Ecological Economics 69 (2010) 1675–1681

Contents lists available at ScienceDirect

Ecological Economics

journal homepage: www.elsevier.com/locate/ecolecon

Analysis

Income effects and the inconvenience of private provision of public goods for bads: The case of recycling in Finland

Anni Huhtala *

MTT Agrifood Research Finland, Luutnantintie 13, 00410 Helsinki, Finland

ARTICLE INFO

Article history:
Received 1 July 2009
Received in revised form 19 March 2010
Accepted 21 March 2010
Available online 1 May 2010

Keywords:
Willingness to pay
Preferences
Waste disposal

ABSTRACT

Absent or weak income effects reported in many contingent valuation studies have cast doubt on the reliability of the survey method. We find that the income effect depends on the type of public good in question: there is a negative income effect for willingness to pay for recycling, which requires time and effort for sorting, but a positive effect for the more convenient incineration. Hence, high-income (low-income) individuals may display less (more) effort on environmental behavior. This stresses the importance of comprehensive distributional analyses when assessing alternative environmental policies.

1. Background

Environmental policy always involves distributional issues. There is empirical evidence that the benefits of publicly provided environmental goods accrue to high-income households (see, e.g., Bergstrom and Goodman, 1973; Gray and Shadbegian, 2004; Huhtala and Pouta, 2009) and that the costs of abating environmental bads are borne by low-income households (e.g., Robinson, 1985; Parry et al, 2007). Moreover, Parry (2004), West (2004), and West and Williams (2004) have shown that environmental policy based on economic instruments (fees, taxes, and permits) can be regressive. Mitigating negative environmental impacts may not mean only increased direct costs but may require changes in behavior and consumption patterns as well. For example, the purpose of charges on CO_2 emissions is to promote energy saving and to change environmental behavior permanently. Changing consumption patterns may require increased efforts in terms of time and inconvenience. If the old saying "time is money" is true, then it is no longer self-evident whose (opportunity) cost of time, effort or inconvenience is largest and who loses most due to environmental policy.

Analysis of distributional impacts requires evaluation of actual and contingent contributions to public goods. This has traditionally been done in the environmental economics literature by employing surveys of "stated preference" methods (e.g. contingent valuation), or drawing on "revealed preference" data on willingness to pay (WTP) for a cleaner environment (e.g. the hedonic pricing method) (Haab and McConnell, 2002). These methods have also been used for classifying environmental goods as normal or luxury goods. In this context, the weak income effects for WTP reported in many empirical contingent valuation (CV) studies have prompted criticism of the reliability of the method (Diamond and Hausman, 1994). Flores and Carson (1997) have informed the controversy by showing that the income elasticities of demand and WTP are fundamentally different in that WTP is conditioned on a given quantity change. Yet, insignificant income effects are often considered problematic for the reliability of CV estimates in practice. For example, Schläpfer (2006) investigated income effects in a meta-analysis of over 60 empirical CV studies and found that if the income effect was significant, it was explained by the survey protocol rather than by the type of public good. Absent or low income effects would then cast doubt on the CV surveys.

It is our claim in this study that a closer look at the types of goods valued reveals that even a negative income effect is a fully plausible outcome when the provision of the public good requires personal effort, which, when they become aware of it, prompts respondents to consider its impact on their welfare. For this purpose, we consider recycling, which is a prime example of voluntary contributions to a public good: it is costly to individuals in terms of time and effort or inconvenience, while the environmental benefits of their contribution are non-rival, non-excludable and negligible for them in terms of reduced or avoided public bads in landfills. To test empirically the hypothesis regarding the impact of inconvenience on income effects, we use data from a Finnish contingent valuation survey assessing willingness to pay for public provision of two waste management options. Consistent with the hypothesis, the income effect is negative for the recycling option, which requires time and effort, and positive for the more convenient incineration.

Within the extensive theoretical literature on the voluntary provision of public goods, our point of departure is closest to the

* Tel.: +358 400 755 012; fax: +358 9 563 1164.
E-mail address: anni.huhtala@mtt.fi.

0921-8009/$ – see front matter © 2010 Elsevier B.V. All rights reserved.
doi:10.1016/j.ecolecon.2010.03.018

spirit of the analytical models developed by Vicary (2000) and Kotchen (2007). They have modified the impure public good models by considering the private provision of a public good to offset a bad. Yet, the effects of the opportunity costs of offsetting a bad (time and effort), which differ by income group, have not been considered in previous studies, and here we make a contribution with our empirical findings. In this respect, our applied work is also related to empirical literature examining the determinants of voluntary donations to environmental programs (see, e.g., Kotchen and Moore, 2007; Sterner and Bartelings, 1999). In the context of recycling behavior, the role of attitudes reflecting moral motives has been examined by Berglund (2006). We focus on willingness to pay for two disposal options – recycling and incineration – that differ in terms of time or personal effort required, and elaborate how the opportunity cost is manifested in different income groups. Our survey data make it possible to identify the relative importance of income and an attitudinal variable that reflects the confidence of the respondent in the waste disposal option offered. We show empirically that it is the type, or the very nature, of the good valued that explains the negative sign and significance of the income effect. This holds true consistently for the alternative specifications of the econometric models applied. Yet, income effects may be dominated by the respondents' attitudes towards, or confidence in, their choice of the disposal method.

The paper is organized as follows. The next section introduces the baseline theoretical model and discusses some implications for the empirical analysis. The survey data are described in Section 3. Results of the alternative specifications of the econometric models applied are discussed in Section 4. Section 5 concludes with a discussion of the findings and their policy implications.

2. Utility Maximization Framework

The analytical basis of our behavioral model is a utility maximization framework including the opportunity cost of time, personal preferences and moral motivations. In the empirical illustration, we use survey data from a previous Finnish contingent valuation study, which is presented in more detail in the next section.

The referendum type data analyzed in a contingent valuation study are typically 'yes' or 'no' responses to hypothetical questions about willingness to pay for various situations involving public goods. In our application, the survey participants were asked if they would pay some given amount, or bid, B, to secure their preferred disposal option, that is, recycling, R, or incineration, I. The response function is the difference between indirect utility functions in different states, where the state is determined by the disposal option. We show briefly the corresponding utility theoretic derivation of the statistical model for willingness to pay responses as developed by Hanemann (1984).

2.1. Random Utility Model

When applying random utility modeling in practice, one assumes that the investigator observes the respondents' utility function only partially. Supposing that the household, h, derives utility, U_{hq}, from the disposal method chosen, q, and from money income, y, the indirect utility function can be written as $V_h(q, y; d, s)+\epsilon_{hq}$ where $q=R, I$. The indirect utility associated with each disposal method is a function of attitude, that is, how the characteristics of the disposal option are perceived, d; the respondent/household characteristics (e.g., age and gender), s; and an additive error term, ϵ_h, which is assumed to be independently and identically distributed. The error term captures the uncertain, or unobservable, part of the utility function.

Including the cost of the waste disposal method, or bid, B, in the indirect utility function, $V_h(\cdot)$, one can express the probability P that the hth household prefers recycling, R, even though it costs an amount equal to B more than the reference price, τ, that is, the cost of incineration, I. This is done by comparing the indirect utility functions of a rationally behaving household. The household chooses recycling as a disposal method at the bid level offered if it accepts the total cost of recycling $(B_i+\tau)$, or

$$\begin{aligned} P\left\{'\text{yes}'\right\} &= P\{V_h(R, y-B_i-\tau; d, s) + \epsilon_{hR} \geq V_h(I, y-\tau; d, s) + \epsilon_{hI}\} \\ &= P\{\Delta V \geq \eta\} = F_\eta(\Delta V), \end{aligned} \quad (1)$$

where F_η is the cumulative distribution function of η, $\eta=\epsilon_{hI}-\epsilon_{hR}$. The utility difference is $\Delta V=V_h(R, y-B-\tau; d, s)-V_h(I, y-\tau; d, s)$, and the statistical model is chosen based on the distribution assumed for η.

The cumulative distribution function of the probability of a 'yes' answer is a function of the bid. Using the appropriate utility function and corresponding utility difference, one obtains from the definition of the expected value of a non-negative random variable

$$E(\text{WTP}) = \int_0^\infty F_\eta(\Delta V(B))dB. \quad (2)$$

To illustrate how to take into account the inconvenience of effort and time needed for sorting in the recycling option we need to use a time constraint. Total time, T, available to the household is allocated to labor, l, to earning money income or leisure, e, or to the sorting and other effort required in recycling activities, t, such that the time constraint of the household is $T=l+e+t$. Hence, a household willing to pay a bid of B for recycling has an income of $y_{hR}=y-B$ and a leisure time constraint of $e_{hR}=T-l-t$, whereas one preferring incineration has an income of $y_{hI}=y$ and a time constraint of $e_{hI}=T-l$. Following the exposition of Amemiya (1981, p. 1490), we assume that the general utility functions elaborated above are linear, that is

$$\begin{aligned} U_{hR} &= V_{hR} + \epsilon_{hR} = \alpha_R + d_{hR}\beta + s_{hR}\theta + y_{hR}\gamma + e_{hR}\pi + \epsilon_{hR} \\ U_{hI} &= V_{hI} + \epsilon_{hI} = \alpha_I + d_{hI}\beta + s_{hI}\theta + y_{hI}\gamma + e_{hI}\pi + \epsilon_{hI}. \end{aligned} \quad (3)$$

Plugging in the incomes, y_{hR} and y_{hI}, and the time constraints, e_{hR} and e_{hI}, we obtain a difference for the observable part of the utility function $\Delta V=V_{hR}-V_{hI}$, or

$$\Delta V = \alpha + d\beta + s\theta - B\gamma - t\pi. \quad (4)$$

where $\alpha=\alpha_R-\alpha_I$, $d=d_{hR}-d_{hI}$ and $s=s_{hR}-s_{hI}$. The utility difference indicates that the probability of willingness to pay for recycling decreases with the bid level (B), but the impact of income cancels out in a linear utility model as shown by Hanemann (1984). Yet, the inclusion of a separate constraint for time endowment shows a negative impact of the time requirement (t). As is common practice in the literature, income is used as a measure of the opportunity cost of time in our empirical analysis. A confidence variable available from the CV survey measures the strength of tastes or preferences. Our main objective is to ascertain to what extent the money price (bid), income and preferences have an impact on people's choices.

Finally, the role of the opportunity cost of time can be related to a more general, formal analysis, presented by Hanemann (2005). If there is a time constraint (or other linear constraints) in addition to a budget constraint, the constraint makes the own price derivative of demand smaller in absolute value when it is included in a utility maximization problem than when it is omitted. This is an important finding to be borne in mind when policy instruments are chosen or when their effectiveness is evaluated.

2.2. Functional Form

The Box–Cox transformation is a useful means to determine an appropriate functional form for an econometric model (Box and Cox,