A REVIEW
FOR DIFFERENT TYPES OF GOVERNMENT EXPENDITURE:
MARGINAL EFFICIENCY COST CALCULATIONS


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ABSTRACT

This paper examines the interaction between the costs of different authors and the price they charge for their work. It focuses on the relationship between the costs of different authors and the price they charge for their work. The authors find that the costs of different authors and the price they charge for their work are positively correlated. This is because the costs of different authors and the price they charge for their work are both determined by the same underlying factors. These factors include the costs of the author's education, the costs of the author's experience, and the costs of the author's time. The authors also find that the costs of different authors and the price they charge for their work are negatively correlated. This is because the costs of different authors and the price they charge for their work are both determined by different underlying factors. These factors include the costs of the author's reputation, the costs of the author's network, and the costs of the author's time.
First of all, it should be recalled that the MECR for a wage subsidy program can be very small, and even negative. More importantly, these welfare cost measures are only one input into the decision about whether to expand government spending programs. The efficiency cost calculations say nothing about the benefits from such spending programs. They merely suggest that, in most cases, the out-of-pocket costs of a spending program are an understatement of the true economic costs, because of the distortionary effects of taxes. Depending on the concavity of the social welfare function (see Ballard (1988)), it would be entirely possible to approve additional redistribution through cash grants, and reject additional exhaustive projects, even though the relevant MECR outweighs the relevant MCF.

IV. Conclusion

In the last 20 years, economists have increasingly recognized that the revenue and expenditure sides of government are intimately connected, both in theory and in practice. If we are to decide whether to approve a new government spending project, we must consider not only the benefits and the out-of-pocket costs, but also the indirect costs that are due to the fact the project is financed with taxes. In most cases, these indirect costs make it less likely to approve projects. In the language of this paper, the MCF and MECR are usually greater than one. For some “average” configuration of tax increases, the MCF is probably something like 1.5 or 1.3 or 1.4.

However, it must be borne in mind that MCFs and MECRs can actually be less than one. In these cases (for Pigouvian taxes and wage subsidies, for example), the benefits of a proposed government expenditure can actually be less than the explicit non-tax costs, and yet the project can still be socially beneficial.

In this paper, I have attempted to clarify (for economists) the distinctions among various marginal efficiency cost calculations. Stepping back from technical details, the best thing to say is probably this: If we are clear about the relevant tax rates and elasticities, and about the experiment that is being undertaken, we will end up with a clearer understanding of the results and of their meaning. As the economics profession increases its understanding of these issues, it can move on toward sounder policy advice. Ultimately, our goal should be to design fiscal policy so that we select the correct level of expenditure, and so that we make maximum use of the revenue sources with the lowest efficiency costs.
Figure 1: Changes in the marginal cost of public funds due to changes in the labor income tax.

Table 1: Marginal cost of public funds for different portions of the labor income tax.

Table 2: Marginal cost of a public good for different portions of the labor income tax.

Table 3: Marginal cost of a public good for different portions of the labor income tax.

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additive social welfare function of the type used by Stern, we can focus on the parameter r, which determines the curvature of the relationship between individual utilities and social welfare. When r is zero, then we have a Benthamite social welfare function: we simply add up the individual utilities without assigning any higher weight to the lower-income individuals. If r is positive, the social welfare function becomes concave, and we place greater weight on the utilities of the poor. In the extreme case of an infinite r, we have a Rawlsian (or maxi-min) social welfare function. For each simulation, it is possible to calculate a critical value of r. If society is believed to be characterized by a value of r that exceeds the critical value, then the marginal redistribution can be said to have been socially beneficial (even though it clearly is not a Pareto improvement). If society is believed to be characterized by a lower value of r, then the extra redistribution would be socially harmful.

For most of Ballard's simulations, the critical value of r is rather small. For his central case simulations, the critical value is 0.397. For many of Ballard's simulations, the critical value is even lower. The construction of an actual social welfare function has well-known problems. The point is that one need not be an extreme egalitarian to prefer more redistribution, even when the marginal efficiency costs seem high.

Browning and Johnson restrict their attention to demograph-type programs. Ballard also calculates the efficiency costs of redistributing through two other schemes. One such scheme is a "notch cash grant" scheme, under which cash grants are increased only for the lowest-income groups, and taxes are increased only for the highest-income groups. In practice, a notch could have severe adverse efficiency effects. Ballard does not directly assess the efficiency cost of the program with the notch, since for any given consumer, he maintains a linear budget constraint. Nevertheless, the results are interesting because they indicate that the notch program may be more efficient than the demograph program, if the notch can be placed in an area of the income distribution where its negative effects are minimized.

For his central case parameters, Ballard finds that the notch cash grant MECR is around 1.14 to 1.18, compared with an MECR for the demograph plan of 1.80. Similarly large differences are found for other parameter combinations. An intuitive understanding of the wide difference between the MECRs for these two plans can be gained if we imagine that a tracking device could be attached to every dollar as it flows into and out of the Treasury. To the extent that some dollars are taxed away from the high-income groups to finance transfers for the low-income groups, there is an element of pure redistribution. This is indeed what occurs in the case of the notch program. However, under the tax-financed demograph plan, some of the taxes raised from each group could be viewed as being paid back to the same group. This is wasteful: when a dollar is raised from an individual with distortionary taxes and paid back to the same individual in a lump sum, there is a welfare loss because of the substitution effect. Finally, at least some of the dollars raised in taxes from the poor under the demograph could be viewed as being paid to the rich. This obviously is not an efficient way to redistribute from rich to poor.

It is interesting that the difference between the MECRs for the notch cash grant and the demograph is so large. This suggests that, even in a model in which the efficiency effects of the notch were recognized explicitly, the notch plan still might be a superior means of redistribution. In fact, the
ANNUAL EXPRESSED COST CALCULATIONS FOR DIFFERENT

MAJOR EXPRESSED COST CALCULATIONS: A REVIEW.

1. Introduction

Keywords: Government, education, training, strategy.

Comparison of Economic-Effectiveness Strategies:

TRENDS OF GOVERNMENT EDUCATION: A REVIEW. Title: 1. Budget

Economic Measures: Basic economic measures of the costs of education and training programs. Therefore, there is a need to develop an economic model to assess the impact of different education programs. This model should consider the costs of various educational interventions and the effects of these interventions on economic outcomes. The economic impact of different education programs can be measured using economic measures such as cost-effectiveness and cost-benefit analysis. These measures help to quantify the economic benefits of education programs and to compare different programs based on their economic impact.

In conclusion, the economic evaluation of education programs is crucial for policymakers to make informed decisions. By understanding the economic implications of different educational interventions, policymakers can prioritize programs that yield the greatest economic benefits, thereby optimizing educational spending.
have used general equilibrium models. However, the partial equilibrium work is sufficiently important that it, too, will receive a substantial amount of attention.

II. The Marginal Cost of Public Funds for Exhaustive Projects

The classic statement of the problem of finding the optimal level of government exhaustive expenditure was given by Paul Samuelson (1954, 1955). He showed that the optimal level of a pure public good will occur where the sum of the marginal rates of substitution between public and private goods is equal to the marginal rate of transformation. If we apply this idea to the cost-benefit analysis of a particular public project, we see that we must add up the marginal benefits to all consumers, and compare them with the marginal costs.

However, Samuelson's formula assumed that the revenue that is needed to finance the project could be raised with lump-sum taxes. Since this is not generally possible, we need to modify the formula to account for the effects of the tax system. The necessary modification is commonly called the marginal cost of public funds (MCF). The MCF is the factor by which the explicit costs of the project for labour, materials, etc., must be multiplied before any comparison with the benefits can be made. In Samuelson's case, where government is entirely financed with lump-sum taxes, the MCF would be 1.00. In any context, the MCF can be calculated by taking the change in consumer welfare brought about by a tax change, and dividing it by the amount of additional tax revenue collected.

Several years before Samuelson wrote, A.C. Pigou (1947, pp. 33-34) discussed how the analysis of public spending might be affected by taxes. He identified two costs of the tax system. The first is the cost of administration and compliance. Although these costs are doubtless important, they have generally been ignored by the economists studying the MCF since the 1970s. 1. too, will put administrative and compliance costs aside. The second of Pigou's costs of the tax system is the "indirect damage (inflicted) on the taxpayers...over and above the loss they suffer in actual money payment." This indirect damage results, at least in part, from the fact that the tax system distorts relative prices. Essentially, Pigou's conjecture is that these costs cause the MCF to be greater than one.

Some recent articles on the relationship between taxes and exhaustive expenditure have focused on the formulas for the optimal level of overall spending, and some have looked at the formulas for the cost-benefit analysis of a particular public project. In virtually every case, however, the work boils down to an attempt to identify the MCF. In the next few sections, my goal is to review and clarify this recent literature. I begin with a discussion of the relevant theory, and then provide some numerical calculations in a simple, partial-equilibrium model. I then compare these results with others from the literature. Finally, I suggest the outlines of what I believe is an emerging consensus. Afterward, I will move on to the literature on the marginal efficiency cost of redistribution.

A. Theoretical Background

Much of the recent work in this literature has built upon the work of Anthony Atkinson and Nicholas Stern (1974), who in turn built upon the pathbreaking work of Peter Diamond and James Mirrlees (1971) and Joseph Stiglitz and Partha Dasgupta (1971). Atkinson and Stern assume that the move the economy closer to the optimal level of capital. In another dynamic model, Kenneth Judd (1987) shows that future taxes can increase the supply of productive factors in the present, and this can also generate MCFs less than one.

III. The Marginal Efficiency Cost of Redistribution

I should note at least two important differences between MCF calculations and calculations of the marginal efficiency cost of redistribution (MECR). First, although some MCF calculations emerge from multi-consumer models, it is perfectly acceptable to calculate the MCF within a one-consumer model. This is not possible for a MECR calculation. Second, the MCF is the only additional information that we need to evaluate a public project, whereas we have information on the benefits and non-tax costs. On the other hand, the MECR is not sufficient to tell us whether a given redistributive program is socially beneficial. Redistribution necessarily implies that different weights are attached to the utilities of different individuals, and a calculation of the MECR says nothing about how to choose the weights. Nevertheless, MECR calculations may be of some use. If the MECR appears to be exceptionally large, then we would need to exercise special caution before expanding redistributive programs. If the MECR is small or negative, such programs will appear more attractive.

The first well-known study of MECR is Browning and William Johnson (BJ, 1984), building on earlier work of Browning (1978). BJ perform calculations in a partial equilibrium setting, in that they hold gross-of-tax wage rates fixed. The model of BJ is a static one, in which the only distortion is to labour supply behavior. They use data from the March, 1975, Current Population Survey, updated and adjusted to 1976 levels.

Browning and Johnson undertake two types of calculation. First, they compare the loss in money income for the upper quintiles of the income distribution with the gain for the lower quintiles, when a demogrant-type system of income redistribution is increased by a small amount. Not surprisingly, the results depend on the labour supply elasticities. For the case preferred by BJ, in which the uncompensated elasticity is 0.20 and the compensated elasticity is 0.31, they find that the top three quintiles experience a loss that is 9.51 times as great as the gain of the bottom two quintiles. For every dollar of money income gained by the poorest 40% of the population, the richest 60% suffer a loss of $9.51.

BJ also attempt welfare calculations. For their favorite parameter values, BJ find that the welfare loss to the top quintiles is 3.49 times as great as the welfare gain to the bottom quintiles. For other combinations of parameters, the ratio of the losses to the quintiles that lose to the gains of the quintiles that gain ranges as high as 6.84 and as low as 2.29. It is not surprising that the tradeoff is less unfavorable when we consider welfare than when we merely consider money income. If we adopt a policy that encourages people to consume more leisure, and if they value that leisure, then calculations that concentrate only on money income (and ignore the leisure) are likely to make the policy look much less efficient.

More than four years after BJ published their study, Ballard (1988) presented new calculations. Once again, a static model was used, in which the central focus was on labour supply distortions. Ballard employs a
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Measurability of Mean and Variance of a Random Variable

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in response to changes in the consumer's budget constraint, then the MCF is exactly 1.0. If labour supply increases, then the MCF is actually less than one. This possibility is empirically important, since many studies have found negative labour supply elasticities, especially among prime-age males. Pigou's conjecture (that the MCF exceeds one) may well be correct for a model such as this. But it will only be correct if labour supply goes down in response to the increase in the wage tax that is necessary to finance additional government spending.

This point is illustrated in Figure 1, for the consumer with perfectly inelastic labour supply. Point A is the consumer's initial, pre-tax choice. The consumer's nonlabour income is given by RS. If a wage tax is imposed, the consumer chooses B, and the government collects revenue of AB. The calculation of an MCF involves an analysis of a change from an already-distorted point like B. If the rate of proportional wage taxation is increased, the consumer will now choose point C. The additional revenue collected by the government will be BC. In order to calculate the MCF, we must compare this revenue gain for the government with the consumer's loss of utility. If we measure the consumer's loss by the equivalent variation, we get BD. The MCF will then be BD/BC. For large discrete changes away from the first distorted equilibrium, this MCF will exceed one. However, for small changes, it will be 1.0.

Thus, in a static model, the MCF of additional government exhaustive spending financed by a proportional tax on inelastic labour is 1.0. This may strike many economists as odd. After all, we are used to thinking of wage taxes as being worse than lump-sum taxes. Many of us would have guessed that the MCF of additional spending financed by a lump-sum tax would be 1.0. However, this latter guess turns out to be incorrect, as shown in Figure 2. There, the revenue collected from an initial wage tax is EF. If a lump-sum tax is imposed on top of the wage tax, the consumer's new choice will be G. This yields additional government revenue of GH. However, the consumer's utility only drops by GJ. Thus, the MCF will be less than one. In a simple model such as this, the MCF of additional spending financed by a lump-sum tax will only be 1.0 if the existing taxes are also lump sums. If the initial tax is a wage tax, then the MCF of adding a lump-sum tax will be less than one.

B. Numerical Calculations from a Simple Model

In order to put some numerical flesh on these ideas, I now present some MCF calculations from a simple, partial-equilibrium model in which labour supply is the consumer's only decision, and labour income taxes are the only distortions. For simplicity, I use a linear labour supply function suggested by Jerry Hausman (1981), along with Hausman's figures for wage rates and nonlabour income. In most cases, I start with a progressive tax system where the average tax rate is 27 percent and the marginal rate is 43 percent. I focus on the case of a separable public good, highlighted above.

The results are shown in Table 1. In the top panel of this table, I present results for the special case of a zero uncompensated labour supply elasticity. As suggested above, for a proportional increase in labour taxes, this gives a MCF of exactly 1.0. This means that, if a public project were to be financed by this type of tax, the project would be socially beneficial if its benefits exceed its explicit (non-tax) costs by any amount. For a lump-sum increasing failure to use lump-sum taxes, rather than the marginal efficiency effects of additional government spending. Thus, their results are only relevant for project analysis if the exhaustive government expenditures under consideration are close substitutes for cash. In addition, the results of Jorgenson-Yun are not directly comparable with those of BSW or Fullerton-Henderson.

Since Jorgenson and Yun employ the techniques of differential analysis, it is not surprising that their estimated marginal efficiency costs are higher than those of BSW. In order to provide a clearer comparison between the two studies, I have used the same GEMTAP model that was used by BSW, along with all of the same parameters, but with lump-sum taxes to provide equal revenue yield. Thus, these calculations are in the tradition of differential incidence analysis, and may be compared with the results of Jorgenson and Yun.

In Table 3, I include the information from Table 4 of Jorgenson and Yun, along with additional results from the differential calculations using the GEMTAP model. Once we use the same type of conceptual experiment, it becomes possible to explain much of the apparent difference between BSW (1985a) and Jorgenson and Yun (1990). For example, when all taxes are incremented, BSW report a MCF of 1.132 when their stochastic elasticity variance are used, and Jorgenson-Yun report a MCF of 1.460. When differential techniques are used, the GEMTAP model of BSW produces a MCF of 1.426. Thus, when the same type of conceptual experiment is used, approximately three-fourths of the apparent difference disappears. This suggests that, if Jorgenson and Yun were to employ the techniques of lump-sum taxes and the analysis (which, I have argued, is the best way to go if we desire to produce calculations that are useful for project analysis), their marginal efficiency cost numbers would be noticeably lower.

Another possible source of the difference is in the specification of consumer dynamics. Both BSW and Fullerton-Henderson employ the GEMTAP model of consumer behavior. Despite its problems (some of which are discussed by Jorgenson and Yun), this model has the advantage that it can be calibrated precisely to any desired degree of intertemporal responsiveness for the part of consumers. Jorgenson and Yun employ an infinite-horizon utility functional. They do not provide a report on the degree of intertemporal responsiveness that their model implies. However, as shown by Ballard (1999b), the infinite-horizon formulation often results in extremely large savings elasticities. Thus, another possible explanation for the difference is that Jorgenson and Yun may employ a much more elastic model. As we have seen repeatedly, higher elasticities tend to lead to lower MCFs.

Jorgenson and Yun attribute the difference in results between their paper and BSW (1985a) to "...the greater precision we employ in representing the U.S. tax structure." Because they carry out a different type of experiment, and possibly because of differences in elasticities, this is a precarious statement.
The marginal efficiency cost calculation is a crucial step in economic analysis. Figure 1 illustrates the effects of a marginal increase in the labor income on the labor supply. The graph depicts the relationship between labor supply (L) and labor income (W), with a downward-sloping curve indicating that as labor income increases, the labor supply decreases, assuming other factors remain constant.

The table below provides a summary of the factors influencing the labor supply elasticity. The table lists various demand and supply factors, such as personal income, labor income, interest rates, and the costs of capital, among others. Each factor is assigned a numerical value, indicating its impact on the labor supply elasticity.

### Table 2: Factors Influencing Labor Supply Elasticity

<table>
<thead>
<tr>
<th>Factor</th>
<th>Elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal income</td>
<td>1.34</td>
</tr>
<tr>
<td>Labor income</td>
<td>1.29</td>
</tr>
<tr>
<td>Interest rate</td>
<td>2.30</td>
</tr>
<tr>
<td>Price of goods</td>
<td>0.45</td>
</tr>
<tr>
<td>Cost of labor</td>
<td>1.28</td>
</tr>
<tr>
<td>Cost of leisure goods</td>
<td>0.05</td>
</tr>
<tr>
<td>Capital cost</td>
<td>1.25</td>
</tr>
<tr>
<td>Price of leisure goods</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Elasticity refers to the responsiveness of the labor supply to changes in a specific factor. A higher elasticity indicates a more responsive labor supply to changes in that factor.
burden (MCF-1) from the balanced-budget experiments exceeds the average excess burden from the differential experiments. However, it is crucial to emphasize that these marginal excess burdens cannot be computed by taking small changes in the average excess burdens, since the two come from different experiments.

Ballard, Shoven, and Whalley analyze the sensitivity of their results with respect to the uncompensated labour supply elasticities, but they do not discuss the role of compensated elasticities. Sensitivity analysis with respect to the compensated elasticities provides some interesting results, which were reported in Ballard (1990a). In their central case, BSW use an uncompensated elasticity of 0.15 for each of the 12 consumer groups in their model. The weighted average of the compensated elasticities is rather high, at 0.479. In this case, BSW calculate an overall balanced-budget MCF (for simultaneous increases, in all tax rates) of 1.332. If we increase the compensated elasticities while holding constant the uncompensated elasticity, the MCF actually decreases slightly. For an average compensated elasticity of 0.55, the MCF is 1.31. For an average compensated elasticity of 0.20, the MCF is 1.41. Similar patterns are observed when MCFs are calculated for decreases in payroll taxes or income taxes only.

This effect is one that could only arise in a general equilibrium model. With a positive uncompensated labour supply elasticity, the increased labour tax leads to a reduction in labour supply. This raises the relative price of labour services, and lowers the relative price of capital services. Thus, the consumer's nonlabour income falls. The decrease in nonlabour income increases labour supply, ceteris paribus. Therefore, the initial decline in labour supply is offset partially. The extent of this effect grows as the compensated elasticity grows.

For a period of several years, the BSW paper was the only one that presented MCF calculations based on a large-scale computational model with a large variety of tax instruments. Recently, other authors have presented such calculations, as well. Don Fullerton and Yoshida Henderson (1985b) use a version of the dynamic multi-sector GEMTAP model that bears a great many similarities to the model of BSW (1985a). Like BSW, Fullerton and Henderson also concentrate on balanced-budget experiments. The one major difference is in their model of capital taxes. BSW calculate the average tax rate on capital for each sector, and then assume that the marginal tax rate is equal to the average tax rate. They also put all capital taxes (including corporate income and franchise taxes and property taxes) into a single vector of capital tax rates. Thus, an increase in capital tax rates in the BSW model does not correspond to any real-world tax policy proposal. Fullerton and Henderson improve upon this by adopting a cost-of-capital approach, in the tradition of Robert Hall and Dale Jorgenson (1967). This allows them to distinguish among a variety of detailed provisions of the tax code, each of which has its own distinct effect on marginal effective capital tax rates.

In Table 2, I reproduce the central results of Fullerton and Henderson, from their Table 1. I also present the corresponding MCFs from BSW, for the two experiments for which a comparison is possible. In these two cases, the results of Fullerton-Henderson and BSW are certainly not identical, but they are moderately close to each other.
Table 1

The Marginal Cost of Public Funds (MCF) For Small Tax Changes, with a Pre-existing Wage Tax as a Function of Labour Supply Elasticities

<table>
<thead>
<tr>
<th>Uncompensated labour supply elasticity</th>
<th>COMPENSATED LABOUR SUPPLY ELASTICITY</th>
<th>PROPORTIONAL WAGE TAX</th>
<th>LUMP SUM TAX</th>
<th>MARGINAL &amp; AVERAGE RATES OF PRODUCTION</th>
<th>ONLY MARGINAL RATES RISES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uncompensated labour supply elasticity</td>
<td>COMPENSATED LABOUR SUPPLY ELASTICITY</td>
<td>PROPORTIONAL WAGE TAX</td>
<td>LUMP SUM TAX</td>
<td>MARGINAL &amp; AVERAGE RATES OF PRODUCTION</td>
<td>ONLY MARGINAL RATES RISES</td>
</tr>
<tr>
<td>0.000</td>
<td>0.100</td>
<td>1.000</td>
<td>0.930</td>
<td>1.047</td>
<td>1.179</td>
</tr>
<tr>
<td>0.000</td>
<td>0.200</td>
<td>1.000</td>
<td>0.870</td>
<td>1.099</td>
<td>1.434</td>
</tr>
<tr>
<td>0.000</td>
<td>0.300</td>
<td>1.000</td>
<td>0.816</td>
<td>1.156</td>
<td>1.834</td>
</tr>
<tr>
<td>0.105c</td>
<td>0.284c</td>
<td>0.936</td>
<td>0.774</td>
<td>1.052</td>
<td>1.540</td>
</tr>
<tr>
<td>0.022d</td>
<td>0.090d</td>
<td>0.984</td>
<td>0.922</td>
<td>1.025</td>
<td>1.136</td>
</tr>
<tr>
<td>0.173e</td>
<td>0.243e</td>
<td>1.147</td>
<td>0.950</td>
<td>1.315</td>
<td>1.989</td>
</tr>
</tbody>
</table>

2. In the same model, with the same assumptions, suppose a public project with production costs (MRT) of $1, and benefits (a MRS) of slightly more than $1, could be funded by a 1% increase in the wage tax. Would this be desirable?

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

Most economists would probably answer 'yes' to question 1, since the wage tax reduces the consumer's welfare while raising the same revenue. In fact, 18 of the 22 usable responses indicated 'yes' to question 1.

I hope that this paper has made clear that 'yes' is also the correct answer to question 2. With inelastic labour supply, the MCF of exactly 1.0. Since the MRS exceeds the MRT, it follows that the project is beneficial. However, 16 of the 22 respondents answered 'no' to question 2. This indicates that, at least as of late 1988, the issues discussed in this paper were not well understood, even by many leading public finance economists.

In the last two years, several papers dealing more clearly with these questions have been either published or accepted for publication. These include Fullerton (1989, 1991), Mayshar (1990, 1991), and Ballard (1990a). It is to be hoped that these papers will help to speed up the slow diffusion of knowledge in this area.

Although dissenting voices remain, I believe that a consensus may finally be emerging. Among the key points for this consensus are the following: (1) For separable public projects, when labour taxes are the only distortion in a static model, the MCF of additional spending financed by additional labour taxes is exactly 1.0 if labour supply does not change. In such a situation, the MCF for lump-sum taxes is less than one. (2) MCFs depend critically on the specific nature of the spending project being undertaken. If the project is a close substitute for cash, its MCF for labour taxes or lump-sum taxes will be higher than for a separable project. (3) The MCF is what is needed by the cost benefit analyst. Much of the literature in the past was cast in terms of 'marginal excess burdens' which often were calculated as MCF - 1. In the future, this literature will probably concentrate on the MCF as the most important and simplest concept to use. (4) Lump-sum taxes are not the only ones for which the MCF may be less than one. In fact, although the MCFs can be very large in some contexts, there are now several papers that present MCFs that are less than one. (Some examples are given below.)

What is needed now is for this emerging consensus to coalesce more fully. In order for that to happen, it will be necessary for the points made here to become a standard part of graduate courses in public finance. Perhaps Mayshar (1990) will become the standard work on graduate reading lists. If we are able to teach the distinctions mentioned here to future generations of public finance economists, we will have moved closer to the goal of being able to give consistently sound policy advice regarding the marginal cost of public funds.

D. Discussion of Related Literature for Larger and Dynamic Models

Ballard, Shoven, Whalley (BSW, 1985a), was the first study of MCFs to have a very wide range of tax instruments. BSW use the GEMTAP model of the United States economy and tax system. At the time that they wrote, the
Thus, if a public project is to be financed from labour income taxes, and if the project is separable from the consumer’s choices over leisure and consumption, the appropriate MCF formulas will depend primarily on uncompensated labour supply responses. My own judgment is that this case is considerably closer to the truth than the other extreme case studied by Harberger, Browning, and others. However, if the government’s spending involves cash transfers, or if the spending can be viewed as a close substitute for cash, then the income effects will once again disappear. In this case, the appropriate MCF formulas will depend primarily upon compensated elasticities.

Over the last decade or so, this point has become clear to more and more economists. The appropriate formula will depend on what is being done with the money. Different formulas can be used, so long as we are clear about the nature of the analyses in which they will be used. Problems arise when a calculation is applied to a question for which it is inappropriate.

C. Discussion of Calculations from Small-Scale, Static Models

The first calculation of MCFs was by Harry Campbell (1975), who found an MCF of about 1.24 for Canadian sales taxes. Edgar Browning (1976) followed with estimated MCFs of between 1.09 and 1.16 for labour taxes. Unfortunately, both of these papers used Harberger formulas, without making clear that the calculations were thus applicable only for cash transfers or for government expenditures that substitute perfectly for cash. In 1987 Browning published new estimates. He used a modification of the Harberger-type formula of his 1976 paper, and once again did not make clear the special assumptions underlying the methodology. The MCFs cover a wide range, depending on parameters. In his 1987 paper, Browning prefers parameters that yield MCFs from 1.32 to 1.47.

Wildasin (1984) and Stuart (1984) were the first to provide MCFs calculated like those reported in Table 1, in which the public good does not affect the uncompensated leisure-labour choice. Unfortunately, Stuart did not emphasize the distinction between his calculations and those of Browning. The distinction comes through more clearly in Wildasin’s paper, but it does not appear to have received the attention it deserved. (Evidence will be presented, below, indicating that large numbers of prominent public finance economists did not understand the distinction, even as of several years later.)

Stuart uses a very small-scale computational general equilibrium (CGE) model, in which a single household allocates its time between a taxed and an untaxed sector. In the case of a zero uncompensated labour supply elasticity and a compensated elasticity of 0.2, combined with an initial marginal tax rate of 42.7 percent, Stuart calculates an MCF of 1.072 for separable government exhaustive spending. When the assumed initial tax rate rises to 46 percent, the MCF rises to 1.09. Stuart’s results are fairly sensitive to the uncompensated labour supply elasticity. (Stuart always uses a value of 0.2 for the parameter between the uncompensated and compensated elasticities.) With an uncompensated elasticity of 0.318, the MCF rises to 1.427 for an initial marginal tax rate of 42.7 percent, and to 1.533 for an initial tax rate of 46 percent.

Stuart also calculates the MCF associated with additional government spending in the form of cash grants (or in some other form that the consumer takes to be equivalent to a cash grant). In this case, the income effects really do wash out, and Stuart’s results in this case really are comparable with those of Browning. Not surprisingly, Stuart gets higher MCFs in this case. In the case with a zero uncompensated elasticity, the MCF is 1.207 for an initial tax rate of 42.7 percent, and 1.244 for an initial tax rate of 46 percent.

In considering the cases of (1) separable government exhaustive expenditure and (2) government spending that is equivalent to cash, Stuart considers two popular cases. It may be that consumers consider many types of spending to be partial, imperfect substitutes for cash. Econometric estimates of this type of substitutability are provided by Roger Kormendi (1983) and David Aschauer (1985). Their estimates may be taken to indicate that a dollar of government purchases is perceived by consumers as substituting for 30-50 cents of private consumption. Thus, the ‘true’ MCF for a model like Stuart’s might be 30 percent of the way between Stuart’s 1.072 for exhaustive expenditure and his 1.207 for cash grants. This would give an MCF of about 1.11. If the 30 percent figure is correct, then models like that of Stuart will underestimate the true MCF by a small amount, and models like those of Browning will overstate the true MCF by a more substantial amount.

It is important to note that Stuart’s MCF calculations for cash grants are not the same as calculations of the marginal efficiency cost of redistribution. Stuart uses a one-consumer model. By definition, it is impossible to consider the marginal efficiency cost of redistribution without having at least two consumers. I will return to the marginal efficiency cost of redistribution in a later section.

Stuart’s model is sufficiently small in scale that it may be wondered whether computational techniques are really required. In fact, Mayshar (1991) is able to provide analytical expressions for a model that is very similar to Stuart’s. For a somewhat more general model, Mayshar shows that the formula for the MCF for a separable government project is

\[ MCF = 1 + \frac{\eta \cdot dm/dt \cdot (\eta \cdot n - \eta)}{\eta \cdot dm/dt \cdot (\eta \cdot n - \eta) + \eta \cdot dm/dt\cdot (\eta \cdot n - \eta)} \]

where \( \alpha \) is the elasticity of output with respect to labour, \( n \) and \( m \) are the compensated and uncompensated labour supply elasticities, \( m \) and \( t \) are the marginal and average tax rates on labour income, and \( dm/dt \) is the ratio of the differential changes in these rates in the tax reform that generates the marginal tax revenue. For a project that is considered by the consumer to be equivalent to cash, the formula is

\[ MCF = 1 + \frac{\eta \cdot dm/dt}{\eta \cdot dm/dt \cdot (\eta \cdot n - \eta) + \eta \cdot dm/dt\cdot (\eta \cdot n - \eta)} \]

For the case of \( \alpha = 1 \) and a proportional tax with \( t = m \) (so that \( dm/dt = 1 \)), these formulas simplify considerably. The excellent discussion in Mayshar’s paper is recommended highly.

So far, I have put the greatest emphasis on the role of elasticities in determining MCFs. However, the initial tax rates are also very important. This is seen most clearly in Hanson and Stuart (1986), which focuses on the Swedish economy. Since tax rates are so high in Sweden, sensitivity analysis with respect to initial tax rates became a natural centerpiece of the Hanson-