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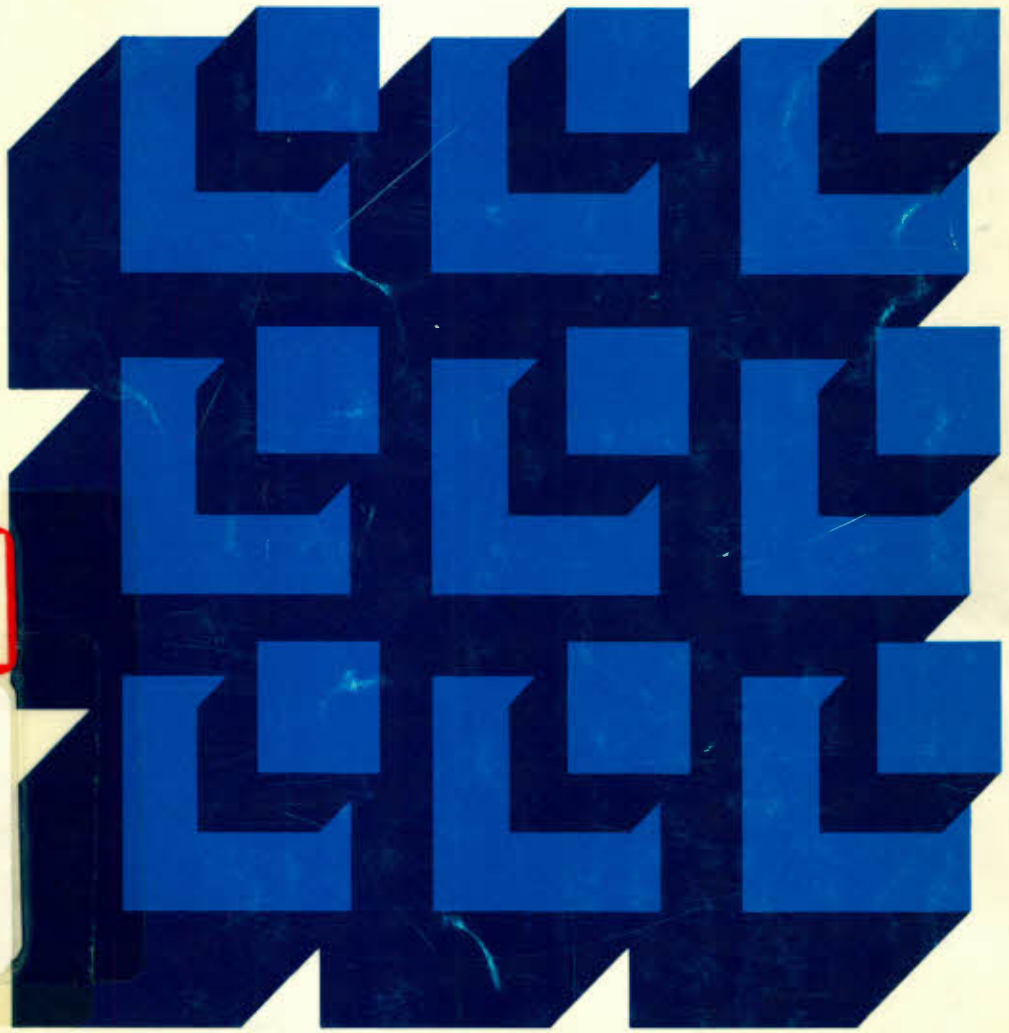

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DISCUSSION PAPER NO. 294

# Indirect Federal Taxes, the Cost of Capital and the Issue of Tax Incidence

by Wayne R. Thirsk



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RÉSUMÉ

L'auteur analyse le rôle que devraient jouer les impôts indirects dans le régime fiscal, ainsi que les effets qu'aurait sur la répartition des revenus et sur le revenu global une réforme qui donnerait plus d'importance aux impôts directs et qui remanierait l'assiette, présentement très déficiente, des impôts indirects fédéraux. En imposant les taxes d'accise à des taux non uniformes, on peut tirer parti des caractéristiques différenciées de la demande de produits divers, tout en facilitant la réalisation soit d'une plus grande équité ou d'une plus grande efficacité au sein du régime fiscal. De même, les taxes de vente d'application générale, prélevées à des taux uniformes, ont aussi pour but d'accroître la capacité du régime fiscal à réaliser les objectifs d'équité, d'efficacité et de simplicité administrative. L'introduction, dans un régime d'impôt sur le revenu, de taxes indirectes de portée générale peut réduire l'effet de distorsion que le niveau élevé des taux marginaux de l'impôt sur le revenu exercent sur les décisions des ménages, tant sur le marché du travail que sur les marchés financiers. En frappant la partie du revenu qui, sans cela, pourrait échapper à l'impôt, ces taxes indirectes peuvent améliorer le degré d'équité "horizontale" du système fiscal. Dans un régime axé sur les dépenses, un impôt indirect uniforme de portée générale - une taxe à la valeur ajoutée, par exemple - pourrait engendrer les gains d'efficacité propres à une taxe sur les dépenses et limiter l'application d'un impôt direct sur les dépenses à une petite catégorie, plus facilement administrable, de ménages qui dépensent beaucoup. Cette combinaison d'impôts directs et indirects engloberait les deux niveaux d'imposition des dépenses décrits de façon plus détaillée dans le rapport Meade (Royaume-Uni).

La taxe de vente à la fabrication est le principal instrument fiscal dont dispose le gouvernement fédéral dans la catégorie des impôts indirects. Cette taxe existe depuis longtemps mais, malgré ceux qui croient que sa longévité suffit à en faire un "bon" impôt, elle comporte de nombreuses imperfections dans sa conception même. En effet, sa structure de taux nominaux n'est pas uniforme, son assiette est définie de façon à englober les moyens de l'activité de production aussi bien que ses résultats - ce qui n'est pas approprié - et ses taux effectifs varient au petit bonheur, d'une entreprise et d'une industrie à l'autre, parce que l'assiette de cet impôt ne comprend pas les marges bénéficiaires des distributeurs et des commerçants. En outre, la taxe de vente à la fabrication constitue un fardeau - non intentionnel, il est vrai - pour les exportations et elle privilégie les importations par rapport aux produits canadiens

concurrentiels. Ce n'est qu'en déplaçant son point d'application du niveau des manufacturiers à celui de la vente au détail qu'on disposerait d'un moyen prometteur d'éliminer ces distorsions. L'imposition d'une taxe à la valeur ajoutée qui serait uniforme et de portée universelle, par exemple, retiendrait la formule de taxation indirecte de la vente au détail, car elle frapperait chacun des apports de valeur finale à un bien de consommation qui serait engendré à chacune des étapes distinctes de la chaîne de production et de distribution. En outre, elle éliminerait les distorsions intersectorielles et intertemporelles propres à la taxe de vente à la fabrication.

La présente étude évalue, dans le cadre d'un modèle d'équilibre général, les effets d'une réforme des impôts indirects et les conséquences d'un réaménagement des instruments fiscaux qui favoriserait davantage les impôts directs que les impôts indirects. Les résultats montrent qu'en substituant à la taxe de vente à la fabrication des rentrées plus élevées tirées de l'impôt sur le revenu des particuliers, les contribuables des tranches de revenu plus faibles, jusqu'au quatrième décile, bénéficieraient d'une amélioration de leur bien-être équivalant à au moins 1 %. Ce réaménagement fiscal ne toucherait guère les ménages à revenu moyen, tandis que les ménages les plus fortunés y perdraient. D'autre part, l'ensemble de l'économie y gagnerait un peu. On parvient aux mêmes conclusions en modifiant les spécifications du modèle et en postulant des valeurs différentes pour certains paramètres critiques.

La seconde expérience est semblable à la première, sauf que les pertes de recettes fiscales sont récupérées en combinant une augmentation de l'impôt personnel à une hausse de l'impôt sur les sociétés. Comme dans le cas précédent, on note une redistribution des revenus à partir du décile le plus élevé jusqu'aux tranches inférieures. Dans cette seconde expérience, le montant qui est redistribué dépend toutefois de la variante du modèle qu'on utilise. Plus le Canada joue un rôle passif à l'égard des prix (un rôle de price taker) sur le marché mondial des capitaux, moins marqué est le degré de redistribution entre les tranches de revenu aux extrémités de l'échelle.

Dans la dernière expérience, l'auteur examine les résultats de la substitution d'une taxe de vente uniforme et universelle à l'impôt sur le revenu des particuliers. Comme on pouvait le prévoir, un tel bouleversement du régime fiscal mène à une redistribution des revenus en faveur des tranches supérieures. En comparant les résultats de cette expérience avec ceux de la première, on peut déterminer l'incidence d'une réforme des impôts indirects qui substituerait à la taxe de vente à la fabrication une taxe de vente uniforme d'application générale. Comme d'autres

études récentes l'ont laissé voir, une réforme de ce genre aurait un léger effet régressif sur la répartition des revenus. On peut donc supposer que, pour avoir beaucoup d'attrait auprès de la population, une réforme des impôts indirects devra peut-être s'accompagner de mesures complémentaires - par exemple, un crédit d'impôt qui supprimerait ce caractère régressif. De plus, une réforme exécutée suivant cette formule s'accompagnerait vraisemblablement d'un accroissement global de bien-être, dont l'importance est sous-estimée dans la présente étude du fait qu'elle néglige les avantages d'une meilleure affectation des ressources dans le temps.

ABSTRACT

This paper explores the appropriate role of indirect taxes in the tax system and estimates the effects on income distribution and total income of altering the tax mix in favor of greater direct taxation and of reforming the highly flawed federal indirect tax base. Excise taxes imposed at non-uniform rates may take advantage of differences in the demand characteristics of commodities and facilitate the attainment of either greater equity or more efficiency in taxation. Broad-based sales taxes levied at uniform rates are likewise intended to enhance the ability of the tax system to meet the objectives of equity efficiency and administrative simplicity. In an income tax system the introduction of broad-based indirect taxes may alleviate the extent to which high marginal income tax rates distort the decision-making of households in both labor and capital markets and, by striking income which may otherwise escape income tax burdens, improve the degree of horizontal equity in the tax system. In an expenditure tax system a broad-based uniform indirect tax such as a value-added tax may be able to deliver the efficiency gains of expenditure taxation and confine the imposition of a direct expenditure tax to a more easily administered small group of high expenditure households. This mixture of direct and indirect taxes would embody the two-tiered approach to expenditure taxation that is described in greater detail in the U.K. Meade Report.

The manufacturers' sales tax is the major element of indirect taxation in the array of federal tax instruments. Despite its longevity and the dictum that an old tax is a good one, this tax has numerous imperfections in its design. Its nominal rate structure is non-uniform, its base is inappropriately defined to include the means as well as the results of productive activity and its effective rate structure varies haphazardly across firms and industries as a result of its failure to include distribution and trade margins in the tax base. In addition, the tax inadvertently burdens exports and treats imports more lightly than competing sources of supply from domestic production. Only a movement of the tax point from the manufacturer's level to the retail level offers a promising approach to removing these distortions. A uniform broad-based value-added tax, for instance, would implement the retail form of indirect taxation by taxing each contribution of final value to a consumer good made by the separate links in the production and distribution chain. It would also eliminate the inter-sectoral and inter-temporal distortions associated with the manufacturers' sales tax.

This study relies upon a general equilibrium approach to assess the impact of indirect tax reform and the consequences of adjusting the tax mix towards greater direct and less indirect taxation. When the manufacturers' sales tax is replaced by the proceeds of larger personal income tax collections lower income groups up to the fourth decile experience a welfare improvement of one percent or better. Middle income groups are little affected by the tax change while the richest decile is made worse off. There is also a modest gain for the economy as a whole. Different variants of the model and alternative choices for the value of certain key parameters yield the same set of conclusions.

The second experiment is similar to the first except that the revenue loss is recouped through a combination of higher personal and corporate taxes. As in the previous experiment there is a redistribution of income from the very top decile to the lower income groups. In this case, however, the amounts redistributed depend on which variant of the model is employed. The more that Canada is a price-taker in world capital markets the less marked is the degree of redistribution from top to bottom income groups.

The last experiment examines the substitution of a broad-based uniform sales tax for the personal income tax. No surprisingly, this adjustment in the tax mix redistributes income from the bottom half of all income recipients to the top half. By comparing the outcome of this experiment with the results of the first, it is possible to determine the impact of an indirect tax reform that replaces the manufacturers' sales tax with a uniform broad-based sales tax. As other recent studies have also suggested, tax reform of this type will produce a small regressive influence on the distribution of income. Therefore indirect tax reform, if it is to have much political appeal, may require complementary measures in the form of a tax credit mechanism which removes this regressivity. Moreover, this particular indirect tax reform promises to be accompanied by an aggregate welfare gain; the extent of which is underestimated in this study because it neglects the benefits of a better inter-temporal allocation of resources.

This paper assesses the role of indirect taxation in Canada. It begins, in section I, with a discussion of the fundamental differences between indirect and direct taxation and goes on to consider the proper mix of direct and indirect taxes under an ideal expenditure tax on the one hand and an ideal income tax on the other. The second section is by and large a review of recent literature on the subject of indirect tax reform in Canada. It examines numerous imperfections in the current system of indirect taxation, paying particular attention to the federal manufacturers' sales tax (MST) and introduces some of the main proposals for reform in this area. In the third section the issue of exactly how indirect taxes should enter economic models is raised. In particular, the way in which indirect taxes may influence the cost of capital in investment decisions and the effective tax rate on capital incomes is analyzed in this section. Section IV outlines the nature of the applied general equilibrium model that has been used to investigate how a reweighting of direct and indirect taxes would affect the distribution of welfare within Canada as well as between Canada and the rest of the world. Alternative scenarios in which the rest of the world either does, or does not, adopt tax measures which move in unison with Canadian tax policy changes are also considered. The results of the general equilibrium analysis are presented and discussed in section V. This is followed by a brief set of conclusions in the final section.

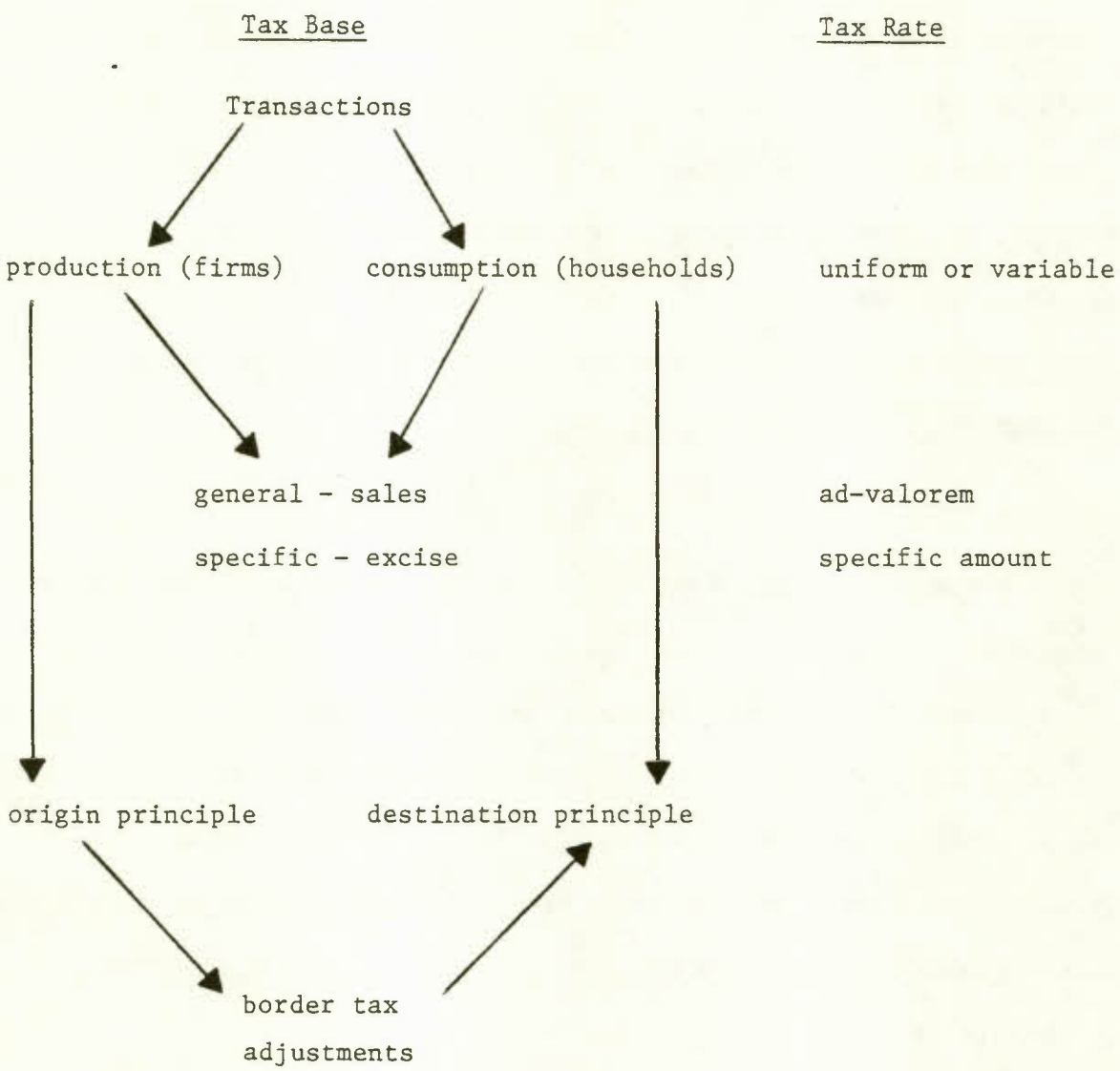
## I. The Distinction Between Direct and Indirect Taxes and Their Appropriate Mix in a Tax System

Indirect taxes have been traditionally distinguished from direct taxes because of their impersonal nature. Direct taxes are imposed on individuals and are typically tailored to fit individual's tax-paying circumstances while indirect taxes are levied against particular kinds of transactions and make no allowance for differences in the economic circumstances of different taxpayers.

Figure I indicates the wide variety of indirect tax which may be fashioned by tax policy. The transaction to which the tax applies may be either an act of production by firms in the economy or an act of consumption by households. Except in an open economy, it does not matter in principle on which side of the market, supply or demand, an indirect tax is assessed. Indirect taxes may apply to a large number of transactions, in which case they are described as sales taxes, or to only a few transactions. Such limited scope indirect taxes are referred to as excise taxes. The base for an indirect tax is either the price of the transaction (ad-valorem taxation), as in the case of sales taxation, or the quantity transacted. The rates of indirect tax may be either uniform or variable across different kinds of transactions. Excise taxes are ordinarily expressed as a specific amount per unit of output, while sales taxes typically absorb a fixed percentage of the transaction per unit of value. Provincial government royalties, for instance, extract a certain percentage of the value of mining, oil and natural gas output that is produced and constitute a form of excise taxation imposed on natural resource industries. User charges such as fees and licenses, on the other hand, have an element of quid pro quo that makes them indistinguishable from most private sector transactions and differentiates them from other kinds of indirect taxes.

Figure I

Schematic Structure of Indirect Taxes



In an open economy, indirect taxes may be applied according to either the destination or origin principle or to some mixture of the two. Under the origin principle the tax base is defined as domestic production and exports are not exempt from indirect taxation while imports from other countries are. If the alternative destination principle were in place, consumption, regardless of the source of supply, would be the relevant tax base. Exports would escape indirect taxes while imports would be subject to the same tax rate as domestic production. Border tax adjustments, which allow rebates of indirect tax on exports and impose equivalent rates of tax on imports, are the means by which origin-based tax systems can be transformed into destination principle taxes.

In practice, in most countries including Canada, the bulk of indirect taxes are related to the consumption or spending behavior of households. In contrast, most direct taxes are geared to the way in which households earn their income. This distinction between the source of income and its uses reflects the two different channels through which taxes impose their burdens on the real incomes of households. Taxes diminish the welfare of households either through a reduction in their money incomes or through an increase in the price of their purchases or through some combination of the two.

Indirect taxes are frequently presumed to affect households on the side of the uses of income, while direct taxes are thought to make their influence felt on the side of the sources of income. Although

there is much truth behind this general presumption, it can be highly misleading if the scope of indirect taxation is limited. For instance, in a small open economy, an indirect tax levied on the production of exports and import-competing industry, i.e., on an origin basis, must be borne by the incomes of imperfectly mobile producers in these industries. Conversely, if only the incomes of resources employed in a particular industry are taxed, the prices of these resources will increase until incomes after-tax are the same in all industries and the higher cost of these resources will be translated into a higher industry price for output.[1]

In order to determine how one tax differs from another, appeal to the relative rather than absolute price effects of a tax will turn out to be a more reliable procedure. Consider, for example, the differences between imposing an indirect tax in the form of a broad-based, uniform rate, value-added tax and a direct tax in the guise of a single rate expenditure tax. Given an institutional structure in which prices are determined on the basis of costs and a value-added tax is perceived by firms as an additional element of cost, the indirect tax alternative would exert its impact on the economy's price level. The direct tax alternative, however, would not be expected to affect the price level but would instead diminish money incomes. Despite the quite different price level manifestations of these two taxes, they are essentially equivalent in the sense that the structure of relative prices, and thus the distribution of income and the allocation of resources, would be the same under either tax.

The admonition to judge taxes by their effects, specifically their relative price effects, rather than their appearance is given greater urgency by the growing tendency in many modern economies to personalize indirect taxes. Refundable sales tax and property tax credits, for instance, go a long way towards converting an indirect tax into a direct tax. Similarly, as Carlson and McLure (1984) point out, recent proposals for a flat rate personal income tax resemble the adoption of broad-based uniform rate value-added tax (VAT) that allows personal exemptions. That is, a VAT with refundable tax credits could be designed so that it was equivalent in all respects to a flat rate tax which allowed businesses to deduct purchases of capital goods and individuals to claim personal exemptions.

Despite the considerable conceptual fuzziness in distinguishing direct from indirect taxes, it is still a worthwhile exercise to inquire how each type of tax may contribute to the achievement of the trinity of goals that serve as the hallmark of a good tax system: equity, efficiency and administrative ease. Equitable taxation incorporates two important value judgements: that those with greater ability to pay taxes should pay more (vertical equity) and that those in similar circumstances should pay the same amount (horizontal equity).[2] Efficient taxation minimizes the distorting effects of taxation on the resource allocation decisions of private sector agents. Taxes typically interfere with the choices of how much to work and save, where to invest and what to buy. Only a poll or head tax has no effects along these different dimensions of choice and is thus nondistorting. With all

other kinds of tax it costs the economy more than a dollar of real income when the tax system delivers a dollar of revenue to the government. The difference between cost and revenue is the so-called excess burden of taxation. Ease of administration encompasses costs of collection as well as the costs of taxpayer compliance. Compliance costs reflect the complexity of tax provisions and motivate many recent demands for tax simplification. In addition, when a tax is poorly administered there is often a significant discrepancy between how that tax is supposed to behave in theory and how it actually operates in practice. Taxes that on paper appear to be equitable and efficient may in fact not be so if administration is poor.

In designing the most desirable tax system, there is frequently a trade-off between the equity and efficiency goals that requires resolution. More equity is usually attainable only if greater inefficiency is tolerated. Thus if direct taxes were considered to be more equitable but less efficient than indirect taxes, the ideal tax system would place greater reliance on direct taxation than it otherwise would if equity considerations received relatively less weight. Besides knowing how to make a suitable trade-off between equity and efficiency, it is also necessary to have some accurate knowledge of how various taxes contribute to the achievement of these goals. By altering our perception of the impact of different taxes, current research into the effects of existing taxation may provide an important impetus for changing the tax system. For example, the inefficiencies associated with certain taxes are now considered to be larger by several orders of magnitude than they were two decades ago.[3]

In the literature on taxation two divergent views emerge on the appropriate role of indirect taxes in a tax system. If for the moment comparisons are restricted to only ideal taxes and questions of administration are put aside, one point of view argues for the superiority of direct taxes on grounds of both equity and efficiency. Quite simply, all indirect taxes should be replaced by direct taxes which are seen as having greater capacity to distinguish between rich and poor in their treatment of taxpayers, are less likely to offend the standards of horizontal equity and may, if broadly based, be less distorting of economic decision-making. Clearly, all of these propositions are capable of either empirical verification or refutation.

On theoretical grounds, however, the burgeoning literature on optimal commodity taxation has established that under certain conditions direct taxes alone may be optimal. It is easy to demonstrate that a uniform commodity tax is equivalent to an income tax if the question of savings is ignored.[4] In general, uniform tax rates are not optimal as there is a unique optimal rate on each transaction depending on its supply and demand characteristics.[5] However, if nontaxable leisure is separable from the consumption of all commodities and all of their income elasticities are unitary, it is optimal, as shown by Atkinson and Stiglitz (1976), to tax all commodities at the same rate, or, equivalently, to rely exclusively upon direct taxation. More generally, if leisure is not separable from the consumption of other commodities, it is optimal to tax more (less) heavily those

commodities which are complements to (substitutes for) the consumption of leisure.

An alternative viewpoint is that direct taxes should be assigned to serve the equity objective while indirect taxes are necessary to satisfy the efficiency goal. For a given revenue requirement marginal tax rates would be higher with exclusive reliance on a single direct tax base. Introducing an indirect tax base, even though it might detract from the equity objective, would permit lower marginal tax rates on the direct tax base and, since efficiency is a function of the square of the marginal tax rates, the combination of direct and indirect tax bases would impose a lower efficiency cost on the economy than would the use of the direct tax base by itself.[6] In general, multiple tax bases are preferable to a single base unless that base generates economic rents, in which case it should be taxed to the hilt since high tax rates in this particular case will not be distorting.[7]

While these propositions are the most widely known results from the optimal tax literature, it is less well known that they rest upon a fairly fragile foundation. As Atkinson (1977) indicates, if poll taxes were feasible only these instruments should be employed on efficiency grounds. Indirect taxes in this case would be required to serve the equity objective and the orthodox assignment of tax instruments to different goals would be completely reversed.

While the theoretical literature is on the whole inconclusive in assigning a unique role to indirect taxation, it does offer a useful framework in which to consider the problem. First of all, it seems that the case one can make for indirect taxation turns on the type of personal tax that is in place, whether it is a broad-based income tax or, alternatively, a broad-based expenditure or consumption tax. Secondly, it is useful to split indirect taxation into two separate categories, narrowly based excises and broadly based sales taxes.

Excise taxes have a rationale that is independent of the choice of direct tax. To a limited extent, excise taxes may be able to implement the benefit principle of taxation. For example, if they are earmarked for expenditures on road construction and maintenance, taxes on gasoline consumption may be a means of taxing road-users in accordance with the benefits which they receive from the consumption of road services. Automobile registration fees, charges for landing rights at airports, service-based property tax assessments and the like all perform a similar function of inducing an efficient provision of public services. In addition, some excises, for example those levied on tobacco products and alcoholic beverages, may be justified on the grounds that certain consumption activities generate negative externalities for the rest of society. Whether in the form of lost productivity or extra expenditures on health care and crime prevention, excessive smoking and drinking exacts a toll on the whole economy. High rates of excise taxation on these activities are needed to make consumers

aware of the social costs of their consumption choices and to induce them to curb their consumption in light of these costs. Excise taxes should be set at the level where the price to the consumer balances the marginal social cost of his consumption. A third efficiency argument for excise taxation is that it may be one of a number of different fiscal instruments designed to collect natural resource rents. Royalties, in conjunction with corporate income taxes and bids for leases, are aimed at collecting resource rents and should be viewed as an excise tax on the production of natural resources. Finally, excises may also be harnessed to serve the equity objective if they are targetted to the consumption of luxury items in the economy. As Atkinson (1977) notes, indirect taxes have historically been used for this purpose. In seventeenth-century England, taxes on silks, coffee and newspapers -- luxuries at that time -- were considered to be more progressive than a one-shilling head tax.

One of the more serious distortions attributable to a broad-based income tax is its tendency to favor current consumption over future consumption.[8] This distortion occurs even if savings rates are insensitive to the rate of return received for saving. A general sales tax such as a broad-based value-added tax could reduce the severity of this distortion if it replaced a portion of the income tax. Whether the work-leisure distortion would also respond to this tax substitution is more difficult to predict. On the one hand, marginal income tax rates would be lower but, on the other, the cost of non-leisure consumption would be higher. If there were no money, or, more precisely, tax illusion in the supply of labor, it would make no difference if labor

effort were burdened less on the income side and more on the expenditure side.[9] On the other hand, it is well known in the public finance literature that a single rate general indirect tax is equivalent, in the sense of achieving the same present value of taxation, to an equal rate payroll tax on labor incomes. Thus a change in the tax mix toward greater reliance on indirect taxation may also lighten the tax burden on capital incomes by replacing a mixed capital and labor income base with a pure labor income base. In that event a partial shift in the direction of heavier indirect taxation may moderate savings inefficiencies but also exacerbate work-related inefficiencies by raising the relative tax burden on earned labor incomes.

However, it is probably easier to avoid or evade income taxes than it is to do so for consumption taxes. If this were true, the actual income tax system, in light of differential opportunities for evasion, might be less desirable than actual indirect taxes even though it could be argued that an ideal income tax would be preferable to an ideal indirect tax. Moreover, indirect taxes would receive higher marks for horizontal equity since they would strike incomes on which little or no direct tax had been paid. Still, a shift to more indirect taxation would also be horizontally inequitable because it would strike consumption out of savings accumulated prior to the tax change that had already been taxed twice under the personal income tax. Moreover, to the extent that the indirect tax was less than perfectly general, differential consumption patterns within income classes would detract from the achievement of horizontal equity.

The argument favoring some form of indirect tax under a direct expenditure tax regime runs along quite different lines. The only advantage of an expenditure tax over a broad-based value-added tax is in the ability to apply multiple rates that will not distort consumption choices. A multiple rate value-added tax would affect consumption choices and would be a poorer redistributive instrument because of greater inability to distinguish between rich and poor consumers. However, as the Meade Report (1978) suggested, there may be considerable merit in combining the direct and indirect forms of consumption tax. A general flat rate tax on value-added would be an efficient revenue-raiser. On top of this a surtax in the form of a multiple rate expenditure tax on high level consumers would be applied for equity reasons. The advantage of a combined or two-tier consumption tax is significant tax simplification since only a relatively small number of taxpayers would have to file for the surtax. The Meade Report concedes, however, that there is a problem in determining who should file and pay the surcharge since those with low incomes but high consumption levels financed from the sale of assets yielding no investment income might be placed beyond the reach of the tax net.

There might also be some less significant benefits from adopting the two-tier approach to consumption taxation. With imperfect averaging individuals could face different tax rates in different time periods, so that even under an expenditure tax inter-temporal consumption choices could be distorted if only the progressive direct portion of the consumption tax were in place.[10] The two-tier approach

would not entirely eliminate this problem, but it would reduce the frequency with which it occurred. Moreover, a progressive expenditure tax by itself may also distort labor-leisure choices more than a blend of direct and indirect consumption tax would since fewer workers would be exposed to rate progression under the mixed approach.

Kesselman (1985) has recently assessed the merits of a tax mix change towards greater indirect taxation in the context of the Australian economy. He concludes that the impact of such a change on improving work and savings incentives, curbing taxpayer avoidance and evasion and in promoting taxpayer acceptance is highly ambiguous and, as a result, the claims favoring this change in tax mix have been grossly exaggerated. Frequently the validity of these claims depends on the existence of some form of tax illusion and on the failure to adequately consider a number of offsetting factors. For example, shifting the tax mix toward more indirect taxation may simultaneously improve savings incentives and impair labor supply incentives leaving any net efficiency gain in serious doubt. In Australia, the modest gains ensuing from a change in tax mix would be overwhelmed by the much larger benefits which could be obtained from a coincident reform of the personal income tax (PIT). Enlarging the PIT base and taxing incomes from different sources more uniformly would do more to raise extra revenue and enable a reduction in top bracket marginal PIT rates than a change in tax mix could. By itself a change in tax mix can neither reach nor remedy numerous distortions that exist <u>within</u> the current direct and indirect tax bases.

In short, a mixture of direct and indirect taxes may be better able to achieve the goals of equity, efficiency and administrative simplicity under either a pure income tax system or a pure expenditure tax design. Much depends on the form of indirect taxation. Indirect taxes that feature exemptions and special industry incentives may not only be administratively complex, but may also seriously distort the inter-sectoral allocation of resources and sacrifice any inter-temporal efficiency advantages which they produce. Specific kinds of indirect tax are considered next.

## II. The Impact of Federal Indirect Taxes, Imperfections in their Design and Proposals for Reform

Indirect taxes so far have been treated in a very general fashion. Here the concern is with how they function in a Canadian context. Excise taxes will be ignored in what follows because their role in a tax system, as indicated earlier, is quite different from that of sales taxation. Attention will be focused instead on the federal sales tax, the manufacturers' sales tax (MST), and on some of its potential replacements such as the value-added tax (VAT). Many of the comments, however, that apply to these taxes are also applicable to provincial retail sales taxes (PRST).

Two earlier studies of commodity taxation in Canada adopted a somewhat broader focus. Both Campbell (1975) and Boadway-Treddenick (1977) considered some of the consequences of removing the entire structure of commodity taxes, federal and nonfederal, sales and excise, and replacing them with a neutral lump sum tax. Using a linear expenditure system to depict consumer choices and 1961 input-output data, Campbell found that at the margin it costs $1.25 to generate another dollar of revenue from commodity taxation. Using a general equilibrium model that featured Cobb-Douglas production and utility functions and assumed fixed factor supplies as well as the absence of other kinds of distortions in the economy, Boadway and Treddenick concluded that the elimination of commodity taxation would have only a modest effect on relative factor prices. In addition, an

efficiency improvement of the order of .4 - .8 percent of GNP would be experienced. Expressing this gain as a fraction of the total revenues from the commodity tax base, it would appear from their study that the average excess burden of all commodity taxation is somewhere between 4 and 8 cents per dollar of revenue.[11]

There is a growing awareness that the federal sales tax component of commodity taxation, which accounts for about 12 percent of federal revenue, is saddled with several deficiencies. Called a fiscal relic by Gillis (1985), it is more nearly a selective excise tax system than a general sales tax since 61 percent of its yield is accounted for by only six commodities. The base of the MST is the price at which a manufacturer sells his product to a purchaser or, in the case of imports, the value of imports inclusive of any customs duty but exclusive of any transport costs to Canada. By definition, services are excluded from this tax base as are all wholesale-retail margins, so perhaps only as much as 30 percent of the value of household consumption is captured in the base. Exemptions are provided for exports and for certain necessities such as food, clothing, footwear and drugs and all producers' goods with the exception of building materials and equipment.

Currently, the nominal tax rate is generally 11 percent; but construction materials and building equipment face a lower rate of 7 percent and alcoholic beverages and tobacco products a higher rate of 14 percent. The failure to exempt construction materials and

building equipment is a major flaw in the design of the tax since it represents a significant departure from the principle of either taxing consumption or taxing value-added in manufacturing only once. As a result, most activities, including those that are officially exempt, face an element of indirect tax on their purchases of capital goods and intermediate inputs. Moreover, there is an imperfect application of the destination principle because of these origin-based elements in the taxation of capital goods and intermediate inputs. Since only the direct tax element receives destination basis treatment, the MST fails to remove tax from exports and it fails to tax imports in an equivalent manner to domestic substitutes. A recent study by Kuo et al. (1985) indicates that only a little over one-half of MST collections originate from consumer purchases. The remainder is accounted for by business purchases of capital goods (13 percent) and intermediate inputs (36 percent).

The combined impact of exclusions, exemptions, multiple rates, indirect taxation of inputs, variations in wholesale-retail margins, and diversity in distribution-trade channels, is to make the MST highly non-neutral. Effective tax rates on commodities, defined as the ratio of the amount of tax imposed to the price paid by the final consumer, can be expected to display wide variation. This expectation is confirmed in the study by Kuo et al. (1985). Their results indicate that effective rates vary within a range of less than one percent to nearly ten percent. Tax rates on exports, moreover, may be as high as 2.5 percent in some industries. Moreover, not only will firms producing

different products face different rates, it is possible that different firms producing the same output could be subject to varying rates of tax.

Proposals for reforming the MST must take as their target a reduction, if not the complete elimination, of the dispersion in effective tax rates across commodities. If a federal sales tax presence is to be maintained, there is an emerging consensus that only a retail form of the sales tax is worthy of serious consideration. Half-way measures such as improved administration of the manufacturers' tax or its movement to the wholesale level of distribution have been closely scrutinized and found wanting.[12] Only a retail form of sales tax would remove the need for clumsy notional value schemes and deal successfully with the problems of how to treat private brands and transportation costs, how to exempt exports, and how to place imports and domestically competing products on an equal tax footing. Only under a retail form would effective sales tax rates be uniform across all taxed items and the destination principle honored in practice.

It is less clear how the transition to a retail sales tax (RST) could be made. There are several possibilities. The Carter Commission recommended that a 7 percent RST be piggybacked onto existing provincial sales taxes and be collected by the provinces at the same time as their own sales taxes. Since provincial sales tax bases are non-uniform, the disadvantage of this solution is that it implies the imposition of a non-uniform federal tax. Presently, for example, residents of Alberta would pay no federal sales tax under this proposal

since that province does not levy a sales tax. Provinces might also be reluctant to bear the political costs of collecting federal revenue.

A second possibility would require the federal government to negotiate an agreement with the provinces on a common sales tax base and to offer to collect the proceeds from whatever tax rate a province chooses to impose on this base. This arrangement would be the sales tax counterpart to the current Tax Collection Agreement for federal-provincial tax sharing of a uniform personal and corporate income tax base. If agreement on a common sales tax base was not forthcoming, the federal government could go it alone and establish a separate and independent retail sales tax. This option would seriously complicate life for retailers who would then be required to administer two sales tax requirements on each sale.

A third solution would have the federal government implement the retail sales tax principle through the back door, in the guise of a value-added tax (VAT). A VAT which exempts purchases of capital goods has a base identical to that of a broad-based RST. While a RST taxes value at the end of the production and distribution chain, a VAT taxes a portion of final value each step along the way to the final consumer. Each firm would have a tax base consisting of its sales value less its purchases of capital goods and intermediate inputs. Because of its novelty it might be more acceptable to the provinces than a RST, but like the RST it would be neutral in its treatment of taxed products and probably better than the RST in capturing services in its base and in applying the destination

principle since it is relatively easier to free exports from taxes on inputs under a VAT.[13]

There are three approaches to implementing a value-added tax: the addition method in which a firm calculates its total payments to all of the resources it hires, a subtraction method in which a firm deducts from sales its purchases from other firms, and the credit or invoice method. Most economists seem to favor the last approach. Under it a firm calculates and remits the tax on the value of its total sales and subsequently obtains a credit for the taxes it has already paid on the purchase of its inputs from other firms. Besides having an important element of self-enforcement, this approach imposes few compliance costs on the firm.

Regardless of which approach is taken, however, important questions remain concerning the comprehensiveness of the VAT base and whether exemptions should be granted for essential items of consumption. Although in principle they belong in the VAT base, it is technically difficult to include housing services, financial services, hospital and educational services, and non-profit institutions. It is beyond the scope of this paper to examine any of these technical issues. Attempts to incorporate these items in the VAT base inevitably add considerable complexity to the administration of the VAT. A simple solution is to exempt them from VAT in which case they will be taxed indirectly through the taxes paid on the purchase of inputs from other sectors. Under the credit approach, if an item is to be entirely freed of tax it must be zero-rated since firms will then be in the system and can claim a refund for taxes paid on the purchase of their inputs.

Several empirical studies in Canada and the U.S. successfully demonstrate how our perceptions of the incidence of sales tax are influenced by the manner in which tax burdens are measured. The traditional partial equilibrium assumption is that sales tax burdens are shifted forward by producers onto consumers. Consumers in different income classes will be burdened differentially if consumption of the taxed items varies according to income. Once burdens are estimated in this fashion, the key issue is how these burdens can be measured in relative terms that will permit comparisons of sacrifice across income groups. The conventional approach to this issue expresses the sales tax burden of each income group as a fraction of current income. When this procedure is followed, sales taxes invariably display a regressive incidence pattern, in part because consumption as a fraction of income steadily declines as income rises and also because many services consumed disproportionately by higher income groups are excluded from the sales tax base. Providing an exemption for food consumption always acts to moderate any tendency towards regressivity, although it does so at substantial revenue cost.

An example of this procedure in the case of the manufacturers' sales tax can be seen in Table 1, the first part of which draws upon data and calculations compiled by Gillespie (1976). Comparing the ends of the income distribution, it is seen that the tax is significantly regressive in 1969, although it is nearly proportional in the middle income ranges. In the penultimate column this incidence pattern is scaled to a more recent year, 1982, in which the overall sales tax rate is substantially lower than in 1969 because of the existence of smaller

Table 1

A. Estimated Incidence of the Manufacturers' Sales Tax

| Family Income Class | Basic Income (millions) | Federal Sales Tax Burden (millions) | Federal Sales Tax Rate-1969 (percent) | Scaled Sales Tax Rate-1982 (percent) | Percent of Families |
|---|---|---|---|---|---|
| less than $2,000 | $ 1,314 | 67.2 | 5.1 | 2.70 | 12.3 |
| $2,000-2,999 | 1,856 | 69.3 | 3.74 | 1.98 | 8.0 |
| $3,000-3,999 | 2,417 | 92.4 | 3.82 | 2.02 | 7.8 |
| $4,000-4,999 | 2,899 | 109.2 | 3.76 | 1.98 | 7.6 |
| $5,000-5,999 | 3,595 | 134.4 | 3.74 | 1.98 | 8.0 |
| $6,000-6,999 | 4,189 | 157.5 | 3.75 | 1.98 | 7.9 |
| $7,000-9,999 | 14,533 | 522.9 | 3.60 | 1.91 | 22.0 |
| $10,000-14,999 | 16,659 | 569.1 | 3.40 | 1.80 | 18.2 |
| more than $15,000 | 16,434 | 378.0 | 2.3 | 1.22 | 8.3 |
| TOTAL | 64,501 | 2,100.0 | 3.26 | 1.73 | 100.0 |

B. Estimated Sales Tax Incidence by Decile - 1982

| Decile | Sales Tax Rate | Decile | Sales Tax Rate |
|---|---|---|---|
| 1 | 2.72 | 6 | 1.97 |
| 2 | 2.02 | 7 | 1.79 |
| 3 | 1.97 | 8 | 1.61 |
| 4 | 1.98 | 9 | 1.43 |
| 5 | 1.97 | 10 | 1.25 |

Table 1, continued.

Source: Gillespie (1976).

Notes: (1) Basic income is a comprehensive definition of total disposable income.

(2) The federal sales tax burden is estimated on the basis of the distributive series consumption of commodities subject to sales tax (Table A-4, Gillespie (1976)).

(3) The federal sales tax rate is obtained as the ratio of the second to the first column.

(4) Federal sales tax collections as a fraction of disposable income are estimated as 1.73 percent in 1982. Thus all of the sales tax rates in column three are scaled by the factor 1.73/3.26 to generate the values for the fourth column. This is only a crude adjustment in that it fails to adequately consider how differences in the list of exemptions may have influenced the sales tax burden in each income group.

(5) The sales tax incidence by decile in part B is derived from a simple linear interpolation of the values shown in the last column of part A.

statutory rates and more generous provision of exemptions. In the second part of the table this updated incidence profile is reformulated on the basis of the inter-decile distribution of income.

Several objections could be lodged against the previous procedure for determining relative tax burdens. It could be argued for instance that households actually pay sales tax out of their after-personal tax incomes and that the latter income concept is therefore more relevant for measuring relative tax burdens. Another objection is that income obtained during a single year may be an inadequate indicator of lifetime economic opportunities. Many households observed in the lower income groups, such as those who are either very young or elderly, may be only temporarily poor from the perspective of a much longer period. If households plan their consumption spending on the basis of expected lifetime income, or some notion of permanent income, it can be argued that consumption is the appropriate denominator in determining relative tax burdens. Both Davies (1959) and Browning (1978) have made adjustments for this problem in their empirical work. Davies treated sales tax burdens as a proportion of total consumer spending in each group and concluded on the basis of this lifetime view that sales tax incidence was decidedly progressive. More recently, Davies, St. Hilarie and Whalley (1984) have developed lifetime income data for Canada and find that rates of indirect taxation range from 15 to 12 percent in moving from the lowest to the highest decile in the income distribution. Indirect taxes appear to be modestly regressive in their study since bequests do not attract any sales tax and upper income groups are more likely to bequeath large estates.

Browning did not embrace the lifetime perspective, but has argued instead that it is a mistake to assume that sales taxes exempt household savings. Savings represent funds set aside for future consumption, so at best saving will only defer the imposition and collection of sales tax. In fact, the present value of future taxes on the later expenditure of current savings is equal to the product of the tax rate applied to current consumption and the amount currently saved. Thus Browning contends that sales taxes are properly measured as taxes on current income rather than current consumption. The argument assumes that households neither make bequests nor move to a foreign country at some point during their life cycle. To the extent that this assumption is valid, the numerator rather than the denominator of the relative tax burden measurement requires adjustment. This adjustment also seems to make sales taxes somewhat progressive.

Another point stressed by Browning (1978) is that lower income groups receive a disporportionate amount of their income in the form of government transfer payments which are often indexed to changes in the cost of living. In this situation if sales taxes boost consumer prices, transfer payments will be adjusted upwards and, in the limit, a household totally dependent upon transfers is shielded from bearing any of the burden of the sales tax. According to this analysis, sales tax burdens should be distributed across different income groups on the basis of the factor earnings each receives rather than the amount consumed. Making this adjustment, along with the other one suggested by Browning, converts an otherwise regressive tax pattern into one in

which the average tax rate levied on the bottom decile is 2.2 percent compared to 5.7 percent for the top decile.

A theoretical study by Bhatia (1982) focuses on the sources side impact of a VAT and inquires how the imposition of VAT would influence relative factor prices. Bhatia shows that unless substitution elasticities between primary factors (capital and labor) and intermediate inputs are equal to zero, a uniform and comprehensive commodity tax will generally induce a change in relative factor prices. If these elasticities have a zero value, the incidence of a partial VAT depends only on the gross factor intensities of the taxed final goods. Moreover, if the taxed sector(s) are relatively capital intensive in gross terms, a VAT will induce a smaller decline in the price of capital services relative to labor than an equal yield corporate income tax will. This is because the latter includes a negative factor substitution effect which is missing from the VAT.

In section IV of this study there is a description of the general equilibrium model that has been used to examine many of the same tax issues that have been discussed above. Before that, however, it is desirable to consider in the next section the logically prior question of how indirect taxes, and the federal MST in particular, should enter the equations of a general equilibrium system.

## III Indirect Taxes and the Cost of Capital

Households bear indirect taxes either in their role as owners of resources or as consumers. Indirect taxes will have allocative effects no matter whether their impact is felt in product markets or in factor markets. If a country is a price taker in world markets, an excise tax imposed on tradeable output must reduce incomes earned in these sectors and induce resource reallocations to other more lightly taxed sectors. This is an example of the origin principle of commodity whose influence is felt in factor markets. Under the alternative destination principle, exports would escape tax and consumers of imports and import-competing products would bear the burden of a forward shifted tax. The composition of demand would shift to less heavily taxed sectors and affect the pattern of resource allocation in a similar fashion as before. Only a perfectly general and uniform indirect tax would be able to avoid these allocative repercussions by leaving the economy's relative price structure intact. Thus the key issues in determining the impact of indirect taxes on factor incomes and consumer prices and deciding on whether their impact should be modelled as either a factor market or product market influence turns on the scope or generality of the tax, the tax principle that is adopted and whether there are any origin-based elements in applying the destination principle. These and related issues are examined in greater detail below.

Study of the capital market consequences of indirect taxes is a somewhat neglected topic in theory of taxation. Only Harberger (1964) and later Jenkins (1972) have shown much interest in the subject and have argued that indirect taxes should be included as one component in the overall taxation of capital incomes in the economy and should,

therefore, have some bearing on the measurement of the cost of capital in different sectors. If the question of whether the indirect tax is forward or backward shifted is set aside for the moment, the Harberger-Jenkins analysis proceeds in two steps by noting first of all that it is a matter of taste whether the impact of indirect taxation is viewed as being on the side of product markets or, alternatively, on the side of factor markets. For example, prior to the imposition of an excise tax at rate $t_e$ on commodity x, assume that total revenues are matched by total costs:

$$(1) \quad P_x X = P_K K_x + P_L L_x ,$$

where $P_K$, $P_L$ are the factor costs of acquiring capital, $K_x$, and labor, $L_x$, respectively.

After the excise tax has been imposed, a product market wedge is driven between the price paid by the consumer, $P_x(1 + t_e)$, and that received by the producers, $P_x$. In the presence of the tax equation (1) can be rewritten as:

$$(2) \quad X P_x(1 + t_e) = P_K(1 + t_e)K_x + P_L(1 + t_e)L_x .$$

Alternatively, the excise tax can be viewed as driving a factor market wedge between the value of the marginal product of capital, $P_K(1 + t_e)$, and the cost of acquiring capital, $P_K$, and creating a similar wedge in the case of labor. Total tax proceeds amount to $t_e P_x X$ while capital's share of those proceeds is $t_e P_K K_x$. The fraction of total tax receipts attributable to the employment of capital is $t_e P_K K_x / t_e P_x X$ or $\theta_{Kx}$, the share of capital in total costs.

To further illustrate this point, consider the alternative treatment of residential property taxes in analytical models. Residential property taxes have been treated either as excise taxes on the consumption of

housing services or, more recently, as income taxes on the use of capital in the housing sector. As long as capital is the only factor used in the production of housing services and land and reproducible capital are taxed at the same rates, the Harberger-Jenkins approach emphasizes that these two tax treatments are equivalent.

The second step in the Harberger-Jenkins analysis is to note that taxes on commodities can be converted into equivalent taxes on value-added. If I denotes purchases of intermediate inputs and it is further assumed that these inputs and primary factors are employed in fixed proportions, a tax rate on value-added, t', is related to the excise tax rate on the commodity, $t_e$, by the following simple formula:

$$(3) \quad t' = t_e P_x X/(P_x X - I) = t_e/(1 - \alpha_I) \text{ where } \alpha_I = I/P_x X.$$

The tax rate t' on value-added is equivalent to $t_e$ in that the increase in price to the consumer is the same, the net returns to capital and labor are identical, there are no incentives for factor substitution and government revenue is unchanged.

The assumption of fixed proportions in production can be relaxed by examining the factor content of intermediate demands and considering price as the sum of all values-added at different stages of production. Indirect taxes attributable to capital use would then be multiplied by the share of capital income in total or gross value-added rather than by capital's income share at some final stage of production.

The issue of exactly which indirect taxes should be attributed to capital use remains to be addressed. The Harberger-Jenkins analysis is motivated by the presumption that if either excise tax rates or depreciation rates are non-uniform across commodities, indirect taxes will be allocatively significant. In his empirical applications of this principle to Canada, Jenkins (1972) allocates a portion of all sales and excise taxes to capital employed in different industries. The justification for this procedure is that neither sales nor excise taxes apply with equal force to different industries. If they did, and indirect taxes were perfectly general in this sense, measured pre-tax rates of return to capital would not vary across industries on account of indirect taxation and indirect taxes would not affect the pattern of resource allocation.

This factor market view of indirect taxation implies nothing about the incidence of these taxes but rather recognizes, as in equation (2), that there is a factor market equivalent of a product market tax in the form of a wedge between the value resource owners produce and what they receive. If the tax is shifted backward onto producers, the incomes of resource owners, both labor and capital, will be reduced. Otherwise, if these taxes are shifted forward, they will burden owners of labor and capital in their role as consumers rather than investors and workers. How the incidence of an indirect tax manifests itself is a logically separate issue from how it should appropriately enter an economic model. From an allocative perspective, what matters is the generality of the indirect tax and not its exact shifting mechanism.

In a small open economy, reliance on the origin principle is likely to produce either backward shifting of indirect taxes or an exchange rate depreciation. Destination principle treatment will more likely occasion full forward shifting and no exchange rate adjustment. In a modelling context, the issue is whether to impose indirect tax changes on production or on consumption activity, including imports, in the economy. Only a portion of federal and provincial sales taxes in fact receives destination type treatment. A significant fraction of these taxes are levied on an origin basis because they apply to purchases of capital and intermediate goods as well as consumer goods. As can be seen in Table 5, only a little over one-half of the federal MST strikes purchases of final products by household and only a slightly larger percentage applies in the case of provincial sales taxes. The part of the tax falling on consumer purchases does not discriminate between imports and domestic production and will tend to be shifted forward to consumers. That part of the tax falling on purchases of capital goods and intermediate inputs is effectively a tax on production and cannot be shifted forward in an open economy.[14]

To the extent that these origin-related elements in the sales tax are not uniform across commodities, it may be expected that they will influence the allocation of capital resources in the economy. Origin-based sales taxes will be perceived by business firms as simply another part of the small tax wedge that sits on top of the required rates of return to investors -- the rate at which funds are supplied to the firm -- and determines the firm's gross rate of return on investment or its cost of capital. How much of that "sits on top" is examined next.

Table 2

Federal and Provincial Sales Tax Bases (1980)

| Percent of Tax Base | Federal MST | Provincial RST |
|---|---|---|
| Final Consumption | 51 | 64.4 |
| Business Acquisition of Capital Goods | 13.4 | 8.1 |
| Business Purchases of Intermediate Inputs | 35.6 | 27.5 |

Source: Kuo et al. (1985).

The cost of capital concept is a useful framework in which to consider how indirect taxes affect investment decisions and, therefore, how indirect taxes should be appropriately entered into analytical tax models.[15] With neither taxes nor subsidies in the economy and in the absence of any anticipated capital gains from holding capital goods, firms would maximize their expected future profitability, or present value , by pushing investment to the point where:

$$(4) \quad c = q(r + d).$$

The return to investment c would be equated to the product of the purchase price of capital goods, q, and the sum of the true depreciation rate, d, and r, the rate of return on funds invested elsewhere in the economy. With a corporate tax rate levied at the nominal rate, u, and an investment tax credit which reduces the cost of acquiring capital goods in the proportion f, capital market equilibrium for the firm requires that:

$$(5) \quad (1 - u)c = q(r + d)\ (1 - uz - f),$$

where uz measures the present value of tax savings from future depreciation and z is the present discounted value of future depreciation allowances permitted under the corporate income tax as a fraction of current capital outlays. The

cost of capital, or the gross return on investment required to earn r, is thus:

$$(6) \quad c = q \frac{(r + d)(1 - uz - f)}{(1 - u)} .$$

The gross return on investment can also be measured as the marginal value product, VMP, of capital or

$$(7) \quad c = P^* \cdot MP_K ,$$

where $P^*$ is the price a firm receives for its value-added and $MP_K$ is the marginal physical productivity of capital. If the firm sells its output to final consumers under the destination principle and is taxed at rate $t_j$ on its purchases of the $j^{th}$ intermediate input, $P^*$ can be written as:

$$(8) \quad P^* = P_i - \sum_j a_{ij} (1 + t_j) P_j ,$$

where $P_i$ is the producer's price for the firm and is invariant under the destination principle to changes in indirect tax imposed on final sales; $a_{ij}$ is the amount of the $j^{th}$ intermediate input whose cost to the firm is $P_j$. If equations (6), (7) and (8) are combined and indirect tax at rate $t_q$ is imposed on purchases of capital goods, the real rate of return that a firm must earn in order to pay r to investors is:

$$(9) \quad MP_K = \frac{q(1 + t_q)(r + d)(1 - uz - f)}{(P_i - \Sigma a_{ij}(1 + t_j)(1 - u)} .$$

It is clear from equation (9) that increases in either $t_q$ or $t_j$, because they cannot be shifted forward, must raise the required $MP_K$ and discourage investment in an activity insofar as they either do not apply to other activities or apply with less force. Increases in the tax rate $t_q$ on purchases of capital goods are equivalent to the imposition of a negative investment tax credit. Increases in taxes on intermediate inputs, on the other hand, are equivalent to increases in the taxation of an activity's value-added.

An equation similar to (9) could also be written for the marginal physical product of labor. An increase in taxation of intermediate inputs implies that labor's marginal productivity must also increase if labor is to be paid a wage comparable to earnings elsewhere in the economy. Thus labor, as well as capital, employment will be depressed by an increase in taxation of intermediate inputs. Taxation of intermediate inputs has the same effect as would a tax on production. Thus, the federal MST is really three taxes rolled into one: a tax on consumption, an additional tax on production or value-added, and a separate tax on capital usage, which correspond to the three distinct bases shown in Table 2.[16]

The MST contained in the general equilibrium model, whose main features are described in the next section, is modelled as three separate taxes. Changes in taxes on capital goods are assumed to be reflected in changes in the firm's cost of capital. Taxes on intermediate inputs are assumed to impinge on value-added and act to raise proportionally both the cost of capital and the cost of labor. Taxes on consumption are reflected in a higher purchase price for final outputs and imports.

Before turning to that material, however, it should be noted that the cost of capital is fundamentally a partial equilibrium concept. In a general equilibrium framework, as will be seen, it is possible for changes in indirect taxation to affect the cost of capital through changes in the required rate of return r. Only if this return is determined in the context of a worldwide capital market, and therefore independent of tax changes in Canada, will this particular avenue of influence be closed off.

To briefly summarize, in a cost of capital framework, the question arises over how indirect taxes should influence the calculation of capital costs and the measurement of effective tax rates on capital incomes. On the basis of the previous discussion, if indirect taxes raise the cost of acquiring capital goods they will be allocatively non-neutral if industries

exhibit different capital intensities or employ different mixtures of taxed and nontaxed forms of capital. For either the production or consumption component of indirect taxation the answer is less clear. If the purpose is to measure the cost of capital relative to labor or the effective tax rate on capital vis-a-vis labor incomes, indirect taxes should be ignored since they exert a proportionate impact on both elements of cost and income. On the other hand, if the object is to determine the impact of capital taxes on inter-sectoral resource allocation, indirect taxes cannot be safely ignored. For example, a relatively low corporate tax rate in one sector may be viewed as distorting if considered only by itself. If however, this low corporate tax is combined with a relatively high rate of indirect tax, the interaction of both taxes could result in an improvement in resource allocation.

This is the central lesson of the theory of second-best for tax policy, that the impact of a particular tax must be examined in conjunction with all other taxes in the system. In a general equilibrium setting indirect and other kinds of taxes can be examined separately and the central concern is to see that they enter the model in an appropriate fashion. In a partial equilibrium study, however, it may be highly misleading to attempt to infer the allocative effect of capital taxes unless the indirect tax burden on capital incomes is taken into account.

## IV A Small General Equilibrium Model of the Canadian Economy

Issues of tax incidence are best handled by a general equilibrium model since only it is capable of capturing the full range of relative price effects associated with a particular tax change. The model described in this section has been employed previously to examine a wide range of potential reforms but none dealing with the reform of federal commodity taxation.(17) There are several reform options in the area of federal indirect taxation including the following scenarios:

(a) replacing the MST with increased revenues from the personal income tax (PIT),

(b) replacing the MST with increased revenues from the corporate income tax (CIT), and

(c) replacing the MST with a uniform VAT.

The effects of all of these tax substitutions will be simulated using the general equilibrium model whose basic properties are described below.

The general equilibrium model used here is an updated version of the one used earlier by Ballentine and Thirsk (1979). It is an extended and disaggregated version of the basic Harberger model of tax incidence that captures Canada's important trade and capital market connections with the rest of the world

and permits some portion of Canadian tax changes to be borne by either foreign consumers or foreign taxpayers. In contrast to the original Harberger model which considered only the impact of the corporate income tax in a world where no other taxes existed, the Ballentine-Thirsk model contains a public sector which is initially financed from a variety of revenue sources including personal income taxes, corporate income taxes, property taxes and commodity taxes.

Production takes place in six sectors: two export sectors comprised of fixed price and flexibly priced exports; and four others producing nontradeable output. One of these is a corporate sector which supplies both consumer and capital goods to the economy while the others are essentially non-corporate activities consisting of domestic agriculture, housing and a heterogeneous collection of services. The flexibly priced export sector is also a predominantly corporate sector of the economy. Households consume five different kinds of output: the four types of nontradeable output plus imports from the rest of the world which are considered to an imperfect substitute in consumption for all kinds of domestically produced output. Imports are purchased from the rest of the world at a fixed world price.

Ten separate groups of consumers, one for each decile of

the income distribution, comprise the household sector of the economy. These households supply capital, labor and land resources to the economy. In addition, the rest of the world supplies some capital to the economy. Domestically supplied capital and land are fixed as is labor in some variants of the model. In other versions of the model a labor-leisure choice is permitted. Households are assumed to be utility maximizers and their demand functions exhibit the property of separability. This means that their utility gained from the consumption of one type of output is unaffected by their consumption of other kinds of output, not an unreasonable assumption given the large size of the consumer aggregates in the model. Savings are viewed as another form of consumption, in this case of future output, but the inter-temporal dimension of consumer choice are ignored.

Firms behave as perfectly competitive profit maximizers and utilize production functions that display constant returns to scale. The housing, domestic agriculture and fixed price export sectors each employ a three factor bundle of capital, labor and land services. All of the other sectors employ only capital and labor in production. Domestic capital and labor are perfectly mobile between alternative employments while land is perfectly mobile between domestic agriculture and fixed price exports but imperfectly mobile between these two sectors and housing. In most cases foreign capital is imperfectly mobile between Canada and the rest of the world.

There is sufficient price flexibility in the economy to insure full employment of all resources. Savings undertaken by both the private and public sectors are viewed as expenditures on the purchases of capital goods in the economy. Still, the model is essentially static because the evolution of the economy over time with growing factor supplies is not considered. A balance of payments equilibrium is satisfied in the sense that the value of exports is matched by payments for imports and the services supplied by owners of foreign capital. Alternatively, capital incomes received by foreign capital owners represent the difference between gross domestic and gross national product in the model.

The following capital letters are used to denote the model's production and consumption sectors:

H = level of housing services produced and consumed in Canada

Z = level of commercial services produced and consumed in Canada

C = level of corporate output produced and consumed in Canada

A = level of final foodstuffs produced and consumed in Canada

E = domestic production and foreign consumption of flexibly priced exports

F = domestic production and foreign consumption of fixed price exports

M = foreign production and domestic consumption of imports

K, L, and N denote respectively the use of capital, land and labor; a subscript attached to one of these variables indicates sectoral usage ($K_H$, $L_A$, etc.)

$P_i$ refers to the net or after-tax price of the i'th factor or product. For instance, $P_K$ is the income received by owners of capital for each capital unit after payment of both corporate income and property taxes but before payment of any personal income tax. $P_K$ is the general equilibrium counterpart of the concept of the required rate of return r used in the previous section. $P_C$, on the other hand, is the net revenue received by firms after payment of any indirect tax. Gross of tax or subsidy prices are indicated by an asterisk. Thus, for products the consumer price of corporate output, $P_C^*$, is linked to producer prices by the equation

$$P_C^* = (1 + t_s^c) P_C$$

where $t_s^c$ is the commodity tax rate in the corporate sector. Since property taxes are deductible under the corporate income tax, the relationship between gross and net prices of capital is that

$$P_K = P_K^* (1 - t_c) (1 - t_k)$$

where $t_c$ and $t_k$ are the effective corporate and property tax rates on reproducible capital used in the corporate sector. Similarly, net and gross land prices are linked by the equation

$$P_L = P_L^* (1 - t_L)$$

where $t_L$ is the property tax rate on land in some unspecified land-using sector. Rather than superscript all property, corporate and commodity tax rates, $t_k$, $t_L$, $t_c$ and $t_s$ respectively, it should be understood that they are generally non-uniform across different sectors of the economy. Finally, since the price of labor, $P_N$, is chosen to serve as the numeraire in our model, there is a real exchange rate e which measures the relative price between both imports and fixed price exports and labor. An increase in this rate corresponds to a depreciation of the currency in which the real wage declines.

The structure of the model is most easily understood if its essential relationships are expressed in terms of differential equations. When the model is linearized in this fashion, certain key parameters in the model require further definition:

$\varepsilon_{ij}$ = compensated price elasticity of demand for the i'th final output in response to a change in the j'th commodity price.

$\theta_{ij}$ = share of the i'th factor of production in the total cost of producing the j'th final output.

$\sigma_{ij}^{k}$ = partial elasticity of factor substitution between the i'th and j'th factors in the k'th sector. Unsubscripted values indicate that only capital and labor are used in production.

$\eta$ = price elasticity of foreign demand for flexibly priced exports in which Canada has some degree of market power.

$\gamma_K$ = elasticity of the stock of foreign capital employed in Canada with respect to either the gross or net return to capital in the corporate sector (model variants one or three respectively).

$\gamma_L$ = elasticity of the supply of land to housing relative to use in other sectors, with respect to relative net prices received for land in these sectors.

$\gamma_N$ = elasticity of total labor supply with respect to changes in the after-tax real income of workers.

$h_i$ = income elasticity of consumer demand for the i'th output.

$\alpha_j^i$ = fraction of disposable income spent by the j'th income group on the i'th final product.

$\hat{J}_i$ = percentage change in demand for the i'th output attributable to changes in the real income of households. This income effect term is the product of the income elasticity for the output and the percentage change in real income experienced by households. Personal income taxes enter the model through this term as a negative item in the determination

of nominal disposable income. These parameters are constrained to obey certain theoretical restrictions such as adding-up, $\sum_i \theta_{ij} = 1$ and $\sum_i \theta_i h_i = 1$, and homogeneity, $\sum_j \varepsilon_{ij} = 0$ and $\sum_j \theta_j \sigma_{ij} = 0$. The latter conditions imply the absence of any money illusion in the demand functions of both households and firms.

Twenty-one differential equations, explicitly set forth in Table A-1, describe the reactions of households, firms and foreigners to a wide variety of tax policy changes. As can be seen from that Table, the first five equations maintain the supply and demand balance for product markets in A, Z, H, C and E. Walras' law ordains a similar balance in the market for F. The next two equations indicate that the percentage change in the exchange rate is equal to both the change in import prices and the change in fixed price exports. Next, there are two factor demand relationships in each of the three factor sectors H, A and F, and a single factor demand relationship in the other three sectors. The supply of land to housing and capital and labor to the Canadian economy is indicated in the subsequent set of equations. The last two equations capture, respectively, the assumption of a fixed land endowment and the choice of labor as the numeraire. Together, these equations are sufficient to determine the value of six capital and labor allocations, three land allocations, four factor prices, $P_K$, $P_N$, $P_L^H$ and $P_L^A$, the exchange rate and the price of imports. By substituting for the value of the numeraire, the exchange

rate and the price of imports, and using the overall supply constraints to eliminate one labor and one land allocation, this system can be reduced to 16 equations in 16 unknown variables.

There are three basic variants of this model as Table A-1 suggests, each one corresponding to a different view of the determinants of the overall supply of labor and capital. In the first variant, the supply of labor, as well as land, is fixed and the supply of capital is assumed to depend on the gross or before-tax earnings of capital in the large corporate sector. As explained more fully in Ballentine and Thirsk (1979), the rationale for this treatment of capital supply is that the existence of a foreign tax credit nullifies the impact of an increase in Canadian corporate rates on the foreign firm's cost of capital if incorporated firms fully repatriate their earnings and if the Canadian rate is less than the foreign rate. Under these circumstances, a higher gross return on foreign capital translates into a higher net return as well and any tendency there may be for Canadian owned capital to flow abroad in response to a lower net return is assumed to be dominated by this foreign capital supply response.

A second variant of the model relaxes the assumption of a fixed labor supply and instead makes the overall supply of

labor sensitive to the real after-tax return received by workers. The third variant of the model, like the first, assumes that there is no labor-leisure trade-off but makes the supply of capital highly responsive to the after-tax return to capital. A highly integrated view of the world capital market is entertained in this third variant in which tax credit offsetting is assumed to be inoperative either because Canadian corporate tax rates exceed those elsewhere or an insignificant fraction of foreign earnings are repatriated by foreign firms.

The exogenous tax instruments in the model consist of six corporate tax rates, six property tax rates levied on reproducible capital, three property tax rates on land and seven commodity tax rates on sales or production of final output. Personal income tax changes, $\hat{Tx}$, are modelled as an endogenous element of the tax system in order to capture the induced revenue effects of different tax experiments. With initial taxes in the model a change in any given tax rate will typically interact with other tax bases and generate revenue gains and losses which, in this model, are compensated by offsetting variations in personal income tax collections so that government revenues are held constant. To see how revenue neutrality has been preserved, consider the government budget constraint below:

$$(10) \quad \sum_{i=1}^{6} t_k P_k^* K_i + t_L P_L^{*H} L_H + t_L P_L^{*A} (L_A + L_F)$$

$$+ \sum_{i=1}^{6} t_c (1-t_k) P_k^* K_i + \sum_{i=1}^{5} t_s P_i X_i + Tx$$

$$= \text{Total spending (constant)}$$

This constraint states that the sum of property taxes on reproducible capital and on land, corporate income taxes plus revenues from commodity taxation (where $X_i$ denotes here a taxable commodity) and taxes on personal incomes Tx are constant. This feature of the budget constraint is incorporated into the household demand functions in the model and highlights the differential incidence framework of the analysis.

If the "hat" symbol ^ denotes percentage changes in a variable, the real income effect appearing in household demand functions can be written as:

$$(11) \quad \hat{J}_i = h_i \{\theta_k \hat{P}_k + \theta_{LH} \hat{P}_L^H + \theta_{LA} \hat{P}_L^A - \theta_{Tx} \hat{Tx} - \sum_{j=1}^{5} \alpha_j \hat{P}_j^*\}$$

The expression contained in large brackets, besides being a measure of tax incidence, is the percentage change in households real after-tax disposable income. Capital incomes, land incomes and personal taxes as fractions of initial disposable income are indicated by the share parameters $\theta_k$, $\theta_{LH}$, $\theta_{LA}$ and $\theta_{Tx}$ re-

spectively. Equation (10) is differentiated and solved for $\hat{Tx}$ and the result is substituted into equation (11) above.

Thus, in modelling tax policy changes, if a non-personal tax is substituted for a personal income tax change, non-personal tax increases are specified exogenously and $\hat{Tx}$ absorbs the brunt of all revenue reductions, both direct and induced. On the other hand, if one non-personal tax is substituted for another, one set of tax rates is reduced and another set raised so as to maintain a constant level of revenue based on initial tax collections while any induced revenue impacts will be automatically compensated by an adjustment in personal taxes $\hat{Tx}$.

The model is calibrated so that its dimensions conform as closely as possible to the Canadian economy in 1980. National Accounts, Input-Output, Tax and Consumer Expenditure data are integrated to provide a picture of the Canadian economy initially in equilibrium in 1980. A special input-output tabulation allows final expenditures by households to be linked to the industry values-added which satisfy these demands. Appendix Table A-2 displays the value-added coefficients associated with a dollar's worth of net spending on the six outputs in the model.[18] As in Ballentine and Thirsk (1979), fixed price exports are taken to be twenty percent of total exports.

Following Ballentine and Thirsk (1979), value-added in each industry is disaggregated into labor and capital income components and the latter income stream is further subdivided into net capital and land incomes and corporate income-property tax payments using the effective capital tax rates shown in Tables A-3 and A-4. The results of this disaggregation can be seen in Table A-5 which uses the figures for net spending by commodity derived in Table 3. Gross spending on these final products is obtained from the National Accounts while input-output information is used to subtract imports and indirect taxes (less subsidies) from the gross values and obtain the net spending that pays for capital and labor services. Units of capital, land and labor are defined such that a unit of any resource is equal to the amount needed to earn a dollar of net income (but before personal income taxes are applied).

Table 4 outlines several important dimensions of the economy. Values for exports, imports, gross investment and government spending are taken from the National Accounts. Consumption spending by households, including imports, is the sum of gross expenditures on A, C, H and Z in Table 6. The gap of $8,000 million between exports and imports represents payments to foreigners for the use of foreign capital employed in Canada. As indicated at the bottom of Table 7, Gross Domestic Product is measured at $272,127 million and Gross Nat-

Table 3

Gross and Net Spending by Households and Government

1980

| | Gross | Gross Less Imports | Imports | Indirect Taxes | Net | Government Purchases | Total |
|---|---|---|---|---|---|---|---|
| | | | | (millions) | | | |
| A | 24,883 | 19,160 | 5,723 | - | 19,160 | 111 | 19,271 |
| C | 66,879 | 51,898 | 14,981 | 14,045 | 37,853 | 7,500 | 45,353 |
| H | 26,540 | 25,551 | 999 | - | 25,551 | 526 | 26,077 |
| Z | 25,815 | 23,673 | 2,142 | 1,213 | 22,460 | 1,275 | 23,735 |
| W | 61,000 | 41,968 | 19,032 | 3,355 | 38,613 | - | 38,613 |
| E | 60,800 | 49,172 | 11,628 | 407 | 48,765 | - | 48,765 |
| F | 15,200 | 12,293 | 2,907 | 102 | 12,191 | - | 12,191 |
| | 281,127 | 223,715 | 57,412 | 19,122 | 204,593 | 9,412 | 214,005 |

Sources: (a) Gross spending is derived from the National Income and Expenditure Accounts;

(b) Imports and Indirect Taxes are from the special Input-Output Table for 1980 described in Table A-1.

Notes: (1) Indirect taxes are measured net of subsidies (i.e., subsidies are negative indirect taxes).

(2) Government Purchases: (a) the total is from the National Accounts; (b) Distribution is determined subjectively assuming that 80 percent of government purchases are from the corporate sector.

Table 4

1980 Dimensions of the Canadian Economy

| Category | Value (mns.) |
|---|---|
| Exports (X) | 76,000 |
| Imports (M) | 68,000 |
| Investment (gross) (I) | 61,000 |
| Government spending on goods & services (G) | 59,000 |
| Consumption by households (C) | 144,127 |

Notes:

GDP = C + I + G + X - M = 272,127

Current account balance: X - M = capital income payments to foreigners
= 8,000

GNP = 272,127 - 8,000 = 264,127

ional Product received by Canadians as $264,127 million. The latter value is about 8 per cent less than the figure reported in the National Accounts and the discrepancy is explained by the deliberate omission of quasi-public services such as health and education (non-profit sectors) whose behavior is inconsistent with the assumption of profit maximization.

Table 5 describes the derivation of the public and private sector budget constraints. This information in necessary to complete a consistent profile of the public sector's revenue and spending. Of the $214,005 million of total net expenditure in the economy (Table 6), only $180,946 million is actually received by households due to the leakages of $25,059 million in capital taxes and $8,000 million in foreign income payments. The difference between what households received from production and what they had available to spend on consumption ($209,127 millions) reflects the value of public sector transfer payments. Transfer payments worth $28,181 million plus labor and commodity purchases of $59,000 million are financed by debt issue ($4,000 million), capital taxes ($25,059 million), indirect taxes less subsidies of $19,122 million and a residual amount of $39,000 million which determines the value of personal income tax revenue.[19] Personal savings in the model are $209,127 - $144,127 million or $65,000 million.[20] Thus the economy's capital account bal-

Table 5

Budget Constraints (mns.)

| | Expenditures on | | | | Net Taxes or Disposable Income |
|---|---|---|---|---|---|
| | M | CAHZ | Labor | W | |
| | (millions) | | | | |
| Public Sector | 10,588 | 9,412 | 39,000 | -4,000 | = 55,000 |
| Private Sector | 42,877 | 120,282 | - | 45,968 | = 209,127 |
| Total | 53,465 | 129,694 | 39,000 | 41,968 | = $264,127 (GNP) |

Notes:

(1) Given G = $59,000 and labor purchases at $39,000, public sector imports as 68,000 - 57,412 (Table 6), spending on CAHZ must be $9,412 in the public sector. Subtracting debt issue of $4,000 mn. net taxes therefore must be $55,000. Given GNP of $264,127, private sector disposable income must be $209,127.

(2) From Table 6, $53,465 is total imports less imports used in exports and $120,282 is private sector net spending on CAHZ. Spending on capital goods (W) consists of $19,032 of imports (leaving 42,877 - 19,032 as consumption spending on imports) and $41,968 as domestic purchases for a total of $61,000.

ances in the sense that the sum of private and public saving exactly matches the expenditure made on capital goods. In many of the tables found in the Appendix, corporate capital goods are indicated by the symbol W while corporate consumer goods are designated by the symbol C. These two components of the corporate sector are combined when the economy's initial equilibrium is disturbed by a tax policy change.

In order to operate the model the price elasticities of consumer demand and factor substitution elasticities must be specified. As explained in greater detail in Ballentine and Thirsk (1979), a search of the empirical literature suggests that appropriate values for the income elasticity of demand for A, C, Z, H and M would be .4, 1.1, 1.2, 1.1 and .84 respectively. These values and the assumption of separable utilities are sufficient to generate the pattern of own- and cross-price elasticities of demand exhibited in Table 6. The same literature search reveals a wide range of factor substitution elasticities for any particular sector. The values reported in Table 7 represent the mid-point of the range of reasonable estimates found in the literature.(21) Values of the land supply elasticity, $\gamma_L$, and the labor supply elasticity, $\gamma_N$, are assumed to be .2 and .25 respectively.(22) The capital supply and foreign export demand are much more difficult to pin down empirically.(23) Thus four separate cases

Table 6

Final Demand Price Elasticities ($\varepsilon_{ij}$)

| Commodity \ Commodity | | i: A | C | H | Z | M |
|---|---|---|---|---|---|---|
| | A | -.25 | .013 | .026 | .029 | .02 |
| | C | .16 | -.28 | .437 | .477 | .333 |
| j | H | .035 | .104 | -.615 | .096 | .073 |
| | Z | .040 | .096 | .096 | -.67 | .073 |
| | M | .025 | .068 | .068 | .076 | -.49 |
| | $\sum$ | 0 | 0 | 0 | 0 | 0 |

Notes: (1) Own-price elasticities are calculated according to the formula $\varepsilon_{ii} = h_i(1 - \theta_i h_i)/\alpha$ where $\alpha$ is the value of the elasticity of the marginal utility of income (assumed to be -1.55 on the basis of empirical estimates for Canada).

(2) Cross-price elasticities are obtained using the formula $\varepsilon_{ij} = -\theta_j h_i h_j/\alpha$.

Table 7

Factor Substitution Elasticities

| Factor Substitution Parameter / Commodity | A | F | E | Z | H | C |
|---|---|---|---|---|---|---|
| $\sigma_{KN}$ | 1.1 | 1.2 | .9 | .5 | .17 | .85 |
| $\sigma_{KL}$ | .1 | .1 | - | - | .75 | - |
| $\sigma_{NL}$ | .8 | .8 | - | - | .05 | - |

Source: Ballentine and Thirsk (1979).

have been distinguished:

| Case | Capital Supply Elasticity ($\gamma_K$) | Foreign Export Demand Elasticity ($\eta$) |
|---|---|---|
| (1) | 0 | -1 |
| (2) | 3 | -1 |
| (3) | 3 | -3 |
| (4) | 3 | -6 |

Although other combinations of values are also possible, the first case corresponds to a short run situation while the succeeding cases refer to longer run scenarios in which foreign capital owners and foreign consumers and suppliers have longer to respond to Canadian tax policy changes.

No attempt has been made to model the financial behavior of firms. It is implicitly assumed that firms do not alter their choice of debt-equity ratios in response to different tax regimes. Thus marginal effective corporate tax rates are measured by average effective tax rates based on the observation of some initial value for debt-equity ratios. The value of these tax rates for various sectors in the model is indicated in Table A-4. As long as the characteristics of the marginal investment do not differ from the average, the percentage change in a sector's cost of capital can be easily obtained from an expression similar to equation (6) as

$$(12) \quad \hat{c} = \hat{q} + \hat{P}_K - (1 \hat{-} t_e) \quad \text{where}$$

$\hat{q}$, the percentage change in the cost of capital goods, is

assumed to result from changes in commodity taxation and $P_K$ or r is the required after-tax real cost of funds. While this approach is a conventional one, recent research such as that by King and Fullerton (1984) suggests that tax rates on new investments are extremely sensitive to the kind of capital asset acquired, the method of finance and the nature of the capital owner. Equation (6) measures the cost of capital for a completely unlevered investment and therefore uses the statutory rate of corporate tax (u). Equation (12) above, on the other hand, recognizes the existing use of debt and equity instruments in each sector, as well as any tax credits or other tax offsets, and relies upon the effective corporate tax rate $t_e$ in measuring changes in the cost of capital.

As explained in the previous section, the manufacturers' sales tax (MST) is a complicated tax to model because of portion of it strikes consumer purchases, another part burdens purchases of capital goods and a final component falls on production of value-added. All three of these features of the tax base should be captured in the measurement of tax rates. In an earlier study Kuo et al. (1985) partitioned the MST into anmounts which apply to intermediate inputs and capital goods by one-digit industry. These amounts, when expressed as a percentage tax rate on GDP in each industry, are shown in Table 8. Using the value-added coefficients of Table A-2, these rates can be converted into equivalent ad-valorem rates on final outputs in the model, as shown in Table 9. The indirect tax on intermediate inputs is

modelled as a tax on total value-added in each sector, i.e., as a tax on production, while the component resting on capital goods is transformed into an equivalent increase in the cost of capital in each sector. This transformation is accomplished by dividing the ad-valorem capital goods tax rates shown in Table 9 by the share of capital in each sector.(24)

The direct tax burden on final purchases can also be calculated from the Kuo study as a weighted average of the individual tax rates applicable to different consumption items. All of these items belong to the corporate consumer goods sector of the model and have a weighted average tax rate of 5.55 per cent.(25) When this rate of 5.55 per cent is averaged over corporate capital goods as well, the average effective MST rate on direct purchases of C is 2.75 per cent. The direct tax rate on purchases of consumer imports is not directly observable but some evidence, for example, the 1981 federal budget papers, hints that import rates may be only about two-thirds of the rate applicable to domestic output. Accordingly, the MST rate on imports is set at 2.0 percent in the model, a value which captures the pro-import bias of the MST.

These tax rates together give about the right amount of total revenue for the MST. Outputs C and W are initially worth about $84,000 million and, when taxed at a rate of 2.75 per cent, generate $2,310 million in revenue or about one-

Table 8

Federal Sales Tax Rates

| Industry | Intermediate Inputs (Percent) | Capital Goods (Percent) |
|---|---|---|
| Agriculture | .25 | .54 |
| Forestry | .17 | .11 |
| Mining | .05 | .10 |
| Manufacturing | .09 | .29 |
| Construction | 4.47 | .21 |
| Transport, Communications, Utilities | .50 | .48 |
| Wholesale Trade | .48 | .17 |
| Retail Trade | .33 | .13 |
| Finance, Insurance, Real Estate | .04 | .09 |
| Services | .10 | .32 |

Source: Kuo et al. (1985).

Table 9

Federal Sales Tax Rates on Final Commodities

| Commodity | Intermediate Input Component (Percent) of value | Capital Goods Component (Percent) of value |
|---|---|---|
| A | .28 | .31 |
| C | .24 | .25 |
| H | .36 | .08 |
| Z | .18 | .31 |
| W | 1.74 | .23 |
| F | .26 | .34 |
| E | .21 | .25 |
| C + W | .99 | .24 |

Source: Tables 8 and A-2.

half of the reported MST total of $4,663 million in 1980. From Table 6 imports were worth $42,877 million in 1980 and thus generated $857 million in MST revenue. By applying the rates in Table 9 to the net spending values in Table 6, it can be seen that the two factor tax components contribute $1,593 million in MST revenue. These relative tax contributions correspond reasonable closely to the tax shares reported in Table 2 and give an initial revenue amount of $4,760 million for MST.

Table 10 describes the manner in which tax rate changes enter the model for the first two experiments. In the first experiment the MST is replaced by increased revenues from higher levels of personal taxation.[26] Direct MST tax rates decline for corporate sector output and consumer goods imports while indirect production taxes are removed from all six production sectors. Effective corporate tax rates are allowed to decline slightly in all of these sectors to capture the change in the cost of capital arising from the removal of tax on capital goods. In the second experiment effective corporate tax rates are raised by 20 percent across the board to replace about one-half the loss of foregone MST revenue while the other half is made up from a higher rate of personal income taxation.[27] In the third experiment a uniform rate VAT is introduced on a consumption base of $209,127 million and the rate is set at 2.23 percent to

Table 10

Tax Parameter Values for Experiments 1 and 2

| Tax Parameter | Experiment 1 (Percent) | Experiment 2 (Percent) |
|---|---|---|
| $(1 \hat{+} t_S^A)$ | -.28 | -.28 |
| $(1 \hat{+} t_S^C)$ | -3.0 | -3.0 |
| $(1 \hat{+} t_S^H)$ | -.36 | -.36 |
| $(1 \hat{+} t_S^Z)$ | -.18 | -.18 |
| $(1 \hat{+} t_S^F)$ | -.26 | -.26 |
| $(1 \hat{+} t_S^E)$ | -.22 | -.22 |
| $(1 \hat{+} t_S^M)$ | -2.0 | -2.0 |
| $(1 \hat{-} t_C^C)$ | +.83 | -3.6 |
| $(1 \hat{-} t_C^A)$ | +.81 | -2.2 |
| $(1 \hat{-} t_C^H)$ | +.10 | -1.0 |
| $(1 \hat{-} t_C^Z)$ | 1.0 | -2.2 |
| $(1 \hat{-} t_C^E)$ | .63 | -6.2 |
| $(1 \hat{-} t_C^F)$ | .75 | -2.3 |
| $\hat{t}_i^C \forall_i$ | - | 20 |

produce the same amount of revenue as the MST. Personal income taxes are allowed to fall in order to preserve revenue neutrality. By comparing the incidence results of this experiment with those of the first experiment, the differential effects of replacing the MST with a broad-based VAT can be estimated.

## V Simulation Results

The procedure for determining the impact of a particular tax substitution is the same in every instance. First, the model is solved for each experiment specification. The solutions for the tax induced factor price changes are used to estimate the associated changes in relative product prices. The percentage change in real disposable income for each income group, $\hat{R}_i$, that is, the effective tax rate imposed on the $i^{th}$ income class, is then calculated according to the formula:

$$(13) \quad \hat{R}_i = \theta_K^i \hat{P}_K + \theta_{LH}^i \hat{P}_L^H + \theta_{LA}^i \hat{P}_L^A - \theta_{TX}^i \hat{TX} - \sum_j \alpha_j^i \hat{P}_j^* .$$

$\hat{P}_K$, $\hat{P}_L^H$ and $\hat{P}_L^A$ indicate the percentage changes in the return to capital, to land used in housing, and to non-housing land respectively, while $\hat{P}_j^*$ is the percentage change in price of the $j^{th}$ consumer product. $\hat{TX}$ indicates the percentage change in the personal income tax (PIT). Shares of factor income in disposable income are denoted by $\theta_K^i$, $\theta_{LH}^i$ and $\theta_{LA}^i$ while the ratio of PIT to disposable income is measured by $\theta_{TX}^i$. Household's expenditure shares on final output are given by $\alpha_j^i$.

All of the information needed to estimate the share data for each income class is contained in Tables 11 and 12, which themselves are based on the distributive series found in appendix tables A-6 and A-7. Each income class constitutes one decile of the income distribution. Two points of clarification may be mentioned here. In the uses table expenditures on corporate consumer output must be added to savings in

Table 11

SOURCES OF INCOME BY DECILE, 1980

| Income Class | Labour Income Ly | Capital Income Ky | Transfers (millions) TR | Personal Income Taxes PIT | Disposable Income Dy | Consumption C | Saving S |
|---|---|---|---|---|---|---|---|
| less than $8,500 | 505 | 1,034 | 4,034 | 78 | 5,495 | 4,751 | 744 |
| $8,501 - 12,700 | 2,355 | 1,189 | 4,937 | 429 | 8,052 | 7,488 | 564 |
| $12,701 - 17,300 | 5,720 | 2,223 | 4,062 | 936 | 11,069 | 9,503 | 1,563 |
| $17,301 - 22,300 | 10,094 | 2,378 | 3,103 | 1,677 | 13,898 | 11,518 | 2,380 |
| $22,301 - 26,800 | 13,964 | 2,430 | 2,624 | 2,925 | 16,093 | 13,534 | 2,559 |
| $26,801 - 31,000 | 18,002 | 3,878 | 2,059 | 3,900 | 20,034 | 14,974 | 5,065 |
| $31,001 - 36,000 | 21,198 | 5,171 | 2,087 | 4,485 | 23,971 | 16,846 | 7,125 |
| $36,001 - 42,000 | 24,731 | 6,722 | 2,003 | 5,460 | 27,995 | 18,718 | 9,277 |
| $42,001 - 50,000 | 29,610 | 8,668 | 1,777 | 6,630 | 32,825 | 20,733 | 12,092 |
| more than $50,000 | 42,060 | 18,614 | 1,495 | 12,480 | 49,089 | 26,061 | 23,028 |
| all classes | 168,239 | 51,707 | 28,181 | 39,000 | 209,127 | 144,127 | 65,000 |

Table 12

USES OF INCOME BY DECILE, 1980

| Income Class | COMMODITY (millions) | | | | | |
|---|---|---|---|---|---|---|
| | A | C | H | E | M | Total |
| less than $8,500 | 917 | 1189 | 1178 | 752 | 715 | 4,751 |
| $8,501 - 12,700 | 1327 | 2600 | 1559 | 1177 | 1123 | 7,488 |
| $12,701 - 17,300 | 1460 | 3320 | 1724 | 1535 | 1462 | 9,502 |
| $17,301 - 22,300 | 1640 | 4069 | 2105 | 1909 | 1795 | 11,518 |
| $22,301 - 26,800 | 1858 | 5014 | 2329 | 2166 | 2164 | 13,533 |
| $26,801 - 31,000 | 2034 | 5396 | 2696 | 2385 | 2763 | 14,974 |
| $31,000 - 36,000 | 2222 | 6151 | 2982 | 2702 | 2789 | 16,846 |
| $36,001 - 42,000 | 2318 | 6998 | 3272 | 3008 | 3122 | 18,718 |
| $42,001 - 50,000 | 2537 | 7613 | 3578 | 3480 | 3524 | 20,733 |
| more than $50,000 | 2846 | 9845 | 4125 | 4557 | 4689 | 26,061 |
| all classes | 19160 | 51898 | 25551 | 23673 | 23845 | 144,127 |

the sources table to yield the appropriate value of the expenditure share for corporate output. Secondly, capital income cannot be partitioned into separate capital components with the data that is available. In implementing equation (12) it has been assumed that each income class owns land and non-land forms of capital in the same proportion. From Table A-5 it can be easily ascertained that income from the ownership of land in housing represents about 10 percent of capital income compared to about 5 percent for other kinds of land. Thus these percentages have been used for each income group to estimate $\theta_{LH}^{i}$ and $\theta_{LA}^{i}$ respectively, and, after subtracting these shares from the ratio of total capital income to disposable income, $\theta_{K}^{i}$, the income share for non-land capital, has been determined residually.

If equation (12) is evaluated for all income classes together, it provides an estimate of the efficiency impact of the tax policy. As shown in Ballentine and Thirsk (1979), this efficiency effect can be reformulated into an alternative expression for the change in the economy's real income:

$$(14) \quad \hat{R} = \theta_E \hat{P}_E + \hat{P}_F (\theta_F - \theta_M) - \theta_K^f \hat{P}_K + EB/Y$$

The first three terms in this expression reveal the channels through which Canadian tax policy changes may influence the distribution of income internationally. The share parameters $\theta_E$, $\theta_F$, $\theta_M$ and $\theta_K^f$ represent, respectively, the share of flexibly priced exports, fixed price exports, imports and foreign capital payments in total income (Y). The first two terms capture terms of trade effects while the third allows corporate income tax revenue to be shifted among

different government treasuries. An increase in the price of flexibly priced exports ($P_E$) or a reduction in the relative price of Canadian imports, since $\hat{P}_F = \hat{P}_M$ and $\theta_M > \theta_F$, will both contribute to higher real incomes of Canadians at the expense of foreigners. Similarly, if $P_K$ falls, foreigners earn less from their employment of capital in Canada or, if a corporate tax rate increase depresses $P_K$, the loss in income to Canadian revenue authorities is made up by a reduction in corporate tax revenue paid to foreign treasuries through the foreign tax credit mechanism.

The final term in equation (13) measures the distorting effects, or excess burden (EB), of tax policy changes on the allocation of the economy's resources. Since there are initial commodity and factor taxes embedded in the model, the sign of this last term is theoretically indeterminate. Experience in operating the model suggests, however, that the crucial determinant of the direction of this effect is the fate of the corporate sector C. Both its corporate and commodity tax rates are significantly higher than in other sectors of the economy so that an expansion in its size will ordinarily improve the efficiency of resource allocation and vice-versa.

The results of the first experiment are shown in Table 13. Eliminating the manufacturers' sales tax (MST) and recouping the revenue loss through the personal income tax would exert a progressive impact on the distribution of income. Income groups up to the fifth decile would enjoy a real income gain of nearly one percent or better. Income

Table 13

Experiment (1): Replacing MST with PIT

| Percentage Change in Real Income by Decile | Model Variant (1) Case (2) | (2) | (3) Case (2) |
|---|---|---|---|
| 1 | 1.69 | same | 1.56 |
| 2 | 1.40 | as | 1.37 |
| 3 | 1.09 | model | 1.06 |
| 4 | .71 | variant | .64 |
| 5 | .07 | one | +.06 |
| 6 | .04 | - | +.07 |
| 7 | .10 | - | +.06 |
| 8 | .05 | - | +.10 |
| 9 | .01 | - | +.07 |
| 10 | -.45 | - | -.40 |
| All Groups | .28 | - | .20 |

| Case \ Percent Change in: | $P_K$ | $P_L^H$ | $P_L^A$ | $P_K$ | $P_L^H$ | $P_L^A$ | $P_K$ | $P_L^H$ | $P_L^A$ |
|---|---|---|---|---|---|---|---|---|---|
| (1) | -.0011 | -.01 | -.07 | -.006 | -.002 | -.05 | - | - | - |
| (2) | .004 | -.009 | -.087 | .007 | -.003 | -.06 | $-.28\times10^{-4}$ | -.009 | -.07 |
| (3) | .004 | -.006 | -.06 | .005 | -.004 | -.05 | $-.26\times10^{-4}$ | -.009 | -.05 |
| (4) | .004 | -.003 | -.04 | .004 | -.004 | -.04 | $-.24\times10^{-4}$ | -.005 | -.05 |

Notes:

(1) Model (1) assumes imperfect international capital mobility and fixed labor supply; model (2) allows a variable labor supply while model (3) assumes perfect capital mobility.

(2) Cases (1) - (4) for models (1) and (2) assume different combinations of values for the capital supply elasticity ($\gamma_K$) and export demand elasticity (n). Case (1): $\gamma_K = 0$, $n = -1$; case (2): $\gamma_K = 3$, $n = -1$; case (3): $\gamma_K = 3$, $n = -3$; case (4): $\gamma_K = 3$, $n = -6$. In model variant (3), $\gamma_K = 10$ in all cases and n varies from -1 in case (2), -3 in case (3) and -6 in case (4).

groups between the fifth and ninth decile would experience an insignificant improvement in economic welfare. The richest income group suffers a deterioration in welfare of almost one-half a percent. Explaining this incidence pattern is a straightforward matter. All groups become better off with the disappearance of the MST as purchase prices decline, but the recoupment of the income loss through PIT is concentrated in the upper income groups.

From the differential equation for the public sector budget constraint, it is found that an 11.5 percent increase in PIT is required to maintain government revenues at their original level. As a result of this particular tax substitution, consumer prices in the first case for model (1) decline by 3.29, .69, .51, 1.13 and 3.20 percent respectively for the final products C, H, Z, A and M. Prices for flexibly priced and fixed price exports fall by .52 and 1.20 percent respectively. Final demand shifts towards the products of the corporate sector and away from imports and, as a result, resources are shifted out of the export sectors and output levels for both E and F fall. Removing the import impetus of the MST also removes an artificial encouragement to foreign trade. Relative factor prices are little affected by these resource allocations. Land prices in the non-housing sectors are affected the most but they exert only a modest influence on the determination of both nominal incomes and product prices.

These results are not at all sensitive to either the choice of parameter regime in cases (1) and (4) or model variant. However, as the export demand price elasticity increases, it is observed that the decline in exports is concentrated more on E than on F. Model (2)

gives virtually identical results to the first model and reflects the absence of any tax illusion in the supply of labor.[28] The change in tax mix has largely offsetting impacts on real income since the higher PIT countervails the effect of lower purchase prices when total tax revenue is held constant. It might also reflect some shortcomings in the data since it is impossible to distinguish the portion of PIT which strikes labor incomes rather than capital incomes. That is, the experiment assumes that the PIT increase applies with the same percentage force to both types of income, an assumption which may not be true in general. Similarly, the data cannot differentiate between expenditure patterns for recipients of labor and capital income and it is therefore necessary to assume that they are the same. The third variant of the model gives a slightly different picture of tax incidence, suggesting somewhat lower gains for lower income groups matched by somewhat smaller losses for the highest income group. Even here, however, the difference in the profile of tax incidence is hardly a significant one.

For all groups together, or the whole economy, there is an improvement in economic welfare which amounts to about .28 percent of disposable income for the first variant of the model and about .20 percent for the third variant. The source of this welfare gain is the realization of slightly better terms of trade and a welfare enhancing shift of labor and capital resources toward the highly taxed corporate sector. This estimate of welfare is subject to a downward bias because it fails to capture any improvement in resource allocation within the corporate sector due to the removal of differential MST rates and because it also ignores the disappearance of any "margin" distortion attributable to the MST. The latter occurs when the MST disturbs the distribution and trade level choices of firms in the economy.

It is worthwhile to pause momentarily and consider whether, and to what extent, the results obtained from general equilibrium methods are at all different from the results which a partial equilibrium approach would predict. Table 14 presents a comparison of the two alternative approaches. The first column shows the inter-decile distribution of MST tax burdens that appears in Table 1 and represents a partial equilibrium approach to the problem based on the assumption of forward shifting of the tax burden. The second column indicates the distribution of PIT burdens by decile when it is assumed that rates for each income class are the same as those used in the general equilibrium model and total revenue is held constant.[29] The differential tax burden is the difference between the two tax rates as shown in the third column. Compared to the general equilibrium incidence pattern in the last column, the partial equilibrium picture of short run impact incidence conveys an impression of much stronger income redistribution from higher to lower income groups than the general equilibrium view of ultimate or long run incidence. The differences in result are sufficiently large that they offer some justification for the construction and use of more expensive general equilibrium techniques of analysis. The latter approach, moreover, has the advantage of measuring the efficiency implications of tax policies in a way that is vastly superior on methodological grounds to a partial equilibrium alternative.

The results of the second experiment are presented in Table 15. In this experiment corporate income tax (CIT) rates are raised by twenty percent to offset the elimination of the MST and any remaining

Table 14

A Comparison of Partial and General Equilibrium Approaches

| Decile | Partial Equilibrium (1) MST Burden as a Percent of Income | Partial Equilibrium (2) Equal Yield PIT Burden (percent) | Partial Equilibrium (1) - (2): MST minus PIT Burden | General Equilibrium: Replacing MST with PIT |
|---|---|---|---|---|
| 1 | 2.72 | .13 | 2.59 | 1.64 |
| 2 | 2.02 | .49 | 1.53 | 1.42 |
| 3 | 1.97 | .78 | 1.19 | 1.09 |
| 4 | 1.98 | 1.12 | .86 | .71 |
| 5 | 1.97 | 1.69 | .28 | .05 |
| 6 | 1.97 | 1.81 | .16 | .07 |
| 7 | 1.79 | 1.74 | .05 | .11 |
| 8 | 1.61 | 1.79 | -.18 | .07 |
| 9 | 1.43 | 1.86 | -.43 | .03 |
| 10 | 1.25 | 2.36 | -1.11 | -.45 |
| All Groups | 1.73 | 1.73 | 0 | |

Sources:

Column (1): Table 1.

Column (2): See the discussion in the text.

Column (3): Column (1) minus Column (2).

Column (4): Table 13.

Table 15

Experiment (2): Replacing MST with CIT and PIT

| Percentage Change in Real Income by Decile | Model Variant (1) Case (1) | (2) Case(2) | (3) Case (3) |
|---|---|---|---|
| 1 | 1.48 | 1.02 | .70 |
| 2 | 1.52 | .91 | .50 |
| 3 | 1.02 | .69 | .46 |
| 4 | .90 | .51 | .31 |
| 5 | .49 | .13 | .10 |
| 6 | .31 | .09 | 0 |
| 7 | .29 | .09 | -.02 |
| 8 | .05 | .00 | .04 |
| 9 | .00 | -.03 | -.02 |
| 10 | -.78 | -.36 | -.18 |
| All Groups | .19 | .13 | .18 |

| Case \ Percent Change in: | $P_K$ | $P_L^H$ | $P_L^A$ | $P_K$ | $P_L^H$ | $P_L^A$ | $P_K$ | $P_L^H$ | $P_L^A$ |
|---|---|---|---|---|---|---|---|---|---|
| (1) | -.044 | -.014 | -.025 | -.022 | .011 | .04 | - | - | - |
| (2) | -.040 | -.014 | -.04 | -.026 | .017 | .10 | -.001 | -.007 | -.175 |
| (3) | -.040 | -.006 | .02 | -.028 | .016 | .11 | -.001 | .006 | -.069 |
| (4) | -.029 | -.002 | .02 | -.030 | .015 | .12 | -.001 | -.069 | .01 |

Notes:

(1) Model (1) assumes imperfect international capital mobility and fixed labor supply; model (2) allows a variable labor supply while model (3) assumes perfect capital mobility.

(2) Cases (1) - (4) for models (1) and (2) assume different combinations of values for the capital supply elasticity ($\gamma_K$) and export demand elasticity (n). Case (1): $\gamma_K = 0$, n = -1; case (2): $\gamma_K = 3$, n = -1; case (3): $\gamma_K = 3$, n = -3; case (4): $\gamma_K = 3$, n = -6. In model variant (3), $\gamma_K = 10$ in all cases and n varies from -1 in case (2), -3 in case (3) and -6 in case (4).

revenue loss is recouped from a simultaneous increase in PIT. As in the case of the first experiment, there is a switch in final demand toward domestically consumed non-tradeables and a reallocation of resources away from the export sectors that reflects the pro-import bias of the MST. However, as the price elasticity of foreign demand for flexibly priced exports increases in cases (3) and (4), resources are reallocated between the export sectors and fixed price exports expand at the expense of flexibly priced exports. There is a slight decline in the gross return to capital employed in the corporate sector, so that when capital becomes internationally mobile in case (2) there is a small capital flight which serves to cushion the fall in capital's net return.

Unlike the first experiment, however, the outcome of this second experiment is sensitive to the choice of model variant. Changes in relative factor prices, and thus relative produce prices, become noticeably smaller as one moves from the first to the third model variant. In the second variant the increase in taxes on capital incomes means that the adjustment in PIT rates is smaller than before so that real labor income rises. The higher level of real labor income induces a larger labor supply in the economy and prevents the net price of capital from falling as much as it did in the case of the first variant of the model. In the third variant of the model the high supply elasticity of capital to the Canadian economy virtually precludes any downward adjustment in the net return to capital and causes taxes on capital income to be felt on the uses side of income.

Looking at case (1) for the first variant, it can be seen that all income groups up to the eighth decile become better off when MST is

replaced by a combination of higher corporate and personal income taxes. These groups enjoy a welfare gain because they own relatively little capital and pay relatively little tax on personal incomes. The richest decile, on the other hand, owns a substantial share of capital and pays a disproportionate share of personal income taxes. In the other model variants differences in the degree of capital ownership are much less important in determining the pattern of tax incidence. While the overall incidence pattern remains the same for these variants, the size of the gains and losses is smaller in each case. In the second model no benefits are received beyond the seventh decile, while in the third model the cutoff between gains and losses occurs at the fifth decile. The increase in PIT rates also varies considerably among the three model variants. For the first variant PIT must rise by 8.2 percent to prevent any fluctuation in government revenues compared to a required PIT adjustment of 7.2 percent in model (2) and 5.7 percent for model (3).

For all three variants of the model there is a sizeable increment in aggregate economic welfare for the tax policy envisioned in the second experiment. Its size varies between .13 and .18 percent of total income. Its origin lies in the ability of corporate tax increases to raise the cost of capital in the flexibly priced export sector and the price that foreigners pay for Canadian exports. In addition, there is a treasury transfer from foreign revenue authorities to Canadian tax collectors that results from the depression in capital's net return. With a smaller decline in the net return to capital in the case of the

second model there is a correspondingly smaller transfer which accounts for the diminished size of the welfare gain. There is virtually no transfer effect in the case of the third model, but the welfare benefit is larger than it was for the second model because the tax induced increase in flexibly priced exports is larger than it is for either of the other two models. In model (1) flexibly priced exports rise by .66 percent; in models (2) and (3) the increase is 1.22 and 2.22 percent respectively.

The outcome of the third experiment, in which a broad-based value-added tax (VAT) replaces a portion of the personal income tax, can be seen in Table 16. Because both taxes do not directly affect factor employment decisions by firms, the tax induced alteration in relative factor prices is minute no matter which version of the model is considered. In contrast to the first two experiments, which exhibited a distinct anti-trade bias, this experiment encourages an expansion in international trade. All nontradeable outputs decline slightly while both export sectors expand somewhat. The higher is the value of the export demand elasticity, the greater is the growth of flexibly priced exports and the smaller is the expansion of fixed price exports. The growth in export activity contributes to a higher price for land outside the housing sector.

For each version of the model, 11.5 percent of PIT is eliminated so that the amount of revenue lost equals the amount that would be generated if a higher PIT were to compensate for the potential loss of

Table 16

Experiment (3): Replacing PIT with Broad-based VAT

| Percentage Change in Real Income by Decile | Model Variant (1) Case (3) | (2) | (3) Case (2) |
|---|---|---|---|
| 1 | -2.18 | same | -2.05 |
| 2 | -1.87 | as | -1.71 |
| 3 | -1.35 | model | -1.24 |
| 4 | -.91 | variant | -.84 |
| 5 | -.17 | one | -.02 |
| 6 | -.04 | - | .07 |
| 7 | -.07 | - | .04 |
| 8 | .07 | - | .14 |
| 9 | .16 | - | .22 |
| 10 | .81 | - | .86 |
| All Groups | -.10 | - | -.04 |

| Case \ Percent Change in: | $P_K$ | $P_L^H$ | $P_L^A$ | $P_K$ | $P_L^H$ | $P_L^A$ | $P_K$ | $P_L^H$ | $P_L^A$ |
|---|---|---|---|---|---|---|---|---|---|
| (1) | .0023 | -.0044 | .047 | .009 | -.0032 | .036 | - | - | - |
| (2) | .001 | -.0046 | .051 | .0003 | -.0032 | .04 | $-.59\times10^{-4}$ | -.0047 | .055 |
| (3) | .001 | -.0064 | .037 | .002 | -.0041 | .03 | $-.58\times10^{-4}$ | -.0067 | .039 |
| (4) | .001 | -.0078 | .026 | .001 | -.0049 | .03 | $-.56\times10^{-4}$ | -.0082 | .027 |

Notes:

(1) Model (1) assumes imperfect international capital mobility and fixed labor supply; model (2) allows a variable labor supply while model (3) assumes perfect capital mobility.

(2) Cases (1) - (4) for models (1) and (2) assume different combinations of values for the capital supply elasticity ($\gamma_K$) and export demand elasticity (n). Case (1): $\gamma_K = 0$, $n = -1$; case (2): $\gamma_K = 3$, $n = -1$; case (3): $\gamma_K = 3$, $n = -3$; case (4): $\gamma_K = 3$, $n = -6$. In model variant (3), $\gamma_K = 10$ in all cases and n varies from -1 in case (2), -3 in case (3) and -6 in case (4).

revenue from the MST. In all three variants of the model there is a significant redistribution of income from lower to upper income groups. The bottom decile experiences a drop in real income of about two percent compared to a real income gain of nearly one percent for the richest decile. Roughly speaking, the bottom half of the income distribution loses out to the top half. It is this regressive incidence pattern which has sparked interest in the feasibility of introducing an income tax credit that would be confined to the lower half of the income distribution and which would alleviate VAT's regressivity. Not surprisingly, the burden of financing this tax credit would fall primarily on the middle income classes.

For all income groups the incidence calculations in Table 19 indicate that replacing a small portion of PIT with a VAT would be accompanied by a small welfare loss, -.09 percent in the case of the first model and -.04 percent for the third. There are no labor market benefits from this tax substitution and anticipated capital market improvements are ignored in this static model. There are also little or no terms of trade gains in this instance as import prices rise by .5 percent in model (1) and .35 percent in model (3), while flexibly priced exports do not increase in price at all in the latter case and rise by only .09 percent in the former situation. Moreover, there are fewer resources allocated to the highly taxed corporate sector in this third experiment and this effect by itself will produce a negative welfare change. Thus, using equation (14) to evaluate the change in aggregate real income, it can be calculated for the first model variant that:

$$\hat{R} = .042 \left\{ \frac{49,172}{264,172} \right\} - .005 \left\{ \frac{12,293 - 47,401}{264,127} \right\} - \frac{8,000}{264,127} \left\{ .001 \right\}$$

$$+ EB/I = -.05 + EB/I.$$

For the third variant of the model the same type of calculation gives

$$\hat{R} = .0035 \left\{ \frac{12,293 - 47,401}{264,127} \right\} - \frac{8,000}{264,127} \left\{ -.00006 \right\} + EB/I$$

$$= -.00046 + EB/I.$$

Differences in these estimates of welfare change are close to the differences in values obtained from using the aggregate version of equation (12).

These minor welfare losses would no doubt be magnified considerably if a non-uniform or variable rate VAT were introduced instead. Ballard and Showen (1985) conclude that the welfare cost of rate differentiation similar to that found in current European VATs is 17 percent of GNP. Their central conclusion is that this rate differentiation is an extremely inefficient method of redistributing income because differences in consumer spending patterns are only mildly associated with the distribution of household incomes.

Ballard and Shoven (1985) also indicate that there would be important welfare gains from substituting a flat consumption-type VAT for a portion of PIT. For the U.S. it is estimated that the benefit from introducing a 10 percent flat VAT with a multiplicative scaling

back of marginal tax rates is almost one percent of the discounted value of future welfare, or approximately $487 billion. Gains of this magnitude are not suggested in this study for two reasons. First, and most importantly, Ballard and Shoven employ a dynamic sequenced general equilibrium model which is attuned to the inter-temporal advantages of consumption over income taxation. Their estimate of welfare gain for a 10 percent VAT is in fact nearly three-quarters of the benefit attainable from completely replacing PIT with a progressive consumption tax. Secondly, their specification of the labor-leisure choice is sensitive to the pattern of marginal income tax rates, a refinement which is also not reflected in this study. Thus their findings do not conflict with ours, but rather complement them in highlighting the significance of labor market and inter-temporal inefficiencies under PIT.

By comparing the first column of Table 16 with the first column of Table 13 or, alternatively, the last columns in both of these tables, it is possible to acquire an impression of the differential incidence of replacing MST with a broad-based VAT. Because PIT yields have been held constant in experiments (1) and (3), it is possible to infer the distributive implications of substituting VAT for MST by simply adding the results of Tables 13 and 16 in the appropriate column for each decile. As shown in Table 17, both the first and third variants of the model, as well as the second, indicate roughly the same incidence pattern in which income is redistributed from the bottom half of the income distribution to the top half.

Table 17

Differential Incidence: Replacing MST with a Broad-based VAT

| Decile | Percentage Change in Real Income | |
|---|---|---|
| | (1) | (2) |
| 1 | -.54 | -.49 |
| 2 | -.45 | -.34 |
| 3 | -.25 | -.18 |
| 4 | -.20 | -.20 |
| 5 | -.12 | .04 |
| 6 | .03 | .00 |
| 7 | .04 | .02 |
| 8 | .01 | .04 |
| 9 | .13 | .13 |
| 10 | .36 | .46 |
| All Groups | .18 | .16 |

Source:

Tables 13 and 16. Column (1) above refers to the first model while column (2) draws on a comparison of the results for the third variant of the model.

At the same time, there is an overall efficiency advantage from this tax substitution which is estimated as being between .16 and .18 percent of disposable income, or between $335 and $370 million dollars in 1980. With welfare gains of this size, it should be possible to design a tax reform package that compensates losers for their losses, perhaps through an accompanying tax credit scheme, and makes all households in the economy better off than they were originally.

It is entirely plausible, however, that the adoption of a VAT will do more than simply replace a defective MST. Once in place, there will be strong temptations to use VAT as a replacement for either PIT, or the corporate income tax (CIT) or both. If this were to happen, some additional equity considerations would have to be addressed as well. There are both inter-generational and inter-regional aspects of equity to consider. If VAT replaces PIT older generations will suffer during the transition to a new tax regime since they will be taxed on the consumption of their wealth which has already been burdened by PIT. Phasing-in the new tax policy, grandfathering consumption financed by the sale of existing assets or an adjustment in pension policies may be necessary to offset this undesired generational impact. A switch to VAT from PIT will also help high income, and harm low income, regions because of the progressive nature of PIT. Some modifications of the equalization program may, therefore, be necessary in this instance.

It is less likely that VAT would be employed to reduce reliance on CIT. Circumstances can be envisioned, however, where considerable pressure for this type of tax substitution could occur because of tax mix policies pursued in the rest of the world. If the U.S., for example, were to introduce a destination principle VAT as a partial substitute for PIT and Canada did not there would be no more economic pressure on Canada to follow suit than there is on the province of Alberta to introduce a retail sales tax and "keep up" with neighboring provinces. In fact, the existence of an international boundary would make it easier to apply the destination principle since there would be no, or far fewer, "border problems" as occur with provincial sales taxation. Presently, for example, consumers in border towns adjoining zero-tax jurisdictions such as Alberta exert considerable force on sales tax authorities to rebate sales tax to merchants in these towns in order to remove the incentive to shop elsewhere. With an international boundary the option of shopping elsewhere is much more limited. Higher taxes on purchases and lower taxes on earnings in the U.S. would impart an incentive to earn more income in the U.S. and spend more of that income in Canada, but very few Canadians have the opportunity to engage in this type of tax arbitrage.

However, if the U.S. were to embrace the VAT as a substitute for CIT there would be compelling pressures on Canada to do the same. A reduction in U.S. corporate rates would have a double-barreled impact on the Canadian economy. Lower corporate tax rates would act to raise the after-tax return from investment in the U.S. for domestic

as well as foreign investors, and on both accounts the volume of investment in Canada would be expected to fall. In addition to the loss of capital, lower corporate tax rates in the U.S. would serve to erode the value of the foreign tax credit and limit the ability of revenue authorities in Canada to tax the incomes of foreign corporations without further jeopardizing the volume of foreign investment. To offset the loss of capital, Canadian corporate tax rates would have to follow any significant decline in the U.S.[30] In offsetting the loss of corporate tax revenue, the temptation to turn to a VAT might prove to be irresistible. In short, the effects of a U.S. VAT on Canada depend very much on the kind of tax that it replaces there.

In a world of flexible exchange rates, the impact of U.S. - Canada corporate tax rate disparities on international trade is of far less concern. If corporate tax rates rose in Canada relative to those in the U.S., a depreciation of the Canadian dollar would neutralize any current account advantage enjoyed by the U.S. While there would be no aggregate effect of a corporate tax rate differential, certain firms and industries might still be worse off after the exchange rate adjustment than they were before the tax differential appeared. This would be the situation for firms and industries with above-average effective corporate tax rates for whom the exchange rate adjustment would be inadequate compensation. On the other hand, firms and sectors with below average effective rates would be better off than before.

## VI Summary and Conclusions

This study has had two major objectives, to examine the role of indirect taxes in the tax system and to estimate some of the effects of changing the tax mix as between direct and indirect taxes and of reforming the indirect tax base. The theoretical case favoring some form of indirect tax has been set out in the first part of this paper. Selective excise taxes, imposed at non-uniform rates, may serve the efficiency goal of taxation by exploiting differences in price elasticity across commodities or, alternatively, serve the equity goal of taxation by exploiting differences in income elasticity across households. Broad-based sales taxes imposed at uniform rates have a quite different role to play. Under an income tax they may reduce the severity of both work-related and savings distortions resulting from high marginal income tax rates and improve the horizontal equity of the tax system by tapping incomes that would otherwise escape tax. Moreover, incentives to evade tax will be smaller if marginal income tax rates are lower. Under an expenditure tax system, like the one envisioned in the Meade Report, a broad-based tax sales tax such as a VAT may accomplish most of the efficiency aims of expenditure taxation and offer important administrative economies over its direct tax alternative by limiting the application of direct tax to a small group of high expenditure households. This is the so-called two tier approach to expenditure taxation.

The most important indirect tax in the federal revenue arsenal is the manufacturer's sales tax. It is a highly flawed tax despite its

long tenure. Its nominal rate structure discriminates among sectors, its coverage includes capital goods and intermediate inputs as well as final outputs, and its effective rate structure is highly variable across both products and industries primarily because the tax applies at the manufacturer's level rather than the retail level and distribution-trade margins are thus exempt from tax. In addition, the tax impinges on exports when it is not intended to do so and it favors imports over domestically produced output.

After a long period of quiescence, awareness of the numerous imperfections in the manufacturer's sales tax has increased and with it the clamor for tax reform in this area. Reform proposals have run the gamut from elimination of the tax, to tinkering with its administration, to moving it to the wholesale level, and, finally, to replacing it with a retail form of tax. One method of achieving a retail form would be to introduce a federal value-added tax (VAT) and tax each slab of final value to a consumer as the product passes through various stages of production and distribution. A broad-based uniform VAT that superseded the manufacturer's sales tax could remove both the inter-temporal and inter-sectoral capital misallocations that are characteristic of the latter type of indirect tax.

This reform possibility and some others have been modelled in a general equilibrium setting in this study. Using a six sector, three factor extension of the basic Harberger model of tax incidence, one that is open to international capital movements and trade flows, three

basic tax experiments were conducted. In the first experiment the tax mix was adjusted so that the manufacturer's sales tax was replaced by a higher personal income tax. In this and the other two experiments simulations were undertaken for four different policy regimes, reflecting a wide range of values for the trade and capital supply elasticities, and three different versions of the basic structural model, each one embodying a different assumption about the supply of labor or capital to the economy. As a result of this particular tax substitution lower income groups up to the fourth decile enjoy a welfare gain of about one percent or better. Middle and upper middle income groups experience very little welfare change while the richest decile suffers a welfare loss. The economy as a whole undergoes a modest improvement in welfare due in part to enhanced terms of trade. These findings are relatively insensitive to the choice of parameter regime and to the variant of the basic model that is selected.

In the second experiment the manufacturer's sales tax is replaced by a combination of higher corporate and personal income taxation. The pattern of tax incidence is similar to the previous experiment in that there is a redistribution of welfare from the top to the bottom groups. In this case, however, all income groups up to the seventh decile become better off. The richest income group becomes worse off because it pays a disproportionate share of personal tax and owns a larger than average amount of capital whose relative return is depressed by the increase in corporate taxation. The extent of the redistribution, but not the pattern, depends on which variant of the model is adopted and becomes

less extreme as the supply of capital tends toward perfect elasticity and as the supply of labor displays less than perfect inelasticity.

The final experiment involves substituting a broad-based uniform sales tax for the personal income tax. As would be expected, this kind of change in the tax mix has a regressive impact on the distribution of income and redistributes income from the bottom to the top half of income recipients. This outcome is little affected by the choice of parameter regime or the selection of model variant. There is also a tiny welfare loss for the whole economy in this experiment but it should not be taken too seriously since the modelling exercise ignores the benefits that would accrue to the economy from an improvement in inter-temporal resource allocation.

By comparing the results of the first experiment with those of the third it is possible to infer some of the effects of an indirect tax reform which would entail substituting a broad-based sales tax such as a VAT for the manufacturer's sales tax. As other recent studies have also shown, a tax reform of this kind will exert a modestly regressive influence on the distribution of income. Therefore, this particular tax reform may have to be coupled with a tax credit initiative which alleviates this regressive tendency if it is going to command popular support. At the same time, this differential incidence comparison suggests that an overall welfare gain may be realized from this tax reform, one whose true size is underestimated in this study because it fails to capture the improvement in inter-temporal resource allocation that would also occur.

Although it neglects the important inter-temporal dimension of changes in tax mix and indirect tax reform, the general equilibrium approach used in this study is able to incorporate a much broader range of relative price effects than its partial equilibrium alternative. For example, in the differential incidence comparison above the general equilibrium method is able to detect an improvement in welfare at the top of the income scale that would not be predicted from the use of a partial equilibrium model. Nonetheless, there is still room for refinement in the application of general equilibrium techniques of analysis. The greatest areas of uncertainty concern the appropriate specification of Canada's linkages to the world economy. For instance, in modelling a situation where Canada is a price-taker in world capital markets, the price of capital was assumed to be virtually fixed with respect to the price of labor. It could be argued, however, that a better treatment would consist of fixing capital's price relative to the price of imports so that the "real" interest rate in the economy was held constant in units of foreign currency.

## Footnotes

1. Thus selectivity under an indirect tax could be duplicated through discriminatory application of the income tax. For example, instead of imposing excise taxes on alcoholic beverages, tax authorities could alternatively, and even less popularly, impose differentially higher taxes on incomes earned in their production.
2. Deciding who equals are and how they should be treated equally creates difficult conceptual problems for tax policy. Utility is the preferred criterion for implementing this principle, but its measurable surrogate, income, is most often used in practice.
3. These findings reinforce popular public opinion which contends that the public sector is currently "too large" and has expanded beyond what efficiency criteria would dictate.
4. Let the household budget constraint be expressed as $Y = \sum_i P_i X_i$ where Y denotes money income, all of which is spent on commodities $X_i$ whose purchase value is $P_i$. Clearly, a tax at rate t levied on money income is equivalent to an equal rate ad-valorem tax imposed on all items of consumption.
5. Generally, rates should be higher where there is a combination of small allocative effects and favorable distributional effects.
6. Whether this prescription for multiple tax bases involves an element of money illusion is discussed below.
7. This assumes that tax instruments can be designed to extract rents efficiently. Rent taxes lose their appeal if they distort economic decisions in their attempt to reach rents.

8. Savings represent purchases of future consumption and an income tax discourages these purchases by reducing the opportunity cost of current consumption.

9. On the other hand, the tax base for an expenditure tax is smaller than that of the income tax. If there was a wholesale rather than a partial replacement of the income tax by the expenditure tax, marginal tax rates would have to increase to maintain government revenues and thus the expenditure tax may be associated with larger labor market distortions than the income tax.

   If there is tax illusion with respect to the average indirect tax rate, a change in tax mix in favor of indirect taxes will raise real perceived incomes and excourage more, rather than less, consumption of leisure.

10. In a two-period example, $(1 - t_1)$ of current consumption exchanges for $(1 - t_2)\ (1 + i)$ of future consumption, if $t_1$, $t_2$ are expenditure tax rates in periods one and two, respectively, and i is the interest rate. Efficient intertemporal exchange requires that $t_1 = t_2$.

11. The average excess burden measures the efficiency gain of completely replacing a tax with a neutral, or non-distorting alternative as a fraction of the amount of tax revenue collected. Marginal excess burden, on the other hand, measures the additional inefficiency cost of raising another dollar of tax revenue from a particular revenue source. Generally, the average burden is approximately one-half the marginal burden.

12. See, for example, the Report of the Federal Sales Tax Review Committee, Ottawa, May 1983.

13. Carlson and McLure (1984) provide a lucid discussion of the difficulties of exempting exports under a retail sales tax.

14. Under flexible exchange rates there may be some off-setting adjustment in the exchange rate but never enough, since the tax applies differentially to various sectors, to completely undo the original tax-induced damage.

15. In an otherwise thorough study of how different features of the tax system influence the cost of capital, King and Fullerton (1984) ignore indirect taxes altogether.

16. However, this treatment of the manufacturers' sales tax implies nothing at all about the actual incidence of the tax, but rather refers only to the manner in which indirect taxes should enter the model.

17. In the original Ballentine-Thirsk study (1979) the emphasis was on various tax substitutions involving personal, corporate income and property taxes. Only in the inter-regional analysis of that study was any attention paid to sales taxation and that was restricted to the provincial level of application.

18. The National Accounts definitions of these outputs are the following:

    A: expenditures on food products and non-alcoholic beverages

    B: expenditures on gross paid and imputed rent and lodging

W: expenditures on construction, machinery and equipment

Z: expenditures on educational and cultural services, medical and hospital care services, restaurants and hotels, household and personal care services

C: expenditures on alcohol and tobacco, clothing and footwear, household furnishings and supplies, reading and recreation, travel and transportation.

19. In the 1980 National Accounts, personal direct taxes including CPP contributions were $42,503 million while indirect taxes, excluding property taxes and less subsidies, were $19,574 million. Personal transfers were valued at $30,847 million. Governments spent $59,405 million on current goods and services of which $39,374 million consisted of wages and salaries. Total consumption was listed at $170,179 million while investment income paid to nonresidents, less that received, was $8,112 million.

20. This is not the usual definition of saving since it includes saving done on behalf of households by corporations.

21. Factor substitution elasticities are invariably estimated for industries rather than outputs so the value-added coefficients of Table A-2 were used to obtain an elasticity defined over a final output.

22. The value of .2 for the land supply elasticity is a result obtained by Ballentine and Thirsk (1979). The labor supply elasticity is in the neighborhood of the values

chosen for this parameter in other applied general equilibrium models.

23. There is some empirical evidence, discussed in Ballentine and Thirsk (1979) that an elasticity value of about 3 may be appropriate for Canada.

24. A typical product price change equation in the model is of the form:

$$\hat{P}_x = \theta_{Kx} (\hat{P}_K - (1 \hat{-} t_c) - (1 \hat{-} t_K)) + \theta_{Hx} \hat{P}_N$$

where $\theta$ indicates a factor share, the $\hat{}$ symbol denotes percentage changes in a variable and the expression in brackets measures the change in the cost of capital. From the Kuo study, $\hat{P}_x$ attributable to the imposition of MST on purchases of capital goods can be ascertained, as shown in Table 8. Thus the equivalent change in the cost of capital is given by the ratio $\hat{P}_x/\theta_{Kx}$.

25. Housing, H, food, A, services, Z, and exports, E and F, are exempt from the MST.

26. It should be kept in mind that the model is only a linear approximation to a more general system of demand and supply equations and is ideally suited to consider the impact of "small" tax changes. As removal of the MST may not be considered to be a small tax change, there will be some unknown degree of imprecision in the simulation outcome resulting from this linearization.

27. It would require almost a 40 percent increase in corporate rates to completely replace the loss of MST revenue. It is extremely unlikely that the federal government would seriously contemplate moving corporate rates in such a large upward direction and escalating Canada's rate to a much higher level than the rest of the world. Even a twenty percent increase may be considered an upper limit for plausible adjustments in the tax instrument.

28. In the model real after-tax labor income is conventionally determined as $P_N (1 - t)/C.P.I.$ where C.P.I. is the consumer price index for labor incomes and t is the ratio of personal taxes to disposable income. The percentage change in real disposable income is $\hat{P}_N + (1 \hat{-} t) - \sum_j \alpha_j \hat{P}_j^*$. In the first experiment $(1 \hat{-} t)$ is approximately equal to $\sum_j \alpha_j \hat{P}_j^*$ so there is no appreciable change in real income and thus no significant change in total labor supply.

29. The MST yield is 1.73 percent of total disposable income. PIT, on the other hand, extracts 18.65 percent of total disposable income. Thus PIT would have to increase by 9.3 percent to replace any loss of MST revenue. The product of this required PIT increase and the share of personal taxes in disposable income by decile ($\theta_{TX}^i$) gives the values in the second column of Table 17.

30. However, recent tax reforms in the U.S., specifically the Economic Recovery Tax Act of 1981 (ERTA) and the Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA), have already significantly reduced the corporate tax burden on marginal investments so that a further reduction associated with the introduction of a VAT may have a relatively small impact on investment decisions.

# APPENDIX TABLES

Table A-1

Differential Equations of the General Equilibrium Model

(1) Demand-supply balance in sector A:

$$\theta_{KA}\hat{K}_A + \theta_{NA}\hat{N}_A + \theta_{LA}\hat{L}_A = \sum_{i=1}^{5} \varepsilon_{Ai}\hat{P}_i^* + \hat{J}_A$$

where the index i refers to the final consumer products, A, C, H, Z and M. Consumer price changes can be expressed as:

$$\hat{P}_A^* = \theta_{KA}(\hat{P}_K - (1\hat{-}t_C) - (1\hat{-}t_K)) + \theta_{NA}\hat{P}_N + \theta_{LA}(\hat{P}_L^A - (1\hat{-}t_L)) + (1\hat{+}t_S)$$

$$\hat{P}_C^* = \theta_{KC}(\hat{P}_K - (1\hat{-}t_C) - (1\hat{-}t_K)) + \theta_{NC}\hat{P}_N + (1\hat{+}t_S)$$

$$\hat{P}_H^* = \theta_{KH}(\hat{P}_K - (1\hat{-}t_C) - (1\hat{-}t_K)) + \theta_{NH}\hat{P}_N + \theta_{LH}(\hat{P}_L^H - (1\hat{-}t_L)) + (1\hat{+}t_S)$$

$$\hat{P}_Z^* = \theta_{KZ}(\hat{P}_K - (1\hat{-}t_C) - (1\hat{-}t_K)) + \theta_{NZ}\hat{P}_N$$

$$\hat{P}_M^* = \hat{P}_M + (1\hat{+}t_S) \text{ and}$$

$$\hat{P}_M = \hat{P}_F = \theta_{KF}(\hat{P}_K - (1\hat{-}t_C) - (1\hat{-}t_K)) + \theta_{KN}\hat{P}_N + \theta_{LF}(\hat{P}_L^A - (1\hat{-}t_L)) + (1\hat{+}t_S)$$

In each price change equation the tax rate changes are understood to be specific to the sector in question.

$$\hat{J}_A = h_A[\theta_K\hat{P}_K + \theta_{LH}\hat{P}_L^H + \theta_{LA}\hat{P}_L^A + \theta_N\hat{P}_N - \theta_{TX}\hat{TX} - \sum_{j=1}^{5}\alpha_j P_j^*]$$

Table A-1, cont.

(2) Demand-supply balance in sector Z:

$$\theta_{KZ}\,\hat{K}_Z + \theta_{NZ}\,\hat{N}_Z = \sum_{i=1}^{5} \varepsilon_{Zi}\,\hat{P}_i^{*} + \hat{J}_Z$$

(3) Demand-supply balance in sector C:

$$\theta_{KC}\,\hat{K}_C + \theta_{NC}\,\hat{N}_C = \sum_{i=1}^{5} \varepsilon_{Ci}\,\hat{P}_i^{*} + \hat{J}_C$$

(4) Demand-supply balance in sector H:

$$\theta_{KH}\,\hat{K}_H + \theta_{NH}\,\hat{N}_H + \theta_{LH}\,\hat{L}_H = \sum_{i-1}^{5} \varepsilon_{Hi}\,\hat{P}_i^{*} + \hat{J}_H$$

(5) Demand-supply balance in sector E:

$$\theta_{KE}\,\hat{K}_E + \theta_{NE}\,\hat{N}_E = \eta(\theta_{KE}\,(\hat{P}_K - (1 \hat{-} t_C) - (1 \hat{-} t_K)) + \theta_{NE}\,\hat{P}_N + (1 \hat{+} t_S) - \hat{e})$$

(6) Fixed-price export sector price equation:

$$\hat{e} = \hat{P}_F$$

(7) Import price equation:

$$\hat{e} = \hat{P}_M$$

Table A-1, cont.

(8) Factor demands in sector H:

$$\hat{K}_H - \hat{L}_H = \theta_{LH} (\sigma^H_{LK} - \sigma^H_{LL}) (\hat{P}^H_L - (1 \hat{-} t_L))$$
$$+ \theta_{KN} (\sigma^H_{KK} - \sigma^H_{KL}) (\hat{P}_K - (1 \hat{-} t_C) - (1 \hat{-} t_K))$$
$$+ \theta_{NH} (\sigma^H_{NK} - \sigma^H_{NL}) \hat{P}_N$$

(9) Factor demands in sector H:

$$\hat{K}_H - \hat{N}_H = \theta_{LH} (\sigma^H_{LK} - \sigma^H_{LN}) (\hat{P}^H_L - (1 \hat{-} t_L))$$
$$+ \theta_{KH} (\sigma^H_{KK} - \sigma^H_{KN}) (\hat{P}_K - (1 \hat{-} t_C) - (1 \hat{-} t_K))$$
$$+ \theta_{NH} (\sigma^H_{NK} - \sigma^H_{NN}) \hat{P}_N$$

(10) Factor demands in sector A:

$$\hat{K}_A - \hat{L}_A = \theta_{LA} (\sigma^A_{LK} - \sigma^A_{LL}) ( \hat{P}^A_L - (1 \hat{-} t_L) )$$
$$+ \theta_{KA} (\sigma^A_{KK} - \sigma^A_{KL}) ( \hat{P}_K - (1 \hat{-} t_C) - (1 \hat{-} t_K) )$$
$$+ \theta_{NA} (\sigma^A_{NK} - \sigma^A_{NL}) \hat{P}_N$$

(11) Factor demands in sector A:

$$\hat{K}_A - \hat{N}_A = \theta_{LA} (\sigma^A_{LK} - \sigma^A_{LN}) ( \hat{P}^A_L - (1 \hat{-} t_L) )$$
$$+ \theta_{KA} (\sigma^A_{KK} - \sigma^A_{KN}) ( \hat{P}_K - (1 \hat{-} t_C) - (1 \hat{-} t_K) )$$
$$+ \theta_{NA} (\sigma^A_{NK} - \sigma^A_{NN}) \hat{P}_N$$

Table A-1, cont.

(12) Factor demands in sector F:

$$\hat{K}_F - \hat{L}_F = \theta_{LF} (\sigma^F_{LK} - \sigma^F_{LL}) ( \hat{P}^A_L - (1 \hat{-} t_L) )$$
$$+ \theta_{KF} (\sigma^F_{KK} - \sigma^F_{KL}) ( \hat{P}_K - (1 \hat{-} t_c) - (1 \hat{-} t_K) )$$
$$+ \theta_{NF} (\sigma^F_{NK} - \sigma^F_{NL}) \hat{P}_N$$

(13) Factor demands in sector F:

$$\hat{K}_F - \hat{N}_F = \theta_{LF} (\sigma^F_{LK} - \sigma^F_{LN}) ( \hat{P}^A_L - (1 \hat{-} t_L) )$$
$$+ \theta_{KF} (\sigma^F_{KK} - \sigma^F_{KN}) ( \hat{P}_K - (1 \hat{-} t_c) - (1 \hat{-} t_K) )$$
$$+ \theta_{NF} (\sigma^F_{NK} - \sigma^F_{NN}) \hat{P}_N$$

(14) Factor demands in sector C:

$$\hat{K}_C - \hat{N}_C = \sigma^C [\hat{P}_K - (1 \hat{-} t_c) - (1 \hat{-} t_K) - \hat{P}_N]$$

(15) Factor demands in sector E:

$$\hat{K}_E - \hat{N}_E = \sigma^E (\hat{P}_K - (1 \hat{-} t_c) - (1 \hat{-} t_K) - \hat{P}_N)$$

(16) Factor demands in sector Z:

$$\hat{K}_Z - \hat{N}_Z = \sigma^Z (\hat{P}_K - (1 \hat{-} t_c) - (1 \hat{-} t_K) - \hat{P}_N)$$

Table A-1, cont.

(17) Supply of land to housing:

$$\hat{L}_H - (L_F / L_F + L_A)\,\hat{L}_F - (L_A / L_F + L_A)\,\hat{L}_A = \gamma_L\,(\hat{P}_L^H - \hat{P}_L^A)$$

(18) (a) Supply of capital to the economy (model 1)

$$\sum_{i=1}^{6} K_i \hat{K}_i = \gamma_K\,(\hat{P}_K - (1 \hat{-} t_C)) \text{ where } (1 \hat{-} t_C) \text{ is the}$$

change in the corporate tax rate in sector C.

(b) Supply of capital to the economy (model 3)

$$\sum_{i=1}^{6} K_i \hat{K}_i = \gamma_K\,(\hat{P}_K)$$

(19) (a) Supply of labor to the economy (models 1 and 3)

$$\sum_{i=1}^{6} N_i \hat{N}_i = 0$$

(b) Supply of labor to the economy (model 2)

$$\sum_{i=1}^{6} N_i \hat{N}_i = \gamma_N\,(\hat{P}_N + (1 \hat{-} TX/DY) - \sum_{i=1}^{5} \alpha_i \hat{P}_i) \text{ where DY}$$

is disposable income

(20) Supply of land to the economy:

$$\sum_{i=1}^{3} L_i \hat{L}_i = 0$$

(21) Numeraire

$$\hat{P}_N = 0$$

Table A-2

Value-added Coefficients per Dollar of Expenditures on Final Output

| Industry | A | C | H | Z | W | F | E |
|---|---|---|---|---|---|---|---|
| Agriculture | 0.2290 | 0.0185 | 0.0006 | 0.0522 | 0.0024 | 0.2934 | 0.0197 |
| Forestry | 0.0019 | 0.0051 | 0.0013 | 0.0040 | 0.0046 | 0.0163 | 0.0263 |
| Mining | 0.0215 | 0.0162 | 0.0060 | 0.0126 | 0.0573 | 0.1392 | 0.2110 |
| Manufacturing | 0.3076 | 0.3770 | 0.0360 | 0.0841 | 0.2551 | 0.2647 | 0.3882 |
| Construction | 0.0088 | 0.0064 | 0.0620 | 0.0063 | 0.3629 | 0.0117 | 0.0109 |
| Transport, Communications, Utilities | 0.0930 | 0.1001 | 0.0350 | 0.0598 | 0.0708 | 0.1042 | 0.1365 |
| Wholesale Trade | 0.0686 | 0.0679 | 0.0110 | 0.0240 | 0.0869 | 0.0491 | 0.0594 |
| Retail Trade | 0.1935 | 0.2639 | 0.0060 | 0.0369 | 0.0187 | 0.0141 | 0.0137 |
| Owner Occupied Dwelling | 0.0 | 0.0 | 0.5740 | 0.0 | 0.0 | 0.0 | 0.0 |
| Finance, Insurance, Real Estate | 0.0475 | 0.0493 | 0.2342 | 0.0486 | 0.0888 | 0.0725 | 0.0861 |
| Services | 0.0288 | 0.0956 | 0.0350 | 0.6716 | 0.0525 | 0.0347 | 0.0484 |
| Total | 1.0002 | 1.0000 | 1.0010 | 1.0001 | 1.0000 | 0.9999 | 1.0002 |

Note: Numbers may not add exactly to 1.000 due to rounding.

Source: Statistics Canada 1980 Input-Output Model Small Space Special Tabulation.

Table A-3

Effective Property and Corporate Income Tax Rates by Industry

| Industry | Net Capital Income | Property Taxes (millions) | Corporate Income Taxes (millions) | Property Tax Rate (percent) | Corporate Income Tax Rate (percent) |
|---|---|---|---|---|---|
| Agriculture | 5,407 | 604 | 74 | 7.0 | 1.4 |
| Forestry | 386 | 63 | 49 | 16.0 | 0.13 |
| Mining | 8,950 | 778 | 1,910 | 8.7 | 21.0 |
| Manufacturing | 9,245 | 1,132 | 4,272 | 12.2 | 46.0 |
| Construction | 4,224 | 285 | 399 | 6.7 | 9.0 |
| Owner-Occupied Dwellings | 10,386 | 4,420 | -- | 42.6 | -- |
| Transport, Communications, Utilities | 4,223 | 817 | 689 | 19.3 | 16.0 |
| Wholesale Trade | 2,273 | 256 | 1,119 | 11.3 | 49.0 |
| Retail Trade | 3,063 | 509 | 680 | 16.6 | 22.0 |
| Finance, Insurance, Real Estate | 10,925 | 3,604 | 1,414 | 33.0 | 13.0 |
| Services | 5,284 | 498 | 779 | 9.4 | 15.0 |
| Total | 64,366 | 12,966 | 11,385 | -- | -- |

Table A-3, continued

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Sources:

(1) Net Capital Income is obtained from the 1980 Input-Output Special Tabulation as the difference between GDP, adjusted to include property taxes, labor income and depreciation. From Ballentine and Thirsk (1979), the labor income in agriculture was adjusted on the assumption of a true labor share of 40 percent.

(2) Property taxes originate from the 1980 Input-Output Special Tabulation provided by the Input-Output Division of Statistics Canada.

(3) Corporate Income taxes are those actually paid and are from Statistics Canada, Corporation Financial Statistics, 61-208, 1980.

Table A-4

Income Shares and Effective Tax Rates for Final Commodities

| Income Share of: | Commodity | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | A | C | H | Z | W | F | E | C + W |
| Labor | .613 | .681 | .255 | .703 | .706 | .546 | .599 | .69 |
| Gross Capital | .387 | .319 | .745 | .297 | .294 | .454 | .401 | .31 |
| Depreciation | .089 | .102 | .225 | .076 | .083 | .094 | .125 | .093 |
| Net Capital | .298 | .217 | .520 | .221 | .211 | .360 | .276 | .217 |
| Land | .069 | .003 | .215 | .016 | -- | .090 | .006 | -- |
| Reproducible Capital | .229 | .214 | .305 | .205 | .179 | .320 | .237 | .217 |
| Corporate Tax Rate | .148 | .270 | .045 | .160 | .210 | .245 | .339 | .243 |
| Property Tax Rate | .161 | .189 | .379 | .181 | .190 | .150 | .170 | .176 |
| Total Capital Tax Rate | .309 | .459 | .424 | .341 | .400 | .395 | .509 | .419 |

Source: Tables A-2 and A-3.

Table A-5

Factor Incomes and Tax Payments by Final Commodity

| | Commodity | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | A | C | H | Z | W | F | E | C + W | Total |
| Net Spending | 19,271 | 45,353 | 26,077 | 23,735 | 38,613 | 12,191 | 48,765 | 83,966 | 214,005 |
| Labor Income | 11,813 | 30,885 | 6,728 | 16,686 | 27,261 | 6,156 | 29,210 | 58,146 | 129,239 |
| Gross Capital Income | 7,458 | 14,468 | 19,349 | 7,049 | 11,352 | 5,535 | 19,555 | 25,820 | 84,766 |
| Depreciation | 1,715 | 4,626 | 5,874 | 1,804 | 3,205 | 1,146 | 6,096 | 7,831 | 24,466 |
| Net Capital Income | 5,743 | 9,842 | 13,475 | 5,245 | 8,147 | 4,389 | 13,459 | 17,989 | 60,300 |
| Land Income | 1,330 | -- | 5,314 | -- | -- | 1,097 | -- | -- | 7,741 |
| Reproducible Capital Income | 4,413 | 9,842 | 8,163 | 5,245 | 8,147 | 3,292 | 13,459 | 17,989 | 52,559 |
| Corporate Income Tax | 850 | 2,657 | 606 | 839 | 1,711 | 1,075 | 4,563 | 4,368 | 12,301 |
| Property Tax on: | | | | | | | | | |
| Land | 200 | -- | 2,018 | -- | -- | 153 | -- | -- | 2,371 |
| Capital | 661 | 1,730 | 3,085 | 883 | 1,440 | 459 | 2,129 | 3,170 | 10,387 |
| Total Capital Taxes | 1,711 | 4,387 | 5,709 | 1,722 | 3,151 | 1,687 | 6,692 | 7,538 | 25,059 |
| After-Tax Capital Income | 2,902 | 5,455 | 4,470 | 3,523 | 4,888 | 1,758 | 6,767 | 10,451 | 29,763 |
| After-Tax Land Income | 1,130 | -- | 3,296 | -- | -- | 944 | -- | -- | 5,370 |

Source: Table A-2 and Table A-4

Table A-6

Budget Shares by Income Class

| Income Group | Commodity | | | | | |
|---|---|---|---|---|---|---|
| | Food | Corporate Good | Housing | Commercial Services | Imports | Total |
| Lowest - 8500 | .262 | .236 | .257 | .087 | .158 | 1.000 |
| 8501 - 12700 | .245 | .296 | .209 | .088 | .161 | 0.999 |
| 12701 - 17300 | .216 | .342 | .181 | .092 | .168 | 0.999 |
| 17301 - 22300 | .204 | .352 | .176 | .096 | .173 | 1.001 |
| 22301 - 26800 | .197 | .370 | .162 | .093 | .178 | 1.000 |
| 26801 - 31000 | .196 | .362 | .165 | .093 | .184 | 1.000 |
| 31001 - 36000 | .191 | .368 | .160 | .094 | .186 | 0.999 |
| 36001 - 42000 | .181 | .380 | .155 | .095 | .189 | 1.000 |
| 42001 - 50000 | .180 | .376 | .150 | .100 | .194 | 1.000 |
| 50001 - Richest | .162 | .390 | .137 | .105 | .207 | 1.001 |
| Average | .190 | .364 | .162 | .097 | .187 | 1.000 |

Source: Family Expenditure Data 1982.

Shares may not sum to 1 due to rounding.

Table A-7

Distributive Series Used to Allocate Incomes and Personal Taxes

| Income Class | Labor Income | Capital Income | Personal Income Taxes | Transfer Payments | Total Consumption | Number of Families |
|---|---|---|---|---|---|---|
| Under $8500 | .003 | .020 | .002 | .143 | .033 | 0.10 |
| 8501 - 12700 | .014 | .023 | .011 | .175 | .052 | 0.10 |
| 12701 - 17300 | .034 | .043 | .024 | .144 | .066 | 0.10 |
| 17301 - 22300 | .060 | .046 | .043 | .110 | .080 | 0.10 |
| 22301 - 26800 | .083 | .047 | .075 | .093 | .094 | 0.10 |
| 26801 - 31000 | .107 | .075 | .100 | .073 | .104 | 0.10 |
| 31001 - 36000 | .126 | .100 | .115 | .074 | .117 | 0.10 |
| 36001 - 42000 | .147 | .130 | .140 | .071 | .130 | 0.10 |
| 42001 - 50000 | .176 | .156 | .170 | .063 | .144 | 0.10 |
| Over 50000 | .250 | .360 | .320 | .053 | .181 | 0.10 |
| All Classes | 1.000 | 1.000 | 1.000 | .999 | 1.001 | 1.000 |

Source: Statistics Canada: Consumer Income and Expenditure Division Family Expenditure Tape, Survey of Family Expenditures in 1982.

The capital income series is from Ballentine and Thirsk (1979).

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