

Do health and environmental cost benefit analyses properly account for the preferences of the population?

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*Keywords: Economics, Environment and public health, Consumer preference,
Environmental policy, Health policy*

Abstract

Cost-benefit analyses enable public or private decision-makers to rationalise their choices. The process is apparently transparent and egalitarian, as the preferences of each individual are aggregated in the same way. However, when they include non-market components assessed through the preferences of the population, individuals are limited in the expression of their preferences by their income and subsistence needs. We explore the consequences of these constraints on the preference-elicitation process and on the monetary valuation of non-market goods. Results show that they implicitly lead to the favouring of the preferences of high-income individuals. Whether the elicited monetary valuations should be corrected when accounting for individual preferences remains an open issue.

Introduction

In terms of environmental health, the decision-maker (public or private) seeks to make the best decision for the community of individuals they represent by comparing the possible alternatives. Each of them will consequently assess negative impacts (costs) and positive impacts (benefits), as well as their possible spread over time and the uncertainties associated with their realisation in order to take into account long-term consequences. This assessment can be made without expressing impacts in monetary terms, using multidimensional approaches or multi-criteria analyses [1]. However, economists favour unidimensional (monetary) expression via a cost-benefit analysis (CBA), even though this approach is not immune from criticism [2]. In this article, we present additional critiques of a conceptual nature, which emerge when a CBA includes non-market components.

Over a century, CBAs have steadily spread to all economic sectors (transport, agriculture, education, social, environment, health, work, corporate, banking) to limit arbitrariness – decisions are backed by economic calculations – and favour equality of treatment – every individual is considered in a comparable, anonymous way. To assess monetary impacts, CBAs rely on either a directly observed price for a market good or, for a non-market good, a value estimated by appropriate methods of assessment, very often the case in the field of health and the environment. This value expresses the intensity of individual preferences for a non-market good, and is measured by willingness to pay (WTP) for the benefits. It represents the quantity of market goods (so actually income) that an individual is ready to forgo in order to benefit from a given quantity of a non-market good. Individual income will impact on the consumption of goods, market and non-market, but will, in addition, affect the expression of preferences for non-market goods. We will show that when CBAs cover the latter, they cannot correctly interpret the preferences of the poorest, prejudicing the equality of treatment of individuals.

Initially, we will offer a reminder of the framework of non-market assessment associated with health and environment risks. Then we will study the importance of the income of individuals in the process of eliciting preferences for a non-market good. We will subsequently evaluate monetary and then societal implications in the context of a CBA.

Aspects of non-market assessment

The existence of prices enables simple monetary assessment of the market impacts of health and environment risks to buildings and infrastructure, agricultural yields and certain health factors (cost of hospitalisation, visits to the doctor and treatment, and related loss of productivity). On the other hand, an absence of prices means it is necessary to seek an economic value for impacts of a non-market nature, such as harm to biodiversity and ecosystems, premature mortality or health factors such as pain, inconvenience and psychological damage.

From a theoretical viewpoint, the assessment of those two components – market and non-market – is based on the same basic postulates of the so-called neoclassical economy, which predominate even though they are challenged [3]. Firstly, the fact that each individual's preferences for a good can be represented by a mathematical function: the utility function. Subsequently, rationality that leads each of them to make the best decision possible (by maximising utility). Then efficacy ensures that the pursuit of individual interests will lead to the best possible collective situation. Finally, equity takes into account the differences between individuals (in terms of needs, preferences and social factors) that are liable to justify differentiated treatment deviating from the egalitarian principle.

In practice, the value of a non-market good depends on the quantity of market goods (or equivalent income) which individuals are ready to sacrifice to benefit from it, in other

words individual demand. There are many decisive factors impacting on the latter: level of income, preferences for each good, their degree of mutual substitutability¹, tendencies to conformism and altruism, sociodemographic factors (type of household or place of residence) or the source of social health inequalities [4, 5].

So the value of a non-market good results from an individual choice between the satisfaction given by an additional quantity of the good, and the reduction in satisfaction resulting from the sacrifice of a quantity of market goods. In this case, we observe that even if two individuals feel the same satisfaction at obtaining a non-market good, the value they attribute to that good differs if one is less willing than the other to sacrifice the market good. So decisive factors in the sacrifice of the market good will lead to differences in the perception of its value by the individuals.

Importance of income and eliciting preferences

An intuitive phenomenon – defined in economics as the law of diminishing marginal utility – states that the more one consumes / possesses a good, the less satisfaction one feels on acquiring an additional unit of that good (except for collectors!). For example, we greatly enjoy drinking a glass of water when we are thirsty (or having a mobile phone to communicate). A second glass of water (or telephone) will give less satisfaction; a third, etc., even less.

So an individual with a small quantity of market goods (in our case, income) will on average be more reluctant to sacrifice part of it than an individual who has a large quantity.

So even if these two individuals have similar determinants of demand, and in particular

¹ Two goods are said to be substitutable if they are interchangeable with no major impact on the level of satisfaction of a need (e.g. a car or train to satisfy mobility needs). Inversely, they are said to be complementary if it is necessary to consume them together (e.g. a car and fuel).

feel the same satisfaction (preference) for the non-market good, the former will on average attribute less importance to it than the latter.

The sacrifice of the market good even becomes impossible below a certain level of income, because the individual will then prioritise their subsistence needs, refusing to sacrifice the little they have for a non-market good, whatever their preference for it. This minimum 'subsistence' threshold is defined by minimum consumption of food, housing, clothing, heating, etc.

This phenomenon has already been observed in surveys eliciting preferences related to health and environment. Olsen et al. [6] compare the ranking of two goods when they are deduced (implicitly) from individual WTP or founded (explicitly) on preferences. They conclude that a large proportion of individuals are indifferent according to the implicit ranking, although it refers to an explicit preference for one of the two goods. Since the latter is not impacted by the effect of wealth, the result can be interpreted as a reflection of the constraints of income and subsistence, which limits the expression of WTP of individuals with low incomes. Smith [7] examines the role of income in the degree of WTP to the extent of the health policy assessed. He shows that income becomes an increasingly strong constraint on the expression of WTP as the scope of the policy increases. Finally, Breffle et al. [8] observe that when two initiatives are needed to improve the environmental quality of a location, individuals with low incomes will agree to pay for the first, but will not be able to pay for the second, even if it would benefit them, because their ability to pay is exhausted.

Implications in monetary terms

It is possible to study the way in which the introduction of subsistence needs affects the monetary evaluation of non-market elements by conducting an analysis that economists describe as comparative statics. It consists of comparing the results of two models, simultaneously modifying only certain parameters and leaving the others unchanged. So here, we are reasoning in terms of given individual characteristics (sociodemographic factors, altruistic or conformist tendencies, and focusing on the influence of the two parameters that interest us – income and strength of preference for the non-market good – with different degrees of substitutability between market and non-market goods.

We choose a very general class of function of utility: the function of constant elasticity of substitution (CES, [9]), enabling a wide variety in the strength of preference for the non-market good and the degree of substitutability. So we compare the results obtained using the standard model to those we obtain when we explicitly introduce a level of minimum subsistence, adapting the approach of Baumgartner et al. [10]. The calculations are not shown here (see details in Champonnois and Chanel, [11]), but the main results are illustrated in Figures 1 and 2, in which subsistence level is arbitrarily set at 10 units.

In Figure 1, we firstly consider two intensities of preference for the non-market good (low and high) and compare WTP for the standard model with that for the model with subsistence. We observe that for a given type of preference, the WTP of the standard model is always higher than that of the model with subsistence; that for a given model, the WTP is higher when the strength of preference is high; and that the WTP of the models with and without subsistence converge when income increases. However, we note the constraining effect of subsistence on WTP: for a low income, the WTP for the model with

subsistence and high preference is lower than the WTP for the standard model with low preference.

On the vertical axis, Figure 2 illustrates the ratio between WTP for a model taking into account the subsistence constraint and that for a standard model that does not take it into account, for the cases of substitutable goods and complementary goods.

Two points should be underlined. Firstly, as a logical consequence of Figure 1, the higher the income, the more the WTP ratio is close to 1, and the lower the income, the closer the WTP is to zero (the WTP for the model with subsistence tending towards zero). This holds whether the goods are complementary or substitutable. Then the ratio is always higher for substitutable goods than for complementary goods, which means that the effect of the subsistence constraint is weaker. This point is all the more important since Baumgartner et al. [10] demonstrated that the introduction of a subsistence need led to a bias in the expression of preferences tending towards more complementarity – so a displacement of the solid-line curve towards the dotted-line curve – and that this bias was reduced when income increased.

Finally, taking into account the subsistence need in modelling implies that WTP for the non-market good among low-income individuals will be deviated downwards (whatever their preference) in a higher proportion than that expected from the sole impact of income.

Societal implications for a CBA

To take into account non-market elements, CBAs generally incorporate individual WTP. However, by taking solely their sum (or their average per individual), they tacitly suppose that dissatisfaction related to the sacrifice of a unit of a non-market good is the same for all, which implies the expression of the hypothesis of equality of marginal utility of income

for all individuals. This widely challenged hypothesis is included in theoretical literature devoted to CBAs by a proposal to weight WTP with a measurement of dissatisfaction linked to the sacrifice of a unit of the non-market good [12]. In this way, we obtain a measurement of satisfaction related to the consumption of the non-market good, which no longer depends (at least directly) on income. Nevertheless, in practice, since it is very difficult to assess this dissatisfaction related to the sacrifice of a unit of market good, no weighting method proves simple enough to be widespread [13].

Taking into account the subsistence needs of individuals implies two additional impacts on the integration of preferences in CBAs. On the one hand, it increases the need to correct CBAs upward in inverse proportion to income to take into account individual differences in marginal utility of income. On the other hand, many individuals refuse to contribute to stated-preference surveys because they do not have enough resources. For them, even if correction is applied, this will have no effect since their WTP remains nil. Consequently, their preferences expressed by CBAs will have little influence, unless a non-monetary means is used to reveal them.

So the integration of CBAs for a non-market good with no correction according to income implicitly gives more weight to the preferences of high-income individuals to the detriment of those of low-income individuals. Because of low dissatisfaction related to the sacrifice of a unit of non-market good, the WTP of an individual with a high income will develop within a much larger bracket than that of an individual with a low income, especially since the latter faces a second constraint: that of subsistence needs.

It is possible to estimate the order of size of this correction, which depends on the spread of income in the population, individual preferences for the non-market good (which we

initially suppose is homogenous) and substitutability between the market and non-market good. On the basis of income observed for the population of France [14], this correction would lead the average CBA for individuals to be increased by just a few percent for very substitutable goods, but double it for complementary goods (see [11]). So in a CBA, this improves the desirability of a given alternative by correctly assessing its non-market benefits. In the case of heterogeneous preferences depending on income, corrections prove more complex and the desirability of an alternative will be more strongly impacted by the preferences of high-income individuals for their non-market component than by those of low-income individuals.

Conclusion

CBAs undeniably enable the criteria governing health and environment decisions to be made explicit. The process seems transparent and the treatment of preferences egalitarian since the preferences of each individual are taken into account in a similar way on integration. However, where there are non-market components assessed on the basis of the preferences of the population, the impact caused by the subsistence constraint on the expression of the preferences of low-income individuals leads us to moderate this optimism. Indeed, CBAs will implicitly and insidiously favour the preferences of high-income individuals. This raises the question of the correction of WTP during the processing of individual preferences, which would turn strict equality into an equity that takes into account individual differences.

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Figure 1: Showing how willingness to pay (WTP) for a non-market good changes with respect to income. We present two types of preferences for the non-market good (low and high) and we compare two models (standard and with subsistence). The minimum level for subsistence is set at 10 units.

Figure 2: Showing how the ratio of willingness to pay (WTP) for the non-market good for the model with subsistence over the one for the standard model changes with respect to income. We consider both substitutable and complementary goods. The minimum level for subsistence is set at 10 units.