0.0209	57.61
71	1.897	2.102	9.881	0.809	0.0221	58.09
72	1.865	2.592	9.775	0.837	0.0235	58.58
73	1.795	3.134	9.682	0.835	0.0268	59.08
74	1.744	3.636	9.609	0.838	0.0271	59.73
75	1.691	4.102	9.547	0.835	0.0278	60.46

Table C3: Parameters and Fitted Gini Coefficients for After-Tax Income using the Double-Pareto Lognormal Distribution.

After-Tax Income (Total Income less direct taxes)

Market Income Gini Coefficient	Parameters				Absolute Square Error	Gini Coefficient of Fit
	Alpha (α)	Beta (β)	Nu (ν)	Tau (τ)		
30	6.008	1.542	10.684	0.183	0.0515	28.90
31	6.004	1.501	10.691	0.192	0.0466	29.52
32	6.005	1.435	10.705	0.201	0.0468	30.45
33	5.989	1.401	10.711	0.212	0.0426	31.07
34	5.939	1.384	10.712	0.229	0.0337	31.69
35	6.001	1.352	10.721	0.234	0.0310	32.15
36	6.017	1.319	10.721	0.251	0.0262	32.98
37	4.835	1.304	10.685	0.232	0.0262	33.63
38	4.629	1.284	10.678	0.237	0.0236	34.24
39	4.427	1.264	10.671	0.243	0.0239	34.88
40	4.259	1.259	10.657	0.254	0.0190	35.43
41	4.089	1.239	10.649	0.259	0.0196	36.08
42	3.943	1.231	10.636	0.270	0.0163	36.66
43	3.746	1.194	10.635	0.260	0.0280	37.33
44	3.667	1.173	10.632	0.269	0.0247	38.00
45	3.523	1.161	10.618	0.275	0.0234	38.64
46	3.414	1.153	10.606	0.283	0.0242	39.21
47	3.302	1.146	10.592	0.292	0.0256	39.84
48	3.196	1.147	10.573	0.304	0.0284	40.41
49	3.107	1.144	10.557	0.315	0.0289	41.02
50	3.017	1.138	10.542	0.325	0.0293	41.64
51	2.932	1.134	10.526	0.335	0.0295	42.26
52	2.860	1.131	10.510	0.344	0.0295	42.82
53	2.786	1.129	10.492	0.354	0.0293	43.42
54	2.711	1.129	10.472	0.366	0.0289	44.07
55	2.646	1.129	10.453	0.376	0.0282	44.65
56	2.583	1.130	10.433	0.386	0.0274	45.24
57	2.519	1.132	10.413	0.396	0.0264	45.84
58	2.463	1.135	10.391	0.406	0.0252	46.42
59	2.411	1.139	10.370	0.415	0.0238	46.96
60	2.358	1.143	10.348	0.424	0.0222	47.51
61	2.304	1.149	10.324	0.433	0.0203	48.11
62	2.255	1.155	10.300	0.441	0.0186	48.66
63	2.204	1.162	10.274	0.450	0.0167	49.25
64	2.159	1.169	10.250	0.457	0.0149	49.80
65	2.115	1.178	10.224	0.464	0.0132	50.35
66	2.071	1.187	10.197	0.471	0.0122	50.92
67	2.029	1.197	10.170	0.478	0.0113	51.47
68	1.991	1.208	10.144	0.483	0.0105	51.99
69	1.952	1.220	10.115	0.489	0.0105	52.54
70	1.913	1.234	10.085	0.494	0.0117	53.11
71	1.877	1.248	10.056	0.498	0.0131	53.65
72	1.841	1.263	10.025	0.501	0.0145	54.20
73	1.792	1.275	9.996	0.486	0.0156	54.65
74	1.759	1.287	9.967	0.486	0.0166	55.21
75	1.727	1.298	9.938	0.485	0.0175	55.79

Table C4: Parameters and Fitted Gini Coefficients for After-Consumption Income using the Double-Pareto Lognormal Distribution

After-Consumption Income (After-Tax Income less indirect taxes)

Market Income Gini Coefficient	Parameters				Absolute Square Error	Gini Coefficient of Fit
	Alpha (α)	Beta (β)	Nu (ν)	Tau (τ)		
30	6.229	1.540	10.587	0.204	0.0476	29.24
31	6.477	1.599	10.580	0.243	0.0381	29.51
32	6.235	1.499	10.589	0.242	0.0377	30.60
33	5.859	1.469	10.587	0.253	0.0344	31.38
34	6.206	1.435	10.589	0.266	0.0291	31.90
35	6.272	1.408	10.605	0.281	0.0269	32.56
36	4.666	1.347	10.568	0.242	0.0241	33.53
37	6.032	1.349	10.606	0.292	0.0189	33.65
38	4.334	1.305	10.557	0.255	0.0154	34.75
39	4.171	1.286	10.549	0.262	0.0125	35.40
40	4.016	1.280	10.536	0.270	0.0134	35.93
41	3.881	1.261	10.529	0.277	0.0109	36.58
42	3.777	1.252	10.517	0.289	0.0125	37.18
43	3.610	1.216	10.517	0.280	0.0279	37.80
44	3.539	1.198	10.512	0.289	0.0285	38.42
45	3.406	1.186	10.498	0.296	0.0298	39.08
46	3.306	1.178	10.487	0.305	0.0298	39.67
47	3.202	1.172	10.471	0.315	0.0302	40.30
48	3.111	1.172	10.454	0.327	0.0302	40.90
49	3.025	1.170	10.438	0.339	0.0302	41.52
50	2.937	1.165	10.421	0.348	0.0308	42.15
51	2.853	1.162	10.403	0.358	0.0311	42.79
52	2.782	1.160	10.387	0.367	0.0313	43.36
53	2.709	1.160	10.368	0.378	0.0313	43.98
54	2.634	1.161	10.347	0.389	0.0312	44.64
55	2.571	1.163	10.326	0.399	0.0309	45.24
56	2.510	1.166	10.305	0.410	0.0305	45.84
57	2.449	1.171	10.283	0.420	0.0300	46.45
58	2.394	1.177	10.259	0.431	0.0294	47.05
59	2.343	1.184	10.236	0.441	0.0287	47.61
60	2.293	1.194	10.211	0.452	0.0277	48.17
61	2.241	1.205	10.184	0.463	0.0267	48.78
62	2.195	1.218	10.157	0.473	0.0256	49.34
63	2.147	1.234	10.127	0.484	0.0245	49.95
64	2.104	1.250	10.098	0.494	0.0235	50.50
65	2.062	1.270	10.068	0.504	0.0224	51.06
66	2.020	1.293	10.034	0.514	0.0213	51.64
67	1.980	1.320	10.001	0.524	0.0202	52.20
68	1.945	1.349	9.968	0.534	0.0192	52.72
69	1.908	1.385	9.930	0.544	0.0182	53.27
70	1.871	1.429	9.890	0.554	0.0171	53.84
71	1.837	1.478	9.849	0.564	0.0162	54.37
72	1.803	1.538	9.805	0.574	0.0153	54.92
73	1.753	1.564	9.771	0.561	0.0156	55.44
74	1.721	1.628	9.728	0.568	0.0146	55.99
75	1.691	1.704	9.682	0.575	0.0137	56.55

Table C5: Federal transfer amounts under selected inequality scenarios, as produced by Statistics Canada's SPSD/M micro-simulation.

Federal Transfers ($ millions)

Market Income Gini Coefficient	Federal Transfer Income	Oas Benefits	GIS Benefits	Spousal Allowance	Total Federal Child Benefits	CPP/QPP Payable	Employment Insurance Benefits	Gst Credit	Federal Other Refundable Tax Credits	Universal Child Care Benefit
29	$113,609	$28,188	$3,885	$272	$8,095	$44,776	$22,318	$2,707	$777	$2,591
30	$113,059	$28,126	$4,017	$280	$8,122	$44,399	$21,984	$2,736	$804	$2,591
31	$112,738	$28,070	$4,157	$290	$8,113	$44,060	$21,864	$2,764	$830	$2,591
32	$111,931	$27,887	$4,279	$299	$8,070	$43,522	$21,643	$2,798	$852	$2,579
33	$111,617	$27,830	$4,427	$311	$8,070	$43,166	$21,520	$2,834	$879	$2,580
34	$111,963	$28,058	$4,914	$320	$8,037	$42,944	$21,309	$2,911	$902	$2,568
35	$111,711	$28,004	$5,059	$332	$8,045	$42,617	$21,207	$2,950	$928	$2,568
36	$111,492	$27,953	$5,206	$344	$8,056	$42,303	$21,119	$2,988	$954	$2,568
37	$111,307	$27,905	$5,351	$355	$8,069	$42,006	$21,046	$3,027	$979	$2,568
38	$111,154	$27,859	$5,494	$366	$8,083	$41,729	$20,987	$3,065	$1,003	$2,568
39	$111,017	$27,813	$5,647	$377	$8,101	$41,443	$20,934	$3,105	$1,029	$2,568
40	$110,457	$27,642	$5,767	$387	$8,131	$40,992	$20,794	$3,130	$1,059	$2,556
41	$110,219	$27,581	$5,912	$392	$8,235	$40,738	$20,541	$3,176	$1,089	$2,556
42	$110,281	$27,524	$6,013	$407	$8,340	$40,550	$20,519	$3,227	$1,144	$2,556
43	$110,289	$27,514	$6,108	$431	$8,465	$40,249	$20,520	$3,301	$1,143	$2,556
44	$109,768	$27,448	$6,277	$426	$8,423	$40,080	$20,111	$3,306	$1,140	$2,556
45	$110,067	$27,417	$6,448	$440	$8,510	$39,878	$20,278	$3,356	$1,182	$2,556
46	$110,104	$27,377	$6,607	$447	$8,508	$39,698	$20,313	$3,391	$1,206	$2,556
47	$110,169	$27,348	$6,763	$460	$8,524	$39,500	$20,350	$3,432	$1,234	$2,556
48	$110,388	$27,325	$6,937	$474	$8,517	$39,339	$20,492	$3,481	$1,266	$2,556
49	$110,515	$27,299	$7,121	$491	$8,566	$39,151	$20,516	$3,524	$1,292	$2,556
50	$110,570	$27,280	$7,263	$504	$8,590	$38,968	$20,526	$3,562	$1,319	$2,556
51	$110,649	$27,263	$7,410	$518	$8,617	$38,791	$20,544	$3,602	$1,347	$2,556
52	$110,747	$27,250	$7,549	$531	$8,644	$38,639	$20,564	$3,639	$1,373	$2,556
53	$110,880	$27,240	$7,707	$545	$8,675	$38,483	$20,591	$3,680	$1,401	$2,556
54	$111,054	$27,231	$7,887	$562	$8,710	$38,319	$20,629	$3,726	$1,434	$2,556
55	$111,233	$27,226	$8,053	$577	$8,743	$38,178	$20,667	$3,769	$1,463	$2,556
56	$111,439	$27,224	$8,225	$593	$8,778	$38,046	$20,709	$3,813	$1,494	$2,556
57	$111,636	$27,216	$8,387	$609	$8,808	$37,929	$20,751	$3,855	$1,524	$2,556
58	$111,906	$27,222	$8,571	$628	$8,857	$37,797	$20,808	$3,905	$1,560	$2,556
59	$112,147	$27,225	$8,733	$646	$8,896	$37,692	$20,858	$3,949	$1,593	$2,556
60	$112,418	$27,229	$8,899	$664	$8,936	$37,590	$20,920	$3,994	$1,628	$2,556
61	$112,725	$27,236	$9,077	$684	$8,983	$37,488	$20,988	$4,045	$1,668	$2,556
62	$113,017	$27,242	$9,239	$704	$9,027	$37,399	$21,053	$4,092	$1,705	$2,556
63	$113,353	$27,250	$9,415	$725	$9,077	$37,312	$21,126	$4,144	$1,747	$2,556
64	$113,663	$27,257	$9,575	$745	$9,122	$37,236	$21,192	$4,192	$1,787	$2,556
65	$113,990	$27,265	$9,736	$766	$9,169	$37,165	$21,261	$4,241	$1,829	$2,556
66	$114,344	$27,275	$9,904	$789	$9,222	$37,097	$21,333	$4,294	$1,874	$2,556
67	$114,697	$27,284	$10,067	$812	$9,276	$37,036	$21,399	$4,346	$1,920	$2,556
68	$115,033	$27,293	$10,218	$834	$9,330	$36,981	$21,461	$4,395	$1,963	$2,556
69	$115,409	$27,302	$10,383	$859	$9,391	$36,928	$21,528	$4,450	$2,011	$2,556
70	$115,783	$27,313	$10,554	$885	$9,454	$36,874	$21,580	$4,506	$2,061	$2,556
71	$116,134	$27,322	$10,716	$909	$9,521	$36,822	$21,621	$4,559	$2,108	$2,556
72	$116,516	$27,331	$10,886	$936	$9,594	$36,773	$21,664	$4,616	$2,159	$2,556
73	$117,434	$27,465	$11,106	$967	$9,706	$36,892	$21,813	$4,695	$2,221	$2,568
74	$117,832	$27,474	$11,280	$995	$9,783	$36,845	$21,859	$4,753	$2,274	$2,568
75	$118,237	$27,481	$11,460	$1,024	$9,866	$36,795	$21,900	$4,813	$2,328	$2,568

Table C6: Provincial transfer amounts under selected inequality scenarios, as produced by Statistics Canada's SPSD/M micro-simulation.

Provincial Transfers ($ millions)

Market Income Gini Coefficient	Provincial Transfer Income	Provincial Other Transfers	Provincial Family Programs	GIS Provincial Top-Up	Refundable Provincial Tax Credits	Provincial Social Assistance	Provincial Other Government Income
29	$24,257	$3,057	$2,692	$223	$3,066	$10,640	$4,851
30	$24,250	$3,047	$2,697	$235	$3,093	$10,600	$4,854
31	$24,365	$3,013	$2,698	$247	$3,122	$10,637	$4,929
32	$24,387	$2,970	$2,688	$258	$3,138	$10,626	$5,003
33	$24,514	$2,912	$2,693	$272	$3,173	$10,668	$5,097
34	$24,578	$2,836	$2,686	$284	$3,249	$10,660	$5,167
35	$24,704	$2,771	$2,693	$297	$3,286	$10,700	$5,263
36	$24,831	$2,710	$2,700	$311	$3,325	$10,739	$5,358
37	$24,959	$2,655	$2,708	$324	$3,364	$10,776	$5,448
38	$25,085	$2,609	$2,714	$336	$3,403	$10,811	$5,532
39	$25,225	$2,567	$2,722	$350	$3,446	$10,847	$5,619
40	$25,314	$2,520	$2,788	$361	$3,471	$10,831	$5,673
41	$25,320	$2,517	$2,808	$372	$3,510	$10,781	$5,666
42	$25,696	$2,660	$2,833	$381	$3,547	$10,909	$5,703
43	$25,503	$2,033	$2,872	$407	$3,605	$10,881	$6,048
44	$25,410	$2,143	$2,824	$414	$3,588	$10,741	$6,048
45	$25,586	$2,029	$2,850	$429	$3,645	$10,816	$6,168
46	$25,707	$2,040	$2,850	$440	$3,698	$10,801	$6,236
47	$25,914	$2,053	$2,860	$452	$3,754	$10,834	$6,325
48	$26,244	$2,056	$2,882	$464	$3,853	$10,911	$6,447
49	$26,486	$2,073	$2,893	$477	$3,895	$11,000	$6,523
50	$26,656	$2,087	$2,899	$489	$3,940	$11,026	$6,596
51	$26,842	$2,101	$2,905	$501	$3,985	$11,065	$6,670
52	$27,026	$2,115	$2,912	$513	$4,027	$11,112	$6,738
53	$27,238	$2,129	$2,919	$526	$4,073	$11,179	$6,809
54	$27,487	$2,145	$2,927	$541	$4,124	$11,263	$6,890
55	$27,725	$2,160	$2,934	$555	$4,170	$11,350	$6,963
56	$27,978	$2,176	$2,942	$570	$4,217	$11,449	$7,036
57	$28,225	$2,192	$2,950	$584	$4,264	$11,549	$7,103
58	$28,523	$2,207	$2,961	$601	$4,314	$11,679	$7,185
59	$28,788	$2,223	$2,970	$615	$4,359	$11,797	$7,252
60	$29,069	$2,242	$2,979	$631	$4,405	$11,923	$7,321
61	$29,382	$2,261	$2,990	$647	$4,456	$12,070	$7,394
62	$29,680	$2,279	$3,000	$663	$4,503	$12,215	$7,462
63	$30,014	$2,298	$3,011	$680	$4,554	$12,382	$7,536
64	$30,327	$2,314	$3,021	$696	$4,601	$12,545	$7,601
65	$30,657	$2,329	$3,031	$713	$4,649	$12,721	$7,669
66	$31,015	$2,345	$3,042	$730	$4,700	$12,918	$7,739
67	$31,374	$2,360	$3,054	$747	$4,749	$13,122	$7,804
68	$31,721	$2,372	$3,066	$764	$4,795	$13,325	$7,865
69	$32,113	$2,385	$3,080	$782	$4,846	$13,559	$7,931
70	$32,516	$2,399	$3,094	$801	$4,898	$13,808	$7,991
71	$32,912	$2,411	$3,109	$820	$4,946	$14,056	$8,047
72	$33,343	$2,423	$3,126	$839	$4,998	$14,335	$8,103
73	$33,900	$2,442	$3,116	$863	$5,069	$14,697	$8,198
74	$34,367	$2,448	$3,134	$884	$5,122	$15,014	$8,255
75	$34,864	$2,454	$3,153	$906	$5,175	$15,358	$8,312

Table C7: Federal and provincial taxation amounts under selected inequality scenarios, as produced by Statistics Canada's SPSD/M micro-simulation.

Federal and Provincial Taxes ($ millions)

Market Income Gini Coefficient	Provincial Taxes	Federal Taxes	Federal Income Tax Payable	CPP/QPP Contributions	Social Benefits Repayments	Federal Commodity Taxes	Employment Insurance Contributions
29	$114,085	$169,313	$97,564	$27,247	$582	$35,013	$8,908
30	$113,974	$169,487	$97,990	$27,152	$576	$34,905	$8,862
31	$113,868	$169,471	$98,242	$27,036	$573	$34,806	$8,814
32	$113,863	$169,528	$98,560	$26,871	$566	$34,773	$8,759
33	$113,773	$169,526	$98,852	$26,749	$560	$34,657	$8,708
34	$113,875	$169,473	$99,029	$26,676	$551	$34,546	$8,671
35	$113,809	$169,478	$99,320	$26,557	$545	$34,436	$8,620
36	$113,749	$169,476	$99,602	$26,437	$537	$34,330	$8,570
37	$113,694	$169,456	$99,860	$26,316	$530	$34,230	$8,520
38	$113,659	$169,451	$100,123	$26,196	$522	$34,138	$8,472
39	$113,625	$169,423	$100,383	$26,064	$514	$34,040	$8,421
40	$113,881	$169,431	$100,532	$26,018	$504	$33,982	$8,396
41	$113,757	$169,280	$100,688	$25,876	$497	$33,883	$8,336
42	$114,113	$169,909	$101,536	$25,748	$494	$33,825	$8,305
43	$113,637	$168,973	$101,037	$25,587	$481	$33,670	$8,197
44	$113,208	$167,647	$100,012	$25,369	$473	$33,678	$8,114
45	$113,286	$167,765	$100,380	$25,213	$465	$33,641	$8,065
46	$113,393	$167,902	$100,806	$25,082	$457	$33,536	$8,020
47	$113,548	$168,122	$101,347	$24,938	$448	$33,419	$7,970
48	$113,542	$168,290	$101,846	$24,858	$440	$33,211	$7,935
49	$113,363	$167,690	$101,593	$24,680	$432	$33,107	$7,878
50	$113,684	$168,165	$102,397	$24,502	$423	$33,022	$7,820
51	$114,031	$168,676	$103,244	$24,320	$415	$32,936	$7,761
52	$114,341	$169,126	$104,005	$24,151	$407	$32,857	$7,706
53	$114,662	$169,579	$104,800	$23,965	$399	$32,770	$7,645
54	$115,010	$170,067	$105,672	$23,755	$390	$32,672	$7,577
55	$115,314	$170,479	$106,434	$23,563	$383	$32,584	$7,515
56	$115,606	$170,858	$107,183	$23,361	$375	$32,490	$7,450
57	$115,948	$171,324	$107,970	$23,175	$368	$32,423	$7,389
58	$116,222	$171,650	$108,747	$22,934	$360	$32,296	$7,312
59	$116,480	$171,980	$109,455	$22,727	$353	$32,199	$7,246
60	$116,754	$172,316	$110,185	$22,508	$347	$32,100	$7,177
61	$117,073	$172,711	$111,016	$22,265	$339	$31,990	$7,101
62	$117,371	$173,083	$111,802	$22,035	$332	$31,886	$7,029
63	$117,673	$173,446	$112,631	$21,775	$325	$31,767	$6,948
64	$117,991	$173,840	$113,463	$21,532	$319	$31,655	$6,871
65	$118,290	$174,194	$114,272	$21,279	$312	$31,538	$6,792
66	$118,604	$174,566	$115,135	$21,007	$305	$31,411	$6,708
67	$118,922	$174,931	$115,989	$20,736	$299	$31,284	$6,623
68	$119,205	$175,260	$116,785	$20,479	$292	$31,161	$6,543
69	$119,513	$175,597	$117,643	$20,192	$286	$31,023	$6,454
70	$119,808	$175,916	$118,507	$19,893	$279	$30,877	$6,360
71	$120,128	$176,280	$119,397	$19,604	$273	$30,736	$6,269
72	$120,410	$176,570	$120,249	$19,298	$267	$30,582	$6,173
73	$119,916	$176,379	$120,769	$18,931	$262	$30,355	$6,061
74	$120,225	$176,699	$121,674	$18,614	$256	$30,194	$5,962
75	$120,492	$176,955	$122,541	$18,285	$249	$30,021	$5,858