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Consumer support for environmental policies:
An application to purchases of green cars

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This paper focuses on how consumer motivation can be tapped in order to encourage the adoption of cleaner technologies. Consumers are heterogeneous – they may be guided by intrinsic motivation or extrinsic motivation. While information provision policies (such as the energy label for cars) may be effective in encouraging certain consumers to adopt green cars, financial incentive schemes (such as subsidies or fines) may be more persuasive for extrinsically-motivated consumers. We develop a dynamic theory of adoption of environmental innovations, in which information-provision policies are followed by financial incentives (first ‘carrot’, then ‘stick’ incentives). Analysis of a survey dataset of Swiss households observes considerable heterogeneity in terms of support of information-provision or financial incentive policies, in line with our conjectures. Our results will be of particular interest to policymakers interested in guiding consumers towards cleaner technologies.

JEL codes: Q53, Q57, O33

Keywords: Environmental policy, Technology adoption, Technology diffusion, Intrinsic motivation, Financial incentives.

1 Introduction

The emerging problems of climate change are largely due to the exploitation of new processes made available through technological innovation. However, it is widely believed that technological innovation can also help to meet the challenge of environmental protection. In this paper, we consider the processes of adoption of pro-environmental innovations by individual consumers. Certainly, adopting efficient cars reduces the personal fuel bill. However, environmental protection is a public good, and not all agents will want to contribute to that by internalizing the externalities which stem from fossil energy use. Government policy may thus have a mandate to intervene in the adoption of environmental innovations such as environmentally-friendly cars. It is unclear, however, which policy would be the most effective. At present, the EU Commission's 'three-pillar strategy' (European Commission, 1995) is a combination of voluntary agreements with manufacturers, information-provision policies (including the provision of energy labels), fiscal incentives and financial and legal devices. In this paper we discuss how policies of information-provision and policies of financial and legal incentives directed at consumers can each have their advantages and drawbacks, and that the effectiveness of these different policies is likely to depend on how these policies are combined.

With policies of information provision, consumers are given information on the state of the environment, and on ways how to make consumer lifestyles less harmful for the environment. For consumers to take some sort of pro-environmental action, several factors can be assumed to matter: knowledge about the existence of a problem, knowledge of better options, a feeling of responsibility, and the belief that one's own actions can improve the problem (Schwartz, 1977).

But consumers seem to differ quite significant in these dimensions: they feel responsible to a different extent and they hold different motivations in relation to the environment. In fact, consumers can in principle be categorized into those rather 'intrinsically' or 'extrinsically' motivated to behave in an environmentally friendly way. Participating in an activity out of intrinsic motivation (here: without any monetary reward) corresponds to the case of altruistic motives in consumer behavior.¹

The standard recipe of economics, i.e. introducing monetary incentives which are assumed to lead to optimal resource allocations, has several shortcomings. Financial incentives alone do not improve the understanding of the problem society faces, and moreover they hinder consumers from taking voluntary action (thus undermining 'democratic' principles). Indeed, the phenomenon of 'crowding out' of intrinsic motivation has been observed to be empirically relevant, pointing to the danger of actually reducing cooperative intentions in consumers by "putting a price on the environment" and introducing a market relationship. To be sure, policy makers should be aware of both intrinsic and extrinsic motivation as forces guiding consumer behavior.

¹ We distinguish between intrinsic and extrinsic motivation only on the basis if individual behavior is guided by financial incentives or not. This approach is in line with the work of Bruno Frey and co-authors (e.g. Frey, 1999) (Section 3.2). Other sources of extrinsic motivation could be forms of social feedback. Individuals might behave in an environmentally friendly way simply to please their peers. However, we do not consider this form of intrinsic motivation for the reason that we cannot examine this empirically with the dataset at hand.

This paper seeks to analyze consumer opinions towards policy strategies aiming at environmental protection. We are specifically interested to see how consumers evaluate policy suggestions, focusing on either information provision or financial incentives or both. We use a survey on car purchase decisions among Swiss households. We seek to analyze if and how many consumers are willing to support pro-environmental policies, and which consumer groups favor which type of intervention. As such, we address both decisions about technology adoption as well as voluntary curtailment. Our findings will be linked to a dynamic model of technology adoption.

Section 2 contains a brief literature review concerning consumer motivation for adopting green cars. Section 3 contains a theoretical discussion on the topic of how consumers can be influenced into adopting environmentally friendly technologies. We begin by considering regularities in the diffusion of innovations (Section 3.1), and then discuss how individuals differ with regard to enthusiasm (intrinsic motivation) for environmental innovations (Section 3.2). Intrinsic motivation and extrinsic motivation both play important roles in the adoption of clean technologies (Section 3.3). In Section 4 we present the database. Section 5 contains some descriptive statistics. Section 6 presents the results of multivariate regressions. Section 7 concludes.

2 Consumer Motivation to Purchase Green Cars

Strategies for encouraging consumers to reduce the ecological impact of passenger transport have been the subject of several studies. Nijhuis and van den Burg (2007) address the effects of energy-efficiency labels and subsidies on car purchase decisions in the Netherlands, focusing on hybrid cars. They find that sales of the Toyota Prius benefited significantly from the introduction of a tax subsidy. When the subsidy was reduced, sales numbers declined. According to the authors, for consumers the environmental impact of their new car does not seem to rank high on the agenda – it is rather a ‘bonus’ if a car is energy-efficient. Moreover, the study indicated that consumers did not always grasp the meaning of the energy label. However, these findings do not imply that the tax subsidy takes effect only as a monetary incentive. According to Kahn (2007) for buyers of hybrid cars symbolic values dominate over purely monetary cost-savings due to reduced fuel bills, and symbolic values are highest for the Prius model. Whether rebound effects (because hybrid cars could replace former smaller cars, or because they could increase car ownership) are induced by hybrid vehicles, is investigated by de Haan et al. (2006). Based on a survey of Swiss Prius buyers, no evidence for these rebound effects can be found, suggesting that the primary motivation for the purchase of hybrid cars is not to save money, but to purchase symbolic values.

Teisl et al. (2008) present a model on the interrelationship between individual consumer characteristics (including consumer motivations) and the content of information policies. The authors find that the underlying psychological factors are crucial and should be accounted for in order to induce behavioral changes in consumption behavior by means of information policies. They stress the importance of well-designed information policies (like eco-labeling), because this impacts on the perception of eco-friendliness. Hence whether a given consumer will show intrinsic or extrinsic motivation may depend on the details of the information or incentive policy in question. This is also investigated by Peters et al. (2008), who address the potential impact a feebate system might have on consumer motivations to adopt a more energy-efficient car (feebate systems imply fees for the purchase of energy-inefficient cars, whereas rebates are paid for the adoption of particularly fuel-efficient

vehicles). The authors find that for financial rebates, consumers show a willingness to change their car choice.

Mainstream economic models treat individual actors to be rational in their decision making. However, individual actors in many circumstances act within a 'bounded rationality' framework. It is generally accepted that this applies in particular to car purchases. Mueller et al. (2008) distinguish between a first stage of the car purchase decision process with bounded rational elements (brand loyalty, etc.) to select a small number of car models to be evaluated in depth, followed by a second stage where car buyers apply unboundedly rational multi-attribute decision making rules to make their final choice.

3 Theory

3.1 Diffusion of Innovations

In this section we develop a dynamic theory of technology adoption in which we frame the switch of consumers to a new cleaner technology. We suggest that the transition to cleaner technologies draws on both intrinsic motivation (a personal sense of responsibility) and extrinsic motivation (here: financial incentives) in consumer behavior.² To be effective, environmental policy needs to take into account both intrinsic and extrinsic motivation (Frey, 1999).

When trying to encourage new technology adoption, policy makers can rely on the well-established theory of the diffusion of innovations developed by Rogers (1995). In the model by Rogers (1995), diffusion is seen as the interplay of a set of heterogeneous individuals, differing in terms of their financial background, social status, knowledge and openness to change. Consumers are categorized in terms of the role which they play in the overall diffusion process (p262). The 'innovator' or gatekeeper embraces new ideas, which she can easily adopt due to her financial situation and technological skills. The 'early adopters' however are the ones serving as opinion leaders and role models, being a source of advice and information for a larger social network. The groups of 'early' and 'late majority' take more time for the innovation-decision process once they have received information from their peers. Especially the late majority consumers react to peer pressure to acquire the new innovation. As 'laggards' are rather conservative and backward-looking in their consumption behavior, they stand at the end of a diffusion process, which shows an s-shaped curve (resulting from a normal-distribution of individual thresholds to adoption).

For the adoption of innovations, awareness of the good and persuasion of its usefulness matter (Rogers 1995, p162). A good is also compared to its alternatives such as the former technology: the relative advantage of a new technology decides about its adoption, encompassing characteristics such as the price and social status. Factors affecting the price of the good thus contribute to increasing its adoption probability. For so-called 'preventive innovations', showing their potential to improve the consumers' situation only sometime in

² Arguably, positive social feedback might also be a type of extrinsic motivation, which fosters the adoption of green technology (this is in line with the following discussion of Rogers, 1995). Due to data limitations, we cannot analyze this aspect empirically, and hence also eliminate it from the discussion.

the future, the relative advantage to alternatives is difficult to demonstrate (pp217).³ According to Rogers' approach the central variables guiding consumer behavior are knowledge, financial constraints, status concerns, and what might be termed "risk preferences". The heterogeneity in motivational states of consumers does not stand at centre stage of this model.

What are the specific incentives that can be used to guide the consumption decisions of leading consumers? This is an important question concerning the adoption of environmentally-friendly consumption behavior. To investigate this, we will now introduce two different types of motivation – intrinsic motivation and extrinsic motivation. These concepts are distinguished on the basis of whether an individual carries out a specific consumption act out of genuine interest, or because a financial (or other types of) reward can be expected. We then weave these different types of motivation into a theoretical framework of adoption of pro-environmental behavior.

3.2 Intrinsic and Extrinsic Motivation

Intrinsic motivation can be an important source of consumer behavior. It is a motivation to act coming from within the individual. If individuals are genuinely concerned about the state of the environment, their behavior can be guided by 'environmental morale' even if there is a cost involved. But there are limits to how far behavior is affected by intrinsic motivation, however: "people are prepared to follow their environmental conscience provided the cost of doing so is not too high" (Frey, 1999, p404). Research shows that intrinsic motivation can be amplified through the use of communication that supports and reinforces environmental morale - "verbal rewards have a significant positive effect on intrinsic motivation" (Frey and Jegen 2001, p598). Although intrinsic motivation can be an important source of pro-social sentiment, "it is difficult to evoke and target, and is neither reliable nor easily sustainable" (Frey 1999, p411). As a result, environmental policy should seek to complement intrinsic motivation with financial and/or legal incentives.⁴

Extrinsic motivation refers to the type of behavior described in standard economic theory. Individuals are assumed to base their decisions on expected payoffs which can be expressed in monetary terms. Marginal increases in the relative cost of environmentally harmful behavior (the "stick") can, in principle, induce individuals to adopt cleaner technologies.

³ A central element of the stylized diffusion process is the communication process, whereby new information is diffused via the mass media towards opinion leaders who then inform and persuade the masses ('two step hypothesis', Rogers 1995, p285). For the technology to diffuse through society as a whole, the connection between social networks, based on heterogeneous actors, is of central importance (the 'strength of weak ties', Granovetter 1973). Hence, the theory points to the importance of central leading figures in the process of technology adoption. It emphasizes that information stemming from the media need not reach the masses of consumers for realizing a change; instead the information sources of opinion leaders should be targeted. We do not pay attention to this element of Rogers' approach. First, one might doubt if the two-stage-hypothesis still holds that way. Second, we do not study the role of peer pressure or imitation for technology diffusion.

⁴ Similarly, Wüstenhagen et al (2007) consider the social acceptance of energy innovations and distinguish between the three dimensions of socio-political acceptance, community acceptance, and market acceptance. They find that factors influencing socio-political and community acceptance allow for the understanding of the apparent contradictions between general public support for energy innovations and the difficult realization of specific projects.

Polluting behavior can be deterred through the threat of punishment. The drawbacks of such an incentive system, however, are that people may begin to think of environmental issues by applying a market-based logic. If environmental protection is associated with extrinsic incentives, individuals may start to base their behavior on the presumption that they have the 'right' to pollute if they bear the associated financial cost (or, in the language of the medieval indulgences, that 'it is acceptable to sin, as long as you can pay for it'). Any intrinsic motivation to care for the environment would thus be 'crowded out' by a financial logic.

This argument holds for both positive and negative financial incentives. Frey (1999) explains how financial incentives can shift the locus of control outside of the person, replacing intrinsic motivation with an extrinsic behavior that responds to external stimuli (this idea is referred to as 'the cost of price incentives' or 'the hidden cost of reward'). If individuals' behavior is controlled by external factors, they view the environment as the responsibility of the government rather than as their own cause. As a result, cooperative behavior may actually decrease after the introduction of financial incentives aimed at encouraging cooperative behavior (the "carrot"). An added danger is that the introduction of price incentives to a specific environment problem may lead them to take on a market-based view of environmental protection in other areas where external incentives are not yet in place (this is known as the 'indirect motivational spillover effect' (Frey, 1999)).⁵ These shortcomings of financial/legal tools to control consumer behavior are amplified by the enormous difficulties of monitoring and sanctioning the behavior of whole populations of individual consumers, especially when dealing with non-point sources of pollution such as vehicle exhaust pipes.

In addition, the devices of extrinsic motivation will not be successful if they do not enjoy the legitimacy granted by 'democratic' support (i.e. if they are introduced when awareness and concern for environmental issues is still relatively low, and are thus perceived as 'unfair'). For example, there is evidence that public acceptance of road-pricing schemes decreases when these schemes are perceived as unfair (Jakobsson et al, 2000; Fujii et al 2004). Similarly, Hammar and Jagers (2007) observe that respondents who adhere to a fairness principle tend to be more positive to increases in the CO₂ tax.

Environmental policy would benefit from considering both intrinsic and extrinsic factors in consumer motivation. Although excessive legislation and financial incentives can undermine environmental morale, at lower levels they can support intrinsic motivation if they have an 'expressive' role (i.e. if they are instituted to acknowledge cooperative behavior and let consumers know what is expected of them). "External interventions crowd out intrinsic motivation if they are perceived to be controlling and crowd in intrinsic motivation if they are perceived to be acknowledging" (Frey, 1999, p399). Intrinsic motivation also increases when people can participate in decision-making – which suggests that legal and financial devices should be as 'democratic' as possible. Concerning legal devices, it has been suggested that a few, easily comprehensible regulations whose punishments fit the damage done to nature are preferable to a large number of complex,

⁵ Similarly, firms may react to mandatory environmental standards by taking a 'legalistic' approach, whereby they focus specifically on meeting the standard but they overlook other actions that might have more significant benefits to the environment (Tenbrunsel et al, 2000).

opaque laws (Frey, 1999, p405).⁶ In this way the behavior expected from consumers can be communicated with clarity.

An analogous line of thought is presented by Markard and Truffer (2006) regarding the beneficial, indirect effects of eco-labeling (in their case, of green electricity products). They argue that while the direct ecological impact of green electricity might be limited, it deserves a role in environmental policy mixes because it induces, as indirect effect, “eco-oriented learning”, i.e., alters consumer preference structures and enhances intrinsic motivation.

Environmental policy should also take into account the ‘cost of price incentives’. Low taxes may play an ‘expressive’ role and support environmental morale. Low taxes need not crowd out intrinsic motivation if these taxes apply to everyone and are not perceived as ‘performance-related’ but are instead perceived as fixed costs (Gneezy and Rustichini, 2000). In contrast, high taxes that vary according to the intensity of polluting activity may guide consumer behavior because of the magnitude of the financial incentives. Intermediate levels of taxation, however, may be counterproductive – they may crowd out environmental morale whilst not being large enough to influence consumption behavior (Frey, 1999). To be effective, the introduction of financial incentives should follow the principle of ‘pay enough or don’t pay at all’ (Gneezy and Rustichini, 2000).

As we have seen, intrinsic and extrinsic motivation are two important factors in consumer behavior that interact with each other in peculiar ways. In the following, we present a dynamic model of adoption of clean technologies that aims to explore the complementarity between intrinsic and extrinsic motivation.

3.3 A Dynamic Model of Adoption of Cleaner Technologies

In the following theoretical model, we assume that agents are heterogeneous with regards to their ‘environmental morale’. We limit ourselves to two groups of consumers - green consumers (who are intrinsically motivated) and mainstream consumers (who are not intrinsically motivated). We do not assume perfect knowledge. We distinguish two stages. In the first stage, green consumers are encouraged to adopt the clean technology. These green consumers are guided by intrinsic motivation to behave in a relatively altruistic way. In the second stage, mainstream consumers who are more sensitive to extrinsic incentives are targeted with appropriate incentive devices. The intuition behind the model is summarized in Figure 1.⁷

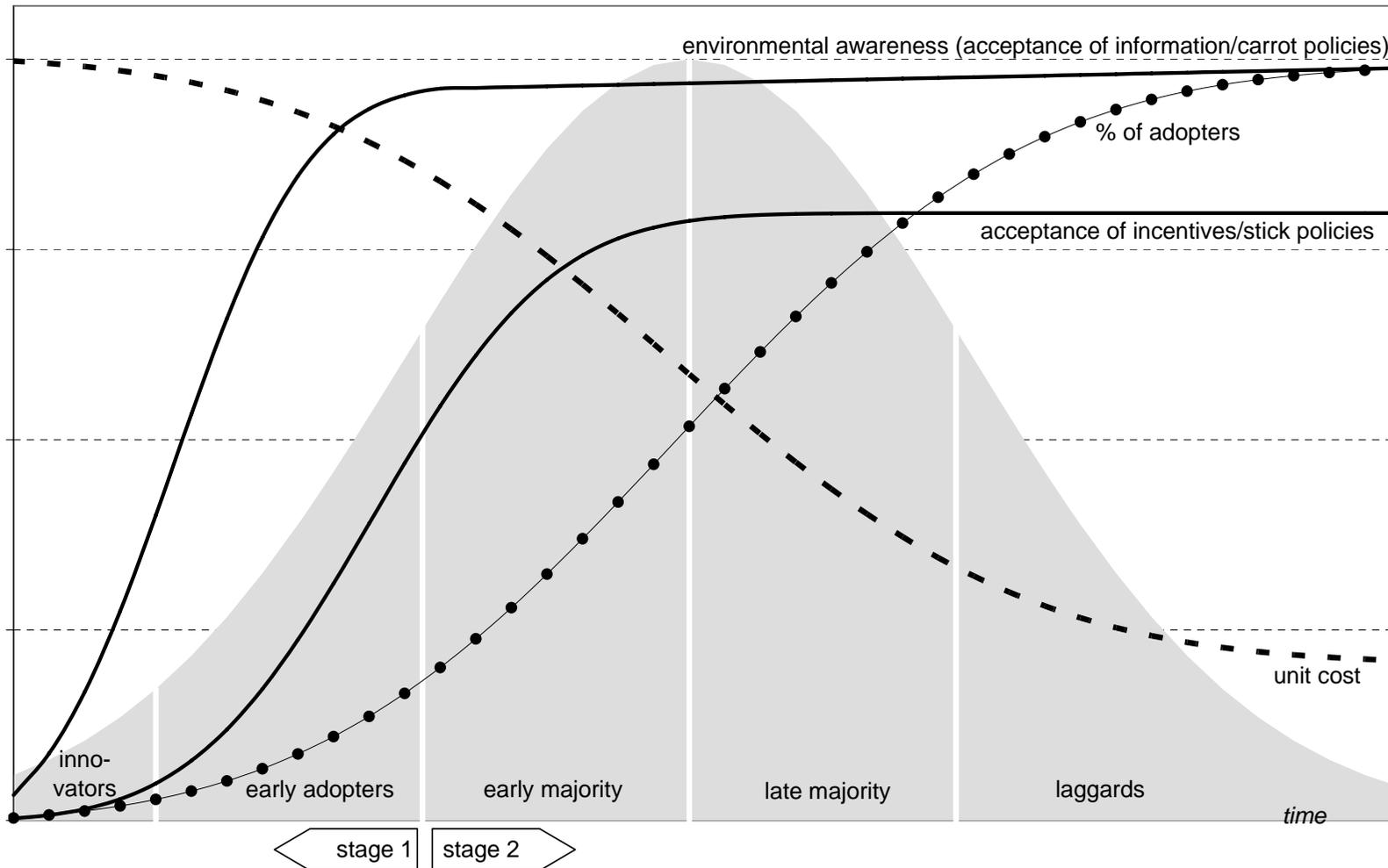
To begin with, all consumers are assumed to use the old, polluting technology (Stage 1). At this stage, there is little awareness of the harmful effects of the old technology. While green consumers have a high level of environmental morale, mainstream consumers are not concerned with environmental issues and respond only to heavy-handed extrinsic incentives. Once they become aware of environmental problems, green consumers self-select themselves towards adoption of the clean technology. After some time has passed,

⁶ Unfortunately, however, it would appear that a widespread feature of the legal sphere is that laws tend to be expanded upon with the course of time, such that a simple law can become a complex web of regulations.

⁷ See similar stylized representations in Vernon (1966), Abernathy and Utterback (1978) as well as Rogers (1995).

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Figure 1: A sketch of the dynamic process of the adoption of clean technologies. The grey shaded areas mark the five consumer segments after Rogers (1995), where innovators plus early adopters are called early market, the other three segments are denoted as late market. The first stage of technology adoption is driven by need for more information, rewarding of altruistic/pro-environmental behaviour of the early market. The level of environmental awareness will eventually approach 100%, that is, the issue has become common knowledge. The second stage is characterized by a majority of the public accepting enforcement by means of incentive schemes, in order to eventually reach the full market potential of the innovative technology in question.



we suppose that there are only mainstream consumers that are still using the old, polluting technology.

In the first stage of the model, policy should provide information to kindle intrinsic motivation. At this stage, the critical matter is to get green consumers to switch to the new technology. All consumers should be made aware of the consequences of their consumption behavior. The provision of information may be enough to encourage green consumers to use the clean technology. For example, attaching labels to different categories of goods according to their environmental performance can be a useful source of information and a practical and effective aid in the consumer decision-making process (Blamey et al, 2000). Given the initially low level of environmental awareness, however, ideals of environmentally-friendly behavior do not have a strong popular basis, and so the introduction of taxes or punishment schemes is difficult due to insufficient democratic support.

As time passes, however, and consumers become more environmentally aware, it might be possible to introduce low levels of extrinsic incentives (i.e. “carrots”), as long as their chief role is to encourage and express support to adopters of the clean technology, rather than to control consumer behavior or fully internalize pollution externalities. At this stage, the green consumers have made the switch to the green technology, whilst the others remain with the old technology. Thanks to the pioneering green consumers, the clean technology has had a chance to become developed and unit costs of the cleaner technology are decreasing, narrowing the gap between the cost of the old technology and the clean technology. Cultural transmission of consumer behavior may also play a role here, if consumers imitate the pioneering ‘green’ consumers (Buenstorf and Cordes, 2008).

The critical issue at the second stage is to get the mainstream consumers to switch to the clean technology. As mentioned before, in this model mainstream consumers respond only to extrinsic motivation. As a result, the introduction of financial incentives at this stage does not risk crowding out intrinsic motivation, because we suppose that the green consumers have already switched to the green technology. These financial incentives should be aimed at helping mainstream consumers to take the initiative to switch to the cleaner technology, rather than rewarding green consumers for their past behavior.⁸ Environmental policy should also continue to disseminate information, however, in order to maintain sufficient awareness that the legal and financial devices have a democratic base.⁹ Once environmental concern becomes legitimate, and norms of appropriate behavior are widely recognized, the government now has a mandate to act in favor of the environment, and so high taxes (the “stick”) can be introduced.

It is important to follow up the policy initiative of diffusion of information (that occurred in stage 1) with the introduction of extrinsic incentives – otherwise green consumers may

⁸ Although financial incentives might crowd out intrinsic motivation at the time of adoption of the cleaner technology, the provision of financial incentives as (unexpected) rewards after an intrinsically-motivated decision will probably not be badly perceived by the green consumers, however (Frey and Jegen, 2001, p598).

⁹ Wüstenhagen et al. (2003) arrive at analogous conclusions, based on a diffusion theory framework applied to the diffusion of green power products in Switzerland. They find that eco-labeling has to play an important role as a tool to facilitate the transition from niche (our Stage 1, corresponding to the Rogers’ early market) to mass market (our Stage 2, corresponding to Rogers’ late market).

lose environmental morale when they observe that mainstream consumers are 'getting away with' non-cooperative behavior. As Frey (1999) argues: "[Environmental morale] may, in particular, suddenly drop when consumers realize that their responsible behavior is being exploited by others. This "sucker" effect is easily observable in everyday life and has been well documented in prisoners' dilemma experiments." (p410) Instead, the later introduction of financial and legal incentives to adopt the clean technology can be seen as government support and approval of the green consumers' behavior.¹⁰ It is also worth considering the different roles of 'stick' versus 'carrot' financial incentives. 'Carrot' schemes may be introduced first as a way of communicating norms of desired consumer behavior, and rewarding cooperative behavior on the part of consumers. 'Stick' schemes, such as penalties for extensive pollution, may well receive more popular opposition than 'carrot' schemes, and so these schemes are likely to be more effective if they are introduced at a later date.

3.4 Research Questions

The preceding theoretical discussion leads us to formulate some assumptions that will guide our empirical investigations. First, we have emphasized the theme of consumer heterogeneity i.e. individuals can be assumed to show different degrees of environmental morale. Accordingly, individuals may well have different preferences for different policies. We argue that the share of extrinsically motivated consumers can be identified by their objection to "financial sticks", and a very probable support for financial incentives. Intrinsically motivated consumers on the other hand do not object financial sticks.

Concerning information policies, there are two distinct ways to interpret support for these measures: first, support can be seen as the legitimacy for environmental regulations with a monetary dimension. Providing information about ecological problems and giving consumers ideas on how to relieve the situation is a very 'democratic' approach towards environmental protection, for consumers (as well as firms) are first given a chance to draw their own conclusions before being restricted by the law. A second argument for information policies stems from acknowledging the heterogeneity of individuals in terms of their environmental motivations. In contrast to financial tools, information provision does not run the risk of crowding out intrinsic pro-environmental motivation.

Each survey is exposed to the possibility of strategic thinking on the part of respondents. First, respondents expressing support for information-provision policies will include those who genuinely believe that information provision is a worthwhile policy. However, this category of respondents may also include those 'cheap talkers' who consider this a relatively harmless policy that will cost them nothing.¹¹ To the extent that support for information-provision policies is merely a manifestation of goodwill and cheap talk, it may

¹⁰ We assume that at the beginning of the diffusion process, there is not that much information on environmental problems around. The intrinsically motivated consumers realize that environmental morale is low and that no democratic support for government interventions exists. Under these circumstances, consumers cannot possibly anticipate when feebate systems would be installed and how much money they could save by waiting. Under such circumstances, we assume, an intrinsically motivated consumer would not wait but try to act in a pro-environmental way.

¹¹ In other work, we are currently investigating this 'cheap talk' hypothesis of support for information provision policies.

be more instructive to concentrate on the responses concerning financial incentives. Second, it may be the case that intrinsically-motivated respondents suspect that the majority of consumers are extrinsically-motivated (i.e. unlike themselves) and so they may behave strategically and support policies of financial incentives, even though such policies are likely to be relatively ineffective when imposed upon these intrinsically-motivated individuals. The possibility of strategic responses along these lines makes it difficult to associate support for either information or financial incentive policies with groups of intrinsically or extrinsically motivated individuals. Hence, especially due to the possibility of strategic answering the support for certain policies will not always imply behavioral changes in favor of the environment.¹²

In addition, different types of information provision policies have to be distinguished. Consumers' interest in information on fuel-efficient cars for instance, does not appeal to environmental morale but to a motive to save money as well. Hence, this type of policy could be favored by both intrinsically and extrinsically motivated consumers. However, information that is related to what we term "problem awareness" represents another issue. We assume that such type of information is much closer related to an intrinsic motivation for it is not related to direct ways of saving money. Furthermore, concerning the support for information provision policies, it has to be distinguished that we analyzed two questions: do consumers want information for themselves or do they support it as a policy tool? That way, we wanted to capture exactly the difference between how well consumers are informed themselves, and what their opinion is about this policy tool in general.

Two issues should not be confounded. On the one hand, there is the theoretical discussion which suggests which type of policies should be effective in which circumstances. For example, if consumers show intrinsic motivation then information-provision policies can be expected to have an impact on consumer behavior.¹³ In contrast to that, policies relying on financial/legal incentives will be necessary tools for getting extrinsically motivated consumer to adopt greener technologies. This is to be distinguished from the empirical analysis which now follows. Next, we examine consumer preferences for environmental policies. Then, we try to infer which consumer motivations might be behind these statements. Thus, per definition we would not expect consumers who show low environmental morale to vote for financial sticks. However, this is the type of policy that might actually be necessary to induce a behavioral change

More precisely, we study the interplay between responses to information based policies as well as financial incentive policies. We take three approaches: a descriptive study of the survey results, as well as correlation analysis, and a multivariate analysis. We put forth the following conjectures:

First, the share of intrinsically motivated consumers will be rather small (corresponding to Rogers' early adopters in the diffusion of innovations).

¹² One might also wrongly attribute behavioral changes of individuals to a feebate system being in place. Imagine an intrinsically motivated consumer who would have purchased the greener car "anyway", but who benefits from a feebate system being in place at the same time. Although the change in behavior would occur while the financial incentive system is at work, it did not cause the individual decision.

¹³ It does not mean that new information will necessarily create intrinsic motivation in consumers, or that every consumer who prefers to be better informed is somehow intrinsically motivated.

Second, we expect a lot more heterogeneity in the reasons behind the response to information based policies as opposed to financial incentive policies (because of possibility of strategic answers). Thus, we expect on average, rather low correlations between the replies to information provision and financial incentive policies.

4 Database

We present results from a survey that aimed at collecting information about decision processes and criteria as well as further influencing factors and consumer characteristics, which are supposed to be of relevance for the purchase of fuel-efficient cars. The survey was conducted in June 2005 among Swiss households randomly sampled from the phonebook. The questionnaire existed in German and in French, for the German- (n=2842) and French-speaking (n=1158) regions of Switzerland. All items from the questionnaire quoted in this paper have been translated in English by the authors. From 4000 questionnaires sent out, 80 were undeliverable and 1581 returned (response rate 40.3%). By asking the questionnaire to be filled out by the household member that will buy the next car or did purchase the last car, the aim was to have a sample representative for car buyers; this explains the high share of males (73.9%). There was no incentive for participation in the survey other than taking part in a lottery that paid out EUR 660 in total. The 16-page survey consisted of 7 parts. In the present paper, we analyzed the responses to items from part 5 (preferences regarding the next car purchase), part 6 (acceptance of policy goals and measures to reduce CO₂ emissions from individual motorized transport), and part 7 (socio-demographics of the respondent and the household). The survey is described in more details in Peters et al. (2008).

The target of the survey was to obtain a sample representative for Swiss car buyers (either brand-new or second-hand cars). We constructed a data set of car transactions out of governmental car registration data. This got us frequency distributions regarding age and geographical regions of car buyers, which were then used to draw a stratified sample out of the Swiss 2000 census data. We then compared our survey sample with the stratified sample out of the census data. The main results are that single households are underrepresented and that higher income/higher education households are overrepresented, as had to be expected. Therefore statistical analyses of the survey data can be considered as being representative for the entity of Swiss car buyers if they are stratified regarding, or including as independent variable, household type and degree of education.

5 Support for Environmental Policies: Descriptive Statistics

The total of respondents amounts to 1,581 of which 66% are male and 34% female. About 40% of respondents are aged 40 to 59 years, about 28% are 17 to 39 years, and 32% of the consumers were aged 60 or older. Applying a CHF/EUR exchange rate of 1.50, the median household earns EUR 4000 to EUR 5350 a month (see Table 5 and 6 in the Appendix). The subsample of those households intending to buy a brand-new car has median monthly earnings of EUR 5350 to EUR 6650.

90% of the respondents possess a driving license and 86% are active car drivers. The majority does not participate in car sharing (95%). About 60% of respondents drive to work. 40% of the consumers do not possess some kind of subscription/season ticket for public transport. Most consumers possess one car (55%), whereas 28% own two and 5% have three cars. 75% of respondents have already bought a car twice or more.

5.1 Car Purchase Plans

An energy labeling scheme for new cars at the point of sale, in analogy to EU directive 1999/94/EC, is in force in Switzerland since 2003. Cars are binned into seven categories from highly energy-efficient (A) to very inefficient (G). The underlying concept of energy-efficiency puts fuel consumption in relation to the curb weight of the vehicle, hence also mid-size cars may be eligible, though to a lesser extent, for the “A” label (de Haan et al. 2007).

When asked about the energy label of their latest car, 74% of respondents did not give an answer and 16% openly said that they do not know. 2% of consumers say it is labeled A and 3.3% claim that it belongs to category B. It should be noted, however, that only respondents having bought a brand-new car since 2003 could have been confronted with the new energy labeling scheme.

About 71% of the respondents are “definitely” or “likely” planning to buy a new car (either brand-new, or second-hand) within the next ten years; 10% reported definitely not to plan on buying a new car. Of those who are looking for a new car, two thirds will buy one either within the next two years (33%) or within the next three to four years (29%). For 86% of the consumers who will purchase a new car “definitely”, it is a replacement; only for 4% it is an additional vehicle. For 36% of the respondents who will buy a new car is it a necessity for getting to the workplace, 24% report to need it for their spare time, whereas 11% depend on it for doing (grocery) shopping.

All consumers (not only the ones planning on buying a car for sure and very soon) have been asked about their general preferences when purchasing a car. They had to depict the ranking of certain characteristics that are likely to affect the decision making process. The car size ranked first (26%) or second (27%) for 54% of consumers. 40% named fuel use as first (7%) or second (33%) priority. The emission level of regulated pollutants however meant first priority only to a smaller part of respondents (3%), it is ranked second priority for 10% of consumers.

61% of all consumers claimed to know the energy label with seven categories from A to G increasingly applied in the EU (and in Switzerland) for household appliances; however, only 26% have heard of energy labels on cars. Of those consumers who claimed to be buying a new car for sure, 35% of respondents reported that the energy label would be “important” for their purchase decision of a new car (“very important” is the highest category); almost half of the consumers who are going to acquire a vehicle with certainty were indifferent towards energy labels with regard to their purchase decision (47%).

A more detailed question assessed for which kind of consumption decision a premium would be an attractive policy: would a premium of ca. EUR 1350 induce consumers to purchase a car with a smaller engine or a smaller car in general? Here, different suggestions had to be evaluated on a five-rank ordinal scale. They could either choose “not useful at all”, “very useful” or something in between that was not named specifically in the questionnaire. In order to present our results, we give names to these categories as well: “not useful”, “indifferent”, and “useful”.

Altogether, no extreme responses were given; the share of respondents which “do not agree”, are “indifferent” or “agree” is very similar for the majority of suggestions. The following table summarizes the results (Table 1).

Table 1: Attractiveness of premium (share of respondents in per cent, adjusted)

<i>Policy suggestion</i>	<i>Do not agree at all</i>	<i>Do not agree</i>	<i>Indifferent</i>	<i>Agree</i>	<i>Agree absolutely</i>	<i>Obs.</i>
<i>Changing to smaller engine for premium.</i>	0	26	41	33	0	100% 694
<i>Changing to smaller car for premium.</i>	0	32	36	32	0	100% 714
<i>Premium would not affect my decision.</i>	0	36	35	29	0	100% 674
<i>Premium would induce me to buy additional features.</i>	0	31	46	23	0	100% 647
<i>I would change from gas to diesel for premium.</i>	0	23	46	31	0	100% 535
<i>For a premium, I would buy a fuel-efficient but larger car.</i>	0	28	42	30	0	100% 687

5.2 Responsibility for Environmental Protection

Consumers have been asked about which kind of policies they would give priority in order to reduce CO₂ emissions. This question is essentially an inquiry into whether consumers feel responsible themselves, or if they prefer car producers to take the lead in environmental issues (Schwartz, 1977; Stern et al, 1999). Table 2 depicts which share of consumers gave first priority to the respective suggestions. Consumers could name up to two suggestions as first priorities, therefore the rows do not add up to 100%. Those policies which demand the initiative of consumers have been given first priority by about one fifth up to more than one third of the consumers. Producers further improving the fuel efficiency of cars has however been seen as first priority for more than half of the respondents (58%). This suggests that consumers do not feel entirely liable for environmental damage brought on by their consumption acts, since a large share of the responsibility is instead attributed to producers.

Table 2: Consumer priorities (share of respondents in per cent, adjusted)

<i>Policy suggestion</i>	<i>...given first priority (%)</i>	<i>...given second priority (%)</i>	<i>...opposition to suggestion</i>
<i>Consumers driving less.</i>	34	22	11
<i>Less second or third cars.</i>	25	23	9
<i>Purchasing more fuel-efficient cars.</i>	30	35	2
<i>More consumers using "alternative" fuels.</i>	32	27	2
<i>Less SUVs.</i>	22	23	10
<i>Car producers building more fuel-efficient cars.</i>	58	22	2

5.3 Information Policies

In the following empirical analysis, we present some results from the survey and focus in particular on the support individuals give to either information-based policies or policies relying on financial/legal incentives. To begin with, respondents have been asked if they themselves would appreciate to receive more information on fuel-efficient or low-fuel cars, provided by the government or car manufacturers.¹⁴ Almost half of the consumers (48%) thought that they would appreciate to be better informed.

Respondents were also asked to evaluate the usefulness of different potential policy measures for achieving a reduction in fuel use on a five-rank ordinal scale (“not useful at all”, “not useful”, “indifferent”, “useful”, “very useful”). Respondents were asked how useful they considered it “to provide more information on the problem of high fuel use” (I.1) or “to provide more information on which cars are economic on fuel use and which are not” (I.2). Obviously, these questions differ in terms of their specificity. About one third of respondents evaluated I.1 as “very useful”. About one quarter was indifferent. Interestingly, there is also a share of consumers who reject further consumer education in terms of problem awareness (“not useful”, “not useful at all”) (see figure 2). This suggests that not so many consumers have given strategic answers. The very largest part of consumers wants to have more information on fuel-saving cars (I.2): about 54% of respondents chose the second highest category i.e. “useful”. Indifferent have been 33%.¹⁵

5.4 Financial Incentive Policies

As financial incentives, an increase in fuel prices had to be assessed (of EUR 0.13 per liter). It was suggested to increase the price of fuel alone (F.1), or alternatively, to increase the price of fuel in combination with a redistribution to consumers through a reduction of health insurance premiums (F.2). Almost half of the respondents thought that the increase in fuel prices alone is not useful at all (47%). Those who considered this a “very useful” policy on the contrary only amount to about 9%. No extreme answers are given to the second suggestion (F.2). In fact, 41% of the consumers showed indifference here.

Moreover, premiums for fuel-efficient cars had to be evaluated: should a premium be paid when purchasing a fuel-efficient car (F.3) or shall those who buy a fuel-intensive car have to pay a fine of about the same amount (F.4)? Almost 40% of the respondents were indifferent towards premiums (F.3); but about the same amount (39%) considered it “useful”. As in the case before, the largest part of respondents were indifferent (38%) towards a fine (F.4). Those consumers finding the measure in particular “not useful” amount to the same number as those finding it “useful” (30–32%).

¹⁴ In that part of the survey, the respondents have already learnt about the presence of the energy-label for new cars and of the availability of fuel consumption brochures (which exist in Switzerland in analogy to EU directive 1994/99/EC, making such brochures mandatory and free-of-charge in all member states).

¹⁵ We mean “effective” information i.e. information that reaches the consumer. In other words, we assume that a consumer who appreciates that more information will be distributed implicitly assumes that this is information which would reach her.

5.5 Interrelations between Information-based Policies and Financial Incentive Policies

Next we investigate how many consumers favor a mix of financial and information based policies. The two policy suggestions on information provision are slightly different: one is related to problem awareness more in general (I.1) whereas the other one is directly related to specific cars (I.2). In what follows, we concentrate on I.1. Studying consumer support for such type of information is a better indicator of environmental morale in contrast to support for information on fuel-efficient cars.¹⁶

Of those consumers who found I.1 very useful (one third of consumers) about 43% strongly opposed higher fuel prices (see Figure 2). Only 12% of those respondents who were very positive about information provision also supported higher fuel prices. This group makes up less than 4% of the total of respondents. Another 4% of total respondents are against both information and higher fuel prices.

These results differ quite substantially from the answers to the policy suggestion that combines higher fuel prices with redistribution to the consumers. No respondent judged this policy as “not useful at all” (also nobody considered it “very useful”), no matter what they thought about information provision. Most salient is that half of the consumers who very much favored information policy I.1 were indifferent towards redistributed higher fuel prices.

How do consumers evaluate premiums for efficient cars? No extreme answers were given here, both in the case of support for information provision and rejection of information policies; but a large part (i.e. 46%), although they had strong opinions about information policies (“very useful”), seems to be indifferent towards premiums. Those consumers who strongly support information provision and consider premiums as “useful” amount to about 8% of the total.

How do consumers evaluate fines for inefficient cars? The largest part of those consumers who were very positive about information (“very useful”) was indifferent towards fines (41%). Again, no extreme positions towards fines seem to exist. Consumers being very positive towards information and also open towards fines (“useful”) made up 8% of the total. Of those who have opposed information provision, 50% also consider fines as “not useful”. The latter finding suggests that probably not so many consumers have given strategic answers when filling out the questionnaire. This brings us to believe that the support expressed for information provision policies can be associated with intrinsically motivated individuals.

¹⁶ The latter one appeals to extrinsically motivated consumers as well.

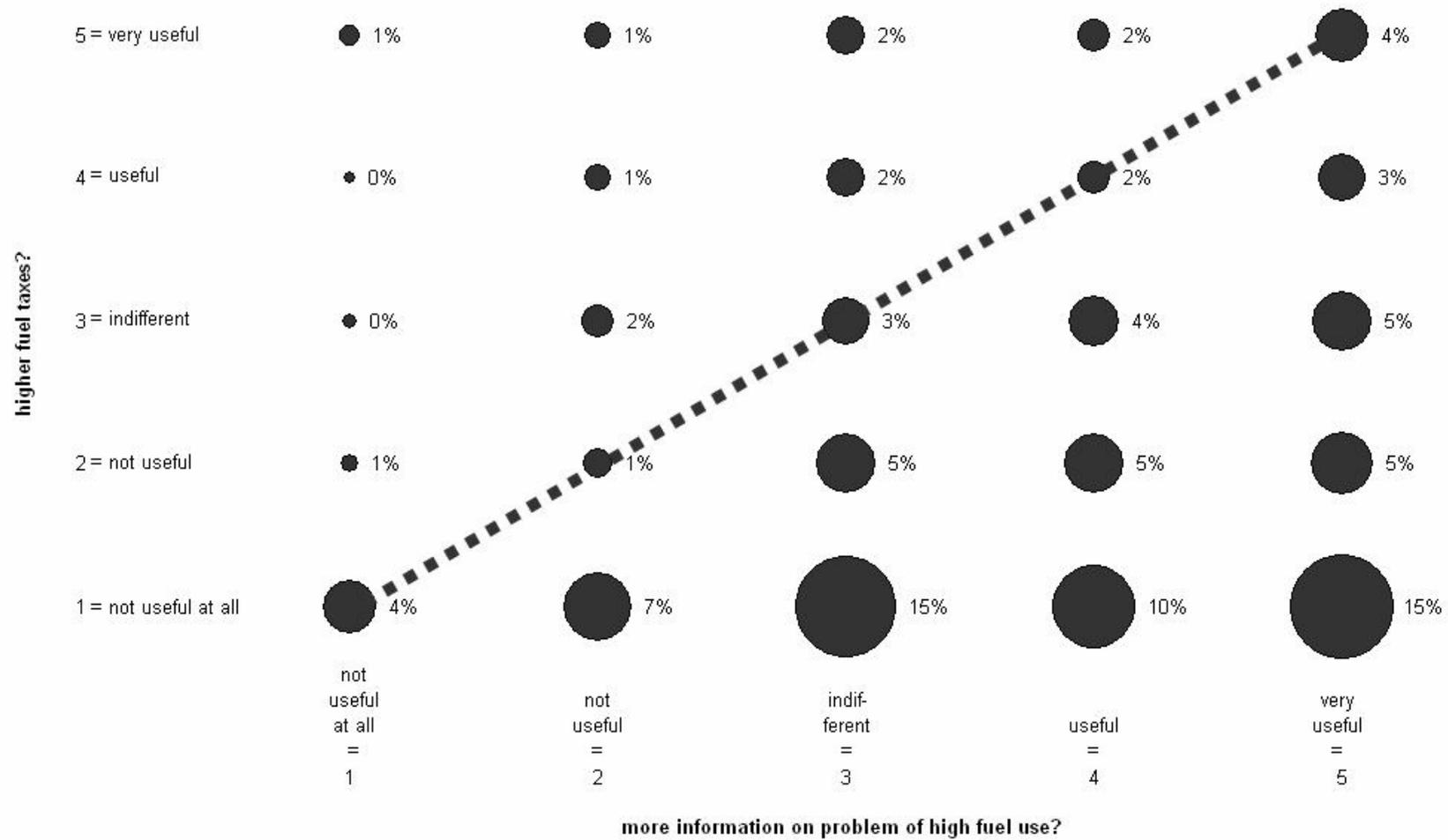


Figure 2: A cross-tabulation of consumer support for more information on high fuel use (an information-provision policy) and higher fuel taxes (a financial incentives policy).

6 Multivariate Analysis

6.1 Correlations

The correlation matrix of the seven dependent variables (three information policy variables and four financial policy variables) used in the following regressions is presented in Table 7 (Appendix 2).

There is a significant positive correlation between responses to information-based policies, although the correlations are not very large. Correlations between responses to the financial incentives-based policies are often positive and significant. Cross-correlations between responses to information- and financial incentives-based policies are often not statistically significant, and in two cases they are negatively related to each other at a statistically significant level. This suggests that those individuals that support information-based policies are not necessarily the same as those who support financial incentive-based policies. (We remind the reader that the questionnaire is constructed in such a way that a response for one policy has no immediate impact on responses concerning support for another policy, i.e. there is no implicit ‘trade-off’ between responses.¹⁷)

In addition, we generated an annual fuel cost variable¹⁸ and observed some interesting negative correlations with the seven other variables. Individuals with high annual fuel costs tend to oppose each of the suggested policies, not only the fuel taxes but also policies of information provision. The correlations are highly significant except in the case of opposition to cash incentives for buyers of efficient cars.

6.2 Multivariate Regressions

The aim of the following analysis is to determine the characteristics of consumers who express support for information-based or financial policies.

When doing regressions with a dichotomous dependent variable, we use the standard probit and logit models (robust for heteroskedasticity). For the other models, ordered probit regressions are preferable to OLS regressions in cases such as ours where the dependent variable is an ordered array of integers. We also use bootstrapped standard errors for extra precision in statistical inference.

Regression results are presented in Tables 8 and 9 (Appendix 4), and a list of variables can be found in Appendix 3. From a list of candidate variables, we retained explanatory variables that were either statistically significant or, failing that, of particular interest for this paper. The more explanatory variables we have, the fewer the number of observations, such that statistical significance of the regression coefficients becomes less likely. Furthermore, specific coefficient estimates are likely to vary slightly across specifications because of differences in sample composition associated with differences in number of observations.

¹⁷ In an attempt to group individuals into groups according to their support for information policies or financial incentive policies, we applied cluster analysis techniques. Preliminary explorations with hierarchical clustering methods, using several linkage techniques, appeared to be unable to make meaningful groups of individuals, however. This underlines the heterogeneity in responses in terms of the support individuals gave for the different policies.

¹⁸ This variable was constructed as follows: Out of all 1581 respondents, there are n=1216 respondents for which we have reliable car data, together with fuel consumption of most recent vehicle of the respective household in question, and also with fuel costs per 100 km and with fuel costs per year.

The main results of the multivariate regressions are shown in Table 3. To sum this up, Individuals display different reactions to information and financial incentive policies. While age is a significant determinant of support for information policies, age was not associated with support for financial incentive policies. Individuals with higher income were more favorable towards financial incentives policies but not for information provision policies. In what follows, we will show in more detail which type of consumer support which policy suggestions.

Table 3: Consumer Characteristics and Policy Support – Regression Results

Should manufacturers give more information on energy efficient cars?

Older individuals and females express support for this proposal. Less-educated individuals, also tend to support this policy. While those travelling to work by car were against it, those travelling by public transport expressed support. Individuals supporting the policy of raising fuel prices also were more likely to support this policy. Furthermore, it is interesting to observe that those individuals who indicated the energy label would play a role in their next car purchase decision were favorable to this policy.

More general information on how fuel consumption can be reduced?

Older individuals and women expressed support for this. Similarly, households with few children, as well as more educated individuals, supported this policy. Individuals who would appreciate having more information from car manufacturers (variable '*mehr_info*') as well as those supporting price increases for petrol supported this initiative. Individuals who indicated the energy label for cars would play a role in their next purchase decision supported this policy.

More information on which cars have high and low fuel consumption?

Opposition to this policy was expressed by older individuals (who incidentally are more likely to be buyers of brand-new cars). In contrast, individuals that spend a long time travelling to work were supportive of this. This policy was also supported by wealthier households, amongst others

Raising the price of fuel?

This policy received support from several groups: females, wealthier households, and those travelling to work by bike. It was opposed by those travelling to work by car, as well as those households with multiple cars. Individuals who supported the policy of producers giving more information also were likely to support this initiative.

Raising the price of fuel and redistribution by lowering health insurance premiums?

Women and wealthier households expressed support for this policy. (Oddly enough, those travelling to work by bike were relatively opposed to it.)

Incentive of EUR 650 up to EUR 1350 for buyers of energy efficient cars?

This policy was supported by wealthier households. It was opposed, *ceteris paribus*, by those who have already purchased a car during their lifetimes (and who therefore might have more experience of the car-buying decision!).

Fine of EUR 1350 for those with polluting cars?

This policy was supported by older individuals, which contrasts with earlier regressions (with *mns_infaut* as dependent variable) indicating that older individuals were relatively opposed to more information on the pollution levels of cars. This policy was also supported by wealthier households and by mobile individuals (likely to move in the near future).

Annual fuel cost is strongly negatively associated with support for either of the policies, which confirms our earlier results from the correlation analysis. One can easily understand why (self-interested) individuals with high fuel costs might oppose financial measures against car travel, but it is less clear why they are strongly opposed to information provision policies. After all, what would they lose from learning about energy efficient cars? One explanation, guided by the model in Section 3, is that individuals with high fuel costs are reluctant to raise awareness about the environmental consequences of high fuel consumption, for fear that higher awareness of these issues will be followed by stricter measures such as steeper fuel taxes. Another explanation could be that they simply consider environmental issues as unimportant. The most salient results are summarized in the following table.

Table 4: support for policies of information provision or fuel taxes.¹⁹

	More information?		Fuel taxes?	
	Probit		Ordered probit	
(log) age	0.2937	2.01	-0.0504	-0.44
	-			
sex	0.0313	-0.29	-0.0428	-0.49
Children	0.0546	1.19	0.0482	1.27
Income	0.0341	1.29	0.1154	5.04
	-			
Education	0.1725	-1.59	-0.1284	-1.44
	-			
Annual fuel cost	0.0002	-3.80	-0.0003	-4.93
Wald Chi ²	25.39		53.29	
R ²	0.0221		0.0216	
Obs.	893		945	

We conducted a further analysis to test in how far the support expressed for information provision policies can be associated with intrinsically motivated consumers. We found that subjective responses on the importance of the energy label in the choice of a new car were positively associated with support for information-provision policies, for two of our three dependent variables. This is an encouraging result, because it is consistent with the hypothesis that individuals who are genuinely concerned about the environment and are

¹⁹ Notes: Probit and ordered probit estimates, standard errors (and hence z-statistics) obtained after 1000 bootstrap replications. Coefficients significant at the 5% level appear in bold ink. 'More information?' refers to the question 'should manufacturers give more information on energy efficient cars (Yes=1) ? 'Fuel taxes?' refers to the reaction (on a five point scale, as before) to the proposal of higher fuel taxes. Sex: female = 0, male = 1. Children: persons under 18 in household. Income = household income (in categories). Education = completion of obligatory schooling (yes=1, no=0).

relatively well-informed of environmental issues tend to support information-provision policies. We did not detect any influence of this variable (importance of the energy label) on support for financial incentive policies, however.

7 Conclusions

In this paper we analyzed to what extent consumers are willing to support public policies promoting energy-efficient cars. We first contrasted voluntary pro-environmental behavior brought on by ‘intrinsic motivation’ to enforced compliance due to financial and legal incentives (extrinsic motivation) from a theoretical viewpoint. Taking car purchase decisions as an example, we then used survey data from 1500 Swiss households, to investigate the responses of consumers to proposals of information-provision and financial incentive policies. In line with our conjectures we observed significant consumer heterogeneity in terms of support for these policies.

It is usually taken for granted that public policies are welcome by some parts of the population but not by others. However, for the overall effectiveness of policy measures it matters to which extent which kind of motivations are present within a population. The descriptive study reveals the heterogeneity of consumer preferences for environmental policies, which is confirmed in both the correlation analysis as well as the multivariate regressions. In many cases, individuals that took a favorable stance towards one of the policies were less favorable to the other policy. Indeed, the two policies were not seen as complementary but had different appeal to different questionnaire respondents. In addition, the multivariate regressions showed that preferences for specific policies (information provision or financial/legal incentives) were related to specific consumer characteristics.

We leave for future research the analysis of the knowledge of environmental issues already possessed by individuals. It would be interesting to examine whether consumers with more knowledge of environmental issues act accordingly, and how they perceive effectiveness of information-provision policies. In addition, we would welcome more information on the role of consumer heterogeneity in the diffusion process, as well as longitudinal datasets describing the adoption of pro-environmental cars (as opposed to the cross-sectional dataset featured here).

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Appendix 1: Summary Statistics

Table 5: Household Size

<i>Number of persons</i>	<i>Frequency</i>	<i>Percent</i>	<i>Cumulative percent</i>
1	415	30.20	30.20
2	563	40.98	71.18
3	167	12.15	83.33
4	229	16.67	100.00
total	1,374		100.00

Table 6: Household Income

<i>Income</i>	<i>Frequency</i>	<i>Percent</i>	<i>Cumulative percent</i>
Less than 2000	21	1.54	1.54
2000-4000	168	12.33	13.87
4001-6000	323	23.70	37.56
6001-8000	302	22.16	59.72
8001-10'000	223	16.36	76.08
10'000-12'000	139	10.20	86.28
12'001-14'000	85	6.24	92.52
More than 14'000	102	7.48	100.00
total	1,363		

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Appendix 2: Table 7: Correlation matrix for the main variables.

	Info_1	Info_2	Info_3	Fin_1	Fin_2	Fin_3	Fin_4
Info_1	1						
	1264						
	1						
Info_2	0.3072	1			LEGEND:	Coeff.	
	0					p-value	
	1204	1444				Obs.	
	0.3155	1				(rank corr)	
	0					p-value	
Info_3	0.1905	0.3913	1				
	0	0					
	624	716	732				
	0.2001	0.3805	1				
	0	0					
Fin_1	0.1474	0.0912	0.004	1			
	0	0.0007	0.916				
	1210	1384	703	1445			
	0.1633	0.1041	0.0521	1			
	0	0.0001	0.1676				
Fin_2	0.0002	-0.0336	-0.1099	0.1744	1		
	0.9963	0.42	0.0524	0			
	505	579	312	574	589		
	0.002	-0.0171	-0.1139	0.1444	1		
	0.9646	0.682	0.0444	0.0005			
Fin_3	0.0295	-0.1019	-0.0197	-0.0249	0.0594	1	
	0.4519	0.0054	0.6774	0.4971	0.2665		
	653	745	447	746	352	772	
	0.0285	-0.1099	-0.028	-0.0041	0.0657	1	
	0.467	0.0027	0.555	0.9119	0.219		
Fin_4	-0.0044	0.0127	-0.046	0.148	-0.0263	0.0934	1
	0.9147	0.7445	0.374	0.0001	0.632	0.0461	
	585	660	376	661	335	456	680
	-0.0047	0.0025	-0.0453	0.1136	-0.0259	0.0885	1
	0.9106	0.9489	0.3807	0.0034	0.6362	0.0591	
Annual fuel cost	-0.1310	-0.1273	-0.1325	-0.1044	-0.1243	-0.0332	-0.1459
	0.0000	0.0000	0.0000	0.0004	0.0000	0.2567	0.0000
	1069	1136	1163	1146	1144	1170	1163
	-0.1390	-0.1550	-0.1383	-0.1437	-0.1529	-0.0416	-0.1534
	0.0000	0.0000	0.0000	0.0000	0.0000	0.1553	0.0000

Notes: Pearson correlations and Spearman rank correlations. Key: Info_1: Should manufacturers give more information on energy efficient cars? (Yes=1, No=0); Info_2: Support for more general information on how fuel consumption can be reduced (5=very useful, 1=not useful at all); Info_3: More information on which cars have high and low fuel consumption (5=very useful, 1=not useful at all); Fin_1: Support for an increase in fuel prices (5=very useful, 1=not useful at all); Fin_2: Raising the price of fuel and redistribution by lowering health insurance premiums (5=very useful, 1=not useful at all); Fin_3: Incentive of EUR 650 up to EUR 1350 for buyers of energy efficient cars? (5=very useful, 1=not useful at all); Fin_4: Fine of EUR 1350 for those with polluting cars? (5=very useful, 1=not useful at all). Correlations significant at the 5% level appear in bold ink.

Appendix 3: List of Variables

Dependent variables:

Mehr_info –	should manufacturers give more information on energy efficient cars?
Mns_inf_pr –	more general information on how fuel consumption can be reduced
Mns_infaut –	more information on which cars have high and low fuel consumption
Mns_hhpr –	raising the price of fuel
Mns_hhkk –	raising the price of fuel and redistribution by lowering health insurance premiums
Mns_prm –	incentive of EUR 650 up to EUR 1350 for buyers of energy efficient cars
Mns_abga –	fine of EUR 1350 for those with polluting cars

Independent variables:

Log_alter –	logarithm of age
Geschl – sex	(0 – female; 1 – male)
Hh_anzkin –	persons under 18 in household
Hh_breink –	household income categories
Ausb_obl –	completed obligatory schooling (yes/no)
Fuelcostannual –	This variable was constructed as follows: Out of all 1581 respondents, there are n=1216 respondents for which we have reliable car data, together with fuel consumption of most recent vehicle of the respective household in question, and also with fuel costs per 100 km and with fuel costs per year.
Aweg_zeit –	time spent traveling to work (categories)
Kauf_anz –	whether the respondent has previously bought a car
Lk_zeit –	time taken to choose a car
Wohn_5j –	likely to live in same address in 5 years (0 if same address, 1 otherwise)
Bedt_ee_korr –	knowledge of the energy label for cars
Nk_abs –	likelihood of buying a car in the next 10 years (0 (surely not) – 3 (certainly))
Hh_autos –	number of cars in household
Dummy_vm_fuss –	travel to work on foot (yes/no)
Dummy_vm_velo –	travel to work on bike (yes/no)
Dummy_vm_auto –	travel to work by car (yes/no)
Dummy_vm_tram –	travel to work on tram (yes/no)

Appendix 4: Regression Results

Table 8: Regression results for the information variables: coefficients and z-statistics. Regression results significant at the 5% level are shown in bold ink. All results bootstrapped with 1000 replications.

	mehr_info			mns_infpr		mns_infaut			Ord. Probit
	Probit	Probit	Probit	Ord. Probit	Ord. Probit	Ord. Probit	Ord. Probit		
log_alter	0.30503	0.22946	0.50930	0.19325	0.22840	0.04566	0.13167	0.28448	-0.34636
	2.03	1.15	1.39	1.43	1.49	0.16	1.06	1.97	-1.18
geschl	0.02147	-0.08544	0.10992	-0.11949	-0.11445	0.03758	-0.26270	-0.32506	-0.12167
	0.20	-0.70	0.61	-1.31	-1.13	0.25	-2.63	-2.90	-0.80
hh_anzkin	0.03960	0.04567	0.02952	-0.06775	-0.05653	-0.13148	0.00197	-0.00498	-0.07343
	0.83	0.89	0.39	-1.87	-1.44	-2.30	0.05	-0.11	-1.20
hh_breink	0.00055	0.05184	0.07459	0.00802	0.00166	0.03917	-0.03501	-0.04432	-0.03282
	0.02	1.67	1.59	0.34	0.06	0.97	-1.50	-1.75	-0.87
ausb_obl	-0.16584	-0.18123	-0.14517	0.15499	0.07089	0.08915	0.11839	-0.01030	0.10621
	-1.47	-1.39	-0.85	1.76	0.78	0.67	1.26	-0.10	0.74
fuelcostannual	-0.00020	-0.00022	-0.00023	-0.00007	-0.00011	-0.00007	-0.00006	-0.00018	-0.00013
	-3.23	-2.89	-2.40	-1.39	-1.91	-0.91	-1.09	-3.10	-1.64
aweg_zeit			0.08899			-0.04725			-0.01916
			1.19			-0.85			-0.34
kauf_anz			-0.20880			-0.02570			0.09535
			-1.50			-0.26			0.83
lk_zeit			0.08032			-0.01659			-0.01788
			1.60			-0.4			-0.4
wohn_5j			-0.01254			-0.01518			-0.10343
			-0.17			-0.24			-1.85
bedt_ee_korr			0.38810			0.21591			0.16486
			6.06			4.29			3.05
nk_abs			0.12582			0.08637			-0.00047
			1.01			0.96			0
hh_autos			-0.12994			-0.10075			-0.03267
			-1.14			-1.02			-0.33
dummy_vm_fuss		-0.04594			0.23983			-0.05829	
		-0.21			1.28			-0.33	
dummy_vm_velo		0.10625			0.02954			0.37086	
		0.61			0.21			2.34	
dummy_vm_auto		-0.15379			0.04303			0.13521	
		-1.00			0.37			1.07	
dummy_vm_tram		0.10072			-0.01535			0.05445	
		0.52			-0.1			0.36	
mehr_info				0.67352			0.77057		
				8.42			9.46		
mns_hhpr	0.14933			0.06197			0.05574		
	4.11			1.96			1.73		
R ²	0.0365	0.0308	0.1341	0.0434	0.0069	0.0260	0.0574	0.0242	0.0239
Obs.	859	675	395	838	695	383	848	706	390
Wald Chi ²	42.4800	24.69	66.61	103.12	12.82	30	118	44.38	22.19

Table 9: Regression results for the financial incentive dependent variables: coefficients and z-statistics. Regression results significant at the 5% level are shown in bold ink. All results bootstrapped with 1000 replications.

	mns_hhpr			mns_hhkk		
	Ord. Probit					
log_alter	-0.08999	-0.23524	-0.17692	-0.19158	-0.15094	-0.25321
	-0.70	-1.47	-0.59	-1.45	-0.98	-0.80
geschl	-0.07502	-0.16405	-0.01752	0.03275	-0.02679	0.00322
	-0.79	-1.47	-0.11	0.34	-0.26	0.02
hh_anzkin	0.04209	0.06410	-0.02873	0.05441	0.07276	0.05199
	1.13	1.48	-0.45	1.37	1.69	0.83
hh_breink	0.12984	0.12118	0.19657	-0.05180	-0.01419	0.05306
	5.13	4.18	4.51	-2.11	-0.52	1.29
ausb_obl	-0.13353	-0.11046	-0.16725	0.23754	0.18431	0.15654
	-1.44	-1.04	-1.19	2.49	1.61	1.06
fuelcostannual	-0.00026	-0.00020	-0.00029	-0.00012	-0.00019	-0.00018
	-4.24	-2.98	-3.09	-2.06	-2.83	-2.04
aweg_zeit			-0.03627			-0.03920
			-0.56			-0.64
kauf_anz			-0.18176			-0.05524
			-1.57			-0.47
lk_zeit			-0.01590			0.00006
			-0.35			0.00
wohn_5j			-0.05338			-0.05279
			-0.92			-0.86
bedt_ee_korr			0.21504			0.01409
			3.56			0.27
nk_abs			-0.08533			-0.16497
			-0.78			-1.52
hh_autos			-0.27591			-0.15956
			-2.46			-1.50
dummy_vm_fuss		0.11244			0.00341	
		0.69			0.02	
dummy_vm_velo		0.15942			0.00004	
		1.10			0.00	
dummy_vm_auto		-0.13070			0.05531	
		-0.95			0.45	
dummy_vm_tram		0.12703			0.46098	
		0.79			2.97	
mehr_info	0.33914			0.09678		
	3.98			1.17		
mns_hhpr				0.44797		
				11.97		
R ²	0.0330	0.0282	0.0699	0.0915	0.0176	0.0204
Obs.	859	691	384	838	690	386
Wald Chi ²	57.94	45.76	49.75	181.74	34.03	17.5

Table 9 (continued): Regression results for the financial incentive dependent variables: coefficients and z-statistics. Regression results significant at the 5% level are shown in bold ink. All results bootstrapped with 1000 replications.

	mns_prm			mns_abga		
	Ord. Probit	Ord. Probit	Ord. Probit	Ord. Probit	Ord. Probit	Ord. Probit
log_alter	-0.48748	0.3742007	-0.53706	0.00980	-0.12065	-0.24883
	-3.82	-2.45	-1.80	0.07	-0.77	-0.91
geschl	0.09643	0.0967739	0.19483	0.24326	0.10520	0.20718
	1.08	0.96	1.32	2.66	1.06	1.37
hh_anzkin	0.04434	0.04733	0.06379	-0.02090	0.01555	0.01099
	1.23	1.2	1.23	-0.54	0.39	0.18
hh_breink	-0.02237	0.0154065	-0.00262	-0.03295	0.05113	0.09593
	-1.00	-0.6	-0.07	-1.35	2.03	2.49
ausb_obl	0.14133	0.1704055	0.22984	0.03037	0.06092	0.00955
	1.57	1.67	1.70	0.33	0.57	0.07
fuelcostannual	-0.00004	-0.000076	-0.00010	-0.00016	-0.00021	-0.00014
	-0.68	-1.33	-1.17	-3.03	-3.63	-1.76
aweg_zeit			0.07619			-0.03663
			1.34			-0.67
kauf_anz			-0.13791			0.01296
			-1.26			0.13
lk_zeit			-0.03133			-0.01462
			-0.74			-0.36
wohn_5j			-0.07232			-0.04004
			-1.22			-0.65
bedt_ee_korr			0.08440			0.17037
			1.65			3.31
nk_abs			0.05194			-0.18595
			0.53			-1.92
hh_autos			-0.04993			-0.31901
			-0.54			-3.45
dummy_vm_fuss		0.1358441			0.09376	
		-0.83			0.58	
dummy_vm_velo		-0.272252			0.02457	
		-1.84			0.19	
dummy_vm_auto		0.0776065			0.06793	
		-0.61			0.63	
dummy_vm_tram		0.1373833			0.19060	
		0.89			1.36	
mehr_info	0.27512			0.31510		
	3.45			4.09		
mns_hhpr	0.04858			0.27027		
	1.52			7.84		
R ²	0.0142	0.0088	0.0209	0.0477	0.0089	0.0348
Obs.	850	701	390	848	700	388
Wald Chi ²	34.74	18.86	23.15	116.7	20.11	41.44