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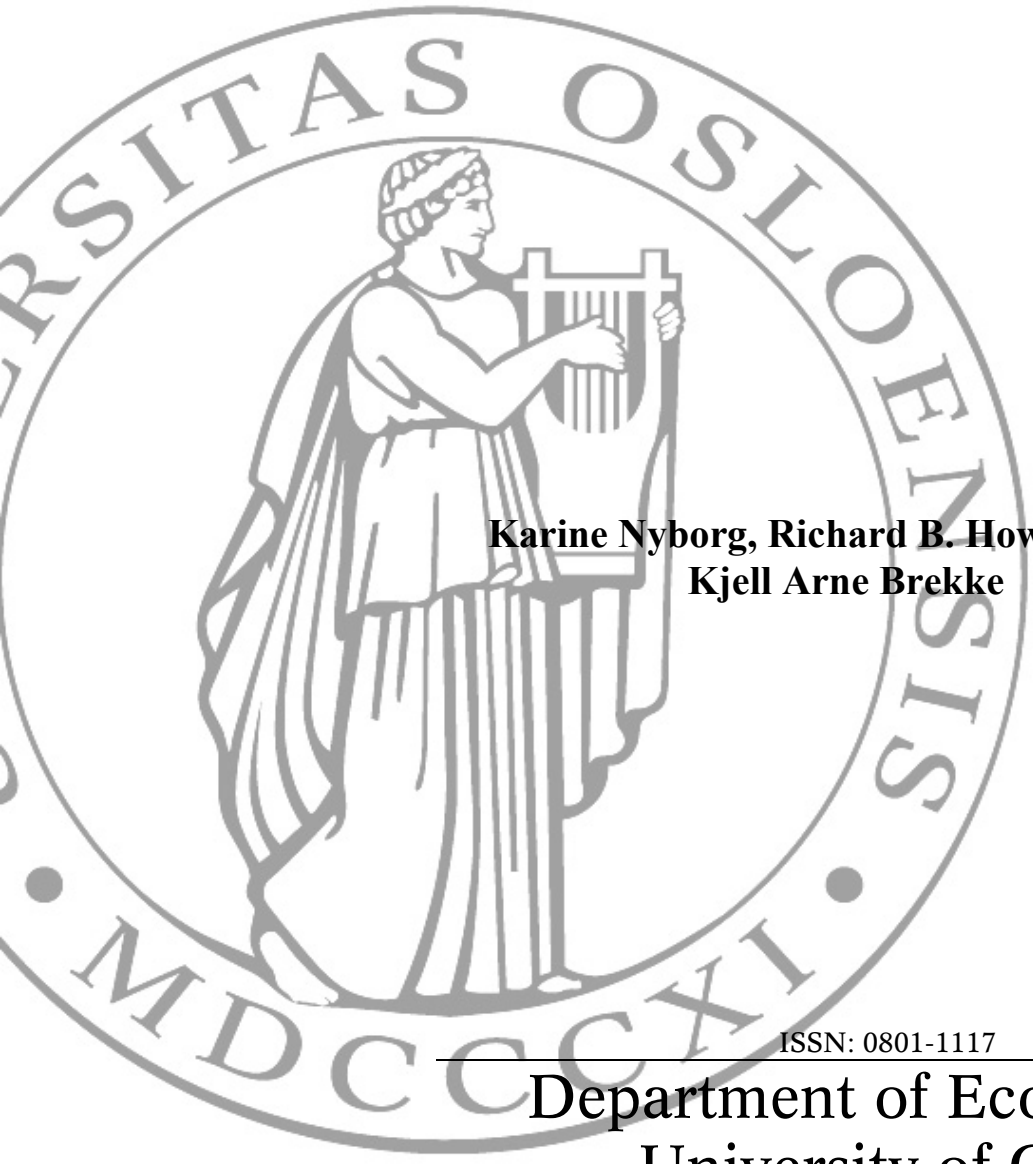
On socially contingent moral motivation



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Green consumers and public policy: On socially contingent moral motivation

Karine Nyborg[1], Richard B. Howarth[2], and Kjell Arne Brekke[3,4]

Abstract

"Green" consumers appear to accept individual responsibility for public good provision. The propensity to take such responsibility may depend on beliefs about others' behavior, even for consumers motivated by internalized moral norms, not by social sanctions. This can produce multiple equilibria, with either high or low demand for "green" products. Permanent increases in green consumption may be achieved through permanent or temporary taxes, or through advertising that temporarily influences beliefs about others' behavior or about external effects. If a tax is interpreted as taking responsibility away from the individual, however, taxes can reduce the influence of moral motivation.

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1. Introduction

In recent years, "green consumerism" has received increasing attention. Consumers' moral concern for the environment appears to have had powerful impacts on their actual behavior in several cases, such as markets for elephant ivory (Heltberg, 2001), dolphin-safe tuna (Teisl *et al.*, 2002), organic produce (Moon *et al.*, 2002), and socially responsible investments (Cullis *et al*., 1992).

Nevertheless, there are also cases in which green consumerism has failed to meet the expectations of marketers and market researchers. As one example, consider the recent attempts to promote the use of renewable energy through "green electricity" contracts in the USA. Careful market surveys suggested that 52 to 95 percent of private households would be willing to pay a price premium to obtain power that was generated using technologies such as windmills, photovoltaic cells, and solar thermal power plants (Farhar, 1999; see also Byrnes *et al.*, 1999). But when green power products became available on the market starting in 1998, only one percent of eligible households opted to purchase renewable power at an average price premium of six dollars per month, a figure that was consistent with household's stated willingness to pay in market surveys (Wiser *et al*., 2001; Roe *et al*., 2001).

In this paper, we will discuss green consumerism as a case of moral motivation among consumers. Drawing on insights from social psychology, we point out that a social interdependency between different consumers' moral motivation must be expected to exist, even if consumers are motivated by internalized moral norms rather than social sanctions imposed by others. This may lead to multiple stable Nash equilibria, including one with very low demand for green goods and one with very high demand for green goods.

There exists by now a substantial literature on the economic analysis of social sanctions (see, for example, Akerlof (1980), Lindbäck et al. (1999), Brock and Durlauf (2001), Manski (2000), Lai et al. (2003), Nyborg and Rege (2003a)). Rege (2003) shows that when contributions to public goods are motivated by the desire for social approval from others, multiple equilibria may result, including one in which no-one contributes and one in which everyone contributes. Such models can explain that social norms for contributing to the environment are sometimes enforced and sometimes not.

However, surveys indicate that people do not engage in proenvironmental behavior just to gain social approval. For example, Bruvoll et al. (2002) report that while 22 percent of those who engaged in recycling agreed fully with the statement "I recycle partly because I want others to think of me as a responsible person", as much as 65 percent agreed that they recycled partly because "I should do what I want others to do". While social approval may be important to most of us, it seems implausible that this should be our only driving force for proenvironmental behavior.

Several authors have attempted to explain behavior which appears to be morally motivated within the framework of economic models, disregarding preferences for social approval (e.g. Andreoni 1990, Frey 1997, Brekke et al. 2003). These models typically produce unique equilibria.[5] In the present paper we will focus on internalized moral motivation for green consumption, but show that cognitive aspects of moral decision-making produce interdependencies between different individuals' demand, even in the absence of preferences for social approval. This leads to dynamic processes with multiple equilibria, sharing many characteristics of the mechanisms described in models of social sanctions. However, when behavior is motivated by internal sanctioning, like guilt or bad conscience, *beliefs* about others' behavior may be important. The present analysis predicts that policy makers or marketers can potentially achieve major changes in consumer behavior through advertising, via changing consumers' impression of the green alternative's market share.

2. The social aspects of perceived responsibility

Enthusiasm concerning the potential for green consumerism is difficult to reconcile with the simplest versions of neoclassical consumer theory, which predicts that when individuals act non-cooperatively, their individual contributions to public goods will be vanishingly small (see e.g. Andreoni 1988). However, green consumerism is consistent with economic models assuming that contributions to public goods also produce some kind of *private benefit* to the contributor (e.g. Andreoni 1990, Holländer 1990; for a survey of different modeling approaches, see Nyborg and Rege 2003b). Our starting point below will be the economic model of moral motivation by Brekke et al.

[5] An exeption is Sugden (1984), who assumes that individuals follow a conditional moral rule saying that "I should contribute what I wish others to contribute, but I don't need to contribute more than the person who contributes the least". Clearly such a rule will produce social interdependency and multiple equilibria, but for different reasons and with somewhat different implications than the model presented here.

(2003), who assumed that individuals have preferences for *a self-image as socially responsible*. In their model, self-image improves when the individual's actual behavior gets closer to his view of the "morally ideal" behavior. The latter is defined as that behavior which (according to the individual's own judgement) would maximize social welfare if chosen by everyone. Since we will focus only on the binary decision of choosing a "green" or "brown" alternative, we will use a simpler version of their argument. Hence, we will assume that if individual i makes the choice that he finds morally superior, this produces a self-image improvement S_i.

Moral decision-making has long been studied by social psychologists. One important contribution is Schwartz (1970), who identified *awareness of consequences* and *ascription of responsibility* as crucial factors for such choices: "[I]n order for a given moral norm to be activated, the actor must become aware of interpersonal consequences of actions governed by that norm. Whether the activated norm will then influence behavior depends on whether or not the actor ascribes some personal responsibility to himself for the actions and consequences to which the norm refers" (Schwartz 1970, p. 130)[6]. Our way of modelling self-image benefits is inspired by this observation in the following way: We assume that the self-image improvement S_i achieved by choosing the green alternative is increasing in the positive external effects of this choice; or rather, the individual's *beliefs* about these external effects. Moreover, S_i is assumed to increase in the extent to which the consumer acknowledges a *personal responsibility* for the issue at hand.

The latter requires some further explanation. Our model is partial; it considers only one type of green consumer good, while there is a nearly unlimited number of other choices to make in everyday life. However, no-one is capable (cognitively or economically) of contributing to every public good in every possible way; there must be some division of labor in society. Hence, in practice, even individuals with a strong preference for considering themselves socially responsible will not feel an obligation to contribute to every possible good cause. They may think, for example, that "reducing pollution from the sewage system is the responsibility of the government; I cannot consider pollution

[6] Stern et al. (1999) developed Schwartz' theory for analyses of proenvironmental behavior. See also Hopper and Nielsen (1991) for a discussion of Schwarz's theory applied to environmental behavior.

issues every time I wash my hands!", or "those people littering the streets are the ones who should clean it". [7]

Sometimes responsibility is defined formally through laws or similar measures. We will assume that there is no such formal sharing of responsibility in the market we are considering. Instead, we will focus on two factors which are likely to influence individuals' perceived responsibility. The first is *descriptive social norms*, defined by Schultz (2002, p. 73) as *beliefs about what other people are doing.* Assume that the individual acknowledges that his action has some external effect, but wonders whether this is his responsibility or someone else's. He finds no formal rule providing the answer. A natural thing to do, then, is to look around to see who carries this responsibility in practice. If he observes that it is common for people like him to take responsibility (in our case, purchase the green alternative), it is more likely that he will conclude that he does have some responsibility. For example, Schultz (2002) quotes several studies indicating that recycling behavior is rather strongly correlated with respondents' beliefs about the frequency of recycling in their community.

Secondly, consider the issue of *fairness* or *reciprocity*. A large body of economic research has recently emerged on these topics (see, for example, Schram 2000, Fehr and Falk 2002, Fehr and Schmidt 1999, Bolton and Ockenfels 2000). A large number of experimental studies have found that individuals are willing to cooperate to a much larger extent than predicted by non-cooperative game theory, even in anonymous one-shot games; but such cooperation is to a large extent conditional on expectations that others will also contribute. Also, studies from social psychology confirm that perceptions of fairness matters for individuals' decision to contribute (Biel et al., 1999).

Both descriptive social norms and fairness concerns imply that, *ceteris paribus,* perceived individual responsibility is likely to be increasing in the population share that chooses the proenvironmental alternative. Rather than trying to provide a comprehensive description of all factors

[7] Recall Milgram's (1965) famous experiment: Under conditions where experiment subjects tended to ascribe responsibility away from themselves and towards the experimenter, such as alleged high prestige with the research institute conducting the experimental study, higher proportions of subjects were willing to impose severe pain on a "victim".

that determine perceived responsibility, we will focus on this particular variable, and study its interaction with other motivational factors.

Note, however, that our interpretation of the concept of "responsibility" differs somewhat from usage of that term within social psychology. In Stern (1999, 2000), for example, "ascription of responsibility" refers to an individual's perceived *ability* to improve the environment; in the argument above, we refer to responsibility as indicating the individual's conception of informal social institutions.

3. The model

Assume that there is a large but finite number n of identical individuals in society. Each individual chooses whether to buy an ordinary consumer good or a more environment-friendly alternative. Choosing the green alternative imposes the incremental cost C on each household. Furthermore, if a household chooses green, it confers a nonmarket environmental benefit of value b on both itself and on all other households. We will assume that $b < C$. Moreover, we will assume that b is negligible in the following sense: The environmental impact of the individual's own choice is too small to be observed by the individual in any reliable way. This has two implications. First, the direct effect of b on individual i's own utility can be ignored when calculating the individual's payoff from choosing green. Second, since the individual cannot observe b, he is dependent on information from some external source to form a belief about its level; nor does he know the true level of external effects of his choice, $b(n-1)$.[8] Let B be the individual's belief about $b(n-1)$.[9]

Further, as explained above, choosing the morally superior alternative yields a self-image improvement S_i. For simplicity, we will assume that individuals' beliefs are always such that the green alternative is believed to be morally superior. Individual i's payoff from the choice of adopting or not adopting the green technology can thus be written as

(1) $$p_i = (S_i - C)x_i$$

[8] See Kempton (1993) for an interesting discussion of consumer misperceptions of the environmental effects of individual behavior.
[9] Since individuals are assumed to be identical we omit subscripts.

where $x_i = 0$ if the individual does not buy the green alternative, and $x_i = 1$ if he does. (The fact that b is ignored here does not affect conclusions as long as $C > b$). The improvement in self-image depends on perceived external effects and perceived responsibility, which is in turn an increasing function of the share of consumers choosing green. Hence, we can write

(2) $S_i = s(B, a)$

where s is a continuously differentiable function, which is increasing in both variables, and $a = (\sum_i x_i)/n$ is the share of the population who chooses green. Together, equations (1) and (2) imply that a utility maximizing individual will choose green ($x_i=1$) if

(3) $s(B, a) > C$.

4. Stable equilibria: High or low demand

Assume now that $s(B, 0) < C$. Then $a = 0$ (no-one buys green) is a Nash equilibrium: When no-one else buys green, individuals' sense of personal obligation to do so themselves is weak, implying that the self-image benefit is not strong enough to overcome the personal cost. Denote this equilibrium NE(0). In this situation there are no green consumers, and no-one feels sufficiently bad about it to change their behavior.

Assume further that $s(B, 1) > C$. This means that when everybody else buys green, the individual feels sufficiently responsible that unless she too buys green, the loss of self-image will be so large that she prefers to buy green in spite of the cost C. With these assumptions, this game is a standard coordination game[10], and $a = 1$ is also a Nash equilibrium. Denote this NE(1).

There is also mixed strategy Nash equilibrium, in which a share a' chooses green, where a' is defined by $s(B, a') = C$. In this equilibrium, which we may denote NE(a'), every individual is exactly indifferent, and buys green with probability a'.[11] While the two pure strategy Nash equilibria are evolutionary stable, NE(a') is not.[12] However, a' is important because it is a tipping point in the

[10] See for example Weibull (1995), Ch.1.
[11] Note that $a'n$ is not necessarily an integer. If it is not, then a share of green consumers of exactly a' is not physically feasible.
[12] A strategy is said to be evolutionary stable if a small share of mutant players cannot get a better payoff than the incumbent players. In NE(0) and NE(1), there is no mutant strategy which beats the dominant strategies of (respectively) never buy green and always buy green. In NE(a'), however, a small share of mutants who always

model: Once the number of adopters exceed *a'*, every individual will prefer to adopt, while no-one will want to adopt as long as the number of adopters is below *a'*.

The existence of two stable Nash equilibria implies that two otherwise identical economies may display highly different demand for the green product, even if individuals' information about the external effects, their preferences for a good self-image, and the way self-image is produces is equal in the two cases.

5. Dynamics

Assume now that individuals do not change their strategy every period, but review it at random times. Green electricity, for example, is not an issue one is frequently faced with in everyday life; and given the fact that making judgements is to some extent costly (in terms of limited cognitive capacity), it seems reasonable that individuals will only reconsider their choice of green versus brown alternatives every now and then.

Assume further that individuals do not have perfect *a priori* knowledge of S_i; that is, they don't know precisely how choosing green or brown will make them feel. As a practical rule of thumb, if the payoff they experience falls short of an exogenous satisficing requirement[13], they revise their strategy choice and simply mimic an arbitrary other person (they try the strategy of their neighbor, regardless of what this is). Benaïm and Weibull (2003) show that his type of adaptation rule gives rise to a specific dynamic originating from evolutionary biology, the replicator dynamics (Taylor and Jonker 1978), which has been studied extensively in evolutionary game theory. The replicator dynamics says that the growth rate of a strategy is proportional to the success of that strategy, where "success" is measured by payoff minus average payoff:

$$\dot{a} = a(1-a)(s(B,a) - C) \tag{4}$$

adopt will get a marginally better payoff than the incumbent players, because their presence will make S_i increase just enough to make the green choice strictly better than the brown alternative. See Weibull (1995).

[13] Alternatively, we may assume that individuals review their strategies at a rate that depends on their expected payoff from current strategy, such that those with lower expected payoff is likely to review their strategy more often than the others. (See Weibull, 1995, section 4.4.1.)

With these assumptions, the popularity of a strategy yielding high payoff increases more over time than strategies yielding less payoff. This produces a dynamic development as illustrated in Figure 1.

When the dynamics of the model are given by the replicator dynamics, the two pure strategy Nash equilibria NE(0) and NE(1) are asymptotically stable; that is, a small deviation away from equilibrium will induce a dynamic movement back towards the equilibrium. The mixed strategy equilibrium NE(*a'*) is dynamically unstable, as can be seen from the figure: The instance the economy moves from *a*= *a'* to an *a* slightly higher or lower than *a'*, this will immediately start a "good" or "vicious circle" moving towards one of the asymptotically stable Nash equilibria.

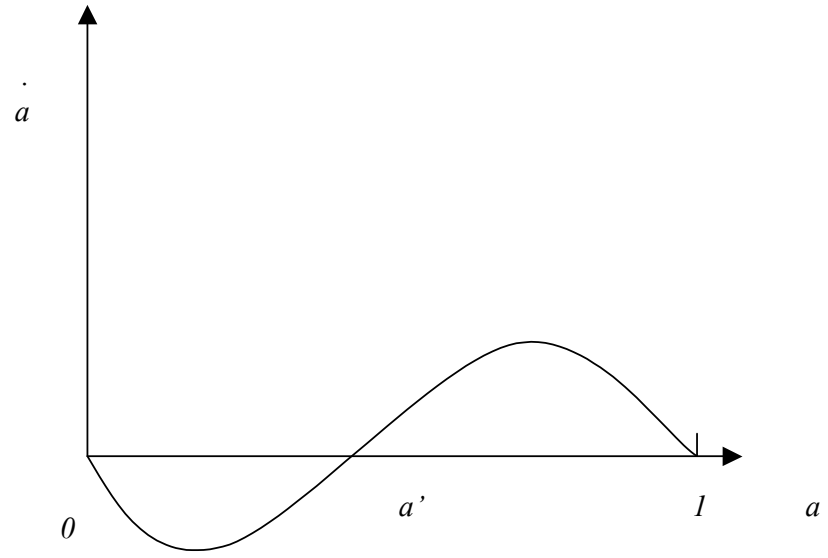

Figure 1: Dynamic development of the share of adopters.

Now suppose that individuals are heterogeneous in their emphasis on self-image, as in Nyborg and Rege (2000, 2003). Let there be *K* types of consumers, where type *j* is a fraction σ_j of the total population, with $\sum_{j=1}^{K} \sigma_j = 1$. Type *j* puts emphasis ϕ_j on self-image, so that $S_j=\phi_j\, s(B,a)$, with $\phi_1 > \phi_2 > ... > \phi_K$. As above we assume that individuals revise their strategies occasionally and change strategy if the payoff they experience falls short of some satisficing requirement. This implies

a replicator dynamics for each of the groups, where the share of green consumers within each group is governed by the differential equation

(5) $\dot{a}_j = a_j(1-a_j)(\phi_j\, s(B,a) - C) \quad \text{for } i = 1,...,K$

where a_j is the share of adopters among type *i* individuals. Now, if $\phi_1\, s(B,0)<C$, $a=0$ is still a stable Nash-equilibrium. Similarly, $a=1$ is a stable Nash equilibrium provided that $\phi_K\ s(B,1)>C$.

A particularly interesting case occurs when $\phi_1\ s(B,0) \geq C > \phi_K s(B,0)$. In this case those who put high emphasis on self-image will have incentives to buy green even if no-one else does, since $\phi_1\ s(B,0) \geq C$. Now a_1 will be increasing; eventually everyone in group 1 will choose green, and the share of green consumers will reach σ_1. If, moreover, $\phi_2\ s(B,\sigma_1) \geq C$, then once the share buying green has reached σ_1, choosing green is attractive to individuals in group 2, who put slightly less emphasis on self-image; hence they follow in choosing green. This cascading will continue, with type $j+1$ following j provided $\phi_{j+1}\ s(B,\sigma_1 + \sigma_2 + ... + \sigma_j) > C$. Thus, even though types with a low emphasis on self-image initially had insufficient incentives to buy green, it is possible that in the end everyone will want to do so, since others' green consumption increases the perceived responsibility to choose green.

Note, however, that if the condition $\phi_{j+1}\ s(B,\sigma_1 + \sigma_2 + ... + \sigma_j) > C$ is not satisfied for some group $j+1$, then the cascading will stop at that point. Even if all types from 1 to j have adopted the green choice, and the share of adopters approaches $\sigma_1 + \sigma_2 + ... + \sigma_j$, that may not be sufficient to attract the next type to adopt. In this case $a = \sum_{k=1}^{j} \sigma_k$ is a stable Nash equilibrium. If no such type exist, $a=1$ is the only stable Nash-equilibrium.

A similar cascading may run in the opposite direction, provided that everyone buys green initially. As above, this cascading may run all the way to no green consumption, or stop at some intermediate group, depending on parameter values.

6. Policy

Green taxes

Consider first the case with homogeneous consumers, assuming that $s(B, 0) < C < s(B, 1)$. When the economy is in the low participation equilibrium, then if the government is able to temporarily change one of the model's exogenous variables C or B sufficiently to ensure that $a > a'$, this will cause the economy to switch all the way to full participation.

More specifically, assume that the economy is in NE(0); that is, nobody buys green. Then, let the government introduce a tax t on the brown consumer good, and assume that consumers consider the tax as being equivalent to an decrease in C. In this situation, both NE(0) and NE(1) are Nash equilibria if

(5) $$s(B, 0) < C - t < s(B, 1).$$

This implies that there is a tax t^* such that $s(B, 0) = C - t^*$. Any tax $t > t^*$ will make NE(0) cease to be a Nash equilibrium. Hence, if the government introduces a tax $t > t^*$, then even if no-one else buys green it will be optimal to do so, because the tax is sufficiently large to compensate the low feeling of responsibility. The moment a tax marginally larger than t^* is introduced, the economy will consequently move all the way to the full participation Nash equilibrium NE(1). Thus, in some situations, a marginal tax increase may induce quite large changes in behavior.

With heterogeneous consumers, at least some green consumption can occur with a tax level lower than t^*. If the tax is $t' = C - \phi_1 \, s(B, 0)$, then all members of the group with the highest emphasis on self-image will buy green. If, moreover, $\phi_i \, s(B, \sum_{k=1}^{j-1} \sigma_k) \geq C - t'$ for all j, then cascading will ensure that the entire population will eventually choose green. Clearly $t' < t^*$, i.e. the tax required to start this cascading process is smaller than the tax leaving everyone indifferent from the outset, since $\phi_1 \, s(B,0) > s(B, 0)$. Consequently, a low tax rate can potentially lead the economy to a

stable equilibrium with full participation, even if the tax itself is not sufficiently high to induce participation among more than a small number of individuals.[14]

To make the green choice weakly optimal for everyone, *irrespective* of the weighing of self-image and the share of adopters, a tax $t'' = C$ would be sufficient. Moreover, we have assumed that $C < b(n-1)$, i.e. the private cost of choosing green is less than its external environmental benefits. This implies the result that $C = t'' < t_p = b(n-1)$, where t_p is the tax level corresponding to a Pigouvian tax. In other words, a tax below the level of a Pigovian tax is sufficient to move the economy towards high adoption of the green alternative.

Note that the tax may work to achieve this even if it is only temporary:[15] If the tax is abolished after a sufficiently high participation rate has been reached, individuals will regard buying green as the responsible thing to do, implying that the self-image benefit to participators may be sufficient to sustain high participation. Such a permanent effect of a temporary tax requires that there are multiple equilibria without taxes, and that the share of green consumers has reached the level corresponding to the high participation equilibrium when the tax is abolished.[16]

Note, however, that there is one important caveat for the use of green taxation to promote moral motivation in this way. A basic assumption for our analysis was that responsibility for the environmental problem under consideration was not formally allocated to any particular institution or individual(s); this is precisely why consumers are assumed to use others' behavior as an indication of their own responsibility. Nevertheless, a tax may in itself change consumers' perception of their responsibility. As discussed more formally in Brekke et al. (2003), the introduction of a tax can be interpreted by consumers in at least two ways: as a reminder that one should not pollute, i.e. a symbolic device *underlining* the individual's responsibility; or as an indication that the government *has taken* over responsibility for the issue, possibly even securing the socially optimal level of environmental quality through Pigou taxes. With the latter interpretation, the mere introduction of a

[14] On the other hand, it is indeterminate whether a tax rate above t^* will be required to avoid the prospect that cascading stops at some adoption level below 100%.
[15] A similar result is demonstrated in Rege (2003).
[16] In the model with homogeneous consumers, the economy will remain in the equilibrium of full participation even if the tax is abolished. If consumers are heterogeneous, the economy will stay in the high participation equilibrium when the tax is removed, but this equilibrium may occur at a somewhat lower participation rate without the tax than with the tax. For details on this, see the Appendix.

tax may wipe away moral motivation altogether. In our formal model, a strictly positive tax is treated as equivalent to an increase in *C*; but if this assumption does not hold, and a tax wipes out moral motivation, then introduction of a green tax will make the model collapse into the standard neoclassical consumer theoretic model. However, a temporary tax is perhaps less easily interpreted as indicating an exogenous change in responsibility than a permanent tax.

Even if we disregard this complication, it is not obvious that a temporary tax below the Pigovian level would be socially preferable to a permanent Pigouvian tax. In practice, however, the former alternative may be interesting in cases where taxation is associated with high administrative costs, imperfect or costly monitoring and/or verification of emissions, or other problems making taxes an imperfect policy instrument. In such cases a temporary tax, followed by high levels of moral motivation by individuals, could possibly be more efficient than a permanent Pigovian tax.

This can be illustrated by the case of studded winter tires in the city of Oslo. Studded tires tear on the asphalt and contribute to a high ambient concentration of particulate matter, which is a major health concern in urban areas. In 1997 only 20% of vehicles in Oslo used non-studded winter tires, and the City of Oslo introduced a temporary tax on the use of studded tires. During a limited time period those who bought new non-studded tires also received substantial subsidies. It was announced that when 80 percent of the vehicles in Oslo used non-studded winter tires, the tax would be abolished. It is interesting to note that the politicians of Oslo[17] actually did have faith in a temporary tax, which would certainly not be very useful according to traditional neoclassical models.[18] Furthermore, it seems somewhat odd to expect social sanctions to be effective in this case, since friends and colleagues hardly spend much time inspecting each others' tires and sending hard looks to those who have the wrong type. The administrative costs of the tax were considerable, however, making a permanent tax scheme unattractive. For example, visitors from other areas had to stop at gas stations to buy a one-day permit before entering or passing through Oslo.

In 2001, the announced goal was reached, and the tax was removed. As a consequence, the use of non-studded tires dropped to 68 percent in 2002, but the decrease did not continue the

[17] And also the politicians of the city of Trondheim, which has recently introduced a similar scheme.
[18] Note that a temporary tax might be useful also if the population had a false belief that non-studded tires were less safe, and that this belief would be corrected after some time's use.

following year, and even turned to a slight increase, to 72 percent, in the winter of 2003 (Johansen, 2003). These data seem roughly consistent with our model, although other explanations might certainly also be possible.

Information campaigns and advertising

To simplify the discussion below, we will concentrate on the homogeneous population model in this section. Assume now that the government can exogenously change beliefs about the external effects, B. With a sufficiently large increase in B, an economy situated in the no participation equilibrium will move to full participation. If the change in beliefs is too small, however, the increase in green purchases will be temporary, and there may be no permanent effects.

Note that if $s(0, a) = 0$, and similarly if $s(B, 0) = 0$, then no policy initiative will succeed in producing substantial and prevalent changes in behavior unless one makes sure that both dimensions are taken care of. Indeed, Stern (1999) emphasizes that policy campaigns for green consumption have had much more success in practice when information and other policy measures have been combined.

To determine the self-image benefits $s(B,a)$ a person derives from choosing green, he must make an assessment of the relative frequency a of adopters. Above, we have implicity assumed that consumers observe a, but it is more reasonable to think that they make an imperfect assessment $\hat{a}$, for example by drawing inferences based on a limited number of observations of others' behavior. The crucial point here is that since this assessment is imperfect, it may be influenced through advertising campaigns.

Tversky and Kahneman (1973) suggested that people infer the prevalence of an event "from the ease with which the event can be recalled or imagined". For example, if it is easier for a person to imagine others using electrical cars than gasoline-fuelled cars, then the person infers that a larger share of consumers use electrical cars. This phenomenon, called the availability heuristic, has been found in several experimental studies (see Schwarz and Vaughn 2002). Schrum (1999) surveys several empirical studies, and concludes that frequent television watching can increase the ease with which a person can imagine events such as violent crime, heroic physicians and private swimming pools, thus making him or her overestimate the prevalence of these events. Similarly, when people

encounter advertisements promoting green consumption, they may unconciously mix real others with people they have 'met' through advertising, biasing their assessment of *a* upwards.[19]

Assume that advertising can temporarily create an assessment $\hat{a} > a'$. As soon as this happens, the economy will start to move towards the full adoption equilibrium, regardless of the true *a*. The false impression can be revealed after some time, but this doesn't necessarily matter: Provided that the false belief is replaced by a correct perception of the situation *after* it is the case that in fact $a > a'$, the movement will not be reversed, and the economy will settle in the full participation equilibrium NE(1). In contrast, if an individual is motivated by social approval rather than an internalized moral norm, then advertising influencing the perception of adoption rates does not necessarily matter: Social approval and disapproval come from real people, so real frequencies do matter; whereas a feeling of moral responsibility may be based only on beliefs.

This aspect of morally motivated demand is interesting for several reasons. First, if the government believes that the economy is in a situation with multiple equilibria and that it is currently located in an equilibrium which is not Pareto optimal, the government can use advertising as a coordination mechanism which will push the economy to another equilibrium. Secondly, however, this can also potentially be exploited by marketers consciously manipulating consumers' perception of a product's "greenness", or its market share, to increase private profits from production of "green" products.

7. Success or failure

Why is it that efforts to market some green products, like dolphin-safe tuna in the USA, have had substantial appeal, while other attempts to promote green consumption fail? In a model of multiple stable equilibria, whether the economy comes to rest in one or the other may of course be a matter of pure coincidence. Nevertheless, some clues to this question may be noted (again, for simplicity, we focus on the homogeneous consumer model below).

[19] Brekke and Rege (2003) develop a theory of advertising as manipulated social learning, based on the idea that advertising may affect the assessment of relative frequencies of consumers using different products.

First, the higher the tipping point *a'* , the larger market share is required to avoid the case in which the economy slides back to NE(0). If individuals perceive external effects to be weak, i.e. *B* is low, then *a'* is high. Here, cognitive effects resembling the availability heuristic described above may be important: We may easily put more emphasis on external effects that are easy to envisage. The external effects of green verus brown energy use, for example, are not visible for the customer, at least not while consuming; nothing happens when you turn on the light that might remind you that somewhere else, this causes pollution (Kempton, 1993). Hence, it is difficult for consumers to envisage the external effects. Informing consumers about external effects becomes an abstract exercise requiring a cognitive effort on consumers' part. Compare this situation to recycling of household waste, where participation rates are amazingly high in many countries; in this case, the consumer has to take some action to get rid of her waste, and even without public information at all, it is easy to imagine that disposing of this must have at least some negative external effects. Similarly, the market for dolphin-free tuna was initiated by television programmes showing very vividly the dramatic effects on dolphins of the traditional tuna nets. Hence, not only the actual external effects, but how easy they are to imagine, may be important.

Secondly, there is the issue of observability of what *others* do. Our model does not require observability to ensure *enforcement* of green choices, since the individual sanctions herself; the instant the consumer believes that $a' > a$, she will want to buy the green alternative even if no-one else gets to know about her purchase. Nevertheless, if one cannot easily observe what others do, there is no guarantee that *perceptions* of the participation rate increases just because *actual* participation increases. Again, the availability heuristic may be important, in fact, social psychological research shows that people tend to overestimate the frequency of events they have encountered recently or frequently (Ajzen 1996, p. 301). Hence, while it is not clear why individuals would feel responsible at all if buying green is *not* observable, it is quite likely that they will *overstate* others' participation if buying green is *easily* observable. Others' purchases of green electricity is, of course, not easy to observe; while others' recycling is something one is frequently reminded of, particularly when there are curbside collection systems.

8 Conclusions

This paper has formalized the role of moral motivation in stimulating the demand for consumer goods that are perceived to provide external benefits in the form of improved environmental quality. Our results show that even if green consumerism is motivated solely by internalized moral motivation, and the desire to gain social approval is disregarded altogether, consumers may display herd behavior, implying that markets for green consumer goods may be likely to become either great successes or complete failures.

In our model, people get an improved self-image from purchasing "green" rather than "brown" products. This self-image benefit is increasing in the individual's beliefs about the external benefits of choosing green, and in the personal responsibility he feels for the issue. Perceived responsibility is, in turn, larger the more common it is to choose the green alternative. High adoption rates thus influence consumers' propensity to interpret product adoption as a matter of moral responsibility.

We have argued that our modeling framework is consistent with an important body of theory and evidence from social psychology. From an economic perspective, this specification of preferences gives rise to an interesting set of results. Our model involves multiple Nash equilibria in which "herd behavior" can promote either universal product adoption or an outcome in which green products are essentially ignored by consumers. This finding squares with the fact that the "green consumer" phenomenon has had dramatic impacts on markets for goods such as elephant ivory, dolphin-safe tuna, organic produce, and socially responsible investments, but has largely failed to support goods such as "green" electricity despite marketing studies suggesting that this good would meet with relatively strong demand.

An even richer set of results arises when our model is generalized to allow for consumer heterogeneity and a specification that depicts the dynamics of product adoption using the tools of evolutionary game theory. In this setting, the early adoption of green products by consumers characterized by a high degree of moral motivation can induce cascading effects leading to widespread dissemination of the product throughout society. Early product adoption can be stimulated

by taxes on "brown" products or advertising campaigns that promote the belief that "green" products provide important environmental benefits. Under favorable conditions, product adoption rates would remain high even after these initial marketing measures were discontinued.

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Appendix: Conditions for permanent effects of a temporary tax

Full green market participation by all groups $j \leq k$, and only these groups, will be a Nash equilibrium if and only if

(A1) $$\phi_k \, s(B, \sigma_1 + \sigma_2 + ... + \sigma_k) > C \geq \phi_{k+1} \, s(B, \sigma_1 + \sigma_2 + ... + \sigma_k).$$

To include the possibility that $k=0$ or $k=K$ in equilibrium, let $\phi_0 \, s(B,0) > C$ and $C \geq \phi_{K+1} \, s(B,1)$ by definition. Suppose that there are two such equilibria, with the threshold group being either k^D or k^E with $k^E < k^D$. Assume that initially, $a=0$. The group which is most concerned about self-image will then start buying green, and cascading will continue until group k^D has adopted. When a tax is introduced, even more groups will join. If the tax is sufficiently large, so that

$$\phi_j \, s(B, \sigma_1 + \sigma_2 + ... + \sigma_{j-1}) > C - t \text{ for all } j \leq k^E,$$

cascading will continue until the share of green consumers reach group k^E. Due to the tax, however, cascading may continue even beyond this point, and stop at group k^F such that

$$\phi_{kF} \, s(B, \sigma_1 + \sigma_2 + ... + \sigma_{(kF)-1}) > C - t \geq \phi_{(kF)+1} \, s(B, \sigma_1 + \sigma_2 + ... + \sigma_{kF})$$

where $k^F \geq k^E$. We have assumed that without the tax, there is no equilibrium where groups $j > k^F$ buys green, thus $C \geq \phi_j \, s(B, \sigma_1 + \sigma_2 + ... + \sigma_{j-1})$ for all $j > k^F$. (To see this, note that if (A1) is not satisfied for $k > k^F$, and $C \geq \phi_{k+1} \, s(B, \sigma_1 + \sigma_2 + ... + \sigma_k)$, it follows that $C \geq \phi_k \, s(B, \sigma_1 + \sigma_2 + ... + \sigma_{k-1})$. Since $C \geq \phi_{K+1} \, s(B,1)$ by assumption, the claim follows by induction.) When the tax is removed, group k^F will no longer have incentive to buy green, and negative cascading will occur until all groups $j \leq k^E$ buy green, but only these groups. Still, since there are multiple equilibria, the new adoption level will be higher than the initial level before the tax was introduced.