

The Benefit-Cost Dilemma

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Previous speakers have discussed the water resource situation from several perspectives. We have heard about the expected conflicts over water use, we have heard about water quality and quantity issues, and we have heard from a distinguished legal scholar about the institutional environment of water allocation in the West. It is my task to turn your attention to the evaluation process wherein changes in the status quo would be considered. I come with a message quite unlikely to gladden your heart. To be blunt, I come to remind you of the conceptual and empirical difficulties inherent in a benefit-cost analysis. This is not a tirade against agency benefit-cost practices—though I will take a friendly jab from time to time. Rather it is a reminder to economists and politicians that one of our favorite analytic devices is not only theoretically weak, but operationally deficient in several important respects.

Before proceeding it would seem helpful to clarify some terminology. The term benefit-cost analysis is often applied to both a *process* and a decision *criterion*. One can easily advocate a benefit-cost *approach*, while remaining mindful of serious problems in the theory from which such an approach derives. The term "analysis" when added to "benefit-cost" connotes rigor and sophistication that, in many cases, is without justification.

Finally, the benefit-cost criterion is usually taken to mean the condition that present-valued benefits exceed present-valued costs.

Hence, while I am pessimistic about benefit-cost analysis in

the conventional sense of that phrase, do not assume that I am critical of a benefit-cost approach. For who can be opposed to well-intended attempts to ascertain the implications of given public actions?

To anticipate somewhat, I will argue that conventional benefit-cost analysis is quite ill-suited to the resolution of coming conflicts over increasingly scarce water resources in the West. To accomplish this I will first outline the historical setting that gave birth and sustenance to traditional benefit-cost analysis. I will then turn to a brief prognosis of how the future will differ from the past. Next, I will present the conceptual and empirical problems from whence my concern and pessimism arise. Following that I will summarize the type of evaluational approach that is best suited to the conditions that we can expect to prevail.

The **H**istorical Setting

To appreciate the several ways in which the future will differ from the past—and therefore to anticipate the ways in which benefit-cost analysis must adapt—it will be helpful to remind ourselves of the political and economic conditions that existed between the late 1930s and the early 1960s.

We must remember that this period followed by scarcely ninety years the great burst of expansion and building that resulted in the settlement of the vast majority of the western frontier. During this process, impatience was the byword. If local conditions were not suitable for some particular activity, people simply moved on to another place. Clearly capital was scarce compared to good sites—as was labor. It made little sense to spend time, money, and labor modifying any given site since the frontier promised many other propitious locations. However, as the frontier began to disappear, and as the better sites were occupied, successive waves of newcomers were left with less and less happy prospects. As settlement doubled back on itself, it became less easy simply to move to a better place.

As this happened, people's thoughts turned from movement to modification. If an area was intermittently too swampy for farming one did not move but began to drain the swamp—an infinitely more expensive activity than merely staking out a

claim in a more favorable location. If the only agricultural land remaining was too arid for crops, then thoughts turned to bringing water to the land for irrigation. If periodic flooding made life hazardous and uncomfortable, then it was time to "solve" the problem by harnessing the river. These modifications became increasingly attractive as state and federal agencies evolved to plan them, construct them, and arrange for the general public (taxpayers) to bear the vast majority of the expense. These facts significantly altered the relative cost of moving vis-à-vis modification.

Having recently read Michener's *Centennial* I am struck once again by the overwhelming entrepreneurial energies of these early settlers. A landed aristocracy simply had no time to develop—in spite of the diligence of English capital, Texas savvy, and frontier "justice"—for there were hundreds of Potato Brumbaughs anxious to build a ditch, string a fence, plow a field, or dig a well if it would make local conditions a little more favorable.

If there were unfavorable conditions for the establishment of a small class of land owners, then it tells us something of the nature of property rights over certain valuable resources. Water was there for the taking, and land was too, although to a lesser extent. And, once its value was recognized by the early users, then they set about to alter the legal structure to protect their newly acquired wealth. When we mention the evolution of prior appropriation water rights we often forget that early settlers simply took water that they wanted, and *then* thought of ways to protect their current use against future claimants. They appropriated resources when property rights were vague or undefined and then created property rights to legitimate what they had done.

As this process of modifying the surroundings was in its early stages, the Great Depression struck. Now, more than ever, there was a legitimate role for government capital and technical expertise. Politicians quickly learned that it was helpful to be able to deliver public works to impoverished districts. Early on these were limited to a few irrigation projects, and some flood-control structures. Benefit-cost analysis—or any facsimile of it—did not exist and these endeavors were undertaken with virtually

no concern for the favorable and unfavorable impacts. Of course, the presumption was that they would allow local farmers to improve their crops—or grow them where it was previously impossible—or that it would stop the flooding each spring. But there was no systematic attempt to judge the beneficial and adverse effects to the nation.

With the Flood Control Act of 1936 there first came some language to the effect that projects could be considered worthwhile if the benefits exceeded the costs. But of course there was no legislative guidance given on what was to be a benefit and what was to be a cost. In a sense, it was an early precursor to the approach taken in the National Environmental Policy Act of 1969. As you know, this act requires an environmental impact statement for every "major" federal action that will have a "significant" impact upon the natural environment. The parallels continue. Just as we were (and still are) unsure exactly how to measure the full range of possible environmental impacts, early economists were not well equipped to provide immediate and expert advice on what was a benefit, what was a cost, and how they might be measured. Indeed, it took over twenty years for the first comprehensive treatise on benefit-cost analysis to emerge.¹

Hence, benefit-cost analysis was a creature of the political process; the result of politicians demanding something that no one yet knew how to deliver. Benefit-cost analysis is, therefore, the result of a search for economic answers to political choices. The tortured political history of benefit-cost practices in the United States is ample evidence of this fact.² The benefit-cost analyst—as well as the benefit-cost approach—has always been malleable to the wishes of those currently holding positions of power.

These two situations taken together—an exuberance for modifying one's immediate surroundings, and the fluid nature of the evaluation method for such activities—render it impossible to speak of benefit-cost analysis. There were as many different benefit-cost analyses as there were projects and analysts; the only constant seems to be the use of a ratio of benefits to costs to determine the presumed soundness of any particular proposal. And this raises the important distinction between the benefit-

cost *approach* and the benefit-cost *criterion*.

The criterion has remained the same; a project must have a ratio of benefits to costs in excess of unity to merit further consideration. A high ratio was not sufficient to insure success, but a ratio less than unity was sufficient to insure oblivion. But it is the approach that has differed. While the discount rate has received most of the attention, analysts were playing a multitude of tricks with assumptions about flood frequencies, flood rating curves, crop yields, normal prices, demands for electricity, recreation use, and the like. There is (and was) infinite scope for maneuvering and the finely tuned imagination of the agency benefit-cost analyst was nourished on the challenge of meeting the one constant—a ratio in excess of unity—for those projects that had the requisite political support.

While academic economists complained of such practices, agencies and politicians blithely continued on their way. It is true that BCA was useful in separating the clearly inferior projects from those that were more reasonable, but its primary role has been one of legitimating political decisions. In a mood of expansion and invincibility it was easy to rationalize this; a young rich nation can afford to rush ahead. It was not so critical that the optimum optimum be found. It was enough to avoid the minima. We can be rather confident that the process of carrying out a benefit-cost study—even if badly performed—was helpful in avoiding the most serious mistakes.

But if this was the past, what of the future? Are the same imperatives there to harness nature? Is it still considered smart to use every drop of water as envisioned by Potato Brumbaugh? Are the same things still scarce?

The Future

If the past can be characterized by enthusiastic growth, resource abundance, political opportunism, and the absence of active interest groups, the future will be characterized by economic stability if not contraction, resource scarcity, political caution and inertia, and a multitude of active special interests. The problems for benefit-cost analysis in this new setting are several.

The life-cycle of national development is traditionally one of early reliance upon extractive resources and agriculture, eventual transition to more industrial activity, and then a gradual shift to the tertiary sector (services). While the West will remain oriented toward extractive resources and agriculture, it will nonetheless become the center of myriad service activities as well; the climate virtually assures that. With this transition will come some changes that may look like economic decline. The extractive industries will become less important. Land will be converted from agriculture to suburbs. But the overwhelming impression will be one of moderation, of slowing down; the boom days of the 1940s and 1950s are probably past.

Instead of a period in which we are preoccupied with "putting natural resources to work" in the traditional sense, we are entering a period in which those resources will be used but not consumed. The modification of our environment to suit the whims of a few farmers, ranchers, or miners is a thing of the past.

Related to this is the issue of resource scarcity. The early period under discussion was one of apparent abundance of natural resources merely waiting to be utilized. Whether timber, land, minerals, or water, the abundance of natural wealth was rarely in doubt; the problem was simply one of controlling those resources and getting rich. Without going into detailed analysis of relative scarcities now vis-à-vis the past, it is safe to say that the sheer demands placed upon those resources now by a large number of potential users renders them scarce. It is an axiom of economics that as items become more scarce and valuable we will observe greater attention being devoted to their definition, their ownership, and their use. Surely the interest in water, land, air, and scenery attest to their perceived scarcity.

The third major difference we will observe in the future is that of a transition from political opportunism based upon exploiting resources to political opportunism based upon protecting them; the current governor of California is perhaps the archetypical opportunist in this regard. The platitudes and clichés will still abound, but the message will be one of "save" rather than utilize and consume. We are being told—correctly I believe—that the future of the United States is to be found in cautious consideration of our environment in contrast to earlier pre-

sumptions that our salvation lay with our ability to conquer nature. The more important contrast for our purposes is, however, the difference in policy formulation. Early on there were few vested interests in the status quo—ignoring of course, as we always have done, the interests of Native Americans. Who was there to object when Potato Brumbaugh utilized irrigation water that otherwise would flow into Wyoming, or Arizona, or California? Who was to object—except some illegal cattle ranchers—when the homesteaders arrived? What interest group was there to protest the mutilation of streams and forests in the search for gold? And this brings us to the fourth significant fact that distinguishes the past from the future.

In the early days there was no politically represented interest group able to mobilize opposition in the face of a threat from some resource user (or abuser). This of course is not to say that hundreds of thousands of individuals were not seriously hurt by the helter-skelter rush to "tame the West." Ranchers had trails bisected by farms and fences; others had previously used water taken from them at will; still others saw resources that they thought were theirs appropriated by someone else. In part this is a result of the ill-defined property arrangements that existed over such resources. In a sense they were open-access resources to be used by whoever was there first, or who had the strength to protect their interests whether or not they were first in time.

From a sense of open access we have now moved to one of common property resources in the correct use of that term.³ That is, common property connotes a situation of coequal ownership—each member of the polity possesses some property (claim) in the resource. Under open access no one has any property since no one has a secure claim over the benefit stream arising from the resource. Under common property every one has property since all have some claim to the benefits. The national forests are a prime example of common property resources; all of us are coequal owners of them in the sense that we may use them whenever we please. The fact that we may not cut down a tree at our leisure is no more relevant for the property right than is the fact that I may not sell petrol in my driveway. We face a variety of covenants on the use of what we

call our "property," and the fact that I cannot cut a tree in the national forest is simply proof of the fact that all of us are co-equal owners; your trees are protected from my chainsaw, my scenic canyon is protected from your desire to search for gold there. One form of our individual liberty is protected by a restriction on other liberties. Such is the nature of civilization as distinct from anarchy and chaos.

Hence we may safely characterize the future as a period of careful attention to one's interest in the status quo. If the past can be characterized by an impatient desire to change things in order that we might be made better off, the future may be characterized by the desire to do very little to the natural environment in order that we not make ourselves worse off. But this conservatism has a less romantic side. Part of doing very little is also accepting the status quo use of resources. The future will surely be a period of intense fighting to protect what one already has, whether it is the farmers of the Texas Panhandle or the loggers of the northern California redwood forests. If the groundwater gives out then that is someone else's problem, as long as it will last another twenty-five years. If the redwoods are gone, so what? City people can always look at douglas fir; they won't know the difference anyway. If we send salty water to Mexico, so what? If my wheatfield replaces a breeding ground for some type of wildlife, what do I care? There are more down the road.

In short there is now a vested interest—and usually an active interest group—aligned on both sides of almost any resource issue. The limited opposition of the past has been altered to an almost pervasive opposition to any change in the status quo. And, against that is an equally determined group of interests seeking change. We are indeed in an era of "one issue politics," but the poor politicians are constantly forced to tally the votes for each of the multitude of issues they are supposed to confront. It was infinitely easier to be a politician in the old days.

Benefit-Cost Analysis: The Problems We Face

In view of the foregoing, what implications might we draw with respect to the role of benefit-cost analysis? What are the

most serious conceptual and empirical problems? What modifications are called for? In what follows I will draw your attention to two rather serious conceptual problems in benefit-cost analysis; problems that logically follow from its foundation in welfare economics. Then I will turn to a discussion of some important problems in performing benefit-cost studies; while there are some conceptual aspects here, the major issues will be empirical in nature.

There are two compelling conceptual weaknesses in benefit-cost analysis that ought to receive more attention than they have. The first one pertains to the meaning of a surplus of benefits over costs. This is not the familiar criterion problem where the argument is whether one should use net present values or a ratio of benefits to costs. The problem is much more serious than that and concerns the validity, for policy purposes, of those things called net benefits.

Simply put, the entire logic of BCA rests upon the concept of the Kaldor-Hicks compensation test. That is, if there is an economic surplus created by the contemplated change that *would* be sufficient to compensate those who oppose the change (or would otherwise be made worse off by it) and still leave some excess for those who favor the change (or those who would be made better off by it), then the change is considered economically efficient. Compensation is not required, and obviously never occurs; it is sufficient to know that compensation *could* take place and leave both groups—gainers and losers—better off than if the change did not occur. The existence of net benefits for a contemplated action—or a benefit-cost ratio in excess of unity—attests to such a surplus. This is so because on the cost side of the ledger we supposedly enter all of the debits incurred.

The logic has a certain beguiling aspect to it. If each project undertaken makes us better off then how can we lose? The problem arises when we ask who it is that is made worse off by the change, and who gains? A benefit-cost study of large-scale agricultural mechanization could no doubt show substantial positive benefits—as long as we assumed that all of those displaced were able to find gainful employment elsewhere. But as long as the compensation test is potential rather than actual we

are playing games with ourselves. As long as we assume that the losers of any change will be able to adjust, and as long as we assume that the new surplus accrues to the nation rather than to a few fortunate gainers able to reap situational rents, then benefit-cost analysis as ordinarily practiced is merely a legitimating device for making a few better off and many others worse off. This is compounded by the realization that it is the already advantaged—economically and politically—who are able to mobilize government in their behalf. BCA is often the lubricant of politically sanctioned greed.

Applied welfare economics—from which BCA derives—is silent on the matter of costs and benefits received by individuals of vastly different initial income positions; a \$10 income loss is considered the same to a \$40-per-week migrant as it is to the owner of 800 acres of strawberries. The average citizen knows better, but we somehow avoid confronting this in our analysis.⁴ Given this problem, the application of benefit-cost analysis is quite consistent with making the rich richer and the poor poorer. The rich are unlikely to protest, and few listen to the poor.

The second major conceptual problem is only rarely mentioned by economists. Any configuration of prices, production possibilities, demand curves, and supply curves rests upon a technical and institutional foundation that defines what is a resource, indicates who owns what, and defines the accumulated technology (tools and knowledge) that allows the transformation of inputs into outputs. In more technical language the production possibility frontier, the utility possibility frontier, and the grand utility frontier are all uniquely defined by the current distribution of income, by the current ownership of capital and natural resources, and by the current structure of prices.

Governmental programs to dam rivers, dredge channels, and deliver irrigation water to farmers alters the very structure of resource endowments and prices that define the basis upon which we evaluate that change. We use an efficiency analysis to evaluate basic changes in economic structure—the import of which is to alter economic advantage among competing interests. It might be argued that any one project is marginal vis-à-vis the

entire economy. The counter argument is that we have just experienced forty years of rather significant public works projects. Any one project may have been marginal; in the aggregate the impacts are clearly nonmarginal.

Each time a benefit-cost study is carried out we are forced to assume away certain things. The difficulty of this practice should be obvious when conducted on a large scale. When the private sector conducts a benefit-cost study of some contemplated change it is quite reasonable to assume away those things beyond the domain (and/or control) of the firm. But for BCA performed for public-sector activities we cannot be so cavalier. Yet the conceptual and computational requirements dictate that many things be excluded.

The basic problem, however, is that an efficiency calculus is being employed to judge the desirability of public sector activities that change the distribution of economic and political advantage. In an era of scarcity and confrontation this fact will assume greater significance.

A third problem concerns the correct computation of project costs. In the conventional wisdom of benefit-cost analysis it is always the benefit measurement that causes problems, while the cost side is considered rather straightforward. But this is far from the truth. Consider the following example. Assume that in any given budget period there are n possible projects that might be undertaken: X_1, X_2, \dots, X_n . If we assume that the public-sector budget is derived from the number of attractive looking projects, then the correct decision rule is to keep authorizing projects until the benefits of the last project are just equal to the costs of that last project; such costs being given by the social value foregone by having those funds spent in the public sector rather than in the private sector. We might express this as:

The last project accepted: $B(X_i) = B(X_0)$

where: $B(X_i)$ = the benefits of the marginal project

$B(X_0)$ = the benefits to society of leaving the costs of project X_i in the private sector (the null project)

Here there is no effective budget constraint; the constraint on the public sector is simply the number of projects it can generate that are more attractive than the investment opportunities in the private sector. Labor and capital used in the two sectors would be costed out in a similar fashion, and we search for the optimal mix of investments between the two competing sectors.

The actual situation is, of course, quite different from that depicted. A more realistic description would start with the recognition that the public sector budget is not determined in the manner just described.¹ Rather, the size of the budget is a predetermined political choice reflecting the combined views of the executive and legislative branches on such issues as: (1) expected federal revenues, (2) expected demands for other (non-public-works) spending, (3) anticipated needs for stabilization actions by the federal government, and (4) the general role of the public sector in a market economy. Once the general level of public-works spending has been decided—and along with that some general guidelines concerning the types of public projects to be performed—then project selection consistent with those guidelines may proceed.

But in this formulation the cost of any given project is different from the previous description. Here, the social cost of a certain project is not its drain on funds from the private sector or, rather, it is not the social benefits foregone by diverting those funds from the private sector. Now, a given project's costs are the benefits foregone by not building some other project with public funds. This would be expressed as:

The last project accepted: $B(X_i) \geq B(X_{i+1})$ with the public
works budget ex-
hausted

Instead of a search for the marginal project in terms of private-sector funds diverted, the search here is for the best mix of projects up to the point that the previously determined budget is fully utilized.

A problem that flows immediately from the above discussion is related to the issue of the appropriate discount rate. Of all

the literature on the discount rate for public actions, I have yet to see a discussion of the distinction between public investments and public rule changes. We are all familiar with the usual arguments that when the public sector undertakes an investment the benefits and costs should be converted to present values by applying a discount rate. Some economists advocate the use of a rate reflecting the private opportunity cost of capital. Others prefer the social opportunity cost of funds diverted from the private sector; the difference here is that the former reflects the costs borne by the private sector to acquire funds, while the latter reflects the social benefits given up when funds are taken away from the private sector. Yet another rate that is often advocated is that at which the public sector must borrow funds; this would tend to approach the interest rate on long term government bonds. And, there is often some sympathy for using a discount rate that reflects "society's willingness to trade present for future consumption." This might be a rate that would be determined by a number of avenues, including direct survey techniques.

There is a further refinement in the above debate that recognized that we might wish to use one rate for the cost side of projects and another for the benefit side. The logic here is to discount projects costs at a rate that reflects the higher cost of diverting funds from the private sector but to discount project benefits at a lower rate that reflects society's rate of time preference for the consumption of those beneficial aspects. Here there are also advocates of one rate for certain types of project outputs, and another rate for others. An example might be a fairly low rate for recreational outputs that the private sector would be unlikely to provide and a higher rate for those outputs where there is a reasonable expectation of a private substitute in the absence of the public alternative.

However, in all of the debate over interest rates you will not find any reference to the public sector as a rule maker. There are three types of rule making activities of the public sector along a continuum from: (1) rules to facilitate individual action toward socially desired norms, (2) rules to induce individual action to be more consistent with social preferences and priorities, and (3) rules to force individual action into socially

preferred directions. Although the expenditure of public funds may accompany the promulgation of each of these, it is also possible that each may arise without any public expenditures at all.

What are some examples of these three types of rules? Facilitative rules would be found when the natural instincts of atomistic agents were consistent with social objectives yet there were some existing institutional arrangements—probably carry-overs from an earlier time when the current problem did not exist—that impede individuals from acting quickly on their instincts. A good example today would be local zoning ordinances that establish legal rights to sunlight so that people will thus be encouraged to invest in roof-top solar collectors free from the threat of shade trees. Here government is simply facilitating the self-interested wish to lower private energy costs; not incidentally this also serves important social objectives as well.

Rules to induce behavior are found where individual tendencies are not as strong as previously, yet action would be taken with some minimal help from the public sector. Investment tax credits for the installation of pollution control equipment would be an example of rules that induce certain behavior.

Finally, rules to enforce behavior can be found in the pollution-control area, in minimum gas-mileage performance for cars, motorcycle helmet laws, and so on. The rationale here is that those in a position to decide on their own will make antisocial decisions in the absence of the rules.

Now, the conceptual issue is one of how to evaluate such rule changes? This question is not an idle one, since I believe that the majority of the adjustments in water use in the West will be rule based rather than investment based. What are some of the differences? In investment analysis we assume that scarce capital is being diverted from productive uses in the private sector and hence we want to make certain that the nation is not deprived of an advantageous investment for the sake of a poor one. A rationale for discounting benefits is that one could always put the capital in the bank and over the project life be able to earn interest at the prevailing market rate. Thus, one must compare the present value of the project with the present value of the future earnings in some alternative.

But what happens in the case of public rule changes? First of all no funds are being diverted from the private sector to the public sector. Second there is no presumption of a return on the investment in which one might at least hope for some indirect benefits arising from some previously underutilized resources. And, there is no "project life" after which the benefits cease to exist. Finally, in public rule changes we do not select from a large number of projects in order to achieve some bundle of net benefits constrained by a public sector budget.

In rule changes we are instead dealing with institutional bottlenecks rather than technological bottlenecks; what I call institutional lag. When new scarcities arise—new problematic situations—the existing set of incentives and sanctions no longer coincide with new priorities. We are not trying to innovate in the sense of new technologies to solve a problem. We are, instead, fine tuning the existing system better to reflect new scarcities. This process has been referred to as involution.⁶ But there is no "project life" to rule changes—unless a tax-credit program will be phased out in five years. There is no front-end capital cost requiring funds that might be spent elsewhere.

What discount rate should be used? What does it mean to talk of the present value of the benefits when two years from now something else will have changed requiring yet another rule change? We are not constructing a dam to stand for thirty-five years, we are dealing with a problem that is most troublesome today in a manner that we hope will help, but there are no implications that next year we will not have to do something else. Because of this the calculation of present-valued benefits from public rule changes via a discount rate is insufficient for a decision criterion, and it is inappropriate conceptually. I will return to this in a subsequent discussion.

The next problem we must confront is that of attaching values to both inputs and outputs of public actions to deal with new scarcities in water use. In earlier times, while this was a problem, it had less of an impact on analysis than it will in the future. As indicated earlier, the history of benefit-cost analysis is one of exuberance, of a rather slack economy, of an activist public sector, and of poorly-articulated interests in the status quo. Under these conditions, the expenditure of \$x for a project

was said to be justified if one could find only $\$(x + 1)$ of benefits, appropriately discounted. In a sense, those advocating a project were not required to search for all of the possible benefits from a change, only enough to insure that they exceeded—by a discrete margin—the project costs. And of course they showed unmatched zeal and ingenuity in this search. But it was, nonetheless, an incomplete search; they were not forced to go as far afield in search of benefits as they would have had the opposition been more contentious.

And this is precisely the message of the future. The day of easy authorization for public actions is past, and the pressure is on the calculation of both benefits and costs. As both sides to any issue press their case, the claims and counter claims for benefits and costs will probably make an erstwhile analyst for the Corps of Engineers appear as a paragon of restraint and propriety. I do not trust either side in the coming conflicts and—more discouraging—I am not confident that economic science is sufficiently developed to allow those of us who claim dispassion to separate fact from fancy.

Related to this, and yet a serious problem in its own right, is the disjointedness in time of the realization of benefits and costs for different public actions. That is, certain proposed actions will result in obvious benefits now but costs that may not become apparent until the passage of a considerable length of time. Or, some actions will entail obvious costs now but not result in benefits for, say, twenty years. Under these circumstances it will be very difficult to perform sound benefit-cost analysis.

Another serious problem in performing benefit-cost analysis in the future will arise in the specification of the proper accounting stance. The accounting stance is the geographic scope over which benefits and costs are defined and compared. In early times where benefit-cost analysis was primarily employed in project evaluation it was rather easy to demarcate a project region or an area of major influence from the planned investment; an irrigation project would benefit a portion of one state, or hydroelectric power would be available for a multistate area. In such instances the political forces were rather clearly identified, and the regions of immediate benefit could at least be surmised.

In the new setting—where public rule making will dominate—it is not so obvious how one will demarcate regions. The gains and losses will be distributed throughout subareas of the West, and the analyst—not to mention the politician—will be hard pressed to make sense out of the myriad effects. This will not only compound the analytical task, but it will prove troublesome for the political process.

The final problem I wish to discuss is that of the proper criterion for decisions about individual actions. We have already discussed, if only briefly, the matter of net present valued benefits versus a benefit-cost ratio. In light of the foregoing discussion it should be clear that I am not optimistic about our ability to perform conceptually and empirically sound benefit-cost analyses for the type of changes which will occur in the West. If reallocation of current water use is to be the predominant means for facing the future with scarce water then what criterion for such reallocations ought we to employ? For a public body to compute net present values for all possible reallocations is a difficult—if not impossible—task.

The majority of transfers will be privately arranged, and will occur where the gainers (those obtaining the water) can compensate the losers (those giving up water) and still retain a surplus. This is the compensation test again, except that now it is *actual* rather than merely *potential*. But there are at least two problems with such privately arranged transfers.

The first problem is that we may often find drastically different income positions as between those who wish to buy water rights and those who now have them. This difference in income may translate into vast differences in power and information. If those now in possession of water rights have imperfect information about the value of water in alternative uses then one of the important assumptions for trades to benefit both parties is violated. In addition, if the difference in income and information of the two parties is pronounced, then one party will possess far greater power in the bargaining process; again one important assumption of mutually beneficial trades is violated.

The second problem relates to the costs and benefits that are to be computed by the negotiating parties. The way in which

water is allocated among competing uses holds important social and economic implications beyond the immediate users. Not only do income and employment multipliers differ among uses, but the structural stability of the western economy over the long run is also at stake. A reallocation of water from agriculture to the production of energy from either coal or oil shale represents a shift in water from one use that is renewable on a yearly basis to a use that is based upon a finite quantity of a depletable resource. Once the coal and oil are extracted water will no longer be needed in those uses. But if the agricultural infrastructure has disappeared in the meantime the switch back to agriculture may be more difficult.

To summarize this discussion about the problems with benefit-cost analysis, let us briefly consider a current issue of some importance in the West—the reserved water rights of Native Americans. As you know, the Supreme Court has held that their water rights encompass sufficient water for all reservation lands that might be "practicably irrigable." When we look to benefit-cost analysis for help in this instance what do we find?

Immediately one of the assumptions of welfare theory is violated in that the basic structure of resource endowments is altered. The magnitudes of water are sufficient that this fact cannot be ignored. Secondly, an institutional change such as this is an example of the public rule changes discussed above where we may not have a "project" in the conventional sense. When the change occurs it will be of unknown duration, and the difficulties in computing present values are severe. The third difficulty is encountered when we begin to assign shadow prices to inputs and outputs. We can be assured that the type of agriculture preferred by the Native Americans would differ from the highly commercial and capital-intensive agriculture so prevalent now. If this difference is pronounced it is possible that by using conventional benefit-cost analysis the reallocation would appear to be "inefficient." I emphasize "appear" precisely because of the difficulties we would have in assigning shadow prices to the two disparate types of agriculture. Finally, what should be done about the appropriate accounting stance. Would one conduct analysis on the basis of an individual reservation? A state? A group of states?

Lest I leave the impression of our total inability to do anything, allow me to emphasize that certain economic analyses can surely be carried out. We can obviously ascertain the specific lands that can be "practicably" irrigated. This would take the form of farm-level budget studies, with some publicly provided irrigation infrastructure. But, this analysis would be at the farm or "project" level and would merely be concerned with the suitability of specific land for irrigation.

It is, of course, unlikely that all reservation land that is "practicably irrigable" will receive water under the Winters Doctrine. But neither will that amount be determined by benefit-cost analysis in the conventional sense. The decision will be reached by political and judicial means, with economics being employed to assist in the search for a reasonable compromise. But we cannot forget that this particular reallocation—as with the majority of reallocations—is a political one.

The basic dilemma we face is that we urgently need a thorough decision analysis *approach* that will lead us to make the correct decision about water use in the future. Unfortunately the correct decision is unknown and unknowable. Economists have an occupational predisposition for clear-cut answers to problems. I have elsewhere referred to this as the deterministic approach (Bromley, 1976). I have also argued that policy formulation is not deterministic in the pure sense of that word, but is rather a dialectical process. By dialectical I mean a process in which a solution only emerges as the result of the forces and counterforces brought to bear on a problematic situation.

The prime difficulty with the dialectical process is that we have no template against which to judge the outcome. What results from such a process bears no burden for being right or correct—it is all we have. Economists—and not a few politicians—are uneasy with this approach, preferring instead a yardstick against which to judge each alternative. The competitive market and a benefit-cost ratio in excess of unity provide this yardstick for the economist as well as for the politician. Unfortunately, the former rarely reveal to the latter the serious flaws in the yardstick. When faced with agnosticism most economists still prefer false gods.

But the process of contending with a water-short future in

the West is the quintessential dialectical problem. It would be relatively easy to calculate income created by sector per acre-foot of water and then to compute the least harmful ways in which to reallocate water. This is social cost effectiveness and our objective would be to reallocate water so as to precipitate the least economic hardship in the aggregate. Of course other things will enter the calculations.

We are, above all else, a nation of interest groups ever alert for opportunities to enhance our comparative position. The analogue of this is that we also are attentive to efforts by others to gain at our expense. Our nation grew on the nourishment of socially sanctioned—and channeled—greed.

Given the conceptual and empirical problems with benefit-cost analysis, it is expecting too much to hope for deterministic answers to the complex water allocation problems we face. But if we are confident enough of the democratic process, the dialectical approach need not be feared.

In the following section I will outline what would be involved.

Is There Hope?

The history of federal water policy is one of immense taxpayer subsidies to construct large-scale projects so that water can be given time, space, and form utility to local residents. Every taxpayer in the nation has contributed to these costs, and a few individuals have been made very rich in the process; a much larger number have benefitted to a lesser degree. Only a fool would claim to know whether or not the nation is better off than if the money had not been spent at all, or if it had been spent on other projects dealing with urban housing, mass transit, human nutrition, or whatever. This in spite of a benefit-cost ratio in excess of unity for every project for which analysis was carried out.

Such is the state of benefit-cost analysis. Why should we be any more confident of the future? I have outlined the reasons why I am pessimistic about a deterministic benefit-cost analysis that is conceptually and empirically sound. I stand by my pessimism.

But I am not so pessimistic about an approach to water policy in the future that is liberated from the apparent rigor and pre-

cision of traditional benefit-cost analysis. Such an approach would require—first of all—that the water addiction of Westerners be broken. Bricks in toilets is tokenism when every suburban homeowner feels deprived without a year-round lawn. Once the presumed God-given right to water is abandoned, we can get down to business. But to continue to focus attention on only the supply side is folly.

Given the public sector's predominant role in creating the current problem it is only fitting that it remain active during the painful transition ahead. The place to start would be to develop an honest long-range planning capability within, say, the U.S. Water Resources Council to guide the West through the hazards ahead. We must avoid water reallocations that render useless capital investments now, only to find we need them again once the coal and shale oil have given out.

Along with this there could be increased technical advice given on water-saving techniques in agriculture, industry, and in homes. States could enact coordinated tax incentives to encourage water saving. There could be a variety of events in which water resource issues would be discussed. There could be stepped-up efforts to recycle water. Units selling water (cities, irrigation districts) might institute a small surcharge on water to finance research, demonstration projects, and the like. Finally, the federal government could undertake a brokerage function to facilitate consensual bargains over water rights transfers; this would also involve monitoring pending transfers for abuse of the weak by the powerful.

In all of this there would need to be an implicit benefit-cost awareness. We can assume that transfers of water rights would involve some private benefit-cost calculation. It would be the public sector's responsibility to assure that these private interests coincide with the public interest.

The basic dilemma of benefit-cost analysis is that it gives the impression of rigor and precision when in fact the truth is largely otherwise. It has taken us forty years to realize this; some still remain unconvinced. The coming problems in western water resources will require an evaluative approach that admits many things ignored in traditional benefit-cost studies, and that takes a more honest account of those effects that have always been considered. The states and the federal government will be re-

quired to work in close harmony. I see no reason why the nation's taxpayers should object to increased funding for such activity. After forty years of public works projects the required expenses for what I have outlined above will seem nominal indeed.

Notes

1. This is Eckstein's *Water-Resource Development*.
2. See Bromley (1976) and Dorfman (1976).
3. For a more detailed discussion see Ciriacy-Wantrup and Bishop (1975).
4. There are a few exceptions: Infanger and Butcher (1974) and Freeman (1967).
5. For an elaboration of this, see Steiner (1969) and Bromley (1976).
6. See Geertz (1963).

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