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The mixed blessing of responsibility relief: An application to household recycling and curbside waste collection

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This paper addresses the role of personal norms and warm glow in influencing households' waste recycling preferences. The purpose is to explore inter-household differences in the preferences toward the introduction of curbside recycling, which implies that households are relieved from the responsibility of transporting sorted waste to assigned drop-off stations. The main theoretical point of departure for the analysis is an existing model that integrates norm-motivated behavior into neoclassical utility theory. This builds on the assumption that the household members have preferences for upholding a self-image as responsible—norm-compliant—persons, and it also contains a warm-glow component. The empirical investigation relies on a postal survey to households in a Swedish municipality, and this asks households about their willingness-to-pay (WTP) for the introduction of a curbside recycling scheme, as well as about time use and the presence of personal norms and warm glow motives. The results are based on a Heckman selection specification and show that individuals expressing a strong personal norm for recycling are more likely to be willing to pay for curbside recycling, while those with strong warm glow motives are less likely to do so. This suggests the existence of a mixed blessing of responsibility relief. Curbside recycling implies that households are relieved from a moral responsibility that takes time away from leisure activities, but they also experience a loss in warm glow as such a scheme removes the possibility to pursue something that they have learned to appreciate. There could then exist 'motivational inertia' making it difficult for policy makers to activate personal norms for new pro-environmental household activities in replacement of existing ones.

KEYWORDS

household recycling, moral motivation, warm glow, opportunity cost of time, curbside recycling, waste collection, Sweden

1. Introduction

Today the importance of household members' efforts to achieve sustainable development is strongly emphasized in official reports and policy statements, not the least within the framework of Agenda 2030. In everyday life, we observe how individuals contribute voluntarily to public goods such as those generated by environmental activities. This behavior is often at odds with the type of utility-maximizing behavior assumed in standard economic models of household decision-making (Sugden, 1984). For instance, unless there is explicit enforcement of household recycling activities and/or outright economic incentives, no such efforts would be predicted by these models. This mismatch between the traditional economic model of household behavior and the empirical evidence on the private provision of public goods has stimulated researchers to integrate norm-based motivation into neoclassical consumer theory. Norms are informal

rules requiring that one should act in a certain manner in a certain situation (Biel and Thøgersen, 2007). Applications in the context of household recycling include Bruvoll and Nyborg (2004), Halvorsen (2008), Hage et al. (2009), Czajkowski et al. (2017), and Berglund et al. (2022).

In this paper, we do not explicitly address the question of why households may choose to contribute to public goods on a voluntary basis. Instead, we depart from existing economics research on norm-based motivation (Brekke et al., 2003; Bruvoll and Nyborg, 2004), and investigate the benefits and costs facing household members in the presence of policy changes implying that they will be *relieved* from previous responsibilities (norms). Responsibility relief situations could become more prevalent in future environmental policy, not the least because of technological development and institutional innovations. For instance, if technological progresses allow for more efficient mechanical sorting of household waste, individual efforts could be deemed ineffective, and a case can then be made for other actors taking over the responsibility for the waste sorting. Another example is when new technologies (e.g., smart electric grids) could remove household members' need to actively engage in various energy efficiency efforts.

The analysis builds on a conceptual discussion about the economic welfare consequences of relieving individuals from past responsibilities, and this discussion provides a mixed picture. One important building block of the theoretical points of departure is the model by Bruvoll and Nyborg (2004). They show that norm-motivated household members will experience a (weakly) positive net benefit in the presence of a shift from individual to central household waste sorting. Still, this result is sensitive to the way in which norms are assumed to affect individual utility. According to Andreoni's (1990) impure altruism model, such a shift would rather imply a welfare loss since it removes the opportunity to obtain a "warm glow of giving." Waste sorting is then an activity that makes people feel good [see also Crumpler and Grossman (2008) and Andreoni et al. (2017) for additional work on warm glow motives]. In Bruvoll and Nyborg's model, though, the warm glow influence will be outweighed by the benefits of being relieved from the risk of not being able to comply with the prevailing waste sorting responsibility: the risk of incomplete norm-compliance. In other words, there then exists a "cold shiver of not giving enough," which is removed in the case of responsibility relief through central waste sorting. The presence of both norm-based and warm-glow motives suggests the therefore potential existence of a mixed blessing of responsibility relief.

This paper addresses the role of personal norms and warm glow in influencing households' voluntary contributions to environmental public goods. This is achieved in the context of household waste sorting activities and so-called curbside recycling. The purpose is to investigate households' preferences towards curbside recycling, thus implying relief from the responsibility of transporting sorted waste to assigned drop-off facilities. Particular attention is devoted to the determinants of inter-household preferences toward such a policy change. The empirical investigation relies on a postal survey to households in a Swedish community asking about households' willingness-to-pay (*WTP*) for the introduction of a curbside recycling scheme, as well as about time use and the presence of personal norms and warm glow motives. The results are based on a Heckman-type selection specification.

By achieving the above, we contribute to existing research in two ways. *First*, quite a few studies have used stated preference methods to measure the welfare effects of relieving households from their responsibility to sort waste (Sterner and Bartelings, 1999; Bruvoll et al., 2002; Bruvoll and Nyborg, 2004; Berglund, 2006; Halvorsen, 2008; Czajkowski et al., 2017; Nainggolan et al., 2019). Some of these studies address the importance of different types of norms—e.g., personal norms, social norms—as well as warm-glow motives for explaining household recycling behavior in general, but few test the extent to which these two motives will influence the preferences toward the responsibility relief policy. This is achieved in the present paper, and it also reflects on the relationship between norm-based and warm glow motives. While we note above that the distinction between these two motives could have important welfare implications, norm-based and warm glow motives are likely to be intermingled in practice. In this context, we suggest that devoting increased attention to households' accumulated experience of waste sorting activities could provide an important avenue for future research on household recycling preferences.

Second, previous research has typically focused on scenarios in which a central sorting facility takes over the responsibility for all recycling activities in the households. We instead focus on the time households spend on transporting the sorted waste to drop-off recycling stations, and the introduction of a responsibility relief policy in the form of a curbside recycling scheme. One advantage of this approach is that it is easier to elicit individuals' preferences toward policy changes that can be clearly described and understood by household members. Curbside recycling schemes already exist in several communities, while complete responsibility relief policies in the form of central waste sorting facilities are scarcer and more difficult to present in detail.¹ It is important to note that previous research has addressed individuals' preferences toward curbside recycling schemes (e.g., Aadland and Caplan, 2003; Karousakis and Birol, 2008). However, this work has not focused on the roles of norm-based and warm glow motives, instead addressing the impacts of various socio-economic variables (e.g., gender, age, income) and individual values (e.g., environmental concern).

The paper's empirical focus on curbside recycling in a Swedish municipality (in which the sample households currently do not have access to such a service) is motivated for at least two reasons. *First*, the Swedish waste management policies have over the years emphasized the importance of convenience for households' recycling activities (Swedish Environmental Protection Agency, 2005; Hage et al., 2018). It is therefore of interest to study households' preferences towards such policies, including why individuals may view these policies differently. *Second*, in Sweden, the social cost of various waste management options (e.g., material recycling vs. incineration of waste), has been debated frequently, and previous reports confirm that the economic value placed on the time that households spend on cleaning, sorting, and transporting waste often consists of a substantial share of the social cost of the recycling option (Bruvoll, 1998; Radetzki, 2000;

¹ Studies show that households often express uncertainty with respect to the wider implications of the introduction of a central sorting facility. For instance, some believe that sorting at home is more thorough compared to what would be achieved in such a facility (Czajkowski et al., 2017; Nainggolan et al., 2019).

IVL Swedish Environmental Research Institute, 2010). Common for these studies is that they base their estimates of the opportunity cost of time on the after-tax wage rate,² but stated preference research eliciting the *WTP* to avoid recycling efforts, including the Swedish studies (Sterner and Bartelings, 1999; Berglund, 2006), consistently report estimates of average *WTP* per hour that are significantly lower than the wage rate after tax. This motivates closer scrutiny, not only of the average valuation of households' recycling efforts, but not least of how the presence of norm-based and warm glow motives can help explain differences in this valuation across households.

2. Theoretical points of departure

This section provides a conceptual discussion of the role of norm-based and warm-glow motives in the context of households' recycling efforts. The model presented by Bruvold and Nyborg (2004) provides an important starting point for this discussion, not least since it acknowledges the roles of both norms and warm glow. However, we also introduce additional considerations and perspectives, including households' accumulated experience of waste sorting activities. The aim is not to test a specific theory or model in an explicit structural econometric approach, but instead shed light on and explain theoretical relationships that can form the basis of the empirical study.

Bruvold and Nyborg (2004) investigate the complex interdependencies between economic motivation and norms—i.e., informal rules requiring that one should act in a specific way in a given situation—in a household recycling context. Their model assumes that the individual has a preference for upholding a self-image as a responsible person, here defined as someone who conforms to a certain norm of recycling behavior [see also Brekke et al. (2003), Czajkowski et al. (2017), and Berglund et al. (2022) for empirical applications].³ It is assumed that the individual's preferences can be represented by the following utility function:

$$U = u(c, l, G, S) \quad (1)$$

where c represents the consumption of private goods, while l is time spent on leisure activities. The individual also derives utility from a pure public good, G , environmental quality, and her self-image, S . The utility function is increasing and quasi-concave in c , l , G , and S .

Labor supply and income are assumed to be exogenous, permitting us to focus on the time devoted to waste sorting activities and leisure, respectively. For our purposes, it is useful to define the time constraint as follows:

$$l + e = l + (e_{TR} + e_{HO}) = T \quad (2)$$

where T is total amount of time available for leisure, l , and recycling efforts, $e = (e_{TR} + e_{HO})$, respectively. Since our focus lies on

the efforts involved in transporting the waste to drop-off recycling stations, we divide the total time spent on waste sorting activities, e , into in-house time (e.g., cleaning and sorting), e_{HO} , and transport time, e_{TR} .⁴

The utility derived from environmental quality, G , stems from two sources. The first component is exogenously supplied by others, G_{-1} , and the second component is represented by the improvement in G arising from the individual's own recycling efforts, g . We have:

$$G = G_{-1} + g. \quad (3)$$

This contribution g is assumed to be voluntary. Although Swedish households are required by law to sort and recycle their household waste, legal enforcement at the household level is lacking, thus making non-compliance easy. In the model outlined by Bruvold and Nyborg (2004), the individual household's contribution is assumed to be determined solely by the time effort, e , so that:

$$g = g(e). \quad (4)$$

The own contribution increases with the time effort but at a diminishing rate and will be zero (0) if no recycling effort is undertaken. In the recycling context, it is reasonable to assume that g is very small compared to G . For this reason, the only real incentive for individual waste recycling efforts is through the inclusion of self-image, S , in the utility function.

Self-image is related to compliance with a specific norm, g^* , which is assumed to be exogenous and given by existing policy. If actual g falls short of this norm, a loss in self-image will occur. This thus suggests that S is a function of the difference between the actual contribution and the norm requirement so that:

$$S = S(g - g^*). \quad (5)$$

Since there exists no *de facto* legal enforcement of households' recycling efforts, it is reasonable to assume that this norm is a *personal norm*. This means that it is internalized in the sense that the individual sanctions herself if she does not comply. Here, thus, Bruvold and Nyborg rely on social psychology studies, which emphasize that ascription of responsibility is a key to the activation of a personal norm (Schwartz, 1977).

It is important to recognize that other types of norms, e.g., norms sanctioned by the approval of others, are not explicitly incorporated in Bruvold and Nyborg's (2004) model. Still, such norms could influence individuals' perception of what personal norm to live up to (e.g., Brekke et al., 2010). Specifically, household members may be uncertain about what contribution to make in terms of waste sorting and could therefore be influenced by expectations from others. In contrast to a personal norm, a social norm is enforced by the approval from other people, e.g., family, friends, and neighbors.⁵ Moreover, the willingness of household members to take responsibility for the

2 Economic theory suggests that the opportunity cost of households' time is the value of lost leisure. If households are drawn from leisure activities, this lost time should ideally be valued at the household's reservation wage (which in the case of a flexible labor market) equals the after tax-wage rate.

3 For instance, Berglund et al. (2022) investigate the role of norms and convenience for explaining households' recycling contributions, i.e., the extent to which household members sort packaging waste.

4 We do not explicitly consider that the transport of waste, especially in the case of personal car use, also imposes other types of costs on the household (e.g., the cost of petroleum). Still, this cost is likely to be closely correlated with transport time for which data are collected in the survey (see below).

5 Social norms could also affect waste sorting behavior directly, but such direct influences may be more evident in the case of behaviors that are more visible, e.g., smoking in public places (Barr et al., 2003).

provision of the public good could also be influenced by perceptions of fairness. The so-called fairness norm dictates that household members should contribute to recycling if they gain from the public good generated and everybody else also contributes (Biel and Thøgersen, 2007). In the empirical investigation we test also for the influence of social norms and fairness norms.

Bruvoll and Nyborg (2004) assume that $S' > 0$ if $g < g^*$, and $S' = 0$ if $g \geq g^*$. These assumptions are important since they imply that over-compliance cannot give rise to self-image improvements above those generated by perfect norm compliance. In other words, at $g = g^*$, S reaches a maximum. This thus differs from Andreoni's (1990) impure altruism model, in which $S = S(g)$ and $S' > 0$ for all g , but it does still contain a warm-glow component.

Since the model presented by Bruvoll and Nyborg (2004) incorporates both norm-compliance and warm glow motives, it is a useful starting point for discussing the welfare effects of transferring the responsibility for waste transport from the household to the central authority (e.g., the municipality), which in turn can procure waste transport services from private entrepreneurs. Based on the assumptions outlined above, the norm requirement can be expected to weakly decrease following the introduction of curbside waste collection. The individual's own transport and drop-off efforts are of no use anymore, i.e., $e_{TR} = 0$ and $g^* = g(e^*) = g(e_{HO}^*)$. Since recycling is assumed to be voluntary some of this time saving could be transferred into more intense in-house recycling activities, but it is reasonable to assume that the *total* time spent on recycling activities, e , falls as the norm requirement is reduced. Moreover, since $-dg \leq -dg^*$, self-image S weakly increases.

The economic welfare effects of this responsibility relief policy on an individual for which norm-compliance is an important recycling motive can be measured by the compensating surplus, which in optimum equals the individual's maximum *WTP* for letting others transport the waste. This *WTP* is defined implicitly by the following equality:

$$u(c, T - e^0, G, S^0) = u(c - WTP, T - e^1, G, S^1) \quad (6)$$

where the superscripts 0 and 1 denote the initial situation and the situation when central authorities care for the transport services, respectively. We assume here that the individual perceives that the shift in responsibility will leave environmental quality, G , unchanged.⁶ Since the individual can allocate more time to leisure ($e^0 \geq e^1$) and S (weakly) increases, *WTP* ought to be (weakly) positive. The above thus suggests that although household members may voluntarily transport their waste to drop-off stations, this responsibility imposes a cost on the households due to limited norm compliance, i.e., what Bruvoll and Nyborg (2004) refer to as “the cold shiver of not giving enough.” Consequently, an individual welfare gain arises when the central authority takes over the responsibility for transporting the waste. However, as noted above, this conclusion is only valid in the case where over-compliance implies no positive warm-glow impacts.

⁶ The validity of this assumption is of course an empirical question. For instance, if the households perceive that there will be less local air pollution due to more efficient transport of waste, their *WTP* for curbside waste collection would likely be affected positively. The policy scenario that is presented in our empirical investigation does not specify any expectations about environmental outcomes (see also below).

If we instead give more room for the presence of strong warm-glow motives, the conclusion about the welfare impacts of a responsibility relief policy will alter. There could be a loss rather than a gain in utility. Bruvoll and Nyborg (2004) remark that one specification of their model that could lead to such an outcome is $S = f(ag - bg^*)$ where $a \neq b$ are positive constants. For instance, if the norm g^* is reduced by the amount k and g is reduced by the same amount, S will decrease as will utility if $a > b$. In the empirical investigation, we do not test any single specification of the self-image function. The key point here is rather that it is important to acknowledge that due to the presence of both norm-based and warm glow motives, the individual welfare effects of responsibility relief could be positive or negative. There could thus exist a mixed blessing of responsibility relief; leisure increases but the new scheme also removes an opportunity to pursue an activity that one has come to appreciate.

Empirically it could be difficult to distinguish between recycling behavior that is derived from the compliance with personal norms on the one hand and warm glow motives on the other. A strong statistical correlation between these two types of motives could be expected; people who express that they recycle because they feel guilty otherwise are likely to also express that they perceive recycling as an activity that makes them feel good. It simply feels good to conform to moral obligations in the form of personal norms. Even though this distinction is a subtle one (at least empirically), it is nonetheless important, not least since—as noted above—the two types of waste sorting rationales may have different implications concerning the impacts of public appeals for increased household recycling as well as of responsibility relief policies.

It is also useful to elaborate on why feelings of warm glow could be weak even in the presence of a strong personal norm for waste sorting (and vice versa). In this context, it is first useful to note that social psychology research argues that a personal norm needs to be *activated* (Schwartz, 1970). Individuals must assume a personal responsibility—a moral obligation—to sort their waste. Research also shows that a personal norm could often be activated by other types of norms, including—as noted above—social norms. The model outlined by Bruvoll and Nyborg (2004) builds on the assumption that a personal norm, g^* , has been activated.

For the household this means—following Stigler and Becker (1977)—that self-image S must be produced and maintained in the daily lives of the households, otherwise a loss in self-image will occur. This is done by combining time efforts, e , but also human capital and different types of intermediate goods (e.g., petrol, water). Over time, however, the households accumulate human capital—i.e., they become more efficient recyclers—and the opportunity cost of maintaining a certain level of g will likely decrease. Thus, in the Bruvoll/Nyborg model this would imply that the impact of (marginal) increases in e on g , dg/de , can be assumed to increase with the accumulation of past efforts, i.e., $\sum e_t$. Even though the norm-compliance motive is still present, household members have learned to conform to the norm easily and the “cold shiver of not giving enough” transfers into more comfortable feelings. This implies in turn that household members who have relatively little waste sorting experience, i.e., being inefficient recyclers with a low dg/de , are likely to be overrepresented in the category of individuals that feel a moral obligation to sort waste but also score low in terms of warm glow motives. Conversely, household members that have managed to integrate waste sorting activities in their daily lives in efficient ways,

may have strong feelings of warm glow even if they do not conform to a strong personal norm for such activities.

3. Data

3.1. Overall design of survey

In April 2020, 500 questionnaires were handed out to randomly drawn single-family dwellings in the municipality of Skellefteå in northern Sweden. All these households were required to sort and clean their waste at source and transport it to assigned drop-off stations. Furthermore, at the time of the investigation, there were no existing curbside pick-up schemes. Since we excluded multi-family dwellings, there were also no households with access to property-close waste collection, i.e., implying that they can drop-off their sorted waste within the borders of the apartment building in which they reside (typically in the basement).

The short survey comprised three main parts. The first collected information about the recycling activities of the households, including the time spent on transporting sorted waste (per month), and the frequency with which the travels to drop-off recycling stations were undertaken solely for the purpose of leaving household waste. This part of the survey also included questions on the presence of recycling norms, i.e., personal norms, social norms, and fairness norms (see below for details). In the second part of the survey, the respondents were confronted with a policy scenario implying that households are relieved from their responsibility to transport their waste. Specifically, the following scenario and questions were presented to each respondent:

Consider a change in policy where households no longer need to transport various packaging waste and newsprint to a drop-off recycling station.

Such a scheme would imply that your household is provided with two new types of bins, each comprising four separate compartments. These built-in compartments provide spaces for various types of packaging materials as well as newsprint, that is for the categories of waste that you today are required to drop-off at a recycling station. Similar waste recycling solutions are already in place in several other municipalities in Sweden.

An important difference compared to the current situation is that the new waste bins will be collected at your house by a contracting company. In other words, this new waste collection scheme implies that households no longer have the responsibility to transport their packaging waste and old newsprint to a drop-off recycling station.

If your household could choose, would you be willing to pay a higher waste fee for this new service?

Yes No

If your answer is yes, how much, at most, would your household be willing to pay per month for the new service?

_____ SEK per month.

Those that responded “no” were instead confronted with a few statements concerning their reason for rejecting the responsibility relief policy, including a statement capturing a warm glow motive: “I do not want to be taken away the possibility to do something that I feel pleased to pursue on my own.” These respondents were also asked whether they rejected the responsibility relief offer because they believed they did not have enough knowledge about the new scheme

described.⁷ The third part of the survey collected information about various socio-economic characteristics, including the age, gender, employment and education level of the respondent, the total income of the household, and whether children were present in the household (see below for details).

The distribution of the postal survey coincided with the advent of the Covid-19 pandemic, in turn leading to a substantial share of the respondents working from home. This could help explain the relatively high response rate (see below), but it could potentially also have affected the perception of the responsibility relief offer. It is probably reasonable to assume that during this period, more respondents (compared to pre-Covid) would choose to reject the curbside collection offer since work from home implies more time available for recycling and other household activities. Hence, driving to a recycling drop-off station might have been perceived as less demanding. On the other hand, though, more homework also implies more waste generated within the household, and for this reason more effort is needed to sort out and transport waste. The net effect is uncertain, and could be a topic for future research.

3.2. Survey responses and descriptive statistics

A total of 285 surveys were returned, thus resulting in a 57% response rate. Four surveys, however, were incomplete and were left out of the final sample. The results show that 44% of the respondents accepted the responsibility relief policy, i.e., answered that they would be willing to state a positive *WTP*, while 56% did not. The former group consisting of 124 individuals stated an average *WTP* of SEK 147 (US\$ 13) per month for the curbside collection service (see further the results section). [Table 1](#) summarizes the independent variables used in the investigation, including how these variables have been operationalized and descriptive statistics.

[Table 1](#) shows that on average the households spend roughly 50 min per month transporting their waste to drop-off recycling stations, and several state that they are combining recycling transport efforts with other errands. For instance, 30% of the respondents disagree entirely with the statement that the travels to recycling drop-off stations are undertaken solely for the purpose of dropping of household waste. In contrast, 18% of the respondents answered that they always undertake sole-purpose waste transport travels.

The results also display the presence of rather strong norm-based as well as warm-glow motives, all measured on a five-point scale (1–5). First, to operationalize the presence of a personal (self-sanctioned) norm for waste sorting, the respondents were asked to what extent they agreed with the following statement: “I feel guilty if I do not recycle.” The average score was 3.67 with over 30% providing the highest score. As noted above, we also include the presence of social norms and fairness norms in the empirical investigation as a

⁷ *WTP* questions can lead to different types of biases in the responses provided. For our purposes, the most likely problem is hypothetical bias (Aadland and Caplan, 2003). Still, the households in the sample already pay for waste collection services, and the proposed change should be relatively easy to understand (see however below). Moreover, the scenario presented involves the valuation of a private good, which should exclude the presence of strategic bias.

TABLE 1 Definition, coding and descriptive statistics for the independent variables ($N = 281$).

Variables	Definitions and coding	Mean	SD	Min	Max
Socio-economic					
Gender	One (1) if male, zero (0) if woman	0.45	0.49	0	1
Age	Age of respondent in years	57.00	15.45	18	89
Education level	1 if university degree, 0 otherwise	0.51	0.49	0	1
Household income	Total income for all household members, including earned income, unemployment benefits, parental allowance, and sick benefits (SEK per month)	51,070	24,362	7,500	100,000
Employment	One (1) if respondent is employed (earning income), and zero (0) otherwise	0.59	0.49	0	1
Children in household	One (1) if one or several persons in the household are children (below 18 years), and zero (0) otherwise	0.33	0.47	0	1
Recycling activities					
Transport/disposal	Time in minutes households spend per month transporting and disposing sorted waste at drop-off recycling stations	49.83	44.97	0	360
Sole purpose travel	The frequency with which the travels to drop-off stations are undertaken solely for the purpose of leaving household waste. 1 for “never” and 5 for “always”	2.76	1.48	1	5
Norms/warm glow					
Personal norm	Extent to which the respondent agrees with the statement: “I feel guilty if I do not sort waste.” 1 for “disagree entirely” and 5 for “agree entirely”	3.67	1.19	1	5
Warm glow	Extent to which the respondent agrees with the statement: “I sort waste because it makes me feel good.” 1 for “disagree entirely” and 5 for “agree entirely”	4.01	1.14	1	5
Social norm	Extent to which the respondent agrees with the statement: “Persons close to me expect me to sort waste.” 1 for “disagree entirely” and 5 for “agree entirely”	3.18	1.54	1	5
Fairness norm	Extent to which the respondent agrees with the statement: “I sort waste because I believe that I should pursue tasks that I expect others to do.” 1 for “disagree entirely” and 5 for “agree entirely”	4.40	0.97	1	5

robustness test. Table 1 displays relatively high average scores for the presence of a social norm (3.18) and a fairness norm (4.40).

Second, information about the presence of warm glow recycling motives was based on the following statement: “I sort waste because it makes me feel good.” In this case, the average score amounted to 4.01, and with as many as 46% of the respondents agreeing entirely with this statement (i.e., scoring five).

4. Econometric specification

The empirical analysis relies on a selection model. *First*, this is a natural approach given the design of the *WTP* scenario outlined above. This is motivated by the fact that some respondents may be keen to state a negative *WTP*, and then employing a direct *WTP* question would de facto force these to answer zero (0). *Second*, accepting to be willing to pay for responsibility relief and deciding upon a specific amount are related issues for the respondents, but these decisions could also be influenced by different factors. For our purposes, one could hypothesize that the presence of personal norms and warm glow motives could have a more profound impact on individuals’ choice to accept and be willing to pay for the responsibility relief policy than the choice on what is the specific maximum *WTP* among those that respond yes in the first step. In contrast, the opportunity costs of waste sorting activities—including

transport time—could have less of an influence for the yes/no choice probability, but instead play a more profound role in explaining stated maximum *WTP* in the second step.

For the above reasons, we follow Heckman (1979) and assume that there exists a latent variable z_i^* that determines whether the willingness-to-pay offer is accepted by individual i . Although z_i^* is unobserved, we can define a dummy variable, z_i , where $z_i = 1$ if $z_i^* > 0$ and $z_i = 0$ otherwise. Thus, we only observe stated *WTP* bids when $z_i = 1$. The individual’s policy acceptance decision (the selection equation) can be formalized as:

$$z_i^* = \beta_1 \mathbf{x}_i' + u_i, \quad z_i = 1 \text{ if } z_i^* > 0 \text{ and } 0 \text{ otherwise}; \quad (7)$$

$$\text{Prob}(z_i = 1 | \mathbf{x}_i) = \Phi(\boldsymbol{\gamma} \mathbf{x}_i'); \text{ and}$$

$$\text{Prob}(z_i = 0 | \mathbf{x}_i) = 1 - \Phi(\boldsymbol{\gamma} \mathbf{x}_i')$$

where Φ denotes the cumulative normal distribution function, \mathbf{x}_{1i} is a vector of observed variables influencing the yes/no decision, β_1 is the associated parameter vector to be estimated, while μ_i is a mean-zero stochastic error representing the influence of unobserved variables affecting z_i^* . Equation (8) determines the stated monetary willingness-to-pay (*WTP*) bid for individual i , and we have:

$$WTP_i = \mathbf{x}_{2i} \beta_2 + \varepsilon_i \quad (8)$$

where \mathbf{x}_{2i} represents a vector of the sets of factors that explain stated *WTP*, β_2 is the associated vector of parameters, and ε_i is the

stochastic error. We assume that μ_i and ε_i have a bivariate normal distribution with means of zero and the correlation coefficient ρ . If z_i and x_{1i} are observed for a random sample of households, but WTP_i is observed only when $z_i = 1$, the regression model (the response equation) can be written as:

$$E(WTP_i | x_{2i} = 1) = x_{2i}\beta_2 + \rho\sigma_2\lambda_i \quad (9)$$

where λ_i denotes the inverse of the Mill's ratio given by $\phi(x_{1i}\beta_1) / [1 - \Phi(x_{1i}\beta_1)]$, and where ϕ and Φ , respectively, denote the normal intensity and the distribution functions of the standard normal distribution. The presence of the variable λ_i in Equation (9) reveals the omitted variable bias that will result if the model is estimated from only the WTP bids. The t -test on the null hypothesis $H_0: \rho = 0$ is a test of the presence of sample selection bias.

Heckman (1979) showed how to estimate Equation (9) in a two-step procedure. This involves first estimating the selection equation in (7) through the probit model, using the entire sample. These estimates can then be used to calculate λ_i . In the second step, one can estimate Equation (9) over the selected sample by ordinary least squares, treating $\rho\sigma_2$ as the regression coefficient for λ_i . This approach results in consistent and asymptotically normal estimators of the parameters of the WTP regression equation. However, this two-step procedure is, in general, not efficient. Nawata and Nagase (1996) compare the finite sample properties of this so-called Heckit method and the maximum likelihood estimator and conclude that if the selection (probit) equation in (7) and the response equation in (9) have a substantial number of variables in common, the Heckit estimator is not the desired choice. This is indeed what we have in our model specification, so our model is estimated by maximum likelihood methods using the data software NLOGIT 5.0. This produces consistent and asymptotically efficient estimators that have an asymptotic normal distribution. In addition, the maximum likelihood method produces a direct estimate of the correlation coefficient ρ .

5. Empirical results

The results from the survey show that the average household in the sample spends around 50 minutes per month transporting and dropping of sorted waste at assigned recycling stations. The introduction of a curbside recycling scheme can relieve the households from this burden. Let us initially assume that the only welfare effect of this policy change is a gain in leisure (as would be the case in a traditional neoclassical model of the household), and that the after-tax rate is 100 SEK (US\$ 9) per hour (roughly corresponding to the lowest after-tax wage level in the Swedish hotel and restaurant sector). With these assumptions, the welfare gains from relieving households from the responsibility for waste transport amounts to on average 83 SEK per month.

The above can now be compared to the stated WTP estimates in the survey. A total of 281 individuals responded to the WTP scenario outlined above, and out of these 124 (44%) replied “yes” and went on to state a specific (positive) WTP amount at the second stage. Among those who responded “yes” at the binary choice stage, the average WTP was 147 SEK per month. If we simplify and assume that all

who responded “no” have a WTP of exactly zero (0),⁸ we end up with an average WTP of about 64 SEK per month. This corresponds to an opportunity cost of time equalling roughly 77 SEK per hour. Like previous research (Berglund, 2006; Nainggolan et al., 2019), WTP is here significantly lower than the after-tax wage rate of 100 SEK per hour, and it is likely to be even lower given that some respondents could have a negative WTP (due to warm glow motives).

Theoretically, this discrepancy can be explained in several ways. For instance, the after-tax wage assumption relies on the premise that labor markets function perfectly, thus ignoring institutional limits on changing work hours. It also ignores the possibility that paid work may be perceived as having an intrinsic value. Our ambition is however not to explain this discrepancy in full. We simply address the possibility that inter-household differences in the preferences toward curbside recycling can be attributed to the presence of both norm-based and warm glow motives, where the latter is expected to contribute to WTP bids that are lower than the after-tax wage rate.

Table 2 presents the maximum likelihood estimates of the Heckman selection model, one model specification in which we leave out the fairness norm and social norm variables (Model A) and one in which both these variables are included as a robustness test (Model B). In both models the estimated correlation coefficient ρ is close to one (1), and statistically significant at the 1% level. This indicates that we can reject the null hypothesis of no sample selection bias.

Focusing on the results emanating from Model A, we first find that the probability to reject the responsibility relief policy bid increases with age, and for the respondents that accept this bid, there is a negative relationship between age and stated WTP . This may in part reflect the lower opportunity cost of time for retired people and for families with grown-up children. However, as Halvorsen (2008) suggests, older people may also be more concerned with the moral obligation of contributing to the community through recycling. This notion gains empirical support in Berglund et al. (2022) in which it is concluded that the recycling of elderly household members tends to be more driven by a sense of moral obligation than a low opportunity cost of time.

This does not imply, of course, that the opportunity cost of time is irrelevant. Our results indeed display that there is a positive statistical relationship between the total time spent on transporting waste to drop-off stations and the probability to accept the policy bid as well as the stated WTP amount for curbside recycling. We find some evidence of a gender effect in that among those that accept the policy bid, female respondents state a lower WTP than male ones. Nevertheless, there is no corresponding difference between men and women in the selection mechanism. The inclusion of additional variables addressing other household characteristics is discussed below.

The results in Table 2 confirm that both norm-compliance and warm-glow motives are related to households' preferences toward curbside recycling. There is empirical support for the notions that: (a) the household members that express a strong personal—self-sanctioned—norm for recycling, are more likely to have strong

⁸ The assumption that $WTP = 0$ for all those who decline the policy offer is of course a simplification. The reasons for responding “no” can be diverse. As indicated in the theoretical section, some may even have a negative WTP , while some answers are perhaps best interpreted as pure protest bids. Later in this section we revert to some of the motives expressed by rejecting respondents.

TABLE 2 Maximum likelihood estimates of the Heckman selection model.

Variables	Model A		Model B	
	Coefficient	t-ratio	Coefficient	t-ratio
Accept or reject policy bid—selection mechanism				
Constant	0.444	0.859	0.621	1.122
Gender	−0.207	−1.334	−0.210	−1.338
Age	−0.017	−2.796***	−0.016	−2.602***
Employment	0.258	1.361	0.270	1.413
Transport time	0.003	2.090**	0.004	2.214**
Personal norm	0.231	2.995***	0.249	3.117***
Warm glow	−0.182	−2.335**	−0.165	−2.032**
Social norm	−	−	−0.024	−0.463
Fairness norm	−	−	−0.068	−0.759
Willingness-to-pay (WTP)				
Constant	126.571	1.698*	142.188	1.787*
Gender	−52.782	−2.290**	−55.738	−2.427**
Age	−2.733	−3.089***	−2.612	−2.933***
Employment	50.499	1.802*	50.004	1.802*
Transport time	0.613	2.834***	0.603	2.823***
Personal norm	29.048	2.479**	29.191	2.475**
Warm glow	−28.527	−2.503**	−26.689	−2.270**
Social norm	−	−	3.116	0.417
Fairness norm	−	−	−8.303	−0.648
Sigma (σ_2)	149.466	14.716***	147.618	14.670***
Rho (ρ)	0.972	2,547.272***	0.972	2,524.115***
Log-likelihood	−908.018		−906.753	

*, **, and *** indicate statistical significance at the 10, 5, and 1% levels, respectively.

preferences in favor of a responsibility relief policy in the form of curbside recycling; while (b) household members that express strong warm glow motives instead are less likely to accept this policy bid as well as to state a high *WTP* for the introduction of curbside recycling.⁹ In other words, individuals are on the one hand relieved from a moral responsibility that takes time away from leisure activities (in line with the model by Bruvold and Nyborg, 2004), but they also experience a loss in warm glow since the curbside collection scheme removes the opportunity to pursue an activity that they have learned to appreciate, and that they therefore prefer to pursue on their own.

We do not, however, find evidence of significant differences when comparing the impacts of the independent variables in the selection equation (yes/no) and the response equation (maximum *WTP*). The presence of personal norms and warm glow motives matter in both cases, and there is no evidence to suggest any heterogeneous impacts when it comes to transport time as well.

⁹ These reverse—and statistically significant—results emanate from the model estimation even though the personal norm variable and the warm glow variable are positively correlated (see further below).

In the survey, we also confronted the respondents that rejected the responsibility relief policy bid with a few statements relating to their underlying motives to opt out. These results show that 41% of this sub-sample agrees, i.e., scoring 4 or 5 on a scale ranging from 1 to 5, with the statement that they do not want to be taken away the possibility to do something that they feel pleased to pursue on their own. Notably, as much as 65% agrees with the related statement that today recycling is not a burdensome household activity. These results are consistent with our findings that the presence of warm-glow motives lowers the probability that people accept the responsibility relief offer. Moreover, 38% of this group of respondents agreed with the statement that they know too little about the new waste collection curbside scheme described in the survey. This thus suggests that the presence of hypothetical bias cannot be ignored.

As expected, we observe a positive statistical correlation between the personal norm and the warm glow variables. The value of the Spearman rank order correlation coefficient, designed to handle ordinal data, equals 0.53. Nevertheless, given the notion that with the accumulation of experience in waste sorting activities, feelings of warm glow may become more prevalent, it is useful to take a closer look at the respondents that report low scores on warm glow but high on personal norm, and vice versa. In the waste transport

context, achieving more efficient recycling efforts could involve identifying better ways of integrating waste transport activities with other types of activities (e.g., buying groceries, visiting friends), thus reducing the frequency with which the travels to the drop-off recycling stations must be undertaken solely for the purpose of leaving household waste.

Our findings show that in our total sample, 9% of the respondents report a strong personal norm for recycling but weak warm glow motives. These are thus household members that express that they feel guilty if they do not recycle but also find it hard to agree with the statement that recycling is something that makes them feel good. In other words, one possible interpretation is that this group represent individuals who wish to act responsibly, but that on the other hand have accumulated limited experience in the recycling area. In fact, the survey responses confirm that people who have a relatively high frequency of sole purpose travels are overrepresented in this group (with an average score of 3.2 compared to 2.8 in the total sample). Seventeen percent of the respondents report a weak personal norm for recycling but strong warm glow motives. In this group, we instead find evidence of more efficient waste transports, not least in terms of a lower reliance on sole-purpose travels (with an average score of 2.4). Consequently, these household members also perceive that the shadow price of contributing to the public good is relatively low. While these results should only be interpreted as preliminary indications of the presence of group heterogeneity given the small data sample, they point to the need for additional research on the relationship between personal—self-sanctioned—norms on the one hand and warm glow motives on the other.

Finally, the above results on curbside recycling preferences are robust to alternative model specifications. Table 2 shows that the results were robust to the inclusion of both the social norm and the fairness norm variables. Moreover, we also test for the inclusion of other household characteristics, including household income, education level, number of children in the household, and the frequency of sole purpose travels. These results are displayed in Table 3 and show no statistically significant coefficients for the added variables. Moreover, the remaining results are unaltered following this inclusion.

6. Concluding discussion

This paper has addressed the economic welfare effects of relieving households from previous environmental responsibilities, and investigated inter-household differences in the preferences toward the introduction of responsibility relief in the form of curbside waste collection. The results show that for many people (44% for our sample) there appears to be a strictly positive welfare gain from removing the responsibility for transport service, i.e., any feelings of warm glow derived from recycling efforts do not appear to outweigh the burden of individual responsibility. The remaining respondents (56%), however, state no willingness-to-pay for the proposed responsibility relief offer in the form of curbside recycling.

The empirical results suggest that household members with a strong personal norm for recycling are more likely to favor the responsibility relief policy, while household members expressing strong warm glow motives are less likely to do the same. Overall, there appears therefore to exist a mixed blessing of responsibility relief. On the one hand people are relieved from responsibilities that take time away from leisure activities, but the new policy also removes from the

TABLE 3 Heckman selection model estimates: additional household variables.

Variables	Coefficient	t-ratio
Accept or reject policy bid		
Constant	0.357	0.562
Income	0.001	0.276
Education level	0.099	0.613
Children in household	−0.084	−0.405
Gender	−0.207	−1.294
Age	−0.017	−2.185**
Employment	0.289	1.219
Transport time	0.003	2.043**
Sole purpose travel	0.073	1.422
Personal norm	0.253	3.102***
Warm glow	−0.149	−1.796*
Social norm	−0.021	−0.418
Fairness norm	−0.087	−0.953
Determinants of WTP		
Constant	148.131	1.663*
Income	0.130	0.207
Education level	2.351	0.101
Children in household	−20.806	−0.722
Gender	−53.040	−2.280**
Age	−2.986	−2.806***
Employment	46.185	1.320
Transport time	0.613	2.847***
Sole purpose travel	3.296	0.434
Personal norm	29.017	2.431**
Warm glow	−25.987	−2.162**
Social norm	4.227	0.566
Fairness norm	−7.758	−0.598
Sigma (σ_2)	146.173	14.671***
Rho (ρ)	0.972	2,667.302***
Log-likelihood	−904.464	

*, **, and *** indicate statistical significance at the 10, 5, and 1% levels, respectively.

individual the possibility to contribute to the provision of a public good and do something that she feels pleased to pursue on her own.

An important implication of these findings is that there may exist a “motivational inertia” making it difficult—or at least costly—for policy makers to activate new norms in replacement of existing ones. Indeed, household efforts to promote the provision of public goods without compensation is a limited resource. If efforts are largely devoted to the recycling area, the preparedness to work toward other public goods with potentially greater value to society could be reduced. If the sorting and transport of household waste can rely on curbside recycling in combination with new sorting technologies, and/or new environmental problems emerge that call for direct household efforts, policy makers may find it necessary to replace the

old norms with new ones. Since people have accumulated a lot of human capital in the waste sorting field, and warm glow motives are strong, they may perceive the cost of this policy shift as quite high.

In economic terms, and from the perspective of the household, waste sorting activities tend to be perceived as a cost-effective way of contributing to environmental public goods. Households' recycling efforts are a good example of how environmental policy can activate personal norms (e.g., through information campaigns), and facilitate investments in the infrastructure that incentivises individuals to act in line with these norms. Nevertheless, one should avoid drawing too far-reaching parallels to other types of voluntary efforts for which the sacrifices could be much more extensive. Waste sorting activities are typically perceived as easy to integrate in daily life, but this may not necessarily apply to other pro-environmental household behavior such as substituting public transport for individual car use and/or learning to live with lower indoor temperatures.

The paper has also provided some initial conceptual and empirical insights with respect to the relationship between norm-based and warm glow motives, primarily by noting the importance of accumulated experience in the recycling field. While these motives tend to be closely related, it is worth noting that weak feelings of warm glow could be present even in the presence of a strong personal norm for waste sorting activities. Although our empirical material is limited, i.e., with a small sample of households, they point toward accumulated experience potentially playing a role in explaining such an outcome. In our context, this experience specifically relates to identifying more efficient ways of integrating waste transport with other duties. The above could set the stage for future research addressing in more detail the relationship between the activation of personal norms on the one hand, and warm glow motives on the other. This applies to the recycling field as well as to other empirical contexts, e.g., consumption patterns, energy savings behavior. Studies with a longitudinal perspective should also be relevant.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

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Ethics statement

Ethical review and approval was not required for the study involving human participants in accordance with the local legislation and institutional requirements. Written informed consent to participate in this study was not required from the participants in accordance with the national legislation and the institutional requirements.

Author contributions

CB and PS: conceptualization and methodology. SA: literature review, data collection, and econometric analysis. SA, CB, and PS: writing original draft and editing. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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