



WHY IS PIGOU SOMETIMES WRONG?

## 1. INTRODUCTION

With lump-sum taxation, the first-best public good level is characterized by the

Is Pigou's conjecture more generally correct? Pigou's intuition hinges on the increase in the marginal cost of funds. What is missing in his analysis is the effect of the distortion cost on the marginal benefit of the public good. In particular, if a proportional tax is placed on a commodity, the price distortion causes the household to substitute into the untaxed numeraire. The direct effect of the increased consumption of the numeraire is to raise the marginal benefit of the public good. I provide an example in which the increase in the marginal benefit exceeds the increase in the marginal cost, so that the net effect of the distortion is to increase the second-best public good level above the first-best level. In addition, my approach provides intuition for the result of Gaube (2000) that, if the second-best public good level exceeds the first-best level, the taxed commodity must be a gross complement; and it allows me to show that, if the second-best public good level exceeds the first-best level, the taxed commodity must be normal.<sup>2</sup>

In my structure, a commodity tax is equivalent to a labor tax. However, as noted by Atkinson and Stern (1974), there are descriptive differences. In particular, a labor tax can be considered as a lump-sum tax plus a leisure subsidy. In this case, my earlier result is reversed: if the subsidized commodity (leisure) is normal, the second-best public good level is less than the first-best level. Thus my analysis explains the result of Gaube (2000) that the second-best level is less than the first-best level when leisure is a normal good.<sup>3</sup>

Other authors note situations which seem to contradict Pigou's intuition, although their emphasis continues to be on the marginal cost of funds.<sup>4</sup> The marginal cost of funds is lowered whenever the increase in the public good interacts with the pre-existing tax structure to create additional tax revenue. In Diamond and Mirrlees (1971), this occurs because the public good level is complementary with the taxed commodities. In Stiglitz and Dasgupta (1971), it occurs

because the higher tax rate required to finance the marginal expenditure induces the household to substitute into other taxed commodities. The lowering of the marginal cost of funds creates the possibility that the second-best level of the public good may exceed the first-best level. Since I want to use the simplest model to challenge Pigou's conjecture, I choose a model in which these complications are absent. In particular, I assume that the demand for the taxed commodity is independent of the level of the public good, and that all taxes are collected using a single proportional tax.

An alternative argument which stresses equity is put forward by Besley and Coate (1991): if the main beneficiaries of the public good are the poor, the public good is a useful instrument with which to effect redistribution; this causes the second-best level to possibly exceed the first-best level. Wilson (1991b) shows that the absence of a lump-sum tax is a crucial assumption of earlier models. If lump-sum taxes and indirect taxes are chosen optimally (reflecting redistribution concerns), the lump-sum tax may be used to finance an increase in the public good. The consequent reduction in the size of the distorted private sector is a favorable effect and may cause the second-best level to exceed the first-best level. Although these effects are important, I abstract from them: my results are obtained in a model in which all households are identical and in which, as noted earlier, all tax revenue is collected using a single proportional tax.

The paper is organized as follows. Section 2 characterizes the first-best and second-best allocations if (in the case of the second-best) tax revenue is collected using a commodity tax. Section 3 shows how the distortion effects the public good level. Section 4 discusses the case of labor taxation. Section 5 concludes.

## 2. THE MODELS



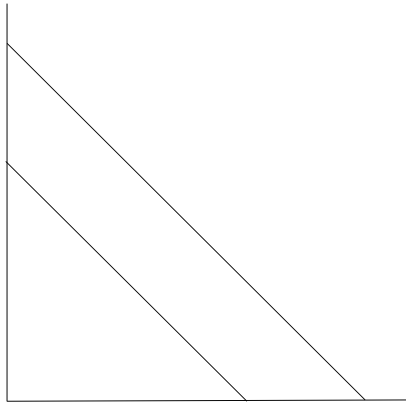




The value of  $z$  which solves Equation (3) is the first-best public service,  $z^F$ . The left-hand side of Equation (3) is the marginal benefit of the public service. It is shown in the Appendix A that the marginal benefit is a decreasing function of  $z$  and, in Figure 1(b), it is shown as the downward-sloping line  $MB$ . The right-hand side of Equation (3) is the marginal cost of the public service, shown in Figure 1(b) as the horizontal line  $MC$ . First-best efficiency requires that the marginal benefit equals the marginal cost, or  $z^F$  occurs at the intersection  $G$  of  $MB$  and  $MC$ .

The household's choice of  $x$  conditional on  $q$ ,  $x^s(q)$ , is implicitly defined by the first-order condition

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### 3. DISTORTION AND PUBLIC SERVICE LEVEL

#### *3.1 Discussion*

In Figure 2(b),  $MB'$  is the marginal benefit schedule when the commodity tax is used instead of the lump-sum tax. It is drawn above  $MB$ , the marginal benefit schedule in the first-best. The second-best public service level,  $z^*$ , lies at the intersection  $G'$  of  $MB'$  and  $MC'$ .

or

$$U_{\ell\ell} - -$$

Appendix C shows that this indirect utility function implies  $U_x > 0$ . The acceptable set  $\{q, M\}$  is restricted because (1)  $0, x > 0$ , and because (2) the Slutsky Restriction (the own-derivative of the implied compensated demand must be non-positive or the implied utility function must be concave).

For ease of calculation, I set





#### 4. LABOR TAX

I now consider the case when the public service must be financed by a labor tax. In considering this case, I use the previous model but interpret  $l$  to be leisure,  $x$  to be the numeraire commodity and  $M$  to be the household's leisure endowment; I follow traditional notation and rewrite the leisure endowment as  $H$ ,  $M \equiv H$ . The household's before-tax wage  $w$  is his productivity or  $w = 1/p$ . The economy's resource constraint is obtained from Equation (1):

$$x + v = w(l) + M.$$

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where  $\varepsilon_L = (\partial L / \partial w) dL/dw$ . The left-hand side is the marginal benefit of the public service ( $MB'$ ) when the public service is being financed by a labor tax and the right-hand side ( $MC'$ ) is the resource cost of the public service multiplied by the marginal cost of funds. As noted by Atkinson and Stern (1974), and by Ballard and Fullerton (1992), the wage distortion may cause the marginal cost of funds to rise above or fall below unity depending on whether an increase in the tax rate causes the tax base to decrease or increase. This is essentially the same argument as put forward by Stiglitz and Dasgupta (1971), that the marginal cost of funds is less than unity if the increase in the tax rate, which is needed to fund the higher public service, changes quantities so that more tax revenue is collected from the pre-existing tax structure. For the subsequent discussion, I restrict attention to the case of  $dL/dw > 0$ , so that the proportional labor tax increases the marginal cost of funds above unity.

*ASSUMPTION 2: the wage elasticity of labor is positive, or  $\partial L / \partial w > 0$ .*





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does not occur is either the price elasticity of the taxed commodity is positive and the taxed commodity is inferior, or the wage elasticity of labor is positive and leisure is normal.



MARGINAL BENEFIT

downward sloping, differentiate the marg

## APPENDIX B: RECOVERING THE INDIRECT UTILITY FUNCTION<sup>15</sup>

APPENDIX C:  $U_x > 0$

Equations (9) and (10) give  $(q, M)$  as implicit functions of  $(, x)$ : write the functional dependence as  $q(, x)$  and  $M(, x)$ . Duality implies

$U($

$$\frac{\partial h}{\partial Q} = \frac{bC}{Q^a} \frac{1}{e^{1-b}} \frac{\partial e}{\partial Q} .$$

(C.1) By duality,

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1. "Marginal benefit" is used synonymously with "marginal revenue" in the paper. Similarly, "first-best" and "second-best" are used synonymously with "first efficient" and "second efficient."

(2000) and my result both assume a constant return to scale.

It presupposes that the labor supply is constant.

It is reviewed in Batina (2004).

The introduction of a public good is discussed in the presentation. The results apply if

the expenditure is

using the following formula (4)





