INTRODUCTION TO COST-BENEFIT ANALYSIS

P A R T I I I

ADDRESSING SOCIAL CONCERNS

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December 2008

<u>Background</u>

From its oldest roots in the early 19th century, applied welfare economics has focused on the goal of economic efficiency. To be sure, its approach was anything but crude -- it could deal, for example, with the supply price of a person's labor being different for different jobs in the same place or for the same job in different places (see Part II). It could also handle the inefficiencies of consumption stemming from each household getting a given ration of milk (in spite of their having very different intensities of demand) with the same facility as it handled the inefficiency of awarding each farmer a given number of acres on which he could plant wheat (in spite of the productivity of the land being very different from one farm to another). But beneath it all was the treatment of a dollar of cost being counted the same, regardless of which person or group within the society ended up bearing that cost, and similarly for dollars of benefit accruing to different persons or groups.

This focus in efficiency is embodied in the three basic postulates on which applied welfare economics has been based. These can be summarized as: 1) benefits being measured at each step by demand price (= willingness to pay), 2) cost being measured at each step by supply price (= willingness to supply) and 3) the aggregation of these benefits and costs across individuals and groups, regardless of who within the society in question) was enjoying the benefits or bearing the costs (= adding up).

It should come as no surprise that even from the earliest days it was the third postulate (adding up) that became the focus of controversy and discussion. Ask 100 people whether an incremental dollar will "do more good" if put in the hands of a poor person or a rich person, and all or nearly all of them will without hesitation side with the poor person. It is only a small step to move from this answer to the idea of "distributional weights" -- of weighing a dollar increment of benefit or cost differently, depending on the individual a family or group to whom it accrues.

But, as we will see later, applying distributional weights systematically, within the frame of cost-benefit analysis: 1) is extremely difficult to do, and 2) carries many implications for policy that most people are unwilling to accept. The standard way to escape from the problems posed by 1) and the dilemma posed by 2) has been to stick to the three postulates of demand price, supply price, and adding up; but at the same time to emphasize that "all we are doing is measuring economic efficiency". This is a key objective in economic policy analysis, and it is something that we really do know how to measure. Thus we can with a clear conscience say that a given agricultural policy has an efficiency cost of $800 million, or that a given slum-clearance project has an efficiency cost of $50 million, and then leave it to the "authorities" to judge whether or not the non-efficiency benefits of that policy or that project are sufficient to outweigh the $800 million or the $50 million of efficiency costs that we measure.

This "efficiency-only" position is probably the safest one for a defender of cost-benefit analysis to take. It does not claim that we are able scientifically to measure the non-efficiency benefits or costs entailed in a shift of a benefit from one group to another, or in the shift by the country's military to a new weapons system, or in measures that, at the expense of economic efficiency, accommodate the policy demand of one special-interest group or another. We measure the efficiency costs, and let somebody else worry about the non-efficiency aspects of a policy or a project.

I believe that all cost-benefit professionals have to adopt something like an efficiency-only position at one level or another. We have no professional business in placing a dollar value on improved relations with India (which may be an important byproduct of a given??? project or program), or in many national defense outlays. But move in a little closer to our own terrain and you enter a sort of no-mans-land, where there are good arguments for applying efficiency standards, yet therein order to do??? so we have to place dollar values on a whole array??? of??? benefits or cost that are often very hard to quantify.

The value of human life is a case in point. The average citizen's instinctive reaction is "no amount of money is sufficient to compensate for the loss of a human life", yet there is a myriad of policies, programs and projects that in effect embody a tradeoff between dollar cost and human life -- the setting of speed limits, the placing of traffic lights and stop signs, the building of median strips on highways, the straightening of dangerous curves are just a few examples related to roads. If we count the life-taking costs and life-saving benefits of such decisions as being outside our purview, simply to be weighed by the "authorities" as non-economic benefits or costs, we find ourselves with a serious problem. For we actually <u>can</u> estimate with some accuracy how many lives per year would be saved by imposing a national speed limit of 55 miles per hour and we can also estimate the costs (mainly in travel time) that such a policy would entail. Relating those two, we have an economic cost per human life saved that is implicit in either adopting or rejecting a 55 mph speed limit. Then we can do the same for the placing of traffic lights and stop signs, for the introduction of median strips, and for the straightening of specific curves on specific roads. During all this we would find that very different implicit values of human life average from these different exercises.

Thus we find ourselves with situations in which we are paying $10 million to save a human life by straightening a specific curve, but we could save other lives at a cost of $1 million per life by the judicious introduction of stop signs. Obviously, we cannot juggle hundreds of such specific comparisons in our heads as we analyze a host of different policies, projects and programs. The way out is the introduction into our cost-benefit framework of a "shadow price" of a human life. If this price if $5 million per life, then the stop sign projects would generate a net benefit of $4 million per life, while the curve-straightening project would show a net cost of $5 million. Instead of all ten??? projects being juxtaposed one to each of the others, each single project would be assigned a benefit of $5 million for every human life it was expected to save, and a cost of $5 million for every life it was likely to take. All of a sudden the saving and taking of human lives has entered the world of efficiency calculation.

The moment we feel ready to place a monetary value on a given "noneconomic" objective, that value opens the door to incorporating that objective into the efficiency-oriented calculus of cost-benefit analysis. What we can do with life years we can also do with the value of commuter time, with the valuation of free public services such as those of public parks. On the cost side of the coin??? we can, for example, introduce prices for the various pollutants that a project might introduce into our atmosphere or our waterways.

It is here that we rather quickly reach a crossroads. While we may be prepared to set a price on carbon emissions into the atmosphere or on nitrogen spewed into a river or lake, we may not be quite ready to do the same for a battalion to be added to the army or a submarine to be added to the navy. Our readiness to quantify some “noneconomic” benefits or costs varies with how well we think we can pin down those numbers. If we are confident that the value we seek lies within a range of 10% or 20%, or even 30%, then we can still feel like professional economists when we incorporate that range (or a central value within that range) into our analysis. But if our valuation is so uncertain that it spans a range of 300% or 500% or 1000%, then we are probably better off not trying to introduce such an item direction into our quantitative analysis, and simply passing the buck on to the “authorities”. Put another way, where the range is very wide, it can end up useless.[1]

In sum, those who want to introduce greater rationality into the decision process on public expenditures have, in cost-benefit analysis, a very worthy product to sell. In every country there is a vast array of projects and programs to which known,??? readily available techniques can be applied. And one can be quite certain that with enough effort and ingenuity, we will be able to keep on expanding the scope for reasonable application of cost-benefit analysis. But we should be aware of overextending ourselves -- there is plenty that we can do while still claiming our work to be “professional”, and there are many interesting reasons??? for extending the range of projects over which we can function as professionals, but there also is another range of projects for which our ability to quantify benefits and costs is too limited or too vague to be useful.

On Distributional Weights

One of the important areas in which “noneconomic” considerations are often broached concerns the distribution of income and/or wealth. The idea that a dollar in the hands of a poor

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Like telling a pregnant mother that you can predict what height her new offspring reach at age 21 -- and then stating the range to be from three to seven feet!

person is worth more (from society's point of view) than a dollar in the hands of someone much richer -- that idea has deep roots in most people's thinking. And it also has roots in the field of economics. The notion of people's well-being being measured by their "utility" dates back at least to the early 19th century, and has a long history from that point on. "Utility" appears at three levels in our literature -- "ordinal utility", meaning individuals can state their preference (or indifference) as between any two bundles of goods and services (or any two situations); "individually measurable utility", meaning that people can rate differences between bundles (e.g., saying that the difference between A and B is bigger or smaller (in utility terms) than the difference between B and C); and "measurable and interpersonally comparable utility", which says that one person is enjoying more utility than another or that an incremental dollar is worth more (in utility terms) to one person than to another. Much of economic theory can be derived just using the notion of ordinal utility (indifference curves, etc.), but the analysis of risk typically requires one to take the next step, to individually measurable utility. Neither of those provides any basis for a distributional weights framework. For that one needs to take the third step -- to measurable??? and interpersonally comparable utility.

Early utilitarian thinking was based on this latter assumption, but did not pursue its detailed implication. That part came later, particularly on the subject of optimal income taxation. Here we have an extensive literature stemming from the past several decades. This literature assume that each of us has the same utility function, transacting??? income (or wealth) into utils of the units in which utility is measured. Higher income translates into more utils, but an extra dollar contributes loss and less as income rises.

In the optimal income tax literature, the problem is posed of raising a certain amount of money through an income tax, when the weight given to incremental dollars declines with income. Typically, the example used in this literature assume the weight is cost by a quarter, a half, or three quarters, every time income is doubled. When such an assumption is applied to income distributions similar to those we observe in the real world, the resulting "optimal" income tax structure tends to have an unexpected shape -- marginal rates of tax tend to fall as income rises. This seems counterintuitive at first, but begins to make sense when we take into account that an income tax structure is composed of a series of income brackets. Raising the marginal rate for any one bracket introduces an efficiency cost by creating a new disincentive for work on the part of people in that bracket. But it produces a distributional benefit by shifting to the government dollar not only from that bracket but also from all higher brackets. Thus, for bracket 1 out of 5 a rise in the tax rate has one efficiency cost plus 5 distributional benefits, for bracket 2 it has one efficiency cost plus 4 distributional benefits, etc. By the time we get to bracket 5 we have one efficiency and only one distributional benefit. It is the distributional benefits that come from the higher brackets that produces the counterintuitive result of the marginal rate declining as income rises.[2]

What is troublesome about the optimal tax literature is that its results come from a pretty fancy set of calculations using distributional weights, and seem to argue for more moderate (i.e., less progressive) income tax structure than those we actually observe in most countries. This is

2

To add to the anomaly, the typical optimal pattern has average tax rates rising (up to the top bracket) at the same time as marginal tax rates fall, as income rises. This is done to the existence of an optimal exemption level. Thus an optimal marginal rate structure might be zero up to $20,000 and 30% from $20,000 to $40,000, taking a tax of 6000 (= 15%) from an income of $40,000. It could then go on to take 25% on incomes from $40,000 to $80,000, the total tax on $80,000 being $16,000 (= 20%) on an income of $100,000, and $42,000 (= 21.2%) on an income of $200,000. This attribute of the optimal structure being progressive in the average rate at the same time as it is regressive in the marginal rate, was sort of reassuring to readers of the optimal tax literature -- the result was not totally counterintuitive.

taken as reassuring by many people; it thus serves to foster the general acceptance of the distributional weights approach.

Unfortunately, this last step is not warranted. In order to assess the merits of any systematic approach, one has to test it throughout the relevant range. In particular, if we are to use distributional weights in the field of project evaluation we have to test that approach as it would apply to the approval of specific projects and to the problem of choosing among alternative projects.

Looking at one project alone, consider:

	Unweighted	Avg. Weight	Weighted
Present Value of			
Benefits	500	1.5	750
Costs	-1000	0.5	-500
Net Present Value	-500		+250

If we take distributional eights seriously, and use the indicated weights, we must recommend acceptance of this project, in spite of its net efficiency cost of 500.

Suppose one says no to this on the grounds that the government could make a simple transfer of 500 to the beneficiaries, and thus get the same distributional benefit without the efficiency cost. Then, if such a transfer can be costlessly made, it clearly should be made. But costless transfers are hard to find in the real world. Suppose that extracting money from one group and transferring it to another entailed resource costs of extraction, of delivery, and administration plus the efficiency cost of the taxes themselves, equal to one third of the amount transferred. Then one would reject the project above, but would accept the following one.

	Unweighted	Avg. Weight	Weighted
Present Value of			
Benefits	600	1.2	720
Costs	-900	0.5	-720
Net Present Value	-300		0

One can quickly see that if the distributional weights of losers and gainers from a project have a ratio of 1.5 (= 1.2/0.8), then that project will be at the margin of acceptability when unweighted costs are 1.5 times unweighted benefits. More broadly, when the weights of losers and gainers have a ratio of $(1+\lambda)$, then projects will be acceptable so long as unweighted costs are less than or equal to $(1+\lambda)$ times unweighted benefits.

Always, there emerges a tradeoff in which at the margin society pays in efficiency costs for what it gains in distributional benefits. One doesn't run into much trouble, then, if the lowest distributional weight is 0.9 and the highest one is 1.1. But such weights would not lead to much in the way of redistributive policies or projects. It is when the weights get to be amply different that the implications of a distributional weights framework lead to policies that would be unacceptable to most people.

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