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Global Climate Policy Will Have Net Benefits Larger Than Anyone Thinks (and Welfare Gains, Strangely, Are Likely To Be Much Larger Yet)☆

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ABSTRACT

As with other public goods lacking strong special interest support, global climate policy suffers from two serious theoretical flaws. The first is failure to endogenize the labor-leisure decision when conducting benefit-cost analysis. Recognition that income generated will not remain the same pre-and-post policy results in downward bias in benefit estimation. Much more importantly, there will generally be free riding in input markets in addition to the well-known output demand revelation problem. Since even households with very high marginal values cannot individually increment public goods, too little income will be generated and too much of the income that is generated will be spent on relatively low value ordinary private goods. The ungenerated income would have all been spent on the public good, apart from general equilibrium considerations, resulting in additional—and perhaps large—downward bias in benefits of global climate policy. The reallocation of spending from relatively low value private goods to higher value public goods may further greatly increase willingness-to-pay for policies stabilizing global climate.

1. Introduction

There is much debate about the importance of global climate policy. How much warming is likely to occur over the next century and what are the costs and benefits associated with that expected warming? If we are under-providing climate abatement from a human benefit-cost perspective, it is certainly the case that we are under-providing abatement from the broader perspective of ecological economics.

In this short note, two central observations of relevance to climate policy are emphasized. First, failure to endogenize the labor-leisure decision in benefit-cost analysis results in undervaluation of policies devoted to public goods, greenhouse gas mitigation being the case of interest here (see Flores and Graves, 2008 for proofs). Acknowledging that labor supply will increase with the provision of a public good justifies larger increments to the public good than if labor-leisure endogeneity is ignored.

The second observation is of much greater importance. The full extent of the free riding problem mentioned toward the end of Samuelson's classic treatment of optimal provision of public goods (see Samuelson, 1954) was not understood until recently (see Graves, 2009). Any time conditions are such that one would expect free riding out of current income—the well-known "demand revelation" problem—it is also the case that free riding is to be expected in input markets, a failure to generate the right amount of income. We work to increase the quantities of goods consumed and if a class of goods (e.g. public goods, such as global climate stability) cannot be individually incremented, income will not be generated for that class of goods. This implies that benefit-cost analysis of such public goods will be conducted at the "wrong" income level. Moreover, *all* of the ungenerated income would have been spent on the public good in question, apart from general equilibrium considerations. Additionally, consuming too much leisure implies, since the marginal utility of goods will be equated to the marginal value of leisure to the extent possible, that too many ordinary

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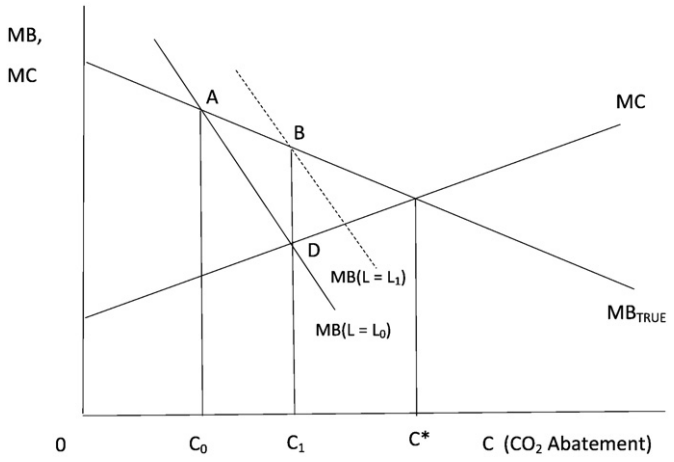

Fig. 1. Benefits are underestimated if the labor-leisure decision is not endogenized.

private goods will be consumed. These effects reinforce each other in that the low-value leisure and low-value goods combine to represent resources available to pay for (potentially high) valued public goods such as climate stability.

The first observation is taken up in greater detail in Section II, employing a simple graph. The implications of free riding in input markets for both non-optimal leisure choice and non-optimal private goods consumption is taken up in Section III, again in the context of a simple graph. Sections II and III reinforce each other, implying underestimates of whatever true valuations exist for public policy aimed at stabilizing global climate. Section IV concludes, putting the arguments here in the context of the broader issue of the appropriate role of government.

2. Labor-Leisure Endogeneity and Climate Policy

For purposes of this section, the initial labor-leisure choice is assumed to be optimal, an assumption that, as a practical matter, is *always* made in benefit-cost analyses of policies. The implications of this assumption are seen in Fig. 1, where C_0 is some initial level of CO_2 abatement (which could without loss of generality be at zero, no current abatement).

MB_{TRUE} represents the true marginal benefits of additional CO_2 abatement when all optimal adjustments are made, and *assuming that there are no demand revelation problems*. Suppose that the regulatory agency is contemplating a policy of increasing CO_2 abatement from C_0 to C_1. In Flores and Graves (2008) it was shown that the marginal benefit curve, conditional on (implicitly) constraining labor supply to its initial level, L_0 (that optimally associated with C_0), will be steeper than the true marginal benefit curve. That is, if the government increases the abatement level, the additional costs associated with the policy (the area under the MC curve between C_0 and C_1) will result in decreased ordinary private goods consumption at initial income levels, hence there will be a higher marginal utility of those goods. This will result in a reduction in leisure, until its after tax value is equated to the now higher marginal utility of private goods, thus the new labor supply will generally be larger, $L_1 > L_0$. Hence optimal generated income will increase if CO_2 abatement is increased.[1] This in turn will increase the marginal value of CO_2 abatement, seen as the vertical distance between D and B. A larger level of CO_2 abatement can be justified if the labor supply is endogenous to the abatement decision, as is appropriate in general equilibrium. That is, the measured benefits of a policy of greater CO_2 abatement would be (mis)estimated to be area C_0ADC_1 by benefit-cost analysis as traditionally conducted, rather than the true benefits seen as area C_0ABC_1. This section accounts for the first (non-parenthetic) part of the title of this paper.

The problem described in this section might not be of great importance if benefit-cost analyses were conducted with sufficient frequency and policies repeatedly revised. That is, if one were to contemplate a further increment in CO_2 abatement, there would be a new fixed-labor conditional marginal benefit curve (at $L_1 > L_0$) passing through point B with a steeper slope than the true marginal benefit curve—the dashed line in Fig. 1. This new conditional marginal benefit curve would intersect the marginal cost of abatement curve at an abatement level greater than C_1 but less than C^* as shown. Additional benefit-cost analyses would, at least in principle, gradually move society to the true optimal level of abatement, C^*.

Being costly, benefit-cost analyses are only conducted infrequently. Moreover, the true marginal benefit curve is itself shifting outward with growing global population and income. So, it is not clear that actual CO_2 abatement levels are even getting closer to the true (moving) optimum (see Graves, 2003a for this notion in the context of traditional pollutants). The situation as depicted in this section is, however, itself deeply flawed for a reason that has gone unrecognized in both economic theory and in policy analysis. We now turn to that flaw, a flaw that is likely to be of particular relevance to climate policy for reasons that will be clear.

3. Free Riding and Climate Policy

In his 1954 article, Samuelson laid out the condition for optimal public goods provision which, in the context of our Fig. 1, is that the individual marginal benefits by all receiving them should, on efficiency grounds, be vertically-summed to obtain the marginal social benefits (MB_{TRUE}) to be compared to marginal provision costs (MC). Samuelson noted, however, near the end of his classic article that it would be difficult as a practical matter to determine individual willingness to pay as is necessary for aggregation to marginal social benefits, since each individual would have an incentive to "free ride." In his statement of the well-known demand revelation problem, Samuelson stated "[It] is in the selfish interest of each person to give *false* signals, to pretend to have less interest in a given collective consumption activity than he really has, etc." (p. 388–89).

That demand revelation problem is, however, more pervasive than has been recognized, as discussed in Graves, 2009. Clarifying, we generate income to buy the goods and services that we want. In any situation (e.g. demand for CO_2 abatement) in which one would expect free riding out of a given income, one would *also* expect the wrong income to be generated. We work to obtain the goods we desire, but if we cannot individually increment a class of goods (specifically pure public goods, CO_2 abatement being of particular importance, given its transnational nature) we will not give up leisure to do so. This observation was *implicit* in Samuelson's article, since he indicated early on that inputs are just like outputs except with a minus sign (i.e. we want to maximize net benefits). The implications for CO_2 abatement policy can be seen with reference to Fig. 2, a variant of Fig. 1 which will require some discussion.

The first difference between the two figures is that MB_{TRUE} is presented as a dashed line reflecting the fact that policy makers are unable to induce individuals to reveal it—they know that it is "there" somewhere, but do not know its location. It represents the value of the public good, in terms of foregone leisure and private goods, *if* the public good could be bought as an ordinary private good.

Now, again consider the initial situation at C_0. The optimal work effort associated with the area under the true dashed MB curve is L_0 as discussed in Section 2. But the L_0 level of work effort will not take place. Rather, individuals will only increase their work effort in moving from 0 to C_0 by the amount that is optimal to pay the higher *costs* at C_0 (the much smaller area under the MC curve between 0 and C_0, area $0FGC_0$), not the work effort associated with the area under MB_{TRUE} between 0 and C_0, area $0EAC_0$, discussed in Section II. That level of work

[1] There will also be changes in the composition of the private goods bundle (increases in complements, decreases in substitutes for the public good). These effects are discussed more fully in Section III.