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Economists have long been concerned with finding an efficient level of public expenditure. The classic statement of the problem was given by Paul Samuelson (1954). He measured the marginal benefits of a pure public good by the sum of the marginal rates of substitution between the public good and a reference private good (ΣMRS). In effect, the amount of the reference private good that people would be willing to give up in exchange for the public good provides a yardstick for measuring the satisfaction provided by the public good. Samuelson then measured the marginal cost of the project by the marginal rate of transformation (MRT) between the public good and the reference private good. An optimal level of expenditure is where $\Sigma\text{MRS} = \text{MRT}$. For the cost-benefit analysis of a particular public project, this condition implies that the sum of the marginal benefits to all consumers should be compared to the marginal cost of the project.

However, Samuelson's formula assumes that all of the revenue needed to finance public goods can be raised with lump-sum taxes. Since this is not generally possible, the formula must be modified to account for the distortionary effects of the tax system. An appropriate modification is to multiply the cost side of the equation by a term that is commonly called the marginal cost of public funds (MCF). The MCF is defined, in terms of the reference private good, as the cost to consumers per unit of revenue. Since the MRT is the revenue cost per unit of public good, multiplication yields the cost to

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consumers per unit of public good. Then government spending should proceed until:

$$\sum \text{MRS} = \text{MCF} \times \text{MRT}.$$

In the case of Samuelson's formula, where government is *entirely* financed with lump-sum taxes, the MCF would be exactly 1.0. In the traditional view of economists, distortionary taxes cause the MCF to be greater than one, thus raising the cost of providing public goods. In this paper, we discuss some cases where the MCF may be *less* than one.

In recent years, public finance economists have produced a large literature on the indirect costs of the tax system, and the implications for government expenditure. Some articles have focused on formulas for the welfare costs of taxation, some derive the optimal level of overall public spending, and others study the cost-benefit analysis of a particular public project. In virtually every case, however, much of the work boils down to an attempt to identify the MCF.

The goal of our paper is to clarify this recent literature. We do not attempt to review all of the findings. We only deal with a government that is not already optimizing. Thus, the MCF may be higher for one kind of tax change than for another. We ignore distributional issues by assuming that all of the individuals in the economy are identical, and that all are treated in the same way by the government. In this case, welfare can be increased by a revenue-neutral reform that reduces a high-cost tax and raises a low-cost tax (see, for example, Drèze and Stern, 1990). In this paper, however, we are concerned not primarily with the composition of the tax system but with the level of taxation. We intend only to address the cost-benefit problem of whether government could improve overall welfare by using one particular tax to finance one particular public project.

In this context, we focus on one important misunderstanding. Under one view, the marginal cost of public funds *must* be greater than one. However, under an alternative view, the MCF can actually be less than one. We will illustrate this possibility using numerical examples for labor taxes. In this case, the MCF *reduces* the costs of the project. A public project with production costs of one dollar could be worthwhile, even if its benefits were less than one dollar! We attempt to reconcile these two views. Although we focus most closely on labor taxes, we also discuss a variety of other cases.

The Pigou-Harberger-Browning Tradition

Even before Samuelson's classic papers, 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 marginal cost of public funds since the 1970s. We, 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 the marginal cost of public funds is greater than one.

The most influential economist in this tradition is Arnold Harberger, whose 1964 paper provides formulas to measure the waste or "excess burden" caused by using distortionary taxes instead of lump-sum taxes. The most prominent calculations of MCF using this approach are those of Edgar Browning (1976, 1987) for U.S. labor taxes. Much other literature debates the relative merits of many different measures of excess burden and of the additional excess burden per marginal dollar of revenue.[1]

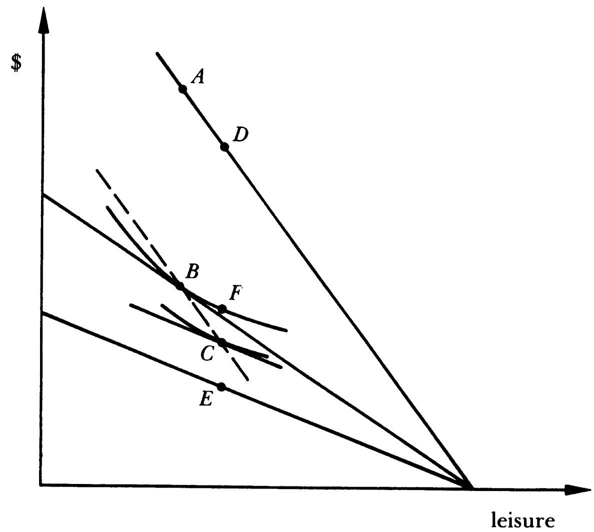
Two important points emerge from this literature. First, since the Pigou-Harberger-Browning approach compares a distortionary tax with an equal-revenue lump-sum tax, and since the two taxes have the same income effects, the comparison involves only substitution effects. Calculations of the marginal cost of public funds using this approach will depend critically on the *compensated* elasticity of demand for the taxed commodity, or (for labor taxes) on the *compensated* labor supply elasticity.

Second, since the Pigou-Harberger-Browning approach compares tax instruments with equal revenue yield, it is primarily concerned with the composition of the tax system, rather than with the overall level of taxation. It measures the efficiency effects of taxes, given the level of government spending. It seems poorly suited to the cost-benefit problem of whether the level of government spending should increase, given that the spending must be financed with additional distortionary taxes.

However, if the marginal public "project" is a lump-sum rebate to the taxpayers, then the Pigou-Harberger-Browning analysis is once again on firm ground. The additional tax alters the consumer price or net wage, but the rebate of revenue removes any significant income effects. Again, the resulting marginal cost of public funds depends primarily on substitution effects. One might question the relevance of a public project that imposes a distortionary tax and then returns the revenue. However, at least some goods provided by the public sector may be highly substitutable for private goods or cash. For example, food stamps and other transfers may be perceived to be just like cash, while public education and health care may replace private expenditures on those commodities.

[1]See, for example, Peter Diamond and Daniel McFadden (1974) and John Kay (1980). Alan Auerbach and Harvey Rosen (1980) subtitle their paper "Seven Measures in Search of a Concept," although all seven measures follow the Pigou-Harberger-Browning tradition. Joram Mayshar (1990) distinguishes several definitions. This plethora of definitions may have helped to obscure the very basic distinction between the two approaches described in this paper.

Figure 1
An Increased Wage Tax with Lump-sum Rebate



With this interpretation, the MCF calculation can be illustrated in Figure 1 for the case of a proportional wage tax on a representative individual. Point A is on a budget line representing the gross wage rate, and the individual initially chooses point B on a line representing the initial net-of-tax wage rate. Tax revenue is the vertical distance AB.[2] Then the tax rate is increased by a small amount. By definition, the MCF refers to marginal changes, but we draw discrete changes for clarity. The tax rate increase would place the consumer on the flattest budget constraint line in Figure 1, except that the marginal revenue is returned in lump-sum form. Because the lump-sum rebate does not alter relative prices, the consumer faces a budget constraint line that is parallel to the flattest budget line in Figure 1. The consumer ends up at a point such as C. The newest indifference curve is below the initial indifference curve; the combination of wage tax and rebate makes the consumer worse off. Since we are dealing with an equal-revenue tax change, the chosen point must be on the dashed line in the figure. The new tax revenue (vertical distance CD) matches the old revenue (AB).

In this diagram, the marginal revenue collected and rebated is given by the vertical distance CE. The additional loss in consumer welfare is some measure of the vertical distance between the two indifference curves, such as distance

[2]Point A is not necessarily the point that would be chosen with no taxation. It just represents the gross earnings at the chosen point B, to show initial tax revenue AB. Thus, this figure does not really say anything about the uncompensated labor supply response that led the consumer to choose B. Similarly, an uncompensated tax increase from point B may lead to more or less labor. However, the rebate of the marginal revenue insures that labor falls when moving from B to C.

CF.[3] The sum of this marginal revenue plus marginal consumer loss is therefore EF. According to the Pigou-Harberger-Browning framework, the marginal cost of public funds is this sum of marginal burdens divided by the additional revenue gained by the government—that is, EF/CE. This MCF *must* be greater than one.

Using such a framework, Browning (1976, 1987) derives formulas that depend on the marginal tax rate, the degree of progressivity, and (especially) the compensated labor supply elasticity. The MCF varies between $1.10 and $4.00 per dollar of marginal revenue, depending on these parameters, but it is always larger than one.[4]

To see the powerful influence of the Pigou-Harberger-Browning view, consider the results of a survey questionnaire that was sent to the invited participants of a taxation conference at the National Bureau of Economic Research in November 1988. The survey is not scientific, but it probably does reflect the current understanding of many who teach graduate public finance at leading institutions. The survey offered two questions:[5]

> 1. Consider a single aggregate individual facing a constant gross wage and a flat 50% wage tax, with Cobb-Douglas utility over leisure and a single consumption good, such that the uncompensated labor supply elasticity is zero and the compensated labor supply elasticity is positive. Is this wage tax distortionary?
>
> yes ________ no ________
>
> 2. In the same model, with the same assumptions, suppose a public project with production costs (MRT) of $1, and benefits ($\Sigma$MRS) of slightly more than $1, could be funded by a 1% increase in the wage tax. Would this be desirable?
>
> yes ________ no ________

Following the Pigou-Harberger-Browning tradition, 18 out of 22 usable responses (82 percent) indicated "yes" to question 1: the wage tax creates

[3]The good on the vertical axis is the "reference commodity," as is common in this literature. The distance CF is the "compensating surplus" of John Hicks (1943). We use this measure for convenience in the diagrams, but other measures such as the compensating variation and the equivalent variation yield the same results. For truly marginal changes, all three of these measures are identical (Mayshar, 1990; Fullerton, 1991).

[4]The concept of the MCF is closely related to a variety of measures of "marginal excess burden." Calculations using the Pigou-Harberger-Browning approach include the partial equilibrium model of Browning (1987) and the general equilibrium models of Auerbach (1985) and Dale Jorgenson and Kun-Young Yun (1990).

[5]To elicit responses based on the current understanding of these issues, respondents were asked to "take 60 seconds right now to answer the following two questions and return this sheet in the enclosed envelope. Please do not ask for precise definitions, work out the whole model, or give long answers. Just use 'standard' definitions and indicate the 'standard' answers that you think the model would provide." We thank Larry Summers for suggested wording of the questions and instructions.

excess burden that depends on the compensated labor supply elasticity. Sixteen of those responses (73 percent of the total) infer that the answer to question 2 is "no": costs exceed benefits because the MRT must be multiplied by a MCF that exceeds 1.0.

This analysis is not complete, however. The next section provides a framework in which the MCF is exactly 1.0 under the assumptions of the questions. In this case, the correct decision for the government is reversed: "yes," the project should be undertaken. For reasons described below, we believe that the best answers to the questions are that "yes" the tax is distortionary *and* "yes" the project should be undertaken anyway. This combination of answers appeared on only two of the 22 responses.

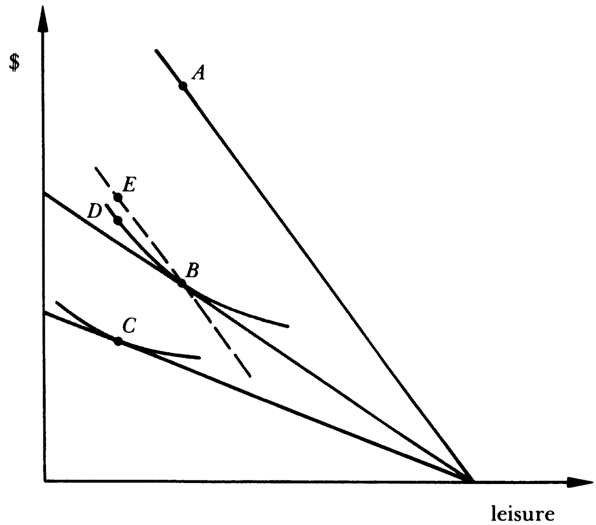
The Stiglitz-Dasgupta-Atkinson-Stern Approach

The problem of distortionary taxes and the provision of public goods was treated in a pathbreaking theoretical model by Joseph Stiglitz and Partha Dasgupta (1971). They assume that a group of identical consumers gets utility from both private goods and public goods, and that net-of-tax producer prices are constant. The government then seeks to maximize utility, subject to the constraint that the revenue must be raised by a set of distortionary commodity taxes. They derive a condition for the optimal provision of public goods (equation 2.4.4, p. 158) that corresponds to our equation above. They do not label the "marginal cost of public funds," but it is isolated in their next equation, and it is defined as "the value of the change in consumption from the required additional tax" (p. 158). They then comment that whether this term is less than one or greater than one "depends simply on whether the supply curve of labour is backward bending or upward sloping" (p. 159).

This result appears to contradict the previous finding that the marginal cost of public funds *must* be larger than 1. To sharpen the contrast, consider Figure 2. The set-up of this figure is identical to that of the previous figure, where the individual chooses initial point B on the initial net wage line with initial revenue AB. Then the tax rate is increased by a small amount, as before, but the revenue is not returned. Instead, it is used for a public project that is assumed to have no independent effect on labor supply. With backward-bending labor supply, the net wage reduction serves to increase labor (decrease leisure) to the new choice point C. Again, the dashed line is parallel to the gross wage line, to show all points with the original revenue AB. Thus, at point C, the additional revenue is CE. The loss in utility can be measured by the vertical distance CD, but the amount of revenue raised actually exceeds the loss of utility. The marginal cost of public funds is CD/CE, and this MCF is *less* than one.

In this model, the marginal cost of public funds depends primarily on the *uncompensated* labor supply effect. If actual labor supply at point C did not change relative to point B, as in the Cobb-Douglas example of the survey

Figure 2
An Increased Wage Tax with No Rebate



questions, then points B, D, and E would coincide. The marginal cost of public funds would be CD/CE = 1.0. The original Samuelson condition would hold, and the project should be undertaken whenever ΣMRS > MRT.

An intuition for this result is provided by Anthony Atkinson and Nicholas Stern (1974). They also isolate the marginal cost of public funds, without using that terminology, and they decompose it into two parts (in their equation 5, p. 122). The first is what they call the "distortionary effect," which depends on substitution effects. They show that this effect always works in the direction of making government projects less attractive. In other words, the distortionary effect tends to raise the MCF to values higher than one. This may be what Pigou had in mind when he made his conjecture.

A second part of the marginal cost of public funds is the "revenue effect," which depends on the income effects of the tax change. *If* the income effects reduce the demand for taxed goods, or the supply of taxed labor, then they reduce the amount of revenue collected by the government. Income effects then reinforce the substitution effects. When this happens, the MCF is all the more likely to exceed one.

With regard to labor supply, however, changes in the net-of-tax wage rate typically lead to income effects and substitution effects that go in opposite directions. Since the income effect of wage taxation increases work effort and therefore *increases* government revenue, it works toward a lower marginal cost of public funds.[6]

[6]In the Stiglitz-Dasgupta-Atkinson-Stern approach, where provision of the public good itself has no effect on labor supply, calculations of MCF or marginal excess burden are provided by Charles Stuart (1984), Ballard, John Shoven and John Whalley (1985), Ingemar Hansson and Stuart (1985), and Fullerton and Yolanda Henderson (1989).

Thus, Pigou's conjecture was on the mark regarding a sales or excise tax on a normal consumption commodity, since the distortionary and revenue effects reinforce each other. In the case of a wage tax, however, the distortionary and revenue effects offset each other, so that Pigou's conjecture may not be correct. If the income effect is large enough that the *uncompensated* labor supply elasticity is negative, the MCF may be less than one. This possibility is empirically important, since many studies have found negative labor supply elasticities, especially among prime-age males. Mark Killingsworth (1983) and Gary Burtless (1987) provide helpful summaries of the labor supply literature.

Reconciliation and Further Results

Only recently has the public finance literature fully recognized the distinction between the two approaches.[7] Perhaps one reason is that neither Stiglitz-Dasgupta (1971) nor Atkinson-Stern (1974) use the "marginal cost of public funds" terminology that is characteristic of the Pigou-Harberger-Browning approach.

Ballard (1990) uses the language of Richard Musgrave (1959) to characterize the distinction, pointing out that the Pigou-Harberger-Browning approach involves "differential analysis," in which a distortionary tax is compared to another tax of equal revenue yield. In this case, the distortionary tax is compared to a lump-sum tax. This lump-sum tax is a hypothetical alternative that is not generally relevant for the actual effects of a tax-financed increase in government spending. To be relevant for cost-benefit analysis, the Pigou-Harberger-Browning approach must assume that the public good itself essentially compensates the consumer so that income effects wash out and only substitution effects remain. This assumption is often left unstated, but it is a strong one: the public good must be just like cash in its effects on consumption of goods and leisure. That is, the tax and rebate must lead to a decrease in labor supply.

In contrast, the Stiglitz-Dasgupta-Atkinson-Stern approach involves "balanced-budget analysis." It involves calculating the effect of a tax-financed increase in government spending. For the case described using Figure 2, however, the assumption is that the public good itself has no effect on labor supply. The actual labor supply may either rise or fall as a result of the tax

[7] The difference between the two approaches was identified in underappreciated papers by David Wildasin (1984) and Stuart (1983). The rest of the literature caught on more recently, with papers by Arthur Snow and Ronald Warren (1989), Firouz Gavhari (1990), Ballard (1990), Mayshar (1990), and Fullerton (1991). In the language of Wildasin (1984), those who use the Pigou-Harberger-Browning approach assume that the public good and leisure are "compensated independents." The consumer receives compensation for the tax, and the provision of the public good has no effect on the compensated labor supply curve. Those who use the Stiglitz-Dasgupta-Atkinson-Stern approach assume that they are "ordinary independents," since provision has no effect on the ordinary labor supply curve. Both cannot hold simultaneously.

change alone. Again, however, the assumption about the effect of government spending has often not been stated explicitly.

Another way to see the distinction is to consider a small lump-sum tax that is imposed on top of a pre-existing wage tax. Users of the Pigou-Harberger-Browning approach would say that this lump-sum tax has no excess burden (relative to a lump-sum tax). Thus, the marginal cost of public funds would be one. Users of the Stiglitz-Dasgupta-Atkinson-Stern approach would note that the additional lump-sum tax has income effects that discourage leisure and encourage labor supply (with the assumption that the public good itself has no effect on labor supply). *Thus, the additional lump-sum tax also increases the revenue from the pre-existing wage tax.* The combined increase in revenue exceeds the loss in utility, so that the "revenue effect" makes the marginal cost of public funds less than one.[8] This example illustrates that the original Samuelson rule requires not just lump-sum taxes at the margin, but no distortions anywhere.

In general, of course, the public good might have some effect on labor supply or other taxed activities. If it increases any taxed activity, it helps offset pre-existing tax distortions. Suppose, for example, that the government provision of a highway is a complement to the private purchase of gasoline, and that gasoline is subject to tax. In this case, the provision of the highway will increase the revenue collected by the gasoline tax, and thereby reduce the marginal cost of public funds for *any* tax used to finance the highway. Thus, the public good may have other effects in addition to income effects. It may be a complement or a substitute for the taxed activities. The provision of a public beach may decrease labor supply (raising the MCF), or the provision of public transit may increase labor supply (reducing the MCF). The MCF ultimately depends not just on the tax, but also on the nature of the government expenditure under consideration.[9] This analysis implies that no general statements can be made about whether taxation raises or lowers the marginal cost of providing public goods. The MCF depends on the entire interaction between the public expenditure and taxed activities.

Which approach is better? As an empirical matter, neither approach exactly captures the effects of government spending on labor supply.[10] In fact, no empirical evidence on this point can be generally right, since the cost-benefit analyst must consider the specific effects of a specific project. Still, it is possible to separate conceptually the effects of the public expenditure from the effects of the tax. John Douglas Wilson (1991) argues that "for the purpose of

[8]See Fullerton (1991) for a diagrammatic exposition.

[9]Shaghil Ahmed and Dean Croushore (1990) show that calculations of the marginal cost of public funds can be quite sensitive to assumptions about the interaction between public and private spending.

[10]Roger Kormendi (1983) and David Aschauer (1985) find that particular types of government spending can affect labor productivity, but *overall* spending does not. Karen Smith Conway (1991) provides some evidence that overall government spending may decrease labor supply, but the effects differ by type of worker.

uncovering a 'general bias,' it seems reasonable to consider the case in which the utility functions exhibit separability between private commodities and the public good" (p. 159). Separability means that utility can be written as a function of two arguments, where one argument is the public good and the other argument is only a function of private goods and leisure. Wilson's point supports the Stiglitz-Dasgupta-Atkinson-Stern approach, since separability implies that the public good has no effect on taxed activities.

We now put some numerical flesh on these ideas. We do not provide new calculations for the Pigou-Harberger-Browning approach, because the survey results suggest that most economists are already familiar with it, and because such calculations are fully described in Browning (1987). As mentioned already, his estimates of the marginal cost of public funds range as high as $4.00 per marginal dollar of revenue, and always exceed $1.00.

For the Stiglitz-Dasgupta-Atkinson-Stern approach, we provide new calculations of the MCF in Table 1.[11] We use a simple, partial equilibrium model in which labor supply is the consumer's only decision, and a labor income tax is the only distortion. In the top panel of Table 1, we present results for the special case where the uncompensated labor supply elasticity is zero. Note that a larger compensated elasticity therefore implies a larger income effect. We start with a proportional labor tax rate of 43 percent.[12] For an increase in this (or any) proportional labor tax, with the revenue spent on a separable public good, the first column shows that the MCF is exactly 1.0. Also, as suggested above, the second column shows that the addition of a small lump-sum tax on top of the wage tax has an MCF of less than one. In this case, a greater income effect implies a larger increase in labor supply, and therefore a smaller MCF. In the third row, a $1 lump-sum tax would raise welfare, even if it were used to finance a public good with marginal benefits of 82 cents.

For columns three and four, we start with a progressive labor income tax. One type of progressive tax could be represented by a kinked budget constraint, with line segments that become flatter as the marginal tax rate rises. Only the chosen segment is relevant, however, so we can describe the individual budget constraint as if it were a linear extension of that segment. The extended straight line has slope reflecting the relevant marginal tax rate, and it has an intercept at zero labor supply which is called "virtual income."

We set this budget constraint such that the average tax rate is 27 percent and the marginal tax rate is 43 percent. When these two rates increase by the same proportion, the MCF can exceed one, even when the uncompensated

[11]Similar calculations of the marginal cost of public funds using the Stiglitz-Dasgupta-Atkinson-Stern approach are presented by Wildasin (1984), Robert Triest (1990), and others.

[12]Both Stuart (1984) and Browning (1987) find that the weighted average of effective marginal tax rates on labor income is close to 43 percent. Below, we use their common finding that the average tax rate on labor income is 27 percent. We follow Gary Burtless (1987) for various labor supply elasticities, and Jerry Hausman (1981) for the linear labor supply function, wage rate, and nonlabor income. The formula for the marginal cost of public funds is consistent with the preceding diagrammatic analysis. For more details, see Ballard and Fullerton (1990).

Table 1
The Marginal Cost of Public Funds (MCF) for Small Tax Changes, with a Pre-existing Wage Tax[a], as a Function of Labor Supply Elasticities[b]

		Proportional Wage Tax		Progressive Wage Tax	
Uncompensated Labor Supply Elasticity	*Compensated Labor Supply Elasticity*	*(1) Increase the Wage Tax*	*(2) Add Lump-Sum Tax*	*(3) Raise Marginal and Average Rates by Same Proportion*	*(4) Raise Only Marginal Tax Rate*
0.000	0.100	1.000	0.930	1.047	1.179
0.000	0.200	1.000	0.870	1.099	1.434
0.000	0.300	1.000	0.816	1.156	1.834
− 0.105	0.284	0.936	0.774	1.052	1.540
−0.022	0.090	0.984	0.922	1.025	1.136
0.173	0.234	1.147	0.950	1.315	1.989

[a]In the case of a proportional tax, both marginal and average tax rates are initially 43 percent. In the case of a progressive tax, the initial marginal tax rate is 43 percent, and the initial average tax rate is 27 percent.
[b]The public project does not affect the consumer's uncompensated demand curves for leisure and consumption.

labor supply elasticity is zero. This result is shown in column three of Table 1. The reason is that this tax change effectively increases the individual's "virtual income." The associated income effect decreases actual labor supply and worsens prior distortions, even when the uncompensated elasticity is zero. The marginal cost of public funds depends on the actual change in revenue, which depends on the actual change in labor supply. Thus the MCF depends on all income and substitution effects of the change in policy (and not just on the uncompensated effect of the change in the net wage).[13]

When the marginal and average tax rates rise by the same percentage (as in the experiments reported in column 3 of Table 1), it is necessary for the *inframarginal* tax rates to rise. The increase in the inframarginal tax rates acts like a lump-sum tax. It generates income effects, but not substitution effects. All else equal, the increase in inframarginal rates will exert downward pressure on the marginal cost of public funds.

In column 4 of Table 1, we consider simulations in which the marginal rate rises, but the inframarginal rate does not change. Here, we assume that the 43

[13]Thus Stuart (1984) finds a MCF of 1.07, even with an uncompensated labor supply elasticity of zero. He models a progressive tax system, and the change in virtual income leads to a change in actual labor supply.

percent marginal rate applies to the final one-third of total labor income. Since the inframarginal rate does not change, the MCF is larger in column 4 than in column 3. For the parameters considered here, the difference can be fairly substantial.

In other calculations, not reported in the table, we raise the marginal tax rate only on labor income above a threshold that is very close to actual labor income. Revenue is effectively determined by all of the inframarginal tax rates in this case, so distortions are the only relevant consideration in setting the top-most marginal tax rate. (Indeed, theory suggests that the tax rate on additional income of the richest individual should be zero.) Thus, an increase in this rate generates excess burden in the numerator, little revenue in the denominator, and an MCF that is arbitrarily large. Actual revenue may even decrease.[14]

The bottom panel of Table 1 shows MCF calculations for different combinations of compensated and uncompensated labor supply elasticities. These elasticities are taken from Burtless's (1987) survey of the labor supply literature: the first row reflects nonexperimental studies of male labor supply behavior, the second reflects studies using the negative income tax experiments for male labor supply behavior, and the last row reflects studies using the negative income tax experiments for the labor supply of wives. The results reinforce the main points made so far, for calculations of the Stiglitz-Dasgupta-Atkinson-Stern type (where the expenditure is *not* like a cash transfer). First, for negative uncompensated labor supply elasticities, the marginal cost of public funds of a proportional tax increase is less than one. Second, the MCF for a lump-sum tax is less than one. Third, the income effect on labor supply is important in determining the deviation of the lump-sum MCF from one, and in determining the size of the MCF for progressive tax changes.

Concluding Remarks

At this point, the rationale for our preferred answers to the brief survey of economists should be clear. Together with just two of the 22 respondents, we believe that the best answers to the survey questions are "yes" and "yes." Yes, the increased wage tax is distortionary, in that it further distorts relative prices and leaves the consumer worse off than a lump-sum tax of equal revenue yield. And even so, yes, the project is still worthwhile.

The "yes" answer to the second question is unambiguous, as long as the public good is separable, because labor supply is unaffected and the MCF is exactly 1.0. However, we recognize that the "yes" answer to the first question is

[14]See Hansson and Stuart (1985). At the peak of the "Laffer curve," where a change in tax rate generates no additional revenue, the MCF is infinite. In the "prohibitive range," where an increase in the tax rate generates less revenue, the MCF is negative. In other words, revenue can be raised in a way that increases consumer welfare, simply by cutting the tax rate.

subject to semantic interpretation. In fact, four respondents to our survey answered "yes," the project is worthwhile, and (therefore) "no," the tax is not distortionary. However, we find it useful to retain the traditional definition of the word distortionary, which involves a comparison with a lump-sum tax. Even though the MCF is 1.0, the tax is "distortionary" relative to a lump-sum tax which has MCF of *less* than one. To use the Atkinson-Stern terminology, the "distortionary effect" is still relevant, but it is exactly offset by the "revenue effect."

More important than the particular example in the survey, however, is that this analysis shows a need to reorient thinking about distortionary taxation and the provision of public goods. In particular, if the tax system is not already optimal, then additional revenue might be obtained in a way that reduces the distortionary effects of pre-existing taxes. Here are a few examples. First, to the extent that an investment tax credit distorts the choice between equipment and other assets, a reduction in the credit can raise revenue while increasing economic efficiency. Fullerton and Henderson (1989) find that a reduction in the investment tax credit has an MCF of 0.62. Second, in a model with pollution, Ballard and Steven Medema (1991) find that a Pigouvian, externality-correcting tax has an MCF of 0.73. For a third example, Raymond Batina (1990) shows that a tax on interest income imposes tax liability later in the life cycle than a tax on labor income, so that it may increase capital accumulation and move the economy closer to the optimal level of capital. In another dynamic model, Kenneth Judd (1985) shows that future taxes can increase the supply of productive factors in the present, and this can also generate MCFs less than one.

The marginal cost of public funds can be used to analyze the composition of the tax system as well as the overall level of taxation. To the extent that the marginal cost of public funds differs among tax instruments, these analyses suggest that welfare can be increased by a reform that raises one tax and lowers another. They also suggest that no general conclusion can be drawn about the marginal costs of taxation used to finance a marginal public project. In particular, economists should set aside the apparent presumption that the marginal benefits of a tax-financed public good must exceed its dollar cost. Instead, we should consider more carefully the effects of particular public goods on labor supply and other taxed activities.

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