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Valuing lives equally: Distributional weights for welfare analysis

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Abstract

Distributional weights for welfare analysis are proposed based on two axioms: (1) all lives are equally valued, (2) the monetary value of a person's life is her own valuation. This implies weights proportional to the reciprocals of the values of statistical lives.

Keywords: Cost–benefit analysis; Social welfare; Value of life; Distributional weights

JEL classification: D60; D61; D63

Social cost–benefit analysis as actually practiced by governments and inter-governmental agencies usually does not systematically incorporate distributional concerns. For example, the European Commission (1997, p. 30) guidelines mention distributional concerns almost as an afterthought while Little and Mirrlees (1994) concluded that the World Bank had "hardly ever used" distributional weights in practice despite publishing guidelines for their use. Projects are typically evaluated on the basis of whether the sum of monetary benefits to all persons exceeds the sum of monetary costs. Economists have pointed out that there is no reason why distributional concerns should not be incorporated in project evaluation (Drèze and Stern, 1987). Pareto-improving projects would pass a cost–benefit test with any welfare function that placed a positive weight on all persons' incomes, not only when the weights are equal, as is the usual practice. The issue is important because most public projects are not Pareto-

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improving since compensating transfers are not made in most cases, and therefore, income is redistributed.

One reason why distributional weights are not often applied is that there has appeared to be no natural choice for the weights.[1] It may appear that a solution to this problem would be to present the decision-makers with the results of the analysis under several sets of weights and allow them to choose. This proposal, however, overlooks one of the advantages of systematic cost–benefit analysis: it constrains decision-makers so as to prevent them from choosing projects to favour private interests. Giving the decision-maker too much leeway to pick and choose undermines this function. The ad hoc manner in which distributional concerns are sometimes incorporated in project choice also has this drawback.

This note proposes a social welfare function based on two axioms: (1) the widely-shared ideal that all lives should be valued equally, and (2) the standard notion of consumer sovereignty that the monetary value placed on a person's life should be the one that she herself places on it. The social welfare function follows from these axioms. The first axiom implies that a given loss of life in a group i of persons with income y_i should have the same value as the same loss of life in a group of persons with any other income. Therefore, a given reduction in the risk of death should have the same value for all persons regardless of their income. Suppose persons in group i value a reduction in the risk of death of p at $\$w(y_i)$ so that their value of a statistical life is $\$w(y_i)/p$. Therefore, a dollar is worth a change in risk of $p/w(y_i)$ to them. Using the second axiom, it follows that the social welfare function must weight incomes accruing to such persons by $1/w(y_i)$. Hence, it must be (up to a positive affine transformation)

$$W(y_1, \ldots, y_n) = \sum_{i=1}^{n} \frac{y_i}{w(y_i)}. \tag{1}$$

The weights in this function are inversely proportional to the value of a statistical life for a person with income y_i. Lives, rather than money, are used as the unit of account.[2]

It may be asked why the weights are functions of income alone, and not of other characteristics of individuals that affect their willingness to pay to reduce risk to their lives. The answer is that we wish to protect people from being discriminated against because their incomes are low, but we do not want to award greater weights to the incomes of people who place a low value on their lives simply because they are less risk averse than others of the same income. For example, people without children may be less risk averse than those with children, implying that the former value money more highly in terms of their lives. But we would not, for this reason, wish to discriminate against people with children.

There are two problems that are inherent in the concept of the value of a statistical life. These are, first, that $w(y_i)$ as defined above is in general a non-linear function of the probability change p but we implicitly assumed linearity. Second, we implicitly assumed that the individual's willingness to pay for a risk reduction of p was the same as her willingness to accept an increase in risk of p in return for $w(y_i)$. These issues have not prevented the use of the value of a statistical life in cost–benefit analysis. For the purpose of assessing changes in income which are not very large, the equivalent changes in risks to life

[1] This appears to have deterred many from using weights. Arrow and Kalt's (1979) study of petroleum price deregulation and Azar and Sterner's (1996) analysis of the costs of global warming are exceptions, but these authors were not acting for governments. They used weights that are inversely proportional to income.

[2] See Brekke (1997) and comments by Drèze (1998) and Johansson (1998) on the choice of numéraire in cost–benefit analysis.

are small, and the linearity assumption may be a reasonable approximation. More importantly, it may be argued that an imperfect set of weights is to be preferred to equal weights that are clearly biased against those with low incomes.

The welfare function implied by the two axioms above is utilitarian in spirit, in that it treats differences in risks to life equally rather than treating levels of risks to life equally (Sen, 1973, pp. 43–46). The difference between the two approaches may be seen from the following example. Suppose individuals in Groups A and B have survival probabilities of 90% and 80%, respectively, perhaps because the latter have lower incomes that reduce their access to healthcare. Suppose a policy were available that raised survival probabilities of those in B to 81% by redistributing income, at the cost of lowering survival probabilities of those in A to 81%. A welfare function, such as the Rawlsian, that treated levels equally would accept the policy while the one described here would reject it.

While most of the practice of cost–benefit analysis has ignored distribution, there are some notable exceptions. Cost–benefit analysis of regulations intended to save lives have taken distribution into account. For example, the US Department of Transportation (2002) explicitly recognises that airline passengers have a higher monetary value of life than automobile passengers but refuses to take this into account in framing safety regulations. It uses a uniform average value of a statistical life to assess the benefit from a safety regulation, thus valuing all lives equally.

Miller (2000) has estimated the elasticity of the value of life with respect to income to range from about 0.85 to 1.00, based on a meta-analysis of 68 studies in 13 countries. This would imply that monetary benefits accruing to a person with twice the income of another would be weighted by only 0.50 to 0.54 times as much as benefits accruing to the latter. Costa and Kahn (2004), using US data at 10-year intervals from 1940 to 1980, get higher estimates for the elasticity ranging from 1.5 to 1.7. These would imply corresponding weights of 0.37 to 0.4. Better and more precise estimates may be expected as research on this topic expands.

While this note has focused on the application of the proposed welfare function to cost–benefit analysis, it should be clear that it can be used to evalulate public policies of any kind, not just investment projects.

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