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PROJECT EVALUATION WITH DEMOCRATIC DECISION-MAKING: WHAT DOES COST-BENEFIT ANALYSIS REALLY MEASURE?

Karine Nyborg[1]

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Abstract

It is often argued that projects involving public good changes should be chosen on the basis of monetary valuation and cost-benefit analysis (CBA). In democratic project selection processes, however, decision-makers cannot generally interpret CBA as measuring projects' social welfare effects. The reason is partly that decision-makers' views of the good society differ – that is, they typically do not hold the same social welfare function – and partly because separating efficiency and distribution is even less straightforward in democratic than in dictatorial decision-making processes.

Keywords: Environmental cost-benefit analysis, ethics, democratic decision-making

JEL codes: A11, D31, D61, D63, D7

1. Introduction

Unregulated markets function poorly when it comes to provision of public goods, such as a stable global climate, air quality, biodiversity and many other ecosystem services. Securing a reasonable supply of such goods is thus an important task for government. Whether consequences have market values or not, economic analysis of potential public sector projects should, to the extent possible, contribute to decision-makers' understanding of what is at stake.

In environmental economics, a common approach to public project evaluation is to estimate people's willingness to pay for changed public good provision, use this as a measure of the social benefits of the environmental change at hand, and then compare these benefits to project costs and other social impacts through cost-benefit analysis (CBA). The result is often interpreted as a measure of the social desirability of the project. [2] Some scholars explicitly consider CBA as a tool for measuring social welfare change; others speak of it as a means to indicate projects' efficiency, while not necessarily accepting the welfare interpretation (for a discussion, see Hammitt 2013). Sunstein (2013) points out that CBA may, by counting effects in a systematic, yet simple way, help prevent cognitive limitations and biases from causing policy-makers to neglect vital aspects of proposed policies.

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[2] Arguments for using CBA as a normative guide to decision-making can be found in, e.g., Harberger (1971), Navrud (1992), Hanemann (1994), Hahn and Litan (2005). For different views, see e.g. Kelman (1981), Sagoff (1988). The popularity of non-market valuation and CBA in environmental economics can for example be confimed by leafing through any volume of *Environmental and Resource Economics.*

The impact of CBA and monetary valuation on actual policy-making, however, appears to be rather limited.[3] Such lack of influence might of course be due to policy-makers not understanding the CBA methodology, or simply not caring about the costs and benefits of proposed policies at all.[4] Below, I will discuss another possibility: Could it be that CBA is answering a different question than the ones policy-makers – even rational and benevolent ones – need to be asking?

Pinpointing exactly what CBA measures turns out to be surprisingly hard – especially if it is to be stated in an intuitively understandable but yet precise way. A main problem is that standard explanations tend to be based on assumptions that can be of limited relevance in applied policy-making contexts.

Economics textbooks often assume, implicitly or explicitly, that the purpose of a CBA is to judge projects' social welfare effects based on the value judgments (the social welfare function) of some unique policy-making entity, like "the planner", "the government", or the "ethical observer".[5] My starting point here is different. I will assume that the aim of the project analysis is to enable each individual participant in a democratic project selection process to judge alternative projects' social welfare effects, *given his or her own value judgments* (his or her own social welfare function).

There are two main reasons why distinguishing between these purposes is important for economic project analysis. First, democratic procedures involve many participants (sometimes called the *demos*). The ethical and political views of these participants – that is, their social welfare functions – must be expected to differ. A very fundamental requirement of democratic decision-making is that every participant should have an equal opportunity to explore and express reasons for her views (Dahl 2006, see also Nyborg and Spangen 2000). Ranking projects according to a unique policy-maker's value judgements begs for *output* from one particular social welfare function. In contrast, enabling each demo to arrive at a well-founded policy evaluation (according to her own normative view) requires information that can be used as *input* into *different* social welfare functions (Brekke et al. 1996, Nyborg 2000, Nyborg 2012).

Second, democratic decision-making is often, by its very nature, fragmented. Powers are divided according to constitutional rules. Different types of decisions are delegated to different political bodies; project decisions may, for example, be made by a regional council, while the tax system is being determined by Parliament. Ruling parties as well as individual decision-makers can be replaced at frequent intervals, and at expected or unexpected times. Democratic decision-making processes are characterized by conflict, compromise, negotiation and renegotiation. The assumptions made in common textbook explanations of CBA, such as the possible separation between efficiency and distributional concerns, often become very questionable in such circumstances.

In the present paper, I will discuss possible interpretations of net benefit (or net present value) estimates from standard unweighted CBA from the point of view of policy-makers involved in

[3] Kuik et al. (1992), Fridstrøm and Elvik (1997), Nyborg (1998), Hahn and Tetlock (2008), Odeck (2010), Rogers et al. (2013).

[4] "The poor quality of analysis can help explain some of this ineffectiveness. However, regardless of how good the analysis is, politicians sometimes choose not to take basic economic ideas seriously.» Hahn and Tetlock (2008), p. 69.

[5] "The key principle that underpins CBA ideally is very simple. (…) The typical project will involve some winners and some losers. Some kind of social welfare function is then used to aggregate across affected individuals" (Perman et al. 2003, p. 368).

democratic decision-making procedures. [6] I will restrict myself to discuss choices between alternative marginal projects (where "doing nothing" may be interpreted as one project). In this context, "marginal" means that the project's impacts on market values, as well as marginal non-market values including individuals' marginal utility of income, are sufficiently small to be disregarded. By a "project" I will simply mean different combinations of exogenous changes in the population's access to public as well as private goods.[7]

CBA can be interpreted normatively or positively (Hammitt 2013). Below, I will first turn to the normative interpretation. Leaning on a very simple formal set-up, I will show why interpreting net benefits (as calculated in standard unweighted CBA) as a measure of each project's social welfare effects is valid only for demos who hold quite particular, and highly controversial, value judgments. This insight is not new (see, e.g., Blackorby and Donaldson 1990, Bromley 1990, Kelman 1981, Drèze and Stern 1987), but seems largely ignored in applied environmental economics. In fact, if one accepts the plausible, but hardly verifiable assumption that a marginal dollar is more important to the poor than to the rich, CBA as a welfare measure gives systematically more emphasis to utility changes for the rich than for the poor. For any demo who does not find a systematic bias in favor of the rich ethically and/or politically acceptable, CBA will not in general rank projects correctly.

There is also a more positively oriented interpretation, namely that net benefits, as measured by unweighted CBA, measures efficiency in terms of potential Pareto improvement. The simple version of this argument goes as follows: if people are, in sum, willing to pay more to realize a project than it actually costs, Pareto improvements can be achieved by implementing the project and redistributing from the gainers (those with a positive net willingness to pay for the project) to the losers (those with a negative net willingness to pay).

This argument presumes that costless lump-sum transfers are available, which is rarely the case. However, it has been demonstrated that a similar result may hold even when lump-sum transfers are unavailable (see Hylland and Zeckhauser 1979, Johansson-Stenman 2005, Kaplow 2008). I will argue below that the latter argument is much more relevant for a dictatorial planner than for someone participating in a democratic decision-making process.

To have an impact in a democratic decision-making process, the economic project analysis has to influence the view of sufficiently many demos. If demos disagree with the normative value judgements integrated in the analysis, or doubt the relevance of central assumptions, they are, of course, free to disregard the entire CBA, leaving it without impact. Still, the argument of Sunstein (2013) should not be forgotten: Demos may need to be reminded of consequences they might otherwise inadvertently neglect.

It is my belief that the strength of economic analysis is its positive, not its normative, content. Interpreted positively, applied economic project analysis can be of substantial help in describing, summarizing and explaining the various consequences of proposed policies. A positive interpretation requires, however, that each demo is able to understand, in descriptive terms, what CBA really measures.

[6] A more elaborate discussion is found in Nyborg (2012).

[7] That is, once the project choice has been made by the democratic body, changes are exogenous from each individual citizens' point of view. Of course, a citizen may still influence the decision itself before it is made, in her capacity of a demo.

There is one straightforward, purely descriptive interpretation: CBA measures the population's total net willingness to pay. Presented as purely descriptive information, total net willingness to pay is one of several indicators that could potentially contribute to demos' overall understanding and judgement of projects' consequences. This may be so even though most demos will presumably make their judgment based on a whole array of indicators. However, since neither the welfare nor the efficiency interpretation are straightforward in democratic decision-making context, summarizing CBA in one number and presenting the result as the project's "net benefits", "welfare effects" or "efficiency effects", ought to be avoided: it is, simply, misleading.

2. Individual utility

Let me start with a very simple formal framework[8].

While discounting, risk and uncertainty have been among the most hotly debated aspects of CBA, they are not crucial to my concern here; for the purpose of simplification, I will thus use a static, deterministic model and hence ignore discounting.[9] In the same vein, I assume that individual income is exogenous, and that any income not spent on supply of public goods is spent on the individual's own private consumption.

Assume that there are $n>1$ individuals in society. For any individual i, the utility level U_i is given by

(1) $$U_i = u_i(X_i, E)$$

where X_i denotes individual i's private good consumption, measured in money, E denotes the supply level of a public good, which can be thought of as environmental quality measured in physical units, while the utility function u_i is increasing and differentiable in both variables[10].

A marginal project is defined by marginal changes in individual incomes ($dX_1, \ldots, dX_n$) and environmental quality (dE).[11] Although inessential for the results, I will discuss the problem as if the purpose of the project is to increase public good provision, while changes in individual private consumption result from citizens being required to contribute to cover the cost of this.

Consider first the importance of a given project for a single individual. The change in i's utility can be found by differentiation of equation (1):

(2) $$dU_i = u'_{iX}\, dX_i + u'_{iE}\, dE$$

where u'_{iX} is i's marginal utility of income and u'_{iE} is her marginal utility of environmental quality.[12]

[8] The model is based on the presentation in Nyborg (2012).
[9] This is not crucial for the results; values below could easily be interpreted as present (discounted) values.
[10] I also make the standard assumption that it is quasiconcave, that is, indifference curves bend towards origo.
[11] That the project is marginal means that we can disregard the effects of dX_i and dE on marginal values – including the individual's own marginal valuation u'_{iE}/u'_{iX}. Thus, if a project changes u'_{iE}/u'_{iX}, it is not marginal in the sense used here, even if all market prices are unchanged. This implies that the difference between willingness to accept and willingness to pay measures (or compensating and equivalent variation) can be disregarded.
[12] To avoid unnecessarily complex notation, the subscript "i" in X_i has not been included in the notation "u'_{iX}".

An individual's willingness to pay for increased public good supply dE, WTP_i, can be defined as the amount of money one must take away from her in order to leave her with exactly the same utility level as she would have had without the environmental change. This definition can be combined with equation (2) to give the following expression for WTP_i:

(3) $$WTP_i = (u'_{iE}/u'_{iX})dE.$$

Willingness to pay, as expressed by (3), is a hypothetical payment. *Actual* payment – the individual's contribution to cover the project's actual costs – may be bigger or smaller than this. Assume now that individual *i* must pay a pecuniary cost, $C_i \geq 0$, if the project is implemented. That is, $dX_i = -C_i$. Using this in (2), rearranging, and applying (3), we get

(4) $$dU_i = u'_{iX}(WTP_i - C_i).$$

That is, *i's utility change is proportional to her net willingness to pay.* We do not know the proportionality factor u'_{iX}, which reflects her marginal utility of income (how important money is to her on the margin). However, it is strictly positive and constant (by assumption). Thus, *i*'s net willingness to pay will rank alternative projects in the same way as her preferences. This is the standard textbook rationale for using net WTP as a welfare measure.

Note, however, that while *i*' net willingness to pay tells us how important one good (environmental quality) is compared to the other (private consumption), it says nothing about these goods' absolute value in terms of utility. If a person's willingness to pay for improved lake visibility is low, it could reflect that she cares little for improved lake visibility, or that money is extremely important to her at the margin. If her WTP is medium-sized, it could mean that she cares little about both goods, or that both are extremely important to her. To draw conclusions about how important improved lake visibility is to a person – in *absolute* terms – from her WTP, we would also need to know her proportionality factor u'_{iX}.

The standard utility concept of neoclassical consumer theory, ordinal utility, is concerned solely with the individual's ranking of alternative consumption bundles (X_i, E). When using CBA as a tool for welfare measurement, however, we are essentially comparing how important a *change* in consumption bundles is for someone, compared with similar changes for others. Individual rankings of projects are then of little help; such welfare comparisons require a utility concept normally not used in neoclassical consumer theory, namely cardinal and interpersonally comparable utility.[13]

Since individual WTP measures individual utility change, one might think that the sum of aggregate WTP is a measure of aggregate utility change. That, however, is not generally true. [14] The analysis

[13] With an ordinal utility concept, individual *i* is able to compare her utility of any two social states A and B, i.e. whether $U_i(A) > U_i(B)$. With cardinal utility, *i* is also able to evaluate her utility *differences* between states, i.e. whether $U_i(A) - U_i(B) > U_i(C) - U_i(D)$ (where A – D are social states). With cardinal and interpersonally (level) comparable utility, the evaluator is able to compare utility differences between states for different individuals, that is, whether $U_i(A) - U_i(B) > U_j(C) - U_j(D)$.

[14] Adding up purely ordinal information (rankings) to yield apparently well-behaved social welfare functions is not, in fact, even possible, unless one individual is given the role of a dictator. This result is known as Arrow's Impossibility Theorem (Arrow 1951). Anyone who has organized a soccer tournament knows well the difficulties in proclaiming a winner based on binary rankings only.

above confirms that individual net WTP is a measure of *ordinal* utility.[15] It unfortunately gives no confirmation that this ordinal measure can be aggregated across individuals. To use unweighted CBA to measure welfare, we actually need to count units of utility, and we need to establish some measurement scale that can indeed be compared between persons.[16]

3. Aggregating utility

If we want to aggregate utility over individuals, the proportionality factor u'_{iX} becomes crucial.

To compare the prices of different goods purchased in Norway, where I live, I don't need to know the exchange rate between Norwegian kroner and US dollars. When travelling to the US and comparing prices there to those at home, I certainly do need to know the exchange rate. The role of the marginal utility of income is similar in the present context: Even if the level of u'_{iX} does not matter for individual (ordinal) utility measurement, it does matter when utility changes for different individuals are added up.

This can be seen very simply by adding dU_i for all n individuals in society, using eq. (4):

$$\sum_i dU_i = \sum_i [u'_{iX} (WTP_i - C_i)] \neq \sum_i (WTP_i - C_i) \quad (5)$$

where the sums are over all $i=1,\ldots,n$. In the special case where u'_{iX} is equal for everyone, it can be placed outside of the summation sign, and the sum of utility changes will be proportional to the sum of net WTP. If u'_{iX} varies between persons, however, aggregate WTP is not, in general, proportional to the sum of utility changes. Nor is there another similarly simple relationship between the two. Unless we know the u'_{iX} corresponding to every single individual WTP, aggregate WTP tells us little about aggregate utility change.

When adding WTP across individuals, we are implicitly or explicitly interpreting WTP not just as a ranking, but as a meaningful number in absolute terms. Understanding the sum of net WTP as a measure of aggregate utility essentially amounts to believing that dollars are equivalent to "utils" – or in other words, that on the margin, money is equally important for everyone.

So what do we know about u'_{iX}, the marginal utility of income? Unfortunately, not much. As pointed out above, we are speaking of a cardinal and interpersonally comparable aspect of utility, which neoclassical consumer economics usually does not deal with at all. Not surprisingly, then, neoclassical economics does not provide any generally accepted method for measurement of such concepts.

[15] If preferences are not exogenously given, or if the individual acts according to different preferences when in different roles (e.g. as citizen or consumer), then net WTP is *not* necessarily a measure of ordinal utility (see Kelman 1981, Sen 1979, 1985, Sagoff 1988, Nyborg 2000). For simplicity, I am disregarding all such complications here.

[16] Further, if the ordinal definition of utility as revealed choice is not to be used, one should specify precisely what "utility" is supposed to mean instead: happiness? a feeling of satisfaction? For the sake of brevity, I will abstain from such clarification here, leaving the concept slightly vague.

Nevertheless, many measurement attempts, all of them of course involving extensions of or alternatives to the purely neoclassical approach, have indeed been made (see van der Praag 1991, Oswald 2008). One promising approach takes its starting point in the recent happiness research, based on the idea that utility and reported happiness, or alternatively life satisfaction, are closely related concepts. This research tends to confirm the intuition that on the margin, money matters more to the poor than to the rich. Layard et al. (2008) used several surveys of self-reported happiness, using data from 50 countries during 1972 to 2005. They found that when household income increases by 1 percent, the marginal utility of income decreases by 1.26 percent. That is, the marginal utility of income u'_{iX} is substantially higher for poor than for rich households.[17]

4. Social welfare change

Above, I was simply summing up individual utilities, without considering whether every utility change is equally important from society's point of view. Let us now introduce social welfare functions, which reflect purely normative views of "the good society". To make everything as simple as possible, I will assume that social welfare *W* depends only on the utilities of individuals.[18]

(6) $$W = V(U_1, \dots, U_n)$$

The function V is differentiable with $V'_i > 0$ for all $i = 1, \dots, n$ members of society (where V'_i is the derivative of V with respect to U_i). One example of V would be the utilitarian social welfare function $W = U_1 + \dots + U_n$, for which $V'_i = 1$ for all *i*.

Let us now consider a marginal project's contribution to social welfare, given any V satisfying these assumptions. Differentiation of (6) and inserting from eq. (4) gives

(6) $$dW = \sum_i (V'_i \, u'_{iX} \cdot (WTP_i - C_i))$$

where the sum is over all $i = 1,\dots,n$. That is, the change in social welfare due to a project is given by a weighted sum of individuals' net willingness to pay. The weight placed on net willingness to pay for individual *i* ($V'_i \, u'_{iX}$) is often called the *welfare weight* for person *i.* The weights are composed by two factors. Each of them is, by assumption, positive, and since the project is marginal, each can be assumed constant, hence welfare weights themselves are positive and constant.

Making assumptions about the level of each factor requires, in practice, subjective judgment. The first factor, V'_i, reflects how important a marginal utility change for person *i* is for society. This is a purely normative judgment, which must be based on ethical and/or political value judgments – it has no economically "correct" value. In a democratic decision-making process, each demo's social welfare function may differ from that of others, reflecting different views of the good society. Hence, the V'_is must be expected to differ between demos. For example, for a person averse to inequality in utility levels, V'_i would be lower than V'_j if *i*'s utility level was higher than j's; while for a utilitarian, V'_is would be identical for all.

[17] See also Stevenson and Wolfers (2008).
[18] This is called *welfarism*; for a critical discussion, see Sen (1979).

The second factor of the welfare weights is the marginal utility of income (u'_{iX}). Although assumptions concerning the size of this factor can be regarded as positive rather than normative, its measurement cannot, as discussed above, be based on neoclassicial economics alone. Measuring the marginal utility of income requires comparison of different individuals' sense of absolute importance, which is subjective in its very nature. As a consequence, it is hard to imagine how one could estimate it without resorting to some sort of subjective judgment. It may well be the case that quite a bit of political disagreement originates in different views on this.

For a project that is an actual Pareto improvement, i.e. a project that benefits at least one person without reducing anyone else's utility, net WTP is weakly positive for every individual. In such a case, we need to know neither the welfare weights nor the level of each individual's net WTP to say that the project increases welfare. The interesting cases are those where there are, in fact, conflicting interests. Then one person's wants must be traded off against someone else's. To make such tradeoffs, one must decide how much weight to give to one person's interests as compared to the others', which is precisely what welfare weights do.

In a democratic decision-making process, welfare weights must be expected to differ between the demos. Even if researchers were somehow able to estimate the marginal utility of income in a reliable and generally accepted way (which is not yet the case), welfare weights would still differ – due to ethical and/or political disagreement on views of the good society, which is a natural part of any democracy.

5. Equal welfare weights: what it means

The overwhelmingly most common approach in applied CBA (a claim admittedly based on casual observation) is to add unweighted estimates of all individuals' WTP and subtract costs. "Unweighted" here means only that weights are not explicit; in reality, the weight given to each person's net WTP equals, of course, one. This procedure yields a measure of social welfare change according to (6) if welfare weights are equal for all *i*: In that case, $V'_i u'_{iX}$ can be placed outside of the summation sign, and the project's contribution to social welfare is proportional to the unweighted sum of net willingness to pay. What is the interpretation of this requirement?

Note, first, that when the purpose of the CBA is to inform participants in a democratic project selection process, trying to estimate or guess the "correct" welfare weights is not meaningful. There will normally exist many, potentially equally correct, sets of welfare weights. The question we need to discuss here is rather the following: Given that decision-makers are, in fact, presented with a standard (unweighted), competently conducted CBA, how can they correctly interpret its results?

The decision-maker should be aware that the CBA result, if interpreted normatively as a measure of social welfare change, is based upon specific ethical and/or political premises. If she can accept those premises, no problem. If she cannot, she must be aware that the ranking provided by the analysis will not, in general, coincide with the correct ranking from her own point of view. The question thus becomes: What are those ethical and/or political premises captured by the assumption of equal welfare weights?

If $V'_i u'_{iX} = V'_j u'_{jX}$ for all *i* and *j*, we must necessarily also have $u'_{jX} / u'_{iX} = V'_i / V'_j$. That is, if any two individuals have a different marginal utility of income, equal welfare weights imply that we are also

giving their interests different weights in the social welfare judgment. Without loss of generality, let us write $V'_i u'_{iX} = 1$ for every *i*, the standard normalization of welfare weights used in CBA. Then, by simple logic, we must also have that for every *i*,

(8) $$V'_i = 1/u'_{iX}.$$

That is, the CBA is implicitly placing an emphasis (V'_i) on each individual's interests which is *inversely proportional* to this individual's marginal utility of income: The more *i* values an extra dollar, the less the CBA procedure (or) cares about her utility.

There seems to be a common misunderstanding that unweighted summation of net WTP, as in CBA, can be justified by utilitarianism. As shown by eq. (8), however, unweighted summation of net WTP is *inconsistent* with utilitarianism. The only exception is if everyone has the same marginal utility of income. In all other cases, CBA gives too much emphasis to the interests of those with a low marginal utility of income, as compared with utilitarianism.

Recall, now, the result of Layard et al. (2008) discussed above: the marginal utility of income is declining substantially in income. If one accepts this result, equation (8) implies the following: Standard unweighted cost-benefit analysis implies using a social welfare function that gives systematically more weight to utility changes for the rich than for the poor. That is, CBA implies that V'_i is higher for the rich than for the poor.

Some textbooks suggest that rather than taking an explicit stand on the issue of welfare weights, the analyst can simply assume that the income distribution is optimal. If the government has already redistributed income to the degree it finds best, and money is still more important (on the margin) to person *i* than to person *j*, it must be because the government values marginal utility improvements less for *i* than for *j.* Hence, with a socially optimal income distribution, welfare weights $V'_i u'_{iX}$ are indeed equal for all. [19] Nevertheless, this does not remove the problem. It is merely a different way of saying exactly what was explained above: If the marginal utility of income is, in fact, decreasing in income, then claiming that the income distribution is optimal is equivalent to saying that society ought to place a larger weight on utility changes for the rich than for the poor.

In a democratic society, in which parties in power can change frequently, it is not obvious that the current government finds the current income distribution optimal. Even if it did, though, one could hardly take for granted that every participant in the democratic decision-making process would do so too. For every decision-maker who does not, the ranking of projects provided by CBA will not generally be correct according to her own value judgments. [20]

If the normative premises embedded in CBA were relatively uncontroversial, this problem might perhaps be considered a minor one; caring systematically more about utility changes for the rich than for the poor, however, is definitely controversial.

[19] See, e.g., Johansson (1993, Ch. 2 and 7).

[20] Nyborg (1998) and Nyborg and Spangen (2000) found that skepticism towards CBA appeared to be greater among transport politicians on the political left than among those on the right. If politicians on the left are more unhappy with the current income distribution than those on the right, their higher degree of skepticism is justified.

6. Efficiency, not welfare

Let us now turn to less explicitly normative interpretations. How about considering CBA a tool for measuring projects' efficiency?[21]

It is common to think of *efficiency* as concerned with maximizing the size of the "pie" to be shared, while *distribution* is about how to share this "pie". In the present context, it is not obvious which kind of "pie" we would be trying to maximize. We thus need to define what "efficiency" should be taken to mean.

The central efficiency concept in economics is that of Pareto efficiency. Based on this, we might define a project A as efficient as compared to an alternative B if choosing A over B increases the utility of at least one individual, while decreasing the utility of no-one. This definition is not very useful here, however. If A represents a Pareto improvement compared to B, there is no need to undertake a CBA in order to rank them: everyone would agree that A should be preferred to B.[22] CBA is designed precisely for cases involving a conflict of interests, that is, those instances where there is in fact a need to trade benefits to some people against costs to others.

In textbook models, *efficiency* is sometimes used synonymously with *welfare improvement*. Accordingly, a project might be considered efficient if it increases social welfare. That definition is of no help here, however: it brings us immediately back to the normative interpretation discussed above, while the aim of the present section was precisely to search for a positive interpretation.

A third possible definition is that a project is efficient if it is a *potential Pareto improvement*: Although it may not represent an actual Pareto improvement, it *could* have been one, provided that feasible lump-sum redistribution *had been* implemented.

There is at least two versions of the view that CBA measures efficiency according to this latter definition. The first one is the simple one familiar to every economist: Call those with a positive net WTP "winners" and those with a negative net WTP "losers". If total net willingness to pay is positive, this must means that the winners' gain is sufficiently large to fully compensate every loser. Hence, by taking money from winners and giving it to losers, the project could potentially become an actual Pareto improvement.

Nevertheless, such redistribution is typically not possible even in theory (see e.g. Hammond 1979). First, costless lump-sum transfers are rarely available, meaning that redistributing the "pie" is infeasible without at the same time changing its size. Except in special cases, a democratic government cannot costlessly take money from one person and give it to someone else in any way it likes. If the transfer is not mandated by the general tax system, doing so may be in conflict with citizens' constitutional property rights or other laws. There will be administrative costs; perhaps more importantly, any non-lump-sum transfer scheme provides incentives for changed behavior, giving rise to deadweight losses.

[21] For a discussion, see Bromley (1990).

[22] I am glossing over some complications here. Recall that I have abstracted from agency, endogenous preferences and non-welfaristic social welfare functions, see footnotes 16 and 19. While one may expect phenomena such as envy and altruism drive a wedge between unanimity and Pareto improvement, this is not obvious if the social part of preferences are included in preferences in a similar way when defining "Pareto improvement" and "unanimity".

A possibly even bigger problem is that identifying losers and winners, and the magnitude of their loss and gain, require private information (such as individuals' preferences). If an individual knows that her reported WTP will be used to determine whether she must pay or will receive compensation, and how much, she has every incentive to misreport her WTP.

However, there is also a slightly different argument why CBA may be said to measure efficiency in terms of potential Pareto efficiency. Hylland and Zeckhauser (1979) demonstrated that under certain conditions, social welfare is maximized by ranking projects according to their unweighted total net benefits (i.e. according to CBA) and taking care of redistribution through the income tax system instead (see also, among others, Christiansen 1981, Johansson-Stenman 2005, Kaplow 2008). This argument is not based on lump-sum transfers, and takes into account that income taxes may be distortionary. The idea is not, as above, that each individual project could potentially be turned into a Pareto improvement through appropriate redistribution, but rather that the tax system is a better tool for redistribution than public projects.

This argument holds under rather specific assumptions, which cannot always be expected to hold in practice.[23] [24] When they do hold, a dictatorial (and benevolent) policy maker should rank projects according to CBA, while ensuring a (second-best) optimal income distribution through the income tax system. But we are now concerned with democratic project selection processes, not dictatorial decision-making.

Imagine that you are a rational, benevolent politician participating in a vote in Parliament. The options are to vote for either project A or B. Total net WTP is higher for A. However, the distribution of costs and benefits in A are such that in your view, the project (viewed in isolation) will reduce social welfare unless compensation measures are implemented.

Your problem is that you are not in control of the available redistribution measures. You have a vote in the project selection process, but the tax system is not currently on the agenda. The next time it is, you may no longer have a seat in Parliament; or if you do, you may not be able to secure enough support for the redistribution measures you propose.

In spite of the fact that the two decisions are not linked in the policy-making process, you may, of course, choose to vote for project A in the hope that redistribution measures will take place anyway. If they are not, however, you will have contributed to a reduction in social welfare. Unfortunately, the same thing is likely to happen again next time: Unless you find the income distribution optimal, CBA (or more precisely, total net WTP) will systematically rank projects differently than yourself, with an emphasis on various people's interests that differs systematically from yours. You may thus even be contributing to what you consider a steady decrease in social welfare, or at least a smaller increase than would have been attainable through other project choices.

[23] According to Johansson-Stenman (2005), it is optimal to use distributional weights in CBA when different projects will affect tax revenues equally much via changed labor supply, and unless differences in distributional welfare effects are offset by corresponding changes in tax revenue effects. Kaplow (2008) introduces "distribution-neutral income tax adjustments" allowing one to largely ignore concerns about distribution when determining the optimal provision of public goods.

[24] See also Quiggin (1995).

7. The power line example

By now, the reader might be asking him- or herself what all all this has to do with the environment. Isn't the problem discussed above an issue that can safely be disregarded for most environmental projects, since they are rarely motivated by redistribution concerns, and often have modest distributional effects? Drawing such a conclusion, however, would be completely missing the point.

Since my analysis is confined to marginal projects, all effects, regardless of whom they harm or benefit, are already assumed to be "small". The discussion is important to environmental economists not because they should necessarily be particularly concerned about changing the income distribution. It is important for environmental economists because counting dollars as if they were "utils" is the technique used for trading off *any* conflicting concerns in CBA - whether the conflict is concerned with society's priorities between private consumption and a stable global climate, between conservation of pristine wilderness or improved access for recreational purposes, or with any other conflict between environmental and other concerns. The natural environment is counted in CBA only to the extent that someone is willing to pay for it. Whenever people disagree on society's priorities, whose views are counted the most obviously matters. In CBA of environmental projects, the views of some citizens – namely those whose marginal utility of income is small, for example because they are wealthy – are systematically given a larger weight when environmental matters are evaluated in CBA.[25]

Let me illustrate by means of an example. In the case discussed below, the demos must choose which of two environmental amenities has to be degraded; the income distribution is not on the agenda, and is no central concern in the project at hand.

The government is considering two alternative routes for a new electric power line. The routes pass through two different recreation areas, A and B, of which only one can be protected. The alternatives are identical in almost every respect: the pecuniary cost and its distribution, the physical environmental impact, the number of individuals using the area for recreational purposes, and users' preferences. The only difference is that users of area A have higher incomes than users of area B (the government is unaware of this). Let everyone in the population have preferences as follows (replacing eq. (1)):

$$U_i = u(X_i) + z(E_i) \tag{9}$$

where u and z are concave and increasing functions, and where E_i = A for one half of the population and E_i = B for the other half.

A valuation study concludes, correctly, that aggregate willingness to pay for protection of area A is higher than for area B.[26] Committed to make its decisions in accordance with CBA, the government protects area A and constructs the power line through area B. The aggregate utility reduction caused by the power line, however, would be identical in the two alternatives. The decision to exploit area B is made solely because its users are poorer.

[25] See also Brekke (1997).

[26] Person *i*'s WTP for protecting the recreation area she is using is $WTP_i = [z'(E)/u'(X_i)]dE$, implying that WTP is increasing in income.

Such a principle would perhaps seem reasonable if losers were in fact compensated through side payments. After all, money is more important on the margin to the users of area B; hence, compensating them is cheaper.

The problem arises when aggregate WTP is used to measure welfare change, while compensation is *not* paid. Their recreation area is exploited because they are poorer and thus *could have been* easily compensated. When *not* compensated, the use of this principle further deteriorates their (relatively) less privileged situation.

Two insights can be taken away from this. First, monetary valuation and CBA do not provide "neutral" measurements of environmental projects' welfare contributions. Second, actual and hypothetical Pareto improvements are fundamentally different things.

If people have different marginal utilities of income, real side payments do not represent zero-sum transfers of welfare between individuals. Payment of monetary compensation then typically *changes* aggregate utility.

8. Explicit welfare weights

Several scholars have proposed that explicit welfare weights – for example, inversely proportional to income – should be used in cost-benefit analysis.[27] This might make the method less controversial.

There are also some problems with this proposal, however. First, it will be harder to implement than the current practice. In addition to estimating total willingness to pay and total costs, the analyst must be able to link each individual's net WTP to other personal information such as income. This obviously requires more detailed data, and possibly also a more thorough analysis of the projects' interactions with markets.

Second, using welfare weights would not change the basic problem discussed here: Interpreted normatively, CBA provides output from one specific social welfare function, not input to any social welfare function chosen by the demo herself. Even if calculated using differentiated welfare weights, adjusted total net WTP provides a direct guide to project selection only for those subscribing to a normative view consistent with the chosen weights. Sensitivity analysis – calculating projects' welfare contributions given a broad range of welfare weight sets – would of course help; note, however, that in principle, one might need a separate analysis for every single demo.

Third, while differentiated welfare weights may make the analysis less controversial as a normative guide, the increased complexity might make the analysis less understandable viewed as positive information.

A decision-maker who fully understands what an indicator means, is of course free to use this information in any way she likes. The aggregate result of an unweighted CBA has, in fact, a simple, straightforward descriptive explanation, making it relatively easy to grasp – namely total net willingness to pay. If total net WTP for protecting a local wetland area is highly positive, for example, this can be viewed as a rough signal that public concern for wetland protection is substantial compared to its costs. To make up their minds, most decision-makers would need a lot more

[27] See Dasgupta et al. (1972), Drèze and Stern (1987), Johansson-Stenman (2005).

information than that: ecological reasons for protection of the site, for example, its size and location, budgetary details, information on who the opponents are and what arguments they refer to. But even if not viewed as a direct normative guide, total net willingness to pay does convey a piece of potentially interesting and understandable descriptive information. A weighted analysis, on the other hand, might be harder to interpret as something other than a welfare measure.

These are not intended as arguments against using differentiated welfare weights in CBA. Rather, they are arguments for the view that advocating the use of explicit welfare weights will not be a satisfactory solution of the problems discussed above, partly because such procedures may well end up not being used in practice. Explicit welfare weights are rarely seen in applied work; even in the World Bank, whose guidelines required distributional weights in CBA for a long time, their use was almost absent (Little and Mirrlees, 1994).

9. Discussion and conclusions

Democratic decision-making is typically fragmented. Power is shared; it is delegated; it is easily lost. A non-dictatorial decision-maker who has supported a public project without regard to conflict and distribution, planning to take care of such issues using of other policy instruments, may find herself powerless with respect to implementation of those other instruments.

Standard economics textbook arguments for using cost-benefit analysis to rank public projects are, in various ways, based on the idea that efficiency and distribution can be considered separately. This idea is the very rationale for abstracting from conflicts of interests in the project evaluation. The relevance of these textbook arguments for democratic project decisions, however, is not always clear. Thus, a non-dictatorial decision-maker can inadvertently support policies she disapproves of if she insists on keeping efficiency and distributional judgements apart.

Cost-benefit analysis represents only one of many possible ways to aggregate individual preferences. As a criterion for prioritizing among alternative public projects, it is neither ethically nor politically neutral. Majority voting would, for example, generally rank projects differently than CBA. With majority voting, the environment wins if the majority prefers it to; in CBA, the environment wins to the extent somebody is willing to pay for it (whether or not this somebody represents someone who *will* pay). This difference is of no importance if the project to be considered is a Pareto improvement and everyone is in favor. As soon as there is a conflict of interests, however, the specific procedure chosen for weighing those interests against each other may be decisive for the outcome.

In CBA, the interests of some people are systematically favored over others', in the sense that their utility changes count more. More precisely, the lower your marginal utility of income, the higher weight is placed on your utility changes in CBA. If one accepts the assumption that a marginal dollar gives more utility to a poor than to a rich individual, this has the following very controversial implication: whenever there is a conflict of interests, CBA systematically emphasizes the interests of the rich at the expense of the poor. Whenever there is some trade-off, whatever this trade-off is about, CBA lends a bigger ear to the concerns of the wealthy. Over time, ranking public projects according to CBA will thus, if not combined with redistribution measures, give priority to the interests of the well off at the expense of already disadvantaged groups. Although one may hope that everyone still benefits in the long run, there is no guarantee that this will happen, since the bias is systematic.

Nevertheless, Sunstein (2013) clearly has a point: Due to cognitive biases, limited time and limited attention, policy makers may easily overlook important consequences of their decisions. It is also conceivable that this happens more easily for those consequences that do not have market values. So what should the analyst do?

Economists are rarely trained in ethics and philosophy. We hardly have special advantages in making ethical and political judgements. We are, however, trained in understanding mechanisms and facts that comprise important elements of the pros and cons of political decisions. The strength of economic project analysis lies, in my view, in our methods for positive, not normative, analysis.

How to best conduct an analysis depends on the purpose of that analysis. The question of which project is socially best is a normative one, and cannot be answered without relying on normative assumptions. Thus, an analysis aiming to point out the socially best project must choose a principle for weighing positive and negative consequences' against each other. This involves explicit or implicit valuation of everything.

In democratic decision-making, however, the purpose of a project analysis may rather be to enable each participant in the process to make *her own* well-founded evaluation of projects. With the latter purpose, the analysis should of course list the pros and cons, but it is not obvious that aggregating all information into one number is always necessary, or even desirable.

In the discussion above, I have focused on what one may call full cost-benefit analysis: A method for project evaluation where the analyst tries, to the extent possible, to value every consequence in monetary terms, and to use these values to arrive at an explicit ranking. In Hervik et al. (1998), a report written by a government-appointed expert group on CBA of which I was a member, we proposed the following distinction between three versions of economic project analysis: 1) Full CBA, as described above; 2) cost-effectiveness analysis, in which projects are ranked (inversely) according to their costs, but where benefits must be assumed to be identical for all projects; and finally, 3) what we chose to name *cost-impact analysis*.[28]

In a cost-impact analysis, pecuniary costs (and possibly also benefits) are calculated just like in standard CBA. However, although all relevant consequences should be listed and adequately described, there is no requirement that all of them need to be valued in monetary terms. The outcome of a cost-impact analysis is simply a list of consequences, providing no explicit ranking. Pecuniary project cost, measured in money, should obviously be one of the listed consequences. Project benefits may be expressed in monetary and/or physical units (the number of birds saved; the share of inhabitants protected from traffic noise; changes in the expected number of fatal accidents).

The criterion for how much to value and aggregate in a cost-impact analysis is that the information provided should be as helpful as possible to decision-makers trying to understand what is really at stake.[29] And this is, in turn, largely a pedagogical and psychological question.

Of course, this leaves it up to policy-makers to make the final evaluations and decisions. But that is a power delegated to them by democracy, not by the economic analysis. If the analysis tries to force

[28] See also Nyborg (2012).
[29] For details, see Nyborg (2012).

policy-makers to use specific normative assumptions in their evaluations, they are free to disregard the analysis anyhow.

Although a final summary indicator is hardly *required* for rational decision-making, it might still be *helpful*. Numbers can be highly interesting even when they do not, on their own, provide definite answers. Decision-makers can use them to get a better understanding of the issue at hand. This requires, however, that the indicator has some intuitively understandable interpretation, preferable a positive (descriptive) one. Total net willingness to pay, the central aggregated indicator as measured in standard CBA, does have a simple, descriptive interpretation: It measures how much the population claim, in sum, to be willing to pay to realize alternative projects, net of the projects' actual costs. It is perfectly possible to find such information interesting even without accepting it as a welfare measure. Some policies' consequences are so complex, and so hard to summarize, that rough indicators are needed to even begin to understand the picture. Total net willingness to pay is a quite simple and transparent indicator, and in some cases it can be very revealing.[30]

When used, however, such indicators should be named and presented according to their descriptive and verifiable content. If the analyst chooses to calculate and present total net willingness to pay, it should be presented as precisely that – total net willingness to pay. Names such as "net benefits", "net social value" and "welfare effects" serve, in my view, to conceal rather than convey the indicator's actual meaning.

When presented by its proper name, it is my belief that policy-makers can understand quite well what it means: It does tell us something about how important the project is to people compared to its costs; it does not provide the only answer of what is best; it can be heavily influenced by the income distribution among those with opposing interests in the project.

Interpreted this way, the indicator's normative significance is, of course, greatly reduced. But if its normative significance was based on a weak foundation in the first place, that is, perhaps, not a big problem.

[30] For an excellent example of using WTP for illustrating complex effects in a very illuminating way, see Bateman (2012), Bateman et al. (2014).

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