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THE SOCIAL RATE OF DISCOUNT, TARGETS AND INSTRUMENTS

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Abstract

Recent contributors to the literature on the social rate of discount seem to be converging to the view that the appropriate discount rate to be used in evaluating public projects lies between the marginal social productivity of private investment and the social rate of time preference. In this note the Tinbergen [14] targets-instruments principle is invoked to argue that this conclusion is based on an unnecessarily restrictive formulation of the problem, and that the outline of a more fruitful approach leading to a different conclusion has already been presented by Marglin and Feldstein.

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The Social Rate of Discount, Targets and Instruments

David Morawetz*

Recent contributors to the literature on the social rate of discount, including Baumol [1], Harberger [4], James [5], Nichols [10], Ramsey [11], Seagraves [12], and Usher [17], seem to be converging to the view that the appropriate discount rate to be used in evaluating public projects lies between the marginal social productivity of private investment and the social rate of time preference (STP). In this note the Tinbergen [14] targets-instruments principle is invoked to argue that this conclusion is based on an unnecessarily restrictive formulation of the problem, and that the outline of a more fruitful approach leading to a different conclusion has already been presented by Marglin [7], [8] and Feldstein [3].

As William Baumol [1] has clearly stated at least two policy targets must be considered in selecting "the" optimal social rate of discount - efficient allocation of resources between the public and private sectors, and optimal allocation of resources over time. Herein apparently lies a dilemma. On the one hand, in order to maintain aggregate production efficiency the discount rate should reflect the marginal social return on private investment. On the other hand, for optimal allocation of resources over time it should reflect social time preferences. Only if the pre-tax marginal social return on private investment is equal to the STP rate will the use of a single discount rate enable full achievement of both targets. But the existence of taxes and other distortions makes it most unlikely that these two rates will in fact be equal. Hence the policy-maker's apparent dilemma.[1]

The dilemma arises, in Tinbergen's [14] terms, because the policy-maker must attempt to attain two targets using only one instrument, the discount rate, in general an impossible task. However, Marglin [7] [8] and Feldstein [3] have overcome this

problem by suggesting that two instruments be used in evaluating projects, a discount rate and a shadow price of capital, the latter representing the present value of the consumption that is foregone because of the resources which the government transfers from the private sector during the life of the project.[2] The introduction of a second instrument enables the two targets to be approached directly: production efficiency by valuing capital subtracted from the private sector at its shadow price, optimal allocation of resources over time by converting all costs and benefits to equivalent increases and decreases in consumption and discounting at the rate appropriate for comparing consumption over time, the STP rate. That is, the apparent dilemma discussed by Baumol exists solely because he, Harberger et al restrict themselves to considering only one policy instrument. It is resolved by the addition of a second instrument.[3]

Two possible objections may be raised to this targets-instruments formulation of the problem. It may be argued first that the two instruments are not independent, and second that the policy-maker cannot manipulate them as he can other policy control variables (for example, fiscal and monetary instruments). These objections are dealt with in turn.

It is true that the actual and optimal values of the two instruments are not independent; indeed, in Marglin's formulation (equation (1) in the footnote above) the shadow price of capital is an explicit function of the discount rate. However, this does not detract from the generality of the analysis because despite this interdependence it is still necessary to actually apply both instruments in order to arrive at the optimal solution. If the interdependence were such that by applying one instrument at its optimal level in project analysis the other was automatically set and applied at its optimal level the interdependence objection would be valid; the policy-maker would need to set only one instrument in order to achieve the optimal solution. However, in the present case even if the discount rate is applied at its optimal level the correct shadow price of capital must be actually applied to all capital in order to attain the

optimum. It can not be attained by using the discount rate alone. To reiterate, although the two instruments are interdependent in the sense that their actual and optimal values are related, both must be used in order to achieve the optimal solution.[4]

In answer to the second possible objection, while it is true that the policy-maker cannot "manipulate" the social rate of discount and the shadow price of capital as he can manipulate interest rates or budget surpluses, this is of no consequence since the nature of the project evaluation problem is different from that of, say, the achievement of internal and external balance. In the internal - external balance problem as for example analyzed by Mundell [9] the policy-maker sees the "symptoms" of disequilibrium (under- or over-full employment, payments imbalance) and adjusts the budget surplus and/or interest rate in an attempt to offset them. If all econometric relationships in the economy were known with perfect certainty the two instruments could be set at their optimal levels and the economy would arrive immediately at the optimum point of full employment and external payments balance. The need for frequent manipulation of instruments arises because econometric relationships are known with less than perfect certainty. On the other hand, in the project evaluation problem we are in the fortunate position of being able to determine the optimal levels of the two instruments directly without need for step-by-step manipulation; given the "true" value for social time preference the optimal value for the shadow price of capital is given by a formula such as (1) in the footnote above.

It may be useful to illustrate diagramatically the project evaluation problem as it is posed here. It is assumed that θ_1 in (1) is constant, independent of a and r. [insert figure 1]. In figure 1 aggregate production efficiency is attained all along PP. Optimal allocation of resources over time is achieved all along TT.[5] The four sectors labelled with Roman numerals represent states of non-optimality. In I too little public investment is done (a is set too high) and it is too long-lived (r is too low). In II too little

public investment is done and it is too short-lived. And so on. Optimal project evaluation policy requires the use of a shadow price of capital of a^* and a discount rate of r^*.

Baumol's dilemma may be clearly illustrated on the diagram. Baumol, Harberger et al assume implicitly that $a = 1$, which implies that the rate of discount which yields aggregate production efficiency is the marginal productivity of capital rate ρ while the rate giving optimal allocation of resources over time is the STP rate r^*. Attainment of the optimum point Z using the discount rate alone will not in general be possible. Indeed it will only be possible in the special case in which there are no corporate income taxes or other relevant distortions and $r^* = \rho$. In this case, the vertical line TT cuts the horizontal axis at ρ and the Baumol-Harberger and Marglin-Feldstein analyses give the same result: capital should be valued at its market price ($a = 1$) and costs and benefits should be discounted at the common STP marginal productivity of capital discount rate $\rho = r^*$.

It is not claimed here that the Marglin-Feldstein approach is the last word on project analysis, for problems remain. For example, there is some controversy over the appropriate method of determining the STP discount rate.[6] Further, Diamond [2] has criticized the assumption of stationarity which underlies Marglin's analysis; it may be noted, however, that Diamond's criticism applies, mutatis mutandis to most other models developed so far in the field of project analysis since most of them implicitly or explicitly assume stationarity. In spite of these problems, an approach to project evaluation like that of Marglin and Feldstein which uses two instruments to attempt to attain two targets seems likely to prove more fruitful than restricting the analysis unnecessarily to the selection of a single "optimal" social rate of discount.[7]

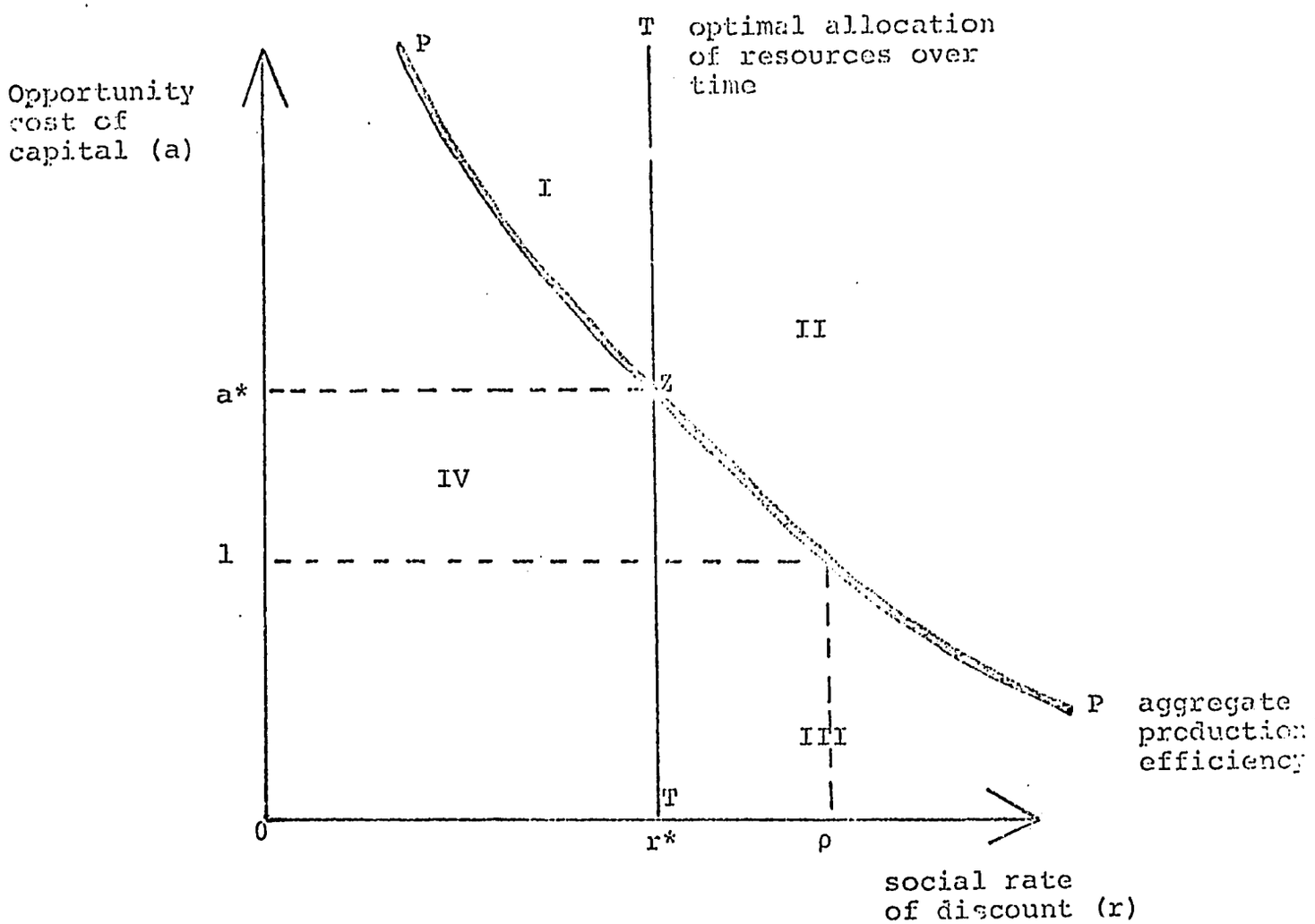

fig. 1: achievement of production efficiency and optimal allocation of resources over time using the opportunity cost of capital and the social rate of discount.

Footnotes

* I wish to thank without implicating Professors Martin S. Feldstein, Stephen A. Marglin, Peter A. Diamond for stimulating discussions and Geoffrey R. Hogbin for helpful comments on an earlier draft.

1. In Baumol's words, "We have seen that there is a basic contradiction in the optimality requirements for the social rate of discount. The condition for efficiency in the allocation of resources between the private and public sectors requires a discount rate significantly higher than that called for by the public's time preferences. Only by the elimination of the corporate income tax and the substitution of a subsidy to private investment to offset the difference between public and private risks can the two requirements be reconciled. [1, p. 800-1]

2. One of Marglin's formulae for the shadow price of capital is [8, p. 279]

$$(1) \quad a = \theta_1 \frac{\rho}{r} + (1 - \theta_1)$$

where r is the STP rate, ρ is the marginal social productivity of private investment and θ_1 is the amount of private investment displaced by a dollar of public investment.

3. In one special case, that in which all benefits and costs associated with a public project occur in the current period, only the shadow price of capital is relevant and the Baumol-Harberger attempt to use a discount rate alone fails completely. I am indebted to Professor Martin Feldstein for this point.

4. The actual and optimal values of other pairs of policy instruments are also interdependent. With the respect to the interdependence of monetary and fiscal policy see Mundell [9].

5. It is assumed for simplicity that social time preference is independent of the shadow price of capital. Abandoning this assumption does not significantly affect the analysis.

6. See for example Lind [6], Tulloch [15], Usher [16] and Sen [13].

7. Of course policy-makers face more than just the two targets discussed above. For an attempt to broaden the analysis by introducing still more control variables see Feldstein [3].

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