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INCOME INEQUALITY, REDISTRIBUTION AND ECONOMIC GROWTH

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SUMMARY

Inequality is on the rise in Canada and this state of affairs has provoked outrage and demands for redistribution at a time when governments at every level are searching for reliable long-term growth. This paper examines the links between income inequality and economic growth and whether there is a trade-off between redistributive policies, and economic growth, or whether income redistribution can enable faster growth. The authors survey the existing literature on the impact of inequality on economic growth, and then conduct an econometric analysis of the association between provincial economic growth in Canada and three different measures of income inequality, finding no statistically significant relationships. One measure of income redistribution, the difference between the market income Gini coefficient and the disposable (after-tax, after-transfer) income Gini is positively associated with provincial growth rates — but since the largest transfer programs in Canada are federal programs financed out of nation-wide taxes, it is unlikely that this association carries over to the national level. Much of the growth in income disparity has been driven by innovation that places a premium on highly trained workers. With that in mind, the Goldin-Katz model, used to explain the rising earnings differentials of highly skilled workers in the US, can be combined with the Aghion-Bolton model of capital market imperfections to develop a framework for examining the impact of education spending, and the taxes that finance it, on earnings inequality and economic growth. The authors then review evidence that raising marginal tax rates on high-income individuals would not raise additional tax revenues, but impose substantial costs on the economy, as would higher corporate income taxes. Punishing high earners is a self-defeating choice, although improvements to the social safety net would give more Canadians the chance to join their ranks.

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INTRODUCTION

The worldwide demonstrations by the Occupy movement have drawn media attention to the rise in the income shares of the top one per cent in the United States, Canada, and other countries.[1] Thanks to this media attention and the outpouring of academic and think tank studies, income inequality has moved up to the policy agenda in many countries, displacing to some degree traditional concerns about poverty. A poll conducted by the Broadbent Institute indicated that, "71 per cent of Canadians think that the widening gap between rich and poor **undermines Canadian values**"[2] (emphasis in the original). A recent survey by the Pew Research Centre found that about two-thirds of US residents believe that there is a strong class conflict between the rich and the poor. The rhetoric of class conflict is also found in the blogosphere in Canada. For example, Mel Watkins, professor emeritus of economics at the University of Toronto, refers to globalization as "the latest stage of imperial capitalism" and argues that:

> "The emergence…of the Occupy movement and its focus on the obscene 'earnings' of the one per cent may well be a harbinger of future progress in lessening inequality. The issue is now more clearly on the political agenda. The left and decent folk, who have been silent too long, should draw from all this the encouragement they need."[3]

Softcore Marxist rhetoric and self-righteous indignation are poor substitutes for careful and dispassionate policy analysis, because the measures that might be adopted in response to the public's concerns about inequality may hamper economic growth and the living standards of the majority of the population.[4] Arthur Okun, a chairman of the Council of Economic Advisers and a fellow at the Brookings Institution, expressed this notion of the equity-output trade-off most succinctly when he argued that, "money must be carried from the rich to the poor in a leaky bucket. Some of it will simply disappear in transit, so the poor will not receive all the money that is taken from the rich."[5] Others have challenged the view that there is a trade-off between growth and equality. The Swedish economist Gunnar Myrdal, winner of the 1974 Nobel Prize in economics, argued in the *Asian Drama: An Inquiry into the Poverty of Nations*[6] that higher pay for low-wage workers in developing countries would make them more productive through

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1 For Canadian studies on the increase in the income share of the top one per cent, 0.1 per cent and 0.01 per cent over the past three decades, see Saez and Veall (2005). "The Evolution of High Incomes in Northern America: Lessons from Canadian Evidence," *American Economic Review* 95: 831-849; (2007). "The evolution of high incomes in Canada, 1920–2000," in *Top Incomes over the Twentieth Century: A Contrast Between Continental European and English-Speaking Countries*, ed. Anthony B. Atkinson and Thomas Piketty Oxford: Oxford University Press) along with Veall (2010). "Top income shares in Canada: updates and extensions," paper presented to the meetings of the Canadian Economics Association, Quebec City; Veall (2012). "Top Income Shares in Canada: Recent Trends and Policy Implications," *Canadian Journal of Economics* 12: 1247-1272; and Fortin et al. (2012). "Canadian Inequality: Recent Developments and Policy Options" *Canadian Public Policy*, 38(2): 121-145.

2 http://www.broadbentinstitute.ca/sites/default/files/documents/equality-project_0.pdf

3 http://www.broadbentinstitute.ca/en/blog/mel-watkins-comment-towards-more-equal-canada.

4 See the Broadbent Institute (2012). "Towards a More Equal Canada: A Report on Canada's Economic and Social Inequality." http://www.broadbentinstitute.ca/issue/towards-more-equal-canada for a range of policies that have been advocated for addressing earns inequality in Canada.

5 Okun, A.M (1975). *Equality and Efficiency: The Big Tradeoffs*, Brookings Institution: Washington, DC. p. 91.

6 Myrdal, G. (1968) *Asian drama: An Inquiry into the Poverty of Nations*, Penguin Press: London.

improvements in their nutrition, health, and education.[7] Therefore measures such as minimum-wage laws that lower earnings inequality could result in higher rates of economic growth. In *The Price of Inequality,*[8] Joseph Stiglitz, winner of the 2002 Nobel Prize in economics, uses the redistribution policies adopted in Brazil as an example of "trickle-up economics." He points out that increases in education spending under former president Fernando Henrique Cardoso and in a social welfare program, the *Bolsa Familia*, under former president Lula, have been accompanied by faster growth and reductions in income inequality in Brazil. Stiglitz has also argued that redistribution could enhance economic growth in developed economies because "widely unequal societies do not function efficiently and their economies are neither stable nor sustainable. The evidence from history and from around the modern world is unequivocal: there comes a point when inequality spirals into economic dysfunction for the whole society..."[9]

While a lot of attention has been focused on the rising shares of the top one, 0.1 and 0.01 per cent, broader indices of income inequality, such as the Gini coefficient, which take into account changes in the income shares across all income groups, are used in most economic studies. The Gini coefficient is an index number that varies between zero and one. A society with completely equal incomes would have a Gini coefficient of zero; a Gini coefficient of one would occur if all income belonged to just one individual — a maximum level of income inequality. In Canada, the Gini coefficient for market income for all family units has increased from 0.447 in 1976 to 0.518 in 2010. Over the same period, the disposable income (or after-tax, after-transfers) Gini coefficient has increased from 0.364 to 0.395. Across provinces in 2010, the Gini coefficient for market income ranged from 0.560 in Newfoundland to 0.483 in Manitoba, while the Gini coefficient for disposable income ranged from 0.414 in BC to 0.339 in PEI.[10]

While not the primary focus of our attention, it is important to briefly consider the factors that are behind the rise in income inequality. A number of social and economic changes have been put forward as contributors to the rise in inequality. For example, an online survey in the *New York Times* asked readers to rank the importance of 14 different factors.[11] Among economists, information and communications technology, globalization, and labour market institutions, are usually put forward as the main factors behind the increase in income inequality.[12] The common element in all of these explanations of the increase in inequality is technological

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[7] Adam Smith expressed somewhat similar views when he wrote that, "Where wages are high, accordingly, we shall always find the workmen more active, diligent, and expeditious, than where they are low." See Smith, A. (1776). *The Wealth of Nations*, Modern Library edition 1937: New York. p. 81.

[8] Stigliz, J. (2012b). *The Price of Inequality*, W.W. Norton: New York.

[9] Stiglitz, J. (2012a) "The One Percent's Problem," *Vanity Fair*, May 3. http://www.vanityfair.com/politics/2012/05/joseph-stiglitz-the-price-on-inequality

[10] Source: Statistics Canada CANSIM Data Base Table 202-0705. For more a more detailed analysis of the trends and variations across provinces in Gini coefficients, see Sharpe, A. and E. Capeluck (2012). "The Impact of Redistribution on Income Inequality in Canada and the Provinces, 1981-2010," CSLS Research Report 2012-08, Centre for the Study of Living Standards: Ottawa.

[11] The 14 factors identified in the New York times survey were: automation and computers, global competition, demographics, deregulation, the slowdown in educational attainment, family structure, fiscal policy, rising health costs, immigration, an innovation plateau, the falling minimum wage, changing cultural norms, the tax code and regulation, and the decline of unions. See *New York Times* 21 August 2012.

[12] See Katz and Murphy (1992); OECD (2007) Offshoring and Employment: Trends and Impacts, OECD Publishing, Paris; OECD (2010). *Tax Policy Reform and Economic Growth*. OECD Tax Policy Studies No. 20, Paris: France; and Fortin et al (2012) op. cit.

change. The widespread adoption of computer technologies in the workplace has increased the productivity, and therefore the demand, for skilled (educated) labour relative to unskilled or low-skilled workers. This skill-biased technological change has increased pay differentials and contributed to the rise in earnings inequality. For example, research by Boudarbat, Lemieux, and Riddell[13] indicates that Canadian men with a university degree earned 32 per cent more than those with just a high school diploma in 1980 and 40 per cent more in 2005. Green and Sand[14] also show that between 1980 and 2005, the share of Canadian employment for high-skill and high-paying jobs increased as compared to low and middle wage-paying jobs. Thus income differences among workers with different education levels seem to be one of the factors giving rise to growing income inequality.

The second factor that has contributed to the rise in income inequality is globalization. The increasing integration of economies through trade and finance has also raised the demand for highly skilled workers in developed countries relative to lower skilled workers who perform routine tasks that can now be outsourced offshore. The decline in employment in routine manufacturing jobs is one manifestation of this trend. Increasing international trade in intermediate inputs is also thought to have contributed to the decline in demand for low- and middle-income workers in developed countries. Another and closely related factor is the decline in private sector unions, which in Canada now represent less than 20 per cent of private sector workers, down from a third in the late 1980s, and the downward pressure on minimum wages.[15]

The technological changes that have made automation, outsourcing, and offshoring economically viable ways of organizing production are, in our view, the single most important factor driving the increase in inequality. However, some are sceptical of this explanation and point out that not all developed countries have experienced significant increases in income inequality, even though they have been exposed to the same forces of technological change. They stress the importance of political, social, and cultural factors in limiting the effects of technological change on the distribution of income.

In response to the legitimate concerns about the rise of inequality in Canada, we need to consider a number of important questions. Does income inequality affect economic growth? Is there a trade-off between income inequality and economic growth or would more redistribution foster economic growth? Which public policies are most likely to foster faster economic growth and greater income equality, or at least produce a lower trade-off rate between these two goals if they conflict? It is only fair to warn the reader that we do not have the answers to all of these questions. What we do provide in this paper is a survey of the literature on growth and inequality, some empirical results on the link between economic growth, inequality and redistribution at the provincial level in Canada, and a framework for thinking about the answers to these very important questions.

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[13] Boudarbat, B., T. Lemieux, and W.C. Riddell (2010). "The Evolution of the Returns to Human Capital in Canada, 1980-2005," Discussion paper 4809. Institute for the Study of Labor (IZA), Bonn: Germany.

[14] Green, D. A., and B. Sand (2011). "Has the Canadian Labour Market Polarized?" HRSDC 9548-10-0001 (October), Human Resources and Skills Development Canada.

[15] See OECD (2010) op. cit.; Fortin et al. (2012) op. cit.; and the Broadbent Institute (2012) op.cit.

THE COMPLEX AND AMBIGUOUS LINKS BETWEEN INEQUALITY AND GROWTH

Does income inequality affect a country's economic growth rate? If so, how and why? Theories about the linkage between inequality and growth are numerous and varied; economists have focused most of their attention on the following causal mechanisms: capital market imperfections, policy responses to inequality, civil strife, and savings rates.[16]

Capital market imperfections. Individuals and families with low incomes and little wealth often cannot make productivity-enhancing investments, especially to finance education and training for themselves or their children (investments in human capital) or in entrepreneurial activities. Since the non-rich have little or no collateral for loans, and personal bankruptcy laws make it difficult for financial institutions to collect on bad loans, they generally are unable to offer loans at interest rates that would make these investments feasible for the non-rich. The informational and legal constraints that prevent private sector financial institutions from financing investments by the non-rich, which would boost their lifetime incomes and total economic output, give rise to what is called a capital market imperfection or market failure. If a highly unequal distribution of income and wealth prevents most of the population from investing in education and entrepreneurial activity, then a more equal distribution of market income, through transfers that increase the disposable incomes of the non-rich or direct funding of education, could boost the level of productive investment in the economy and the rate of economic growth.[17] In this view, inequality not only limits the rate of economic growth, it may also exacerbate economic volatility because low-income people cannot smooth consumption spending by borrowing when faced with an economic shock, such as a layoff. In response to a negative income shock, they have to reduce their consumer spending, which exacerbates the economic impact of the initial shock.

Since investment in human capital is one of the most important contributors to economic growth, we will explore the linkage between public sector investments in education, the disincentive effects of taxes that are used to finance public sector spending, and economic growth in more detail in a later section.

While capital market imperfections are generally thought to provide a link between more equality and faster economic growth, there are counter arguments or forces that might limit or even reverse this effect. Some types of investments, such as those in new and innovative activities, may require a relative large minimum investment. Because innovative projects cannot be easily funded through conventional capital markets, they often need high-net-worth individuals, so-called angel investors, to provide the initial capital. An economy with a more unequal distribution of income or wealth may be able to fund a larger number of innovative investments, which contribute to a faster rate of economic growth. Perhaps this was behind former finance minister Michael Wilson's plea that Canada needs more millionaires.

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[16] For more on how inequality may affect a nation's economic performance, see Aghion, P., E Caroli; and C. García-Peñalosa (1999). "Inequality and Economic Growth: The Perspective of the New Growth Theories," *Journal of Economic Literature* 37(4): 1615-1660; and Barro, Robert J. (2000). "Inequality and Growth in a Panel of Countries," *Journal of Economic Growth* 5(1): 5-32.

[17] García-Peñalosa and Wen ((2008). "Redistribution and Entrepreneurship with Schumpeterian Growth," *Journal of Economic Growth* 13: 57-80) use a Schumpeterian model of innovation to show that income redistribution programs financed by income taxes could increase economic growth rates because transfers provide income insurance, which encourages the entry of entrepreneurs and the rate of innovation in an economy.

Political economy models of redistribution. Measures to redistribute income can give rise to disincentives to work, save, and invest through higher taxes that have to be levied to finance income transfers. Persson and Tabellini[18] developed a simple voting model, where the pressure to redistribute income through cash transfers is greater when the ratio of the average income to the median income in the society is larger. The voter with the median income has more to gain from an equal per-capita transfer from the government that is financed by a proportional income tax the greater the average income in the society. However, the taxes used to finance such transfers erode incentives to invest, lowering the rate of economic growth. The Persson-Tabellini (PT) model predicts that in a democracy, a more unequal distribution of market income leads to greater pressure to redistribute income through a distortionary tax-transfer system, which slows the rate of economic growth.[19] Another prediction of the PT model is that growth should decline when fiscal redistribution increases. This could be measured by an increase in the gap between the pre-fiscal or market income Gini coefficient and the disposable income or post-fiscal Gini coefficient.

In addition to fiscal measures that erode economic performance, governments may adopt populist policies that inhibit new investments or reduce labour and product market flexibility. The labour market and industrial policies adopted by the Peronist governments in Argentina and the subsidization of fuel and food in Venezuela by the late president Hugo Chavez are examples of populist policies that divert resources into a swollen public sector, ossify labour markets, and sap investment incentives.

In short, the Persson-Tabellini model predicts that more market income inequality generates more pressure to redistribute income through income transfers financed by distortionary taxes — which leads to slower growth. However, their model is based on the assumption that redistribution does not increase the productive capacity of the economy. Saint-Paul and Verdier[20] also developed a political economy model of redistribution in which more earnings inequality creates more pressure on the government to spend on education, which increases the relative incomes of the bottom half of the income distribution, lowering inequality, while at the same time increasing the rate of economic growth. In contrast, in the Alesina and Rodrik political economy model,[21] the government provides a productivity-enhancing public input, financed by a tax on capital income, and a more equal distribution of income leads to a lower rate of taxation and faster growth.[22] Thus the impact of popular pressure to redistribute on growth depends on what form the government's spending takes and what taxes are used to finance it.

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[18] Persson, Torsten and Guido Tabellini (1994). "Is Inequality Harmful for Growth?" *American Economic Review* 84(3): 600-21.

[19] For political economy models of redistribution and growth, see Benabou, R. (1996). "Inequality and Growth," in *NBER Macroeconomics Annual 1996*, Volume 11, edited by Ben S. Bernanke and Julio J. Rotemberg, MIT Press, pages 11-92. http://www.nber.org/chapters/c11027.

[20] Saint-Paul, G. and T. Verdier (1993). "Education, Democracy, and Growth," *Journal of Development Economics* 42(2): 399-407.

[21] Alesina, A. and D. Rodrik (1994). "Distributive Politics and Economic Growth," *Quarterly Journal of Economics* 109(2): 465-490.

[22] In the Alesina and Rodrik model, there is an inverse U-shaped relationship between the tax rate on capital and the growth rate. At low rates of taxation, an increase in the tax rate and provision of the public good boost the growth rate, while at high rates of taxation, the disincentive effects of a higher tax rate outweigh the productivity-enhancing effects of an increase in the public input and the growth rate declines.

Social unrest, rebellions, and revolutions. While populist pressures for redistribution in democratic countries might lead to growth-sapping fiscal and regulatory policies, in non-democratic countries these pressures can set off violence and civil wars. The Russian and Mexican revolutions are historical examples of the destructive forces that are unleashed when autocratic and oligarchic regimes implode. The threat of civil conflicts in non-democratic countries makes property rights insecure and erodes domestic investment, because the elite invest abroad in safe havens where property rights are secure.

Savings rates. Because individuals' savings rates generally decline with income, a more unequal income distribution might give rise to a higher aggregate savings rate. Stiglitz[23] has argued that growing income inequality in the US has been one of the factors contributing to slower rates of economic growth. He claims that, "as more money becomes concentrated at the top, aggregate demand goes into a decline. Unless something else happens by way of intervention, total demand in the economy will be less than what the economy is capable of supplying — and that means that there will be growing unemployment, which will dampen demand even further."[24] However, this Keynesian demand-side view of the determinants of output and growth is at variance with the traditional economic view, espoused by Kaldor,[25] that higher savings rates of the rich lead to higher investment rates. Therefore, a more unequal income distribution leads to higher growth rates, at least in transition to the new steady state.[26] Furthermore, Stiglitz's view is at variance with the decline in aggregate US household savings rates in the 20 years prior to the Great Recession when inequality was increasing.

More sophisticated versions of the inequality-savings-growth hypothesis have been put forward by Paul Krugman[27] and Raghuram Rajan,[28] who have argued that the increase in income inequality has led to increases in consumer debt, which in turn triggered the housing bubble and bust in the US.[29] In this view, the lower- and middle-income groups in the US, which have experienced stagnant incomes in the last two decades, have responded by increasing their household debt in order to maintain a middle-class lifestyle. Indeed, Rajan[30] has argued that successive US governments have introduced policies that made it increasingly easy for US households to borrow as a deliberate reaction to the slow growth in the incomes of middle Americans, and this set the stage for the financial market meltdown in 2008.

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[23] Stiglitz (2012a). op. cit.

[24] Stiglitz (2012a). op. cit.

[25] Kaldor, N. (1957). "A Model of Economic Growth," *Economic Journal*, 67(268): 591-624.

[26] Of course in a small open economy, the investment rate may be independent of the domestic savings rates if capital can flow in or out of the country. Still, there is a considerable body of empirical evidence that countries' aggregate investment rates are highly correlated with their domestic savings rates.

[27] Krugman, P.(2010). "Inequality and Crises," New York Times blog 'The Conscience of a liberal' (krugman.blogs.nytimes.com)

[28] Rajan, R. (2010). *Fault Lines: Howe Hidden Fractions Still Threaten the World Economy*. Princeton University Press, Princeton: New Jersey.

[29] On the link between rising income inequality, increasing household debt and financial crises, see Kumhof and Ranciere ((2010). "Inequality, Leverage, and Crisis," IMF Working Paper, WP/10/268) and Paul Krugman and Joseph Stiglitz, in their lengthy interview on income inequality hosted by the Center for New Economic Thinking at http://www.social-europe.eu/2012/10/paul-krugman-and-joseph-stiglitz-on-the-economy-and-inequality/

[30] Rajan, R. (2010). op.cit.

REVIEW OF ECONOMETRIC STUDIES ON INEQUALITY AND ECONOMIC GROWTH

As noted in the introduction, since the 1950s and perhaps earlier, economists have debated whether a trade-off exists between income inequality and economic growth.[31] However, it was only in the mid-1990s, with the renewed interest in the economics of growth and the availability of data on a large number of countries' economic, political, and social characteristics, that systematic empirical investigations of the link between income inequality and economic growth were undertaken. A number of these early studies, using international cross-section data, found that countries with less inequality had faster rates of economic growth. However, within a few years, other studies using better data and more advanced econometric estimation techniques challenged these early results and concluded that, at least for developed countries, higher inequality is associated with faster economic growth.

The relevance of these studies, which use data from countries with vastly different levels of economic development, ranging from Swaziland to Sweden, may be of limited policy relevance for developed countries such as Canada. For this reason, we also review a number of empirical studies that have been conducted into the link between income inequality and economic growth rates of the US states. These studies, which are reviewed in Section 3.2, also yield conflicting results concerning the effects of inequality on economic growth. Even in those studies with seemingly strong and robust results, there are problems of interpretation concerning the mechanisms by which inequality affects economic growth at the state or regional level.

Studies Using International Cross-section and Time Series Data

Table 1 summarizes some of the key studies that have used data on real GDP per capita, measures of income inequality, and other key conditioning variables to investigate the link between income inequality and economic growth.[32] These studies typically include, as conditioning variables, the initial GDP per capita of the country because countries that start with lower GDP per capita typically grow at faster rates than high-income countries. They also include other variables such as education levels, physical investment, changes in the terms of trade, and socio-political variables, such as indices or corruption or democracy, which have been associated with economic growth in other studies. As noted in the introduction to this section, the early studies by Alesina and Rodrik,[33] Persson and Tabellini[34] and Perrotti[35] found that countries with lower levels of inequality tended to grow more quickly.

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[31] For the empirical and theoretical literature on the link between inequality and economic growth, see Osberg, L. (1995). "The Equity/Efficiency Trade-Off in Retrospect." Keynote address to conference on "Economic Growth and Income Inequality." Laurentian University, Sudbury: Ontario, March 17, 1995; and Lloyd-Ellis, H. (2003). "On the Impact of Inequality on Productivity Growth in the Short and Long Term: A Synthesis," *Canadian Public Policy* 29(Supplement): S65-S86.

[32] For a more comprehensive list of studies of income inequality and economic growth using international time series and cross section data, see Neves, P., S. Silva, and O. Afonso (2012). "A Meta-Analytical Assessment of the Effects of Inequality on Growth," CEF UP Working Paper, 2012-14, Centro de Economia e Finanças da UP: Portugal.

[33] Alesina and Rodrik (1994). op. cit.

[34] Persson and Tabellini (1994). op. cit.

[35] Perotti, R. (1996). "Growth, Income Distribution, and Democracy: What the Data Say," *Journal of Economic Growth* 1: 149–187.

TABLE 1: EMPIRICAL STUDIES OF INEQUALITY AND GROWTH BASED ON INTERNATIONAL CROSS-SECTION AND TIME SERIES DATA

Key Studies Arranged by Date	Data Used	Conclusion Regarding Effect of Inequality on Growth	Other Conditioning Variables
Alesina and Rodrik (1994)	Cross-section data on 46 to 70 countries from 1970 to 1985. Gini coefficients on land distribution (for 54 countries around 1960) and income.	Greater initial inequality in the distribution of land and income is associated with slower growth over the subsequent 25 years.	Initial per-capita income, primary school enrolment ratio, and a democracy dummy variable.
Persson and Tabellini (1994): Historical Evidence	Nine countries: Austria, Denmark, Finland, Germany, the Netherlands, Norway, Sweden, the US and the UK, 1830 to 1985, growth rates calculated over 20-year periods (57 observations). Inequality measure is the share of income of the top 20 per cent of the population (38 observations).	Coefficient on the income share of the top 20 per cent is negative and statistically significant.	Political participation (share of the population that is not eligible to vote), schooling (a weighted average of education levels of the population), a measure of economic development (the gap between GDP per capita and highest GDP per capita at that date in the nine countries).
Persson and Tabellini (1994): Post-WW II Data	56 countries, growth rates calculated from 1960-1985; income inequality measure is the income share of the third quintile.	A larger income share of the middle quintile is associated with a higher growth rate in democracies but not significant in non-democracies.	Percentage of population attending primary schools, dummy variable for whether country is democracy, initial GDP per capita in 1960.
Perotti (1996)	Cross-section data for 67 countries, 1960 to 1985. Inequality measure is the share of the income in the third and fourth quintiles.	In the baseline model, a one standard deviation increase in the middle-income group's share is associated with a 0.6 per cent increase in the growth rate. (Table 4, page 160).	Basic model includes per-capita GDP, the average years of secondary schooling in the male and female population, and the purchasing power parity value of the investment deflator relative to the US (a proxy for capital market distortions) all measured in 1960. Other variables include share of population over age 65, urbanization rates, regional dummies, and life expectancy.
Li and Zou (1998)	Panel data from 46 countries, five-year averages for growth rates and other variables, 217 observations.	"Our baseline estimations and the sensitivity analysis have shown that income inequality is positively, and very often significantly, associated with economic growth." p.332	Initial or lagged GDP, urbanization rate, population growth rate, investment-to-GDP ratio, financial market development, exports to GDP, primary school enrolment ratio, back market currency premium, and democracy dummy variable.
Barro (2000)	Panel data from roughly 100 countries from 1960 to 1995, with growth rates calculated for three time periods 1965-75, 1975-85, and 1985-95. Gini coefficient used as measure of inequality.	Inequality retards growth in poor countries (less than $2000 US per-capita GDP in 1985) but inequality promotes growth in high-income countries.	Log of GDP per capita at beginning of period and squared value, government consumption to GDP, rule of law index, democracy index and squared value, inflation rate, years of schooling, log of the fertility rate, growth rate of the terms of trade. Country and time period dummy variables.
Forbes (2000)	Panel data for 45 countries with growth rates calculated over five-year periods from 1966-95. A total of 180 observations. Gini coefficient used as measure of inequality.	"A 10-point increase in a country's Gini coefficient is correlated with a 1.3 per cent increase in average annual growth over the next five years" p.878 See Table 3 page 877. "Countries may face a trade-off between reducing inequality and improving growth performance." p.885	Log of real GNP per capita in 1987 dollars, measures of female and male education levels, price level of investment.

The Persson and Tabellini study, in particular, found evidence in support of their political economy model. They estimated regression equations on two sets of data — a historical data series from 1830 to 1985 for nine countries and a post-war data series on 56 countries from 1960 to 1985. With the historical series, the coefficient for the income share of the top 20 per cent was negative and statistically significant, and they interpreted this as indicating that a more unequal income distribution reduces growth rates by increasing pressure for redistribution. However, one of their key political economy variables, the share of the population that was eligible to vote, did not have a statistically significant effect on growth as predicted by their model. With the post-war data set, the estimated coefficient on the income share of the middle class (the third quintile) was positive and statistically significant in democracies, but not in non-democracies. They interpret this as further evidence in support of their model, because a larger income share for the middle class would mean reduced pressures for redistribution in a democracy, but might have little effect on the policies of an oligarchy or dictatorship. Overall, Persson and Tabellini conclude that, "Equality affects growth by promoting investment, and this effect is present only in democracies."[36]

The Persson and Tabellini results on the differences between democracies and non-democracies — which seem to provide support for the political economy model of the link between inequality and growth — have been challenged by the authors of the other studies that found a positive association between inequality and growth. Alesina and Rodrik rejected "the hypothesis that the relationship between inequality and growth is different between democracies and non-democracies."[37] They argue that the political economy model does not predict systematic differences between democracies and non-democracies, because non-democratic regimes are subject to the same pressures to satisfy the demands of the middle class as democratic governments. They attributed the difference between their result and the Persson and Tabellini results to differences in the measures of inequality and definitions used to define democratic countries. Perotti[38] also concluded that democracy does not affect the relationship between growth and inequality. He attributed the differential effects found by Persson and Tabellini to the fact that most democracies are high-income countries and non-democracies were low-income countries. Furthermore, he found little evidence of a negative association between the middle-income group's share of income and spending on health, social security, and education or marginal tax rates. Thus one of the main pieces of statistical evidence used to support the Persson and Tabellini political economy model — the differential link between inequality and growth in democratic and non-democratic countries — is highly contested.

The early econometric studies concluded that a more equal income distribution promotes economic growth, based on cross-sectional data from a large number of countries with widely varying levels of economic development and inequality. The most comprehensive of the early international cross-section studies was by Perotti, who undertook a detailed examination of the links between inequality and growth from fiscal policies, social and political instability, and capital market imperfections affecting human capital investment, and education and fertility decisions. His overall conclusion was that the link between inequality, social and political instability, and economic growth was strong and that "more equal societies have lower fertility rates and higher rates of investment in education. Both are reflected in higher rates of growth."[39]

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[36] Persson and Tabellini (1994). op. cit. p. 615.

[37] Alesina and Rodrik (1994). op. cit. p. 481.

[38] Perotti (1996). op. cit.

[39] Ibid. p. 182.

Within a few years of the publication of the studies discussed above, Li and Zhou,[40] Barro,[41] and Forbes[42] challenged these results. Li and Zhou used panel data from 46 countries and concluded that, "income inequality is positively, and very often significantly, associated with economic growth."[43] However, when they estimated cross-section regression equations based on average annual growth rates from 1960 to 1990 for between 34 to 42 countries, the Gini index had negative and statistically significant coefficients as in the other studies that used cross-section estimation, such as Alesina and Rodrik.[44] Thus they attributed the positive association of inequality and growth in the earlier studies to the use of cross-section as opposed to panel data sets.

Robert Barro is one of the pioneers of empirical growth literature, and his study is a major challenge to the earlier results. Barro[45] used data from approximately 100 countries to estimate a model of their growth rates over three 10-year time periods. He found that the relationship between growth rates and inequality, as measured by the Gini coefficient, was non-linear. In particular, he found that more inequality was associated with reduced growth rates in low-income countries and higher growth rates in high-income or developed countries. He also found that the coefficient of the Gini coefficient was negative and statistically significant in the entire sample of countries when a measure of the countries' fertility rate was omitted.[46] Thus countries with higher fertility rates (often less-developed countries) also have higher inequality and the omission of the fertility rates in earlier studies may have introduced a negative bias in their estimates for the effects of inequality on growth.

Forbes also contributed to the revisionist view of inequality and growth. By limiting her study to a panel of 45 countries with reasonably good-quality income distribution data, and by using estimation methods that took into account unobserved differences across countries that are not reflected in the conventional set of conditioning variables, she found that a "10-point increase in a country's Gini coefficient is correlated with a 1.3 per cent increase in average annual growth over the next five years."[47] She interpreted this as indicating a "short-run relationship between inequality and growth within a given country," and that it did not "directly contradict the previously reported long-run negative relationship across countries."[48]

Perhaps not surprising anti-revisionist studies have begun to appear. Berg and Ostry[49] report on a study that found that inequality affects the length of spells of relatively rapid growth, such that a 10 per cent reduction in inequality increases the expected length of a growth spurt by 50 per cent.

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[40] Li, H., and H. Zou (1998). "Income Inequality Is Not Harmful for Growth: Theory and Evidence," *Review of Development Economics* 2: 318–334.

[41] Barro (2000). op. cit.

[42] Forbes, K., (2000). "A reassessment of the relationship between inequality and growth," *American Economic Review* 90: 869-887.

[43] Li and Zhou (1998). op. cit. p. 332.

[44] Alesina and Rodrik (1994). op. cit.

[45] Barro (2000). op. cit.

[46] Perotti (1996). op. cit. also emphasizes the link between income inequality, fertility rates and economic growth.

[47] Forbes (2000). op. cit. p. 878.

[48] Ibid. p. 871.

[49] Berg, A. and J. Ostry (2011). "Inequality and Unsustainable Growth: Two Sides of the Same Coin?" IMF Staff Discussion Note, SDN/11/08.

Neves, Silva, and Afonso[50] have conducted a meta-analysis of 25 econometric studies of growth and inequality that used international cross-section and time series data. They performed a statistical analysis of 45 estimates of the impact of inequality on growth from these studies. Many of their conclusions reinforce the impressions derived from the less formal review of the literature presented here. In particular, they concluded that studies based on cross-section data typically report a negative effect of inequality on growth, while panel studies yield more diverse results. They also found that regional dummies in regression equations reduced the impact of inequality, and that the impact of inequality on growth is more robust in developing countries. Neves, Silva and Afonso also reported evidence of a publication bias — journals are more likely to publish papers with statistically significant results — and a publication cycle "according to which negative and positive effects are reported following an expected cycle of fashion and novelty."[51] Their overall conclusion, based on their statistical analysis of the studies, is that "the overall impact of inequality on growth is insignificant, both statistically and economically…"[52]

Studies Using Panel Data for the US States

While studies that used data drawn from countries with levels of economic development ranging from Cameroon to Canada are widely cited, the policy conclusions that can be drawn from them are limited, especially for developed countries. Of potentially greater relevance are the recent studies of the link between inequality and economic growth among US states. Partridge[53] studied the link between inequality and the growth rates of US states over three 10-year periods from 1960 to 1990. His study included two measures of inequality at the beginning of each of these 10-year periods — the Gini coefficient of before-tax family income based on census data and the income share of the third quintile (the middle class). His econometric results indicated that both inequality measures had positive and statistically significant coefficient effects on growth rates, even though the two inequality measures were negatively correlated in his sample (a higher income share for the middle class usually implies a lower Gini coefficient). Thus higher inequality as measured by a higher Gini coefficient was associated with a higher state growth rate, but this effect is holding the middle-income classes share constant, and therefore reflects the effects of increases in the income shares of the top quintiles at the expense of the income shares in the lowest-income groups. He interpreted the positive effect on growth of the income share of the third quintile as consistent with the Persson and Tabellini model's emphasis on the deleterious effects of political pressures to redistribute income in societies with a weak middle class.

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[50] Neva, Silva and Afonso (2012). op. cit.

[51] Ibid. p. 28.

[52] Ibid. p.3.

[53] Partridge, M. D. (1997). "Is Inequality Harmful for Growth? Comment." *American Economic Review* 87: 1019–32.

Partridge's "semi-revisionist" study was subject to a major critique by Panizza.[54] He used data for US states for the years 1940 to 1990 with the Gini coefficients and the income share of the third quintile based on tax data on incomes instead of census data. He also argued that since most of the variation in the Gini coefficient is between states, the fixed-effects estimation technique may yield unstable and unreliable results.[55] In his regression results, the Gini indices' estimated coefficients were often negative and statistically significant and he concluded that, "the cross-state relationship between inequality and growth is not robust to small changes in the data or econometric specification."[56] Partridge defended his earlier results and reiterated the importance of including fixed effects "to eliminate an omitted-variable bias that occurs if there are unmeasured time-*invariant* factors correlated with the explanatory variables…" although he acknowledges that fixed-effects methods "may produce inaccurate results for measures that mostly vary cross-sectionally" and that "this problem is especially acute for income distribution."[57]

While the Partridge and Panizza papers have raised questions about the appropriate regression techniques to use in studies using panel data on growth rates and inequality measures, two recent papers by Frank[58] and Huang and Yeh[59] continue to use fixed-effects regression techniques. Frank[60] used a variety of inequality measures constructed from tax data to examine the relationship between inequality and the log of real per-capita income in US states. He found that the income share of the top one per cent, as well as the Atkinson, Entropy, and Gini indices of income inequality, were positively associated with higher levels of economic development at the state level. Huang and Yeh,[61] using the same database as Frank, found that there is a positive and significant relationship between income inequality and growth for US states over the period 1945-2004. Thus, while by no means conclusive, the results of the empirical studies at the state level in the US support the view that more income inequality is associated with faster economic growth.

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[54] Panizza, U. (2002). "Income Inequality and Economic Growth: Evidence from American Data," *Journal of Economic Growth* 7: 25–41.

[55] For a critique of the use of fixed effects in growth regressions, see Quah, D. (2001). "Some Simple Arithmetic on How Income Inequality and Economic Growth Matter," discussion paper, LSE Economics Department.

[56] Panizza (2002). op. cit. p. 37.

[57] Partridge, M. D. (2005). "Does Income Distribution Affect US State Economic Growth?" *Journal of Regional Science* 45: 363–94, p. 371

[58] Frank, M. (2009). "Inequality and Growth in the United States: Evidence From a New State-Level Panel of Income Inequality Measures," *Economic Inquiry* 47(1): 55-68.

[59] Huang, Ho-Chuan and Yeh, Chih-Chuan (2012). "A reassessment of inequality and growth in the United States," *Applied Economics Letters* 19(3): 289-295.

[60] Frank (2009). op. cit.

[61] Huang and Yeh (2012). op. cit.

TABLE 2: EMPIRICAL STUDIES OF INEQUALITY AND GROWTH BASED ON PANEL DATA FROM US STATES

Key Studies Arranged by Date	Data Used	Conclusion Regarding Effect of Inequality on Growth	Other Conditioning Variables
Partridge (1997)	Panel data for 48 US states, 1960-90, growth rates of states calculated over 10-year periods, (144 observations). Inequality measures are Gini coefficients of before-tax family income and the income share of the third quintile based on census data.	Gini coefficient is positive and significant. "States with greater overall economic inequality subsequently experienced greater economic growth..." p. 1022 Income share of the third quintile is associated with faster economic growth. (Both variables have positive coefficients either separately or together in the same regression.)	Labour force skills (percentages with high school and four-year college degrees), initial real per-capita income, measures of the states' industrial mix from employment shares, state and local public welfare expenditures, state and local tax rates, percentage of population employed in agriculture, time dummy variables, regional dummy variables.
Panizza (2002)	Panel data for the US states, 1940-90, with 10- and 20-year growth rates. Gini coefficients based on tax data on incomes and income share of the third quintile.	"A one standard deviation decrease in the Gini index is associated with a 0.2-percentage-point increase in average annual growth over the next 10 years." p.34 (based on col. 5 and 6 of Table 7)	Percentages of adults with high school and college degrees, fraction of the population living in urban areas, percentage of the population over age 65, regional dummy variables, state and time dummy variables, initial income.
Partridge (2005)	Panel data for 48 US states, 1960-2000, growth rate of per-capita personal income over 10-year periods and over a 40-year cross-section. Gini coefficient and income share of the third quintile.	"The middle income-class share and overall inequality are positively related to long-run growth." p.363	Same as in Partridge (1997)
Frank (2009)	Annual panel data for 48 US states, 1945-2004. (2,784 observations). Log of real state per-capita income. Various measures of inequality (top decile share, top one per cent share, Gini, Atkinson, and Entropy indices) based on tax data.	"The long-run relationship between inequality and growth is positive." p.55 "Top one per cent share, Atkinson indices Entropy, and Gini coefficient all show positive effects of inequality on long-run growth." Table 3, p.63	Real income per capita, high school and college attainment, industrial composition of employment, fixed time and state effects.
Huang and Yeh (2012)	Same data set as in Frank (2012) but with growth rate of real per-capita income by state.	A two standard deviation increase in the income share of the top decile is associated with a 2.4 per cent increase in the growth rate.	Same as in Frank (2009).

THE EFFECTS OF INEQUALITY AND FISCAL REDISTRIBUTION ON PROVINCIAL GROWTH RATES

While the results from the previous econometric studies are diverse, contested, and difficult to interpret in a simple causal framework, the recent studies based on data from US states support the notion that more inequality is associated with faster economic growth. On the basis of these studies, some might make the intellectual leap that there is a trade-off — policies that reduce inequality come at the expense of economic growth. Given the results of the US studies, it is interesting to see if they extend to the Canadian provinces. In this section, we report on some statistical tests of the link between income inequality and provincial growth rates in Canada. The econometric analysis builds on Ferede and Dahlby,[62] in that it uses the same data on provincial growth rates of real per-capita GDP over five-year periods from 1977 to 2006 and the same set of conditioning variables, but now with the addition of Gini coefficients at the start of each five-year period. The conditioning variables include the log of the initial GDP per capita, the investment-to-GDP ratio, the US growth rate's interaction with the GDP share, a measure of the growth rate of the province's major exports, the population growth rate, the corporate tax rate, a dummy variable for how provinces with a retail sales tax rate interacted with the sales tax rate (to reflect the distortionary effects of retail sales taxes because they fall on business inputs), the ratio of government expenditure to GDP and the ratio of the provincial government's deficit to GDP. See Table 3 for summary statistics on the key variables used in the regression models.

TABLE 3: SUMMARY STATISTICS, 1977-2006

Symbol	Variable Name	Mean	Std. Deviation	Minimum	Maximum
dlpcgdp	Real GDP per capita growth rate	0.0173	0.0115	-0.0102	0.0524
ginim	Inequality[a]	0.4871	0.0327	0.4180	0.5580
ginitot	Inequality[b]	0.3898	0.0188	0.3540	0.4400
ginitax	Inequality[c]	0.3566	0.0163	0.3250	0.4080
ginired	Inequality[d]	0.1305	0.0339	0.0590	0.2150
lpcyo	Log of initial real GDP per capita (1997 dollars)	10.0472	0.2655	9.4327	10.6029
pvtinvgdp	Private investment-to-GDP ratio	0.1287	0.0456	0.0710	0.2774
popg	Population growth rate	0.0072	0.0089	-0.0138	0.0415
L1. expodef	Lagged export price growth rate	0.0720	0.1160	-0.1327	0.4642
usgrowshare	US GDP growth rate[e]	0.0031	0.0039	0.0001	0.0147
govgdpo	Government consumption-to-GDP ratio	0.2988	0.0555	0.1728	0.4159
defgdpi	Deficit-to-GDP ratio	-0.0151	0.0201	-0.0687	0.0323
citprovav	Corporate income tax rate	0.1427	0.0263	0.0605	0.1700
pstavnew3	Sales tax rate X RSTdummy	0.0625	0.0403	0.0000	0.1200

Notes: The number of observations is 60.

[a] *Measured using Gini coefficient for market income (all family units).*

[b] *Measured using Gini coefficient for total income (all family units).*

[c] *Measured using Gini coefficient for after-tax income (all family units).*

[d] *Measured using the difference between Gini coefficients for market income and after-tax income.*

[e] *This variable is the US growth rate's interaction with the respective GDP shares of provinces.*

[62] Ferede, E. and B. Dahlby (2012). "The Impact of Tax Cuts on Economic Growth: Evidence from Canadian Provinces," *National Tax Journal* 65(3): 563-594.

The use of Canadian data at the provincial level allows us to explore whether it is inequality in market income, total income, or disposable income that affects economic growth at the provincial level.[63] Table A1 in Appendix 1 shows the correlation matrix for the growth rates (dlpcgdp), the three versions of the Gini index (ginimar, ginitot, and ginidis) and the other conditioning variables. First note that none of the simple correlation coefficients between the Gini indices and the growth rate variable are large. They range between 0.0389 and -0.0338. The highest correlation coefficients between the Gini indices and the conditioning variables are with the log of per-capita GDP, indicating that a higher *level* of provincial output is associated with more inequality with the correlation coefficients varying between 0.7172 (for total income) and 0.0503 (for market income). The positive correlation coefficients between these measures of income inequality and provincial economic development suggests that in Canada we may have an inverted Kuznets curve — provinces with more economic development have more inequality. While this is an interesting observation, our main focus is on the link between inequality and growth and not the link between the level of income and inequality.

The only other conditioning variable with consistently large correlation coefficients with the Gini indices is the government spending-to-GDP ratio. The correlation coefficient between this variable and the market income Gini is 0.3834. More market inequality is associated with more government spending, although the association is not particularly strong. For the other Gini coefficients, the correlation coefficients are negative. Correlation coefficients between government spending and the total and disposable income Ginis are -0.4892 and -0.5918 respectively, indicating that total and disposable income inequality is higher in provinces with lower government spending. All of this is consistent with the view that government spending helps to reduce disposable income inequality.

Tables 4, 5, and 6 contain our econometric estimates of the relationship between the three measures of income inequality and provincial economic growth rates. Table 4 shows the results with the market income Gini. In the absence of other conditioning variables, there is a weakly significant positive relationship between market income inequality and economic growth as shown in column (1). In the other columns we enter the conditioning variables. In columns (2) and (3), we include the non-fiscal conditioning variables; the coefficients of the market income Gini are positive but no longer statistically significant. In columns (4) and (5) we also include the fiscal variables. Now the market income Gini coefficients are negative, close to zero and relatively large standard errors. The other variables in the model have broadly the same coefficient estimates as in the regressions in Ferede and Dahlby[64] that did not include the Gini coefficients. Thus, these econometric results do not indicate any strong linkage between market income inequality and the growth rate of a province over the subsequent five-year period.

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[63] Total income is market income plus government transfers. Disposable income is total income minus personal income taxes and social security contributions levied on individuals.

[64] Ferede and Dahlby. (2012). op. cit.

TABLE 4: GROWTH AND MARKET INCOME INEQUALITY REGRESSIONS, 1977-2006

	(1) OLS	(2) OLS	(3) 2SLS	(4) 2SLS	(5) Fuller (1)
Gini coefficient for market income	0.232** (0.089)	0.149 (0.107)	0.157 (0.121)	-0.004 (0.127)	-0.004 (0.127)
Log of initial GDP per capita		-0.056** (0.023)	-0.056* (0.028)	-0.057** (0.028)	-0.057** (0.028)
Investment to GDP ratio		0.079 (0.083)	0.141 (0.121)	0.198** (0.090)	0.198** (0.090)
US growth rate X GDP share		3.013 (2.018)	3.242 (2.081)	5.438** (2.255)	5.433** (2.252)
Lagged export price growth rate		-0.013 (0.018)	-0.016 (0.017)	-0.015 (0.022)	-0.015 (0.022)
Population growth rate		0.115 (0.307)	0.031 0.0328	0.110 (0.316)	0.110 (0.316)
Corporate tax rate				-0.181* (0.102)	-0.180* (0.102)
RSTdummy X Sales tax rate				-0.122*** (0.044)	-0.122*** (0.044)
Government expenditure-to-GDP ratio				0.019 (0.107)	0.019 (0.107)
Deficit-to-GDP ratio				-0.158* (0.086)	-0.158* (0.086)
Constant	-0.107** (0.044)	0.504 (0.265)	0.489 (0.337)	0.593 (0.328)	0.593 (0.328)
Provincial effects	Yes	Yes	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes	Yes
Over-identification test (p-value)			0.783	0.798	0.798
Observations	60	60	60	60	60
Adj. R-Squared	0.413	0.488	0.478	0.455	0.455

Notes: Figures in parentheses are robust standard errors. Asterisks denote significance at the one per cent (***), five per cent (**), and 10 per cent (*) levels. In columns (3), the log of initial GDP per capita and investment ratios are treated as endogenous. In columns (4) and (5), we use the same instruments as in column (3) and we also treat the government consumption-to-GDP ratio, corporate income and sales tax rates as endogenous. See the text for a description of the instruments.

TABLE 5: GROWTH AND TOTAL INCOME INEQUALITY REGRESSIONS, 1977-2006

	(1) OLS	(2) OLS	(3) 2SLS	(4) 2SLS	(5) Fuller (1)
Gini coefficient for total income	0.129 (0.135)	-0.010 (0.144)	-0.014 (0.162)	-0.145 (0.138)	-0.145 (0.138)
Log of initial GDP per capita		-0.065** (0.028)	-0.078** (0.037)	-0.070** (0.031)	-0.070** (0.031)
Investment-to-GDP ratio		0.069 (0.083)	0.154 (0.115)	0.198** (0.087)	0.198** (0.087)
US growth rate X GDP share		3.335* (1.891)	3.615* (1.863)	6.063*** (2.238)	6.060*** (2.236)
Lagged export price growth rate		-0.018 (0.019)	-0.023 (0.018)	-0.016 (0.021)	-0.016 (0.021)
Population growth rate		0.127 (0.316)	0.003 (0.331)	0.140 (0.318)	0.140 (0.318)
Corporate tax rate				-0.194** (0.095)	-0.194** (0.095)
RSTdummy X Sales tax rate				-0.130*** (0.044)	-0.130*** (0.044)
Government expenditure-to-GDP ratio				0.033 (0.111)	0.033 (0.111)
Deficit-to-GDP ratio				-0.156* (0.088)	-0.156* (0.088)
Constant	-0.046** (0.057)	0.675** (0.333)	0.805* (0.445)	0.784 (0.360)	0.784 (0.359)
Provincial effects	Yes	Yes	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes	Yes
Over-identification test (p-value)			0.617	0.795	0.795
Observations	60	60	60	60	60
Adj. R-Squared	0.361	0.462	0.436	0.440	0.440

Notes: Figures in parentheses are robust standard errors. Asterisks denote significance at the one per cent (***), five per cent (**), and 10 per cent (*) levels. In columns (3), the log of initial GDP per capita and investment ratio are treated as endogenous. In columns (4) and (5), we use the same instruments as in column (3) and we also treat the government consumption-to-GDP ratio, corporate income and sales tax rates as endogenous. See the text for a description of the instruments.

TABLE 6: GROWTH AND DISPOSABLE INCOME INEQUALITY REGRESSIONS, 1977-2006

	(1) OLS	(2) OLS	(3) 2SLS	(4) 2SLS	(5) 2SLS
Gini coefficient for disposable income	0.185 (0.159)	0.011 (0.169)	-0.001 (0.192)	-0.138 (0.157)	-0.138 (0.158)
Log of initial GDP per capita		-0.064** (0.028)	-0.077** (0.038)	-0.068** (0.031)	-0.068** (0.031)
Investment to GDP ratio		0.071 (0.082)	0.154 (0.116)	0.199** (0.087)	0.199** (0.087)
US growth rate X GDP share		3.281* (1.904)	3.578* (1.874)	5.896*** (2.187)	5.906*** (2.192)
Lagged export price growth rate		-0.018 (0.019)	-0.023 (0.018)	-0.016 (0.022)	-0.016 (0.022)
Population growth rate		0.123 (0.317)	0.003 0.332	0.130 (0.318)	0.130 (0.318)
Corporate tax rate				-0.189* (0.095)	-0.190* (0.096)
RSTdummy X Sales tax rate				-0.128*** (0.043)	-0.128*** (0.043)
Government expenditure-to-GDP ratio				0.033 (0.109)	0.033 (0.110)
Deficit-to-GDP ratio				-0.155* (0.088)	-0.156* (0.088)
Constant	-0.064 (0.062)	0.655 (0.339)	0.782* (0.451)	0.755** (0.368)	0.754** (0.370)
Provincial effects	Yes	Yes	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes	Yes
Over-identification test (p-value)			0.624	0.765	0.766
Observations	60	60	60	60	60
Adj. R-Squared	0.368	0.462	0.438	0.441	0.439

Notes: Figures in parentheses are robust standard errors. Asterisks denote significance at the one per cent (***), five per cent (**), and 10 per cent (*) levels. In columns (3), the log of initial GDP per capita and investment ratio are treated as endogenous. In columns (4) and (5), we use the same instruments as in column (3) and we also treat the government consumption-to-GDP ratio, corporate income and sales tax rates as endogenous. See the text for a description of the instruments.

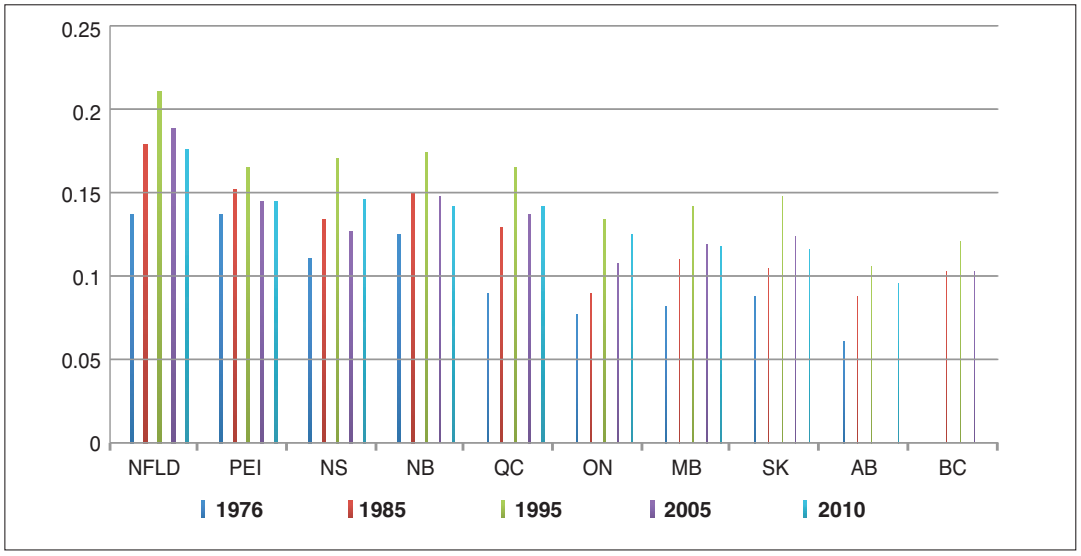
Tables 5 and 6 show similar sets of regression results with the total income and disposable income Gini coefficients as explanatory variables for provincial growth rates. Since the results are similar in qualitative terms to those shown in Table 4 for the market income inequality Gini, we will not comment on them in detail. Thus, in contrast to the recent empirical results at the state level in the US, our econometric results do not support the existence of any significant link between the various measures of income inequality and economic growth at the provincial level in Canada.

While most of the empirical literature has focused on the relationship between income inequality and economic growth, much of the discussion of the link between the two is framed in terms of the effects of income redistribution on economic growth. Redistribution can — according to the models discussed earlier — have a positive effect on growth if the transfers allow low-income households to make investments in education and training that they would not be able to make in the absence of the transfer. On the other hand, more fiscal redistribution

could reduce economic growth to the extent that transfers reduce incentives to work or to move to areas of higher economic activity, or if the taxes that are used to finance them reduce overall investment and output. In this section, we estimate the effects of fiscal redistribution on economic growth.

A natural, albeit rather crude, measure of the overall level of fiscal redistribution is the difference between the market income Gini and the disposable income Gini, since the difference between these two inequality measures reflects the effects of taxes and transfers on the distribution of income.[65] Cash transfers are responsible for 70 per cent of the gap between the market income Gini and the disposable income Gini.[66] Figure 1 shows the level and trend in this measure of fiscal redistribution across provinces from 1976 to 2010. Note that fiscal redistribution is higher in the four Atlantic provinces than in the western provinces. This is not surprising given that many workers in the Atlantic region are regular recipients of EI benefits and that the percentage of the population over age 65 is higher in the Atlantic region than in the western provinces, indicating that there are more Old Age Security (OAS), Guaranteed Income Supplement (GIS) and Canadian Pension Plan (CPP) recipients. Finally average incomes are lower in these provinces, which may reflect more social assistance recipients.

FIGURE 1: FISCAL REDISTRIBUTION BY PROVINCE 1976 TO 2010



Notes: Fiscal redistribution is the difference between the market income Gini coefficient and the disposable income Gini coefficient.

[65] For trends and variations across provinces in this measure of fiscal redistribution, see Richardson, S. (2012). "Some Observations on the Concept and Measurement of Income Inequality," School of Public Policy Communique, Volume 4, No. 1, February; and the Centre for the Study of Living Standards (2012). op. cit. Note that this measure of fiscal redistribution does not include redistribution through in-kind provision of public services such as health care or education.

[66] For an extensive analysis of the trends in these inequality measures in Canada see Sharpe, A. and E. Capeluck (2012). "The Impact of Redistribution on Income Inequality in Canada and the Provinces, 1981-2010," CSLS Research Report 2012-08, Centre for the Study of Living Standards: Ottawa.

This measure of fiscal redistribution peaked in all provinces in the mid-1990s and it was significantly lower in 2010 than in 1995. Figure 2 allows us to compare the level and change in fiscal redistribution in Canada with other OECD countries. Fiscal redistribution in Canada was slightly lower than the average for the 23 OECD countries shown in Figure 2 in both the mid-1990s and the late 2000s. It also shows that the decline in fiscal redistribution in Canada was not unusual. Fiscal redistribution declined in roughly half of these 23 countries in Figure 2. Particularly large reductions in these measures of fiscal redistribution were observed in Finland, Israel, the Netherlands, and Sweden. The underlying causes of these changes in fiscal redistribution — increases in some countries, declines in others and little or no change in others, such as the US — warrant further analysis but are not pursued here.

FIGURE 2: FISCAL REDISTRIBUTION IN OECD COUNTRIES

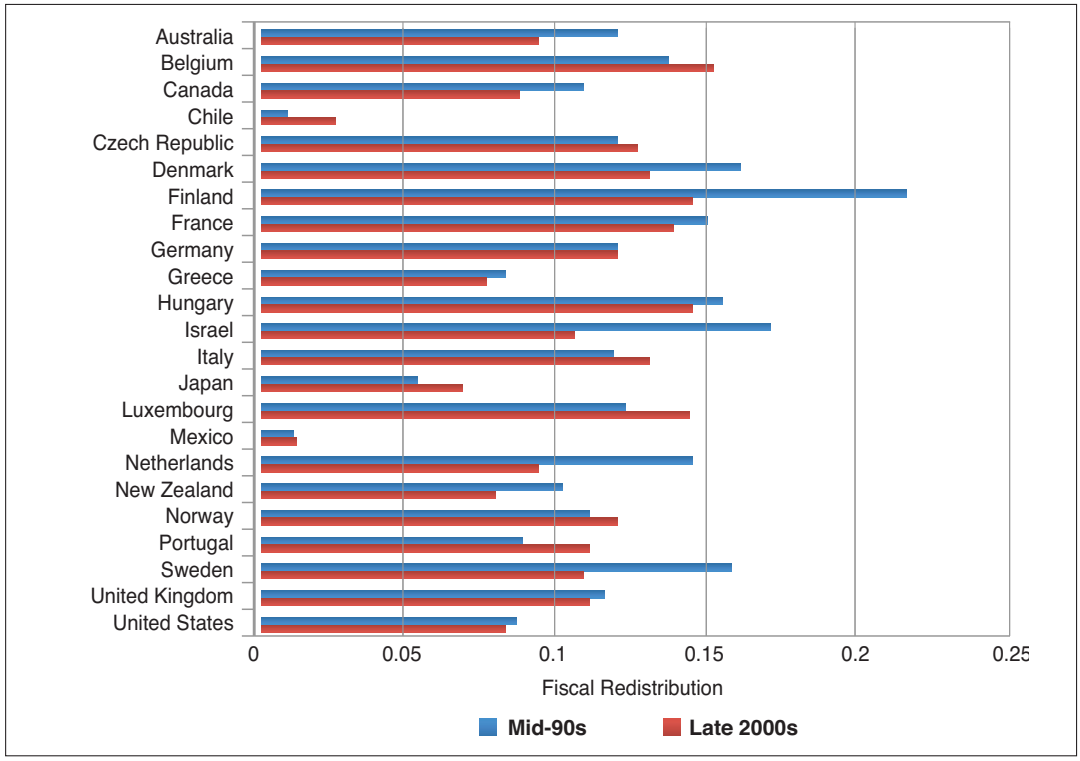


Table A2 indicates that this measure of fiscal redistribution is positively correlated with government spending, which is to be expected given that transfers are a large part of government spending included in our fiscal redistribution measure. Note also fiscal redistribution is negatively correlated with population growth. This suggests that more redistribution occurs in provinces with slower population growth, which may be linked to slower economic growth, although the correlation coefficient between population growth and economic growth in this sample is negative (-0.0871).

In Table 7, we investigate the linkage between this measure of fiscal redistribution and economic growth, using the same conditioning variables used in Tables 4, 5, and 6. Column (1) shows that in the absence of other conditioning variables, more fiscal redistribution at the start of a five-year period is associated with a higher growth rate during that period. When the non-fiscal conditioning variables are added to the regression equations in columns (2) and (3), the coefficient on the fiscal redistribution is positive and statistically significant. In columns (4)

and (5), we include the provincial deficit-to-GDP ratio as an additional explanatory variable to control for provincial governments' budget constraints. Note that our specification excludes tax rates and government spending, with the exception of those used for redistribution purposes as captured by the fiscal redistribution variable. Thus, in columns (4) and (5), the coefficient of the fiscal redistribution variable can be interpreted as the effect of redistributive government spending, or taxes that are financed by either a decrease in non-redistributive spending or an increase in tax rates. The coefficient of fiscal redistribution in column (4) is again positive but statistically significant only at the 10-per cent level. This suggests that fiscal redistribution has only a weak positive effect on growth. Two-stage least squares (2SLS) results may be unreliable if the instruments used are weak. To address this concern, we use the Fuller[67] maximum likelihood (Fuller (1)) estimation method that is robust to the presence of potential problems of weak instruments and preferred to 2SLS in column (5). Now the coefficient of the fiscal redistribution variable is still positive but statistically insignificant. This indicates that the positive effect of fiscal redistribution on growth is not robust.

TABLE 7: GROWTH AND FISCAL REDISTRIBUTION REGRESSIONS, 1977-2006

	(1) OLS	(2) OLS	(3) 2SLS	(4) 2SLS	(5) Fuller (1)
Fiscal redistribution[a]	0.402** (0.162)	0.394** (0.183)	0.389** (0.195)	0.365* (0.215)	0.364 (0.217)
Log of initial GDP per capita		-0.062*** (0.021)	-0.069** (0.026)	-0.068** (0.026)	-0.069** (0.027)
Investment to GDP ratio		0.069 (0.082)	0.125 (0.111)	0.195* (0.108)	0.205* (0.114)
US growth rate X GDP share		3.399* (1.812)	3.585* (1.822)	3.518* (1.884)	3.540* (1.889)
Lagged export price growth rate		-0.007 (0.019)	-0.010 (0.018)	-0.012 (0.018)	-0.012 (0.018)
Population growth rate		0.137 (0.274)	0.057 0.303	0.000 (0.291)	-0.012 (0.018)
Deficit-to-GDP ratio				-0.073 (0.083)	-0.076 (0.085)
Constant	-0.035* (0.018)	0.596 (0.225)	0.658 (0.273)	0.651** (0.281)	0.652** (0.289)
Provincial effects	Yes	Yes	Yes	Yes	Yes
Time effects	Yes	Yes	Yes	Yes	Yes
Over-identification test (p-value)			0.705	0.585	0.592
Observations	60	60	60	60	60
Adj. R-Squared	0.416	0.529	0.519	0.483	0.477

[a] *Fiscal redistribution is the difference between the market income Gini and the disposable income Gini. The dependent variable is the five-year per-capita growth rate of the province.*

Notes: Figures in parentheses are robust standard errors. Asterisks denote significance at the one per cent (***), five per cent (**), and 10 per cent (*) levels. In columns (3)-(5), the log of initial GDP per capita and investment ratio are treated as endogenous. See the text for a description of the instruments.

[67] Fuller, W. A. (1977). "Some properties of a modification of the limited information maximum likelihood estimator." *Econometrica* 45, 939–954.

The regression results in Table 7 provide some weak evidence that more fiscal redistribution increases provincial economic growth, but these results have to be interpreted with care. The largest transfer programs — Employment Insurance (EI), OAS, and GIS — are federal programs financed out of taxes that are levied nation-wide. In addition, for part of the period under study, provincial social assistance payments were matched by federal transfers under the Canada Assistance Plan. Consequently, an increase in fiscal redistribution in a province did not lead to a corresponding increase in that province's taxes that would offset any stimulative effects of the transfers. However, the higher federal taxes that have to be levied to finance more fiscal transfers may reduce growth through disincentive effects in the rest of the country. With this caveat in mind, it is still interesting that fiscal redistribution may have a positive effect on growth through aggregate demand stimulation, and perhaps more speculatively by offsetting capital market imperfections that restrict private sector borrowing by low-income individuals to finance productivity-enhancing investments.

HUMAN CAPITAL FORMATION, PRE-DISTRIBUTION POLICIES, AND ECONOMIC GROWTH

While income redistribution programs, such as Employment Insurance, Social Assistance, Old Age Security and Guaranteed Income Supplement, play an important role in equalizing the distribution of income, perhaps governments' most important impacts on the distribution of income are through labour market policies (such as regulations concerning collective bargaining, public sector pay and minimum wage rates), trade and investment policies, immigration policies, and most importantly education policies. All of these policies affect the distribution of wages generated by the market and could be considered pre-distribution policies to distinguish them from the redistribution programs such as social assistance.

In this section, we focus on governments' most important pre-distribution policy instrument — education. The importance of human capital formation for the growth-inequality nexus has been emphasized by Claudia Goldin and Lawrence Katz in their prize-winning book, *The Race Between Education and Technology*.[68] Goldin and Katz's central thesis is that the increase in earnings inequality in the US since the 1980s is largely due to the mismatch between skilled-biased technological change (e.g., the widespread use of computer and communications technology in the workplace) which has increased the relative demand for highly educated workers and the failure of the US education system to increase the supply of highly skilled workers at the same rate. Their analysis of the US labour market indicates that the demand for skilled workers has grown faster than the supply produced by the education sector, resulting in an increase in the skill premium that workers with advanced education now earn in the US.

[68] Goldin, C. and L. Katz (2008). *The Race Between Education and Technology*, Harvard University Press: Cambridge. For an extensive review and assessment of the Goldin and Katz book, see Acemoglu, D. and D. Autor (2012). "What Does Human Capital Do? A Review of Goldin and Katz's The Race between Education and Technology," *Journal of Economic Literature* 50(2): 426–463.

In their view, this has been a major factor behind the increase in earnings inequality in the US since the mid-1980s.[69] Their analysis of the increase in inequality in the US is based on the broad shifts in the earnings distribution and is not focused on the growth of the income share of the top one per cent. The rise of the income share of the top one per cent and the policy issues related to higher taxes on the top one per cent will be discussed later.

Investment in education plays a central role in modern models of economic growth, not only because it directly increases workers' productivity, but also because it stimulates the creation and adoption of new technologies. While the public generally believes that government provision and financing of education promotes equality of opportunity, theoretical models developed by economists and empirical studies yield conflicting results concerning the effect of education on the earnings distribution.[70] In a major review of 64 empirical studies of the impact of education on earnings inequality, Abdullah et al.[71] found that in the 868 regression equations with aggregate inequality as the dependent variable, education had a positive and statistically significant coefficient in 223 equations, and negative and statistically significant coefficient estimates in 196 equations. In other words, the econometric evidence is mixed to say the least. However, by performing a meta-regression analysis that tried to account for systematic differences in the results based on the data used in the 64 studies, Abdullah et al.[72] concluded that the results from the empirical studies are consistent with education "reducing the income share of the rich and increasing the income share of the poor."[73]

Given the attention that the Goldin-Katz analysis of the skill premium in the US has received, it is interesting to compare the growth rates of human capital in Canada and the US. A broad measure of an economy's human capital is the population's average number of years of schooling. Figure 3 shows the average annual growth rates of this measure of the stock of human capital for Canada and the US over five-year periods from 1950 to 2010.[74] During the

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[69] A model that restricts its analysis to two groups of workers, skilled and unskilled, obviously has its limitations. In particular, as pointed out by Acemoglu and Autor, the model cannot explain the growth of low-wage jobs and the decline in middle-income employment in the US. At least three types of workers or skill levels are required to explain changes in the top, middle and bottom of the income distribution. Nonetheless, the framework developed by Goldin and Katz provides a useful starting point for empirical and policy analysis. Note that a recent study by Beaudry, Green and Sand ((2013). "The Great Reversal in the Demand for Skill and Cognitive Tasks," working paper, Department of Economics, University of British Colombia) has documented a decline in the demand for skilled labour in the US since 2000. However, that study does not indicate the impact that this might have on income inequality in the US.

[70] See for example a model developed by Hendel et al. ((2005) "Educational Opportunity and Income Inequality," *Journal of Public Economics* 89: 841-870) in which individuals have unobservable differences in ability and access to funds to finance education. The provision of a public subsidy makes it easier for high-ability individuals to signal their ability by acquiring education, resulting in a reduction in the wage rates paid to low-ability workers who do not acquire an education.

[71] Abdullah, A., H. Doucouliagos, and E. Manning (2011). "Education and Income Inequality: A Meta-Regression Analysis," working paper, Deakin University.

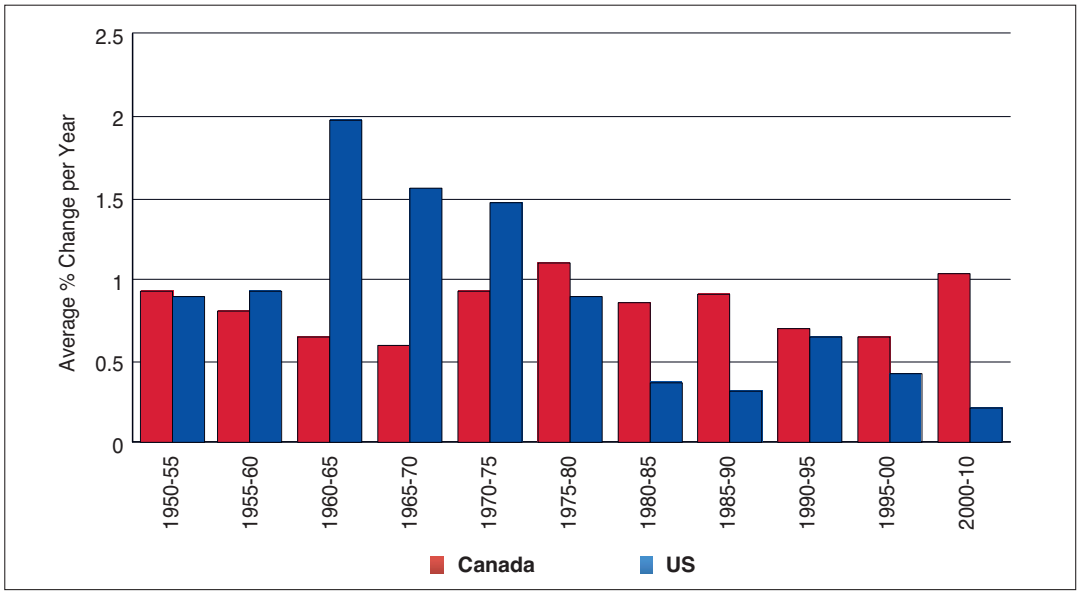
[72] Ibid. p. 24.

[73] For the effect of education spending on inequality, see Sylwester, K. (2002). "Can Education Expenditures Reduce Income Inequality?" *Economics of Education Review* 21: 43-52.

[74] These data are from the Barro-Lee database at http://www.barrolee.com/. The final observation in Figure 3 is based on the average growth rate of the average years of schooling over the 10 years, 2000 to 2010, because the 2005 number for Canada in the Barro-Lee data set seems anomalous and so we have calculated the growth rate over 10 years instead of five years.

1960s and the early 1970s, the stock of human capital increased much faster in the US than in Canada, but since the mid-1970s, average years of schooling have increased at a faster rate in Canada than in the US and the education gap between Canada and the US has closed. These numbers are consistent with Goldin-Katz's observation that there has been a major slowdown in the acquisition of human capital in the US since the mid-1970s. In their view, the slowdown in the acquisition of human capital in the US was responsible for at least some of the increase in earnings inequality. It is interesting to speculate whether the faster rate of growth in the average number of years of schooling in Canada since the mid-1970s has been at least partly responsible for the smaller increase in income inequality in Canada.[75]

FIGURE 3: GROWTH RATES OF THE STOCK OF HUMAN CAPITAL IN CANADA AND THE UNITED STATES



Notes: Average annual percentage change in the average number of years of schooling of the population 25 years and older. Calculation by the authors based on the Barro-Lee (2011) database.

While human capital has grown faster in Canada than in the US, the skill premium has also increased in Canada over the last 30 years. Boudarbat, Lemieux, and Riddell[76] used Canadian census data from 1980 to 2005 to estimate the earnings differentials of workers with different levels of education. They found that after adjusting for work experience, the wage premium for males with a university BA compared to workers with only a high school education increased from 32 per cent in 1980 to 40 per cent in 2005. For females the wage premium increased from 45 per cent in 1980 to 51 per cent in 2005.

The incentives to acquire human capital depend not only on the gross wage premium, but also on the effective public sector subsidies for post-secondary education, and the effective tax rates on the return from investments in higher education through the personal income tax system.[77]

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[75] See Bastagli, F., D. Coady, and S. Gupta (2012). "Income Inequality and Fiscal Policy," IMF Discussion Note, SDN/12/08, Table 1, p. 25. A comparison of the Gini coefficients for advanced economies indicates that the Gini coefficient for Canada increased from 0.284 in 1980 to 0.319 in 2010. Over the same period, the Gini coefficients in the US increased from 0.301 to 0.386.

[76] Boudarbat et al. (2010). op. cit.

[77] This section is based on the review of Burbidge, J. K. Collins, J.B. Davies, and L. Magee (2012). "Effective Tax and Subsidy Rates on Human Capital in Canada," *Canadian Journal of Economics* 45(1): 189–219 in the Canadian Tax Journal (2012) by Bev Dahlby.

The effective tax rate on the return to human capital is largely determined by the progressivity of the tax system and the extent to which students can deduct the direct costs of education from their taxable income. With a progressive tax on personal income, the opportunity cost of acquiring an education — the foregone earnings — is implicitly deducted at a lower tax rate than the tax rate that applies to the post-program earnings. The effective tax rate is therefore higher the more progressive the tax system. The effective subsidy rate is largely determined by government support for higher education institutions. Burbidge et al.[78] have computed the effective tax rate (ETR) and effective subsidy rate (ESR) for college, bachelor's, master's and doctoral programs in 1997, 2000, and 2006. They also calculated the net subsidy rate, ETS — ETR, to show the trend in the tax-subsidy system for the post-secondary education (PSE) system. They found that the ETR for median income earners with bachelor's degrees declined from 12.8 per cent in 1997 to 8.5 per cent in 2006 for males and from 19.9 per cent to 12.0 per cent for females. Over the same period, the decline in real public sector spending on PSE resulted in a reduction in the ESR for males from 15.4 per cent to 9.2 per cent and from 10.6 per cent to 6.2 per cent for females. As a result of these changes, the net subsidy rate for graduates with bachelor's degrees, while still positive, declined for males and especially for females. There was also a decline in the net subsidy rate at the master's and doctorate levels, although the net subsidy rates in 2006 at the doctoral level remained relatively high at 22.7 per cent for males and 32.2 per cent for females.

To the extent that the progressivity of the tax system and the public sector subsidies for higher education influence individuals' decisions to pursue advanced education, the changes in the net subsidy rates documented by Burbidge et al. imply that the incentives to acquire higher education may have been reduced, which may further slow the growth of human capital in Canada and contribute to a further widening of the wage premium earned by workers with a post-secondary education.

Although the level of spending on education may affect earnings inequality through its labour market impacts, the quality and distribution of the spending can also have a major impact on the distribution of earnings and the need (or demand) for fiscal redistribution.[79] One measure of the (low) quality of the education system is the percentage of students at age 15 whose reading score on the PISA test is below Level 2. There were significant differences across provinces in the percentage of students whose PISA reading scores were below low Level 2. In 2000, the percentage of poorly performing students in the Atlantic provinces was above 12.0 per cent, while only 7.8 per cent in Alberta and 8.3 per cent in Quebec. A detailed investigation of the impact of poor reading performance at age 15 on subsequent earnings potential is beyond the scope of this paper, but some tantalizing evidence can be gleaned from Figure 4, where the level of fiscal redistribution for unattached individuals in 2010 is plotted against the percentage of students with PISA scores below Level 2 in 2000. The solid line in the diagram is the OLS regression and there is a significant positive relationship between a provinces' poor performance on the PISA score in 2000 and the extent of fiscal redistribution in 2010.

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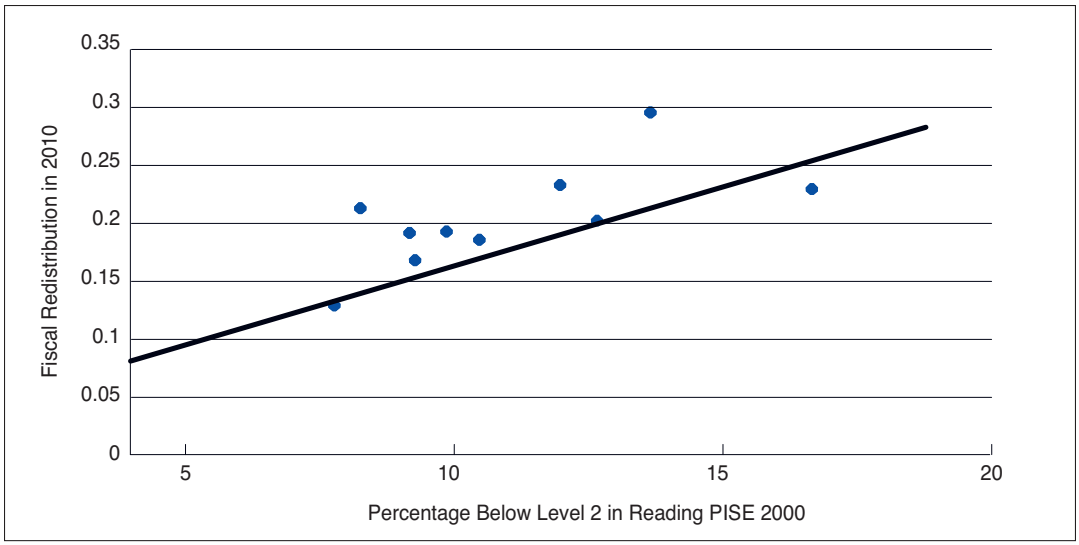
[78] Burbidge et al. (2012). op. cit.

[79] For example, a high percentage of public education spending in Brazil was devoted to public universities, which drew students almost exclusively from the upper income groups. The pattern of public education spending in Brazil was one of the factors that contribute to one of the most unequal income distributions in the world.

Obviously this is rather weak evidence, but it is suggestive that when education systems fail to raise significant numbers of their students above basic standards of literacy, there will be higher subsequent public expenditures on income redistribution programs, such as unemployment insurance and social assistance, to offset their poor labour market performance. Addressing the consistently weak performance of the education systems in Atlantic Canada should be a major public policy priority.

FIGURE 4: FISCAL REDISTRIBUTION IN 2010 AND PISA SCORES IN 2000



Note: Fiscal redistribution is the difference between the market Gini and the disposable income Gini in 2010 for unattached individuals.

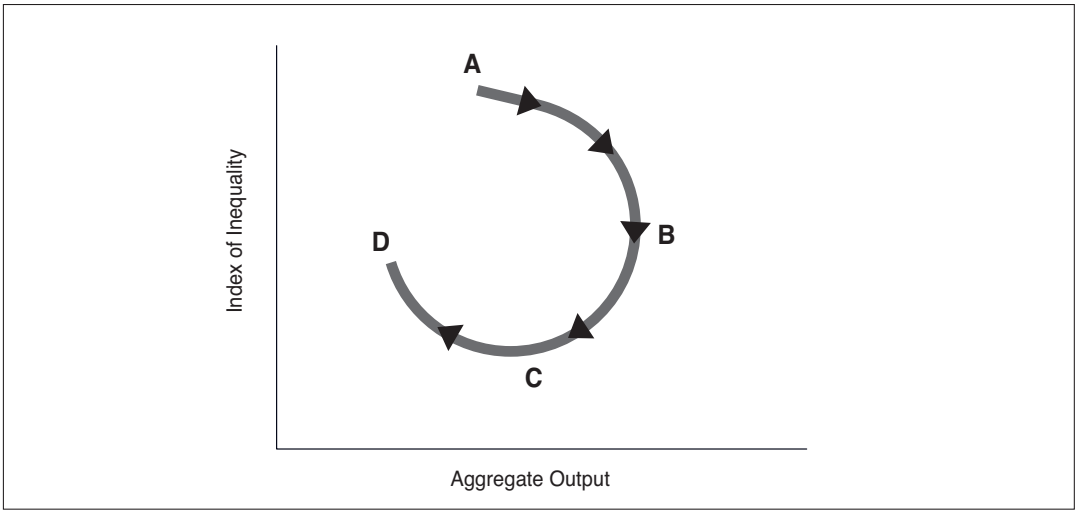
A VIRTUOUS-VICIOUS CIRCLE?

In this section we provide a framework for portraying the effects of government policies on the inequality-growth relation. Figure 5 shows a stylized version of the nexus between earnings inequality and aggregate output generated by a government's education spending and tax policies. It illustrates both the potential for win-win policies that reduce earnings inequality and generate higher aggregate output, as well as the trade-off dilemma that policy makers may face. This stylized V-V circle is based on the Aghion and Bolton[80] growth model, in which capital market imperfections arise because borrowers' limited liability to repay loans to finance education reduces their incentive to expend the effort needed to successfully complete an education program. This moral hazard problem means that interest rates on such loans have to be very high to offset the risk of default on the loans, which discourages borrowing to finance investment in education. In the absence of government intervention there is underinvestment in education that constrains the rate of economic growth. Aghion and Bolton show that lump-sum transfers of wealth to the non-rich, financed by lump-sum taxes on the wealthy, can be growth-enhancing by increasing aggregate investment in education. While this is an interesting result,

[80] Aghion, P and P. Bolton (1997). "A Theory of Trickle-Down Growth and Development," *Review of Economic Studies* 64(2): 151-172.

it lacks policy relevance because governments generally do not levy lump-sum taxes to finance education spending or other redistribution programs. Rather, they levy taxes that distort economic decisions. As Aghion et al. acknowledge in their review of the Aghion and Bolton model, the effect of lump-sum transfers on the growth rate when distortionary taxes are used to finance redistribution "depends on whether the standard [negative] effect of taxation on those individuals with large wealth endowments is smaller or greater than the positive impact [of the transfer] on the effort of those with small endowments [of wealth]."[81]

FIGURE 5: A VIRTUAL-VICIOUS CIRCLE?



Note: The arrows indicate the effects of increasing education subsidies and higher taxes.

We have developed a modified version of the Aghion and Bolton model in which governments levy a proportional income tax to finance a subsidy that covers a fraction of the cost of an education program rather than a lump-sum transfer. We adopt a version of the Goldin and Katz labour market model in which there are two types of workers — skilled workers who have received tertiary education and (for lack of a better term) manual workers. Although simplistic, this model links the acquisition of human capital, which is important for economic growth, to the determination of the wage rate differential between skilled and manual workers which determines earnings inequality. The model adopts an extreme version of capital market imperfections by assuming that individuals cannot borrow funds from private financial institutions to finance higher education. In the absence of any government subsidies for higher education, only the children of the rich, those with family wealth more than W_0, can attend university. Figure 6 shows a stylized distribution of the wealth that families could devote to higher education for their children. The proportion of the workforce that could afford higher education in the absence of government subsidies would be the area to the right of W_0 under the f(W) curve. Figure 7 then shows the determination of the skill premium in the labour market, where s is the wage rate of a skilled worker and m is the wage rate of a manual

[81] Aghion et al. (1999). op. cit. p. 1631.

worker. Given this potential supply of skilled workers, given by the S(γ = 0) curve, the relative wage rates for skilled and manual workers would be $(s/m)_0$, where the negatively sloped demand curve for skilled workers, D, intersects the supply curve.[82] As a result of capital market imperfections and the limited supply of skilled workers, the skill premium and earnings inequality, as measured by the Gini coefficient, would be relatively high.

FIGURE 6: A STYLIZED MODEL OF THE DISTRIBUTION OF WEALTH AND PARTICIPATION IN HIGHER EDUCATION

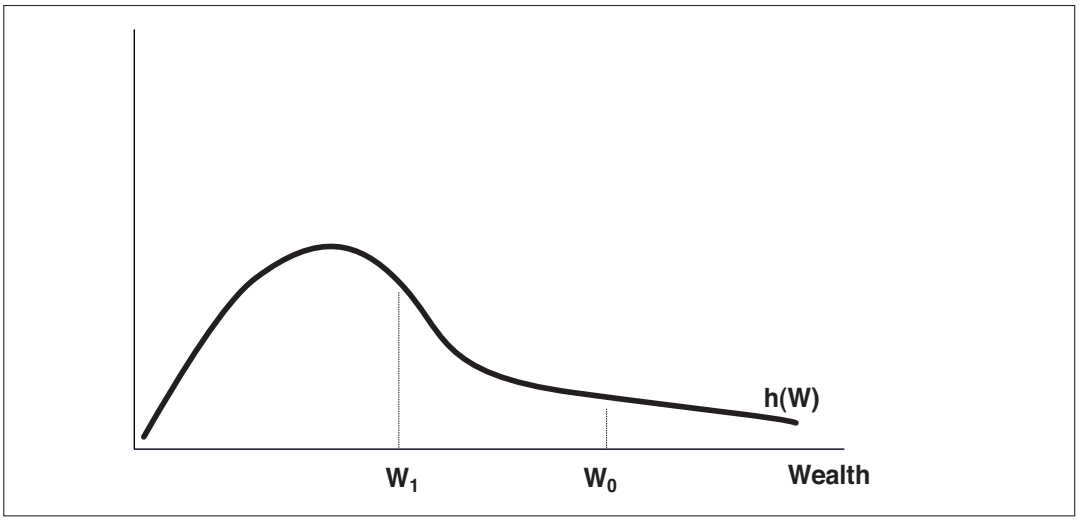
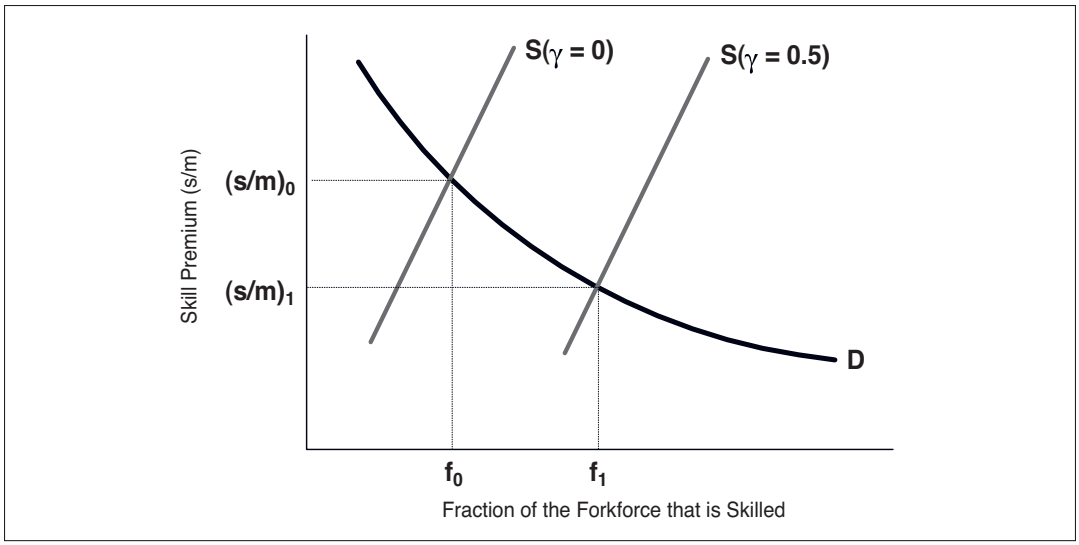


FIGURE 7: THE EFFECT OF AN EDUCATION SUBSIDY ON THE SKILL PREMIUM



[82] The supply curve has a positive slope, because a higher skill premium induces a higher proportion of the offspring of those with enough private wealth to pay for higher education to undertake the effort required that is also required to acquire skills. The demand function for skilled workers is based on the canonical model and is based on a CES production function. It has the following form: $\ln \frac{f}{1-f} = c - \sigma \ln \frac{s}{m}$ where f is the fraction of the workforce that is skilled, c is a constant, and σ is the elasticity of substitution between skilled and unskilled workers. Studies from the US indicate that σ is in the range 1.4 to 1.8. See Acemoglu and Autor (2012). op. cit. p. 435. This implies that the elasticity of the demand for skilled workers with respect to the skill premium is -(1 – f)σ. If f = 0.25 and σ = 1.6, this implies that the elasticity of demand for skilled workers is -1.2.

Now suppose the government subsidizes a fraction, γ, of the cost of higher education and finances this expenditure with a proportional income tax on the earnings of all workers. As a result of this subsidy, families with wealth greater than W_1 in Figure 6 can afford to finance higher education for their children. The potential supply of skilled workers increases because the participation rate in higher education increases. Suppose the subsidy rate is 50 per cent. As shown in Figure 7, there would be a shift in the supply curve of the skilled workers to the right from $S(\gamma = 0)$ to $S(\gamma = 0.5)$. The skill premium would fall to $(s/m)_1$, and earnings inequality would decline. Although the reduction in the skill premium and the increase in the income tax rate needed to finance the government's subsidy for education would reduce the incentive to acquire a higher education, we would expect that the fraction of the labour force that would acquire skills would increase to f_1. In addition to the reduction in inequality, one would expect the total output of the economy to increase, because the expansion of the number of high-productivity skilled workers would more than offset the decline in manual workers. Thus the introduction of a subsidy for higher education, financed by a proportional tax on earnings, could lead to a win-win situation, a reduction in inequality and an increase in total output. Not only would inequality fall, but the after-tax wage rates of manual workers could be higher. Even though part of the cost of the education subsidy is paid by manual workers through higher taxes, manual workers could benefit through higher wage rates that more than offset taxes that they have to pay to finance the education of the skilled workers. As shown in Figure 5, there could be some range of government education subsidies and associated tax rates over which earnings inequality declines and total output increases.

A win-win situation, more output and a reduction in earnings inequality, seems possible when a government subsidizes higher education at a relatively low rate. This situation occurs along the AB section of the V-V circle in Figure 5. This happy situation may come to an end at higher subsidy rates because the higher tax rates that have to be levied to finance the education subsidies erode the incentive to exert effort to acquire skills or supply labour. This occurs on the BC segment of the V-V curve in Figure 5, where an increase in the education subsidy may reduce earnings inequality but total output declines. Over this range of subsidies, there is a trade-off between achieving a more equal distribution of incomes and higher aggregate output. Finally, if subsidies are pushed to very high levels and very high tax rates are needed to finance them, output may decline and the disincentives to acquire skills may be so large that the skill premium increases as output falls. This is the vicious CD segment along the V-V circle in Figure 5.

The subsidization of higher education out of general tax revenues is often criticized as a regressive policy because participation rates in higher education are much higher among the children of well-to-do families. For example Stiglitz has argued that: "… since the beneficiaries are mainly children of the middle- and upper-income groups and state taxes are often regressive, the net effect of state support of higher education is redistribution from the poor to the middle- and upper-income groups."[83] In this view, targeted tuition subsidies or bursaries for students from low-income families may be more cost-effective in reducing earnings inequalities than general tuition subsidies. However, one implication of the canonical model is that up to a point, education subsidies financed by a general income tax increase can improve the well-being of the unskilled, even though they do not directly benefit from access

[83] Stiglitz , J. (1973). "Education and Inequality," *The ANNALS of the American Academy of Political and Social Science* 409 (1): 135-145. p. 137.

to education, because the increase in the proportion of the population that is skilled raises the wage rates of unskilled workers. Therefore we need to incorporate general equilibrium effects in assessment of the incidence of education subsidies. The gain in the wages of workers who do not participate in higher education could be estimated from the Goldin-Katz demand functions for skilled workers, and these gains should be taken into account in any analysis of the distribution of the costs and benefits of public subsidies for higher education.

What are the implications of a V-V circle for public policy? Given a V-V circle, where should we be on it? Do our policy choices affect the shape of the circle? These questions are addressed below.

First, given a V-V circle such as the one portrayed in Figure 5, where on the circle would we want to be? If we approach this question from an ethical or normative perspective and if we value, as I believe most people in our society do, both a more equal distribution of income and a greater capacity to produce public and private goods and services, then we would never want to be on either the AB or CD segments of the circle. By moving down the AB segment we get more of both attributes that we value — higher average living standards and greater equality in living standards — and obviously along CD we could also achieve more equality and more output by cutting back on the programs or policies that generate this segment of the circle. Therefore, a society where the vast bulk of the population values both equality and growth should arrange its policies such that it is on the BC segment of the circle, i.e., the trade-off segment. In other words, *a trade-off between equity and growth is not inevitable but it is desirable*. If we are not on the trade-off segment of the circle, then we do not have the socially optimal policies.

Furthermore, on the BC segment of the circle, most people would reject policies that put us either at point B, which maximizes aggregate output or growth, or at point C, which minimizes inequality. The choice of policies affecting the distribution of income is not simply a question of morality as Zoe Williams has asserted in a recent article in *The Guardian*.[84] Some compromise between maximum output and minimum inequality is inevitable because we value both. Where we want to be on the trade-off segment of the circle depends on the strength of our preferences for equality and growth and on how rapidly we have to give up one for the other. The trade-off rate depends on the particular set of policies that we adopt and this is discussed in more detail below. With regard to preferences, we believe that most people approach these questions based on a mixture of motives — self-interest and altruism. The simple political economy models that assume that individuals vote for redistribution policies solely on the basis of self-interest are naive and do not accurately predict the policies that are adopted by governments. There is a strong element of empathy or "there but for the grace of God go I" in most peoples' views about income redistribution policies. In holding this view, we are in good company because Adam Smith emphasized the role of empathy in social interactions in his *Theory of Moral Sentiments*, a work that has been overshadowed by his *Wealth of Nations* but which is now receiving more attention from both scholars and commentators.

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[84] In Williams, Z. (2012). "The Debate About Wealth Must Start with Morals," *The Guardian*, 7 November 2012, the author claims that, "we will not tackle inequality until we start talking about wages that are fair. We cannot make any dent on what is fundamentally a moral issue unless we're prepared to talk about morals."

The income redistribution instruments that a government adopts and how they are financed will determine the equity-output trade-off rate that a society faces. Some programs and the taxes that are used to finance them are more efficient than others, in the sense of involving a lower rate of sacrificing growth in achieving a more equal distribution of income. Education policies (including early childhood programs) are probably among our most efficient means of achieving greater equity for relatively modest sacrifices in aggregate output. Welfare programs, with very high implicit marginal tax rates on earnings by recipients, achieve this goal at a much higher cost in terms of aggregate output, although some form of social safety net is necessary. Other fairness policies, such as minimum wages or living wages, are at best third-best policies.[85] It would be better to beef up earned income tax credits for low-wage workers than introduce the distortions and rigidities that inevitably accompany governments' setting wage rates in labour markets.

The taxes that finance redistribution policies also affect the equity-output trade-off. Ferede and Dahlby[86] and Dahlby and Ferede[87] have shown that the major taxes used to finance governments in Canada — corporate income taxes, personal income taxes, and sales taxes — have different effects on economic growth rates and output. Their analysis of the determinants of provincial growth rates indicates that higher provincial corporate income tax rates and retail sales taxes (which tax business inputs) reduce provincial growth rates in Canada. While the Ferede and Dahlby[88] study did not find a significant growth effect from higher provincial personal income tax rates, Dahlby and Ferede[89] found that personal income tax rate increases have a significant negative effect on the level of output. The marginal cost of public funds (MCF) from personal income tax was calculated in 2011 to range from 1.44 in Alberta to 3.81 in Quebec. The extent to which the MCF is greater than one can be considered an approximation or heuristic measure of the lost output that is incurred by a society when it raises an additional dollar of tax revenue from that source. Calculations of the MCFs for the provincial governments in Canada indicate that among the major sources of revenue, the corporate income tax is the most costly way, in terms of lost output, to raise additional revenues while a broad value-added sales tax is the least costly form. The cost of raising additional revenues through a personal income tax in most cases fell somewhere between that of a corporate income tax and a HST. This ranking of taxes in terms of their impact on output and growth is consistent with the conclusions reached in studies by the OECD[90] and a recent IMF working paper, Acosta-Ormaechea and Yoo (2012),[91,92] except that they also note that tax on real property imposes low efficiency costs on the economy.

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[85] Jackson commentary in G&M and articles in the Guardian.

[86] Ferede and Dahlby. (2012). op. cit;

[87] Dahlby, B. and E. Ferede (2012). "The Effects of Tax Rate Changes on Tax Bases and the Marginal Cost of Public Funds for Canadian Provincial Governments," *International Tax and Public Finance* 19: 844–883.

[88] Ferede and Dahlby (2012). op. cit.

[89] Dahlby and Ferede (2012). op. cit.

[90] OECD (2010). op. cit.

[91] Acosta-Ormaechea, S. and J. Yoo (2012). "Tax Composition and Growth: A Broad Cross-Country Perspective," Fiscal Affairs Department, IMF Working Paper WP/12/257.

[92] The OECD study and Acosta-Ormaechea and Yoo also find that taxes on property impose low efficiency costs on the economy.

However, in contrast to the studies by Ferede and Dahlby and Lee and Gordon ((2005). "Tax Structure and Economic Growth," *Journal of Public Economics* 89 (5-6): 1027-1043), Acosta-Ormaechea and Yoo find that personal income taxes and social security contributions have stronger negative growth effects than corporate income taxes.

The efficiency effects of taxes point to financing the expansion of redistribution programs through sales taxes or at least personal income taxes, and not through high corporate income taxes. But the choice of taxes to finance redistribution also depends on the distribution of the tax burden across different income groups and not just on their impacts on growth and output. While the public generally thinks that the corporate income tax is a progressive tax, borne by the shareholders and senior managers of corporations, economists have emphasized the complex economic interactions and adjustment that ultimately determine the incidence of the corporate income tax. For example, the simple two-sector general equilibrium model of the corporate income tax incidence, which was developed by Harberger[93] for a closed economy with fixed supplies of labour and capital, indicates that the corporate income tax burden could be borne in varying degrees through lower wages or returns to capital depending on the factor intensities of the corporate and non-corporate sectors, the substitutability of the output of these two sectors, and the substitutability of the labour and capital in the two sectors. Based on parameter values for the US in the 1950s, Harberger concluded that the corporate income tax burden fell mainly on the return to capital.

In contrast with Harberger's closed economy assumption, in the last two decades economists have generally adopted an open economy framework in thinking about the incidence of the corporate income tax.[94] In these models, the supply of capital to a small open economy is perfectly elastic at a net rate of return determined on the world capital market. Under the assumption of perfectly competitive markets for labour, capital, and outputs, the burden of a tax on the return to capital is shifted to the inputs in the economy that are relatively fixed in supply, labour and land. Wage rates decline when the corporate income tax rate increases because a tax on the return to capital discourages investment in the economy, which reduces labour productivity. In the absence of any economic rents, the optimal source-based tax on the return to capital, from the perspective of workers, is zero because any tax on capital is borne by labour through a lower wage rate, and tax on wage incomes has a smaller impact on output and employment than a tax on the return to capital.

Recently, economists have moved beyond theoretical models of corporate income tax incidence and started to estimate the effect of the corporate income tax on wage rates. Most of these recent econometric studies suggest that a significant portion of the corporate income tax burden is borne by workers through lower wage rates because an increase in the corporate income tax rate causes a decline in investment, which reduces labour productivity, or because a reduction in after-tax profits reduces economic rents that are paid to workers through a wage bargaining process. Studies by Hassett and Mathur,[95] Desai, Foley and Hines,[96] Felix,[97] Carroll,[98] and

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[93] Harberger, A. (1962). "The Incidence of the Corporation Income Tax," *Journal of Political Economy* 70(3): 215-240.

[94] For a more detailed overview of these models see Gentry, W. (2007). "A Review of the Evidence on the Incidence of the Corporate Income Tax," OTA Paper 101. Office of Tax Analysis, Department of the Treasury, Washington, DC.

[95] Hassett, K. and A. Mathur (2006). "Taxes and Wages," Working Paper #128, American Enterprise Institute for Public Policy Research.

[96] Desai, M., F. Foley, and J. Hines, Jr. (2007). "Labor and Capital Shares of the Corporate Tax Burden: International Evidence," Paper presented at the International Tax Policy Forum and Urban-Brookings Tax Policy Center conference on *Who Pays the Corporate Tax in an Open Economy?* 18 December 2007.

[97] Felix, A. (2007). "Passing the Burden: Corporate Tax Incidence in Open Economies," working paper, Federal Reserve Bank of Kansas City; (2009). "Do State Corporate Income Taxes Reduce Wages?" working paper, Federal Reserve Bank of Kansas City.

[98] Carroll, R. (2009). "Corporate Taxes and Wages: Evidence from the 50 States," Tax Foundation Working Paper No. 8, Tax Foundation: Washington.

Arulampalam, Devereux, and Maffini[99] find that as much as 75 per cent of the corporate income tax burden is borne by workers through lower wage rates. Although none of the literature cited above used Canadian data, studies by Abowd and Lemieux[100] and Gera and Grenier[101] indicate that wage rates in Canada are affected by firms' economic profits. Wage bargaining over a share of the after-tax profits is one of the mechanisms by which a higher corporate income tax rate may be passed on to Canadian workers through lower wage rates. The high cost of raising corporate income tax revenues, in terms of lost economic output, and the likelihood that a substantial share of the burden is borne by workers through lower wage rates, make the corporate income tax a poor choice for financing enriched income redistribution programs.

The lowest-cost source of funds to finance income redistribution programs is general sales taxes, such as the GST levied by the federal government and the HSTs levied by six of the provinces. Public antipathy to a sales tax was clearly demonstrated during the BC referendum on the adoption of the HST in 2011. Because savings rates generally increase as households' annual incomes rise, general sales taxes are viewed as regressive taxes by the general public. While economists often respond to this simplistic view with the rejoinder that savings rates show less variation by income when income is measured over longer periods, such as five or 10 years, a degree of regressivity may still characterize the sales tax, especially if capital market imperfections prevent households from smoothing the burden of a consumption tax over longer periods of time. Any proposal to increase sales taxes has to involve some expansion of the mechanisms to offset the impact of the tax on low-income households. Consequently, increasing sales taxes to finance increases in fiscal redistribution programs may be counterproductive, especially if it leads to very high marginal tax rates on transfer recipients. Although we support increased use of sales taxes in Canada to finance general government spending, using a sales tax to finance enhanced income redistribution programs is probably counterproductive, because in practice it would involve a relatively steep equity-efficiency trade-off.

That leaves the personal income tax as the most attractive source for financing income redistribution programs. The impact of increasing personal income tax rates, especially those in the top income brackets, will be discussed in more detail in the next section. Here we will note that the OECD[102] and others have advocated expansions in the tax base, instead of higher marginal tax rates, as the best way to finance redistribution at a low equity-efficiency trade-off rate. The OECD[103] recommends increasing taxation of carried interest and stock options, as well as reducing tax relief for private pension contributions and capital gains from the sale of a

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[99] Arulampalam, W., M. Devereux, and G. Maffini (2009). "The Direct Incidence of Corporate Income Tax on Wages," WP 09/17, Oxford University Centre for Business Taxation.

[100] Abowd, J. and T. Lemieux (1993). "The Effects of Product Market Competition on Collective Bargaining Agreements: The Case of Foreign Competition in Canada," *Quarterly Journal of Economics* 108(4): 983-1014.

[101] Gera, S. and G. Grenier (1994). "Inter-industry Wage Differentials and Efficiency Wages: Some Canadian Evidence," *Canadian Journal of Economics* 27(1): 81-100.

[102] OECD (2012). "Income inequality and growth: The role of taxes and transfers," *OECD Economics Department Policy Notes*, No. 9. January 2012.

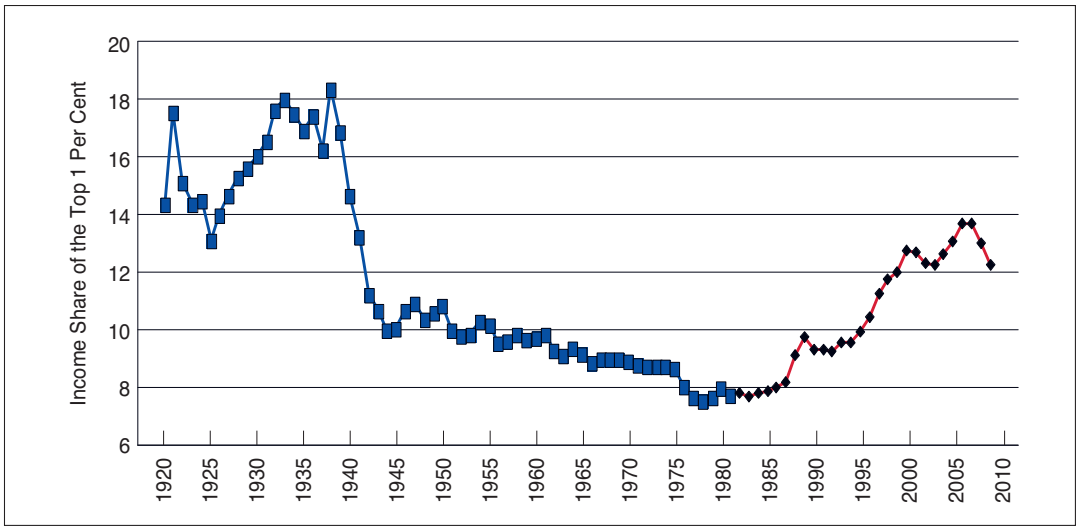
[103] Ibid. p. 10.

principal residence. While higher taxes on carried interest and stock options would be supported by many tax policy experts, the same cannot be said for tax relief for private pension contributions and capital gains on own-occupied housing, which help to move the personal income tax system closer to a personal expenditure tax system. Shifting the tax base from income to consumption is growth-enhancing, and the benefits from tax relief for private pension contributions and capital gains on own-occupied housing are not as concentrated among high-income earners as the stock option and carried interest measures are.

A 75-PER CENT SOLUTION?

The worldwide demonstrations by the Occupy movement have attracted enormous media attention to the increase in the income shares of the top one per cent, 0.1 per cent and 0.01 per cent in the US, Canada, and some other countries. See Atkinson, Piketty, and Saez,[104] Saez and Veall,[105] and Veall[106] and Figure 8. The low average personal income tax rates of high-income taxpayers, such as Mitt Romney and Warren Buffet, have fueled public pressure to raise tax rates on high-income earners. In response to these pressures, the French government, under its recently elected Socialist President François Hollande, tried to increase the tax rate to 75 per cent on incomes in excess of €1 million. Is a 75 per cent top marginal tax rate the solution for Canada?

FIGURE 8: THE INCOME SHARE OF THE TOP ONE PERCENT IN CANADA, 1920 TO 2009



Source: The World Top Incomes Database
http://g-mond.parisschool of economics.eu/topincomes/
Dowloaded 22-10-2012. There is a break in the series in 1982.

[104] Atkinson, A., T. Piketty, and E. Saez (2011). "Top Incomes in the Long Run of History," *Journal of Economic Literature* 49(1): 3–71.

[105] Saez and Veall (2005). op. cit.

[106] Veall (2012). op. cit.

Motivations for increasing tax rates on the rich range from a desire to raise more tax revenue to finance more government spending or tax cuts that benefit the bottom 99 per cent, to a desire to reduce the political influence of the rich by reducing their disposable incomes. Consciously or not, the language used to describe the changes in the income shares earned by the top one per cent reveals some of the motives behind proposals to increase taxes on the rich. The eminent economists and leading researchers on income distribution, Atkinson, Piketty and Saez,[107] repeatedly use the word "captured" to describe the share of the income that has accrued to the top one per cent, where the word "earned" could be used instead. The word "captured" is not usually used to describe the incomes that accrue to middle- to low-wage earners. For example, one rarely hears the phrase: "A worker at minimum wage in Alberta captured $9.75 per hour in 2012." The word "captured" connotes "undeserved" or "unwarranted" and its use, instead of the word "earned," reveals much about the authors' attitudes toward the top one per cent.

If the motivation for higher tax rates on the top one per cent is to raise additional tax revenues to finance more government spending or tax reductions that benefit low- and middle-income earners, then (assuming that one does not care about the effect of the tax increase on the well-being of the rich) the key policy question is: What is the revenue-maximizing top marginal tax rate? Econometric studies of taxpayer responses to tax rate changes, summarized in Saez et al.[108] and Veall,[109] indicates that taxable income declines when marginal tax rates increase. Therefore the revenue-maximizing marginal tax rate on the rich is less than 100 per cent. This body of research also indicates that the tax sensitivity of taxable income increases as income rises because high-income earners have more flexibility in how, when, and where they earn their income than do low- and middle-income earners. The computation of the revenue-maximizing top marginal tax rates in Canada is discussed at length in Veall.[110] Here we will only report his main findings that, given the distribution of top incomes and the elasticity of taxable income to the taxpayer's net-of-tax share (one minus the taxpayer's marginal tax rate), the optimal top marginal tax rate on wage and salary income in Canada is probably less than or equal to 50 per cent.[111] In other words, given that the top combined federal and provincial marginal tax rates currently range from 39 per cent in Alberta to 49.5 per cent in Ontario, there is little scope for raising additional tax revenues by increasing marginal tax rates in Canada based on recent estimates of the tax sensitivity of taxable income.

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[107] Atkinson et al. (2003). op. cit.

[108] Saez, E., Slemrod, J., and S. Giertz (2012). "The Elasticity of Taxable Income with Respect to Marginal Tax Rates: A Critical Review," *Journal of Economic Literature* 50(1): 3-50.

[109] Veall (2012). op. cit.

[110] Veall (2012). op. cit. For the effects of the recent increase in the marginal tax in Ontario, see also Laurin, A. (2012). "Ontario's Tax on the Rich: Grasping at Straw Men," C.D. Howe Institute e-Brief.

[111] If we use Veall's central estimates of 0.62 for the elasticity of taxable income to the after-tax share and 2.00 for the Pareto parameter that describes the distribution of incomes above some cut-off, then the revenue-maximizing top marginal tax rate is 45 per cent. See Veall (2012) op. cit. Table 3, p.34.

A 75 per cent top marginal tax rate would reduce taxable income and total tax revenues collected from high-income earners in Canada. It would not be supported by those who want to finance more government spending or tax cuts for low- and middle-income Canadians, but it still might find favour with those who would like to reduce the ability of the rich to exert political power through their donations to political parties. The $430,000 campaign contribution that the *Globe and Mail* alleges was made by an Edmonton businessman to the Progressive Conservative Party of Alberta has brought the role of money and politics to the surface. However, dealing with this issue through higher tax rates on the rich seems to be a roundabout and highly destructive way to solve this problem. Election-financing reforms, strict enforcement with transparent reporting and major sanctions for infringement are much better approaches.

Would the above analysis and computations convince the Occupy protesters that marginal tax rates on the top one per cent should not exceed 50 per cent in Canada? It seems unlikely because the protests reflect a view that the increase in the income share of the top one per cent has come at the expense of the remaining 99 per cent. Piketty, Saez, and Stantcheva[112] have developed a formal model of optimal income tax policy when the gains of the rich are at the expense of the rest. Their model incorporates the conventional effort and tax-shifting responses to tax rate increases, but it also has a compensation-bargaining response to higher tax rates that is novel and controversial.

Piketty, Saez, and Stantcheva do not develop a formal bargaining model of the compensation bargaining or the income-generation process in a firm. They simply assume that an executive's compensation can exceed the value of his marginal product and that an executive's gain can come at the expense of other workers' incomes. Executives simply bargain over their share of income generated by the firm, but bargaining requires effort on the executive's part. A higher marginal tax rate on an executive's income discourages him from bargaining for a higher salary.[113] With this form of compensation bargaining, the optimal tax rate could be very high, perhaps as much as 83 per cent. See Piketty, Saez, and Stantcheva.[114] Their compensation-bargaining model is, to say the least, highly controversial and needs more theoretical and empirical support before it is widely accepted by public finance economists as a guide to taxing the top one per cent.

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[112] Piketty, T., E. Saez, and I. Stantcheva (2011). "Optimal Taxation of Top Labor Incomes: A Tale of Three Elasticities," NBER Working Paper No. 17616.

[113] The authors simply assume that the substitution effect of a higher tax rate dominates the income effect which might induce more effort devoted to bargaining.

[114] Piketty, Saez and Stantcheva (2011). op. cit. Table 3.

CAN WE — SHOULD WE — PUT THE GINIS BACK IN THEIR BOTTLES?

There are two Ginis in our story — the Gini of technology and the Gini of income inequality. Clearly, technology is a powerful Gini that cannot be put back in the bottle, but we can use our wishes wisely. By wishes we mean the policies and regulations that shape the way in which new technologies and innovations affect our lives, and most importantly in the present context, the distribution of income. Clearly, in the case of the financial sector, the wishes that were granted over the last two decades by the rogue Gini of financial innovation (e.g., collateralized debt obligations (CDOs) that gave rise to the sub-prime mortgage crisis) damaged the economy instead of boosting it. The lessons learned from the financial crisis and the regulations that are now being proposed and adopted are intended to limit the damage from rogue financial market Ginis in the future. On balance the other technology Ginis — the automation of routine tasks in the workplace and the reduction in communications and transportation costs that have made the globalization of production feasible — have been benign, although clearly the distribution of the benefits from these gifts has been uneven.

Which brings us to the other Gini in our story — the degree of income inequality in our society. Can we — should we — put this Gini back into the bottle? Could we reverse the upward trend in income inequality and return to the levels of income inequality experienced in the pre-1980 period? In a recent commentary in the *Globe and Mail*, Margaret Wente argues that even though Canada has "few super rich, fewer single moms, less inequality and more social mobility" than the United States, a more divided society is here to stay because:

> Globalization means that the rewards for innovation and entrepreneurship – especially for those who can extract favourable rules from governments – are vastly greater than ever before. But for many people at the bottom of the heap, life isn't likely to improve. They're stuck there – and it's not a lack of jobs that holds them back.[115]

There is an element of truth in Wente's assessment of the difficulty of completely reversing the trend to greater inequality over the last 30 years, but sensible measures could be taken to shore up Canada's social safety net, especially by expanding early childhood services, enhancing education programs, and providing more for income support and training for workers displaced through changes wrought by technological change and globalization. We need to avoid the adoption of high-cost measures, such as mandating living wages for government procurement contracts or adopting protectionist trade policies. We must also avoid resorting to the high-cost measures to finance more social spending — such as increases in corporate income tax rates and higher marginal income tax rates in the top tax brackets. Perhaps most importantly, we need to find ways to contain the growth of health-care costs, while maintaining acceptable levels of care and access, because otherwise we will not be able to fund existing levels of spending on education and social assistance that are essential to reducing income inequality.

[115] Wente, M. (2012). "Why Income Inequality Is Here to Stay," *Globe and Mail*, November 15.

APPENDIX A

TABLE A1: DATA SOURCES

Variable	Description	Source
Real GDP	Gross Domestic Product in 1997 dollars	Statistics Canada, *Provincial Economic accounts*
Investment	Total private investment in 1997 dollars	Statistics Canada, *Provincial Economic accounts*
Population	Total provincial population	CANSIM Table 051-0001.
Corporate marginal tax rate	Provincial statutory top marginal corporate income tax rate (General rate)	*Finances of the Nation* (formerly *National Finances*)
Top personal marginal tax rate	Provincial income tax rate of the top income bracket	*Finances of the Nation* (formerly *National Finances*)
Sales tax rate	Provincial sales tax rate (PST)	*Finances of the Nation* (formerly *National Finances*)
Export price	Export price index of provinces' major exporting commodities	Statistics Canada CANSIM Table 176-0006 and Table 228-0044)
Budget Deficit	Provincial government budget deficit	Statistics Canada CANSIM Table 385-0001
Government expenditure to GDP ratio	Provincial and local government expenditures to GDP ratio	Statistics Canada CANSIM Table 385-0001
US growth rate	Growth rate of US GDP in 2000 dollars	Statistics Canada CANSIM II, Table 451-0010
Market income Gini (*ginimar*)	Market income (before taxes and transfers) Gini	Statistics Canada CANSIM Table 202-0705
Total income Gini (*ginitot*)	Total income(i.e. after transfers but before income taxes) Gini coefficient	Statistics Canada CANSIM Table 202-0705
Disposable income Gini (*ginidis*)	Total income less income taxes Gini coefficient	Statistics Canada CANSIM Table 202-0705
Fiscal Redistribution (*fiscred*)	Market income Gini less Disposable income Gini	Statistics Canada CANSIM Table 202-0705

TABLE A2: CORRELATION MATRIX

	dlpcgdp	ginimar	ginitot	ginidis	fiscred	lpcyo	pvtinvgdp	popg	expodef	usgrowshare	govgdpo	defgdpi	citprovav	pstavnew3
dlpcgdp	1													
ginimar	0.0389	1												
ginitot	-0.0338	0.3774	1											
ginidis	-0.0009	0.1725	0.9582	1										
fiscred	0.0379	0.8816	-0.0952	-0.3129	1									
lpcyo	-0.2603	0.0503	0.7172	0.6937	-0.2839	1								
pvtinvgdp	0.3866	-0.0934	0.1511	0.1859	-0.1792	0.2149	1							
popg	-0.0871	-0.5576	0.1793	0.3082	-0.6854	0.3695	0.1866	1						
expodef	0.4102	-0.4352	-0.2585	-0.1449	-0.3502	-0.3162	0.3759	0.2291	1					
usgrowshare	-0.1487	-0.28	0.2589	0.2519	-0.3907	0.4945	-0.2136	0.4023	-0.084	1				
govgdpo	0.0224	0.3834	-0.4892	-0.5918	0.6533	-0.7545	-0.3613	-0.6539	-0.1681	-0.5025	1			
defgdpi	0.1333	-0.1753	0.115	0.1848	-0.2576	0.2315	0.3121	0.2555	0.3864	0.0077	-0.4091	1		
citprovav	-0.0733	0.1599	0.0032	-0.0186	0.1631	0.0612	0.0187	-0.1702	-0.1351	-0.2802	-0.0562	-0.0441	1	
pstavnew3	-0.2521	-0.0403	-0.4615	-0.4473	0.1755	-0.5074	-0.4598	-0.1665	-0.0599	-0.0926	0.4671	-0.3395	0.2204	1

About the Authors

Bev Dahlby and Ergete Ferede are currently engaged in a number of studies of the provincial governments' tax and expenditure policies and responses to intergovernmental grants.

Bev Dahlby, Professor of Economics and Distinguished Fellow at The School of Public Policy, University of Calgary, attended St. Peter's College, the University of Saskatchewan, Queen's University and the London School of Economics. Dr. Dahlby has published extensively on tax policy and fiscal federalism.

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