Tax Incidence, Progressivity, and Inequality in Canada

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Abstract Knowledge about the distribution of the burden of taxes—as measured by their progressivity and their inequality impacts—is crucial for tax policy choices. Yet actual practice for both the formulation and assessment of tax policy does not draw on much of the best research knowledge. This study offers the first comprehensive critical survey of the field for Canada in nearly 20 years, a period of wide-ranging refinement and extension of research methods. We group the existing field of research into three principal genres. Inequality (INEQ) studies measure the inequality reduction from taxes borne directly by individuals, principally the personal income tax. Computable general equilibrium (CGE) studies examine the distribution of lifetime utility burdens of stylized taxes using complex mathematical economic models. Fiscal incidence (FINC) studies compute the pattern of progressivity or regressivity for each tax and the entire tax system using micro-simulation methods. We assess the relative strengths and weaknesses of each type of study. We offer a compact overview of the measures of inequality and tax progressivity used in the empirical literature, followed by a review of the methodological issues that arise in measuring economic well-being for tax distributional analysis. We provide some evidence on the relative equalizing effects of transfers and personal taxes in Canada. Then we examine the comparative findings and methods of representative studies of each type, with emphasis on studies that include Canadian taxes and with a focus on the underlying assumptions about tax incidence.

Transfers are found to be more important than income taxes in reducing inequality of Canadian incomes for all periods since 1971 and for most types of households (except those with high per-capita incomes). INEQ studies find that Canada's ranking in inequality reduction from personal income taxes is intermediate among countries and dependent upon the measure of inequality; some studies find Canadian personal taxes to be less equalizing than the US counterparts. CGE studies have been developed most for analysis of the US tax system, with little comparable available for the Canadian tax system though the US results are suggestive of the Canadian situation. Based on lifetime income groups in the long-run equilibrium, only the personal income tax is found to be strongly progressive. Payroll taxes are strongly regressive; sales, excise, and property taxes are significantly regressive except for the top two deciles of lifetime incomes; and even the corporate income tax is somewhat regressive over lifetime income groups except for the top decile. All taxes taken together are found to be roughly proportional for the bottom nine deciles and highly progressive for the top decile. FINC studies using annual data, which have been most frequently applied for Canadian taxes, find either slight or substantial progressivity for the tax system overall; a lifetime study finds somewhat less progressivity than comparable results based on annual data. Like with CGE findings, the FINC studies assign a key role to personal income taxes in any net progressivity of the total tax system, given the regressivity of many other tax types.

Our analysis gives special attention to the economic basis for assumptions about the incidence of the major tax types used in the three types of studies. Tax incidence, and the possible shifting of tax burdens from the taxpayer to other parties, plays a critical role in analysis of the distribution of the tax burden. Multifaceted theoretical and empirical

research casts doubt on the standard assumption that the personal income tax is borne fully by individual taxpayers. This evidence suggests that personal taxes on higher earners are at least partially shifted onto other parties, thus reducing the effective progressivity of the tax. Given the key role of personal tax progressivity in many studies' findings of overall tax progressivity, this issue warrants further research. If one were to use incidence assumptions more consistent with the cited evidence for the personal income tax, even these mildly progressive findings might be overturned. Most of the Canadian studies reviewed here are already quite dated in their periods covered and would benefit by updating to include the important tax policy changes since 1988. Also, the use of datasets permitting inferences about lifetime effects would permit better assessments of income-based versus consumption-based taxes. Still, priority in future research should be given to improved understanding of the incidence of personal taxes.

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1. Introduction

The modern state plays an important role in molding the distribution of income and well-being across its citizens and thus in moderating inequalities generated by the market economy. It achieves this goal through a variety of policy tools—setting the legal framework for business, regulating labour markets, supplying public goods and services, providing cash transfers, and collecting the taxes needed to finance its activities. With contemporary welfare states typically taking from one-third to one-half of national income in taxes, their distributional pattern is of paramount importance. Additionally, the tax system is often used as a vehicle for redistribution through explicit and implicit transfer provisions such as tax credits and benefit clawbacks. Moreover, the state's interventions (including taxes) to moderate inequality exert their own influence on distributional outcomes through market responses. Yet there remains much dispute over the distribution of the tax burden and the effects of taxes on inequality in Canada. These issues are at the core of public debate over the size and scope of the welfare state, how to finance its activities, and how to mitigate inequality.

Improved understanding of how taxes are distributed across the population and how to measure these impacts is vital in formulating and assessing taxation policies. For example, does greater progressivity in the rate schedule for personal taxes contribute to increases in *effective* progressivity and inequality reduction, and if so, to what extent? Does the answer to this question differ depending upon whether one is considering tax policy at the national versus the subnational level? How do indirect taxes on consumption affect distributional outcomes, and does the answer hinge on whether one takes an annual versus a lifetime perspective? Similarly, what are the short-run and long-run distributional impacts of shifting the personal tax base further from income and toward consumption? And how should one assess the progressivity or inequality impacts of changes in the corporate tax system, payroll taxes, and property taxes or shifts in the overall tax mix among these tax types and personal and indirect taxes? While tax economists tend to focus on the efficiency and growth aspects of tax policies, politicians and the public are almost entirely fixated on the distributional dimension. As observed by a leading tax economist who has served in a top advisory capacity, "Tax policy debates among policy makers are grounded in no small part in their perceptions of the effects of policy changes on the distribution of well-being" (Hubbard, 1995: 81).

There exists a large body of research investigating the distribution of the tax burden, with some studies focusing on the inequality impacts and others on the progressivity of taxes. The studies cover a wide range of methodologies and are widely dispersed. Despite their diverse methods, a key issue in all of the studies is how to deal with the economic incidence of each tax—what parties actually bear its burden. It has been noted that "The study of incidence is an active area of research among economists, though the contributions of recent research are not always integrated in the distributional assessments presented to policy makers" (Hubbard, 1995: 81). In this paper we critically assess the state of knowledge about the distributional impacts of the tax system,

reviewing both foreign and available Canadian research.[1] We examine the conceptual and methodological issues involved in the research as well as the substantive findings. The distributional impacts are gauged in terms of inequality and progressivity, and we review the relevant measures and their interrelations. An overarching theme across the three classes of studies examined here is the implied or explicit approach to treating the incidence of various taxes. Previous work on tax incidence has sometimes been casual in describing the progressivity of taxes and in making comparisons. By bringing together the analysis of tax incidence with formal measurement of progressivity and inequality, we improve the rigour of the discussion. We examine these issues in a selective synopsis of research on the distributional impact of taxes, both in Canada and cross-nationally, along with the comparative impact of cash transfers. Finally, we offer suggestions about priorities for future research and thoughts about tax policy inferences that can be drawn based on the current state of knowledge.

2. Issues, Concepts, and Analytical Frameworks

A. *Types of analytical frameworks*

Studies of the distributional impacts of taxation can generally be classified into three types based on their analytical frameworks and methodologies.[2] They vary in the range of taxes considered, their treatment of the incidence of the taxes, their measure of economic well-being, the unit and time span of observation, the extent to which they incorporate economic modeling of behaviour, and their use of inequality or progressivity to measure distributional impacts. Hence, the studies vary in the types of social science and public policy questions that they can be used to address. Table 1 summarizes several characteristics that distinguish the three types of studies, which are denoted "inequality" (INEQ), "computable general equilibrium" (CGE), and "fiscal incidence" (FINC). Each type of study presents advantages as well as weaknesses relative to the alternatives.

"Inequality" studies are an offshoot of recent research to track income inequality both in changes over time and differences across countries. These studies estimate the difference in inequality measures between gross (or market) income and net (or disposable) income of households. Typically they make adjustments using family equivalence scales to gauge the well-being of individuals in households of differing sizes. Many INEQ studies do not distinguish between the impacts of taxes and the impacts of cash-type transfers; they simply compare the pre-tax, pre-transfer distribution with the post-tax, post-transfer distribution. Identifying the taxation effects on inequality requires abstracting from the effects of the cash transfer system. Since they examine primarily the

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[1] The last comprehensive survey of Canadian tax incidence and inequality impacts is now quite dated, and much research has appeared subsequently; see Dahlby's (1985) study for the Macdonald Commission. A similarly dated survey of the technical economics of tax incidence was provided in Kotlikoff and Summers (1987) and recently updated in Fullerton and Metcalf (2002).

[2] The more conventional economic way of classifying these approaches would refer to "partial equilibrium" versus "general equilibrium" models. In that context, the studies designated here as INEQ are partial equilibrium; the CGE studies are clearly general equilibrium; and the FINC studies incorporate the results of both partial and general equilibrium analyses. This paper does not include the macro literature on taxes, growth, and inequality, which is mostly dynamic economic modeling; for example, see Benabou (2002).

difference between gross and net incomes, INEQ studies usually consider only personal income taxes and, in some cases, payroll taxes for social security programs. These types of taxes are assumed borne fully by the individual, thus obviating any incidence analysis.

INEQ studies have the principal advantage of using datasets that are constructed to allow tolerably consistent comparisons across countries both at a point in time and across years. They can also decompose households into individuals using family equivalence scales, and they can decompose inequality impacts into within-group and across-group effects. INEQ studies can additionally support the analysis of how various components of a personal income tax affect inequality outcomes. They allow for variations in the inequality parameter to examine the effects of different degrees of inequality aversion. However, INEQ studies are severely limited in considering only direct personal taxes, thereby omitting the full range of indirect taxes and business taxes. These studies further assume that the personal taxes are fully borne by taxpayers, thus missing any economic shifting of the tax burdens and most likely overstating the redistributive effects of progressive personal taxes. INEQ studies are also limited to annual data and therefore do not capture the lifetime impacts, which again likely overstates the long-run inequality reduction from tax policy.

A second class of studies uses computable general equilibrium economic models rather than drawing their tax incidence assumptions from other studies; the assumed structure and parameters of the model dictate the incidence outcomes. CGE studies attempt to deal with the long-run distributional effects of taxation via the impacts on employment, wages, profits, prices, and economic growth. These studies can report distributional outcomes by both income class and summary inequality measures, and the outcomes can be computed in utility as well as net income terms. Utility or its monetary equivalent may be more informative than net income when comparing alternative tax regimes that affect patterns of leisure and consumption. Typically CGE studies are highly stylized in their treatment of individuals (as against households) and the range of taxes considered (often cast as labour income, capital income, and consumption, and they do not always distinguish between taxes imposed at the business versus the individual level). Most CGE studies are geared to consider the lifetime as well as the transitional and inter-generational distributional impacts of taxes.[3]

The methods used by CGE studies offer several advantages over the other types of studies.[4] A dynamic CGE model can reveal the time path of the distribution of gains or losses from tax changes; static analysis ignores the impact of tax changes either on future generations or on transitional generations during the economy's adjustment. A CGE model generates the incidence of all taxes in an economically logically consistent framework rather than making various assumptions about tax incidence. The implied incidence of taxes can be related to key behavioural parameters in the model—the elasticities of substitution between capital and labour and between current and future consumption—where empirical evidence can be used. The CGE approach also can

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[3] Earlier-generation CGE tax models were static and did not incorporate dynamic or intertemporal effects; see the review of early CGE studies in Shoven and Whalley (1984).

[4] This discussion draws heavily on Fullerton and Rogers (1993).

simultaneously assess the distributional and efficiency effects of taxes within the same model. In a policy context with competing goals, both of these effects are germane to public decision-making; a more progressive tax system may entail greater inefficiencies. Finally, the lifetime view of individual well-being in this approach accords with empirical evidence about the consumption behaviour of individuals, which is tied more closely to longer-term income flows than current income. The lifetime view may also conform to ethical views about how society should gauge the impact of public policies.

CGE studies also suffer significant limitations relative to alternatives.[5] CGE models require specific functional forms, structural assumptions, and parameter values for which good empirical estimates are lacking. They employ highly aggregated modeling and data, so that they cannot capture the effects of detailed tax policy changes. Data for lifetime incomes and their composition between capital and labour sources are not directly available, so that they need to be simulated, with many associated uncertainties and limited guidance from longitudinal datasets. The use of a common interest rate for borrowing and lending means that capital income is irrelevant in computing lifetime income, but this assumption is empirically false and ignores the constraints on borrowing faced by many households. Hence, for those households, income over an annual period, or at least something short of a lifetime, may be a better gauge of their behaviour and well-being. An annual perspective may be more readily understood by policymakers than the lifetime perspective, given the political reality of frequent changes to the tax system. The complexity of CGE modeling also means that its distributional findings will be less comprehensible to policymakers and politicians than those from other types of studies.

A third class of studies focuses on "fiscal incidence," and this includes the earliest research undertaken on this topic as well as substantial research of more recent vintage. FINC studies typically present their results by income classes of taxpayers, so that the findings are reported in terms of progressivity (the pattern of average tax rates or ATRs) rather than inequality measures. They usually consider the household rather than the individual as the unit of observation. Most of these studies utilize annual data, but the method has been extended using simulated lifetime data. FINC studies can be pursued either with relatively aggregated data by income class (for the distributions of income receipts of various types and savings patterns) or with micro datasets.

FINC studies, while being the earliest employed, have notable strengths that account for their continued widespread use. They can include a large number of tax types and can consider a wide range of assumptions about the incidence of each tax. Sensitivity analyses can then be undertaken to explore the implications of the alternative incidence assumptions. Our extended discussion of tax incidence assumptions is reserved for the review of FINC studies. As they build on micro datasets that often contain details about particular tax provisions, some FINC studies can examine the distributional effects of those provisions. This class also includes studies that cover the distributional impacts of the expenditure as well as the revenue side of public budgets. The methodology of

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[5] This discussion draws heavily on Gale et al. (1996) and Block and Shillington (1994). Note that the cited drawbacks to the lifetime perspective also apply to FINC studies that use lifetime incomes and taxes.

FINC studies forms the framework for most distributional analyses undertaken by governments in Canada and elsewhere for marginal changes in tax policy.[6]

Several comparative weaknesses of FINC studies also warrant noting. There is controversy among researchers over the appropriate income base to use in computing the ATRs; this choice can significantly affect the appearance of progressivity or regressivity of taxes. And ATRs measure the departure of the tax system from proportionality, which does not directly reveal the extent of inequality reduction, unlike the use of inequality indices in INEQ studies. Moreover, ATRs are computed for households and expressed across household income groups, in some studies without adjustment (or equivalizing) for the numbers or ages of individuals in each household. The use of households may be questioned for Canadian studies, as the single largest tax, the personal income tax, is normally applied on the basis of individual rather than family incomes.[7] Finally, the unlimited flexibility of choice of shifting assumptions for each tax in FINC studies may lead to economically inconsistent choices for groups of taxes. Even though undertaken within a simplified and restrictive economic model, CGE studies at least enforce consistency in the underlying economics of tax incidence.

B. Budgetary measures of tax distribution

In most real-world decisions about tax policy, the distributional impacts are paramount and dominate considerations of economic efficiency and operational simplicity. Public discourse on tax policy also focuses on the distribution of gainers and losers. Hence, the manner in which government officials assemble and present their information on the distributional effects of proposed or budgetary tax changes is critical, since this is the format most readily accessible to the public. Two methods are most commonly employed by governments to generate a picture of these tax impacts—the "typical taxpayer" approach and the use of "distribution tables," each described below. Canadian budget documents at both the federal and provincial levels contain only typical taxpayer figures and rarely present any distribution tables. In contrast, US official tax proposals and tax expenditure accounts have traditionally contained tax distribution tables, although in the last several years the published materials have been much more limited (Sullivan, 2003). Nevertheless, both of these official methods of presenting information about tax distribution will be seen to fall short of the best practice in the economic literature on tax incidence and tax distribution. Thus, the effects of tax policies on inequality or progressivity are not reliably captured in official documents.

Budgets often present "typical taxpayer" examples of tax impacts for illustrative households by level of income and demographic traits. This method is almost always restricted to assessing types of taxes with incidence assumed to fall fully on the individual taxpayer—such as personal income tax, sales and excise taxes, employee payroll taxes, and property tax. However, as will be shown in our critical review of tax

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[6] These can use either "static" or "dynamic" assumptions about behavioural responses (see the studies in Bradford, 1995) but still do not attempt to capture the deadweight efficiency costs of taxes.

[7] Couples file a "joint" return in Canada only when one partner has income below the taxable threshold (about C$8,000). In fact, most countries tax on an individual basis (the US and France being among the exceptions), and this may make little difference if household members pool their incomes.

incidence for FINC studies, these simple incidence assumptions are not all well settled in the literature. They likely overstate, for example, the impacts (positive or negative) of personal income tax changes on the highest income groups. The typical taxpayer method also neglects to distribute the burdens of taxes imposed on businesses, whose incidence is more disputed. Moreover, this method of presenting information about tax distribution is susceptible to politically driven manipulation. Atypical taxpayer situations can be chosen to make a government's tax policies look better, and other taxpayer situations that would make the policies look worse can be selectively omitted.[8] Rarely are taxpayers with incomes above $100,000 presented in these examples of tax impacts, despite the fact that this group accounts for a disproportionately large share of all the personal tax revenues.

A second method for presenting budgetary information on tax impacts is through "distribution tables," which summarize the results of microsimulations using large datasets of taxpayers. They allow the impacts to be differentiated by characteristics such as income class, family type and/or size, and age. This method is implemented very much like FINC studies except that discrete tax rate and base changes are assessed rather than the entire tax system. Still, the application of this method for budgetary purposes shares most of the same potential weaknesses as FINC studies. Foremost are uncertainties about the incidence of some taxes, the use of annual rather than lifetime data, and (unlike CGE studies) the failure to consider the dynamic path of the tax impacts over time and various generations. The procedures used by finance officials in Canada are not well documented,[9] but there has been informed review of the differing methods employed by various US agencies involved in the formulation of tax policy.[10] For example, the incidence of the corporate income tax has been controversial, and until 1992 the Joint Committee on Taxation did not even attempt to distribute the associated burden. As noted by one observer, "JCT's refusal to distribute corporate tax changes had enormous practical consequences for policy makers relying on distributional tables as a basis for their political decisions" (Graetz, 1995: 47). Similarly, any particular choice of incidence or other approaches in constructing distribution tables could sharply alter the course of tax policy decisions.

C. Measures of inequality and progressivity[11]

While it is easy for budgetary officials and tax policy protagonists to select ways

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[8] For example, Ontario's 2000 budget documents provided many typical taxpayer examples but none with capital gains that would have benefited greatly from the proposed tax cuts in that area. See Hugh MacKenzie, "Ontario's Little Capital Gains Game," *Toronto Star*, May 9, 2000, p. 1.

[9] The microsimulation models and datasets are proprietary to the federal Department of Finance and the provincial finance ministries. A widely used system in the public domain is Statistics Canada's Social Policy Simulation Dataset/Model, whose construction, use, and limitations are documented in Bordt et al. (1990).

[10] See the studies in Bradford (1995), including discussion of the methods used by the US Treasury Department's Office of Tax Analysis, the Congressional Budget Office, and the Joint Committee on Taxation of the US Congress.

[11] This section draws heavily on the comprehensive analysis by Lambert (2001) and the compact exposition by Litchfield (1999). For analysis of the relations between local and global progressivity measures and inequality reduction, see Podder (1997) and Duclos (1997).

of presenting distributional impacts that cast their preferred tax policies in a favourable light,[12] the research literature offers more rigorous types of measures. Comparing the results of various studies, and making sense of them individually, requires a clear understanding of inequality and progressivity indices. Although the two kinds of measures can be inter-related, they are also quite distinct. Inequality is defined over the entire income distribution, while progressivity is defined over the tax system as it applies at different income levels. Inequality measurement involves taking the distribution of incomes (whether pre-tax or post-tax) and transforming it into an index. So long as it satisfies some plausible assumptions, an inequality index is comparable across different income distributions. That is, we can say whether one income distribution is "more equal" than another and by how much. For present purposes, the application would be to compare inequality either pre-tax versus post-tax or before and after certain tax changes. Inequality indices can also be used to compare the distributional impacts of taxes across countries, despite dramatic differences in their tax systems.

Progressivity measures, in contrast, focus on the relative average tax rates faced by various income groups. These measures can be either local—that is, showing the ATR for each of many such income groups—or a global index summarizing the overall pattern of tax progressivity. Local progressivity measures allow for a more detailed view of the relative impacts of taxes on each of many income groups than a summary index. However, local measures of progressivity do not allow for easy comparability of tax policies across countries or over time for a given country. As will be shown, global progressivity measures can be constructed so that they correspond directly to counterpart inequality measures of the impact of taxes. More briefly we also consider measures of the horizontal inequity dimension of taxes; this is closely related to both inequality and progressivity measures.

i. Measures of inequality

The characteristic common to all inequality indices is that they measure the dispersion, or spread, of income across the population. Inequality indices offer both benefits and challenges for assessing the distributional impacts of taxes. We must first clearly define what we want to measure and then find an appropriate index to measure it. The difficulty is that researchers are not in complete agreement about what constitutes an appropriate and informative measure. A second issue concerns the relationship between inequality measures and social welfare functions. Some analyses seek to determine the types of social welfare functions implied when income distributions are ranked in terms of a particular index of inequality (Blackorby and Donaldson, 1978). Since an index by definition summarizes an entire income distribution in one number, some judgment is required in formulating the index. This judgment, in turn, is based on how the observer values inequality, which is in effect the choice of the social welfare function. For example, should the index use equal weights for the full population, or should lower-income households be given a greater weight? Theoretical analysis finds that, in order to obtain indices that satisfy some plausible criteria, the social welfare functions underlying

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[12] For a striking example of the divergent ways in which the distributional impacts of a specific tax policy change can be characterized, see Gravelle (2001: 370, Table 4).

them may have to be very restrictive. We review the principal methods used to measure inequality in studies of tax incidence and then briefly consider other indices. We also note the formulation, merits, and drawbacks of the various indices.

a. The Lorenz curve and Gini coefficient

A simple way of illustrating inequality is the Lorenz curve. It is not a numerical index per se, but it clearly motivates how such indices are created. The Lorenz curve is drawn graphically in a square of length of 1 (for 100 percent), as in Figure 1. The horizontal axis represents the proportion of the population, ordered by income from lowest to highest. The vertical axis plots the cumulative proportion of income held by that part of the population. In a completely equal society, where everybody has identical incomes, the Lorenz curve will be the straight line connecting the points along the diagonal labeled D. That is, the bottom 10 per cent of the income distribution has 10 per cent of the income, and so forth. If there is any inequality in the society, the Lorenz curve will lie below this diagonal because the poorer half of the population must have less than half of total income. This deviation from the 45-degree diagonal allows some income distributions to be ranked. If the Lorenz curve of a distribution *B* lies entirely below that of distribution *A*, we say that distribution *A* "Lorenz-dominates" *B*, or that distribution *A* is more equal than *B*. In effect, this means that it is possible to go from distribution *A* to *B* (assuming their means to be equal) by transferring income from the poor to the rich. However, this ranking criterion is not complete. If the Lorenz curves of two income distributions cross, neither can be said to dominate the other, and hence we cannot claim that one distribution is more equal than the other without further assumptions about how one values equality at various points in the income distribution.

This incomplete ordering of income distributions using Lorenz curves prompted the development of a summary index of inequality that allows any two distributions to be compared. The Gini coefficient is an inequality index related to the Lorenz curve and has a mathematical formulation (see Table 2). For any income distribution, the Gini coefficient is twice the area between the diagonal and its Lorenz curve (see Figure 1). Since the Lorenz curve for a fully unequal distribution (one person has all the income) coincides with the bottom and the right edges of the box, the maximum value of the Gini coefficient is 1, twice the area of the triangle under the diagonal. The smallest value of the Gini is 0, which occurs with complete equality when the Lorenz curve coincides with the 45-degree line. The Gini coefficient has some desirable properties that make it the most commonly used inequality index (Myles, 1995). The Gini is independent of scale, so that a proportional change in everyone's income will not alter its value. It satisfies the Pigou-Dalton principle of transfers, which states that any transfer from a poorer household to a richer household must increase inequality. The Gini coefficient also can be defined over negative income observations, which frequently occur in empirical data.

b. Generalized entropy class of indices

A "generalized entropy" class of inequality indices based on information theory includes as special cases the often-used Theil, squared coefficient of variation, and mean log deviation indices. Formulae for the generalized entropy index and its subcases appear in Table 2. All members of this class of indices share several useful properties—scale independence, Lorenz domination, the principle of transfers, and decomposability

(defined below). However, some forms of the index involve taking the natural logarithm of income and thus are not defined over zero or negative values of income. These indices assume values ranging from 0 (complete equality) to unboundedly large (extreme inequality). A major benefit of this class of indices is their ability to decompose overall inequality into within-group and cross-group inequality, which can be useful in assessing the effects of tax policies. For example, assume that we have defined subgroups of households with and without earners; and further that an entropy index of before-tax incomes is stable but the index of after-tax incomes is falling over time, which indicates that net incomes are becoming more equal due to tax changes. We can then decompose this fall in the index into a between-groups component and a within-groups component to see how changes in the tax system have exercised their equalizing influence.

Generalized entropy indices contain a parameter (c) to reflect the weight assigned to distances between incomes at different parts of the distribution; this parameter can assume any real value. Choosing lower values for c make the index more sensitive to changes in the lower tail, while higher values for c make the index more sensitive to changes in the upper tail. Certain values of the parameter yield the special subcases of the index shown in the table. A value of $c = 0$ produces the mean logarithmic deviation, which weights by population shares, while a value of $c = 1$ produces the Theil (1967) index, which weights by income shares. The Theil index is more bottom-sensitive than the Gini, thus giving more weight to changes at the lower end of the income distribution. Choosing $c = 2$ yields another common measure of inequality, the squared coefficient of variation (CV^2), which is more sensitive to income changes at higher incomes.

c. Atkinson index

Atkinson (1970) formulated an inequality index that stresses the linkage between statistical measures and social welfare. Its general expression, I_e, with inequality aversion parameter e, is given in Table 2. Higher values of e correspond to greater social valuation of equality. Atkinson inequality indices range from 0 (for no inequality) to 1, like the Gini coefficient. This index shares the desirable properties of the generalized entropy indices; indeed, setting $c = 1 - e$ makes the generalized entropy class of indices ordinally equivalent to the Atkinson class, for $c < 1$. With $e = 1$, the Atkinson index yields the mean logarithmic deviation, just as does the generalized entropy index for $c = 0$. The Atkinson index can also be expressed in the following form:

$$I = 1 - \frac{x_{EDE}}{\bar{x}},$$

where $\bar{x}$ is mean income and x_{EDE} is "equally distributed equivalent" income as follows:

$$\sum_{i=1}^{n} U(x_i) = nU(x_{EDE}).$$

In words, x_{EDE} is the level of income that, if given to every individual, would create the same level of social welfare (the sum of individual utility levels, U) as the actual income distribution. Assuming concavity of the utility function, $x_{EDE} \leq \bar{x}$, which ensures that the Atkinson index will lie between 0 (complete equality) and 1 (complete inequality). Intuitively, the index says that as equality rises, a higher level of equally distributed

income is needed to achieve the same level of welfare as the original distribution; hence the index I falls. Atkinson gives the example that if I were 0.3, then only 70 per cent of the present national income would be needed to achieve the current level of social welfare, if incomes were distributed equally.

d. Other measures of inequality

Still other indices are used to measure inequality, and their advantages and disadvantages often hinge upon the researcher's focus. Three basic indices involve computing the ratio between incomes of certain individuals. The P_{10} and the P_{90} take the incomes of the individuals at the 10th and 90th percentiles of the distribution, respectively, and divide it by the income of the median individual. These indicate the state of the poor and the rich relative to the median in the population. Dividing the P_{90} by the P_{10} yields the "decile ratio" or "social distance." These three measures can serve as a quick standard of comparison in cross-country or time-based studies of inequality. However, because they do not make use of the entire income distribution, they lose much of the information present in more complex indices discussed above. Some studies, such as Gottschalk and Smeeding (2000), report the P_{10}, P_{90}, and P_{90}/P_{10} alongside the Gini coefficient. Indeed, it is common for empirical studies of tax incidence to report more than one index of inequality. Jäntti (1997), for instance, works primarily with the CV^2 because he is interested in decomposing the between-group and within-group elements of inequality, but he also reports the Gini coefficient and the mean logarithmic deviation. Zandvakili (1994) computes inequality using both the generalized entropy and Atkinson indices, each for a range of parameter values.

e. Axiomatic view of inequality indices

Many authors have outlined axioms that an inequality index should meet; it is informative to check if the measures cited above satisfy these axioms.[13] The Pigou-Dalton principle of transfers, noted earlier, is satisfied by the Gini, generalized entropy, and Atkinson indices. Scale independence is satisfied by most indices, with the exception of the variance. Anonymity or symmetry requires that the inequality measure not be affected by the order in which households are labeled; that is, inequality depends solely on the distribution of incomes, not on which individuals hold it. Again, the Gini, the generalized entropy, and Atkinson indices satisfy this. Finally, decomposability is a desirable attribute for applying an index to study the channels of redistribution by the tax system.[14] As noted above, the Theil, squared coefficient of variation, and other entropy indices are decomposable. The Atkinson index is also decomposable, although this has to be implemented in a special manner (see Blackorby et al., 1981). However, the Gini coefficient is decomposable only if the subgroups do not overlap in the income distribution.[15] Hence, our example above involving the inequality effects of taxes on households with and without earners could not be decomposed using the Gini coefficient

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[13] See, for example, Myles (1995) and Litchfield (1999).

[14] Litchfield (1999) offers a summary of decomposition techniques for assessing the sources of inequality.

[15] If the subgroups do have overlapping incomes, there is a "residual" that measures overlap and that has been used in tax studies to capture re-ranking (see Aronson et al., 1994, and Wagstaff et al., 1999).

because there is clearly overlap in incomes between these groups.

ii. Measures of tax progressivity

Another way to gauge the distributional impacts of taxes is by assessing their progressivity and/or regressivity—that is, the pattern of effective average tax rates across incomes. The ATR for an income group is computed as its tax liability divided by a relevant measure of its income (an issue discussed later). An ATR that rises over a range of income is said to be progressive in that range, an ATR that declines is regressive, and an ATR that is steady is proportional. Local indices of progressivity can rank a given type of tax or the total tax system over a given range of income, but because progressivity can vary with income level, a global progressivity index is needed to characterize the tax or tax system across the entire income scale. Hence, a global index is usually needed to compare the progressivity of taxes across time, countries, or policy changes. Global progressivity indices have been constructed to match corresponding inequality indices, such that a more progressive tax is associated with a more equal after-tax distribution (and conversely). Local progressivity can be thought of as how much the tax system deviates from proportionality *at a specific point in the income distribution.* A tax or tax system can be progressive at the lower tail of the distribution but regressive at the upper tail, or vice versa. Local progressivity measures can reveal patterns of ATRs such as an inverted-U, whereas global measures cannot. Thus, estimates of the pattern of local progressivity can add information to that of a global index.

a. Local indices of progressivity

The simplest way of displaying local tax progressivity is to chart the pattern of ATRs computed by income level, where income is shown either by dollar intervals or by groups such as percentiles or deciles. This approach was standard in early FINC studies and remains popular in recent studies of that type.[16] A closely related local index is called the "relative share adjustment" (RSA), developed in Baum (1987) and used in the empirical work of Ruggeri and Bluck (1990) and Ruggeri et al. (1994). It measures the local redistributional impact of a given tax compared with a proportional tax:

$$RSA_i = (1 - ATR_i)/(1 - ATR),$$

where ATR_i is the average tax rate paid by the ith income group, and ATR is the total tax collected divided by aggregate income. Clearly, if the ith income group's taxes were at the overall average rate, $RSA_i = 1$. An $RSA_i > 1$ indicates that this income group pays a locally progressive tax, and an $RSA_i < 1$ indicates a locally regressive tax. The RSA index can be used to calculate the gain or loss to a specific income group of switching to a fully proportional tax. For example, an RSA_i of 1.03 implies that the ith taxpayer would suffer an income loss of about 3 per cent if the existing tax system were replaced by a proportional tax. Charting the RSA_i against income produces a virtual mirror image of the chart of ATRs by income, since the numerator of RSA_i is $1 - ATR_i$ and the denominator is constant across incomes.

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[16] A CGE study could also chart the pattern of lifetime ATRs with respect to lifetime incomes, but the typical approach is to focus on the pattern of gains and losses to lifetime utility by lifetime incomes.

This approach to characterizing the progressivity of a tax can also be implemented using other local measures. Jakobsson (1976) assesses four such measures: average rate progression (rate of change of the ATR), marginal rate progression (rate of change of the marginal tax rate), liability progression, and residual income progression. The last two measures were proposed by Musgrave and Thin (1948). Liability progression (*LP(x)*) is the elasticity of tax liability with respect to pre-tax income, and residual progression (*RP(x)*) is the elasticity of post-tax income to pre-tax income, each evaluated at a given gross-of-tax income level, *x*. Their formulas follow:

$$LP(x) = \frac{xMTR(x)}{T(x)} = \frac{MTR(x)}{ATR(x)} > 1 \quad \text{for progressivity;}$$

$$RP(x) = \frac{x[1 - MTR(x)]}{x - T(x)} = \frac{1 - MTR(x)}{1 - ATR(x)} < 1 \quad \text{for progressivity,}$$

where *T(x)* is the tax function, *MTR(x)* the marginal tax rate, *ATR(x)* the average tax rate (= *T(x)/x*), and *MTR(x) > ATR(x)* for all *x* for strict progression. Jakobsson proves that of these four indices only residual progression satisfies the property that, if it is increased at every income level, then the Lorenz curve shifts upward. Graphically, this "Lorenz criterion" states that if the tax system is everywhere progressive, then the post-tax Lorenz curve should lie above the pre-tax Lorenz curve at all incomes and without crossing.

b. Global indices of progressivity

Global indices of progressivity offer a compact and informative way to measure the impacts of taxes on the distribution of incomes. They are especially useful in tracking progressivity over time or in comparing progressivity across countries. Note that global progressivity indices can be constructed so as to focus on departures from proportionality or on the redistributive effects of taxes. As articulated by Musgrave and Thin (1948: 510, emphasis in original), "effective progression … measures the extent to which a given tax structure results in a *shift in the distribution of income toward equality*." Computing a global progressivity index requires knowledge of the income distribution to which a tax or tax system is applied. Hence, a change in the pre-tax income distribution will usually affect the measured global progressivity of an unchanged tax or tax system. The less equal is the pre-tax income distribution, the greater will be the equalizing effects and hence the global index of progressivity of a given progressive tax structure. Thus, comparisons of global tax progressivity measures across countries or over time for a given country may reflect changes or differences in pre-tax distributions along with changes or differences in the taxes under study. There is no similar impact of the pre-tax income distribution on local measures of tax progressivity.

One global index builds on the local index of relative share adjustment described above. The global index of redistribution is a weighted sum of the RSA_is taken over each income class (Cassady et al., 1996):

$$RSA_G = \sum_{i=1}^{n} w_i RSA_i \quad \text{where} \quad w_i = y_i(y_i + 2\sum_{j=i+1}^{n} y_j),$$

and y_i is the ith taxpayer's share of post-fisc income (see later discussion). The index is designed so that it places greater weight on lower income classes. The interpretation of

the index is similar to the local index: an $RSA_G > 1$ indicates that the overall tax system is progressive, $RSA_G = 1$ for proportional, and $RSA_G < 1$ for regressive. The value of the index ranges from 0 to 2. We next review global indices of tax progressivity that have been proposed as companions for the inequality indices summarized in Table 2.

Several global progressivity indices have been proposed based on the Gini index of inequality. The Kakwani (1977) progressivity index reflects the extent to which a tax system departs from proportionality and can be derived graphically. On the same axes used for the Lorenz curve, one plots the tax concentration curve, which is the cumulative proportion of taxes versus position in the pre-tax income distribution (see Figure 1). If the tax system is proportional, then the tax concentration curve coincides with the Lorenz curve for pre-tax incomes. A progressive system implies that the tax concentration curve lies outside the Lorenz curve, and conversely for a regressive tax. The Kakwani index is twice the difference in area between the Lorenz curve and the tax concentration curve, defined so that the index is positive if the tax is progressive, zero if proportional, and negative if regressive. Table 2 shows the mathematical expression for the Kakwani index, P_K. It is the difference between the tax concentration coefficient (the Gini for taxes using the ranking by pre-tax incomes) and the Gini for pre-tax incomes (x^g).[17]

Two other global tax progressivity indices based on the Gini inequality index focus on the redistributive effect rather than departures from proportionality. An index attributed to Musgrave and Thin (1948) uses the Gini coefficients of the distributions of pre-tax and post-tax (x^n) incomes (see the table).[18] Another Gini-related progressivity index is that of Reynolds and Smolensky (1977), P_{RS}; it reduces to simply the difference between the Gini coefficients computed for the pre-tax and post-tax income distributions. A useful relationship between Kakwani's disproportionality index of progressivity and the Reynolds-Smolensky redistributive index of progressivity is:[19]

$$P_{RS} = \frac{g}{1 - g} P_K \, ,$$

where g is the aggregate average tax rate. Intuitively, a tax that is highly progressive (in the sense of departure from proportionality) can exert a large redistributive effect only to the extent that the tax system is applied heavily, with a high overall average tax rate.[20] A country with only moderate progressivity of rate schedules but a high average tax rate can

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[17] Note that the Kakwani progressivity index has a range that depends on pre-tax income inequality, $G(x^g)$; maximum regressivity is $-(1+G(x^g))$ and maximum progressivity is $(1-G(x^g))$. A related tax progressivity index of Suits (1977) uses *relative* concentration curves to gauge disproportionality; conveniently, it ranges between -1 and $+1$.

[18] This formulation was suggested by Blackorby and Donaldson (1984: 688), but it is consistent with the original view of Musgrave and Thin (1948: 510) that effective progression can be expressed as the ratios of the coefficients of equality of distributions of post-tax to pre-tax incomes.

[19] If the ranking of units by pre-tax incomes differs from their ranking by taxes, a correction term for re-ranking needs to be introduced to the relationship. See Kakwani (1984).

[20] This point was also recognized by Musgrave and Thin (1948: 510): "effective progression depends upon the general level of rates as well as upon the steepness of the rate structure as such."

redistribute more than another with rates that are more steeply graduated but lower.

Global progressivity indices can also be constructed for the generalized entropy and Atkinson inequality indices. These measure the redistributive effect of taxes rather than departures from proportionality *per se*. For the generalized entropy indices, Zandvakili (1994) offers a progressivity index that is simply the difference between the entropy measure of pre-tax incomes and the entropy measure of post-tax incomes. A positive difference indicates a progressive tax, a negative difference a regressive tax, and equality a proportional tax. The decomposability of the generalized entropy index extends to the index of progressivity, so that one can analyze the progressivity of taxes between and within subgroups of the population. Two global progressivity measures have also been advanced for the Atkinson inequality index. Kiefer (1984) proposes the simple difference between the Atkinson index computed for pre-tax and post-tax incomes, while Blackorby and Donaldson (1984) suggest a progressivity index that is the proportionate increase in equality relative to the initial level of equality (see Table 2). Hence, the Kiefer version would rate two tax regimes as equally progressive if they reduced the Atkinson index by identical amounts; Blackorby-Donaldson would rank as more progressive the regime that is applied to a less equal pre-tax income distribution.

iii. Measures of horizontal inequity

Real-world tax systems redistribute incomes not only vertically but also inevitably apply different tax burdens to units with the same incomes. Traditionally this "unequal treatment of equals" has been called the horizontal inequity of the tax system. However, more recently analysts have distinguished between the tax system's horizontal inequity and its "re-ranking" units from their pre-tax to their post-tax rankings even when their pre-tax incomes are unequal. The total redistributive effect (RE) of taxes can thus be decomposed into three components: vertical redistribution (V) if there were no differential tax treatment of equals, the loss of redistributive effect due to horizontal inequity (H), and the further loss due to re-ranking (R): [21]

$$RE = G(x^g) - G(x^n) = V - H - R .$$

The total redistributive effect is measured as the difference between the pre-tax (and post-transfer) Gini coefficient $G(x^g)$ and the post-tax Gini $G(x^n)$.

The inequality reduction from the vertical redistribution component is $V = P_{RS}$, the Reynolds-Smolensky progressivity index; as defined earlier, this index is proportional to the Kakwani tax progressivity index (P_K) and the aggregate tax rate. So long as the income tax rate schedule is progressive, P_K will be positive, and the total redistributive effect has an inequality-reducing vertical component offset in part by the inequality-increasing effects of horizontal inequity and re-ranking.[22] Horizontal inequity (H) is

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[21] See Wagstaff et al. (1999) or Aronson and Lambert (1994) for more detailed discussion of this decompostion. See Lambert and Ramos (1997) for a critical review of measures of horizontal inequity.

[22] This approach *assumes* that pre-tax incomes are a good measure of "ability to pay" and hence define "equals" among taxpayers. Yet many special provisions (credits, exemptions, deductions, etc.) of the personal income tax are intended to refine the measure of ability to pay (such as recognizing medical care

measured as a weighted sum of the post-tax-income Gini coefficients of households with given pre-tax incomes; these Ginis are zero only with no differential tax treatment of equals. Re-ranking (R) is measured as the difference between the post-tax Gini coefficient and the post-tax concentration coefficient. Re-ranking can arise only with differential tax treatment, so that positive values of R imply positive values of H. However, horizontal inequity need not imply re-ranking. Since H and R must be non-negative, these effects reduce the tax system's redistributive effect.

D. The measurement of economic well-being

i. Unit of observation: individual or household

The studies are based on data for families and unattached persons (usually micro data), and in INEQ and some CGE and FINC studies they are converted into "equivalized" individuals (or adult equivalents) to reflect the scale economies of shared consumption.[23] This conversion can be done using the equivalence scales implicit in poverty thresholds, those derived from budget studies, or by applying a formula for the number of adult equivalents in a household (see Cutler and Katz, 1992: 548-49):

$$N = (A + aK)^b \qquad 0 \le a \le 1, \quad 0 \le b \le 1,$$

where the unit contains A adults and K children. Each child's needs can be counted as proportion a of an adult's needs, and scale economies are shown by b less than one. Total money income of the family is deflated by the equivalence scale factor to obtain equivalized individual income, and a similar deflation is applied to the family's total taxes to obtain equivalized individual taxes. The equivalized data are then weighted by the number of adult equivalents in each family based on its composition. This procedure assumes that all persons in each family enjoy equal shares of the family's total income; it ignores the possible presence of differential shares by age or sex of the family members. Another complication is that equivalence scales may be income-dependent because the consumption bundles differ across income levels (Pendakur, 2002).

Various equivalence scales have been employed in this kind of research. Jäntti (1997) uses the scales implied by the US poverty lines (the poverty line for a family of four persons equals twice that of a single person); Fritzell (1993) uses the so-called OECD equivalence scale (a factor of 1.0 for a one-person household, 0.7 for each other adult, and 0.5 for each child); and Wagstaff et al. (1999) use the formula given above with the parameters a and b both set equal to 0.5.[24] Another method is simply to take the square root of the total number of persons in the household; this is equivalent to setting a at 1 and b at 0.5.[25] Inequality measures—whether Lorenz curves, Gini coefficients,

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costs as different from ordinary consumption), so that one need not agree with the measures of H or R.

[23] US Congressional Budget Office (2001: 19-20) discusses the relative merits of using the household or family as the unit of analysis and opts for the household.

[24] Aronson et al. (1994) found that these parameter values minimized the measure of horizontal inequity for the UK's personal income tax.

[25] See for example Atkinson et al. (1995) and the US Congressional Budget Office (2001: 24). On occasion this has been called the OECD method.

quintile distributions, decile distributions, or 90/10 decile ratios—are then based on the weighted equivalized individuals. A few INEQ studies do not convert their household income data into equivalized individuals. For example, Zandvakili (1994: 480) asserts that "at this time, complete sets of equivalence scales are not available" and thus simply uses household income. Taking the household as the unit of observation without equivalizing is also common in FINC studies.[26] This creates some confounding of larger households with higher incomes—since FINC studies present their results as ATRs in relation to household income levels—and a less accurate measure of the well-being of individuals. An exception is a FINC study by Ruggeri et al. (1994, 1996), which uses the scales of Statistics Canada's low-income measure (1.0 for the first member, 0.4 for the second, and 0.3 per additional member). Fullerton and Rogers (1993) undertake a CGE study that ignores children per se and assigns half of the parents' combined income to each without any accounting for scale economies.

ii. Income measure: pre-fisc, broad money, or post-fisc

To assess the distributional impact of taxes, a measure of individual well-being is needed. This measure is required both for ranking individuals and for expressing a group's tax burden relative to its economic resources. An ideal measure could be based on lifetime levels of utility, but problems of measurement restrict most analyses to annual data and some form of income. The definition of income can be narrower or broader, reflecting either less or more of the impacts of public policies. The principal choices for the income measure are as follows:

• Actual market income including (often) imputations for in-kind forms such as employee fringe benefits and owner-occupied housing;

• Money income including transfer payments along with actual market income;

• "Pre-fisc income" based on what market income (plus any imputations) would be in the absence of taxes and public expenditures; this measure adds back the taxes that are assumed to be borne by lower gross payments to capital and labour;

• "Broad income," which is "pre-fisc income" plus public transfer payments and cash-like subsidies (such as food stamps or rent subsidies) but not the benefits from publicly supplied goods and services;

• After-tax or disposable income, which subtracts taxes from broad income and hence includes cash transfers but not the benefits from other public spending;

• "Post-fisc income," which reflects the addition of benefits from publicly supplied goods and services as well as transfers and nets out the taxes borne, to obtain a measure of material well-being after all government fiscal actions.

Broad income has often been used in FINC studies that examine only tax incidence, whereas studies that also examine the incidence of public expenditures typically employ the post-fisc income measure. In order to implement the post-fisc

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[26] However, the US Congressional Budget Office (2001) undertakes FINC estimates of ATRs using equivalized incomes for ranking of households by percentile groups, but it presents its results based on total household incomes unadjusted by household size (2001: 24, 30, 36).

income measure, one has to allocate the benefits of publicly supplied goods and services across the population. This exercise is subject to arbitrary choices—whether the benefits of a particular program should be allocated on a per-head basis, proportionate to income, or in some other manner—giving much uncertainty to the resulting income figures. A study that examines only tax incidence can sidestep these complexities and uncertainties by considering pre-fisc income or broad income. However, these measures omit the benefits of certain public outlays, and broad income is sensitive to policy shifts between delivering a particular benefit via cash transfers and in-kind services. For that reason, some analysts argue that only pre-fisc or post-fisc income offers a consistent measure of fiscal incidence (Ruggeri et al., 1994: 422; Gillespie, 1966: 6-11). In response, proponents of the broad income measure argue that it avoids the vagaries of allocating non-cash public expenditures and that it also accords more closely with measuring taxes as a proportion of the income that individuals directly control, namely their market plus transfer receipts (Vermaeten et al., 1994: 353-354). Regardless of which measure is chosen, comparisons of results from different studies need to recognize that a post-fisc income base will make taxes look more progressive (or less regressive) than a broad income base, since the former adds equalizing program benefits to incomes. The use of pre-fisc income will make taxes appear most regressive for low-income households, since it excludes the cash transfers that make up a large part of their total resources.

CGE studies can most closely approximate a lifetime utility measure, as they are based on dynamic CGE models that include individual utility functions. INEQ studies of tax incidence typically compare the distribution of disposable income with that of broad income. Because most such studies consider only the personal income tax and assume that its full incidence falls on the individual, they do not need to use a "pre-fisc" adjustment to find what market incomes would have been in the absence of the tax. One INEQ study that includes payroll taxes does make such an adjustment by adding the employer's portion of the tax to market incomes, which then enters broad income (Jäntti, 1997). This adjustment reflects the assumption that workers bear the full economic incidence of the employer's share of payroll taxes, so that their gross compensation would be that much higher in the absence of the tax. Otherwise, INEQ studies generally are not concerned with adjustments for the benefits of non-transfer public expenditures. One study found that adding the benefits of public spending for healthcare and education reduced income inequality in 1979-81 for most countries, especially so in West Germany and Canada, but was slightly favourable for upper earners in Sweden (Smeeding et al., 1993). If a tax incidence study were to be performed using this broader measure of income, it likely would find less redistributive effects of taxes since the pre-tax income distribution would already be more equalized.

iii. Period of observation: annual or lifetime

Almost all income and tax data for studying distributional issues are available on an annual basis, and most personal tax systems use an annual accounting period for applying their progressive rates (though some countries have provisions to allow for cross-year tax averaging). Nevertheless, it is an open question whether the year or a longer period, such as the individual's lifetime, is preferable for measuring inequality and

the distributional pattern of taxes.[27] Advocates of the lifetime perspective cite the fact that annual income is highly variable, both year-to-year and over the various stages of life, whereas annual consumption has a much smoother pattern both across years and over the lifetime. From these observations they infer that consumption levels are a better index of well-being of the individual and that lifetime-discounted income is superior to annual income. Moreover, they refer to the permanent income and lifecycle income theories as demonstrating how transitory deviations from the individual's average income will provide exaggerated measures of the regressivity or progressivity of various taxes when measured annually. It has been estimated that lifetime labour endowments display about one-third to one-half less inequality than annual labour endowments (Mincer, 1974: 119; Blomquist, 1981: 255). The lifetime perspective has been used in a couple of FINC studies, by simulating lifetime incomes, ranking individuals by their lifetime incomes, and assessing lifetime taxes on that basis. Most recent CGE studies are constructed to answer questions about the lifetime incidence of taxes, both in the transition following tax rate changes or reforms and in the economy's steady-state outcome.

Advocates of the annual perspective argue that the need to simulate lifetime income series leads to much uncertainty. They query the strong assumption of ready borrowing and lending at a common interest rate required in lifetime models. And they assert that both individual taxpayers and policymakers are most interested in the pattern of taxes over a much shorter period than a lifetime. They further cite the frequency of changes in tax policies as a reason to focus on annual incidence. All INEQ studies and the great majority of FINC studies take an annual perspective for observing incomes and the associated tax burdens. The use of an annual period for assessing the effects of transfers and taxes on inequality, or the progressivity of transfers or taxes, combines two kinds of redistribution. Since a substantial part of transfers and public spending is aimed at smoothing year-to-year income variability (unemployment insurance, social assistance, and workers' compensation) or smoothing incomes over different life stages (public pension plans, educational subsidies, and public healthcare), it is engaging in horizontal redistribution; the same individuals are receiving benefits in some years and paying for them through taxes in other years. Much of the high ATRs of "progressive" personal taxes for individuals with unusually high income in a given year or the high ATRs of "regressive" sales taxes for individuals with unusually low income in a given year would be smoothed away if they were observed over more years. A multi-year or lifetime perspective can much better distinguish the vertical component of redistribution.

E. Range of tax policies and tax incidence

Studies of distributional impact must draw a line between tax policy and transfer policy. In many countries, the tax system is used to deliver transfer-like programs, often via refundable tax credits.[28] Canada has been a leader in this area, first in 1978 with the refundable child tax credits, sales tax credits in the 1980s, and the GST tax credits and the

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[27] For proponents of the lifetime view, see Davies et al. (1984) and Fullerton and Rogers (1993: 17-21); for proponents of the annual view, see Goode (1980) and Vermaeten et al. (1994: 355).

[28] The tax system is commonly used for delivering transfers in both Canada and the US, although the approaches differ; see Kesselman (1992).

Child Tax Benefit in the 1990s. The latter was then expanded into the National Child Benefit with a supplementary payment for lower income families that replaced part of social assistance benefits. If such provisions are counted as part of the tax system, this raises issues of cross-country comparability (since other countries may deliver their benefits through direct cash transfers) and of temporal comparability for a given country (such as when Canada converted family allowance cash benefits into the tax-based Child Tax Benefit in 1993). Yet, when a refundable tax credit is used to offset the burden of a particular tax on lower income families, this might be regarded as an offset to that tax and therefore part of the tax system. For example, Canada's GST tax credit serves as an alternative to offering more relief for necessities in the coverage of the GST itself. Moreover, many tax expenditure provisions are motivated by relief for those at lower incomes or in special circumstances, and thus they substitute for more explicit cash transfer programs. Further issues arise when the personal income tax is used to claw back cash transfer benefits from higher income earners; without any adjustment to the data, these clawbacks make the personal tax appear more progressive over certain income ranges, whereas in other times or countries the income targeting is achieved within the benefit program. Careful choices must be made to ensure maximal comparability over time or across countries, but an arbitrary element will inevitably remain.

This body of research varies widely with respect to the range of taxes considered and the economic incidence assumed for each tax. INEQ studies consider only the difference between post-transfer, pre-tax incomes and post-transfer, post-tax incomes — or essentially the personal income tax and payroll taxes for social insurance. In practice, many of these studies ignore the payroll taxes and examine only the income tax. Thus, INEQ studies ignore the impact of a wide range of indirect, property, and business taxes on both market incomes and on the real value of disposable incomes. Virtually all studies of the distributional impact of taxes, of all three types, assume that the full burden of personal income taxes falls on the individual taxpayer. If, in fact, the tax is partially shifted forward into higher remuneration for the individual, then the measure of distributional impact will be distorted. It is most likely that highly skilled, mobile, well-paid workers (such as the professions, top management, and creative and technical workers) are able to shift part of increased personal taxes to their clients or employers. In that case, the reported pre-tax distribution will not accurately measure the distribution of market incomes that would arise in the absence of the personal tax; market incomes of higher earners would in fact be lower without the tax shifting. Hence, this method may overstate the efficacy of nominally progressive personal taxes in reducing inequality.

Studies of the CGE and FINC types consider a wider range of tax policies and some alternatives for the incidence of each tax.[29] CGE studies examine several stylized forms of tax within a CGE model; these stylized taxes cover the great majority of total tax revenues but do omit a few of the smaller taxes. Incidence in this framework is generated by the structure and parameters chosen for the CGE model. Typically, the parameters are chosen so that the model generates equilibrium outcomes that benchmark

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[29] Devarajan et al. (1980) compare earlier forms of studies of the CGE and FINC types and find patterns of incidence that are generally similar but substantially different in magnitudes; the early CGE studies assumed fixed supplies of capital and labour.

aggregate measures for the economy. Sensitivity analysis can be undertaken to see how variations in parameter values and/or structural features affect the incidence of the taxes. FINC studies allow for the widest range of tax types and shifting patterns for the various taxes. In these studies the incidence of each tax type must be specified by the researcher, drawing on information from both theoretical and empirical studies. Alternative shifting assumptions are easily introduced to examine the effects on the distribution of the tax across income groups as well as the incidence of the total tax system. In our later review of FINC studies, we critically examine the standard incidence assumptions used for the personal income tax as well as for other taxes.

F. Primer on tax and expenditure progressivity and inequality

Both taxes and the public expenditures that they finance affect the inequality of incomes or economic resources of individuals. In assessing the effects of taxes on inequality, it is essential to bear in mind the expenditure side of the equation. Public expenditures include both cash transfers and outlays for public goods and services, each of which has its distinct distributional pattern. Note that most studies of inequality, including almost all of the INEQ type, count the impacts of cash transfers but completely neglect the distribution of benefits from in-kind benefits and general public services. For a *given level and composition* of public expenditures, and a given total of tax revenues, the mix and structure of taxes will affect the inequality of after-tax incomes. Shifting the tax system toward greater progressivity will, by most measures, reduce the inequality of after-tax incomes. Moving the tax system to lesser progressivity or to regressivity, conversely, will increase the inequality of after-tax incomes. Changes in the tax system that increase progressivity (or reduce regressivity) in some income ranges while lowering progressivity (or raising regressivity) for other incomes will have a net impact on inequality that depends on the index employed (and the inequality aversion parameter).

Many issues of public policy involve raising (or lowering) the scale of public spending along with total tax revenues; this perspective is also relevant when making comparisons across countries with differing relative sizes of their public sectors. Then the net impact on inequality will hinge upon the progressivity of taxes (P_t) relative to the progressivity of expenditures (P_e).[30] We later show that cash transfers are highly progressive in Canada; they decline sharply as a percentage of money income as one moves up the income quintiles. The progressivity of total public expenditures—including in-kind benefits and general public outlays as well as cash transfers—has been addressed in several studies.[31] The benefits of non-cash programs can be distributed in various ways; the choices range from lump amounts per head to proportionate with income to rising as a percentage of income. Clearly, the type of program will affect its distributional pattern, with the benefits of health care being closer to per capita sums (and

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[30] The present discussion addresses the general conceptual issue and not exact definitions of progressivity; assume simply that progressivity for both taxes and expenditures is measured with respect to the same money income base. Moreover, we apply the term "progressive" to expenditures that decline as a proportion of income with higher incomes; some studies have called this pattern "regressive" for parallelism with the term's use for taxes (for example, Dahlby, 1985: 116; Lambert, 2001: 269).

[31] For example, see Dodge (1975), Gillespie (1980), and Ruggeri et al. (1996).

thus highly progressive) and those of public opera houses rising more than proportionately with incomes. Since cash transfers include some income-targeted programs, they are more progressive than overall public spending, but total public spending is still found to be significantly progressive.

For purposes of illustration, let us first assume that the entire tax system is strictly proportional. In itself, a proportional tax system will not affect the level of inequality nor will changes in the proportional rate of tax, so long as the extra revenues are disregarded. But raising overall taxes will finance larger public outlays, and with $P_e > P_t$, this will reduce measured inequality. By extension, even if the tax system is regressive, raising more taxes and spending them in a progressive way can also reduce economic inequality, so long as the progressive effects of spending outweigh the regressive effects of the taxes.[32] This inequality-reducing effect of larger government will be even stronger if the tax system is proportional or progressive, but progressivity of taxes is not required. Hence, the size of government may be even more important to reducing inequality than the progressivity of taxes *per se*. Of course, the progressivity of public expenditures also affects the degree of inequality mitigation. According to Ruggeri et al. (1996: 9), almost all Canadian studies prior to 1994:

> … found that the redistribution of income generated by the fiscal system results largely from the progressive (pro-poor) distribution of government transfers to persons. Taxation was found to be roughly proportional or mildly regressive and government spending on social goods was found to be mildly progressive.

3. Inequality Studies of Taxes

The inequality impacts of personal income taxes have been studied as an offshoot of research that measures trends in inequality for a given country over time and differences in inequality across countries. The basic methodology of INEQ studies is simple—take the difference between the pre-tax and post-tax measures of inequality (usually the Gini). Typically the only tax considered is the personal income tax, although social security taxes are occasionally included as well. As noted above, the income tax is assumed to be borne fully by the taxpayer, which likely overstates the efficacy of the tax in reducing inequality. Moreover, in ignoring all other taxes, INEQ studies focus on the most redistributive element of the tax system and neglect other major taxes that are much less progressive and often regressive. Consequently, they provide a misleading view if one is interested in the equalizing effects of the tax system as a whole. Two studies of this type have gone a step further by exploring components of the personal tax structure that contribute to the equalization of incomes.

A. *Taxes, transfers, and the pattern of inequality in Canada*

To set the stage for the redistributive effects of personal income taxes, it is useful to compare their magnitude with those of cash transfers for various income groups.[33]

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[32] Exactly this outcome was reported in a study of Quebec for 1981. Taxes were found to be regressive, while transfers and government spending on goods and services were progressive, yielding a slightly progressive net outcome. See Payette and Vaillancourt (1986).

[33] For a somewhat similar analysis for the period 1971-1992, see Beach and Slotsve (1996: 98-108).

Table 3 presents, by income quintile (separately for unattached persons, families, and all units), by five-year periods from 1971 through 2000, the proportion of total money incomes received from cash transfers and paid in personal income taxes (PIT). Transfer-like programs that are delivered through the personal tax system (provincial tax credits, the Child Tax Benefit, and the GST credits) have been classified as transfer receipts rather than offsets against income taxes. Several points emerge clearly from the table. First, over the period covered, there have been continual upward trends in the total percentages of money income received from transfers (except for the latest five years; and resulting from the rising share of seniors in the population) and paid in income taxes (except a plateau for the top two quintiles in the latest five years), and these trends appear across all quintiles and household types. Second, the transfer receipts percentage has increased much more for quintiles 1 through 3 than for quintile 5, while the average income tax rate has increased much more for quintiles 4 and 5 than for quintiles 1 and 2 (except in the latest five years).[34] Hence, the redistributive tilt of both cash transfers and personal taxes has increased over the period. Third, transfer programs exert a *proportionately* much larger impact in raising the money incomes of the lowest two quintiles than PIT in reducing the net incomes of the top two quintiles.[35] Fourth, the PIT is strongly progressive for all household types and time periods.

Using the same data, Statistics Canada has computed annual Gini coefficients from 1971 through 2000 for income before transfers, total money income, and income after tax.[36] Hence, one can observe the patterns of inequality over time, both pre-tax, pre-transfer and post-tax, post-transfer, as well as the separate effects on inequality of the cash transfers and the income taxes. One must keep in mind that this analysis completely omits all other types of taxes (which on balance are regressive in an annual view) but also neglects in-kind transfer programs, such as public provision of healthcare and education (which are progressive in the sense that they raise real incomes by larger proportions for those at lower than higher incomes). Table 4 presents the resulting measures of inequality for unattached individuals, families, and all households, for five-year intervals. Taking market incomes (or income before transfers), one can see that inequality as measured by the Gini has been fairly constant from 1971 through 2000 for unattached individuals but has increased for families. The cash transfer and income tax systems together have substantially lowered inequality of income after tax for individuals over the period but mainly served to prevent after-tax income inequality for families from rising.

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[34] The notable jump in the latest five years in the average income tax rate faced by the bottom quintile is likely the result of both rising nominal incomes and an income tax system with deficient indexation.

[35] Somewhat curiously, for unattached individuals, in most periods transfers play an even larger role in money incomes of the second quintile than the first quintile. This may be a result of the growing numbers of retirees whose transfers plus pensions place them above the lowest quintile. Further disaggregation of the data by age would be useful.

[36] Frechette et al. (2003) report that the surveys that underlie these Gini coefficients (the Survey of Consumer Finances to 1996 and thereafter the Survey of Labour and Income Dynamics) may understate levels and trends in inequality. They base this view on comparative analysis with more comprehensive tax-based and census datasets and suggest that the survey coverage may be missing growing numbers of the lowest income households.

The total decline in inequality in any given period can be decomposed into the transfer effects and the tax effects. Moving from the pre-tax, pre-transfer distribution to total money income reflects the impact of adding transfer receipts alone; moving from total money income to income after tax reflects the impact of income taxes alone. Hence, the total decrease in inequality from these two types of programs can be allocated between transfer impacts and personal tax impacts.[37] The last two columns in Table 4 report the percentages of the total reduction in the Gini attributable to each type of policy. For unattached individuals, transfers account for about three times as much of total inequality reduction as income taxes, and this ratio is fairly uniform across the period. For families, transfers account for about two times as much of total inequality reduction as PIT near the end of the period, and the relative influence of transfers in reducing inequality for this group is generally rising and then falling somewhat over the period.[38] Table 5 shows comparable figures for eight other countries, though the taxation policies include social security contributions along with PIT. For most of the countries, the relative role of taxation in equalizing net incomes has declined relative to that of cash transfers over the varying (and rather dated) periods of observation. There is also substantial diversity across countries in the relative influence of transfers versus taxes.

Table 6 presents the decomposition of inequality reduction in Canada for 2000, this time disaggregated by type of family. As expected, inequality in incomes before taxes and transfers is greatest among the elderly, unattached individuals, lone-parent families, and households with no earner. The largest total reduction in inequality from transfers and PIT combined, as measured by the percentage cut in the Gini of market incomes, arises for the same groups. The role of transfers relative to taxes in reducing inequality is also largest for elderly families (82 percent of the total Gini reduction), lone-parent families (78 percent), and unattached individuals (73 percent). The relative role of transfers is even larger for subgroups that combine some of those characteristics—such as female-head lone-parent families (83 percent), female-head lone-parent families with no earner (100 percent), elderly unattached females (87 percent), and two parents with children but no earner (95 percent). It is not surprising that transfers play the dominant role in reducing inequality for groups that not only have high dispersion of market income but also low average income, since the PIT can have little influence over income distribution when most of those incomes are below the taxable level or at most fall into the lowest positive tax bracket. Even a group such as two parents with children and one earner has more than half its inequality reduction attributed to transfers vis-à-vis taxes.

One study of the distributional impacts of Canada's fiscal system focuses on the

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[37] An important caveat is needed here. The order in which the two "programs" (transfers and taxes) are considered can affect the relative equalizing effect attributed to each, since the first program applied will naturally have the largest opportunity to reduce inequalities in market incomes (unless the two programs are orthogonal). Hence, the discussion in the text should be read as indicating the general trends over time, across countries, and over household types. Also, it is natural to consider cash transfer programs first, since income taxes apply to total incomes including many of the transfers. Ervik (1998) proposed this approach.

[38] Wolfson and Murphy (2000) found that for both Canada and the US, income transfers had significantly stronger equalizing effects than income taxes. They also found that for the period 1985 to 1997, income transfers had a stronger equalizing effect in Canada than in the United States.

relative contributions of personal income taxes and cash transfers to *horizontal* inequity. Duclos and Lambert (2000) begin by proposing an index that expresses the gain in per capita revenue that would arise from eliminating a horizontal inequity in a welfare-neutral manner. Their index also measures the horizontal inequity's associated loss of vertical equity based on the Blackorby-Donaldson progressivity index (see Table 2). They apply their schema to assess Canadian income taxes and cash transfers between 1981 and 1994. They find that the largest source of horizontal inequity arises from old-age transfers for the bottom 60 to 85 percent of the income distribution and from income taxes for the top 15 to 40 percent.[39] They also find a slight increase in the variability of income taxes between 1981 and 1990 (which bracket the 1987 tax reforms) for market incomes below the median but no change for persons in higher percentiles. Increased variability for incomes in the lower tail is attributed to the growing differentiation of provincial tax policies over this period.

B. Personal taxes and cross-country inequality

Several INEQ studies examine the inequality impacts of personal taxes in a cross-country framework. However, some of these studies do not distinguish the effects of taxes from those of transfers (e.g. Fritzell, 1993; Atkinson, 2000); that is, they compare pre-tax, *pre-transfer* inequality with post-tax, *post-transfer* inequality. Other studies distinguish the separate effects of income taxes (and employee social security premiums in some studies) on inequality but do not include Canada in their sample of countries (e.g. Ervik, 1998). Moreover, the exclusion from these studies of indirect, property, and business taxes affects not only the measured impact of taxation on inequality but also distorts the comparisons across countries. Most of the excluded types of taxes are relatively regressive, so that differences in tax mix across countries can substantially bias the cross-country measure of inequality reduction from the tax system in its entirety.[40] In concept, many of the excluded taxes could be incorporated into the analysis via tax effects on the consumer price index. However, as shown in Pendakur (2002), the relevant price indices may differ across income groups, and this point is especially relevant for retail sales taxes and value added taxes that use exempt or zero-rated classes of goods for distributional purposes. Some of the excluded taxes may exert their effects by backward shifting from business into lower employee compensation, and this would be very difficult to include in INEQ studies.

Most studies of this type use the Luxembourg Income Study (LIS) dataset, which was carefully designed for cross-country comparability over time. Nevertheless, several

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[39] The other categories of cash transfers examined in the study are family benefits and related tax credits; and social assistance and unemployment insurance benefits. Of these two categories, the latter displays more variability (within income class) across the income spectrum. Note that old-age transfers are characterized as horizontally inequitable only in the sense that they increase variability of net incomes for households with identical market incomes. These policies undoubtedly serve equity purposes based, for example, on the lower earning ability of the aged (see later discussion of the general issue).

[40] However, Canada and the US have very similar tax mixes at least with respect to the share of personal income taxes in total tax revenues including social security contributions—38 percent for Canada and 42 percent for the US in 2000. The other major tax types are also closely matched in weighting for the two countries, if one considers social security (payroll) taxes jointly with indirect taxes on goods and services.

issues of comparability remain with the LIS, as discussed by Gottschalk and Smeeding (2000). Some forms of measurement error—such as those that are independent of decile rank, common across countries, or time-invariant—do not affect cross-country comparisons of inequality. The data are annual and therefore have all the deficiencies of short-term observations of the income experience of individuals. Furthermore, the studies cited in this and the next subsection are all now relatively dated in the periods they cover. They all predate the personal tax hikes in the US in the early 1990s and the Canadian personal tax cuts in the later 1990s (at the provincial level) and in 2000 and later (at the federal level). Moreover, most also miss the major Canadian tax reforms of 1988 and some even miss the major US tax cuts of 1981 and reforms of 1986. Hence, it could be useful to repeat similar analyses to explore the inequality effects of tax reforms and rate cuts in Canada and other countries in more recent years.

One relatively simple research strategy is to test for Lorenz dominance of tax progression curves in comparing tax systems either over time or across countries. Bishop et al. (1995) pursue this method using the personal income taxes plus payroll taxes of six countries, including Canada, for two points in the late 1970s and the 1980s. These tax progression curves can be constructed based on either the residual progression or the liability progression concept, as defined earlier. Those concepts apply at a given point in the tax schedule or distribution of pre-tax incomes, and a corresponding tax progression curve can be constructed similar to that of a Lorenz curve.[41] Then the tax progression curves can be compared either across countries or over time to assess whether one curve "Lorenz dominates" the other (meaning the former is more progressive), whether the two are Lorenz equivalent, or whether there is "Lorenz crossing" (where no conclusive ranking is possible). Using the liability progression concept, Bishop et al. (1995) find for systems around 1980 that Canadian direct taxes were more progressive than those in Sweden and the UK, less progressive than West Germany, equivalent with Australia, and Lorenz-crossing with US taxes.[42] Using the same concept, they find for observations around 1986 that Canadian direct taxes were more progressive than those of Australia, Sweden, the UK, and the US and less progressive than those of West Germany. Between 1981 and 1987, Canadian direct taxes exhibited no change in liability progression.

Zandvakili (1994) assesses the impacts of personal income taxes in nine countries including Canada using the LIS and inequality measures of the generalized entropy and Atkinson types. His method is to compute the inequality measure for each country based on gross income (x^g) and net income (x^n); then, the two inequality measures can be compared to gauge the impact of income taxes. Income tax progressivity is gauged by the index P_E, which is the difference between pre-tax and post-tax generalized entropy measures of inequality. Table 7 presents Zandvakili's findings based on generalized

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[41] The residual progression curve is constructed by adding values of $LC(x^n) – LC(x^g)$ at each quantile point to the ordinate of the 45-degree line, where LC is the Lorenz curve of post- or pre-tax income distributions. Similarly, the liability progression curve is constructed based on $LC(t) – LC(x^g)$, where $LC(t)$ is the Lorenz curve of taxes paid.

[42] The authors do not report their results using the residual progression curves but note that of the 30 possible cross-country comparisons, only two cases were significantly different at the 10 percent level.

entropy indices for a range of values of the parameter c (his rankings of countries using the Atkinson indices are very similar and are not replicated here). As shown, the choice of parameter c affects the ranking of countries. For high inequality aversion at lower incomes ($c = -1$), Canada ranked near the middle of the nine countries on pre- and post-tax income inequality and tax progressivity but last on percentage decline in inequality of pre-tax incomes. For lower inequality aversion (larger values of c), Canada's ranking worsened on tax progressivity but improved on percentage decline in inequality. Sweden ranked highly on pre-tax income inequality but near the bottom on both measures of the equalizing effects of taxes. This outcome may reflect the dependence of this tax progressivity measure on the distribution of pre-tax incomes. [43] Yet the Netherlands had nearly as much pre-tax income equality as Sweden but nevertheless its tax system performed much better in measured progressivity and inequality reduction.

Because the generalized entropy family of inequality measures is decomposable, it can be used to assess the relative contribution of income taxes to equality arising from within-group and cross-group effects. Very roughly speaking, this corresponds to the distinction between the horizontal and vertical equity effects of taxes. Zandvakili (1994) pursues this decomposition based on numbers of earners in the family (ranging from zero to three) and also by household size (ranging from one to five-plus). Setting parameter $c = 0$, the largest share of redistribution arises within rather than between groups of households with different numbers of earners for most countries—100 percent for France and Sweden, 76 percent for Switzerland, 71 percent for Canada, 69 percent for the Netherlands, and 65 percent for the US. For two countries most of the redistribution arises between groups—99 percent for Germany and 60 percent for the UK. When the data are decomposed by household size, the great bulk of tax redistribution is found to arise within rather than between groups—88 percent in Switzerland and the Netherlands and more than 90 percent in all other countries, except for 68 percent in Germany.

Jäntti (1997) similarly uses the LIS to explore the role of income taxes in reducing inequality in five countries including Canada. This study distinguishes the equalizing contributions of personal income tax and payroll taxes as well as the separate effects of social insurance benefits and income-tested benefits. Income-tested transfers would be expected to contribute much more to equalization (in the vertical equity sense) than social insurance transfers (which aim more at horizontal redistribution). Social insurance programs could even raise inequality, insofar as their benefits are positively linked to earnings and many of the lowest income households have no earned income. However, with annual data social insurance benefits could appear as equalizing in that they tend to buffer earnings during temporary dips such as joblessness or illness. These benefits also are typically capped in dollar terms even if they are earnings-linked, and those at the highest incomes have a higher proportion of unearned income.

Jäntti's study decomposes income inequality, measured by the squared coefficient of variation, by income source, type of tax, and type of transfer. For each country two years are observed, but none of the years is more recent than 1987. In absolute

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[43] On this general point of the effect of the pre-tax income distribution on the measured redistributive effect of a progressive income tax, see Lambert and Pfähler (1992).

contribution to reducing inequality, income taxes are most effective in the US and least effective in the UK, with Canada and the others intermediate. In their relative contribution to equality, income taxes are most equalizing in Sweden and the Netherlands; they become more important in relative terms for those countries because of their initially lower levels of market income inequality. Additionally, the relative contribution of income taxes to reducing inequality declined only in Sweden and the US, which were the only countries undertaking major tax reforms to reduce rate progressivity between the two years. Payroll taxes are also significantly equalizing in all the countries (except Canada, which lacks this data), actually rivaling or exceeding the impact of income taxes in Sweden, the Netherlands, and the UK. Means-tested transfers are found to be equalizing in almost all cases, though the size of the effect is quite small. Social insurance transfers are slightly equalizing in Canada and the UK but disequalizing in the other three countries. The small estimated role of transfers relative to taxes in equalizing incomes contrasts with the evidence given earlier in Tables 4 and 6 for Canada. This may be explained by the differing inequality indices; Jänti's squared coefficient of variation is much less sensitive to the lower tail than the Gini used in our tabulations.

C. Decomposing personal tax policies and cross-country inequality

Some research has attempted to distinguish among the redistributive dimensions of the personal income tax in a cross-country setting. Wagstaff et al. (1999) applies a methodology developed in Aronson and Lambert (1994) to purse this issue for 11 European countries plus the United States; Canada is not among the countries covered. The study decomposes the redistributive effects into the three components noted earlier— vertical redistribution (V), horizontal inequity (H), and a re-ranking effect (R). Table 8 presents the results of the decomposition, with each of the components expressed as a percent of the total redistributive effect in each country, and thus they sum to 100 percent (with negative signs attached to H and R). Horizontal inequity is relatively small in all countries, and differential taxation manifested as re-ranking is substantial only in Denmark, France, and Switzerland.[44] The personal tax is found to be most progressive in France, Ireland, and Spain and least progressive in Sweden and Denmark; despite their rate-reducing reforms of the 1980s, the UK and US income taxes remained relatively progressive. Note the relatively low tax progressivity found in Scandinavian countries (in this study and in Jäntti); this results from the combination of a progressive national tax combined with larger flat-rate income taxes applied by localities.

At least one study has taken the decomposition a step further to explore how the *structure* of the personal income tax affects inequality in a cross-country comparison. Wagstaff and Van Doorslaer (2001) distinguish among allowances (or personal exemptions in North American jargon), deductions (such as those for medical costs), nonrefundable tax credits, and the statutory rate schedule. The progressivity of net taxes depends upon both the mix of these components and the progressivity of each. For example, one country may allow deductions that decline as a percentage of income, while

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[44] The authors concede that the division between H and R is sensitive to the size of the income groups used to define "equals," so that a more reliable approach may be to view the sum of H and R as the differential tax treatment.

another may allow the most generous deductions at the highest incomes. The study covers 15 OECD countries, but unfortunately the year for Canada is 1986, which predates the 1988 reforms that converted personal exemptions and several deductions (for medical expenses, tuition fees, and employee premiums for social insurance) into nonrefundable credits. The data used in the study are decile averages, exclude all non-taxfilers, exclude subnational taxes in some countries, and take as the unit of observation the tax unit, the definition of which varies across countries. Moreover, interpolation problems arising from the data cause the sum of the estimated contributions of the four components to depart in some cases from the total estimated progressivity. This divergence is particularly severe for the US and Canada.

Keeping in mind the study's limitations, we note some general findings of Wagstaff and Van Doorslaer (2001). Net tax liabilities are found to be least progressive with respect to income subject to tax (before deductions and allowances) in the Scandinavian countries (again because of their flat local income taxes) and most progressive in France, the Netherlands, Spain, Canada, and Australia. The tax credit's contribution to progressivity is relatively small, with the exceptions of Denmark and Italy; in Australia and France tax credits *reduce* the progressivity of net tax liabilities. Deductions reduce progressivity in most countries but increase progressivity in Australia, Finland, France, and Germany. Tax progressivity is attributable almost entirely to the rate structure in Italy, the Netherlands, and Spain. In contrast, allowances account for almost all progressivity in Canada, Ireland, the UK, and the US. It would be useful to undertake this analysis with a better dataset and for a more recent year, after Canada's 1988 conversion of all allowances and some major deductions into tax credits. Since those provisions were converted into credits at the bottom bracket tax rate, this change should have increased effective progressivity. However, the 1988 Canadian reforms also flattened the tax rate schedule and lowered the top rate, thus offsetting the increase in progressivity (see Cloutier and Fortin, 1989).

4. Computable General Equilibrium Studies of Taxes

Computable general equilibrium models offer another approach to assessing the distributional impact of taxes and the tax system. Recent CGE studies build on the dynamic framework developed by Auerbach and Kotlikoff (1987). These analyses can evaluate the efficiency and distributional effects of taxes jointly. Because these models reflect the labour supply and savings responses to tax policies, the distributional impacts can be measured in terms of impacts on households' lifetime utilities (or the equivalent money sums). Net income does not measure all of the induced effects on household well-being, once the tax system alters work-leisure and intertemporal consumption choices. The Auerbach-Kotlikoff model includes multiple overlapping generations but not multiple households in each generation, so that its distributional analysis is limited to intergenerational issues but cannot consider intragenerational impacts (across households of the same cohort but with differing lifetime incomes). Later analysts have extended the framework to encompass within-generation distributional impacts of taxes as well as multiple generations; we call these CGE studies. Most of these studies have been applied to assess the distributional impacts of tax reforms—such as changing the personal tax

base to consumption or to comprehensive income or flattening the personal tax rate schedule—rather than the impacts of existing taxes. [45]

Fullerton and Rogers (1993) offer one of the few CGE studies to assess the distribution of the existing tax system and its components. While the study is applied to the US, the similarities of its economy and tax mix to those of Canada make the findings of interest. [46] Table 9 summarizes the study's key distributional findings. The upper part of the table displays the impacts of replacing each of the five main types of taxes with a proportional tax on each household's labour endowment (present value of all years' fixed leisure hours valued at its wage rate each year). Households are arrayed by lifetime income decile, with the bottom and top deciles each further subdivided into the lowest and highest 2 percentiles and the balance. The impacts are stated in terms of a dollar measure of utility, equivalent variation[47] (EV), as a percentage of that income group's lifetime income. For example, replacing a tax might increase the net income while decreasing the leisure time of a particular group; because leisure affects utility, the net income impact alone would overstate the utility gain to that group. The figures in the upper part of the table reflect the EV gains as a percent of lifetime income to the "steady-state" generation, which is the cohort after all economic adjustments to the tax change have taken place. For the steady-state generation, only the personal income tax is found to be strongly and consistently progressive; payroll tax is regressive; sales and excise taxes are regressive except slightly progressive for the top decile; corporate taxes display a shallow U-shaped incidence pattern; and property tax has a highly variable pattern with its heaviest incidence on the top and bottom 2 percentiles. All taxes taken together display a variable pattern, but the top decile bears the heaviest relative tax burden. [48]

In models of this kind, the steady-state utility gains of replacing a distorting tax with a non-distorting form are not pure efficiency gains. The gains to the steady-state generation omit the economic effects on transitional generations. When moving to non- or less-distorting taxes, future generations benefit at the expense of earlier generations,

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[45] Altig et al. (2001) introduce intragenerational distribution into the Auerbach-Kotlikoff model and have the further property of perfect-foresight behaviour along the transition path vis-à-vis Fullerton-Rogers' use of myopic expectations. However, Altig et al. examine fundamental tax reforms (including variants that protect lower-earning households) and not the impacts of the existing mix and structure of taxes. Similarly, Fullerton and Rogers (1996) apply their CGE model to distributional aspects of fundamental tax reforms.

[46] One caveat here is that the Canadian economy is much smaller and more open to international flows of capital and labour, which can affect the economic modeling and implied tax incidence. Also, Canada applies indirect consumption taxes more heavily than the US, which in turn applies payroll taxes more heavily than Canada.

[47] EV, a standard measure of efficiency costs, is the maximum amount of income that an individual would pay to forego the tax or tax change.

[48] Recall that all of the tabulated impacts are relative to a proportional tax on lifetime labour endowments, which rise with the wage rate of each lifetime income group. This is an example of "differential tax incidence" analysis, which avoids the problems of assuming an unbalanced budget when removing taxes, but it yields results that are sensitive to the choice of tax that is assumed to replace the lost revenues. Also note that Fullerton and Rogers (1993) model the brackets of the personal income tax as all having the same marginal rate (30 percent) but differing intercepts, so that they do not capture the economic effects of marginal rate progressivity.

which bear the costs of the adjustment. For example, replacing the income tax with an endowment tax raises the burdens on older individuals who paid income taxes during their working years and are now retired and enjoying leisure. This additional revenue from those who are old at the time of the change means that less tax needs to be collected from those who are young and from future generations. Since part of the gain to the steady-state generation reflects this form of redistribution, a true efficiency measure needs to sum the present value of EV impacts for all annual cohorts. The last two rows of Table 9 show these efficiency costs of the various taxes, expressed as percentages of lifetime income and revenue, respectively. Relative to revenues generated, the most costly tax in efficiency is that on corporate (or capital) income, followed by property tax and personal income tax. Sales and excise taxes (or a broad tax on consumption) is the second least costly tax in efficiency terms, and payroll tax the least costly.[49]

Little research using the CGE approach has been undertaken for the Canadian tax system, and what has been done uses static CGE models that do not account for the full intertemporal dynamics or the tax system's lifetime effects on individuals. Moreover, the Canadian research has been applied to investigate the efficiency and distributional effects of switching the personal income tax to a flat tax rather than the effects of the existing set of taxes. One such study, Beauséjour et al. (1996), finds that a simple flat tax would benefit two-earner couples and singles; adding a $500 credit to the scheme increases the gains for singles and also benefits seniors.[50] The losers under these schemes are found to be single parents and one-earner families. Using an Atkinson index with a moderate degree of inequality aversion (parameter $e = 1.5$), the study finds that the simple flat tax would raise inequality of after-tax incomes by 10 percent; adding the credit reduces this increase in inequality to 6 percent. This adverse effect on inequality could be mitigated by, for example, providing large additional credits for single parents and for nonworking spouses, as has been done under Alberta's provincial flat tax scheme.

5. Fiscal Incidence Studies of Taxes

The earliest and still most popular method of assessing the distribution of the tax burden is denoted as fiscal incidence. FINC studies combine assumptions about the incidence of each type of tax with datasets on the distribution of incomes by sources and uses to derive the income profile of ATRs.[51] Typically the analysis is performed on household units using annual data, though there are exceptions. This approach seeks to capture the effects of taxes, via demand and supply, on prices in the economy—chiefly the prices of factors of production (wage rates and the return to capital) and the prices of

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[49] This ranking of taxes by their efficiency costs accords roughly with that found in several other economic studies. For a review of this literature, see Kesselman (1997: 42-49). Auerbach and Kotlikoff (1987), for example, rank their stylized taxes (from highest to lowest efficiency costs) as follows: capital income, labour income, total income, consumption; most other studies have a similar ranking except that the labour income base has lower efficiency costs than the total income base.

[50] This study is unpublished, but a detailed account of it, as well as another unpublished Canadian CGE study that focuses more on methodological issues, is provided in Ruggeri and Vincent (1998: chapter 5).

[51] Many of these studies consider jointly the fiscal incidence on the expenditures side of public budgets, but we focus here on their methods and findings with respect to taxation.

consumption goods at various times and of various types. When the tax impact falls on the prices of factors, it is said to operate on the "sources" side of households' incomes, which are decomposed into the categories of labour, capital, and transfer incomes. When the tax impact falls on prices of consumption goods, it is said to operate on the "uses" side of income, which is decomposed into consumption and savings and may distinguish between forms of consumption taxed at lower and higher rates (such as food vs. alcohol). Assumptions about the incidence or "shifting" of each type of tax are taken from partial and general equilibrium models and empirical studies. Then a micro dataset distributive series of each type of income source and use by household income can be applied to each of the taxes, using a specified set of shifting assumptions, to compute the distributional burden of each tax and of total taxes.

FINC studies were pioneered in the US by Musgrave et al. (1951) and by Pechman and associates (1974, 1985) at the Brookings Institution and in Canada by Goffman (1962) and in Gillespie's (1966) research for the Carter Commission and his later work (1980).[52] This method also underlies the distributional tables produced for tax policy changes in the budgets of Canada and many other countries. A series of periodically updated studies by the Fraser Institute, now in its 13th version (Emes et al., 2004), uses this method. This section begins with the findings of a few of the more recent Canadian studies of this type, including both annual and lifetime perspectives. It then examines in detail the incidence or shifting assumptions that these studies employ for each type of tax and the related economic evidence.

A. Overview of Canadian findings

Before turning to the findings of the more recent Canadian FINC studies, it is useful to review an earlier analysis that highlights the critical role of tax shifting assumptions. Table 10 shows the pattern of estimated total ATRs by household income group for 1972 using the researcher's "central case" view of the most plausible shifting assumptions (Whalley, 1984). The result is moderate progressivity of total taxes across the income groups, which were originally specified for income intervals and are shown for the income percentile groups; ATRs range from 27.5 percent for the lowest income group to 43.0 percent for the highest. Combining the most progressive of shifting assumptions for the various taxes yields a pattern that is sharply more progressive—with ATRs ranging from 11.6 to 70.6 percent. Conversely, the assumption that capital income does not bear any tax burden and capital income is construed to include all human capital yields a highly regressive pattern—with ATRs ranging from 83.5 percent at the lowest incomes to 22.2 percent at the highest. Note that all of these results employ an unchanged definition of the income measure, which in this study includes transfer incomes and is gross of personal income taxes but net of all other taxes.[53] Varying this income definition (such as making it net of transfers or using income gross of all taxes) further alters the measured regressivity or progressivity of the tax system.

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[52] For references to and reviews of these and other FINC studies in these two countries and others, see Dahlby (1985), Vermaeten et al. (1994: 348-355), and Ruggeri et al. (1996: 6-11).

[53] See Whalley (1984: 671-74) for discussion of the income measure and tax incidence. Some choices for the income measure require recomputing individual incomes for each choice about tax shifting.

Two more recent studies of Canadian tax incidence offer contrasting findings and a useful backdrop to our subsequent discussion of the economics of tax shifting. Both of these studies utilize Statistics Canada's Social Policy Simulation Dataset/Model (SPSD/M) with various adjustments to the data. First are the findings for 1988 of Vermaeten, Gillespie, and Vermaeten (1994; denoted VGV), as summarized in Table 11.[54] This study uses both the pre-fisc and broad income concepts, but we present mainly their findings for the latter. In this study's "standard-case" shifting assumptions, both the personal and corporate income taxes are sharply progressive; commodity taxes (including both excises and broad-based forms) and property taxes are highly regressive; and the ATRs for payroll taxes display an inverted-U shape, with their heaviest relative burden at middle incomes. Grouping taxes by level of government, federal taxes overall are quite progressive, provincial taxes are roughly proportional, and local taxes are regressive. The table also presents variants of VGV's results for "progressive" and "regressive" shifting assumptions as well as the standard shifting case using a pre-fisc income base. The latter makes the overall tax system very regressive at low incomes and otherwise roughly proportional.

A second FINC study applies a similar database and methodology to that of VGV but uses a post-fisc income base and partially differing tax-shifting assumptions (especially with respect to the incidence of commodity taxes, as discussed later). This research for the year 1986 by Ruggeri, Van Wart, and Howard (1994, 1996; denoted RVH) is reported in two different forms with differing emphases. Table 12 shows their computed global relative share adjustment (RSA) indices both by type of tax and level of government; a base case as well as variants with more progressive and more regressive shifting assumptions are shown. As with VGV, personal income tax is found to be the most progressive tax by RVH, but due to different shifting assumptions the corporate income tax is much less progressive. Also mainly due to a different shifting assumption, RVH find general sales taxes to be progressive, although liquor and tobacco taxes are examined separately and found to be regressive. RVH's ranking of tax progressivity by level of government turns out the same as VGV's, with federal taxes the most progressive, but unlike VGV, RVH also find provincial taxes to be progressive and local taxes to be about proportional rather than regressive. Table 13 presents RVH's findings for effective ATRs by income group and household type, with personal income tax and all other taxes shown separately.[55] The income tax remains progressive with income for all household types, but all other taxes display ATR patterns across incomes that vary with household type. In comparing the findings of VGV and RVH, we recall that the income base used by the latter should make taxes appear more progressive. The 1988 year used by VGV should also reflect the slightly decreased progressivity of personal tax rates resulting from tax reforms that year, relative to the 1986 year examined by RVH.

The general methodology employed by VGV and RVH has been updated by Dyck

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[54] The same authors also provide findings from a useful extension of this analysis to show changes in tax incidence in Canada over the period 1951 to 1988 (Vermaeten et al., 1995).

[55] Ruggeri et al. (1994: 440-443) also present the ATRs by income class for each type of tax, but it is in graphical rather than tabular form and hence not replicated here.

(2003) to examine the Canadian "fiscal restructuring" of the latter 1990s. This was a period when governments at all levels were reigning in large deficits by controlling public spending and initially raising taxes and then, in some cases, reducing taxes for lower and middle-income households. The study finds that overall fiscal redistribution (including expenditures as well as taxes) remained progressive in the period 1994 to 2000 and in fact increased slightly since the 1980s; the RSA index for total taxes was more than twice as large as for transfers and for non-transfer public expenditures; as in earlier periods, taxes were most redistributive at the federal level, followed by the provincial level, and last the municipal level; and the personal income tax remained by far the most progressive category of taxes. The estimated RSA index for total taxes of 1.100 in 1997 exceeded the 1.085 estimated by RVH for 1986, suggesting a significant increase in total tax progressivity. This change could be explained by a series of tax increases from the latter 1980s until 1996 targeted most heavily at upper incomes.

In an earlier, path-breaking study, Davies, St-Hilaire, and Whalley (1984; denoted DSW) applied the FINC methodology to examine the distribution of lifetime taxes over lifetime incomes. This required the micro-simulation of lifecycle savings and bequest behaviour, which was implemented for stylized households consisting of couples with children during part of their lives. DSW generated lifetime distributive series on income, consumption, transfers, and taxes, each of which displayed much less dispersion than annual data because it removed both year-to-year and lifecycle variations. This approach allowed for the comparison of lifetime and annual tax incidence patterns using a common dataset, which they drew from Canadian data for 1970. Table 14 presents the DSW findings by major type of tax for both the annual and lifetime bases and for a couple of variants of tax shifting for the lifetime results. Both the annual and lifecycle views yield moderate progressivity in total taxes across the household income deciles, though progressivity is reduced in the lifetime view (except for the bottom decile). While the personal income tax is less progressive in the lifetime than the annual view, this is offset by the fact that most other taxes are less regressive. The lifetime incidence results are also much less sensitive to alternative tax shifting assumptions than the annual results, because of the lesser lifetime dispersion of the underlying economic series.

B. Incidence by type of tax

i. Personal income taxes and labour earnings

All distributional studies of the FINC type, as well as those of the INEQ type, assume that the economic burden of personal income taxes (PIT) falls fully on the individuals who nominally pay them. This approach was endorsed in an official US analysis of the distribution of federal taxes as follows: "employees bear the full individual income tax on their earnings … That assumption … is accepted by virtually all economists" (US Congressional Budget Office, 2001: 25). This is a critical assumption for tax distribution studies on account of the relative size and progressivity of the PIT. The personal income tax is the largest single source of tax revenue in Canada. For all levels of government taken jointly in 2000, the PIT was 43 percent (38 percent) of tax

revenues excluding (including) social security contributions.[56] Corresponding figures for the PIT broken down by level of government are as follows: federal, 57 percent (46 percent); provincial, 37 percent (35 percent); and local, 0 percent. Because of its dominance in revenues, the extent to which the PIT is effectively progressive is privotal in the cited findings that the overall federal tax system is substantially progressive and provincial taxes somewhat progressive. If the PIT were found to be less progressive in its economic incidence than conventionally assumed, then these findings might also be considerably altered, since most other major taxes are proportional or regressive.

Despite this standard assumption in tax distribution studies, there exist several forms of evidence that individual taxpayers do not bear the full incidence of the PIT. More worrisome for the validity of results from existing studies, there is evidence of a distributional twist in the incidence of the PIT that reduces effective progressivity. One study noted this phenomenon: "at the upper end of the income distribution, after-tax income is the basis for negotiations on remuneration," which suggests some shifting of the PIT by higher earners (Block and Shillington, 1994: 37). A similar result arises with the "tax equalization" provisions offered by many multi-national corporations when they relocate top managers to Canada. Their salaries are increased to offset the amount by which their Canadian income taxes exceed those in their home country. By a process of emulation or competition, similar salary premiums may spread to top managers of domestic origin. In a dual labour market model with imperfect competition and bargaining, it was found that diminished progressivity of the PIT reduced the gross wages of skilled labour, and this was empirically confirmed for Denmark (Hansen et al., 1995). Thus, the shifting of PIT works to undo at least part of its progressivity. This result is also common to long-run models of human capital formation and occupational choices. If one uses the pure "schooling" variant of the human capital model and assumes that there are no ability or quality differences across individuals, tax progressivity will be completely undone in the long run by occupational choices and related schooling investments (Montmarquette, 1974). Individuals will choose their schooling to maximize lifetime earnings net of tax, which makes tax progressivity useless for reducing inequality of net incomes; the PIT progressivity is simply shifted into correspondingly higher gross wages.[57] In a more realistic model with ability differences across individuals, the effective progressivity of a PIT would still be reduced but not eliminated.

An intriguing analysis by Lockwood and Manning (1993) relates the progressivity of the PIT and other labour taxes to wage formation via a bargaining model.[58] They suggest that their model extends beyond unionized workers to include the bargaining power that high earners may exercise over their employers through their firm-specific

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[56] These figures were derived by the authors from the Organisation for Economic Co-operation and Development (2002: Tables 45, 142). Federal social security funds include all contributions to CPP and EI; provincial social security funds include all contributions to QPP and hospital insurance premiums; provincial payroll taxes are classified along with tax revenues.

[57] The extreme regressive findings illustrated by Whalley (1984), as shown in the right-hand column of Table 10, reflect a similar economic assumption that human capital does not bear any of the tax burden.

[58] If this kind of bargaining power exists, it would undermine the validity of the perfect competition assumptions that underlie the models of CGE studies.

skills. In a fairly general model of firm-union wage setting, they reach several conclusions when the firm profit and union utility functions are iso-elastic.[59] First, an increase in the marginal tax rate (MTR), while holding constant the ATR, will decrease the pre-tax real wage rate. Second, an increase in the ATR, while holding constant the MTR, will raise the pre-tax real wage by more than the tax increase—hence backward shifting over 100 percent. Third, it is the ratio of the ATR to the MTR that affects the wage rate. As a result, the number of tax brackets affects the pre-tax income distribution; a strongly progressive PIT, with many rising MTRs, yields the flattest pattern of pre-tax wages and the most progressive distribution of net incomes. And a linear tax system would worsen the distribution of *pre-tax* labour incomes. The authors find that their model can explain the increase in gross wages of high earners in the UK in the 1980s following large cuts in their MTRs, and this outcome has nothing to do with improved incentives for hard work. They also find that the UK tax system, which has a basic MTR covering the bulk of workers, acts to redistribute gross wages towards higher earners within the basic bracket. Their empirical tests provide support for the role of the wedge between average and marginal tax rates as a determinant of pressure on gross wages.

Additional evidence stems from research that relates PIT rates to labour supply or migration responses that affect gross wages, particularly for skilled workers. These studies find partial or complete shifting of the PIT into higher wages that reduces the effective progressivity of the tax. Bingley and Lanot (2002) examined the impact of income taxes on labour supply and gross wages simultaneously; if the tax reduces the amount of labour supplied at a given wage, it will raise the equilibrium pre-tax wage rate, thus shifting part of the burden onto employers. They found that more of the adjustment was in gross wages than hours, which would be consistent with a model where aggregate labour supply was more elastic than labour demand.[60] However, that study did not distinguish between tax shifting for high versus low wage labour and thus does not directly address the progressivity issue. Feldstein and Wrobel (1998) attacked this problem by examining differential progressivity (including PIT, sales, and property taxes) across states in the US and asking, "Can state taxes redistribute income?" Using cross-state and cross-time data, their answer is "no"; interstate migration in response to tax rate differentials causes gross wages to adjust so that net-of-tax wages are equalized across states. This wage adjustment, with full incidence falling on employers rather than individuals paying the PIT, means that a more progressive state tax system raises the cost to firms of hiring more highly skilled workers.[61] The adjustment, which was found to occur within just a few years, does not require extensive migration. There needs to be enough movement of more heavily taxed workers to raise their marginal product relative

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[59] Their analytical result on the tax determinants of wage pressure involve the coefficient of residual progression, *RP(x)* as defined earlier, and hence the ATR and MTR are relevant factors.

[60] See Bingley and Lanot (2002: 174-175) for a review of recent literature on PIT shifting.

[61] Hence, it is the *differential* progressivity of subnational PIT systems that gives rise to the migration. If all lower jurisdictions had the same degree of progressivity, there would be no migration, and the taxes would remain effectively progressive with full incidence of the higher rates falling on the workers.

to that of less heavily taxed workers to offset the tax rate differential.[62] Day and Winer (1994) provide a review of Canadian studies of interprovincial migration in response to fiscal policies, suggesting that this process is at least partially operative in Canada.

Also relevant is empirical research on international migration, principally the asserted "brain drain" from Canada to the United States. The fact that emigration from Canada has been concentrated in a few highly paid occupational categories has been cited as evidence that Canada's tax rates are too high and too progressive (see Finnie, 2001, for review of studies and critique). The economic adjustment process here would be similar to that across subnational jurisdictions with differing degrees of progressivity. That is, within the limits of allowed immigration, the outflow would continue until the gross wage differentials across countries offset the tax rate differentials. That would constrain the ability of Canada to implement greater PIT progressivity than the US.[63] However, while Canadian PIT rates overall are higher than in the US, they are less progressive at the federal level (with higher bottom and lower top rates, and the top rate incurred at lower incomes) but more progressive at the subnational level (Kesselman, 2000, 2004). For that reason, any tax-motivated emigration from Canada might better be ascribed to the level rather than the progressivity of Canadian taxes.[64] Most likely, non-tax factors such as higher gross wage rates (unrelated to tax factors) and unique work opportunities in the US are the predominant explanation.

ii. Payroll taxes

The most common incidence assumption for payroll taxes in FINC (and INEQ) tax distribution studies is that the full burden of both employer and employee portions falls on employees via lower gross wages and salaries. This is the benchmark assumption in the VGV, RVH, and DSW studies cited above as well as the methodology of the US Congressional Budget Office (2001: 25). However, variations on the assumed incidence of payroll taxes, particularly for the employer share, are used for sensitivity analysis in a number of FINC studies. For example, VGV (1994: 368-369) adopt the standard payroll incidence view as consistent with a small open economy model where capital is more mobile than labour and product markets are highly competitive. In a "progressive" variant, they consider a small open economy with less capital mobility than in their standard model, full mobility of consumer outlays, and labour market imperfections that inhibit the backward-shifting of business taxes (such as unions bargaining on an after-tax basis with respect to payroll taxes). In that case they assume that the employer portion of

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[62] Also see Wildasin (1993) for a related analysis of this issue. However, Wildasin *assumes* that the supply of high-skilled workers to each state is perfectly elastic and that low-skilled workers and capital are completely immobile. Discussant Roger H. Gordon roundly critiques the study for this and other implicit assumptions (in Wildasin, 1993: 76-80).

[63] The overall process is somewhat more complex, as individuals consider the public services and civic values that they enjoy in each country as well as the taxes they pay, and those taxes in turn influence the level of public services and civic values; see Kesselman (2001).

[64] The sole empirical study of the relationship between Canada-US tax differentials and migration, by Wagner (2000), found that only about 10 to 15 percent of flows to the US could be explained by taxes.

payroll taxes is borne by capital, while the employee portion is borne by labour.[65] In a "regressive" variant, VGV consider an economy with fully mobile capital but imperfectly competitive product markets with oligopolistic elements that allow for forward shifting of taxes to consumers. In that case they assume that the employer portion of payroll taxes is shifted onto consumers via higher product prices, while the employee portion remains a burden on labour.

One needs to distinguish between payroll taxes that have a strong benefit linkage and "general" payroll taxes. A general payroll tax is one whose revenues go into the consolidated budget or one with no linkage between the taxes paid by or on behalf of workers and their benefit entitlements. The incidence of such taxes is discussed below. A benefit-linked payroll tax has more the character of a user charge for a publicly supplied service, where the tax reflects the value of associated benefits. Rather than the "wedge" imposed between the buyer's and seller's price by a conventional tax, the labour supply curve is shifted down by the prospective benefits just as the labour demand curve is shifted down by the payroll tax. If a worker values the benefits at their full cost, these shifts are equal, and the full incidence of the tax will fall on the employee without any decline in equilibrium work hours (Summers, 1989). Yet one might ask whether benefit-linked payroll taxes should even be included in tax incidence studies, any more than the charges for a publicly supplied water or electricity.[66] Tax distribution studies for Canada and the US typically find that payroll taxes are progressive from low to middle incomes and regressive over higher income ranges. However, this reflects the dominance of benefit-linked forms of payroll tax and their use of annual ceilings on taxed earnings of each worker; it fails to reflect the fact that the associated benefit entitlements are similarly capped by annual maximums. Canadian Employment Insurance premiums have an element of both benefit-linked and general payroll taxes. The Quebec and Canada Pension Plans have a close linkage between premiums and future benefits except for the portion needed to finance shortfalls arising from early cohorts of retirees.

The incidence of general payroll taxes, sometimes not distinguished from benefit-linked payroll taxes, has been subject to intensive research along with their employment effects (Kesselman, 1997: 55-81, for review). When a general payroll tax is applied to all employment income across a national economy, the incidence is determined by the interplay of aggregate labour demand and labour supply curves. While there is some divergence of estimates, most research finds that a general payroll tax on employees is fully and immediately borne by workers and that a tax on employers is shifted fully or almost fully to workers via lower wages and salaries over several years. Hence, the standard assumption used for payroll taxes in most tax incidence studies appears to be supported for both benefit-linked and general payroll taxes of broad application. It is a well-established proposition in tax economics that the ultimate incidence of a tax does

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[65] It is somewhat curious that VGV do not consistently argue that part or all of employee payroll taxes and/or PIT is also shifted back onto capital.

[66] A payroll tax for social insurance is a mandatory payment, unlike a user charge for a public utility, but it does have an associated benefit. This along with political reasons may explain why governments, and the OECD, often describe social security contributions as something other than taxes. Also see Kesselman (1997: 38-39) for discussion of the economic distinctions between benefit-linked and general payroll taxes.

not depend on whether the tax is nominally levied on buyers and sellers, if markets are competitive, and this result is upheld for payroll taxes after an adjustment period.

The employer payroll levies of four Canadian provinces have no linkage between payments (all by employers) and individual worker healthcare benefits, for which they are nominally applied, so they are entirely general payroll taxes. In addition, all provinces apply employer payroll taxes to finance schemes of workers' compensation, with the rates often varying by industry and at times by firms (so-called experience rating). General payroll taxes applied at differential rates across provinces, industries, and/or firms raise further questions about economic incidence. To the extent that a payroll tax is applied at a differentially high rate on certain firms, they will bear the burden (reducing the return to owners or capital), while the base rate of tax applying to all firms will be borne by labour (Vaillancourt and Marceau, 1990).[67] If the tax is applied at a differentially high rate on a particular industry, it is likely to be shifted to output prices and thereby borne by consumers of that industry's product. Most interesting is the question of incidence of a provincially differentiated payroll tax rate, such as those applied by four provinces. To the extent that the findings on incidence of subnational PITs, cited earlier, are applicable to the Canadian provinces, these provincial payroll taxes will be borne by business (and thus fall on capital and/or consumption) rather than by labour due to its high interprovincial mobility. This result is contrary to the shifting assumption commonly used in tax incidence studies.

iii. Taxes on goods and services

Indirect taxes on goods and services are the second largest source of tax revenues for the Canadian federal and most provincial governments. These take the form of a multi-stage Goods and Services Tax for the federal and four provincial governments; single-stage retail sales taxes for five provinces; excise taxes on alcohol, gasoline, and tobacco products at both levels; and federal import duties.[68] While the various indirect taxes have differences that can affect their incidence, the key issue in tax distribution studies is whether the burdens should be allocated based on the "uses" or the "sources" side of households' budgets. The traditional view was that these taxes are borne by households in proportion to their outlays on taxable items. That is, consumers who pay the tax also bear its full economic incidence. Intuitively, when one goes from an income tax to a consumption tax, the prices of the taxed consumer goods increase relative to untaxed capital goods. There is no change in relative factor prices, so the price increase falls on consumers and not savers. Because in annual data the savings rate rises with household incomes, the traditional view leads to a finding that indirect taxes are very

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[67] Yet another consideration is that, if the premiums are experience-rated by firm, they may reflect benefits that are valued by firms at the same rate. For example, workers' compensation relieves firms of legal liability for civil suits related to worker injuries, so they may have no change in their demand curve for labour as a result of the combined premiums and benefits.

[68] Canadian duties are low or non-existent on most goods. However, import quotas and marketing board restrictions raise the prices on goods that rank relatively large for the budgets of lower-income households (eggs, chicken, dairy products, and low-priced clothing) and thus have a regressive impact. See Emes et al. (2004: 21-22).

regressive.[69] The higher proportion of outlays on the highly taxed excise products by lower-income households accentuates the regressive pattern. The traditional incidence assumption is adopted as the standard case in VGV. Revealingly, when DSW use this incidence assumption and move from an annual to a lifetime view, sales and excise taxes change from highly regressive to only slightly regressive ("central case" in Table 14).

An alternative view about the incidence of indirect taxes was proposed by Browning and with Johnson (1978, 1979; henceforth BJ). This view asserts that the burden of indirect taxes should be distributed by the sources side, or factor incomes, rather than the uses of income.[70] BJ observe that the traditional incidence view was based on only two types of income—labour and capital—and ignored transfer incomes. Transfer payments make up a larger proportion of lower household incomes (as in Table 3) and are often indexed for changes in the price level. Hence, when an indirect tax rate is raised, the recipients of transfer income are insulated from the price level impact via an adjustment of their transfer payments. To the extent that transfer recipients are compensated for the impact, the indirect taxes can be borne only by the recipients of market incomes and in particular labour incomes. The BJ view thus renders indirect taxes progressive from low to middle incomes, proportional for upper-middle incomes, and regressive for high incomes, as seen in RVH's standard case results.[71] When the BJ assumption is combined with lifetime income measures, DSW find that indirect taxes have a slightly progressive distributional pattern across all incomes. The BJ view can be critiqued on several grounds.[72] Transfer benefits are not the only source of income that is partially indexed; many wage contracts are indexed, as are some pensions, and interest incomes also respond to higher inflation rates induced by indirect tax rate hikes. Moreover, the fact that some transfer benefits (such as CPP, GIS, and Old Age Security) are indexed ignores the fact that benefit levels are subject to periodic legislative review, and any discretionary raises are likely to be diminished if there is indexation.

Another issue arising with the distributional analysis of indirect taxes relates to goods and services other than the final consumption of households. Some forms of indirect taxes, such as provincial retail sales taxes (RST), fuel excises, and the federal manufacturers' sales tax that preceded the GST, apply to business intermediate inputs and investment goods. It has been estimated that more than one-third of the total revenues collected from RSTs arises from such business inputs. Value-added taxes such as the GST offer firms credits for their taxes paid on these inputs and are thus designed to apply

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[69] Note that the regressivity of indirect taxes is accentuated by the progressivity of the PIT, as households can spend only out of their after-PIT incomes, which are eroded by proportionately larger amounts of PIT at higher incomes.

[70] Browning (1985) later applied differential tax incidence to argue that indirect taxes should be assigned to factor incomes and not transfer incomes, even abstracting from any indexation of transfer payments. This result followed from the standard assumption in differential analysis that transfers and other public outlays should be held constant in real terms when assessing the substitution of a sales tax for some other tax.

[71] RVH use a middle-ground approach developed in Ruggeri (1993), which assigns most of the indirect tax burden based on consumption, following the traditional view, but subtracts the estimated compensation to recipients of indexed transfers. The BJ approach assumes that all transfer payments are fully indexed.

[72] For further critique, see Dahlby (1985: 137), Vermaeten et al. (1994: 365), and Davies (1992: 180).

solely to households' final consumption. The burden of RSTs and some excises on business is typically assigned to the factors of production, based on the assumption that both exporters and import-competing firms are price takers at world prices (see Ruggeri and Bluck, 1990). However, there are variants on how to proceed in assigning this burden. RVH split the burden equally between labour and capital, while VGV take a more regressive view by assigning the indirect taxes paid by business to labour, the more immobile factor of production. Most Canadian studies of tax distribution take periods prior to the 1991 replacement of the federal manufacturers' sales tax with the GST. There is some debate over how to allocate the shifting burden of taxes on business investment arising with this policy change (see Grady, 1990; Gillespie, 1991).

A final issue for the incidence of indirect taxes is how to treat any associated compensation provisions for lower-income households. It is common for indirect taxes to be structured so as to offer relief for households at lower incomes via differential rates on various goods and services. For example, RSTs typically exempt items such as groceries and residential rents; the GST offers zero-rating for groceries and exempts residential rents. These provisions are fully recognized in standard tax distribution studies by allocating the actual indirect taxes paid by income class. However, additional compensation for indirect tax burdens is provided by the federal GST refundable tax credits for lower-income households (and credits for the preceding federal sales tax) and by the sales tax credits of some provinces. The question is whether provisions of these kinds should be treated as transfer payments, and therefore ignored in tax distribution studies, or whether they should be counted as offsets to indirect taxes paid by households receiving the credits.[73] Statistics Canada classifies such tax credits as part of the transfer system rather than the tax system (as in our Tables 3, 4, and 6). In their study of the distribution of taxes and public benefits, RVH also classify the federal and provincial sales tax credits as transfers. In contrast, VGV net out federal and provincial tax credits for sales tax from the indirect tax burdens of the beneficiaries; they similarly net out provincial property tax credits against the property tax liabilities of the credit recipients. This approach seems preferable, as the relief for lower-income payers of a tax can be provided through either an income-targeted tax credit or a relieving provision in the tax.

iv. Property taxes

Property taxes are the overwhelming source of tax revenues for municipal governments, and two alternative views about their economic incidence have commonly been used in tax distribution studies.[74] Property taxes are levied on land and structural improvements, whether residential, industrial, or commercial. Both of the views about property tax incidence agree that landowners bear the property tax on land owing to its immobility. Where the "traditional" and "new" views diverge relates to the incidence of property tax on structures, which are a form of capital and thus subject to behavioural responses. In the traditional view, the property tax has "excise" effects that shift the tax

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[73] Ruggeri and Bluck (1990: 371) assert, "Treating transfers as if they were an integral component of the tax structure would yield misleading results for tax incidence because it would assign to the tax structure effects which result from changes exogenous to the tax."

[74] For analysis of the alternative views on property tax incidence, see Mieszkowksi (1972), Aaron (1975), and Kitchen (1992).

burden from the owners of structures to the consumers of the structures' services. The combined assumptions of a small open economy, internationally mobile capital, and immobile renters and consumers means that this part of the property tax operates like an excise tax on structures. The tax on structures is then borne by owner-occupants and owner-operators as well as renters of housing; this part of the tax for commercial and industrial properties is passed forward to consumers via higher product prices. Thus, the traditional view yields a relatively regressive pattern of property tax incidence. This view is adopted in the standard case of VGV and the "regressive" variant of RVH.

In the "new" view of property tax incidence, the tax on structures falls entirely on the profits of capital owners. The underlying model for the new view assumes that labour and consumers are more mobile than structural capital, so that property tax changes are reflected in changes in the value of capital. Hence, the property tax on structures is borne by the owners and falls on capital income. Because capital ownership is correlated with household income, the new view implies that the property tax is progressive, contrary to the regressive pattern resulting in the traditional view. However, the "factor return" effects of the new view can also be considered jointly with the excise effects of the traditional view, with the latter applying to tax rate differentials in nearby municipalities. The new view is adopted for property tax incidence in the "progressive" variants of VGV and RVH as well as the standard case of DSW. In addition, the base case of RVH and a "regressive" variant of DSW use shifting assumptions intermediate between the new and traditional views; the tax on structures is borne half by renters and consumers and half by capital owners.

v. Corporate and capital income taxes

Taxes on capital income can be distinguished by who pays the bill: corporate income tax (CIT), paid directly by corporations, and PIT paid by individuals on their capital incomes, including dividends, interest, rents, capital gains, and profits from unincorporated business.[75] However, studies of tax incidence tend to make the same incidence assumptions about both kinds of tax. Most analyses of capital income tax incidence for Canada use a small open economy model in which capital moves freely between countries. Hence, some of the tax can be shifted from the owners of capital to more immobile taxpayers and factors of production. In contrast, for the much larger US economy, the Congressional Budget Office assumes that the CIT (like the PIT) falls entirely on households, allocated in proportion to their income from interest, dividends, rents, and capital gains.[76] For Canada, the portion of the CIT that cannot be shifted is the common world capital tax rate, which VGV assume is the US tax rate; this portion is fully borne by owners of corporate income. VGV argue that the burden of the rest of the CIT is shifted either to immobile factors, such as labour, or forward to consumers. VGV suggest that effective tax rates and average corporate tax burdens are similar for the two

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[75] Property taxes also impinge on capital incomes from structures, plant, and equipment, but their incidence analysis is treated separately.

[76] The US Congressional Budget Office (2001: 25) notes that "Economists disagree on whether people bear the [corporate] tax as shareholders in corporations, owners of all capital assets, employees, or consumers." Nevertheless it regards its assumption of full incidence on all owners of capital as the "dominant view."

countries, so that the differential shifted portion is zero. Thus VGV assume that the entire CIT is borne by owners of capital income, which makes the tax look progressive overall because of the income pattern of capital income receipts. In contrast, RVH employ a less progressive approach, assuming that half of the CIT and PIT on capital income is borne by owners of capital, while the other half gets shifted forward to consumers. In both of these studies, the portion of capital that is held by foreign households is deducted from the income base; this accounts for 31 per cent of the CIT. RVH also deduct the foreign tax credit from the domestic tax on capital.

One complication arising for CIT incidence is the degree of integration between the CIT and the personal tax system. VGV argue that unless the Canadian CIT is fully integrated with the PIT, the theoretical shifting assumptions may be called into question. A fully integrated CIT is one that results in all earnings generated through corporations being taxed at the PIT rate of the individual shareholder. Under a fully integrated CIT, a change in the CIT (and hence PIT) rate will not cause movement of capital between the corporate and unincorporated sectors; this means that the capital tax will be fully borne by capital owners, the standard assumption. However, if the CIT is not fully integrated, then a rise in the CIT rate will drive capital from the corporate to the unincorporated sector. The unincorporated sector will see its after-tax rate of return fall, thus bearing some of the CIT burden. The Canadian PIT and CIT are less than fully integrated with dividend tax credits that are inadequate except for small Canadian-controlled corporations. VGV note that this differential is more than offset by PIT provisions such as preferential tax on capital gains, resulting in a slight advantage for the corporate sector vis-à-vis the unincorporated sector. Indeed, VGV assume the difference to be zero in their incidence analysis, which could be a small potential source of error in their study.

The difference between annual and lifetime incidence calculations also affects the treatment of corporate and capital income taxes. DSW note that capital income, while important in annual incidence calculations, is not part of a household's discounted lifetime income. Capital income simply reflects a choice between consuming now and consuming later in life. Hence, capital income does not belong in a lifetime income base, so how does the researcher assign the burden of capital income taxes? Rather than focusing on capital-owning households, DSW assign the burden of these taxes to families that defer consumption, namely savers. This is distributed via the discounted value of all investment income received over the lifetime. Their justification is that capital taxes have a sources-side impact and a uses-side impact. On the uses side, capital taxes reduce the net interest rate to savers, which increases the price of future consumption. The taxes thus hurt savers and benefit consumers. On the sources side, the lower after-tax interest rate lowers the relative discounted incomes of those who receive income later in life, again hurting savers. (In contrast, annual incidence calculations assume only a sources-side impact of capital taxes.) Because the amount of consumption that a family forgoes as a result of capital taxes equals the reduction in current investment income, discounted lifetime investment income is the appropriate distributive series.[77] Estimates of lifetime incidence of the CIT show less progressivity than annual calculations, which is consistent

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[77] Of course, this assumes that tax rates are strictly proportional.

with DSW's other findings. DSW also consider alternative shifting assumptions, such as a "regressive" variant that shifts half of the CIT to consumer outlays, and they find a less progressive lifetime incidence, as expected.

Another difference in the treatment of capital income between studies using annual and lifetime incidence arises from life-cycle effects. As Fullerton and Rogers (1993) find, the ratio of capital income to income is U-shaped when households are categorized by annual income. This result stems from the large number of retirees who have low annual income predominantly coming from savings. Thus annual incidence analyses may find some regressivity of the capital tax across lower income ranges, while the capital income tax's putative goal is to redistribute from more wealthy to less wealthy households. On the other hand, Fullerton and Rogers find that lifetime incidence calculations do not exhibit this result; lifetime-rich households tend to have higher lifetime capital-labour income ratios, so that they do end up bearing more of the burden of the capital tax. Whether this is a significant problem in the PIT is unclear because of the age and capital income exemptions that may relieve the burden faced by these low-income groups. Because of the desire to smooth consumption over their lifetimes, households whose peak incomes arise earlier in life have to save more and thus bear more of the capital tax burden. Fullerton and Rogers estimate lifetime wage profiles separately by lifetime income groups and find that those at high lifetime earnings peak relatively early in life. For that reason, those with high lifetime incomes will be subject to more capital income taxation.

vi. Tax expenditures

Various features in each type of tax—such as deductions, exclusions, credits, and deferrals—represent departures from a broad base taxed at a consistent rate. These relief and incentive provisions are commonly designated as "tax expenditures." Their effects on the distributional pattern of taxes are of obvious interest and have been examined for Canada (Kesselman, 1977; St-Hilaire, 1996)[78] and other countries (Ervik, 1998). Some provisions operate to reduce the effective progressivity of the PIT or to reduce the regressivity of indirect taxes.[79] However, most research to date has assumed that the full benefit of each tax expenditure provision is reaped by the individual taxfiler making the claim.[80] In fact, market responses may work to shift some or all of the benefit of a tax expenditure provision to parties other than the direct taxpayer. For example, a PIT deduction or exclusion related to the costs of or return from owner-occupied housing will increase households' demand for housing and may thereby raise its market price. The benefits of the tax expenditure are thereby shifted from the taxpayers who use the provision in the first instance to owners of capital or land more generally. Similarly, an exemption of food or other "necessities" from a sales tax may raise the equilibrium market price in that product market, thereby partially offsetting the gains to taxpayers and

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[78] The Canada Department of Finance (2003) publishes periodic tax expenditure accounts that report the estimated aggregate revenue loss from each provision, but no distributional breakdowns are reported.

[79] The earlier cited INEQ study by Wagstaff and Van Doorslaer (2001) examined the extent to which total deductions in the PIT of several countries worked to increase or decrease the redistributive effect.

[80] One exception is Stabile's (2002) analysis of incidence of tax expenditures for health insurance.

shifting them to capital owners or workers in the producer industries. A tax exemption for particular goods but restricted to some households could leave them with a net benefit but impose burdens on other consumers of the goods not eligible for exempt purchases.

6. Additional Issues and Research Priorities

Our review of studies on the distributional impacts of taxes, which has focused on methodological issues and findings relevant to Canada, suggests directions for future research. First, almost all studies of the Canadian tax system are now quite dated, relying on datasets from the 1970s and 1980s. Few capture the major PIT reforms in Canada of 1988, the adoption of the GST in 1991, or the increasing use of payroll taxes since 1990. None capture the move of provincial PITs to "tax on income" basis and the associated flattening of rate schedules beginning in 2001, nor the federal and provincial PIT and CIT rate cuts in 2000 and beyond. Even with unchanged research methods, these tax changes are likely to affect the findings because of how they alter the tax mix and the bases and rate structures of component taxes.[81] Moreover, changes in our understanding of the economic incidence of some taxes, such as the PIT and indirect taxes, and the possible change in incidence of taxes for the Canadian economy need to be incorporated in future research. We examine those and several other issues in this section.

A. *Theoretical and empirical analysis of tax shifting*

The shifting or incidence of component taxes is a crucial underpinning of INEQ and FINC studies.[82] Even if we assume a closed national economy, the incidence of a national PIT and subnational PITs and payroll taxes is not fully resolved. Given the relative magnitude of the PIT and its role as the leading progressive component of the entire revenue system, the distributional burden of this tax warrants high priority for further theoretical and empirical research. Our preceding review indicated several lines of inquiry that could be pursued further, and it would be useful to employ Canadian data and tax institutions. Moreover, the distributional effects of subnational taxes is a vital item for research, because study has been limited for the US and absent for Canada. One might expect that linguistic and cultural barriers to internal migration would enter the analysis, as Quebec traditionally has had the highest provincial tax burden and the Atlantic provinces the highest sales and income tax rates. Moreover, the shift by the provinces from PIT based on federal tax to a "tax on income" approach beginning in 2001 has greatly relieved the constraints for provincial tax progressivity to mirror federal progressivity. Some provinces have flattened their tax rate schedules, Alberta's single-rate tax being the polar case. Based on the analysis in Feldstein and Wrobel (1998), it is *differences* in subnational tax progressivity (not the degree of rate progressivity *per se*) that undermine effective progressivity of taxes applied at that level.[83]

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[81] Davies (1992) uses these three dimensions of tax policy to compare Canadian and US tax incidence. He also assumes that the incidence of each tax is similar in Canada and the US because of their similar overall tax mixes, despite the greater openness and much smaller size of the Canadian economy.

[82] In CGE studies the incidence of taxes is determined by the modeling structure and parameter values, but the related economic assumptions are still open to debate.

[83] One can imagine a nation with perfect labour mobility between its two states, changing from identical state PIT rate schedules with moderate progressivity to one slightly reducing its progressivity and the other

Recognizing that Canada is a small open economy with international mobility that is high for capital, significant for highly skilled labour, and limited for most occupations adds further insights to the incidence analysis. The effective progressivity of the PIT may be attenuated for Canada, especially with respect to the highest earnings brackets, in a way that does not arise for a larger economy. While this issue has been addressed in a few studies on Canada-US migration and the determinants of "brain drain," it is still unknown how far this process undermines the effective progressivity of Canada's federal PIT. The numbers migrating to the US have been estimated as quite moderate, but as noted before in the provincial tax context, it may not require large-scale movement of workers to induce significant tax shifting. Nevertheless, informal observations of relative gross pay for professional, skilled, and managerial workers in the two countries suggests that any diminution of effective progressivity of the Canadian PIT has been limited. Carefully designed research may provide more definitive conclusions. Moreover, the incidence of taxes on corporate and capital incomes will be affected by provisions for foreign tax credits, bilateral tax treaties, the definitions of tax residence, and mobility of capital owners as well as legal structures for moving assets outside their country of tax residence. Studies of the integrating European economies and theoretical analyses of the impacts on redistributive tax and transfer policies of factor mobility across borders (Wildasin, 2000, and sources therein) may provide useful insights for Canada.

Another aspect of tax incidence that has been neglected in research to date relates to the upper tail of the income distribution—the top few percentiles. Personal and (likely) corporate income taxes are paid disproportionately by very high earners, and having a sound economic understanding of their behaviour is a prerequisite for assessing the shifting of their taxes. Many top earners derive their income as proprietors, owners, or entrepreneurs of very successful businesses, which combine their labour, abilities, and financial capital. Standard economic analysis of this phenomenon divides their returns into capital and labour components; the analysis relates capital-based taxes to the capital component and labour-based taxes to the implicit labour return. However, a highly prosperous business involves the application of labour-like skills to give capital a rate of return far above the normal rate. While the excess return could be attributed entirely to the labour, the labour alone without access to financial capital (or retained earnings of the business) would not generate the extraordinary return. Hence, the underlying economic behaviour needs to be properly modeled in order to provide a basis for estimating the incidence of personal or corporate taxes on the combined return to labour and capital.

B. Annual versus lifetime measures and data needs

Lifetime measures of tax incidence or progressivity offer advantages over annual measures, in that they avoid the confounding effects of lifecycle and annual income fluctuations. However, the simulation of lifetime incomes and taxes undertaken by CGE and a few FINC studies has significant limitations in terms of the underlying models. It would be useful to undertake tax incidence research using methods that avoid these

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sharply increasing its progressivity. Naively measured, aggregate tax progressivity will increase, but effective progressivity (after shifting of the tax) will decrease due to the out-migration of skilled workers from and resultant rise in their gross wages in the sharply progressive state.

hazards and are better grounded in actual datasets. One such method would be to pursue FINC studies on groups disaggregated by lifecycle cohorts and then to apply adjustments based on aggregate data to reflect characteristic savings and spending patterns of each cohort. Another method would minimize the impact of year-to-year variations in individual incomes by taking multi-year averages. The development over the past decade of a Canadian longitudinal dataset, from the Survey of Labour and Income Dynamics (SLID), should facilitate this exercise. Each panel of respondents is included in the survey for a six-year period, with the first intake in 1993, a period sufficiently long to smooth the effects of temporary shocks to labour, business, and investment incomes.[84] Hence, a measure of the tax unit's permanent income can be obtained for use in the tax incidence analysis. It might also be feasible to combine the two methods sketched here, so as to remove the effects of both inter-year and lifecycle income variations.

C. Horizontal equity, differential tax treatment, and inequality

Existing tax distribution studies use a measure of market, pre-fisc, or post-fisc income, in some cases with various imputations, as the index of well-being for individuals or households. Thus, tax provisions that differentiate the tax liabilities for units with the same measured level of taxpaying ability typically reduce the estimated equalizing effects of the tax system. A few of the studies (e.g. Wagstaff et al., 1999) attempt to estimate separately such horizontal inequity and re-ranking effects to see how they offset the vertical redistribution effects of taxes. However, many tax provisions that apply differential treatment for units with the same measured taxpaying ability are in fact designed to *augment* horizontal equity.[85] These provisions recognize characteristics of taxpayers—such as disabilities, medical costs, high living costs in remote locales, moving costs, age, or dependants—that affect well-being or taxpaying ability *for a given level of measured income*. For these reasons, such tax provisions actually work to improve the horizontally equitable treatment of taxpayers, whereas they are measured in these studies as muting the vertical redistribution of the tax system and in some studies as *creating* horizontal inequities. Future studies should take care to recognize this fact and make adjustments in the index of well-being that parallel the tax provisions aimed at this goal.

D. Tax evasion and distributional effects

Research on distribution of the tax burden surveyed here has implicitly assumed full compliance to all taxes and full reporting of all incomes. There is a much smaller body of research on the distributional effects of non-compliance to taxes (see Bishop et al., 1994, for sources). Neither theoretical nor empirical work to date offers strong conclusions as to whether non-compliance exerts a progressive or regressive impact on

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[84] To the extent that the samples under-represent households with very low, or temporarily very low incomes, there may be hazards in using the SLID dataset, as suggested by Frechette et al. (2003).

[85] Lerman and Yitzhaki (1995) recognize that re-ranking may improve equity by unscrambling an "unfair" pre-tax ranking of households to reflect other characteristics relevant to well-being. For the analytics of dealing with differences in characteristics and measuring horizontal inequities, see Lambert (2001: 183-186), Aronson and Lambert (1994), and Aronson et al. (1994). See Le Grand (1987) for careful discussion of the broader issues around the horizontal equity concept.

tax incidence.[86] The limited evidence focuses on evasion of the PIT, using data from the US Taxpayer Compliance Measurement Program, which applies intensive audits to a sample of taxpayers to uncover unreported incomes and unjustified deductions. In this way it is possible to distinguish among the PIT's "apparent progressivity," its "actual progressivity," and its "post-audit progressivity." Apparent progressivity is that measured using standard tax or survey data as reported by individual taxfilers, similar to the studies covered here. Actual progressivity is what can be computed based on tax liabilities reported on unaudited returns and on actual incomes including those reported plus those discovered on audit. Post-audit progressivity reflects the total taxes due based on the levels of income established by audit; hence it captures the intended progressivity of the PIT.[87] The discrepancy between actual and apparent progressivity reflects the bias arising from measures that fail to account for tax non-compliance. Using measures of residual and liability progression, Bishop et al. (1994) estimate that non-compliance exerted little effect on vertical equity in the US from 1979 to 1985.[88]

Another aspect of non-compliance relates to the economic incidence of tax evasion behaviour. Those who benefit from such activity may differ from those who engage in it. Kesselman (1989) develops a general equilibrium model of income tax evasion involving separate markets for the production of tax-compliant and tax-evading goods and services. The extent to which the benefits of evasion accrue to the evading workers vis-à-vis their consumers hinges upon two key behavioural parameters—the elasticity of substitution in consumption between the two types of products and workers' elasticity of movement between the two sectors.[89] If both elasticities are infinite, thus removing all frictions to the flow of resources between the two sectors, all the benefits of evasion accrue to consumers of output from the evading sector and none to the evaders themselves. Where sales taxes are being evaded, the benefits may similarly be captured by the evading producer or seller (collecting a tax-inclusive price but remitting nothing to the government) or shifted in part or fully to the purchaser. By offering the customer a transaction free of sales tax, the vendor may induce a cash payment that then eases the task of evading income tax on the activity. Moreover, successfully evading the PIT may require consistently evading any associated sales tax (see Kesselman, 1993).

E. Tax avoidance and high earners

For legal avoidance of taxes using preferentially taxed or tax-free assets, the tax benefits may be shifted to parties other than the tax avoider. If the tax-preferred asset is in short supply, it will be held solely by top-tax-bracket taxpayers, and its gross rate of return will fall to yield a net rate of return equalized with that of taxable assets held by

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[86] Schuetze (2002) estimates rates of tax non-compliance for the self-employed in Canada differentiated by head's education and occupation but does not examine how non-compliance varies across income levels.

[87] Of course, even the TCMP's intensive audits will not uncover all evasion by filers, and so-called ghosts who evade taxes by non-filing and concealing their existence will also be omitted.

[88] The only exception was for the bottom decile in 1985 with liability progression, where actual progression exceeded apparent progression; the difference was statistically significant but very small.

[89] The original analysis is framed in terms of the elasticity of evasion costs for the marginal entrant to the evading sector rather than workers' elasticity of movement between the two sectors.

that group. In equilibrium the tax avoiders will gain nothing from holding the tax-preferred asset, but both their taxes and reported capital incomes will be reduced such that measured tax progressivity will be understated. If the tax-preferred asset is in greater supply, it will be held by taxpayers in lower marginal brackets as well, and its gross rate of return will fall less, yielding a gain for top-bracket holders of the asset. This case reduces the effective progressivity of the PIT; it has been said that "for the rich … the best tax shelters are those that are patronized by the poor" (Bittker, 1980: 28). There has been limited economic modeling of the distributional effects of tax avoidance arising through capital market adjustments (studies in Feldstein, 1983) and growing research on the tax-induced portfolio patterns of various income groups (Scholtz, 1994, and sources therein). However, these lines of analysis have not been linked to distribution studies of the types surveyed here. This phenomenon is central in understanding tax progressivity for top income groups, which generate a disproportionate share of PIT revenues. Some analysis has been undertaken for top taxpayers in the US (studies in Slemrod, 1994, 2000), but there has been nothing comparable for Canada.[90]

Yet another body of tax avoidance research carries implications for income distribution. Studies of the response of taxable income to tax rate changes reflect both "real" responses (such as labour supply) and income reporting responses (various forms of tax planning such as the timing or form of income). Even if the imposition of higher tax rates simply transforms some income to non-taxed forms, it may distort the measure of total income. If the response of taxable income varies by the income level of taxpayers, the measures of tax progressivity will be biased. Two Canadian studies of this genre have found a strong income tilt to the taxable income response. Gagné et al. (2000) examined 1972 to 1996 and subperiods with provincially grouped data for three middle- to high-income groups. They found large responses of total reported income to tax rates for high earners ($100,000 to $150,000 in 1995 dollars), especially for 1988-1996. For their top income group (above $150,000) the estimated absolute elasticity exceeded unity, suggesting that tax rate cuts at the top end would increase revenues. However, given their research design, this result may reflect interprovincial shifting of tax revenues rather than an increase for the nation as a whole.[91] Sillamaa and Veall (2001) studied Canada's 1988 tax-rate flattening reforms using a micro-level national panel dataset. They estimated the overall tax-price elasticity of taxable income to be a comparatively small minus 0.25. They obtained larger elasticity estimates for self-employment income and for the labour income of seniors. When restricting the sample to higher incomes (above $60,000 in 1986 dollars), they estimated absolute elasticity values of unity or larger. This finding suggests that the true economic incomes of high income groups are substantially understated in tax data and perhaps also in survey data.[92]

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[90] A recent study by Saez and Veall (2003) uses Canadian income tax return data to produce a long historical series on the concentration of incomes in the very highest fractiles. While they do not directly assess tax avoidance, the authors infer by comparison with US experience that increasing Canadian income concentration at the top cannot be explained by tax cuts.

[91] This situation could parallel the earlier-cited Feldstein-Wrobel (1998) finding of tax-induced inter-state mobility of workers and tax bases.

[92] One common example of how this effect can arise is the deferral of sale on assets that have substantial

7. Tax Policy Inferences

The research literature on the distributional effects of taxes is large, diverse, and inconclusive in many ways. Any inferences that can be drawn for the direction of Canadian tax policies to reduce inequality must be highly qualified.[93] The most salient finding is that the personal income tax plays a key role in the progressivity of the overall tax system, which contains many taxes that are more nearly proportional or outright regressive. This result is robust to the use of annual or lifetime perspectives. However, this finding is subject to challenge by several lines of economic analysis concerning the incidence of personal taxes. At best the personal tax is less progressive than the most commonly used naïve assumption of no shifting, and this reduction in effective progressivity is likely more pronounced at the level of provincial than federal taxes. If the personal tax is less progressive than commonly assumed and measured, this can be interpreted in two alternative ways. For those desiring more inequality reduction, regardless of any attendant economic costs, the statutory rate progressivity of the personal tax would need to be further steepened or its base expanded in progressive fashion. For those more concerned about economic efficiency and growth, this finding would counsel moderating the steepness of rate schedules, since society is achieving less effective tax progressivity for a given economic cost than previously believed.[94]

A common theme in the prescriptions of tax economists is a call for shifting the tax system away from income bases and further toward consumption-type bases. The main objective of this change is to improve the economy's efficiency and growth rate by making the tax system more neutral vis-à-vis savings, investment, and capital. If one is also concerned about the distributional dimension, this has further policy implications since this change would affect most heavily individuals with high earnings and wealth.[95] First, any move toward a consumption base should be pursued through changing the personal tax base, since progressive rates can be applied in the personal tax, rather than by shifting the tax mix toward greater reliance on indirect consumption taxes. The evidence is that indirect taxes are regressive, albeit more so in an annual than in a lifetime perspective. Second, in reforming the personal tax toward a consumption base, it is important to use transitional methods that do not provide a windfall for holders of savings and wealth at the time of the change, but rather to shelter incremental savings generated from labour earnings after the change.[96] Regardless, a shift of the tax base toward consumption would carry some unavoidable reduction in effective tax progressivity, even in a lifetime view, unless rate schedules were steepened.

A related question is how tax policies that shift the base toward consumption to

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accruing gains, which should be counted as part of income.

[93] The discussion in this section mirrors some of the policy prescriptions in Kesselman (2004).

[94] An earlier version of this study (Kesselman and Cheung, 2003) provides a brief review of the evidence that finds more progressive tax rate schedules to be economically costly.

[95] The great majority of Canadian taxpayers are already treated on a consumption basis by the personal tax due to provisions for registered savings and the non-taxation of capital gains on homes.

[96] This design issue is discussed in Kesselman (2004) and Kesselman and Poschmann (2001).

promote economic growth would affect the distribution of *pre-tax* earnings. According to conventional economic findings, increasing the economy's capital stock would tend to increase inequalities between skilled and unskilled labour (e.g. Murphy et al., 1998). This effect could arise either through the complementarity between capital and skilled labour or through skill-biased technology embodied in new capital. Thus the increased inequality of market incomes would compound with the reduced equalization from the reformed tax system to increase the inequality of net incomes. However, a recent development in modeling and estimating the causes of inequality suggests a very different conclusion (Beaudry and Green, 1998, 2003). If an increased capital stock affects the choice of techniques by industry, it may push disproportionately more capital into the sectors that employ less-skilled labour intensively. This effect will raise the productivity of labour and wages in both sectors but will be relatively more favourable to unskilled labour, thus reducing the inequality of market earnings. Consequently, tax policies that shift toward consumption could in the long run reduce pre-tax earnings, perhaps to a sufficient extent to offset any initial diminution in tax progressivity. This strategy could also mitigate inequality by reducing the long-run returns to capital owners, though this effect would be muted for the open Canadian economy with high international mobility of capital.

Another tax policy implication of this literature is a need to differentiate between federal and provincial policies in terms of their effective progressivity. Because of the much greater inter-regional than international mobility of labour, one would expect redistributive policies to be weakened much more at the provincial than the federal level. Provinces that seek to have more progressive tax policies than elsewhere will lose some of their higher earners and thereby push up the gross wages of skilled labour. Thus, the effective burden of those higher taxes gets shifted to the industries that employ them, in turn shrinking the high-value-added sectors of the provinces seeking more progressive policies. These observations apply with respect to both the progressivity of personal taxes and with respect to the overall tax burden (including payroll, sales, and property taxes) relative to the value of public services supplied. In the Canadian context, this effect may be restrained by factors that inhibit mobility of skilled labour even when heavily taxed: Quebec's linguistic distinctness, Ontario's economic rents for top earners in certain industries, and Atlantic Canadians' regional preferences. Nevertheless, any remaining restraint on redistribution at the provincial level may warrant more progressive tax and expenditure policies at the federal level.

Taxes on corporate income and capital as well as other business taxes such as property taxes on land, structures, and equipment are popular on account of the belief that they are paid by the owners of capital. In fact the incidence of these taxes is disputed among economists, with some assigning their burden entirely to capital owners, some splitting it between capital and consumption, and others seeing a part of it shifted to labour. With Canada's highly open economy and capital mobility, it is reasonable to assume that business taxes at rates that equal foreign rates will be borne by capital but that any higher rates will be shifted onto relatively immobile factors such as workers and consumers. Because of these effects, corporate and business taxes are better viewed as instruments for promoting growth of the economy, productivity, jobs, and real wages than as direct instruments for inequality reduction. Additionally, one needs to recognize

that corporate income taxes on many small and medium-sized businesses bear on both capital incomes and labour earnings of owner-proprietors who do not take their returns in the form of salaries. Hence, tax provisions that favour smaller businesses, including lower corporate tax rates and the lifetime capital gains exemption, may exert significantly regressive effects with respect to some of the highest earners.

A final important implication of the research literature for the inequality effects of taxes is that the size of the tax bite matters as much as its progressivity.[97] Even if the tax system reflects a pattern of tax rates that is only moderately progressive, it can be substantially redistributive if the overall tax level is high.[98] Moreover, the larger the tax revenues, the more potential this offers for redistributive policies on the expenditure side of public budgets. Our examination of the inequality reduction from cash transfers found them to be more important than personal income taxes for most groups other than the highest earners. Public spending through in-kind goods and services can also play a major redistributive role, especially in areas such as health care and education. One can point to the experience of northern European countries, which have tax systems of relatively low progressivity—with heavy weights on regressive payroll and sales taxes and with Scandinavian income taxes that have a progressive national component combined with larger flat-rate local levies. Yet these countries apply very high overall rates of taxation that enable them to finance generous social programs that are highly redistributive. Any assessment of the potential for using tax policy to mitigate inequality in Canada must take a similarly holistic view of the problem.

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[97] This point was encapsulated in the Reynolds-Smolensky redistributive index of progressivity, which is the product of the Kakwani progressivity index (the degree to which the tax system departs from proportionality) and a term reflecting the aggregate average tax rate.

[98] Economic research has produced mixed but generally weak findings as to whether higher overall tax rates are adverse to economic growth, but it is widely agreed that a tax mix that bears heavily on capital income, savings, and investment is much more adverse than a base of consumption and labour incomes. See the assessment of the literature in Kesselman (2000, 2004).

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Table 1: Types of Studies of the Distributional Impact of Taxation

Type[a]	Taxes covered	Tax incidence	Time horizon	Observation unit	Income measure	Distributional impact measure
INEQ	Only PIT and, in some studies, payroll tax	Assumed to fall fully on the individual	Annual	Individuals using family equivalence scale	Net income	Index of inequality
CGE	Stylized forms of major taxes	Generated by CGE model, structural and parameter assumptions	Static or dynamic over lifetime	Individual or stylized household	Net income or utility	Utility change by lifetime income groups
FINC	All taxes	Taken from other studies, sensitivity analyses	Annual or lifetime	Household	Pre-tax, pre-transfer income or broad income	ATRs by income groups or index of progressivity

Note: [a] INEQ = inequality; CGE = computable general equilibrium; FINC = fiscal incidence.

Table 2: Major Inequality Indices and Their Progressivity Indices

Inequality index	Progressivity index
Gini $$G = \frac{1}{2n^2\bar{x}} \sum_{i=1}^{n} \sum_{j=1}^{n} \left| x_i - x_j \right|$$	Kakwani $\quad P_K = C(t) - G(x^g)$ Musgrave-Thin $$P_{MT} = \left[1 - G(x^n)\right] / \left[1 - G(x^g)\right]$$ Reynolds-Smolensky $\quad P_{RS} = G(x^g) - G(x^n)$
Generalized entropy (for $c \neq 0, 1$) $$E_c = \left\{\frac{1}{nc(c-1)}\right\} \sum_i \left[\left(\frac{x_i}{\bar{x}}\right)^c - 1\right]$$ Mean logarithmic deviation ($c = 0$) $$E_0 = \frac{1}{n} \sum_i \ln \frac{\bar{x}}{x_i}$$ Theil ($c = 1$) $$E_1 = \frac{1}{n} \sum_i \frac{x_i}{\bar{x}} \ln \frac{x_i}{\bar{x}}$$ Squared coefficient of variation ($c = 2$) $$E_2 \Rightarrow CV^2 = \frac{1}{n\bar{x}^2} \sum_i (x_i - \bar{x})^2$$	$$P_E = E_c(x^g) - E_c(x^n)$$
Atkinson (for $0 < e \neq 1$) $$I_e = 1 - \left[\frac{1}{n} \sum_i \left(\frac{x_i}{\bar{x}}\right)^{1-e}\right]^{1/(1-e)}$$ Atkinson (for $e = 1$) yields mean logarithmic deviation (as with generalized entropy for $c = 0$)	Kiefer $$P_I = I_e(x^g) - I_e(x^n)$$ Blackorby-Donaldson $$P_I^* = \left[I_e(x^g) - I_e(x^n)\right] / \left[1 - I_e(x^g)\right]$$

Notes: There are n individuals; x_i = income of individual i; x^g = vector of pre-tax (gross) incomes; x^n = vector of post-tax (net) incomes; x_{EDE} = equally distributed equivalent income (see text); $C(t)$ = tax concentration coefficient; and $\bar{x} = \frac{1}{n} \sum_i x_i$.

Table 3: Transfers and Income Taxes as % of Money Income, Canada, 1971-2000

Transfer Receipts

Quintile	1	2	3	4	5	Total
Unattached						
1971–75	58.1	66.0	17.9	5.0	1.6	12.3
1976–80	66.8	61.4	18.4	6.1	1.6	13.3
1981–85	61.9	64.5	23.8	7.2	2.2	15.7
1986–90	59.5	63.6	24.5	8.4	2.9	16.9
1991–95	61.9	70.2	34.2	12.4	3.5	20.5
1996–2000	58.3	65.1	32.9	12.3	3.6	19.3
Families						
1971–75	43.8	11.6	6.0	4.1	2.5	7.2
1976–80	47.6	13.4	6.9	4.4	2.7	8.0
1981–85	52.1	18.9	9.3	5.5	2.8	9.8
1986–90	53.2	20.0	9.6	5.7	2.8	10.1
1991–95	60.0	26.7	13.0	7.1	3.4	12.4
1996–2000	53.6	23.9	11.6	6.2	3.0	10.9
All units						
1971–75	55.9	20.0	7.3	4.5	2.7	7.9
1976–80	57.9	22.5	8.6	5.1	2.8	8.7
1981–85	59.6	28.8	11.7	6.4	3.1	10.7
1986–90	59.2	30.4	12.8	6.8	3.2	11.2
1991–95	65.5	38.7	17.1	9.0	3.9	13.8
1996–2000	61.4	34.3	16.1	8.1	3.5	12.3

Income Taxes

Quintile	1	2	3	4	5	Total
Unattached						
1971–75	0.8	1.0	7.1	13.4	19.9	14.0
1976–80	0.4	0.7	6.7	13.3	19.7	13.6
1981–85	0.2	1.5	8.8	15.4	21.9	15.3
1986–90	0.8	3.3	11.8	17.9	24.5	17.4
1991–95	0.9	2.9	11.5	18.1	26.0	18.1
1996–2000	3.5	3.7	11.4	18.0	26.2	18.5
Families						
1971–75	2.6	9.0	13.0	15.5	20.1	15.2
1976–80	2.1	9.0	13.3	15.7	19.8	15.2
1981–85	2.1	9.1	13.9	16.8	20.7	15.9
1986–90	3.2	11.6	16.6	19.7	24.0	18.8
1991–95	2.8	11.0	16.8	20.4	25.6	19.6
1996–2000	5.7	12.1	17.3	20.3	25.4	20.0
All units						
1971–75	1.8	7.2	12.1	14.9	19.6	15.1
1976–80	1.3	6.9	12.1	15.1	19.3	14.9
1981–85	1.7	7.3	12.8	16.3	20.3	15.8
1986–90	2.8	9.5	15.4	18.9	23.4	18.5
1991–95	2.6	8.9	15.3	19.5	24.9	19.3
1996–2000	5.5	10.1	15.9	19.6	24.8	19.7

Source: Statistics Canada (1996, 1999, 2001, 2002) and authors' calculations; figures are averages of the annual figures for the specified periods.

Table 4: Gini Coefficients for Various Income Measures and Attribution to Transfers and Taxes, Canada, 1971-2000

Family type	Gini coefficient for income			Reduction in Gini coefficient		
	Before transfers	Total money	After tax	Total %	% by transfers	% by inc. tax
Unattached						
1971–75	0.556	0.449	0.414	25.5	75.4	24.6
1976–80	0.544	0.428	0.390	28.2	75.6	24.4
1981–85	0.545	0.411	0.367	32.6	75.5	24.5
1986–90	0.533	0.391	0.343	35.7	74.8	25.2
1991–95	0.565	0.392	0.338	40.1	76.3	23.7
1996–2000	0.563	0.410	0.358	36.4	74.5	25.5
Families						
1971–75	0.378	0.330	0.302	20.1	62.1	37.9
1976–80	0.378	0.326	0.297	21.3	64.9	35.1
1981–85	0.396	0.329	0.299	24.5	68.6	31.4
1986–90	0.402	0.331	0.295	26.4	66.5	33.5
1991–95	0.422	0.336	0.294	30.3	67.6	32.4
1996–2000	0.430	0.352	0.310	27.9	65.3	34.7
All units						
1971–75	0.446	0.394	0.367	17.7	66.4	33.6
1976–80	0.448	0.390	0.363	18.9	68.9	31.1
1981–85	0.459	0.386	0.357	22.3	71.8	28.2
1986–90	0.467	0.389	0.355	24.0	69.8	30.2
1991–95	0.492	0.395	0.356	27.6	71.5	28.5
1996–97	0.497	0.402	0.363	27.0	70.5	29.5

Source: Statistics Canada (1996, 1999, 2001, 2002) and authors' calculations; figures are averages of the annual figures for the specified periods; Statistics Canada stopped publishing Gini coefficients for "all units" after 1997.

Table 5: Gini Coefficients for Eight Countries, Pre-Transfer and Post-Tax, and Role of Transfers, Income Taxes, and Social Security Contributions

Country/ year	Gini coefficient for income			Reduction in Gini coefficient		
	Before transfers	Total money	After inc. tax + SS	Total %	% by transfers	% by inc. tax + SS
Australia						
1981	0.390	0.351	0.301	22.8	42.8	57.2
1985	0.414	0.367	0.307	25.9	43.9	56.1
1989	0.437	0.378	0.323	26.1	51.8	48.2
Denmark						
1987	0.455	0.313	0.278	38.9	80.3	19.7
1992	0.480	0.315	0.259	45.9	74.9	25.1
Finland						
1987	0.369	0.297	0.249	32.4	60.2	39.8
1991	0.369	0.294	0.253	31.2	65.0	35.0
Germany						
1984	0.462	0.320	0.264	42.8	72.0	28.0
1989	0.468	0.331	0.263	43.8	67.1	32.9
Norway						
1979	0.380	0.305	0.246	35.2	55.9	44.1
1986	0.379	0.295	0.256	32.5	67.9	32.1
1991	0.424	0.297	0.252	40.7	73.6	26.4
Sweden						
1981	0.432	0.258	0.205	52.5	76.8	23.2
1987	0.471	0.285	0.240	49.0	80.7	19.3
1992	0.504	0.284	0.252	50.1	87.1	12.9
United Kingdom						
1979	0.411	0.323	0.285	30.6	69.8	30.2
1986	0.462	0.354	0.303	34.5	67.6	32.4
1991	0.472	0.388	0.353	25.4	70.3	29.7
United States						
1979	0.408	0.372	0.321	21.2	40.9	59.1
1986	0.428	0.394	0.347	18.9	42.3	57.7
1991	0.437	0.396	0.351	19.7	48.1	51.9
1994	0.463	0.423	0.375	18.9	45.9	54.1

Source: Ervik (1998: 30, 32).

Table 6: Gini Coefficients for Various Income Measures and Attribution to Transfers and Income Taxes, by Family Type, Canada, 2000

Family type	Gini coefficient for income			Reduction in Gini coefficient		
	Before transfers	Total money	After inc. tax	Total %	% by transfers	% by inc. tax
Families of 2 or more	0.424	0.354	0.314	25.9	63.6	36.4
Elderly families	0.555	0.316	0.264	52.4	82.1	17.9
Married couples	0.547	0.302	0.247	54.8	81.7	18.3
Other elderly	0.566	0.351	0.304	46.3	82.1	17.9
Non–elderly families	0.391	0.348	0.311	20.5	53.8	46.3
Married couples	0.371	0.338	0.301	18.9	47.1	52.9
No earner	0.599	0.414	0.376	37.2	83.0	17.0
One earner	0.401	0.352	0.312	22.2	55.1	44.9
Two earners	0.317	0.303	0.265	16.4	26.9	73.1
2 parents + kids	0.355	0.318	0.278	21.7	48.1	51.9
No earner	0.897	0.306	0.277	69.1	95.3	4.7
One earner	0.461	0.376	0.308	33.2	55.6	44.4
Two earners	0.319	0.291	0.249	21.9	40.0	60.0
3+ earners	0.278	0.261	0.231	16.9	36.2	63.8
Lone–parents	0.498	0.346	0.304	39.0	78.4	21.6
Male head	0.395	0.326	0.284	28.1	62.2	37.8
Female head	0.506	0.334	0.299	40.9	83.1	16.9
No earner	0.832	0.204	0.202	75.7	99.7	0.3
One earner	0.402	0.283	0.244	39.3	75.3	24.7
2+ earners	0.334	0.277	0.253	24.3	70.4	29.6
Unattached individuals	0.550	0.409	0.358	34.9	73.4	26.6
Elderly male	0.685	0.340	0.276	59.7	84.4	15.6
Non–earner	0.698	0.304	0.250	64.2	87.9	12.1
Earner	0.560	0.383	0.313	44.1	71.7	28.3
Elderly female	0.681	0.289	0.229	66.4	86.7	13.3
Non–earner	0.690	0.274	0.217	68.6	87.9	12.1
Earner	0.483	0.320	0.254	47.4	71.2	28.8
Non–elderly male	0.461	0.407	0.365	20.8	56.3	43.8
Non–earner	0.918	0.414	0.388	57.7	95.1	4.9
Earner	0.391	0.365	0.325	16.9	39.4	60.6
Non–elderly female	0.512	0.440	0.397	22.5	62.6	37.4
Non–earner	0.839	0.461	0.423	49.6	90.9	9.1
Earner	0.413	0.388	0.344	16.7	36.2	63.8

Source: Statistics Canada (2002: 83-85) and authors' calculations.

Table 7: Ranking of Nine Countries' Pre- and Post-Tax Income Distributions by Generalized Entropy Inequality Measures, 1979-1983

Country/year	Generalized entropy parameter c =		
	–1	0	0.5
Australia/1981			
$E_c(x^g)$	1.0835 [8]	0.2997 [7]	0.2605 [6]
$E_c(x^n)$	0.8225 [8]	0.2323 [6]	0.2020 [6]
P_E	0.2610 [2]	0.0674 [2]	0.0585 [2]
% decline in $E_c(x^g)$	24.0% [3]	22.4% [2]	22.4% [3]
Canada/1981			
$E_c(x^g)$	0.6840 [6]	0.2695 [5]	0.2324 [5]
$E_c(x^n)$	0.5629 [6]	0.2293 [5]	0.1990 [5]
P_E	0.1211 [4]	0.0402 [6]	0.0334 [7]
% decline in $E_c(x^g)$	17.7% [9]	14.9% [7]	14.3% [6]
France/1979			
$E_c(x^g)$	0.5927 [5]	0.3508 [9]	0.3514 [9]
$E_c(x^n)$	0.4782 [5]	0.2737 [8]	0.2655 [9]
P_E	0.1145 [5]	0.0771 [1]	0.0859 [1]
% decline in $E_c(x^g)$	19.3% [6]	21.9% [4]	24.4% [1]
Germany/1981			
$E_c(x^g)$	0.3262 [1]	0.2025 [3]	0.1831 [3]
$E_c(x^n)$	0.2356 [2]	0.1574 [3]	0.1454 [3]
P_E	0.0906 [7]	0.0451 [5]	0.0377 [5]
% decline in $E_c(x^g)$	27.7% [2]	22.2% [3]	20.5% [4]
Netherlands/1983			
$E_c(x^g)$	0.3306 [2]	0.1897 [2]	0.1719 [2]
$E_c(x^n)$	0.2309 [1]	0.1439 [1]	0.1328 [1]
P_E	0.0997 [6]	0.0458 [4]	0.0391 [4]
% decline in $E_c(x^g)$	30.1% [1]	24.1% [1]	22.7% [2]
Sweden/1981			
$E_c(x^g)$	0.3584 [3]	0.1854 [1]	0.1659 [1]
$E_c(x^n)$	0.2927 [3]	0.1611 [2]	0.1436 [2]
P_E	0.0657 [9]	0.0243 [9]	0.0223 [9]
% decline in $E_c(x^g)$	18.3% [8]	13.1% [8]	13.4% [7]
Switzerland/1982			
$E_c(x^g)$	0.7689 [7]	0.2875 [6]	0.2851 [7]
$E_c(x^n)$	0.5996 [7]	0.2509 [7]	0.2497 [8]
P_E	0.1693 [3]	0.0366 [8]	0.0354 [6]
% decline in $E_c(x^g)$	22.0% [4]	12.7% [9]	12.4% [9]

United Kingdom/1979			
$E_c(x^g)$	0.4207 [4]	0.2512 [4]	0.2259 [4]
$E_c(x^n)$	0.3413 [4]	0.2135 [4]	0.1962 [4]
P_E	0.0794 [8]	0.0377 [7]	0.0297 [8]
% decline in $E_c(x^g)$	18.8% [7]	15.0% [6]	13.1% [8]
United States/1979			
$E_c(x^g)$	1.5697 [9]	0.3427 [8]	0.2902 [8]
$E_c(x^n)$	1.2495 [9]	0.2762 [9]	0.2331 [7]
P_E	0.3202 [1]	0.0665 [3]	0.0571 [3]
% decline in $E_c(x^g)$	20.3% [5]	19.4% [5]	19.6% [5]

Source: Zandvakili (1994: 482-483); E_c is the generalized entropy index of inequality based on pre-tax income (x^g) and post-tax (x^n) income, respectively; P_E is the associated tax progressivity index (see Table 2); c is the inequality aversion parameter; figures in square brackets show ranking of countries for each measure (and same c value), where rank [1] denotes lowest inequality, highest tax progressivity, and largest percentage decline in $E_c(x^g)$.

Table 8: Decomposition of Tax Systems' Redistributive Effects for Twelve OECD Countries

Country/year	$G(x^g)$	$G(x^n)$	RE	g	K_T	V	V (%)	H (%)	R (%)
Denmark/1987	0.3023	0.2703	0.0320	0.2966	0.0938	0.040	123.8	1.9	21.9
Finland/1990	0.2685	0.2253	0.0432	0.2188	0.1644	0.046	106.7	1.0	5.7
France/1989	0.3219	0.3065	0.0154	0.0620	0.2717	0.018	116.6	1.9	14.8
Germany/1988	0.2591	0.2312	0.0279	0.1108	0.2433	0.030	108.5	1.3	7.3
Ireland/1987	0.3870	0.3418	0.0452	0.1540	0.2685	0.049	108.2	1.0	7.3
Italy/1991	0.3248	0.3009	0.0239	0.1354	0.1554	0.024	102.0	0.4	1.6
Netherlands/1992	0.2846	0.2517	0.0329	0.1487	0.1977	0.035	104.9	0.7	4.2
Spain/1990	0.4083	0.3694	0.0389	0.1397	0.2545	0.041	106.1	0.4	5.7
Sweden/1990	0.3004	0.2608	0.0396	0.3270	0.0891	0.043	109.3	1.5	7.8
Switzerland/1992	0.2716	0.2541	0.0174	0.1210	0.1528	0.021	120.7	1.7	19.0
United Kingdom/1993	0.4121	0.3768	0.0352	0.1421	0.2278	0.038	107.1	0.9	6.3
United States/1987	0.4049	0.3673	0.0376	0.1370	0.2371	0.038	102.6	0.4	1.9

Notes: $G(x^g)$ and $G(x^n)$ are pre-tax and post-tax Gini coefficients; RE is the redistributive effect, the difference between the two Ginis; g is the average income tax rate; K_T is Kakwani's index of progressivity computed on the assumption that all households face the same tax schedule; V, H, and R are the values of the vertical redistribution, horizontal inequity, and re-ranking effect, respectively, with $RE = V + H + R$ and each component expressed as percents of RE.

Source: Wagstaff et al. (1999: 82).

Table 9: Distribution of Tax Burden in Equivalent Variation for Steady-State Generations, US, 1984

Lifetime income decile or group	Equivalent variation as % of lifetime income for steady state generations from the tax on:					
	Personal income	Sales + excises	Payrolls	Property	Corporate income	All taxes[a]
1a (bottom 2%)	−4.31	2.69	1.24	0.84	1.16	−0.06
1b (next 8%)	−0.23	1.70	0.69	0.63	0.90	3.13
2	−0.92	1.35	0.59	0.21	0.79	1.41
3	0.35	1.19	0.55	0.29	0.81	2.37
4	1.99	1.09	0.56	0.01	0.77	3.58
5	0.03	0.90	0.48	0.08	0.76	1.39
6	1.64	0.89	0.44	0.50	0.85	3.46
7	1.60	0.74	0.45	−0.01	0.75	2.51
8	2.13	0.68	0.45	0.01	0.76	2.95
9	2.26	0.70	0.38	0.04	0.74	3.01
10a (next 8%)	3.92	0.91	0.24	0.76	0.83	5.55
10b (top 2%)	9.00	1.03	0.23	1.20	0.94	11.10
Total	2.02	0.94	0.44	0.30	0.80	3.52
Steady–state EV as % of revenue	9.83	7.29	5.93	7.27	240.03	6.48
Efficiency measure as % of:						
Lifetime income	0.68	0.28	0.10	0.20	0.26	1.29
Revenue	3.14	2.11	1.29	4.47	65.01	2.26

Note: [a]Because of economic interactions among the taxes, the figures for "all taxes" do not equal the sum of the component taxes.

Source: Fullerton and Rogers (1993: 172-185); note that the incidence is estimated relative to a proportional labour endowment tax; a positive gain from the removal of a tax is interpreted as the burden of that tax.

Table 10: Average Tax Rates for Alternative Incidence Assumptions and Income Bases, Canada, 1972 (percents)

Households by income (percentiles)	Tax incidence and income base assumptions		
	Central case	Most progressive	Most regressive
Bottom 16.6	27.5	11.6	83.5
7.1	32.7	19.6	59.2
6.9	35.4	23.0	53.5
8.0	35.0	25.5	45.4
8.9	36.1	27.5	40.8
8.6	35.3	30.3	40.0
8.5	35.6	32.0	38.4
7.3	35.7	35.0	38.2
5.6	37.8	38.3	35.8
4.6	37.1	37.4	35.6
9.3	37.4	44.4	34.5
Top 8.6	43.0	70.6	22.2

Source: Whalley (1984: 660, 666, 670); see original study for incidence and income base assumptions of each case.

Table 11: Average Tax Rates by Family Broad Income Groups, Canada, 1988 (percents)

Family income percentiles[a]	Low 8.3	14.4	13.3	11.8	10.5	8.8	7.0	5.7	4.7	3.7	7.9	3.1	Top 0.8	All 100.0
Base case taxes														
PIT	0.7	4.4	7.6	9.9	11.5	12.9	13.7	14.0	14.2	14.7	15.5	16.2	14.5	13.1
CIT	0.3	0.5	0.6	0.6	0.7	0.8	0.8	0.9	1.0	1.1	1.3	3.8	12.3	2.2
Commodity	14.6	11.9	11.1	10.7	10.0	9.5	8.9	8.3	7.8	7.7	7.0	6.1	4.2	8.2
Payroll	2.2	3.6	5.1	6.1	6.3	6.5	6.3	6.0	5.8	5.5	4.8	3.0	0.8	4.9
Property	7.0	5.6	4.6	4.2	3.8	3.5	3.3	3.2	3.1	2.9	2.8	2.5	2.4	3.3
Other taxes	5.3	3.2	2.4	2.0	1.8	1.7	1.5	1.4	1.4	1.3	1.2	1.1	1.2	1.6
Total taxes	30.1	29.2	31.4	33.5	34.2	34.9	34.5	33.8	33.2	33.3	32.6	32.7	35.3	33.4
Federal taxes	8.7	10.9	13.8	15.8	16.6	17.4	17.5	17.3	17.2	17.3	17.2	17.8	19.0	16.8
Provincial taxes	13.9	12.3	12.7	13.3	13.5	13.8	13.5	13.2	12.7	12.9	12.4	12.2	13.8	13.0
Local taxes	7.5	5.9	4.9	4.4	4.1	3.7	3.5	3.3	3.3	3.1	3.0	2.6	2.5	3.5
Progressive case	19.6	22.1	25.3	27.4	28.6	29.3	29.5	29.1	28.6	29.2	29.4	32.7	42.3	30.2
Regressive case	42.2	37.4	36.9	37.7	37.4	37.0	36.3	35.2	35.0	33.9	33.8	33.4	33.0	35.5
Base case with pre-fisc income	89.3	41.6	39.7	38.6	38.1	37.4	36.1	35.3	34.4	34.1	33.3	33.1	35.5	36.4

Note: [a]All results except for the last line use the broad income measure. For progressive, regressive, and pre-fisc income base cases, the income percentiles differ somewhat from the charted figures, though the underlying dollar income ranges are unchanged; see the original study for incidence and income base assumptions of each case.

Source: Vermaeten et al. (1994: 401, 414-415).

Table 12: Redistributional Impact of Taxes by Order of Government and Type of Tax, Global RSA Index, Canada, 1986

Order of government	Base case	Progressive variant	Regressive variant
Federal	1.041	1.042	1.038
Provincial	1.024	1.025	1.022
Local	1.001	1.006	0.996
Type of tax			
Personal income tax	1.0567	1.0576	1.0562
Corporate taxes	1.0019	1.0021	0.9988
Payroll taxes	1.0018	1.0023	1.0013
General sales taxes	1.0018	1.0022	1.0014
Fuel taxes	1.0000	1.0001	1.0000
Liquor and tobacco	0.9985	0.9986	0.9983
Natural resources	1.0001	1.0001	1.0000
Real property tax	1.0009	1.0061	0.9967
Fees and charges	1.0000	1.0001	1.0000
Miscellaneous revenue	1.0017	1.0018	1.0016
Total	1.0853	1.0958	1.0728

Source: Ruggeri et al. (1994: 431, 439); see text for definition of global RSA index; see original study for incidence and income base assumptions of each case.

Table 13: Average Tax Rates by Household Type and Income Level, Canada, 1986 (percents)

| Income group	Household type					
	Nonelderly singles	Single parents	1–earner couples	2–earner couples	Seniors	Combined total
Poor	[27.9]	[48.6]	[17.1]	[4.5]	[35.6]	[21.6]
PIT	0.7	0.2	1.0	1.3	0.0	0.5
Other taxes	31.8	11.1	14.8	18.3	7.7	16.3
All taxes	32.5	11.3	15.7	19.7	7.7	16.8
Low income	[19.6]	[20.1]	[17.6]	[10.1]	[29.9]	[18.5]
PIT	6.8	3.7	5.9	6.1	1.0	4.5
Other taxes	29.8	16.8	20.1	21.3	6.8	17.9
All taxes	36.6	20.5	26.0	27.4	7.8	22.4
Lower–middle	[13.1]	[15.1]	[19.5]	[15.6]	[11.3]	[14.7]
PIT	11.8	8.2	10.1	10.4	4.1	9.4
Other taxes	32.7	23.2	23.1	24.0	9.7	22.6
All taxes	44.5	31.3	33.1	34.4	13.8	32.0
Upper–middle	[21.1]	[11.3]	[25.1]	[30.8]	[11.2]	[22.2]
PIT	14.9	12.2	13.7	15.2	8.0	13.9
Other taxes	33.1	23.8	23.7	24.2	10.0	24.0
All taxes	48.0	36.0	37.3	39.4	18.0	37.9
High income	[16.7]	[4.5]	[16.1]	[33.8]	[9.8]	[19.6]
PIT	19.1	15.3	17.5	20.6	12.8	18.9
Other taxes	29.0	24.0	21.8	22.9	12.9	22.6
All taxes	48.0	39.3	39.3	43.5	25.7	41.5
Rich	[1.7]	[0.3]	[4.6]	[5.2]	[2.2]	[3.3]
PIT	26.6	37.8	28.5	31.0	25.8	29.2
Other taxes	21.2	21.5	16.7	17.2	15.8	17.3
All taxes	47.8	59.3	45.2	48.3	41.6	46.5
All incomes	[100.0]	[100.0]	[100.0]	[100.0]	[100.0]	[100.0]
PIT	13.5	6.0	14.0	17.9	7.0	14.1
Other taxes	30.3	17.7	20.9	22.5	9.9	21.2
All taxes	43.9	23.7	34.9	40.3	17.0	35.3

Source: Ruggeri et al. (1996: 24, 45); figures in square brackets are the percent of that household type in that income group.

Table 14: Average Tax Rates for Households by Deciles, Annual vs. Lifetime Views, Canada, 1970 (percents)

Tax/Decile	1	2	3	4	5	6	7	8	9	10	All
Annual incidence (deciles ranked by annual income) **central case**											
Corporate inc. tax	1.0	1.3	1.6	1.6	1.2	1.4	1.2	1.7	2.7	9.8	4.2
Property tax	1.1	1.5	1.8	1.7	1.3	1.5	1.3	1.9	2.9	10.6	4.5
Sales and excises	27.2	20.3	15.8	14.6	14.0	13.4	13.5	13.2	12.8	8.5	12.4
Payroll tax	1.7	2.5	4.1	4.3	4.2	3.9	3.8	3.4	3.0	1.4	2.9
Personal inc. tax	4.3	2.8	6.8	9.77	11.9	13.4	13.8	14.8	15.4	15.7	13.5
All taxes	35.4	28.4	30.1	31.9	32.6	33.6	33.7	35.0	36.8	46.0	37.5
Lifetime incidence (deciles ranked by lifetime resources), **central case**											
Corporate inc. tax	2.2	2.9	2.6	3.0	2.9	3.3	3.3	4.1	3.4	5.1	3.6
Property tax	2.4	3.1	2.8	3.3	3.2	3.6	3.6	4.5	3.7	5.6	3.9
Sales and excises	15.0	14.3	14.1	13.9	13.8	13.5	13.6	13.3	13.2	12.4	13.5
Payroll tax	3.9	4.0	3.9	4.0	3.8	3.8	3.6	3.6	3.4	2.8	3.6
Personal inc. tax	7.3	11.3	12.5	13.5	14.5	15.1	15.7	16.7	17.7	20.5	15.8
All taxes	30.9	35.5	35.9	37.7	38.1	39.3	39.8	42.2	41.3	46.5	40.2
Lifetime incidence (deciles ranked by lifetime resources), **"noncompetitive" case** (other taxes as in central case)											
Corporate inc. tax	3.1	3.3	3.2	3.4	3.3	3.4	3.4	3.8	3.4	4.2	3.6
Property tax	3.4	3.6	3.4	3.6	3.9	3.7	3.7	4.2	3.7	4.6	3.9
All taxes	32.8	36.4	37.1	38.4	39.2	39.5	40.1	41.6	41.4	44.6	40.2
Lifetime incidence (deciles ranked by lifetime resources), **"Browning–Johnson" case** (other taxes as in central case)											
Sales and excises	12.0	12.7	13.1	13.3	13.3	13.6	13.5	13.7	13.8	13.9	13.5
All taxes	27.9	34.0	34.9	37.0	37.6	39.4	39.8	42.6	41.8	48.0	40.2

Source: Davies et al. (1984: 641, 644); see original study for incidence and income base assumptions of each case.

Figure 1: Lorenz and Tax Concentration Curves, Gini and Progressivity Indices

Cumulative % of income (LC) or taxes (TCC)

Cumulative % of population
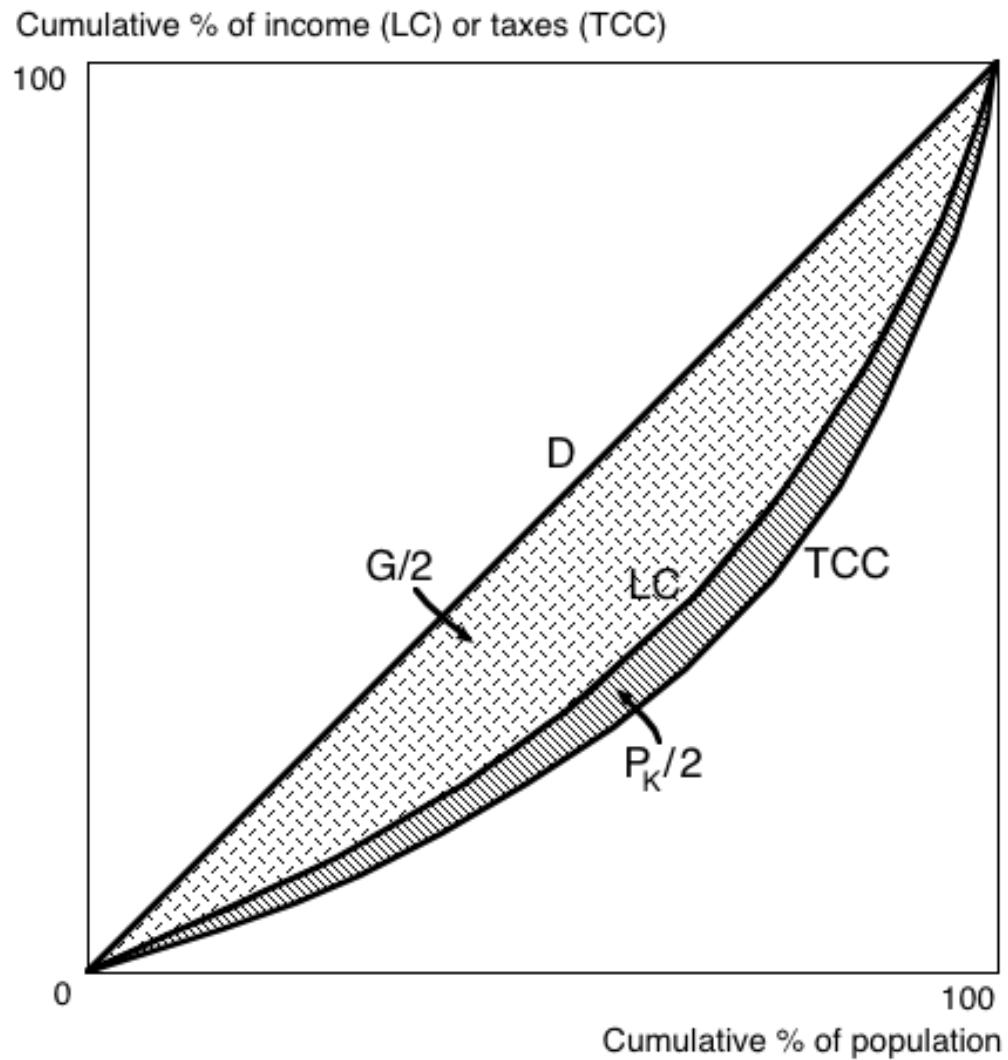
D = diagonal line for complete equality

LC = Lorenz curve for pre-tax incomes

TCC = tax concentration curve (shown for a progressive tax system)

G = Gini coefficient for pre-tax incomes (twice the shaded area between D and LC)

P_K = Kakwani progressivity index (twice the shaded area between LC and TCC; shown
for a progressive tax system)