

grams if the criterion for selection of improvement of programs were solely the addition to income, no matter whose income is increased. But it does matter who benefits. For example, an analysis of the Job Corps program estimates that average net earnings gained by participants in the program are 200 percent of the per-trainee costs. In addition, the program is and should be evaluated by the characteristics of the recipients of the assistance. Nearly all of the recipients are poor and under 21 years of age. In comparison, an analysis of our 1967 experience with the Manpower Development Training Act On the Job Training Program indicates that this program apparently increases the average earnings of participants by about five times the cost, but only one-third of the participants were poor and under 21. In order to choose the desired mix of programs—or for possible orientation of each program—a weighting for each criterion is necessary, and we have no objective social basis for assigning a specific value to a dollar transferred to a poor person relative to a dollar transferred to someone with higher income.

When we are dealing with a program that has the provision of a public good or the redistribution of income as an important part of its objectives, evaluation must take the form of cost-effectiveness analysis rather than cost-benefit analysis. A cost-effectiveness analysis, as I am using the term, is an analysis that compares the cost of alternative ways of doing a given job with output measured in physical, social or some other non-market-oriented terms. I contrast it with the typical cost-benefit analysis that compares costs and benefits directly in dollar terms.

The distinction is one with important implications for the analysis of public resource allocation. Unlike cost-benefit analysis, cost-effectiveness analysis does not provide information on how far we should carry public expenditure in a specific program area. To choose an obvious example, the meaninglessness of a dollar value of changes in the strength of our deterrence of nuclear war makes it necessary to determine the level of deterrence by the judgment of the responsible officials; in the water resource area, by contrast, there is general acceptance of the proposition that only projects whose dollar benefits at least equal the costs (approximately computed) should be undertaken.

The inability to compare the value of additional spending on national security and on water resources, or education, or highways means that formal, quantitative analysis cannot determine the broad priorities among areas of government spending. If the principal role of analysis is, as I believe, in choosing efficient ways of achieving public objectives *within* each of the broad areas of public activity, nevertheless, it has an important role in improving the process by which political, social, and economic considerations are combined to determine broad priorities. I believe it can exercise this role by making more explicit and summarizing more effectively the cost and output consequences of alternative resource allocations.

Even when benefits and/or costs can be measured in common resources, there are problems in measurement. Cost estimates are usually based on engineering drawings which generally exhibit predictable degrees of accuracy. Estimates of benefits, however, must often rely on more speculative data, such as unforeseen changes in technology and population shifts which will affect the benefits that accrue from additional irrigation land, protection of urban lands from potential flooding, and new recreational facilities. Under these difficult measurement conditions, estimates of benefits are likely to have, at best, substantial margins of uncertainty.

THE RATIONALE FOR DISCOUNTING IN EVALUATING PUBLIC INVESTMENTS

Let me turn next from the evaluation of public expenditures in general to the evaluation of public investments. The distinction rests, of course, on the introduction of time into the considerations of costs and benefits. The typical investment program is one in which an early net outlay of resources is balanced by a later net inflow of resources. The evaluation of patterns of net resource flows requires some method of comparing different streams over time. The economist's approach to this problem is derived from the possibility open to an individual of altering the time stream of resources available to him by borrowing or lending, or some combination of both over time. The terms under which present income can be traded for future income are, of course, determined by consumers' time preference for income on the one hand and by the productivity of capital on the other.