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The Marginal Cost of Public Funds in Closed and Small Open Economies

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Abstract

The efficiency cost of taxation has become an increasingly important consideration in the evaluation of alternative tax policy options. This paper provides a review of estimates of the efficiency costs of taxation and presents some new estimates for small open economies. The available studies suggest that, in closed economies, the distortions from taxation are highest for corporate taxes and lowest for wage taxes. This efficiency ranking of different taxes does not hold in small open economies. It is shown that, in a small open economy, this ranking is reversed. Personal income taxes are less distortionary than wage taxes primarily because the link between domestic saving and investment is severed. Corporate taxes are also less distortionary for a variety of factors, such as changes in depreciation levels, payments to foreigners and terms of trade.

JEL classification: H2.

I. INTRODUCTION

Taxes are compulsory payments to government which are generally used to finance transfer payments or to pay for the purchase of goods and services. When tax revenue is spent on transfer payments, there is no shift of resources from the private to the public sector, but simply a redistribution of spending power among individuals and families which may result in higher, lower or unchanged aggregate demand. When tax revenue is used to pay for the purchase of goods and services, resources are shifted from the private to the public sector and some private spending is replaced by public spending. In either case,

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however, there is the possibility that the coercive nature of taxation may produce behavioural responses that affect society's welfare.

Let us consider the case where the government has the choice of raising $1 of revenue through either a lump-sum tax or a proportional tax on wages. Under the first option, the taxpayers transfer $1 to the government but there is no change in the relative price of work vs. leisure or current consumption vs. saving which would generate substitution effects, although there may be income effects depending on the use of the tax revenue. When a tax does not induce behavioural responses, the cost to society of raising $1 of revenue is exactly $1. In the second option, taxpayers experience a reduction in net labour compensation. The tax makes work less attractive than leisure at the margin, because leisure has remained untaxed, and taxpayers have an incentive to acquire more leisure, thus reducing their labour supply. This effort at avoiding the tax burden by reallocating the use of time from taxable work to non-taxable leisure results in less employment, output and income. The net loss of economic welfare to society from this tax-induced distortion in the work–leisure choice is called the dead-weight loss (or excess burden) of taxation.

The measurement of the dead-weight loss can be applied to the total burden of a tax or to the tax system as a whole. It may also be confined to increases in the rate of taxation, for a given tax or for a variety of taxes individually or in combination. In the case of marginal increases in rates of taxation, the welfare costs to society are estimated by a measure commonly known as the marginal cost of public funds (MCPF). If raising an additional dollar of tax revenue does not change the existing level of the dead-weight loss of taxation, then its cost to society is $1 (the amount of tax paid) and the MCPF is 1. If the tax increase raises the dead-weight loss of taxation by increasing distortions in the allocation of resources, it will cost society more than $1 to transfer a dollar's worth of resources from the private to the public sector and the MCPF is greater than 1. For example, an MCPF of 1.2 indicates that an additional dollar of tax revenue (not considering the benefits from the spending of these funds) generates a cost to society of $1.20 — $1 from the tax payment and 20 cents from the loss of output and utility produced by the tax-induced distortions of private agents' choices.

MCPF calculations have been used for a variety of purposes. First, MCPF estimates have been used as a metric for comparing different taxes on efficiency grounds. For example, if the government has decided to raise revenue and has the choice of two different taxes, one with an MCPF of 1.2 and the other with an MCPF of 1.3, efficiency considerations alone would dictate the selection of the first tax. The MCPF has also been used in the evaluation of the economic viability of government spending programmes. If a government programme can be financed through a lump-sum tax, then the spending of an extra dollar can be justified as long as it generates a dollar's worth of benefits. However, if the MCPF is 1.2, then the spending programme can be justified only if it generates

1.2 dollars' worth of benefits for each dollar spent. Finally, the MCPF may help define the dimensions of the equity–efficiency trade-off that is usually associated with progressive taxation. Since the MCPF for a given tax increases as average and marginal tax rates rise, higher income redistribution through more progressive taxation would be paid for in increasing efficiency costs.

Given the potentially important role that MCPF calculations can play in tax policy analysis, estimates of the value of the MCPF should be sufficiently accurate to provide a reliable guide to tax policy. A review of various estimates of the MCPF found in the literature, complemented by some additional estimates by the author, is contained in this paper. The paper has two main objectives. First, it compares MCPF estimates for closed economies to determine whether there are large differences in the estimated values for different taxes and to identify the methodological factors that may explain these differences. Results for closed economies need not be relevant to tax policy in small open economies such as Canada's. To shed some light on this issue, the paper also presents new estimates of MCPF for three tax policy changes derived through the use of a static computable general equilibrium (CGE) model which portrays Canada as a small open economy. These estimates serve the second objective of determining whether levels of MCPF for given tax changes differ between closed and small open economies and whether the shift from closed- to open-economy assumptions affects the ranking order of different taxes in terms of their potential distortionary effects. A comparison of the results shows that using MCPF estimates for a closed economy to guide tax policy in a small open economy may lead to inefficient tax structures.

II. APPROACHES TO THE ESTIMATION OF THE MCPF

Studies that measure the MCPF of various tax changes differ both with respect to their use for policy analysis and to the methodology employed for their estimation. The first difference determines whether MCPF estimates are used for cost–benefit analysis of public expenditures or to provide efficiency comparisons of different taxes. The second difference identifies whether the MCPF estimates were derived by using partial equilibrium or general equilibrium models.

1. Balanced-Budget versus Differential Analysis

This terminology was originally suggested by Musgrave (1959) to distinguish different approaches to the measurement of tax incidence. It has been extended to the concept of MCPF (see, for example, Ballard (1990)) in order to clarify the interpretation of different MCPF estimates. In its pure form, the 'differential' approach to the measurement of the MCPF involves an experiment where 'the effects of a distortionary tax are compared with the effects of a lump-sum tax that raises the same revenue' (Ballard, 1990, p. 263). This type of experiment

compares the dead-weight loss of financing the same level of expenditures through different taxes. In this case, as pointed out by Ballard (1990), since there is no shift of resources from the private to the public sector, the only possible difference between a distortionary tax and a lump-sum tax is that the former generates substitution effects and the latter does not. A shift from a lump-sum tax to a distortionary tax on wages, for example, eliminates the income effect of a change in after-tax real wages so that the choice between work and leisure is determined exclusively by the substitution effect. Therefore the relevant labour supply elasticity is the compensated elasticity and the value of the MCPF measures the distortionary effect of a given tax.

As pointed out by Stuart (1984, p. 352),

> 'lump-sum taxation is not the alternative foregone in raising an additional dollar of tax revenue. To calculate the welfare cost of raising an additional dollar of revenue, one wishes to compare changes in utility and revenue as the economy moves from one equilibrium before a tax increase to one after the increase'.

This is a 'balanced-budget' experiment. Unlike differential analysis, where both tax revenue and government spending are held constant when a lump-sum tax is replaced by a distortionary tax, 'in a balanced-budget analysis, the spending level is changed, and the level of distortionary taxation is changed accordingly' (Ballard, 1990, p. 263). In this case, the measurement and interpretation of the MCPF depends on the use of the additional revenue.

If the additional revenue is spent on lump-sum transfers, the resulting MCPF may be viewed as the result of a differential experiment. Although neither government revenues nor government expenditures remain constant, taxpayers on the aggregate are compensated in cash for the taxes paid. This eliminates the income effect of the tax increase and leaves only a substitution effect. The two differential experiments are not identical because, in one case, there is a balanced budget at existing levels of spending and taxation while, in the other case, the balanced budget is associated with a higher level of both. As pointed out by Thirsk and Moore (1991), in the second case, 'households are not restored to their original level of utility'; therefore 'their welfare loss reduces their real income and induces them to work more. This extra work effort leads to an increase in revenue and hence necessarily produces a lower estimate of welfare cost than [the first case]' (p. 560). None the less, either differential approach to the calculation of the MCPF is suitable for comparing the efficiency effects of different taxes. Since, in either case, the comparison is between an extra dollar from a distortionary tax and an extra dollar either raised through a lump-sum tax or spent on a lump-sum transfer, the estimated MCPF values serve as an indication of the relative efficiency losses from the economic distortions associated with different taxes.

When the additional revenue raised through distortionary taxation is spent on the purchase of goods and services, there is a shift of resources from the private to the public sector, rather than simply a reallocation of private incomes and expenditures as in the case when the additional revenue is redistributed in the form of lump-sum transfers. Taxpayers are not compensated with direct transfers for the loss of income from taxation; instead, the government spends the extra tax revenue on exhaustive expenditures which have no effect on private utility and the labour supply. In this case, as pointed out by Ballard (1990, p. 263), 'income effects are important, and efficiency calculations depend chiefly on uncompensated elasticities'. This is the MCPF calculation that is most suitable for the cost–benefit analysis of government exhaustive expenditures. It suggests that a government project with a given expected benefit should be financed with revenue from a tax with the lowest uncompensated labour supply elasticity, other things being equal.

As shown by Stuart (1984), the estimated MCPF for a given tax change is higher when the revenue is redistributed to taxpayers than when it is spent on government purchases that do not affect private utility. Returning the additional tax revenue to taxpayers through lump-sum transfers

> 'induces an income effect that increases the tendency for labour to leave the taxed sector when tax rates rise. This makes tax revenue increase less rapidly than would be the case if public spending were directed towards government consumption. The net effect is ... to make the change in excess burden per dollar of additional revenue greater' (p. 359).

This result implies that using MCPF values estimated from differential analysis in cost–benefit calculations may lead to a suboptimal provision of exhaustive government expenditures because it overstates the marginal social benefit that a public project must generate in order to match the marginal social cost of financing it.

2. Type of Model Used

The earlier studies of the MCPF used partial equilibrium analysis, applied primarily to a wage tax. The starting-point was Harberger's (1964) formula for the average excess burden of taxation transformed into its marginal counterpart (Browning, 1976 and 1987). These models have the virtue of providing a direct and visible link between the value of key parameters and the estimated MCPF values. As pointed out by Browning (1987, p. 11), 'One of the virtues of the partial-equilibrium approach is that it clarifies the contribution these key parameters make to the final estimate, something that is often obscured in large-scale general equilibrium models'. This directness in the cause and effect link in partial equilibrium models is acquired at the price of missing important

interactions, obscure as they may appear. According to Stuart (1984), Browning's extension of Harberger's formula to calculate the MCPF may not be appropriate, for a variety of reasons. First, Harberger's formula applies strictly around an undistorted equilibrium in the case of an economy operating with a linear production frontier. Second, this formula and its extension are suitable primarily for measuring the efficiency cost of not using lump-sum taxation. Third, it does not allow differentiation of the effects of different uses of the additional revenue. As shown in the survey of selected studies presented in Section III, economists continue to use both partial equilibrium and general equilibrium analysis to estimate MCPF values. The former approach is generally confined to the analysis of the efficiency effects of changes in a single tax, while the latter is used to compare a variety of tax changes.

III. MCPF ESTIMATES: PARTIAL EQUILIBRIUM AND GENERAL EQUILIBRIUM FOR CLOSED ECONOMIES

Marginal cost estimates have been derived with either differential or balanced-budget experiments and through partial equilibrium or general equilibrium analysis. A selected number of studies encompassing all the above categories are briefly reviewed in this section. In order to facilitate the comparison, studies using differential experiments are identified by the label (D) and those involving balanced-budget experiments are identified by the label (BB).

1. Partial Equilibrium Models

Browning, 1976 (D)

Although the notion that evaluating the benefits of government expenditures should recognise the welfare costs of raising the necessary tax revenue is not new (see, for example, Pigou (1947), Buchanan and Tullock (1965), Vickrey (1963) and Musgrave (1969)), a formal analysis of the marginal cost of public funds was initially developed by Browning (1976). For his initial estimates of the MCPF from raising wage taxes in the US, Browning assumed a competitive private sector and a government that raised revenue through a tax on labour income in order to provide lump-sum transfers. This approach involves a differential experiment; therefore Browning appropriately used the compensated labour supply elasticity to which he assigned a value of 0.2. He estimated the MCPF by using Harberger's (1964) formula for the welfare cost of labour taxation for an individual worker. Browning included five taxes that affect the work–leisure choice: the wage tax component of the personal income tax, social security payroll taxes, state and local sales taxes, state and local income taxes, and excise taxes. The combination of these taxes resulted in a schedule of effective marginal tax rates on labour income ranging from 34 per cent for the lowest income tax bracket to 56 per cent for the top bracket, with an average of

about 43 per cent. Browning performed three policy experiments. In the first, he added a proportional tax on wages to the existing combination of taxes on wages which, because of the labour income component of the personal income tax, has a progressive structure. In the second experiment, he added a degressive tax in the following manner: 'to estimate the marginal welfare cost for a degressive tax that is added to the present system, it will be assumed that a certain amount of labour income is exempt from taxation' (p. 295). In the final experiment, he added a wage tax with a progressive rate structure that left each taxpayer's share of the total tax liability unchanged. He calculated the marginal welfare cost of the various tax changes for the taxpayers in each of 27 tax brackets, but used a single compensated labour supply elasticity for all workers. For the proportional tax increase, Browning found a marginal welfare cost of 8.3 per cent of the revenue collected and assumed a marginal cost of administration and compliance of 0.7 per cent for a total MCPF of 1.09. For the degressive tax increase, he found a marginal welfare cost of 13.4 per cent and an MCPF of 1.14. For the progressive rate structure, he estimated an MCPF of 1.16.

Browning, 1987 (D, BB)

In this paper, Browning provides updated estimates of the MCPF for an increase in wage taxes in the US derived by making a number of adjustments to the original methodology. First, Browning corrected what he considered to be an error in his original formulation. He points out that Harberger's formula is based on values of compensated elasticities and labour earnings that are not distorted by taxation. Since the actual observed values are distorted by taxes, an adjustment is necessary to apply the formula correctly. Browning shows that the adjusted values of the MCPF can be derived by dividing the original estimates by $(1 - m)$, where m is the average marginal tax rate on labour income. Second, he uses a range of compensated elasticity values between 0.2 and 0.4, rather than the single value of 0.2. Third, he uses the average marginal tax rate for all workers rather than the group-specific marginal tax rates. Finally, he performs simulations with three values of the average marginal tax rate of 38 per cent, 43 per cent and 48 per cent. Browning repeats the three tax experiments performed in the original paper, but makes a distinction with respect to the use of the tax revenue. In one set of experiments, he assumes that the additional revenue is spent on marginal government spending that returns taxpayers to their initial utility levels. In the other experiment, the additional government spending is assumed to provide no benefits to taxpayers. Following Ballard (1990), one may argue that the first case represents a differential experiment because government spending is equivalent to a lump-sum transfer, while the second case represents a balanced-budget experiment because taxpayers do not receive direct compensation for the tax paid. However, Browning uses compensated elasticities

TABLE 1

MCPF for Selected Tax Changes:
Summary Results for Partial Equilibrium and General Equilibrium for Closed Economies

	Taxes on labour income			Personal income tax	Taxes on capital		
	At industry level	*Proportional increase*	*Progressive increase*		*At industry level*	*Corporate income taxes*	*Corporate and non-corporate income taxes*
Partial equilibrium							
Browning, 1976							
D		1.09	1.16				
Browning, 1987							
D		1.18–1.30	1.27–1.47				
BB		1.15–1.23	1.21–1.32				
Thirsk and Moore, 1991							
D		1.22–1.37	1.42–1.81				
BB		1.18–1.27	1.30–1.45				
Dahlby, 1994							
BB			1.09–1.38				
General equilibrium							
Stuart, 1984							
D		1.21–1.57					
BB		1.07–1.43					
Ballard, Shoven and Whalley, 1985							
BB	1.12–1.23			1.16–1.31	1.18–1.46		
Fullerton and Henderson, 1989							
BB	1.06–1.17			1.14–1.25		1.26–1.31	1.25

in both cases, a procedure that, according to Ballard (1990), is suitable only for differential experiments. Therefore the results for the balanced-budget experiment may be biased because they are calculated using compensated rather than uncompensated elasticities.

Browning's adjusted results suggest that the MCPF is substantially higher than in the initial estimates. In the differential experiment, for the same compensated elasticity (0.2) and an average marginal tax rate (43 per cent), the MCPF increases from 1.09 to 1.18 for the proportional tax increase and from 1.16 to 1.27 for the progressive tax increase. The corresponding MCPF values for an elasticity of 0.3 — the value preferred by Browning — are 1.30 and 1.47. Consistent with Stuart's (1984) analysis, the MCPF values estimated by Browning under the balanced-budget approach are lower than the corresponding values derived from the differential approach. With an elasticity of 0.2, the MCPF is 1.15 for a proportional tax increase and 1.21 for a progressive tax increase. For an elasticity of 0.3, the corresponding MCPF values are 1.23 and 1.32.

Thirsk and Moore, 1991 (D, BB)

These authors effectively repeat Browning's (1987) experiments for Canada. In their calculations, wage taxes include the wage component of the personal income tax (federal and provincial), unemployment insurance contributions and commodity taxes (federal and provincial). They estimate the overall effective marginal tax rates on labour income to range between 27 per cent for the bottom income tax bracket and 59 per cent for the top bracket, with an average of about 47 per cent. As in Browning (1976), they assume that all workers have the same compensated labour supply elasticity and calculate the MCPF for all workers by aggregating the marginal welfare cost of a tax increase for the taxpayers in each tax bracket. Their results show that the estimated value of the MCPF depends on the values of the compensated labour supply elasticity, on the progressivity of the tax rate structure and on the benefits from government spending. When government spending is equal to cash transfers (a differential experiment), a proportional increase in a wage tax has an MCPF of 1.22 for a compensated elasticity of 0.2 and 1.37 for an elasticity of 0.3. The corresponding values for an increase in a progressive rate structure are 1.42 and 1.81. When government spending yields no utility to taxpayers (a balanced-budget experiment), the MCPF for a proportional wage tax increase is 1.18 for an elasticity of 0.2 and 1.27 for an elasticity of 0.3. The corresponding values for the progressive rate increase are 1.30 and 1.45. The MCPF estimates obtained by Thirsk and Moore for Canada are generally larger than those derived by Browning (1987) because both the average tax rate and the degree of progressivity of labour taxes in their calculations are higher than in Browning's. However, the range of MCPF values

preferred by Thirsk and Moore out of all their simulations is 1.30 to 1.43, very similar to the preferred range of 1.32 to 1.47 in Browning (1987).

Dahlby, 1994 (BB)

Dahlby also calculates the MCPF from taxing labour income in Canada but, unlike Thirsk and Moore, he bases his calculations on the uncompensated labour supply elasticity. His results can be interpreted as representing a balanced-budget experiment. Dahlby assumes that all workers have the same labour supply elasticity. In his base case, the uncompensated labour supply elasticity is 0.1 and the income effect is 0.2, but he also calculates MCPF values for uncompensated labour supply elasticities of 0 and 0.2. Dahlby includes in tax on labour the wage component of personal income taxes, contributions to unemployment insurance and to the Canada Pension Plan, sales taxes, and provincial payroll taxes and healthcare levies. The effective marginal tax rates, and the corresponding marginal welfare costs of tax increases, are calculated for a single taxpayer in each tax bracket who receives only employment income. The MCPF values are then obtained through aggregation. Dahlby finds that raising the federal basic personal income tax rates (an increase in a progressive labour tax) produces an MCPF of 1.09 for an uncompensated labour supply elasticity of 0 and an MCPF of 1.38 for an uncompensated labour supply elasticity of 0.1 (and associated compensated elasticity of 0.3). The MCPF value estimated by Dahlby falls between the values for similar balanced-budget experiments derived by Browning (1987) and Thirsk and Moore (1991) using compensated labour supply elasticities of 0.3.

2. General Equilibrium Models

Stuart, 1984 (D, BB)

Stuart uses a two-sector model of the US economy which involves a representative agent who maximises a Stone–Geary generalised utility function and allocates a fixed amount of labour time between a taxed and an untaxed sector. Each sector has a fixed and immobile stock of capital, and output is produced through variable labour supply using Cobb–Douglas production functions. The government maintains a balanced budget and spends the additional revenue from an increase in tax rates either on lump-sum transfers or on government consumption which does not affect the labour supply and the marginal rate of substitution between the outputs of the two sectors. Therefore Stuart performs both a differential and a balanced-budget exercise. Only taxes on wages are included in the estimation. These include the wage component of personal income taxes, payroll taxes, consumption taxes and the ‘tax effect of income-indexed transfers’. He uses the weighted average of marginal tax rates for the different tax brackets, where the weights are the shares of income in each

bracket. The estimated average and average marginal tax rates are 27.3 per cent and 42.7 per cent, respectively. The compensated and uncompensated elasticities are 0.2 and 0, respectively.

Stuart finds that raising the marginal tax rate by one percentage point and returning the revenue as a lump-sum transfer (the bench-mark case) produces an MCPF of 1.21, very similar to the value of 1.18 obtained by Browning (1987). The MCPF is much lower when the additional revenue is spent on government consumption, having a value of only 1.07, considerably lower than the value of 1.15 obtained by Browning (1987). Stuart also finds that the value of the MCPF is very sensitive to the labour supply elasticities. Repeating the exercise by using an uncompensated elasticity of 0.318 and a compensated elasticity of 0.518, he found that the MCPF for the increase in wage taxes is 1.57 when the revenue is used to finance lump-sum tax transfers and 1.43 when the revenue is used for government consumption.

Ballard, Shoven and Whalley (BSW), 1985 (BB)

These authors use a dynamic general equilibrium model of the US economy to measure the MCPF for increases in a variety of taxes. Their model contains 19 producer-good industries that combine labour and capital in a CES production function. Each producer good is used for investment, exports and government purchases. Consumers allocate their expenditures among 15 different goods, derived from a fixed transformation from producer goods, according to a nested CES utility function. There are 12 consumer groups, according to their level of money income, but only one type of labour. The BSW model can account for temporal decisions between work and leisure as well as intertemporal decisions between present and future consumption by making saving in a given period dependent on the future return on saving under the assumption of myopic expectations. They use, alternatively, values of the uncompensated labour supply elasticity of 0 and 0.15 (associated with compensated elasticities of approximately 0.2 and 0.35) and saving elasticities of 0 and 0.4. The government collects revenue from taxes on labour income, capital income and consumption and spends the revenue by purchasing producer goods, making transfer payments and subsidising government enterprises.

For taxes on labour income and on capital income, both at the industry level, and personal income taxes, BSW estimated the MCPF by raising the marginal tax rates by one percentage point and using the additional revenue to finance exhaustive expenditures that do not enter a household's utility function. Therefore, as they explicitly point out, BSW perform a balanced-budget experiment. Their results show that an increase in wage taxes at the industry level, which generally have a proportional rate structure, produces an MCPF in the range 1.12 to 1.23, depending on whether the uncompensated labour supply elasticity is 0 or 0.15. The saving elasticity has no noticeable effects on the

MCPF in this experiment. The MCPF values derived by BSW are very similar to Browning's (1987) balanced-budget estimates with nearly identical labour supply elasticities. Personal income tax increases have a higher MCPF than labour taxes — a range of 1.16 to 1.31 — primarily because they have a progressive rate structure. This range of MCPF for personal income tax increases is very similar to the range for a progressive rate increase in labour taxes found by Browning (1987) in his balanced-budget experiment. In BSW's experiment, MCPF values for personal income tax increases are more sensitive to changes in labour supply elasticities than to changes in saving elasticities. With a saving elasticity of 0, an increase in the uncompensated labour elasticity from 0 to 0.15 raises the MCPF from 1.16 to 1.28. However, increasing the saving elasticity from 0 to 0.4, keeping the labour supply elasticity at 0, raises the MCPF from 1.16 to 1.18. The largest MCPF values were derived for capital taxes at the industry level, with a range of 1.18 to 1.46. In this case, the estimated values are more sensitive to the saving elasticity than to the labour supply elasticity. With a labour supply elasticity of 0, an increase in the saving elasticity from 0 to 0.4 raises the MCPF from 1.18 to 1.38. Raising the labour supply elasticity from 0 to 0.15, while keeping the saving elasticity at 0, raises the MCPF from 1.18 to 1.22.

Fullerton and Henderson (FH), 1989 (BB)

Fullerton and Henderson use a dynamic general equilibrium model similar to that of BSW to evaluate the marginal excess burden of labour taxes at the industry level, corporate income taxes and personal income taxes. FH's model includes 12 households, differentiated by income level, which maximise a nested CES utility function by allocating resources first between present and future consumption and then between work and leisure. Producers allocate capital and labour according to CES production functions. The main feature of the model is a detailed disaggregation of the corporate sector, where each sector of 18 industries faces a separate user cost of capital for each of 38 assets. This disaggregation allows FH to capture intersectoral and interasset distortions as well as intertemporal distortions. Instead of using average effective corporate tax rates, as in BSW, FH derive effective marginal tax rates by sector and by asset. In their experiment, they used, for sensitivity analysis, uncompensated labour supply elasticities of 0, 0.15 and 0.3 and saving elasticities of 0, 0.4 and 0.8. In order to facilitate the comparison with other studies, only results for the first two sets of elasticities are reported in Table 1. The MCPF values estimated by FH are lower than those derived by BSW under the same elasticity values, but the ranking of taxes in terms of marginal welfare effects is the same. The largest difference between the two studies is noted in the case of corporate income taxes, which have a lower distortionary effect according to the FH estimates. It suggests that, given the complexity of the corporate income tax structure, using

average effective tax rates instead of detailed effective marginal tax rates may lead to a sizeable upward bias in MCPF estimates.

3. Summary Evaluation

Despite the wide differences in the approaches used to estimate the MCPF for various tax increases, the published results allow some qualified generalisations.

1. The marginal welfare cost of raising additional revenue through taxation is not negligible and may be quite large, depending on the labour supply and saving response.
2. MCPF values are higher for differential experiments, where a distortionary tax is compared with a lump-sum tax or where the additional revenue is spent on lump-sum transfers, than for balanced-budget experiments, where the comparison is between a higher or lower level of distortionary taxation and the additional revenue is spent on exhaustive expenditures that do not affect consumer utility and labour supply responses.
3. Labour taxes may have lower or higher MCPF values than personal income taxes, depending on their relative levels and structures. A proportional rate increase in a roughly proportional wage tax with a low average rate, as in the case of increases in industry-level wage taxes, has a substantially lower MCPF than an increase in personal income tax rates. A progressive rate increase in a package of labour taxes with a progressive rate structure, however, may be more distortionary than a similar increase in personal income tax rates and may be as distortionary as corporate tax increases.
4. In closed economies, corporate taxes were found to be more distortionary than personal income or labour taxes in models that use an aggregate approach to capital taxation. When differences in the tax treatment of different sectors and assets were explicitly modelled, corporate taxes were found to have similar distortionary effects to personal income and labour taxes. Even in closed economies, the widely-held view that corporate taxes are the most distortionary may largely reflect an aggregation bias.

IV. ESTIMATES OF THE MCPF IN A SMALL OPEN ECONOMY

The MCPF estimates discussed in Section III do not take into account international effects because they use either partial equilibrium analysis or general equilibrium models for closed economies. Countries such as Canada are more realistically characterised as small open economies. Unless it can be shown that shifting from a closed- to a small-open-economy characterisation does not affect MCPF estimates for all taxes, using the general conclusions from the studies summarised in Table 1 as a guide to tax policy in small open economies may lead to inefficient tax structures.

1. Channels of Influence

A major feature of a small open economy is the perfect mobility of capital across borders. This feature severs the link between domestic savings and domestic investment, which is a vital component of equilibrium in a closed economy and has important implications for the efficiency effects of personal and corporate income tax changes. For personal income taxes, perfect mobility of capital means that the effect of changing tax rates on capital income received by individuals is confined to the intertemporal allocation of consumption. In a small open economy, an increase in the taxation of capital income under the personal income tax will produce marginal welfare losses to the extent that it distorts consumer choices between present and future consumption, thus altering the rate of saving. The potential reduction in domestic savings, however, does not influence the rate of domestic investment and the level of output.

The channels through which perfect mobility of capital influence domestic investment are more complex. In a closed economy, an increase in corporate income taxes raises the before-tax rate of return that is required to yield a given after-tax rate of return and therefore reduces the rate of investment. However, since the supply of funds is a positive function of the rate of return, as investment falls so does the after-tax rate of return received by the saver. The lower rate of return associated with the reduced saving needed to match the new lower equilibrium investment mitigates the potential negative effects of the tax increase on investment. This cushion is no longer available in a small open economy because the marginal investment is financed at the world rate of interest which is not affected by changes in domestic taxation. This channel of influence would tend to raise the distortionary effect of an increase in corporate taxes. Its effects, however, are counteracted by other influences in opposite directions. First, with a lower capital stock, there is a reduction in the level of depreciation. Therefore a lower portion of current output must be diverted to expenditures that yield no utility to consumers. Second, the reduced investment requires a smaller inflow of capital, for a given level of domestic savings. This, in turn, involves reduced payments to foreigners from current production, leaving a larger share of gross domestic product (GDP) to domestic factor owners, thus increasing the ratio of gross national product (GNP) to GDP. A reduced inflow of capital also requires a smaller flow of exports in order to rebalance the balance of payments. If the demand for exports is not perfectly elastic, which is a deviation from the strict definition of a small open economy, then the corporate tax increase will generate terms-of-trade effects that tend to reduce its potential welfare losses. With a downward-sloping demand for exports, a reduction in the amount exported will tend to increase the price of exports relative to imports, thus improving the terms of trade. Although less is being sold in the world market, more is being received on each unit sold.

2. MCPF Estimates

These complex interactions can be captured only through a detailed general equilibrium model that incorporates the major features of a small open economy. Multisector static general equilibrium models of the Canadian economy, treated as a small open economy, were used by the author and by Beausejour and Williams (BW) (1996) to measure the efficiency effects of changes in labour income taxes, personal income taxes and corporate income taxes. The basic structure of the model is the same for both studies; therefore the main elements of the model will be described only once. The models used in the simulations differ only with respect to the details of the tax system. The simulations performed by the author incorporate a detailed representation of the personal income tax system in order to capture all the statutory rates as well as the effect of deductions, exclusions and credits on effective marginal tax rates. The corporate income tax is treated on an aggregate basis as is done in the study by Ballard, Shoven and Whalley (1985). BW, on the other hand, use a less detailed representation of the personal income tax but a very disaggregated approach to the corporate income tax, along the lines of the study by Fullerton and Henderson (1989), in order to capture the differential tax treatment of different sectors and assets.

In that model, the population is divided into 160 groups (136 in BW) based on income levels and family characteristics, such as single people and families with children, and each group is represented by an agent with average income within each income class. These agents make both temporal decisions with respect to work and leisure and intertemporal decisions with respect to current consumption and savings for the purpose of maximising a nested CES utility function where agents first allocate resources between current and future consumption and then make work–leisure choices. The intertemporal decision is captured by including savings in the utility function as an approximation of the present value of future consumption. The labour supply response is based on an uncompensated labour elasticity of 0.1 and an income effect of 0.2. The saving decision is based on an elasticity of substitution between current consumption and saving of 0.2. Production takes place in 42 sectors which combine labour and capital (both endogenously determined) and intermediate inputs through a Cobb–Douglas production function to produce 42 commodities. The domestic capital stock is fixed; therefore, with perfect capital mobility, marginal adjustments in domestic investment are accommodated by changes in international capital flows. Canada trades with the United States, the European Union and the rest of the world. The prices of imports are fixed in the international market, but the demand for exports is less than perfectly elastic. Export demand functions are isoelastic, making the demand for Canadian exports depend only on relative prices. The government maintains a balanced budget by spending the revenue it raises from a variety of tax sources as a lump-sum

transfer. The model was calibrated to the 1992 input–output database for output, income and expenditures. The 160 agents (136 in BW) were identified with respect to income levels and family status on the basis of Statistics Canada's Socio-Policy Simulation Database and Model (SPSD\M).

Two experiments were performed by the author, the results of which are summarised in Table 2. In the first experiment, tax rates were raised proportionally on the labour income component of the personal income tax. In the second experiment, the proportional rate increase was applied uniformly to all sources of income subject to personal income taxation. In both experiments, the additional revenue was spent on lump-sum transfers, as is done in differential experiments. For the proportional rate increase in labour taxes, the simulations generated an MCPF of 1.18. This value is identical to the lower value in the range estimated by Browning (1987) and slightly lower than the corresponding values estimated by Thirsk and Moore (1991) and Stuart (1984). It suggests that, as one would expect, a shift from a closed- to a small-open-economy structure does not affect greatly the social welfare cost of labour taxes. As discussed earlier, the main impact of such a shift in assumptions is on the efficiency effects of capital income taxation under the personal income tax because of the increased mobility of capital. For the proportional increase in personal income taxes, the simulation yielded an MCPF of 1.13, thus suggesting that increases in personal income tax rates are less distortionary than increases in labour taxes with the same progressive rate structure. The major reason for the lower social welfare cost of personal income taxes is the inclusion in the personal income tax base of income sources not associated with labour supply responses, such as pension income and taxable transfer payments to people who are not in the labour force. A tax increase on these components of taxable income would have no effect on labour supply. Therefore, for the same revenue increase, a personal income tax rate change that involves a non-distortionary component will generate lower social welfare costs than an equivalent rate increase on an entirely distortionary tax such as a labour income tax.

TABLE 2

MCPF for Selected Tax Changes:
General Equilibrium Estimates for a Small Open Economy

	Proportional increase in corporate income taxes	*Proportional increase in personal income taxes on labour income only*	*Proportional increase in personal income tax rates*
Beausejour and Williams, 1996			
D	Approximately 1.0		
Author's estimates			
D		1.18	1.13

BW concentrated their simulations on the corporate sector. They reduced corporate income tax rates by 5 percentage points across the board and offset the revenue by reducing lump-sum transfers, as is done in differential experiments. Their results show that such a cut in corporate income tax rates would raise the capital stock, real GDP, real wages and the labour supply, but would produce a small reduction in social welfare as measured by the change in utility. A number of factors explain this generally unexpected result. First, the increase in the capital stock is financed entirely through foreign capital; therefore some of the additional income has to be paid to foreign lenders. As a result, GNP increases by a fraction of the increase in GDP. Second, the increase in labour supply involves a reduction in leisure which partially offsets the increase in labour income. Third, the larger capital stock requires higher depreciation expenditures, which involve the use of part of the GDP increase for purposes that do not yield utility. Finally, the increase in exports is associated with a worsening of the terms of trade so that the additional output that is diverted to exports brings in a lower revenue per unit sold.

Although BW's results suggest that small changes in corporate income tax rates in a small open economy such as Canada's may generate an MCPF in the neighbourhood of 1, these results should be interpreted with caution. In particular, they reflect the assumption of a fixed supply of domestic saving, perfect mobility of capital across international borders and a less than perfectly elastic demand for exports. Their results, however, suggest three important points. First, changes in corporate income tax rates generate strong effects on employment and output, as in the case of a closed economy. Second, the gap between changes in macroeconomic variables, such as GDP, and changes in utility widens in the case of a small open economy because of the additional payments to foreign investors and the potential terms-of-trade effects. Finally, these special effects on utility tend to reduce the value of the MCPF, for a given corporate income tax rate change, compared with the closed-economy case.

V. CONCLUSIONS

There is a widely-held view that tax increases have large efficiency effects and that those effects are strongest for corporate taxes and weakest for wage taxes (not considering consumption taxes, which were not included in the studies reviewed in this paper). This view is supported by studies that are based on closed-economy assumptions and use an aggregate approach to the simulation of corporate taxes. This view, and particularly the part on the efficiency ranking of different taxes, no longer holds when corporate taxes are simulated to incorporate the differential tax treatment of different sectors and assets and when the analysis applies to a small open economy. The comparison of MCPF estimates using different approaches, different assumptions and different treatments of taxes suggests the following major conclusions.

Both personal income taxes and corporate taxes are less distortionary within a small open economy than within a closed economy. For personal income taxes, the lower MCPF results from the elimination of the link between domestic savings and domestic investment caused by capital mobility. For corporate taxes, the difference is due to a variety of factors, such as changes in depreciation levels, changes in payments to foreigners resulting from changes in foreign investment, and adjustments to the terms of trade.

The ranking of taxes in terms of efficiency effects is turned upside-down when we shift from a closed economy to a small open economy. Let us compare first wage taxes with personal income taxes. MCPF estimates for closed economies indicate that increases in personal income taxes are more distortionary than increases in wage taxes. In these models, wage taxes distort only the work–leisure choice while personal income taxes affect also the level of saving and, indirectly, the rate of investment. Since a personal income tax has a broader base than a wage tax, an equal revenue shift from a wage tax to an income tax trades a lower increase in the wage component for the taxation of capital income. The results of these models suggest that the added distortion from the taxation of capital income exceeds the reduced distortion from the lower tax rate on wages. In a small open economy, the distortionary effects of capital income taxation are lowered because they are confined to the intertemporal decision about present and future consumption. MCPF estimates for a small open economy indicate that, when the link between domestic saving and investment is severed, the beneficial effects of the lower taxation of wages and the lump-sum taxation of non-factor income exceed the distortionary effects of the taxation of capital income.

The efficiency ranking of corporate taxes depends both on the details of the corporate tax structure captured by the model and on whether the analysis is performed for a closed or a small open economy. As shown by Fullerton and Henderson (1989), using a detailed representation of the corporate tax structure lowers the MCPF of corporate taxes to a level similar to that of personal income taxes. When a detailed corporate tax structure is analysed within the framework of a small open economy, the MCPF is further reduced to a level below the estimates for wage taxes and for personal income taxes. In a small open economy, corporate taxes may be less distortionary than either wage or personal income taxes.

If the results for a small open economy reported in this paper are confirmed by future studies for other countries, they will have important implications for the direction of tax policy. Let us consider the case of Canada as an example. The federal government has eliminated its budget deficit and has put in place a fiscal structure that will generate surpluses of increasing magnitude over time. It has promised to use part of these surpluses to reduce taxes. In this respect, the federal government has promised to lower personal income tax rates and is being pressured by business groups to reduce corporate taxes. These surpluses,

however, are being created largely by the reform of the unemployment insurance programmes which has resulted in an excess of contributions over benefits. Since these excess contributions are effectively a new payroll tax, the tax policy change being contemplated is a shift in the tax burden from capital income, at the personal and perhaps corporate levels, to labour income. This policy is consistent with the efficiency ranking of different taxes under a closed economy. The MCPF estimates for a small open economy, however, would suggest a different set of priorities. They would lead to a policy change that would first eliminate the surplus in the unemployment insurance programme and then would use the portion of the remaining surplus that was dedicated to tax cuts to fund a further reduction in labour income taxes through a combination of lower payroll and personal income taxes.

The changes in the efficiency ranking of different taxes associated with a shift from a closed to a small open economy also have important implications for countries that are re-evaluating their tax structures in light of the globalisation of international trade and the increasing mobility of capital. If their tax structures were designed to meet the MCPF requirements in a closed economy, they would incorporate a favourable treatment of capital income because of the large distortions generated by corporate taxes. This approach would no longer be efficient if those countries shared the main characteristics of a small open economy and relied to increasing degrees on human capital as the engine of growth.

REFERENCES

Ballard, C. L. (1990), 'Marginal welfare cost calculations: differential analysis vs. balanced-budget analysis', *Journal of Public Economics*, vol. 41, pp. 263–76.

—, Shoven, J. B. and Whalley, J. (1985), 'General equilibrium computations of the marginal welfare costs of taxes in the United States', *American Economic Review*, vol. 75, pp. 128–38.

Beausejour, L. and Williams, B. (1996), 'The firm's financial decision and the welfare costs of corporate taxation', paper presented at the 1996 meeting of the Canadian Economics Association, St Catharines, Ontario.

Browning, E. K. (1976), 'The marginal cost of public funds', *Journal of Political Economy*, vol. 84, pp. 283–98.

— (1987), 'On the marginal welfare cost of taxation', *American Economic Review*, vol. 77, pp. 11–23.

Buchanan, J. M. and Tullock, G. (1965), 'Public and private interactions under reciprocal externality', in J. Margolis (ed.), *The Public Economy of Urban Communities*, Washington, DC: Resources for the Future.

Dahlby, B. (1994), 'The distortionary effect of rising taxes', in W. Robson and W. Scarth (eds), *Deficit Reduction: What Pain, What Gain*, Toronto: C. D. Howe Institute.

Fullerton, D. and Henderson, Y. K. (1989), 'The marginal excess burden of different capital tax instruments', *Review of Economics and Statistics*, vol. 71, pp. 435–42.

Harberger, A. C. (1964), 'Taxation, resource allocation and welfare', in *The Role of Direct and Indirect Taxes in the Federal Revenue System*, Conference Report of the National Bureau of Economic Research and the Brookings Institution, Princeton: Princeton University Press.

Musgrave, R. A. (1959), *The Theory of Public Finance*, New York: McGraw-Hill.

— (1969), 'Cost–benefit analysis and the theory of public finance', *Journal of Economic Literature*, vol. 7, pp. 797–806.

Pigou, A. C. (1947), *A Study in Public Finance*, London: MacMillan.

Stuart, C. (1984), 'Welfare costs per dollar of additional tax revenue in the United States', *American Economic Review*, vol. 74, pp. 352–62.

Thirsk, W. and Moore, J. (1991), 'The social cost of Canadian labour taxes', *Canadian Tax Journal*, vol. 39, pp. 554–66.

Vickrey, W. S. (1963), 'General and specific financing of urban services', in H. G. Schaller (ed.), *Public Expenditure Decisions in the Urban Community*, Washington, DC: Resources for the Future.