JOURNAL OF ENVIRONMENTAL ECONOMICS AND MANAGEMENT **18**, S-65–S-71 (1990)

Perspectives on Government Discounting Policies[1]

JOEL D. SCHERAGA

Office of Policy, Planning and Evaluation, U.S. Environmental Protection Agency, 401 M St. SW, Washington, D.C. 20460

Received December 27, 1988; revised April 15, 1989

The papers by Robert Lind, Randy Lyon, and Robert Hartman illustrate the continued debate over the choice of an appropriate discounting policy for federal agencies. Despite an extensive literature, a consensus does not yet exist on an appropriate procedure for discounting the costs and benefits of government programs and regulations, nor on the choice of discount rates for use with any particular procedure.

The Office of Management and Budget (OMB) issued guidelines in 1972 requiring most federal agencies to use a 10% real discount rate when evaluating the costs and benefits of federal actions. The guidelines allow other rates to be used if there is an adequate rationale, but it is not clear when the use of alternative rates would be acceptable. But recent advances in the economics literature on the "shadow price of capital" approach to discounting have shown that the conventional approach of using a single discount rate is not appropriate for all situations. Instead, the discount rate should vary according to the type of resources displaced and the time profile of benefits and costs. According to this literature, the discount rate generally should be higher if capital is displaced (as opposed to consumption) and lower if benefits are long term or they occur with a lag.

Further clouding the debate, as Lind notes, is the fact that the world economy is changing. There is now a greater degree of capital mobility worldwide which may have a significant impact on the amount of crowding out of investment by government actions. Discounting policy must reflect these changes.

Although the debate continues, several conclusions emerge. First, there does not exist a single discounting procedure that is appropriate for the analysis of all government actions. The types and quantities of private resources displaced by a government action differ among government programs and regulations, and this fact must be taken into account in the analysis. For example, the incidence and magnitude of costs in the form of displaced private resources depend crucially on whether a government project is financed through taxes, debt, or some combination of both. How a project is financed will influence the approach used for discounting its costs and benefits. This all suggests that the conventional approach of using a single discount rate to evaluate the costs and benefits of government actions is incorrect.

Second, advances have been made in the literature that permit one to identify discounting procedures that clearly dominate over others in particular circumstances. For example, the two-stage procedure developed by Kolb and Scheraga [1]

---

[1] The views expressed in this paper are those of the author and do not necessarily represent official EPA policy.

0095-0696/90 $3.00

that is a derivative of the shadow price of capital approach is more appropriate for the evaluation of environmental regulations when the costs of control can be fully passed through to consumers.

Finally, many discounting procedures are subject to manipulation. The outcomes from these procedures are sensitive to the way in which they are implemented and to the choice of discount rates. This can lead to manipulation of the outcomes by some clever (or perhaps ignorant) analyst. This poses a dilemma for policymakers who strive to formulate more sophisticated (yet tractable) guidelines for discounting that are consistent with fundamental economic principles, yet want to minimize the possibility of manipulation by imposing uniform discounting procedures on most federal agencies.

I. SOME FUNDAMENTALS

Hartman correctly observes that the proper perspective for evaluating government projects is one of opportunity costs. Consumption and private investment are foregone when government actions displace resources from the private sector to public uses. The discount rate should reflect the rate of return that could be earned by the resources in alternative private sector uses. If a government action is predicted to reduce the consumption of goods and services, the "social rate of time preference" (approximated by the consumption rate of interest) is the appropriate discount rate. On the other hand, if the government action is likely to displace alternative private investments, then the marginal pre-tax real rate of return on private investment should be used as the discount rate.

A strength of the shadow price of capital (SPC) approach is its ability to account in a meaningful way for the displacement of both investment and consumption. The logic underlying the SPC procedure is that the costs and benefits of a public project or regulation should be evaluated in terms of its net effect on future consumption. That is, a comparison should be made between the stream of consumption to be yielded by the project and the stream of consumption that would have resulted from the private employment of the resources that are diverted to the public project.

The advantage of this procedure is that it makes the choice of discount rate unambiguous. Once all of the costs and benefits of the government action are converted into consumption units, the social rate of time preference—*whatever it may be*—is the appropriate rate at which to discount the consumption adjusted streams of benefits and costs to their present values.

A limitation of this approach is that the value of the numerical factor (called the shadow price of capital) by which benefits and costs are multiplied to convert them to consumption equivalents depends on the marginal rate of return on private investment, the consumption rate of interest, the marginal propensity to save, the rate of reinvestment, and the marginal rate of taxation on capital income. This point is rightly noted by Lyon. But issues regarding the rate of return on private investment, the social rate of time preference, and the extent of displacement of private investment, though highly important to the implementation of the SPC approach (as well as the Kolb–Scheraga two-stage procedure), are not unique to that approach. They are important to implementing any discounting technique.

It is evident from the papers under review here, as well as other papers in the literature, that there is a wide range of estimates for the marginal rate of return on private investment and the consumption rate of interest. But the problem of identifying appropriate discount procedures must be differentiated from the empirical question of choosing "defensible" discount rates.

II. ADJUSTMENTS TO THE SHADOW PRICE OF CAPITAL PROCEDURE

The idea that no single discounting procedure can be appropriately applied to all situations can be illustrated by considering some of the assumptions underlying the SPC technique.

A. The Displacement of Capital

Most of the models used to calculate the shadow price of capital implicitly assume that the capital stock remains permanently lower once private capital is displaced. This is equivalent to assuming that the capital costs imposed by regulations are not passed through to consumers. Since this assumption is inappropriate for environmental (and other types of) regulations, Kolb and Scheraga developed an alternative two-stage discounting procedure that is a variant of the SPC approach. The two-stage procedure is a simplified method for implementing a SPC model in the special case where initially displaced capital is recouped over the lifetime of the environmental investment. The estimated capital costs of a regulation first are annualized using the marginal rate of return on capital. Benefits and costs then are discounted at the social rate of time preference.[2]

The two-stage version of the SPC approach yields significantly different results than alternative discounting procedures when there is a substantial lag between the time when costs are incurred and benefits are realized (e.g., when there are latency periods), or when the benefits stream is long term relative to costs (e.g., the protection of stratospheric ozone). A comparison of this approach with the conventional single-rate discounting procedure (e.g., OMB's uniform 10% rate) reveals that the latter often underestimates the benefits of regulations with these characteristics. The two-stage procedure generally yields higher benefit-cost ratios than the conventional single-rate approach. The disparity in results increases as the period of time over which the benefits occur lengthens and as the lag between the time when costs are incurred and benefits are received widens. The benefit–cost ratios are the same when benefits and costs exactly coincide in time. Furthermore, if one calculates a single "equivalent" discount rate that can be used with conventional discounting procedures to yield the same results as the two-stage approach, one finds that *one discount rate is not appropriate in all circumstances*. As the period of analysis increases or as the lag between costs and benefits increases, lower "equivalent" discount rates are more appropriate.

Randy Lyon has noted that one of the most important issues surrounding the SPC approach is the treatment of depreciation and the rate of reinvestment of returns from capital. As Lyon notes, these issues may seem minor in other contexts,

---

[2] For environmental regulations, the social rate of time preference can be approximated by the riskless consumption time preference rate. As Hartman suggests, this rate can be estimated from the yield on government securities.

but they can dramatically affect the calculated SPC. The arguments in favor of the two-stage procedure suggest that with respect to environmental regulations in particular, the prospects are brighter than Lyon suggests. For many environmental regulations, capital costs are completely passed on to consumers over the lifetime of the capital (e.g., scrubbers in utilities) and capital is not forever displaced by the regulation. Application of the two-stage variant of the SPC model, which is the appropriate approach under these circumstances, greatly simplifies the problem and mitigates the concerns about reinvestment raised by Lyon.

This does not detract from Lyon's key point: The SPC is very sensitive to the values of rates of opportunity cost, time preference, and reinvestment of returns from capital. We are only arguing that for specific types of *environmental* regulations, the problem is not as serious.

B. The Problem of Foreign Capital Flows

The need for a two-stage variant to the standard SPC approach begins to illustrate the assertion that no single discounting procedure is appropriate for the analysis of all government actions. Lind raises a further complicating issue that emphasizes this point; that is, the role that foreign capital flows play in the displacement of private investment by government actions.

Current discounting procedures, including the conventional and SPC approaches, consider the resources displaced by a government action to be in the form of either consumption or private investment. If a government action is funded through borrowing or will require the private sector to invest in plant and equipment (as in an environmental regulation), it usually is argued that the resulting increase in demand for capital raises interest rates and squeezes out private investment elsewhere in the economy. Since the interest elasticity of saving is thought to be quite low, a simplifying assumption generally is made that there is a dollar-for-dollar displacement of capital.

This assumption, however, makes sense only in a closed economy. In an open economy such as ours, where foreign capital flows freely into various capital markets—such as markets for government bonds, real estate, corporate bonds and stocks—an increase in interest rates may well attract additional foreign capital. As Lind observed, there is now a high degree of capital mobility in the world economy.

Lind suggests that if we truly have an open economy with unlimited foreign capital flows, then the displacement of private investment by government projects may not be as severe as previously estimated. If there is a high degree of capital mobility worldwide, then it might be appropriate to analyze government projects as if they do not have a significant impact on investment through crowding out. That is, if government expenditures do not have a significant impact on investment through increases in the interest rate caused by a reduced supply of savings, then the social rate of time preference becomes the appropriate discount rate. The first step of the SPC approach is no longer relevant. The net effect is that more government projects will satisfy the benefit–cost criterion.

Recent work by Kolb and Scheraga [2] addressed the question of whether the potentially complicating factor of foreign capital flows needs to be incorporated in discounting procedures for the analysis of environmental regulations. The preliminary conclusion of that work is that although the manner in which foreign capital flows might affect discounting procedures is an interesting *theoretical* question, it is highly unlikely that the opportunity costs of federal environmental regulations would, in practice, be affected enough to alter policy decisions. Thus, it is concluded that there is no compelling reason to alter and to complicate the discounting procedures already in use or under development.

Further study of this issue is warranted.

III. THE ABSENCE OF A SINGLE "BEST" DISCOUNTING PROCEDURE

Much of the previous discussion suggests the inappropriateness of adopting a single discount rate or even a single discounting procedure for evaluating the costs and benefits of government actions. The incidence of costs (in the form of foregone consumption and investment) differs significantly across government actions. A fundamental problem underlying all discounting procedures is that of identifying the division of cost and benefit flows between consumption and investment. An even more difficult problem, as Lind notes, is that of identifying the extent to which the costs and benefits of public programs crowd out private investments. Nevertheless, the SPC technique enables one to account for displacement of consumption and investment in a more meaningful way than the somewhat ad hoc conventional single-rate approach. Furthermore, it has already been argued that the use of the conventional single-rate approach will understate benefits relative to costs, particularly in cases where benefits are long term relative to costs or when there are significant lags between the time costs are incurred and benefits realized.

The robustness of the SPC approach is itself limited by the need to consider the way in which government actions are financed. The present value of the foregone consumption stream that would have resulted from the private employment of resources that are diverted to a public project depends on the mix of borrowing and taxation used to finance the marginal dollar of federal expenditures. Adjustments in the computed value of the SPC must be made to account for the mix of taxation and government borrowing.

Consider, for example, public works projects which can be assumed to be financed through a mix of taxation and government borrowing. An *adjusted SPC*, called the "shadow price of federal spending" (SPFS), would have to be used to convert the costs of public works projects into a foregone stream of consumption. The SPFS is similar to the concept of the shadow price of capital; it is defined as the present value of the consumption stream displaced by a dollar's worth of investment today in a public works project.

Environmental regulations, on the other hand, impose costs directly on the private sector. For example, government regulation may increase a firm's operating expenses or may require the firm to make investments in capital equipment. In either case, the costs often can be assumed to be passed on to consumers in the form of higher prices. To account for this phenomenon, the two-stage variant of the SPC approach should be used. But even in this case, there is an exception. The assumption that the costs of environmental regulations are fully passed forward to consumers is not a bad one for situations where environmental regulations will affect new products or investments. There are, however, quite a few regulatory situations in which costs are not likely to be passed through to consumers. For example, the costs in markets with strong foreign competition cannot be passed forward. Use of the conventional SPC approach is probably more appropriate in such situations.

The conclusion to be drawn, as Lind and Lyon correctly observe, is that discounting procedures must be project specific. Government actions can take several forms, including public works programs, regulations, and internal government investments.[3] Each of these has a different effect on private sector resources and therefore warrants a different approach to discounting.

IV. WHERE TO FROM HERE?

A careful reading of the Lind, Lyon and Hartman papers is encouraging because there is a reasonable consensus about what the problems are with the existing discounting techniques. Disagreements exist, however, over the severity of the problems and the desired remedies.

Lyon observes that if the SPC approach is correct, then neither OMB's 10% rate nor GAO's Treasury rate is correct for all analyses. Rather, the correct approach would be to use a project-specific rate. Yet Hartman and Lyon suggest that given the empirical challenges and limitations of the SPC approach, including the problem of identifying program cost incidence and rates of depreciation and reinvestment, the preferred approach is to use the conventional single-rate procedure with sensitivity analyses (in the form of different discount rates). I would argue that this is not the correct approach despite the fact, as Lyon observes, "that decision-makers who are not economists or specialists in this field will not be aware of the effects of the alternative assumptions" about the SPC approach. Rather, government analysts should implement the SPC approach or the two-stage variant (depending on the situation) using specific rates for the marginal rate of return on private investment and the consumption rate of interest, and then perform sensitivity analyses by altering the period over which capital is displaced from the economy and the rate of reinvestment.

Many problems remain with all of these procedures. Lind, for example, identifies the problem of evaluating the costs and benefits of long-term environmental programs.[4] Further, much project-specific empirical analysis needs to be done to identify the incidence of costs of government actions. But the SPC and two-stage techniques represent a clear improvement over previous discounting procedures.

Government policymakers who are currently trying to formulate guidelines on discounting face the difficult tradeoff between establishing an extensive menu of possible discounting procedures—each appropriate for the analysis of different programs with different characteristics—from which an analyst can choose, and a concern that such an array of procedures can lead to manipulation of results by the analyst. Development of procedures like the two-stage approach that are simple and straightforward to apply in the analysis of particular environmental regulations may

[3] Internal investments are expenditures of federal funds on durable assets used by a federal agency to pursue its mission. The assets provide benefits only to the agency and not directly to the public.

[4] The two-stage discounting procedure can be applied to long term environmental problems, but other supporting analyses should be undertaken to better illustrate the distribution over time of risk and environmental damage. Selection of an appropriate government action would then depend on a variety of factors, including discounted benefits and costs.

go a long way towards solving this problem. Much work, however, remains to be done.

REFERENCES

1. J. Kolb and J. D. Scheraga, A suggested approach for discounting the benefits and costs of environmental regulations, unpublished working paper.
2. J. Kolb and J. D. Scheraga, Evaluation of the effect of foreign capital flows on discounting procedures, unpublished working paper.