

# **The cold shiver of not giving enough:**

## **On the social cost of recycling campaigns**

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## **Abstract**

Governments sometimes try to increase individuals' contributions to public goods through *appeals* to consumer responsibility, rather than by economic incentives, for example in recycling campaigns.

Using standard consumer theory, one would hardly expect such campaigns to work at all; but if consumers are motivated by norms, appeals may work through changing consumers' perception of the norm requirement. However, increasing voluntary contributions through appeals may come at a social cost. The reason is that appeals work through imposing a heavier (perceived) responsibility on consumers. This represents a welfare loss, which is not necessarily outweighed by "warm glow" benefits.

# I. Introduction

Households' recycling efforts provide one example of consumers' voluntary contributions to public goods. Due to the positive external effects of such contributions, public authorities usually welcome them, and sometimes even develop policies aimed at stimulating them. While such policies might involve monetary incentives like taxes or subsidies, often they do not. In the case of recycling, *appeals* to the public, in the form of advertising campaigns or other use of the media, appear to be a widely used policy instrument for authorities trying to increase households' efforts. Appeals to the public are used in many other cases as well, either to promote desirable behaviors – such as energy saving or volunteering in schools – or to discourage undesirable behaviors, for example littering, drinking and driving, or tax evasion.

Using standard consumer theoretic models, it is hard to see why appeals to consumer responsibility would have any effect on behavior at all. The classical *Homo Economicus*, who cares only about his own access to goods and services, would hardly recycle anyway, campaigns or no campaigns. The impure altruist or warm-glow giver (Andreoni 1990), on the other hand, may wish to recycle, but it is not clear why he would *increase* his contributions due to a campaign.<sup>1</sup> Still, it is hard to believe that governments would continue their campaign efforts if this was not believed to produce at least *some* of the desired behavioral response.

Since it has been somewhat theoretically unclear why such campaigns may work, the theoretical underpinning of applied analyses of policies aimed at increasing voluntary contributions has also tended to be vague. Applied analyses of households' recycling efforts, for example, often assume – implicitly or explicitly – that if consumers can be made to increase their recycling efforts voluntarily, there is no strictly positive social cost associated with the increased effort. The argument would go as follows: If there had been a net cost, the household would not have chosen to increase its recycling; so if we actually observe a voluntary (uncompensated) increase in recycling, it cannot be associated with a net private cost.

While this observation is undoubtedly correct (indeed, within the revealed preference paradigm, it is quite tautological), it is also misleading, because it does not specify properly the baseline and alternative scenarios to be compared. It is correct in the sense that with a *given public policy*, consumers would not increase their recycling efforts if they were better off by not doing so. But introducing a campaign, or another policy stimulating consumer responsibility, implies a *change* in the public policy, which is exogenous from consumers' point of view. While consumers will adapt their choices optimally to the new policy (which may, for example, involve increasing their recycling efforts), this does not necessarily imply that their welfare *after* the policy change is at least as high as *before* the policy change.

To identify analytically the social cost of a given policy change, one must formalize the policy change in terms of the analytical model's variables, and then use the model to calculate the social welfare effects of a policy shift. Our main purpose of the present paper is to do precisely this. Using a simplified version of the moral motivation model of Brekke et al. (2003), we will derive explicit analytical expressions for the social cost of increasing voluntary efforts through policies that stimulate consumer responsibility. We will argue that although authorities may succeed in increasing consumers' voluntary contributions through such means, this will generally come at a social cost, which may or may not be outweighed by the policy's benefits such as improved environmental quality and increased "warm glow".

Like Brekke et al. (2003), we will assume that individuals recycle (or more generally, contribute to public goods) partly because they genuinely want to be socially responsible. An individual's self-image is impaired if her actual effort falls short of the effort required by a social, moral or legal norm. Public appeals and similar measures are assumed to influence consumers' perception of the norm requirement, i.e. the "ideal behavior" that individuals compare their actual behavior against. Under certain conditions, the government can succeed in increasing voluntary recycling efforts through appeals: but by doing so, it increases the individual's feeling of responsibility, which in itself is a burden.

The question of whether there are social costs associated with increased voluntary efforts is relevant, for example, in cost-benefit comparisons of different waste treatment policies. Recycling has been increasingly emphasized over the last decade, in Europe as well as in the US. As compared to landfill and incineration, recycling relies heavily on voluntary sorting in the households: indeed, the incentives have not been primarily based on economic incentives and legal enforcement, still participation in recycling programs has reached impressive levels.<sup>2</sup> For example, the percentage of recycled waste in US increased from 10 to 30 percent from 1989 to 1997, and 73 percent of the households recycled in the absence of legal or economic incentives (Kinnaman and Fullerton 1999). In Norway, the percentage of sorted waste in households increased from 9 to 44 percent from 1992 to 2001 (Statistics Norway 2002), as a result of publicly arranged recycling systems and awareness drives. Survey results indicate that idealistic or altruistic motivation plays a crucial role (Bruvoll et al. 2002).

A range of studies point to the effect of increasing conscientiousness in order to increase voluntary recycling effort (Hopper and Nielsen 1991; Hornik et al. 1995; Vining et al. 1992). However, despite the extensive literature on recycling behavior and identification of factors that motivate or facilitate recycling, the treatment of non-market costs associated with households' efforts differs a lot between authors; in many cases it appears, in fact, to be neglected. Some studies have estimated households' willingness to pay for recycling (see Huhtala 1995; Tiller et al. 1997; or Kinnaman and Fullerton 1999 for an overview). However, these estimates include several elements, such as the anticipated positive environmental effects net of the pure effort costs. A few cost-benefit analyses have attempted to include households' pure time costs (DeLong 1994; Bruvoll 1998; Radetzki 2000). These studies have typically used labor costs after tax as an approximation for the private effort costs. Recent analyses on the costs of waste handling also call for analyses on the cost elements (Callan et al. 2001).

Below, we will provide some empirical illustrations of our findings by means of survey data (Bruvoll et al. 2002), but our emphasis will be placed on the theoretical framework. Our results indicate that there is a social cost of increasing voluntary contributions through stimulating consumer responsibility. This cost does not necessarily outweigh the warm glow benefits obtained by those consumers who increase their efforts. In fact, we show that for consumers whose feeling of

responsibility is determined by how much their actual effort falls short of the norm requirement, increased consumer responsibility unambiguously lowers welfare (disregarding any environmental improvement due to aggregate changes in behavior). In principle, this cost should be taken into account in cost-benefit analysis of alternative waste treatment systems, along with their market costs and environmental costs and benefits. However, the cost of increased consumer responsibility will not in general be equal to the value of the increased time spent recycling, but will consist of several elements. Although it may be difficult to identify its components separately in empirical analysis, the total cost of changed consumer responsibility can in principle be measured empirically through contingent valuation.

## II. Changing the norm requirement

The analysis below follows Brekke et al. (2003) in assuming that, in addition to the preference for a good environment, consumers' recycling activities are motivated by a desire to keep an image of oneself as a *responsible person*, defined as a person who conforms to certain norms of responsible behavior. Since we focus on norm-based behavior, we will disregard economic incentives to simplify. Such incentives could easily be incorporated into the model.

Consider, thus, an individual with the following utility function:

$$U = u(c, l, G, S) \tag{1}$$

where  $c$  and  $l$  represent the individual's consumption of private goods and leisure, respectively, and  $G$  is environmental quality, which is assumed to be a pure public good.  $S$  is the individual's self-image.

The utility function is increasing and quasi-concave in  $c$ ,  $l$ ,  $G$  and  $S$ .

Environmental quality,  $G$ , equals the quality supplied by others,  $G_{-i}$ , which the individual regards as exogenous, plus the improvement due to the individual's own recycling efforts,  $g$ :

$$G = G_{-i} + g \tag{2}$$

The contribution<sup>3</sup>  $g$  is determined by time spent on recycling activities,  $e$ :

$$g = g(e) \tag{3}$$

where  $g_e > 0$ ,  $g_{ee} \leq 0$ , and  $g(0) = 0$  (subscripts denote derivatives).

The total time available for leisure,  $l$ , and recycling activities,  $e$ , is given by  $T$ :

$$l + e = T \tag{4}$$

To simplify, we will consider the individual's labor supply and total income as exogenously given, implying that we focus on the allocation of time between leisure and recycling efforts, while disregarding any effects the consumer's recycling choices may have on labor supply and pecuniary income. Hence,  $T$  is total available time less working hours, and consumption will be considered exogenous.

Self-image is assumed to be related to norm compliance: If one does not conform to the norm under consideration, a loss of self-image occurs. It does not matter to the discussion below whether this is a moral or a legal norm, as long as the norm is *internalized* in the sense that the individual sanctions herself if she does not conform: individuals feel bad about themselves if they do not comply to the norm. However, to fix ideas, we will focus on a moral norm.

Assume now that new guidelines from the authorities, or a new advertising campaign emphasizing consumer responsibility, or other signals from the authorities about what constitutes responsible behavior, changes the norm, in the sense that individuals come to feel that the effort demanded of a socially responsible individual has increased. In accordance with Becker (1968), we will assume that the individual is not literally *forced* to comply with the norm. She will choose to comply only if the expected utility of not complying is less than the expected utility of complying. To focus on internal motivation, we will disregard any external sanctions such as economic incentives, social disapproval or legal prosecution.

Assume that to comply with the moral norm, the individual's contribution must be at least  $g^*$ .  $S$  depends positively on the individual's own contribution  $g$ , and negatively on the ideal contribution

according to the norm,  $g^*$ . For simplicity, we will assume that self-image depends on the *difference* between actual behavior and the behavior required by the norm:

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

The best possible self-image is obtained if  $g \geq g^*$ . We assume that  $S' > 0$  if  $g < g^*$ , and  $S' = 0$  if  $g \geq g^*$ . Further,  $S'' \leq 0$  everywhere (‘’ denotes derivatives).

Maximizing  $U$  subject to [2] - [5] yields the following first order condition:

$$g_e (u_G + u_S S') = u_l \quad [6]$$

In optimum, the benefit accruing to the individual when she increases her recycling efforts marginally equals the marginal cost in terms of lost leisure. The benefit consists of two parts: the environmental benefit accruing to the individual herself, plus the benefit of an improved self-image.

The main difference of the model set-up above from that of Brekke et al. (2003) is that the effort required by the norm is exogenous to consumers in our model, and that it can be influenced by the government. In Brekke et al., the ideal effort is endogenous to the individual, determined through explicit moral deliberation. However, in their model public policy will still affect individuals' perception of the morally ideal effort *indirectly*, since changes in public policy may change individuals' beliefs about the consequences of their actions, as well as perceptions of the limits of individuals' responsibility.

Before proceeding with the formal analysis, let us also point out that in spite of the model's similarity to the impure altruism model of Andreoni (1990), there is a crucial distinction. In Andreoni, individuals contribute to public goods to obtain a "warm glow of giving", and this "warm glow" depends on the individual's contribution. This is also true with the self-image function [5]. The difference lies in the inclusion of the norm requirement  $g^*$ , since without it there is no reason why advertising campaigns, new guidelines or similar means aimed at increasing consumer responsibility would affect neither behavior nor utility. Hence, in every case where  $g^*$  is unchanged, our model will



yield the same conclusion as an impure altruism model would; however, whenever a policy implies a change in the requirement of the norm, conclusions may differ.

### **The social cost of tightening the norm**

Since marginal costs equal marginal private benefits in optimum, changing effort marginally from the equilibrium level will have no net effect on utility, provided that exogenous factors are kept constant. This follows from the fact that effort is endogenous to the consumer. However, if the government increases households' recycling efforts by increasing  $g^*$ , this implies a heavier (perceived) individual responsibility to recycle, which imposes a cost on consumers.

Assume that initially  $g \leq g^*$ . Then, the government announces a stricter norm (i.e.  $g^*$  increases).<sup>4</sup> To investigate the effect on behavior and welfare, we perform a total differentiation of the first order condition [6] with respect to the norm requirement  $g^*$ :

$$\frac{de}{dg^*} = \frac{u_{SG}S'g_e - u_{Sl}S' + u_{SS}(S')^2g_e + u_S S''g_e}{2[u_{SG}S'g_e^2 - u_{Sl}S'g_e - u_{lG}g_e] + u_{SS}(S'g_e)^2 + u_{GG}(g_e)^2 + u_{ll} + u_S[S''(g_e)^2 + S'g_{ee}] + u_Gg_{ee}} \quad [7]$$

In general, this expression may be either positive or negative. In the latter case, a policy of increasing  $g^*$  to stimulate recycling would in fact be counterproductive. This occurs only under quite special conditions, however. With plausible assumptions, recycling efforts will be increasing in the norm requirement: If leisure is a normal good, the individual considers  $G$  as exogenous (the change in  $G$  due to one's own marginal effort is imperceptible), and  $g(e)$  is linear, we will always have  $de/dg^* > 0$ .<sup>1</sup>

Alternatively, recycling effort is increasing in  $g^*$  if the utility function is strictly concave and linearly separable in  $S$ , and  $G$  is considered exogenous by the individual. Below, we will focus on the case where  $de/dg^* > 0$ , since we find this case most interesting for policy purposes. .

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<sup>1</sup> A proof can be obtained from the authors. To see that  $de/dg^*$  may in fact be negative under certain conditions, note that (as shown below) an increase in  $g^*$  reduces utility. If leisure were an inferior good, the income effect of this would increase the individual's demand for leisure, and thus reduce effort. Moreover, the substitution effect works unambiguously in the direction of a lower demand for leisure and higher demand for self-image (and thus more recycling) as long as  $g(e)$  is

How does a stricter norm affect utility? Differentiating the utility function with respect to  $g^*$ , inserting for [2] - [5] and the first order condition [6], and assuming that a change in  $g^*$  may change others' contributions as well as the individual's own contribution, we get:

$$\frac{dU}{dg^*} = u_G \frac{dG_{-1}}{dg^*} - u_S S' \quad [8]$$

The first term reflects that if *others* recycle more due to the stricter moral norm, the individual will benefit from the environmental effects. This term is strictly positive provided that others' aggregate contribution increases in  $g^*$ . The second term,  $-u_S S'$ , is the first order effect on utility in terms of a reduced self-image: When  $g^*$  increases, the individual becomes less in compliance, *ceteris paribus*, so self-image decreases. This term is unambiguously negative. Hence, the utility impact of a stricter norm consists of the environmental benefits of others' effort *minus* a cost associated with the heavier strain on the individual's self-image. Thus, with these assumptions, there *is* a social cost of increasing an un-enforced norm for individual recycling effort, and this holds whether or not the strengthening of the norm is accompanied by an *actual* increase in effort.

Another and perhaps more familiar way to write [8] is to decompose it into environmental benefits (both the external effect on others, and the private benefit part), loss of leisure time, and net self-image effects (i.e. both first and second order effects on self-image):<sup>5</sup>

$$\frac{dU}{dg^*} = u_G \frac{dG}{dg^*} - u_l \frac{de}{dg^*} - u_S S' \left(1 - g_e \frac{de}{dg^*}\right) \quad [9]$$

The first term reflects that the environmental gain contributes positively to the individual's utility. The second term reflects that, given that a stricter norm increases effort, the cost in terms of lost leisure contributes negatively. Regarding net self-image effects, however, the impact on utility is ambiguous: The first term in the brackets,  $-u_S S'$ , is negative, and reflects that when  $g^*$  increases, it becomes harder to keep a good self-image. The second term,  $u_S S' g_e \frac{de}{dg^*}$  is positive, given that  $\frac{de}{dg^*} > 0$ , reflecting that the individual at least partially compensates the direct effect on self-image by increasing her

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linear. However, when  $g(e)$  is strictly concave, the substitution substantial, an increase in  $g^*$  may increase the marginal cost

effort. In general, it is not possible to determine a priori which of these effects dominates.

Nevertheless, this discussion is concerned with a decomposition of the costs and benefits into environmental gain, time costs and net self-image costs: we already know from [8] that there is a cost of increasing voluntary effort through tightening the norm. The cost associated with increased consumer responsibility may or may not exceed the environmental gains.

### **The cost-benefit analysis**

To perform a complete cost-benefit analysis of a stricter moral norm  $g^*$ , we aggregate costs and benefits for all individuals.<sup>6</sup> Assume that the society consists of  $N$  individuals, and that the social welfare function is utilitarian:

$$W = \sum_i U_i \quad [10]$$

The change in social welfare  $W$  due to a stricter moral requirement can then be found by aggregation of [9] (adding subscripts  $i$  to denote different individuals), using [10]:

$$dW / dg^* = \sum_i \left[ u_{iG} \frac{dG}{dg^*} - u_{iL} \frac{de_i}{dg^*} - u_{iS} S_i' (1 - g_{ie} \frac{de_i}{dg^*}) \right] \quad [11]$$

In addition to the environmental benefits, time costs and self-image costs enter this expression.<sup>7</sup> Social welfare increases in  $g^*$  if and only if the net welfare loss from reduced leisure and reduced self-image is outweighed by the environmental benefits. The model does not ensure *a priori* that this will hold.

Consequently, even in the absence of external sanctions, the change in the moral norm can be perceived as a kind of regulation that imposes a cost on individuals. This may seem to contradict conclusions from the simple Homo Economicus model of undergraduate textbooks. However, Homo Economicus would not increase voluntary effort at all due to changed un-enforced norms, so if changing the norm in fact leads to changed behavior, the Homo Economicus model is unsatisfactory.

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of improving one's self-image enough to change the direction of the substitution effect.

### III. The benefits of responsibility relief

Our analysis has so far been concerned with the social costs of imposing *marginal increases* in responsibility upon individuals. To compare the welfare effects of systems relying or not relying on voluntary contribution, let us analyze a situation where the government in fact completely *relieves* the individual from a previous responsibility.

Imagine that new technology becomes available, facilitating centralized sorting of household waste. As a consequence of the new opportunities, the government abandons its curbside collection system for different household waste fractions, and invests instead in a waste separation plant with mechanical separation of waste components. All household waste will now be collected without separation of fractions, thus personal sorting effort will no longer affect the environment. The formal implication is that the consumer will regard  $G$ , the aggregate environmental quality, as exogenous, and not affected by individual recycling efforts. When the government has taken over the responsibility for recycling, and the individual's own effort is not of any use to society any more, she will not feel a moral obligation to recycle. The moral norm requirement can then be specified as  $g^* = 0$ .

To focus on the costs of individual responsibility, assume that environmental quality is kept constant, equal to the level that previously resulted from voluntary, decentralized waste sorting in households. Let superscripts  $0$  denote variable values in the initial situation (source separation in households). The total utility change for individual  $i$  can then be written as:

$$dU_i = u_i(c_i, T, G, S_i(0)) - u_i(c_i, T - e_i^0, G, S_i^0) > 0 \quad [12]$$

When the government takes over the responsibility for sorting, self-image weakly increases: If the individual previously did not comply completely to the norm, her self-image would have been harmed from this, while with a requirement of zero, self-image will reach the maximal level even with no effort. In addition, leisure increases by  $e_i^0$ . Consumption and environmental quality are unchanged. Consequently, when we disregard the investment and operation costs of the central sorting system, and the environmental effects are the same in both alternatives, there is a welfare gain when recycling is

done by central sorting rather than by voluntary efforts. If we take extra investment and operation costs of the waste sorting plant into account, the investment would be welfare improving if  $dW = \sum_i dU_i > B$ , where  $B$  is the present value of extra investment and operation costs of the investment alternative as compared to the alternative of household sorting of waste.<sup>8</sup>

Assume, now, that consumption is measured in monetary units. A monetary measure of the individual utility difference caused by the shift of responsibility is then given by willingness to pay,  $WTP_i$ , defined implicitly by the following:

$$u_i(c_i, T-e_i^0, G, S_i^0) = u_i(c_i - WTP_i, T, G, S_i(0)) \quad [13]$$

where  $WTP_i$  equals the loss of consumption which leaves the individual at the same level of utility as in the initial situation (i.e.  $WTP_i$  is the compensating surplus of the shift). Since  $c_i$  and  $G$  are unchanged, and  $l_i$  and  $S_i$  both (weakly) increase,  $WTP_i$  must be (weakly) positive. In principle,  $WTP_i$  can be measured through a contingent valuation survey, or through market experiments.<sup>9</sup>

## IV. Modifications

The above conclusions may appear to be at odds with Andreoni's (1990) impure altruism model. In Andreoni's model individuals obtain a "warm glow of giving" from contributing, and since centralized sorting takes away the opportunity to achieve this "warm glow", this may produce a welfare *loss*. In our model, however, there is also a "cold shiver" of not giving *enough*. In Andreoni's model, there is no such loss of self-image due to failure to fulfill moral obligations. When  $g^*$  is kept fixed, our conclusions equal those of the impure altruism model; conclusions differ only when the moral requirement changes.

Nevertheless, our assumption that self-image is determined by the *difference* between actual contributions and the ideal contribution (equation [5]) is important for some of our conclusions. When personal responsibility for waste sorting is abolished, and  $g_i^*$  is reduced to zero, then in the central sorting example above, we get  $-dg_i \leq -dg_i^*$ : hence self-image will weakly improve. Under a more

general formulation, where self-image depends positively on the actual contribution and negatively on the morally ideal contribution, but not necessarily via the difference between the two as assumed in equation [5], the loss of "warm glow" may be either smaller or larger than the benefits of decreased individual responsibility. The unambiguous sign of the welfare change in equation [12] thus depends on the particular form of the self-image function. Although we find it reasonable that the ideal contribution enters the self-image function, it is not evident that the specific functional form we have employed here is the most plausible one.<sup>10</sup>

It should be noted, however, that equation [5] is perfectly consistent with the observation that some consumers recycle more and *improve* their self-image when stronger recycling requirements are imposed. As can be seen from equation [9], it is quite possible that consumers "over-compensate" even with this formulation of self-image; but in that case the increased self-image benefits will be more than outweighed by the loss of leisure, so *utility* decreases as shown by [8].

Further, it is of course possible that self-image depends on other variables than actual and ideal contributions. For example, for some people moral satisfaction appears to be associated not with how useful their effort is to society, but to how large burdens they bear: the more suffering, the better self-image. Self-image may also be related to others' social acceptance, although our model focuses on sanctioning mechanisms that are internal to the individual. Social approval may require that one is actually observed performing recycling activities, and if a recycling company takes over, this opportunity to derive social approval vanishes.

Also, we have assumed that recycling activities are not fun or meaningful *in themselves*. Some of the respondents in Bruvold et al. (2002) reported that they did find recycling pleasant in itself. In such cases, recycling efforts can be regarded as a kind of leisure. Since central sorting removes the opportunity to participate in an appreciated activity, this may possibly imply a loss of welfare.

In general, all the above-mentioned modifications of the self-image function may influence the conclusions. Thus, in the next section, we discuss briefly some empirical estimates of willingness to pay to let others do the sorting of household waste. The data presented cannot be interpreted as a

formal test of our model, and further empirical investigation needs to be made in this respect.

Nevertheless, if the existing data indicated that individuals were not willing to pay for centralized sorting services, this would speak strongly against our model. As it turns out, however, a substantial share of respondents report a positive willingness to pay to let others do the sorting of their household waste.

When discussing aggregate willingness to pay data below, it is important to bear in mind that when we relax the assumption of identical individuals, interpersonal aggregation of *WTP*-data – and interpretation of aggregate *WTP* as a welfare measure – requires strict assumptions. One of them is that the social marginal utility of income must be equal for all individuals, an assumption which cannot be empirically measured and verified (see Medin et al. 2001; Nyborg 2000). Hence, since we do not know whether this assumption is reasonable, aggregate *WTP*-data cannot uncritically be interpreted as measuring welfare.

## **V. Empirical illustrations**

Bruvoll et al. (2002) present a survey covering a representative gross sample of 2000 respondents in the age group 16-79 years, drawn from the Norwegian population. The response rate was 59 percent, yielding a net sample of 1162 individuals. The survey investigated the time use and motivation for sorting waste, attitudes towards expanding sorting systems and towards leaving the sorting to others, and the willingness to pay for having others take over the job. The survey indicates that individuals have a multitude of motives for sorting their household waste. 63 percent of those who recycled agreed or partly agreed to the statement "*I recycle partly because I consider it an imposition from the authorities*". This might be interpreted as an exogenously imposed norm, but this norm may possibly be enforced through external incentives, while our model has focused on internal motivation. However, as much as 73 percent agreed or agreed partly to the following: "*I recycle partly because I want to think of myself as a responsible person*", and 88 percent agreed or agreed partly that "*I recycle*

*partly because I should do what I want others to do*". These responses indicate that internalized norms based on self-sanctioning are part of the motivation for household recycling behavior.

*Social approval*, disregarded in the theoretical analysis above, also appears to be one motive, although somewhat weaker: A minority of respondents (41 percent) agreed or partly agreed that they recycled partly because "*I want others to think of me as a responsible person*". Finally, quite a few respondents (38 percent) agreed or partly agreed that sorting of waste is a *pleasant activity* in itself. The two latter motives are not considered in the theoretical model above, and both may reverse conclusions concerning a weakly positive *WTP*, as discussed above.

To indicate whether individuals did in fact consider their responsibility for waste sorting a burden, we asked the following question: "*Assume that a recycling company can make use of your waste. New technology makes it possible to sort waste centrally so that the environmental effect will be the same. The company collects the unsorted waste from your home. Would you make use of the offer if this did not increase your expenses, or would you prefer to sort yourself?*".

This corresponds to the hypothetical investment project discussed above, where we assume that environmental benefits are kept unchanged, and that the individual effort required goes down to zero if the respondent makes use of the offer. 72 percent replied that they would make use of the offer, while 27 per cent would prefer to sort themselves. This indicates that the actual process of sorting is perceived as a burden for most people – but not for everyone.

Those respondents who would make use of the company's recycling arrangements reported an average *WTP* of USD 30 per year<sup>11</sup>. Unfortunately, the survey did not allow respondents to report negative *WTPs*, which may be relevant for those motivated by social approval and the view that recycling is a pleasant activity. Nevertheless, about 65 percent of those who would make use of the offer reported a strictly positive *WTP* to let others do the sorting. For these respondents, thus, it seems to be the case that warm glow benefits derived from sorting activities do *not* outweigh the burden of individual responsibility.



The survey implies an average willingness to pay per tonne of sorted household waste of about USD 87, which is considerable compared to estimated total waste treatment costs.<sup>12</sup> If we divide the average *WTP* by the hours that respondents claim to spend on recycling activities, however, we get a *WTP* per hour of only about 45 cent.<sup>13</sup> This is substantially lower than average hourly wages after tax. This relatively low value may be caused by an inflexible labor market, or by modifying factors as discussed in section IV.<sup>14</sup> In addition, as argued in Bruvoll et al., there are reasons to believe that the time use is overestimated, which leads to a corresponding underestimation of willingness to pay per unit of time use. A more fundamental explanation is that our theoretical model may underrate the identity gains from sorting waste: Environmentally concerned individuals might perceive waste sorting as a symbolic act, which cannot simply be substituted by central systems without reducing the feeling of acting morally, regardless of the environmental effect of the act.

The empirical evidence above indicates that a large number of individuals have some intrinsic motivation to recycle, but also that many of those individuals perceive waste sorting activities as a burden which they would prefer others to do for them. It also indicates, however, that attempting to estimate this burden by measuring the time spent on recycling activities and then value this time by average after tax wage rates may yield very inaccurate estimates. Since our survey was not specifically designed for formal testing of the theoretical model above, however, further empirical work would be needed for this purpose.

## **VI. Conclusions**

If governments have direct or indirect means to increase consumers' feelings of individual responsibility, and if this, in turn, increases individual efforts to contribute to public goods, then the use of these means imposes costs on individuals. This holds even if efforts are voluntary, not backed by legal enforcement or monetary incentives.

When consumers accept responsibility for a certain contribution level, they may experience both a warm glow of giving and a *cold shiver of not giving enough*. A stricter norm, requiring individuals to contribute more than before to comply to the norm, will generally increase the latter.

Whether these costs are outweighed by the policy's benefits, such as an improved environment and "warm glow" benefits, is an empirical question. If public good supply can be substantially increased by giving consumers more responsibility, then such a policy may of course be well worth pursuing even if it implies some costs.

It is important to keep in mind that we have discussed the effects of exogenous shifts in policy instruments, not changes in individual's morality per se. Preferences are fixed in our analysis.

*Changing* voluntary efforts when the economy is initially in equilibrium requires a change in at least one exogenous variable. This holds, naturally, whether or not consumers are morally motivated. We have assumed that individuals have preferences for a self-image as a responsible person, i.e. someone who conforms to moral norms. Imposing *more* responsibility on such individuals is to lay a heavier burden upon them, because it makes it more difficult to keep a good self-image. In the special case of additively separable utility functions, we show that the burden of increased responsibility is in fact strictly *larger* than the value of the lost leisure time.

Survey data confirms that many individuals' recycling efforts are motivated by a preference to conform to moral norms. A majority of those who recycle would prefer to leave their sorting of household waste to a central sorting facility, if this was possible without reducing the environmental impact. This confirms that the recycling effort is in fact considered as a burden for most consumers.

## References:

- Andreoni, James. 1990. "Impure Altruism and Donations to Public Goods: A Theory of Warm-Glow Giving." *The Economic Journal* 100: 464-77.
- Becker, Gary. 1968. "Game and Punishment: An Economic Approach." *Journal of Political Economy*, 76 (2): 169-217.
- Brekke, Kjell Arne, Snorre Kverndokk and Karine Nyborg. 2003. "An Economic Model of Moral Motivation." *Journal of Public Economics* 87 (9-10), 1967-1983.
- Bruvoll, Annegrete. 1998. "The Costs of Alternative Policies for Paper and Plastic Waste." Report 98/2, Statistics Norway.
- Bruvoll, Annegrete. 2002. "Factors influencing solid waste generation and management." *The Journal of Solid Waste Technology and Management* 27 (3-4): 156-62.
- Bruvoll, Annegrete, Bente Halvorsen and Karine Nyborg. 2002. "Households' Recycling Efforts." *Resources, Conservation and Recycling* 36 (4): 337-54.
- Callan, Scott J. and Janet M. Thomas. 2001. "Economics of Scale and Scope: A Cost Analysis of Municipal Solid Waste Services". *Land Economics* 77 (4): 548-60.
- DeLong, James V. 1994. "Wasting away. Mismanaging municipal solid waste." Environmental Studies Program, Competitive Enterprise Institute, Washington DC.
- Fullerton, Don and Thomas C. Kinnaman. 1996. "Household Responses to Pricing Garbage by the Bag." *The American Economic Review* 86 (4): 971-84.
- Hong, Seonghoon, Richard M. Adams and H. Alan Love. 1993. "An Economic Analysis of Household Recycling of Solid Wastes: The Case of Portland, Oregon." *Journal of Environmental Economics and Management* 25: 136-46.
- Hopper, Joseph and Joyce M. Nielsen. 1991. "Recycling as Altruistic Behavior. Normative and Behavioral Strategies to Expand Participation in a Community Recycling Program." *Environment and Behavior*, 23 (2): 195-220.

- Hornik, Jacob, Joseph Cherian, Michelle Madansky and Chem Narayana. 1995. "Determinants of Recycling Behavior: A Synthesis of Research Results." *The Journal of Socio-Economics*, 24 (1): 105-27.
- Huhtala, Anni. 1995. "Is Environmental Guilt a Driving Force? An Economic Study on Recycling". University of Lapland, Rovaniemi.
- Kinnaman, Thomas C. and Don Fullerton. 1999. "The Economics of Residential Solid Waste Management." National Bureau of Economic Research. Working Paper 7326.
- Medin, Hege, Karine Nyborg and Ian Bateman, 2001. "The Assumption of Equal Marginal Utility of Income: How Much does it Matter?" *Ecological Economics* 36 (3): 397-410.
- Morris, Glenn E. and Duncan M. Holthausen, 1993. "The Economics of Household Solid Waste Generation and Disposal". *Journal of Environmental Economics and Management* 26: 215-34.
- Nyborg, Karine, 2000. "Project Analysis as Input to Public Debate: Environmental Valuation versus Physical Unit Indicators". *Ecological Economics* 34 (3): 393- 408.
- Nyborg, K., and M. Rege (2003): Does Public Policy Crowd Out Private Contributions to Public Goods? *Public Choice* **115** (3): 397-418.
- Radetzki, Marian. 2000. "Fashions in the Treatment of Packaging Waste: An Economic Analysis of the Swedish Producer Responsibility Legislation." Multi-Science Publishing Co Ltd, UK.
- Statistics Norway. 2002. "Natural Resources and the Environment 2002". *Statistical Analyses* 55.
- Tiller, Kelly H., Paul M. Jakus and William M. Park. 1997. "Household willingness to pay for dropoff recycling". *Journal of Agricultural and Resource Economics* 22 (2): 310-20.
- Van Houtven, George L. and Glenn E. Morris. 1999. "Household Behavior Under Alternative Pay-As-You-Throw Systems for Solid Waste Disposal." *Land Economics* 75 (4): 515-37.
- Vining, Joanne, Nancy Linn and Rabel J. Burdge. 1992. "Why Recycle? A Comparison of Recycling Motivations in Four Communities." *Environmental management* 16 (6): 785-97.

## Footnotes:

- <sup>1</sup> For an overview of modelling approaches for analyzing voluntary contributions to public goods, see Nyborg and Rege (2003).
- <sup>2</sup> The effect of economic instruments on waste treatment is thoroughly studied in the literature, see e.g. Hong et al. (1993), Morris and Holthausen (1993), Fullerton and Kinnaman (1996), Van Houtven and Morris (1999) and Bruvoll (2002).
- <sup>3</sup> The contribution  $g$  can for example be interpreted as the share of the individual's household waste that is sorted for recycling, assuming that the total amount of waste is fixed. The numeraire of the public good  $G$  must be chosen accordingly.
- <sup>4</sup> If  $g > g^*$  initially, nothing would happen if the government increased  $g^*$  marginally:  $S$  would remain unchanged, since  $S' = 0$  for  $g > g^*$ . Since  $g^*$  only enters the model through  $S$ , neither behavior nor utility would change.
- <sup>5</sup> [9] is obtained by inserting [2] - [5] into [1], differentiating with respect to  $g^*$ , and rearranging terms.
- <sup>6</sup> Below, the system costs of collection, transportation and industrial processing of sorted household waste etc. are not taken into account. In an applied analysis, all costs should of course be considered.
- <sup>7</sup> Note that [10] is expressed in utility, not in money or consumption units. To measure aggregate welfare in monetary units, we must normalize the utility effects of each individual using his or her marginal utility of income. In applied cost-benefit analysis, one usually implicitly assumes that every individual has the same social marginal utility of income. For a discussion of this assumption, see Medin et al. (2001).
- <sup>8</sup> Since we use utility units throughout most of the welfare analysis,  $B$  is measured in welfare units. To express the aggregate welfare measures in monetary units, one needs to introduce specific assumptions on how one chooses to compare utility between individuals, which is not our concern here. The choice of unit is of course not important for the results.
- <sup>9</sup> Note, however, that to interpret  $\sum_i WTP$  for all individuals  $i$  as a welfare measure, one must add the assumption that the marginal utility of consumption (income) is equal for everyone – like in any standard cost-benefit analysis. See also footnote 7.
- <sup>10</sup> For example,  $S = s(g/g^*)$  would be one alternative,  $S = f(ag - bg^*)$ , where  $a \neq b$  are constants, is another ( $s$  and  $f$  are increasing functions). The first of these is not defined for  $g^*=0$ . For the second, however, the consumer can obtain a warm glow of giving even if no effort is required by the norm ( $g^*=0$ ). Hence, in the latter case, taking away consumers' opportunity to contribute could yield a loss of utility.
- <sup>11</sup> When the survey was conducted, USD1  $\approx$  NOK 8.
- <sup>12</sup> Estimates from Bruvoll (1998) and Radetzki (2000) indicate that total social costs (also including conventional and environmental costs) of waste treatment range from USD 30 to USD 520 per tonne.

<sup>13</sup> However, those who spend a lot of time sorting waste tend to have substantially lower *WTP* per hour than those who spend little time. This can reflect that people with a high time cost recycle less, or it can simply be caused by measurement errors in the time variable.

<sup>14</sup> In a model with endogenous labor supply, the marginal value of a unit of time would equal the after tax wage rate, but this result requires the assumptions that all individuals face a fully flexible labor market, and that paid work does not have any intrinsic value. Both these assumptions are questionable.