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Working Paper 19/316
March 2019

Economics Working Paper Series

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

The Impact of Policy Awareness: Evidence from Vehicle Choices Response to Fiscal Incentives

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March 22, 2019

Abstract

Isolating the role of limited knowledge, psychological frictions and policy characteristics is key when evaluating a public program and designing future policies. This paper explores the role of awareness about the presence of fiscal programs in determining their impact on individual choices. Our identification strategy exploits quasi-experimental variation in the introduction of fiscal incentives aimed at promoting the purchase of energy efficient vehicles, and a direct measure of policy awareness at the individual level. We find an important impact of awareness on consumers' vehicle choices, highlighting that limited awareness may represent a critical barrier to the effectiveness of public programs.

Keywords: Policy awareness; Fiscal programs; Environmental taxation; Vehicle choices
JEL codes: D12, D83, H23, H31, Q48

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This research is also part of the activities of SCCER CREST, which is financially supported by the Swiss Commission for Technology and Innovation (CTI) / Innosuisse.

1 Introduction

The proper design of policy measures crucially relies on the understanding of the reasons why some programs work while others do not. The effectiveness of a public program might be limited for several reasons, ranging from flaws in the incentive scheme to barriers related to the individuals' decision making process such as limited information, low program awareness, stigma, inattention, and other behavioral failures. The role of these factors have been discussed, for instance, in the context of the take-up of tax credits, subsidies for saving accounts, food stamps, Social Security, health insurance and environmental policies (Benartzi and Thaler, 2007, Congdon et al., 2009, DellaVigna, 2009, Gillingham et al., 2009, Chetty et al., 2014, Madrian, 2014, Bhargava and Manoli, 2015, Chetty, 2015, Allcott, 2016). One key challenge for academics and policy makers is to isolate the impact of a single potential factor on the (lack-of) individuals' response to economic incentives.

In this paper, we aim at identifying the impact of awareness about the presence of a fiscal policy in determining its impact on individual choices. Clearly, only those individuals in the target population that are aware about the existence of a specific public program may incorporate its incentives in their decision making process and possibly respond to its introduction. However, the mere knowledge of the existence of the fiscal measure is not sufficient to guarantee that the policy reaches its desired goals in the presence of inadequate incentives, low salience, or behavioral or psychological biases in the individuals' decision making process. Nonetheless, failing to properly consider the role of low policy awareness might have consequences for the evaluation of a program and the design of future policies. Policy makers might indeed conclude that the low effectiveness of a program is due to limitations in its design or other behavioral failures, even though its limited outcomes are only due to the lack of adequate knowledge among the target population. Moreover, corrective non-price interventions can have an equivalent effect than sizable price changes at a fraction of their cost (Allcott and Mullainathan, 2010, Bertrand et al., 2010).

To assess the consequences of limited policy awareness on individuals' responses to fiscal incentives, we consider the case of vehicle taxes on consumers' choices in Switzerland. As in many other European countries, Swiss drivers have to pay each year a tax on car ownership - also known as registration tax. The local administrative areas (cantons) are free to set the structure of the tax. In addition, some cantons introduced a Bonus/Malus system based on vehicle energy efficiency or CO_2 emissions. A bonus (malus) applies to very energy efficient (inefficient) cars and provides a sizable percentage discount (increase) to the baseline registration tax. Because the incentives are applied automatically to the baseline vehicle tax, this policy is particularly well suited to study the role of policy awareness as we can rule out

the role of transaction costs to access the fiscal benefits.

The Bonus/Malus system provides consumers with incentives for the purchase of efficient vehicles.[1] To estimate the causal effect of individuals' awareness on vehicle choices, we exploit the variation in the introduction of the Bonus/Malus system across cantons and over time, as well as the availability of a direct measure of policy awareness both in the presence and in the absence of the policy. Isolating the role of awareness about the features of the vehicle registration tax scheme in Switzerland provides insights beyond the specific context because it sheds light into the relative importance of different potential factors as barriers to individuals responses to fiscal incentives.

We use data from the Swiss Household Energy Demand Survey (SHEDS), held in 2018 with a representative sample of Swiss individuals. The data include detailed information on respondents' characteristics, their households, as well as their main vehicle. We also ask respondents whether they knew, at the time they bought their main car, if the registration tax in their canton of residence was based on fuel efficiency rating and/or CO_2 emission rate, and define as "policy aware" respondents who answer correctly. Around 42% of respondents do so.

Our main finding is that policy awareness plays a prominent role to understand consumers' response to the fiscal incentives set by the Bonus/Malus system. In fact, while ignoring policy awareness would lead to conclude that such measures are ineffective, we find that awareness about the presence of the incentives has a relevant impact on individuals' vehicle choices when the incentives are in place. Following the introduction of the Bonus/Malus system, policy awareness induces individuals to buy more fuel efficient and newer vehicles. This result is robust to a series of different specification checks, to the addressing of compositional differences between aware individuals in treated and control cantons, and is confirmed by an IV strategy that we exploit to deal with the potential endogeneity of awareness. These results inform policy makers about the potential boost in individuals' response from increased program awareness, providing an upper bound of the impact of information campaigns complementing the introduction of future policies.

Starting from Simon (1955), a large literature in economics has attempted to relax the traditional assumption of individuals taking decisions under full information. Less attention though has been devoted to considering the role of lack-of knowledge in the context of the evaluation of public programs. Our paper is related to a recent literature that considers the role of limited information on the individuals' responses to public policies (Mastrobuoni, 2011, Kling et al., 2012, Chetty and Saez, 2013, Bhargava and Manoli, 2015, Liebman and

[1] Throughout the paper we refer to both vehicles with high fuel efficiency rating and low CO_2 emissions as *energy efficient* cars.

Luttmer, 2015). This literature typically uses information treatments to study the impact of limited knowledge about the characteristics of a policy measure on individuals' choices. However, the effectiveness of an information treatment in influencing behavioral responses to the incentives of a public program depends on whether the intervention affects the actual level of individuals' knowledge about the policy. The process through which knowledge about a policy measure is shaped is largely unknown (as discussed, e.g., by Chetty and Saez 2013). In fact, several factors might hinder this process, including the initial level of understanding about the policy, the program's complexity, the financial literacy of treatment recipients, and the type and framing of the information provided. We abstract from using a specific information treatment, while exploiting an explicit measure of knowledge about the presence of a program that allows to rule out other factors influencing the process of knowledge accumulation. Heterogeneity in knowledge about the presence of the public program might reflect into substantial improvements in the effectiveness of the existing policy framework given an appropriate information treatment.

Using a descriptive analysis of the survey data carried out following their main experiment, Bhargava and Manoli (2015) have already suggested that low program awareness may be one of the possible barriers to the take-up of fiscal benefits. Our main contribution in this paper is to isolate the causal effect of awareness about the presence of a fiscal program on individuals' responses from that of other potential behavioral factors or policy characteristics influencing individual choices.

This work is also largely complementary to the paper by Chetty et al. (2013), who estimate the impacts of the Earned Income Tax Credit in the US on labor supply exploiting variation of knowledge at the local level. Although they recognize that, ideally, one would want to use a direct measure of knowledge at the individual level, they proxy for knowledge using an indirect measure at the local level of individuals' residence. In contrast, we exploit a direct measure of policy awareness at the individual level to estimate the impact of fiscal incentives on vehicle choices. To our knowledge, we are the first to use an explicit, direct measure of awareness about a specific public program to study the implications for its effectiveness. We argue that the concept of awareness is distinct from other behavioral anomalies, like salience.[2]

Finally, we contribute to the growing literature on the effects of environmental taxation

[2]The difference between awareness and salience is clear when considering contexts where low salience has been found to play a role as, for instance, automatic road tolls and sales taxes analyzed by Finkelstein (2009), and Chetty et al. (2009), respectively. While individuals might process partially the information about the existence of a toll or a sales tax when taking a decision due to their low visibility (low salience), it is very likely that they would still recognize their existence when explicitly asked about it. In our context, the concept of salience would apply only to the fraction of aware individuals that acknowledges the presence of the policy measure.

and information on vehicle choices (D'Haultfœuille et al., 2014, Klier and Linn, 2015, Alberini and Bareit, 2017, Alberini et al., 2018, Grigolon et al., 2018, Allcott and Knittel, 2019, Cerruti et al., 2019). We show a large lack of awareness by consumers about the presence of tax incentives for the purchase of an energy efficient vehicle. We highlight that limited knowledge might represent a substantial barrier to the effectiveness of vehicle taxes in influencing vehicle purchases.

The rest of the paper is organized as follows. Section 2 sketches a simple model to consider the role of lack-of program awareness in the consumers' decision making process. In Section 3 we describe the Bonus/Malus system in Switzerland. Section 4 presents the data, the measurement of awareness and descriptive evidence. In Section 5 we discuss the identification strategy we exploit for the impact of awareness and present the empirical results. Section 6 concludes.

2 Policy awareness and fiscal policy

In this work we wish to analyze the role of limited policy awareness in the evaluation of policy measures. We consider the introduction of fiscal incentives to promote the adoption of energy efficient cars. This section sketches a simple theoretical framework to highlight how limited awareness about the presence of tax incentives to promote the purchase of energy efficient vehicles can affect consumers' decisions.

2.1 Vehicles purchase and awareness about fiscal incentives

We consider the decisions of consumers with respect to the purchase of a new vehicle in the presence of limited awareness in a framework that is similar to DellaVigna (2009) and Allcott et al. (2014). The consumer draws utility from the mileage she is going to drive each year m and other cars characteristics X (such as car engine, number of doors etc.), and disutility from fuel costs (which depend on the vehicle's fuel efficiency f and the fuel price c), vehicle registration tax - to be paid each year a car is owned - τ and upfront costs P.

The consumer then chooses the vehicle i that maximizes her utility over the car's lifetime L. Assuming separability in utility between vehicle's characteristics and vehicle's costs, we can write the problem of the consumer as follows:

$$\max_i V^i = \sum_{l=1}^{L} [u(m_{i,l}, X_i) - cf^i m_{i,l} - \tau_l] - P(f^i) \tag{1}$$

Assume for simplicity that there are only two types of cars in the consumer's choice set, characterized by different levels of fuel efficiency A and B, with $f^A < f^B$. We also

assume that the two cars provide the same flow of utility ($u(m_A, X^A) = u(m_B, X^B)$) such that the decision of purchase only depends on the comparison of total life-cycle costs.[3] In the absence of incentives towards the adoption of fuel efficient cars ($\tau^A = \tau^B$), it is trivial to show that an optimizing consumer will choose the car with higher fuel efficiency A only if $L(cf^B m_B - cf^A m_A) > P^A - P^B$, that is if the savings in the driving costs over the vehicle's lifetime associated with greater fuel efficiency (what Allcott et al. 2014 call "gross utility gains" from energy efficiency) more than compensate the larger upfront costs.

We consider a policy maker introducing a discount D^A to the registration tax of a car with fuel efficiency f^A. In the presence of the fiscal incentive, an optimizing consumer will choose the fuel efficient car A only if:

$$L(cf^B m_B - cf^A m_A) + L\tau D^A > P^A - P^B \tag{2}$$

Several behavioral and psychological biases can influence individuals' valuation of the savings coming from fuel efficiency, and then the effectiveness of the discount to the registration tax to increase the adoption of efficient vehicles. In particular, individuals can correctly evaluate the savings coming from adopting a vehicle with fuel efficiency A if: (i) they have the energy-related knowledge (i.e. they can correctly evaluate fuel efficiency - $f^A \neq f^B$ - and fuel prices) and skills to perform an investment calculation (Blasch et al., 2018); (ii) they have no present bias (such that they do not value the future stream of fuel cost and registration tax savings); (iii) they have no limited attention due to salience bias (DellaVigna, 2009); (iv) they are aware about the existence of the policy measure.

In the presence of the discount, a misoptimizing consumer will then choose the efficient vehicle A only if:

$$\Gamma(L(cf^B m_B - cf^A m_A) + L\tau\eta^P D^A) > P^A - P^B \tag{3}$$

where Γ is the standard valuation weight in the presence of behavioral and psychological biases (i) to (iii), and η^P is an indicator for whether a consumer is aware about the presence of the discount ($\eta^P = 1$), or not ($\eta^P = 0$).

Although only the consumers that are aware about the existence of the discount ($\eta^P = 1$) might respond to its introduction, separating the effect of limited policy awareness from that of other potential behavioral failures (i) to (iii) is key in the design and evaluation of this policy measure. In this work we use a direct individual measure of consumers' knowledge about a specific feature of the fiscal scheme to disentangle the role of policy awareness from

[3]Clearly, as in (Allcott et al., 2014), the intensive margin m_i is endogenously determined in the optimization problem and typically depend on the vehicle fuel efficiency. We take mileage as determined in a first step of the maximization problem.

that of alternative psychological biases.

Clearly, the presence of policy awareness may interact with other behavioral anomalies. Two remarks are worth making. First, although (lack-of) policy awareness and limited attention due to salience bias are observationally equivalent, they are two separate concepts with different policy implications. In fact, in the presence of salience bias, a consumer will choose the efficient vehicle A only if $(L(cf^B m_B - cf^A m_A) + L\tau\eta^P(1-\theta)D^A) > P^A - P^B$, where $\theta = \theta(S)$ is a function of the salience of the discount and indicates the degree of limited attention, as in DellaVigna (2009). While policy unaware consumers ($\eta^P = 0$) do not know about the existence of the discount D^A, consumers with limited attention see the discount but then process the information only partially (DellaVigna, 2009). Second, we do not exclude that, in the presence of other behavioral biases that keep consumers from making an investment calculation, awareness about the policy measure might still enter the individuals decision making process through the usage of heuristics.

In the next sections we describe how we exploit heterogeneity in registration taxes in Switzerland and information on knowledge about fiscal incentives for the purchase of energy efficient cars at the individual level to identify the impact of awareness on the effect of these fiscal policy measures.

3 Institutional context

As in many other European countries, car owners in Switzerland have to pay a vehicle registration tax each year. The amount of these taxes is substantial. For instance, the median annual tax on a vehicle bought in 2015 is around 362 CHF, which compares to the median vehicle sale price of about 33'000 CHF. The amount to pay typically depends on vehicle weight, engine size, and engine power, so that larger and more powerful cars pay more. Registration tax rates are not set by the central government: each of the 26 administrative areas of Switzerland (known as cantons) are free to introduce their own scheme.

Between 2005 and 2013, some cantons have introduced a Bonus/Malus incentive system in addition to the regular vehicle tax: generally, while driving a fuel efficient or low CO_2 emission vehicle might guarantee a percentage discount to the baseline registration tax (bonus), driving a fuel inefficient or high emission car might increase the registration tax by a certain percentage (malus).[4] Among the 26 cantons in Switzerland, seventeen introduced some vehicle registration tax incentives based on fuel efficiency, CO_2 emissions, or

[4] All cantons that applied a malus system to the registration tax, also applied discount for efficient or low emission cars. Three cantons introduced a Bonus/Malus system based on fixed monetary amounts instead of percentage discounts/penalties.

both. Appendix A provides details about the incentive scheme, and its differences across local admninistrative areas.

The registration tax incentive is based on the energy efficiency rating of the car in seven cantons, on the CO_2 emission rate in other seven, and on both criteria in other three cantons. Two cantons adopted a bonus system and then abolished it. While, in most cases, the bonus component of the tax applies only for three or four years after the purchase of the car, the malus component applies for the entire lifetime of the vehicle. The incentives associated with the Bonus/Malus system can be considerable. The discounts to the baseline vehicle tax range from 40% to 100%, while the penalties range from 10% to 50%.

As mentioned earlier, there are two possible criteria used to define which cars are affected by the Bonus/Malus. The first is the CO_2 emission rate, expressed in grams per 100 km, while the second is the energy efficiency rating. There are seven categories of energy efficiency rating, from "A" (most efficient) to "G" (least efficient), and each vehicle is assigned to one rating based on its fuel consumption per 100 km and its weight. Both CO_2 emissions and the energy efficiency rating of a vehicle are listed in its energy label (see Figure 5 in Appendix A). The energy label is assigned to each vehicle on sale in Switzerland and is accessible to consumers before purchasing a car. Contrarily to the registration tax, the information displayed in the energy label and the criteria used to assign the efficiency rating of a vehicle are set by the Swiss federal government and thus are the same in all cantons. The criteria for the application of the Bonus/Malus incentives are different in each canton. However, most cantonal incentive schemes share some common characteristics. For instance, the application of the bonus or malus based on CO_2 emissions to the registration tax depends on whether the vehicle emission rate is below or above a certain threshold, respectively. In the case of the efficiency bonus, a vehicle must have a rating equal to A or B to be eligible. Finally, in most cantons, the age of the car cannot exceed a certain limit (3 or 4 years old) to benefit from a registration tax discount.

Importantly, any discount or penalty to the registration tax is applied automatically when the consumers pay the registration tax every year. Therefore the scheme does not require an application by the consumer, who is affected by the discounts and the penalties regardless of her level of knowledge about the features of the registration tax. This characteristic of the fiscal policy allows to rule out the role of transaction costs in the consumers' decision making process when studying the impact of policy awareness.

4 Data and the measurement of awareness

4.1 Data

We use data from the Swiss Household Energy Demand Survey (SHEDS), an annual survey collecting data on a sample of about 5000 households representative of the French and German speaking Swiss population of 25 cantons (excluding the Italian-speaking canton of Ticino).[5] Details about the information used in the main analysis, and the construction of the final sample are provided in Appendix C.

Most of the information we use comes from the 2018 wave of the SHEDS survey, while some additional data comes from waves 2016 and 2017.[6] The 2018 sample contains 5011 households. Among those, 3621 (72.26%) owned at least one car. Car ownership distribution in our data looks very similar to what has been found by official statistics from the Swiss government.[7]

The survey collects detailed information on respondents' socio-economic characteristics and their main vehicle. Data on standard socio-economic characteristics, such as age, education, language and household income, are complemented by a rich set of information on environmental attitudes, values and social norms, life values, trust regarding advice on energy saving provided by various subjects (neighbours, government institutions, environmental organizations), membership to environmental clubs, voting preference for the green party, energy literacy and financial literacy (as in Blasch et al. 2018 and Lusardi and Mitchell 2014).[8] Information on canton of residence and living area are also available.

Moreover, the survey asks respondents to report information on their vehicle fuel consumption per 100 km, its energy efficiency rating (from A to G), year of purchase and year of first registration. Most of the respondents (94.53%) were able to provide information on fuel consumption per 100 km. On the other hand, only a small fraction of the respondents with at least one car (41.62%) provided information on the energy efficiency category of their

[5]The full text of the questionnaire, and information on how to get access to the data, can be found on https://www.sccer-crest.ch/research/swiss-household-energy-demand-survey-sheds/.

[6]Some questions are asked only the first time an individual participates to the survey, and are not asked again in the following waves. Regardless, the most relevant information for our analysis and baseline socioeconomic characteristics have been collected in the 2018 wave. In particular, because the key question about policy awareness has been asked only in 2018, we restrict the sample to individuals that have been interviewed in 2018.

[7]In our sample, 27.74% of households do not have a car, 45.52% have one, 22.13% have two and 4.61% have three or more. A 2015 survey by the Swiss Federal Statistical Office found these shares to be 22%, 49%, 23% and 6% respectively (Swiss Federal Statistical Office, 2017, p. 11).

[8]Some of the questions on environmental attitudes and literacy are asked only to new respondents. Thus, those questions might have been asked in the 2016 or 2017 wave for people who participated to the questionnaire more than once. Questions on baseline socio-economic characteristics, vehicle fuel economy, and policy awareness were all asked in the 2018 wave.

main vehicle.[9]

We use fuel consumption per 100 km as main outcome variable in the empirical analysis. In fact, fuel consumption rate is strongly correlated with the efficiency rating and, within fuel type, exactly proportional to CO_2 emissions per km. In Appendix B, using the population of Swiss cars, we show that the distribution of actual fuel consumption is matched well by that of the self-reported fuel consumption, and provide descriptive evidence about the association of fuel consumption with efficiency rating and CO_2 emissions.

In the paper we also use the available information on efficiency rating to confirm our main findings. Because of the low response rate on this question, substantial selection might arise from using this outcome variable and thus we prefer to use the self-reported fuel consumption as main outcome.

From the 3621 respondents of our sample with at least one vehicle, we further drop 30.84% of the observations with missing values for any of the variables used in the empirical analysis.[10] The final sample used in the analysis includes 2504 observations.

4.2 Measuring policy awareness

We elicit information about respondents' policy awareness about the presence of the registration tax incentives for efficient cars using a survey question. We ask respondents whether they knew, at the time they bought their main car, if the registration tax in their canton of residence was based on fuel efficiency rating and/or CO_2 emission rate. The exact phrasing of the question is "*At the time you bought your main car, did you know if in your canton the annual registration tax depended on the level of fuel efficiency and/or on CO_2 emissions of the cars?*". The possible answers are "*Yes, it depended on the fuel efficiency or on CO_2 emissions*", "*No, it did not depend on the fuel efficiency or on CO_2 emissions*" and "*I do not know*".

The policy awareness question does not ask about specific characteristics of the Bonus/Malus, or even mentions the terms "bonus" or "malus".[11] Our aim is to capture even vague awareness about the presence of the tax incentives, rather than the respondents' knowledge of the

[9]The share of missing answers decreases when the car was bought in recent years, suggesting that information about the efficiency rating might be only available at the time of purchase. Nevertheless, only 50.0% of respondents who bought a car in 2017 reported the efficiency rating.

[10]In Appendix C are reported details about the sample selection. The number of missing values is especially relevant for household income (14.94 %) and financial literacy (11.18%). Financial literacy presents a substantial number of missing values because these questions were not asked to respondents surveyed in both 2016 and 2018, but not in 2017. All the results in this paper hold when omitting household income and financial literacy from the set of controls or when adding a "missing answer" category and including the missing observations in the analysis.

[11]Registration taxes can be based on engine size, vehicle power, or weight, but only the Bonus/Malus is an explicit and direct link between the tax amount and the efficiency rating or the CO_2 emission rate.

details of the registration tax scheme. This allows us to capture the potential role of policy awareness without excluding some potential mechanisms through which this knowledge affects the vehicle choice. Furthermore, asking explicitly about the presence or the absence of the incentives allows us to distinguish between policy aware and not aware individuals also in cantons that never introduced a Bonus/Malus scheme on top of their registration tax.

Our measure of policy awareness combines information coming from the respondents' answer to the awareness question and the presence of the Bonus/Malus in their canton of residence at the time of purchase of the car. We classify as "policy aware" those respondents who answered "yes" and who bought a car in a canton that has introduced some registration tax incentives, when those incentives were in place. Respondents who bought a car when the incentives were not in place and who answered "no" have also been classified as "policy aware". All other respondents were classified as not aware.

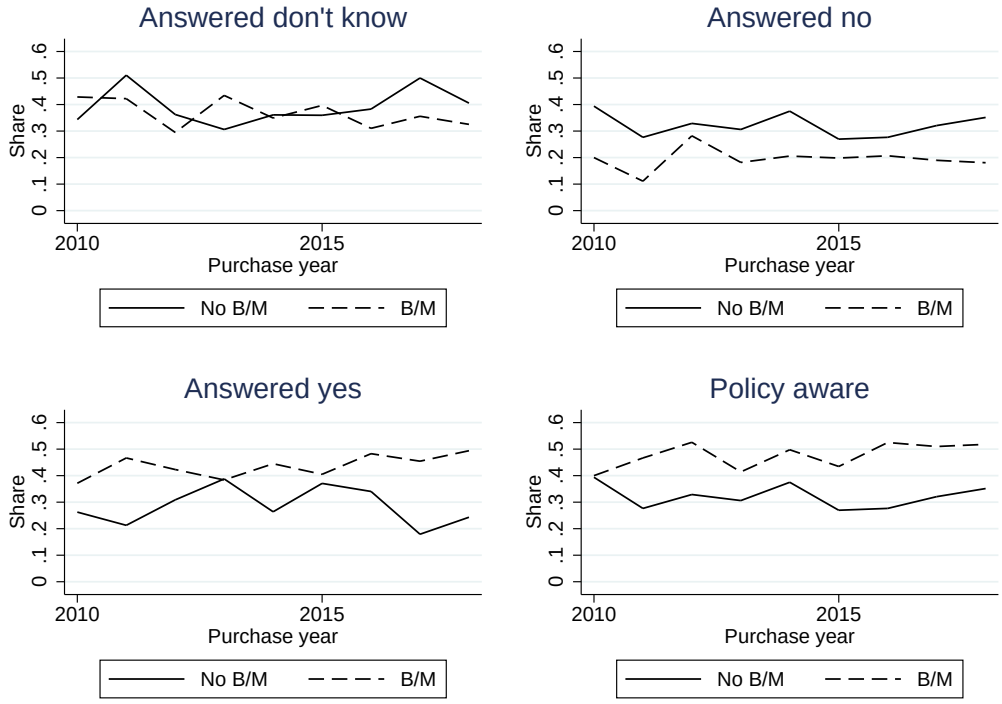
Policy awareness in the data A substantial share of respondents could not answer correctly to our policy awareness question. We find that about 42.21% of the individuals in our sample are classified as "policy aware" according to our definition. About 37.81% of respondents answered "don't know", while 19.96% gave the wrong answer. Figure 1 shows the evolution of answers to policy awareness question and the share of policy aware individuals, based on the year in which respondents bought their main car and whether a Bonus/Malus was in place.[12] While answers do not seem to change dramatically over purchase years, we observe that respondents are more likely to answer "no" if they bought the car in absence of the incentives, and "yes" if they were present.

Policy awareness and vehicle characteristics To illustrate differences in vehicle fuel consumption among our groups of interest, in figure 2 we compare its distribution between cars bought when a Bonus/Malus scheme was in place and when not, distinguishing between aware and non-aware respondents, and between incentives based on CO_2 emissions and efficiency rating. When a Bonus/Malus is in place, we observe a shift towards the left of fuel consumption distribution for the group of aware respondents.

We also want to see if there is a correlation between awareness under a bonus and vehicle age at purchase time. Because in many cantons eligibility to discounts to the registration tax depends also on the age of the car, there are two mechanisms why a person responding to the incentives might buy a newer car. First, newer cars are on average more efficient and with lower emissions and thus are more likely to be eligible for a bonus or not affected by a malus. Second, newer cars can become eligible to the bonus, or remain eligible for a longer

[12] We include only years from 2010 as most vehicles were bought starting from that period.

Figure 1: Answers to policy awareness question



period of time, compared to older cars with the same efficiency rating and CO_2 emissions.

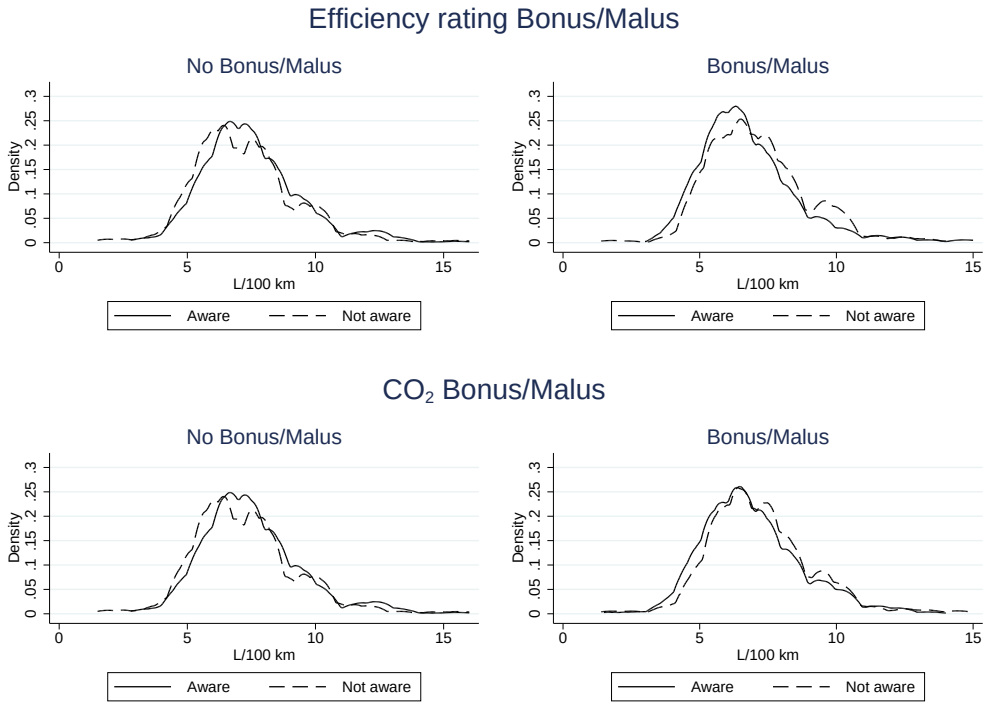
Similarly to figure 2, in figure 3 we show the different distribution of car age at purchase time.[13] Vehicle age distributions between aware and non aware individuals in the absence of fiscal incentives are almost overlapping while, in the presence of a Bonus/Malus system, we observe a much higher frequency of new cars being purchased by policy aware individuals.

Policy adoption, awareness, and respondents' characteristics We are also interested in whether respondents' characteristics are correlated with policy adoption and policy awareness. The presence of compositional differences between groups of individuals defined by their policy treatment and awareness status might indeed inform about possible selection patterns. Appendix D contains various tables reporting mean values between different groups of respondents for the variables used in the main analysis.

First, we want to check how different are respondents living in cantons that have introduced the fiscal incentives to promote efficient cars at some point in time, and respondents living in cantons that never had (Appendix D, tables 16, 18, 20, 22, 24, 26, 28, 30, 32, 34).

[13]We calculate vehicle age at the time of purchase as the difference in years between date of purchase by the respondent and date of first registration.

Figure 2: Policy awareness and fuel consumption distribution

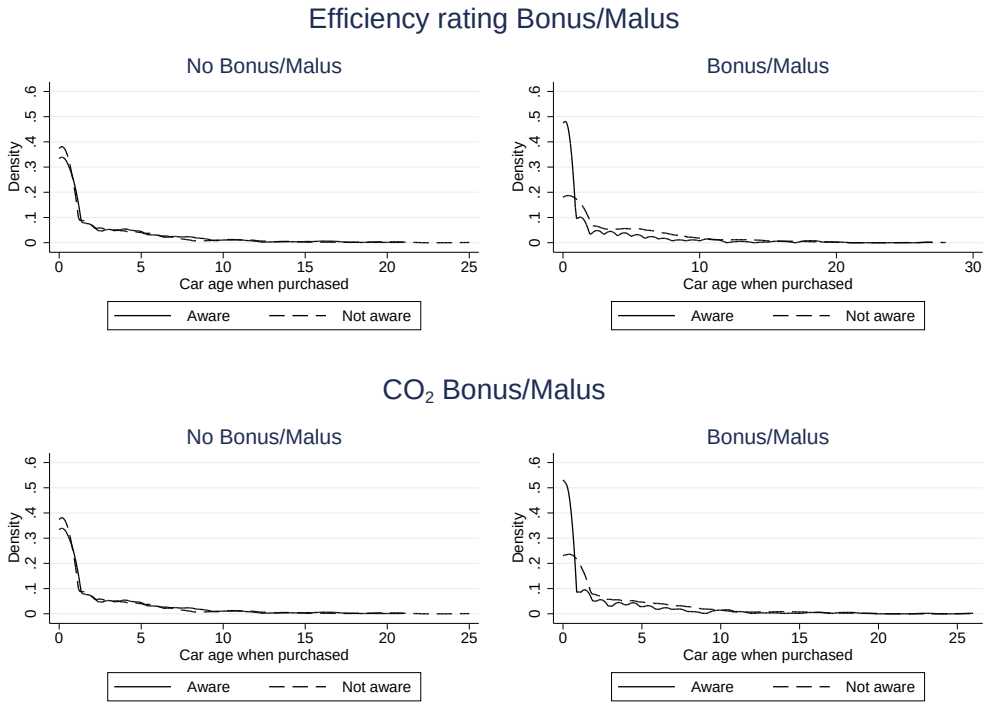


We find no statistically significant differences between those two groups in terms of baseline characteristics like gender, education, occupation or household size. Instead, we do find that respondents in cantons that have introduced a Bonus/Malus scheme are more likely to live in urban areas, are more likely to be part of a household earning more than 9000 CHF per month, are less likely to be German speakers, and are older. We do not find systematic differences in other characteristics linked to environmental attitudes or life values. For instance, rate of voting preferences for the Green Party or membership in an environmental club are very similar among the two groups. People in cantons adopting the incentives perform worse on average in terms of financial literacy and of certain aspects of energy literacy.[14]

Policy aware and policy unaware respondents appear to be balanced in most of the characteristics considered (Appendix D, tables 16, 18, 20, 22, 24, 26, 28, 30, 32, 34). We do find however that policy aware respondents are more likely to be male, with a university education, older and self-employed, and less likely to be German speakers and unemployed or students. They are also more likely to provide the correct answer to our financial literacy

[14]The financial literacy indicator is based on the understanding of interest rates and inflation. The indicator for energy literacy is based on the understanding of energy labels and energy costs of certain products. Detailed explanation of these variables is in Appendix C.

Figure 3: Policy awareness and vehicle age (years) distribution



questions. We do not find systematic differences in environmental attitudes or behaviors between policy aware and unaware respondents.

Finally, we compare characteristics between respondents who bought their car when the fiscal incentives were in place and those who bought it when there were no incentives (Appendix D, tables 15, 17, 19, 21, 23, 25, 27, 29, 31, 33). In doing so, we consider separately aware and unaware respondents. We do find both pair of groups to be well balanced. This is especially the case for unaware respondents living in a canton that have introduced some fiscal incentives to promote the adoption of efficient cars, and unaware respondents that live in a canton with no such policy. We find some differences between policy aware individuals. Aware respondents who bought their car in a canton that has introduced a Bonus/Malus scheme are older, less likely to be German speakers and less likely to answer correctly to certain financial and energy literacy question.

5 Identification and Empirical Strategy

The Bonus/Malus system introduced in some administrative areas in Switzerland decreases the vehicle registration tax on high efficiency cars that consumers need to pay each year, while

increasing the amount to be paid for the least efficient vehicles. It thus provides incentives for the purchase of vehicles with higher fuel efficiency. This paper aims at estimating the causal effect of individuals' awareness about the presence of the Bonus/Malus system for the vehicle registration tax on their vehicle choices.

The ideal setting to address the question we are asking in this paper would be one where awareness about the presence of the incentive scheme had been randomly distributed to a group of individuals in cantons where the Bonus/Malus system is in place, with no possibility of information spillovers to the other consumers in the same areas. If individuals' awareness was determined exogenously, we could estimate the causal effect of being aware about the presence of the policy by simply comparing the fuel consumption of the vehicle purchased by aware consumers to that of unaware consumers only when the Bonus/Malus system is in place.

In our context, the identification of the causal effect of awareness about the presence of the Bonus/Malus system on vehicle choices is challenging because individuals' policy awareness is endogenous. For instance, prior to the vehicle choice, consumers might determine their level of awareness about the characteristics of the vehicles in their choice set as well as the associated taxation system, depending on the individual incentives that they face and that are unobservable to the researchers.

Our main strategy to identify the causal impact of policy awareness exploits the variation in the Bonus/Malus system across cantons and over time, as well as the availability of a direct measure of policy awareness both in the presence and in the absence of the policy. Hence, we use aware individuals in cantons without the Bonus/Malus system as a comparison group in a difference in differences framework with multiple treatment groups and treatment periods. In this context, the key identifying assumption is that the evolution of vehicle choices over time for policy aware consumers in cantons where the Bonus/Malus system has been introduced would have been the same, in the absence of the policy, as that of policy aware consumers in cantons where the Bonus/Malus system has not been introduced. Importantly for the credibility of this assumption, all cantons in Switzerland require the payment of a registration tax with different characteristics. Therefore, consumers in both treated and control cantons have an incentive to accumulate knowledge about the structure of the registration tax.

We perform standard pre-treatment parallel trend tests to provide evidence that the necessary condition for the validity of the key identifying assumption is satisfied. Moreover, because we exploit data in the form of a repeated cross-section, where the time dimension refers to the year of vehicle purchase, while measuring individual characteristics only at the time of the interview, we need to emphasize that the validity of this strategy relies on the

assumption of exogeneity of the control variables. In Section 5.2 we discuss possible threats to the validity of this identification strategy and how we address them.

5.1 Main specification

Our basic empirical specification takes the form:

$$y_{ict} = \beta Aware_i * BMP_{ct} + \theta BMP_{ct} + \psi Aware_i * BM_c + \gamma Aware_i + \delta X_i + \eta_c + \xi_t + \epsilon_{ict} \quad (4)$$

where y_{ict} is an indicator of the vehicle choice by individual i living in canton c in year t, $Aware$ is a dummy for whether the respondent is policy aware, BM is a dummy for whether a canton has adopted some Bonus/Malus incentive at any point in time, BMP is a dummy that indicates if a Bonus/Malus system was in place in the canton and year in which the car was purchased, X is a set of respondents' characteristics, and η and ξ denote canton of residence dummies and year of purchase dummies, respectively. As discussed in Secton 4 we use log fuel consumption per 100 km of the vehicle purchased as main indicator of vehicles' energy efficiency, and then perform robustness checks exploiting information on the vehicles' efficiency rating on the subsample for which this information is available. We then use the age of the vehicle at the time of purchase to study whether the incentives set by the Bonus/Malus system induced aware individuals to purchase newer cars. We cluster standard errors at the canton by year of purchase level.[15] The coefficient of main interest β indicates the reduced form effect of consumer's policy awareness on vehicle choices in the presence of the fiscal incentives. The coefficient θ gives the effect of the Bonus/Malus system for the unaware consumers. In the absence of supply side effects of the policy, we would expect the estimated θ to be equal to zero. Finally, ψ captures the time-invariant heterogeneity in vehicle choices within treatment group by awareness status.

To investigate the importance of considering policy awareness when studying the consequences of the Bonus/Malus system on vehicle choices, we also estimate equation 4 setting β, ψ and γ equal to zero. In this case, θ indicates the average effect of the Bonus/Malus system on the treated.

We include a large set of covariates to control for compositional differences among policy aware respondents in cantons with and without the policy. These include standard socio-demographics as well as investment literacy and environmental attitudes that can potentially influence both the decision of purchase of an efficient vehicle and the probability to be aware

[15] This is consistent with Abadie et al. (2017) who suggest that, in a model with fixed effects and in the presence of heterogeneous treatment effects, clustering should occur at the level of treatment assignment. Our findings do not change when applying the more conservative clustering at the cantonal level.

about the presence of the fiscal incentives.[16]

We conduct some robustness checks on the main specification. First, to control for possible unobservables that might affect the choice of purchase of efficient cars at the same time as the introduction of the Bonus/Malus incentive scheme, we also estimate equation 4 including canton by year of purchase fixed effects. Second, one could be worried that the time gap between the interview and the decision of purchase might be correlated with the probability to remember about whether the registration tax depended on the vehicle efficiency at the time of purchase, thus determining a mechanical association between the probability to be aware according to our definition and the presence of the policy. To avoid this potential issue, we conduct a robustness check using only information from vehicles purchased after 2010.[17] Moreover, as the average vehicle fuel efficiency in the consumers' choice set has increased over time, individuals that are about to purchase a new vehicle might have different incentives to accumulate information about vehicle in their choice set (and then become policy aware) over time. To address this possible issue, we estimate equation 4 including the interaction of the awareness dummy with year of purchase dummies.[18] Finally, estimation is conducted also including the interaction of the policy awareness variable *Aware* with three dummies that indicate the Bonus/Malus type (based on CO_2, on efficiency rating, on both) instead of the treatment variable BM. We do this to control for potential unobserved factors that might be correlated with vehicle choices and influence how awareness status is determined depending on the type of incentives in place in one's canton of residence.[19]

5.2 Addressing possible threats to the validity of our main strategy

The validity of our main identification strategy for the impact of policy awareness on vehicle choices relies on whether consumers that are aware about the features of the registration tax system, living in cantons that have not introduced a Bonus/Malus system are comparable to aware consumers in cantons where a Bonus/Malus system has been introduced. Although the key identifying assumption in this framework is milder than that it would take to simply compare aware and unaware respondents in the presence of the Bonus/Malus system, some

[16] In particular, the set of controls includes: age, age squared, gender, education and employment status of the respondent, household size, monthly gross household income, respondent's main language, type of living area (city, agglomeration, countryside), indicators for energy and investment literacy, preferences towards the environment, life attitudes and values. See Appendix C for a detailed description of the control variables used in the analysis.

[17] We obtain similar results using different sample period cutoffs.

[18] We aggregate years of purchase at the treatment period level. See Appendix A for details about the frequency of the introduction of the Bonus/Malus system.

[19] The share of aware individuals in the treated cantons indeed varies with the type of Bonus/Malus incentives: 39.09% if the incentive was based only on efficiency rating, 60.25% if based only on CO_2 emissions, and 36.02% if based on both.

potential issues can undermine its validity: (i) selective introduction of the Bonus/Malus system across administrative areas; (ii) lack of control for unobserved individual-specific characteristics that influence the process of information accumulation in the presence and in the absence of the policy; (iii) the presence of measurement error in awareness.

Are aware consumers in the treated group comparable to aware consumers in the control group? Although the descriptive evidence presented in Section 4 shows that respondents living in treated and control cantons, as well as aware and unaware individuals, are comparable with respect to several observable dimensions, some compositional differences emerge. For instance, administrative areas that have introduced a Bonus/Malus system are more urban. Moreover, the share of French speakers is higher in cantons that have introduced some fiscal incentives to promote the adoption of efficient vehicles. This might be problematic for our main identification strategy because heterogeneity in the incentives to foster the adoption of efficient vehicles and/or cultural differences may drive selection into the Bonus/Malus awareness status. Generally, in the presence of selection into treatment or awareness status based on observables that may affect the evolution of vehicle choices over time, the identifying assumption in our basic empirical strategy is not valid.

To overcome this potential issue, we combine our main strategy with a propensity score matching approach that addresses the 'common support problem' (Heckman et al., 1998). The aim is to construct comparison groups that reproduce as close as possible which vehicles the treated consumers would have purchased in the absence of the Bonus/Malus system (or which vehicles aware consumers would have purchased if they did not know about the fiscal incentives), so that the change in the vehicle choices of aware consumers in the presence of the Bonus/Malus system is only due to awareness about the fiscal incentives and not by endogenous selection into the treatment or awareness status.

We perform a regression version of the propensity score matching difference in differences exploiting the rich set of individual characteristics available in our dataset. The analysis is carried out in two steps. In a first step, the matching is performed using the propensity score method (Rosenbaum and Rubin, 1983, 1984), separately for the presence of the Bonus/Malus system and awareness status. In our application, the propensity score $P(X)$ is the probability that an individual lives in areas with a Bonus/Malus system, or that an individual is aware about the presence of the fiscal incentives, conditional on the matching characteristics X. We estimate the propensity score using Probit models that include a large number of respondents' and cantons' characteristics and then perform a kernel matching.[20] In a second step, we run regression 4 applying the kernel-based weights and restricting the estimation sample to the

[20]The complete list of variables used in the matching procedure is reported in Appendix C.

common support defined by the propensity score.

In this context, the standard matching assumption of conditional independence must be valid in terms of the before-after evolution instead of levels. Hence, the identifying assumption is that there are no unobservable characteristics that affect both the change in vehicle choices and the treatment or awareness status (i.e., any potential selection occurs through observable individual characteristics). While the matching procedure takes care of the selection into treatment (or awareness status) based on observables, the difference in differences deals with selection on unobservables under the assumption that the bias is time-invariant, conditional on the set of controls. The credibility of this approach relies on how well the set of covariates used in the matching procedure explains the selection process. We perform the propensity score matching using a long list of individual characteristics that might influence both selection and vehicle choices. Importantly, in addition to a rich set of socio-demographics, we include measures of energy and investment literacy, as well as proxies for environmental values and attitudes.

How is policy awareness determined? A crucial assumption we take to identify the effect of policy awareness exploiting the difference in differences strategy is that all control variables X are exogenous (that is, using the potential outcome notation: $X^1 = X^0 = X$). Some concerns about the validity of this assumption might arise for policy awareness. The exogeneity assumption would not be met for policy awareness ($Aware^1 \neq Aware^0$) if the process determining individuals' awareness differed in the presence and in the absence of the Bonus/Malus system. For instance, in the presence of the Bonus/Malus system, individuals might be exposed to information about the introduction of the policy that, based on individual-specific factors unobserved to the researchers (e.g., attention to fuel efficiency, opportunity cost of the time spent in accumulating information), might or might not be incorporated in the determination of the knowledge about the features of the incentive scheme for the vehicle registration tax. In this case, also the conditional independence assumption of the matching difference in differences is not met. This threat might be severe in this context because we do not control nor observe the process that determines individuals' awareness about the features of the vehicle registration tax scheme.

Clearly, the presence of unobserved heterogeneity affecting both vehicle choices and policy awareness is the reason why we cannot simply compare the vehicle choices of aware and unaware consumers in the presence of the Bonus/Malus system to estimate the impact of awareness.

We address the potential issue of endogeneity of policy awareness adopting an instrumental variable (IV) approach. This is implemented both to: (a) simply compare vehicle

choices of aware and unaware respondents in treated cantons, after the introduction of a Bonus/Malus scheme, and (b) in the difference in differences framework. In the first case (a), a good instrument must be a good predictor of individuals' awareness about the presence of the Bonus/Malus system, and influence vehicle choices only through individuals' awareness, conditional on the set of controls. In case (b), we require a milder identifying assumption: an instrument must influence the evolution over time of vehicle choices between aware individuals in cantons with a Bonus/Malus system and aware consumers living in cantons that did not implemented such incentives only through individuals' awareness, conditional on the set of controls.

We use two instruments for policy awareness: (i) the distance in years from the introduction of the incentives in a specific canton and (ii) the voting participation rates to eight national referendums on energy, environmental, and transportation topics at the municipality of respondents' residence level, interacted by canton of residence dummies.[21] Because in our difference in differences framework not only policy awareness need to be instrumented, but also its interaction with the treatment variable BM and the indicator for the presence of the Bonus/Malus system BMP, in the set of instruments we also include the interaction of the treatment variable BM with (i) and (ii), as well as the interaction of the indicator for the presence of the Bonus/Malus system BMP with (i) and (ii).

The distance between the introduction of the policy and the purchase of the car as an instrument for policy awareness exploits the idea that advertisement and promotion of the Bonus/Malus system in the local media might be higher immediately after its introduction. Hence, the less time has passed from the introduction of the fiscal measure, the higher the probability for consumers to be aware about the incentive scheme when they take the decision of purchase. The exogeneity of the timing of introduction of the fiscal incentives to individuals' decisions of purchase ensures the validity of the exclusion restriction for this instrument.

At the municipality level, higher voter turnout might be related to higher individual policy awareness through the presence of higher social capital.[22] Clearly, the validity of the exclusion restriction for this instrument depends on the absence of unobserved heterogeneity influencing both voter turnout and the probability to purchase a more energy efficient

[21] The eight referendums were held from 2013 to 2017 and concerned the following issues: increase of highway tolls to fund road infrastructure; replacement of the value added tax with a tax on non-renewable energy; restoration of the Gotthard tunnel; earmarking of the revenue from the mineral oil tax exclusively for road circulation purposes; setting goals for the reduction of natural resources consumption; phasing out nuclear power; creation of a permanent government fund for national roads; approval of the new Swiss energy policy (Energy Strategy 2050).

[22] Previous literature has indeed used voter turnout as a proxy for social capital at the local level (see Guiso et al. 2004).

vehicle. Because we also control for several factors at the individual level related to environmental preferences and attitudes, including environmental activism, we believe the exclusion restriction is valid.

Measurement error in awareness Individuals' awareness about the presence of Bonus/Malus system is measured at the time of the interview but refers to the time at which the current vehicle was purchased. This might reflect into measurement error and attenuation bias in the estimated effect of awareness on vehicle choices.[23] The IV approach also aims at addressing the issue from the potential measurement error in individuals' awareness.[24]

5.3 Results

Main specification Table 1 reports the main results of the empirical analysis. To underline the importance of considering individuals' policy awareness to evaluate the consequences of the Bonus/Malus system, we first estimate the average effect of these fiscal incentives without taking into account whether respondents were policy aware or not.[25] Column (1) shows the results of this analysis. When we do not distinguish between aware and unaware respondents, we estimate an average effect of the Bonus/Malus system on vehicle fuel consumption of about -0.05%, not statistically significant.

To gain insights about the association between individuals' awareness and vehicle choices, we first consider only individuals that purchased a vehicle in a treated canton, after the introduction of the incentives. We then simply regress the log of fuel consumption on awareness status and a large number of respondents' characteristics, canton and year of purchase dummies.[26] Results reported in Column (2) of Table 1 show that individuals living in treated cantons, that are aware of the presence of the Bonus/Malus system and purchased a vehicle after its introduction, own vehicles that consume on average around 6.8 percent less than unaware individuals.

We then start our investigation of the impact of individuals' awareness on vehicle choices by estimating our basic difference in differences specification (4) using OLS. The results are reported in Column (3) to (8) of Table 1. Estimation results in Column (3), obtained omitting individuals' characteristics, show that the introduction of the Bonus/Malus system has a negative and highly significant impact of 10.9% percent on the fuel consumption of the vehicles purchased by individuals that are aware about the features of the registration tax

[23] On the topic of attenuation bias in case of measurement error, see Levi (1973).

[24] Besides instrumenting awareness, to address potential concerns related to its measurement, we conduct additional robustness checks modifying the way we characterize unaware individuals.

[25] In practice, this implies setting coefficients $\beta = \psi = \gamma = 0$ in equation 4.

[26] This implies setting $\beta = \theta = \psi = 0$ in equation 4.

scheme. We find no significant effect of the Bonus/Malus system on the vehicle choices of unaware consumers. The results are almost unaffected when we include a large set of respondents' characteristics (Column 4), include canton by year of purchase fixed effects (Column 5), consider only vehicles purchased in 2010 or later (Column 6), include the interaction of awareness status and treatment period dummies (Column 7), or allowing for Bonus/Malus type specific effects by awareness status (Column 8).

Placebo Bonus/Malus Our basic specification assumes that vehicle choices of aware individuals living in administrative areas where a Bonus/Malus system has been introduced would have evolved over time similarly to those of aware individuals in cantons without incentive schemes to promote energy efficient cars. To provide evidence that such condition is met in the pre-treatment periods, we perform a placebo test where we set the introduction of the Bonus/Malus system in some pre-treatment period in each treated canton, and restrict the sample period to years before the actual introduction of the Bonus/Malus system.

Clearly, failing to reject the null of parallel pre-treatment trends between vehicle choices of aware individuals in cantons with and without fiscal measure would raise serious concerns about the validity of this strategy. For instance, aware respondents in cantons that eventually introduced a Bonus/Malus might have a stronger preference for efficient cars - not captured by our observables - than aware respondents in cantons without such policy. Then, the effect we would measure in the main specification would not be due to the introduction of the Bonus/Malus, but rather due to the higher propensity to buy the more energy efficient cars launched on the market over the years.

Results of the placebo difference in differences regressions are reported in Table 2, where Columns (1) to (3) show results when the placebo Bonus/Malus is introduced 2 years, 3 years and 4 years earlier than the actual introduction, respectively. The coefficients associated to $Aware * BMP$ are statistically equal to zero in all three cases, suggesting that there are no differences in the trend of vehicle choices among aware respondents in cantons with and without fiscal incentives.

Propensity score matching difference in differences The first step of our approach is to match respondents along two dimensions separately: (i) Bonus/Malus treatment status and (ii) policy awareness status. We then estimate two separate Probit models for the Bonus/Malus treatment and policy awareness variables. Selected estimated coefficients are reported in Table 35 in Appendix E.

Although the aim of this estimation procedure is to match respondents on all observable characteristics that may influence selection into either Bonus/Malus treatment status or

Table 1: Effect of policy awareness on vehicle choices, OLS estimates of the main specification and robustness

	Without awareness (1)	Only policy (2)	No controls (3)	Main (4)	Canton x Year FE (5)	Year ≥ 2010 (6)	Aware x Post (7)	BM type (8)
BMP x Aware			-0.109***	-0.103***	-0.080**	-0.087**	-0.084**	-0.108***
			(0.032)	(0.031)	(0.037)	(0.041)	(0.040)	(0.031)
BMP	-0.005		0.032	0.035		0.022	0.026	0.036*
	(0.018)		(0.022)	(0.022)		(0.026)	(0.025)	(0.022)
BM x Aware			0.038	0.025	-0.010	0.010	0.010	
			(0.038)	(0.038)	(0.045)	(0.048)	(0.043)	
Aware		-0.068***	0.015	0.012	0.025	0.008	0.024	0.012
		(0.006)	(0.026)	(0.025)	(0.031)	(0.029)	(0.028)	(0.025)
N	2504	1349	2504	2504	2504	2138	2504	2504
Controls	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Purchase year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Canton FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Canton x Year FE	No	No	No	No	Yes	No	No	No
Aware x Post	No	No	No	No	No	No	Yes	No

Notes: Dependent variable is the log of fuel consumption per 100 km. *BM* represents respondents living in cantons who adopted a Bonus/Malus at some point; *BMP* represents respondents buying a vehicle with a Bonus/Malus in place *Aware* represents policy aware respondents. Column (1): Effect of Bonus/Malus without considering awareness. Column (2): Effect of awareness, only years and cantons with Bonus/Malus in place. Column (3): Main specification from equation 4, without respondent-specific controls. Column (4): Main specification from equation 4. Column (5): Including canton by year of purchase fixed effects. Column (6): Only vehicles purchased in 2010 or later. Column (7): Including fixed effects of awareness by year of purchase (grouped by policy changes). Column (8): Interacting BM x Aware by type of policy (only label, only CO_2, both). Standard errors in parenthesis, clustered at the canton by time of purchase level. */**/*** indicate statistical significance at the 10, 5, and 1 percent level, respectively.

Table 2: Awareness and vehicle choices before the introduction of the fiscal incentives

	-2 years	-3 years	-4 years
	(1)	(2)	(3)
BMP x Aware	-0.009	-0.046	0.005
	(0.058)	(0.054)	(0.053)
BMP	0.042	0.035	0.021
	(0.038)	(0.044)	(0.044)
BM x Aware	0.017	0.036	0.009
	(0.045)	(0.048)	(0.052)
Aware	0.023	0.023	0.023
	(0.027)	(0.027)	(0.027)
N	1110	1110	1110
Controls	Yes	Yes	Yes
Purchase year FE	Yes	Yes	Yes
Canton FE	Yes	Yes	Yes

Notes: Dependent variable is the log of fuel consumption per 100 km. Column (1): placebo Bonus/Malus starting 2 years before actual introduction. Column (2): placebo Bonus/Malus starting 3 years earlier. Column (3): placebo Bonus/Malus starting 4 years earlier. Years in which the Bonus/Malus was in place are dropped. Standard errors in parenthesis, clustered at canton by year of purchase level.

awareness status and not to estimate a casual model of selection, some relevant associations emerge in the Probit estimates. These largely confirm the descriptive evidence reported in Section 4. Individuals living in cantons that have introduced a Bonus/Malus scheme are less likely to live in rural areas, tend to have lower income, are associated with a lower level of investment literacy and have a lower probability to be German speakers. Without getting rid of these compositional differences, one might fear that, for instance, cultural differences and heterogeneity in the incentives of the two groups, due to the different availability of resources and type of living areas, induced a selective introduction of the Bonus/Malus incentives and influenced the decisions with respect to the efficiency of the newly purchased cars. The propensity score matching procedure based on the Bonus/Malus treatment status identifies 192 individuals in the treatment group that are not comparable in terms of observable characteristics to those in the control group.

The probability to be policy aware shows a hump-shape profile over the age of the respondents, is higher for male respondents and individuals that are self-employed or retired, and is positively associated with the level of energy literacy. However, the compositional differences between aware and unaware individuals that emerge as a result of the propensity score matching are less relevant than those resulting from the matching procedure based on the Bonus/Malus treatment status.[27]

Column (2) of Table 3 shows the estimation results of our propensity score matching difference in differences approach with the matching based on the Bonus/Malus treatment status, while Column (3) reports the results obtained when the matching is performed based on the awareness status. These estimates for the effect of policy awareness are very close to those estimated with our basic differences in differences estimation. This evidence suggests that issues related to selection on observables into treatment and awareness status do not represent a relevant threat to our main identification strategy.

IV estimates Columns (4) and (5) of Table 3 show the IV estimates obtained when policy awareness is instrumented to deal with its potential endogeneity.

In particular, Column (4) reports the 2SLS estimates of equation 4 when we set $\beta = \theta = \psi = 0$ and restrict the estimation sample to individuals that purchased a vehicle when fiscal incentives towards the adoption of energy efficient vehicles were in place in a treated canton. The policy awareness variable *Aware* is instrumented with the distance in years from the introduction of a Bonus/Malus system in a certain canton and the purchase of the vehicle, and the voter turnout in the national referendums at the municipality of residence

[27]No individual is found to be off the common support defined by the propensity score obtained by the matching procedure based on policy awareness status.

level, interacted by canton. The results of the first stage regression lead us to reject the null of weak instruments at the 1 percent confidence level.[28] The 2SLS estimate indicates that, in the presence of the Bonus/Malus system, policy awareness induces individuals to purchase vehicles that consume on average 16.3% less than unaware consumers. Notice that this estimate is larger than the corresponding OLS estimate reported in Column (2) of Table 1, suggesting that neglecting the potential endogeneity of awareness in this simple framework might bias its estimated effect downwards.

In Column (5) we report the IV estimates of our main specification when we instrument $Aware$ (and its interaction with the policy variables $Aware * BMP$ and $Aware * BM$) with the distance in years from the introduction of a Bonus/Malus system in a certain canton and the purchase of the vehicle, the voter turnout in the national referendums at the municipality of residence level, and the interaction of those with the treatment variable BM and the indicator for the presence of the Bonus/Malus system at the time of purchase BMP. Also in this case, the first stage regression results lead us to reject the null of weak instruments at the 1 percent confidence level.[29] Adopting the 2SLS estimation approach for equation 4, we find that policy awareness induces individuals living in a canton with a Bonus/Malus scheme in place to purchase vehicles that consume on average 30.3% less than unaware individuals living in those cantons. This IV estimate for the impact of policy awareness is substantially larger than the corresponding estimate obtained with our basic difference in differences specification. Hence, our results confirm that the endogeneity issues might tend to attenuate the magnitude of the effect of policy awareness estimated with OLS.

Alternative definitions of unaware respondents So far we defined unaware respondents those who provided a wrong answer to our awareness question, together with those who answered "Don't know". However, individuals who gave a wrong answer might have different expectations towards the fiscal incentives in place in their canton of residence compared to respondents who hold no information on the presence or absence of such incentives. In fact, a wrong answer to our awareness question in the absence of the Bonus/Malus implies that, at the time the respondent purchased her car, she mistakenly believed that a fiscal incentive to promote the purchase of efficient vehicles had been in place. In contrast, individuals that gave a wrong answer in the presence of the policy believed that there was no fiscal incentive to purchase an efficient car when this was instead in place. Hence, these unaware individuals might act on such believes by purchasing vehicles with higher energy efficiency in the absence of the policy compared to those that unaware individuals buy in the presence of the policy.

[28] The p-value of the F-test of excluded instruments is (0.0000).

[29] The p-value of the Sanderson-Windmeijer F-test of excluded instruments is (0.0000) for all three first stage regressions.

Moreover, some previous research discuss the role of self-confidence on the probability to give a definite answer vis à vis reporting "Don't know" (see, for instance Lusardi and Mitchell 2014). This could be problematic if this self-confident attitude was correlated with vehicle choices.

In column (6), we include in the sample only unaware respondents who answered "Don't know" to our awareness question. In column (7) only respondents who gave the wrong answer ("yes" in absence of a Bonus/Malus, "no" when it was present) are included in the estimation sample. In both cases, we observe a strong and significant effect of the Bonus/Malus on aware respondents.

However, when we consider only people who provided the wrong answer, we estimate a positive and significant effect of the presence of the Bonus/Malus for the unaware consumers. This suggests consumers that believe that there is no fiscal incentive towards efficient vehicles, in cantons with a Bonus/Malus, buy less efficient cars than consumers that believe such incentives exist in cantons with no such measure.

Alternative indicators of vehicle choices As discussed in Section 4, in the main analysis we use self-reported fuel consumption as dependent variable because almost all our respondents were able to provide it, its distribution matches quite well that of the population of vehicles in Switzerland, and it is strongly correlated with both CO_2 emissions and efficiency rating (see Appendix B). Nevertheless, in this section we use the two vehicles' features that determine the eligibility to the Bonus/Malus system, namely efficiency rating and CO_2 emission rate, as dependent variables.

We construct two indicators for efficient cars: a dummy for vehicles with rating A, and a dummy for vehicles with rating A or B. Equation 4 is estimated for each of these as a linear probability model, where the coefficient of interest β is now the effect of respondents' policy awareness under a Bonus/Malus scheme on the probability of buying a high efficiency rating car. We also construct a measure of CO_2 emissions per 100 km based on self-reported vehicle fuel consumption and fuel type. This is possible because a linear relationship exists between fuel consumption and CO_2 emission rate within fuel type.[30]

Results in columns (1) and (2) of table 4 show that the introduction of fiscal incentives for efficient vehicles increased the probability of aware respondents of buying a rating A vehicle (+31.1%) and a vehicle with either rating B or higher (+38.4%). One important

[30]We use data from the Swiss vehicle registration database to estimate the linear relationship between fuel consumption and CO_2. Regressing CO_2 emissions on fuel consumption separately for diesel and gasoline vehicles and omitting the intercept gives a coefficient of 26.44701 and 23.6457 respectively, with virtually perfect fit (R-squares 0.9998 and 0.9997). See Appendix B for more information about the Swiss vehicle registration database.

Table 3: Effect of policy awareness: OLS, Matching, IV, and alternative definitions of unaware respondents

	Main	Matching by treatment	Matching by awareness	IV only policy	IV	Only "don't know"	Only wrong answer
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
BMP x Aware	-0.103***	-0.118***	-0.114***		-0.303***	-0.078**	-0.139***
	(0.031)	(0.035)	(0.032)		(0.073)	(0.037)	(0.039)
BMP	0.035	0.047*	0.026		0.109***	0.001	0.080**
	(0.022)	(0.026)	(0.023)		(0.031)	(0.027)	(0.031)
BM x Aware	0.025	0.058	0.030		0.200***	-0.000	0.060
	(0.038)	(0.042)	(0.037)		(0.077)	(0.045)	(0.047)
Aware	0.012	-0.004	0.016	-0.163***	-0.052	0.011	0.001
	(0.025)	(0.027)	(0.025)	(0.049)	(0.048)	(0.030)	(0.034)
N	2504	2312	2504	1330	2471	1939	1557
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Purchase year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Canton FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Dependent variable is the log of fuel consumption per 100 km. Column (1): Main specification. Column (2): Propensity score matching by canton treatment status. Column (3): Propensity score matching by awareness. Column (4): Instrumental variable specification or awareness status, considering only respondents buying a vehicle when the Bonus/Malus was in place. Column (5): Instrumental variable specification for awareness status. Column (6): Including only aware respondents and unaware respondents answering "Don't know" to the awareness question. Column (7): Including only aware respondents and unaware respondents giving a wrong answer to the awareness question. Standard errors in parenthesis, clustered at canton by year of purchase level. */**/*** indicate statistical significance at the 10, 5, and 1 percent level, respectively.

caveat in interpreting this set of results is that a large number of respondents (58.38%) were not able to indicate the efficiency rating of their car. Thus, it is possible that estimates obtained by using the rating as dependent variable suffer from selection bias. For instance, unobservable factors such as limited attention or cognitive abilities might drive both the selection into the awareness status and the probability to report the efficiency rating of the vehicle. Another possibility is that consumers are more likely to remember the energy rating of a highly efficient car.

The estimated impact of awareness on CO_2 emissions, reported in Column (3), is very similar in magnitude to that on fuel consumption, corroborating the results of the main specification.

Table 4: Effect of awareness on vehicle choices: fuel efficiency ratings and CO_2 emissions

	Rating A	Rating A or B	CO_2
	(1)	(2)	(3)
BMP x Aware	0.311***	0.384***	-0.090***
	(0.066)	(0.088)	(0.029)
BMP	0.055	0.029	0.026
	(0.065)	(0.073)	(0.022)
BM x Aware	-0.170**	-0.156	0.032
	(0.072)	(0.096)	(0.037)
Aware	-0.039	-0.130**	0.004
	(0.054)	(0.061)	(0.024)
N	1070	1070	2290
Controls	Yes	Yes	Yes
Purchase year FE	Yes	Yes	Yes
Canton FE	Yes	Yes	Yes

Notes: Dependent variable in Column (1) is an indicator for A rating vehicle. Column (2) uses an indicator of A or B rating vehicles as dependent variable. Dependent variable in Column (3) is the Log of grams CO_2 emissions per 100 km. Standard errors in parenthesis, clustered at canton by year of purchase level. */**/*** indicate statistical significance at the 10, 5, and 1 percent level, respectively.

Vehicle age and fuel consumption As discussed in Section 3, age of the vehicle is typically an eligibility criteria under the bonus component of the Bonus/Malus system. Moreover, newer models tend to be more energy efficient.

The fiscal incentives can then induce a behavioral response of consumers through at the least two mechanisms: (i) they might access the fiscal incentives provided by the Bonus/Malus system through the purchase of a more efficient vehicle of the same age (efficiency channel); (ii) they could buy newer cars to receive the registration tax discount for a longer period of time (vehicle age channel). We wish to check whether both or only one of those two channels are driving our main results.

In column (1) of table 5 we report results obtained using vehicle age at the time of purchase as a dependent variable. Aware consumers buying a car under a Bonus/Malus scheme choose vehicles on average around 1.46 years newer. In column (2) we use fuel consumption as dependent variable instead, but we look at the effect of awareness in the presence of fiscal incentives, conditional on the age of the vehicle at the time of purchase. In particular, we distinguish between new cars, second-hand cars still eligible to the Bonus (maximum 4 years old), and second-hand cars not eligible anymore (more than 4 years old).[31] We find that policy awareness has an impact on the fuel economy of the newly purchased vehicles up to four years of age at the time of purchase. In contrast, when the vehicle purchased cannot be eligible anymore due to age limits, we do find any effect of policy awareness. Thus, both the *efficiency channel* and the *vehicle age channel* play a role in determining the overall impact of policy awareness on vehicle choices. Importantly, the virtually zero effect for cars not anymore eligible due to their age confirms the robustness of our main findings.

Heterogeneity by respondents' characteristics Finally, we provide illustrative evidence that aware consumers are not homogeneous in terms of their response to fiscal incentives for efficient cars. For instance, perspective buyers with high income might be less prone to switch to a more efficient vehicles even when aware about the presence of the fiscal advantages in doing so. This would be the case, for instance, if the budget constraint was binding for low income earners in the absence of the Bonus/Malus scheme. In addition, aware individuals with low energy and investment literacy might not be able to incorporate the fiscal incentives correctly in their decision making process. Finally, conditional on being aware, individuals with strong pro-environmental values might be more responsive to the fiscal incentives.

In tables 6 and 7 we present results that aim at highlighting what are the most important sources of heterogeneity in the effect of policy awareness. We focus on a selected group of respondent characteristics that might influence vehicle choices, such as monthly house-

[31] Age criteria for the eligibility to the bonus are quite similar over cantons, and the age limit is never lower than 3 years. See appendix A for more information about canton-specific criteria.

Table 5: Effect of awareness on vehicle choices: age of the vehicle at purchase vs. fuel consumption by age at purchase

	Vehicle age	Fuel consumption by vehicle age at purchase
	(1)	(2)
BMP x Aware	-1.457***	
	(0.407)	
BMP x Aware (new car)		-0.112***
		(0.030)
BMP x Aware (2-4y car)		-0.138***
		(0.037)
BMP x Aware (>4y car)		0.004
		(0.039)
BMP	0.554**	0.029
	(0.271)	(0.021)
BM x Aware	0.666	0.013
	(0.459)	(0.036)
Aware	-0.017	0.013
	(0.322)	(0.025)
N	2453	2453
Controls	Yes	Yes
Purchase year FE	Yes	Yes
Canton FE	Yes	Yes

Notes: Column (1): Vehicle age in years at time of purchase as dependent variable. Column (2): Effect of awareness under Bonus/Malus policy disaggregated by vehicle age group at the time of purchase. Dependent variable is the log of fuel consumption per 100 km. Standard errors in parenthesis, clustered at canton by year of purchase level. */**/*** indicate statistical significance at the 10, 5, and 1 percent level, respectively.

hold income, gender, language, environmental activism, important values in life, and energy literacy.[32]

Results show some considerable heterogeneity in the response of aware individuals over some of those dimensions.[33] In particular, aware respondents react less strongly to a Bonus/Malus scheme when high income earners, or when they indicate "pleasure" or "wealth" as important personal life values. On the opposite, aware respondents who are Green Party voters, are member of an environmental club, or have higher energy literacy, tend to choose even more efficient cars than other aware consumers. We find no heterogeneity in the response between male and female consumers or between consumers belonging to different language groups.

These results reveal that information campaigns complementing the introduction of fiscal policies might have substantially heterogeneous effects across different groups of consumers. Importantly, the heterogeneity in the effect of policy awareness between individuals with low and high energy literacy suggests that policy awareness enters the decision making process mainly through the reduction in the vehicles' life cycle costs and not through heuristics. This prompts policy makers to complement information campaigns with literacy programs that allow policy aware consumers to better understand the role of the fiscal incentives in their decision making process.

While these results allow to gain some insights into how awareness may interact with other individual factors in determining their responses to the fiscal incentives, we want to stress that the present analysis cannot pin down the exact mechanism through these factors induce aware respondent to react differently to the fiscal incentives.[34]

[32] As in the previous results, such characteristics are also included as controls. For energy literacy here we mean whether a respondent understands that the efficiency rating is a relative measure of fuel efficiency.

[33] We also check for heterogeneity for all other individual characteristics we consider as baseline controls. In the majority of cases, the coefficients are not statistically significant, but the sign of the coefficients are in line with the results presented here.

[34] For instance, the evidence that aware respondents who value wealth highly tend to react less to the incentives might be due to either personal beliefs or a different financial situation, even after controlling for household income.

Table 6: Heterogeneity in the effect of awareness by household income, language and gender

	HH income	Language	Gender
	(1)	(2)	(3)
BMP x Aware	-0.141***	-0.102***	-0.095***
	(0.038)	(0.035)	(0.030)
BMP x Aware x 6001-9000 CHF	0.014		
	(0.030)		
BMP x Aware x >9000 CHF	0.074**		
	(0.031)		
BMP x Aware x German		-0.002	
		(0.028)	
BMP x Aware x Female			-0.023
			(0.026)
BMP	0.034	0.035	0.035
	(0.022)	(0.022)	(0.022)
BM x Aware	0.026	0.025	0.026
	(0.038)	(0.038)	(0.038)
Aware	0.013	0.012	0.012
	(0.025)	(0.025)	(0.025)
N	2504	2504	2504
Controls	Yes	Yes	Yes
Purchase year FE	Yes	Yes	Yes
Canton FE	Yes	Yes	Yes

Notes: Results disaggregating the effect of awareness by selected respondents' characteristics. Dependent variable is the log of fuel consumption per 100 km. Coefficients associated with respondents' characteristics (rows 2-5) show the change in the baseline effect of awareness in the presence of Bonus/Malus (row 1). Standard errors in parenthesis, clustered at canton by year of purchase level. */**/*** indicate statistical significance at the 10, 5, and 1 percent level, respectively.

Table 7: Heterogeneity in the effect of awareness by political preferences, values, energy literacy

	(1)	(2)	(3)	(4)	(5)
BMP x Aware	-0.094***	-0.101***	-0.129***	-0.163***	-0.073**
	(0.032)	(0.031)	(0.032)	(0.037)	(0.034)
BMP x Aware x Green party	-0.086**				
	(0.040)				
BMP x Aware x Env. club		-0.116*			
		(0.070)			
BMP x Aware x Value: wealth			0.065**		
			(0.028)		
BMP x Aware x Value: pleasure				0.078***	
				(0.027)	
BMP x Aware x Energy literacy					-0.060**
					(0.027)
BMP	0.034	0.034	0.035	0.036	0.034
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)
BM x Aware	0.026	0.025	0.027	0.026	0.023
	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)
Aware	0.011	0.013	0.012	0.012	0.013
	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
N	2504	2504	2504	2504	2504
Controls	Yes	Yes	Yes	Yes	Yes
Purchase year FE	Yes	Yes	Yes	Yes	Yes
Canton FE	Yes	Yes	Yes	Yes	Yes

Notes: Results disaggregating the effect of awareness under Bonus/Malus by selected respondents' characteristics. Dependent variable is the log of fuel consumption per 100 km. Coefficients associated with respondents' characteristics (rows 2-5) show the change in the baseline effect of awareness in the presence of Bonus/Malus (row 1). Standard errors in parenthesis, clustered at canton by year of purchase level. */**/*** indicate statistical significance at the 10, 5, and 1 percent level, respectively.

6 Discussion and Conclusion

When evaluating the impact of a public program, separating the role of policy awareness from that of other behavioral anomalies or possible limitations of the policy design is important because each of these factors have different implications for the understanding of individual behavior and the design of future policies.

In this paper we explore the role of awareness about the presence of fiscal incentives for the purchase of energy efficient vehicles on consumers' vehicle choices. To identify the impact of policy awareness, we exploit the variation in the introduction of the policy over time and across administrative areas, as well as a direct measure of awareness at the individual level. While ignoring policy awareness might lead to conclude that the fiscal incentives are ineffective, we find that policy awareness induces individuals to purchase more efficient and newer vehicles. This result is robust to several robustness checks, to the addressing of compositional differences between aware individuals in treated and control cantons and is confirmed by an IV strategy to deal with the potential endogeneity of awareness. Our findings about the impact of policy awareness complement previous descriptive evidence suggesting low program awareness to be an important barrier to the take-up of fiscal benefits (Bhargava and Manoli, 2015).

In the context of fiscal incentives to promote the adoption of efficient vehicles, our results suggest that a simple information treatment (e.g., a mandatory registration tax disclosure), making consumers aware of the existence of the fiscal incentives at the time of purchase, would induce a significant vehicle choice response. More generally, the evidence we present prompts then policy makers to complement the design and introduction of public policies with adequate information campaigns. We show that failing to do so might lead to a low average impact of the policy measure, which could be wrongly blamed on flaws of the policy design or other behavioral factors that would need different interventions to be corrected. Importantly, our estimates for the impact of policy awareness should be interpreted as the potential increase in individuals' response that could be achieved with an information treatment that succeeds in making everyone in the target population aware about the existence of the fiscal program. Another implication of our results is that the tax burden of fiscal measures disproportionally affects unaware individuals. While aware individuals might modify their behavior to benefit from the monetary incentives, unaware consumers will not respond even though they could potentially be better off when doing so.

These findings have important implications for a wide range of existing public programs. The impact of increasing awareness on individual behavior might be especially prominent in contexts where the application of the benefits is automatic and requires little or no addi-

tional effort from the recipients (e.g., Medicare, marriage taxes and benefits, student quotas, discounts for public transport subscriptions). Clearly, the presence of other barriers to the access of fiscal benefits, such as transaction costs or stigma, might hinder the response of aware individuals to a public program. Moreover, in contexts with higher policy complexity, possible behavioral failures might play a more prominent role.

A limitation of this study is that we cannot specify the minimum level of knowledge about the fiscal system and individuals' sophistication that are necessary to induce a behavioral response to the policy. In order to identify the effect of awareness, we use a basic indicator capturing an even vague knowledge about the presence of the policy. Although we document some heterogeneity in the response to the policy among the group of aware individuals, we cannot say which level of sophistication is required for the consumers to react. We believe such a question should be addressed by future research. Future work should also explore what type of interventions are best suited to foster the relevant individuals' awareness in different contexts.

References

Abadie, A., Athey, S., Imbens, G. and Wooldridge, J. (2017), 'When Should You Adjust Standard Errors for Clustering?', *NBER Working Paper* **24003**.

Alberini, A. and Bareit, M. (2017), 'The Effect of Registration Taxes on New Car Sales and Emissions: Evidence from Switzerland', *Resource and Energy Economics* **Article in press**.

Alberini, A., Bareit, M., Filippini, M. and Martinez-Cruz, A. L. (2018), 'The Impact of Emissions-Based Taxes on the Retirement of Used and Inefficient Vehicles: The Case of Switzerland', *Journal of Environmental Economics and Management* **88**, 234–258.

Allcott, H. (2016), 'Paternalism and Energy Efficiency: An Overview', *Annual Review of Economics* **8**(1), 145–176.

Allcott, H. and Knittel, C. (2019), 'Are Consumers Poorly Informed about Fuel Economy? Evidence from Two Experiments', *American Economic Journal: Economic Policy* **11**(1), 1–37.

Allcott, H. and Mullainathan, S. (2010), 'Behavior and Energy Policy', *Science* **327**(5970), 1204–1205.

Allcott, H., Mullainathan, S. and Taubinsky, D. (2014), 'Energy policy with externalities and internalities', *Journal of Public Economics* **112**, 72–88.

Benartzi, S. and Thaler, R. H. (2007), 'Heuristics and Biases in Retirement Savings Behavior', *Journal of Economic perspectives* **21**(3), 81–104.

Bertrand, M., Karlan, D., Mullainathan, S., Shafir, E. and Zinman, J. (2010), 'What's Advertising Content Worth? Evidence from a Consumer Credit Marketing Field Experiment', *Quarterly Journal of Economics* **125**(1), 263–305.

Bhargava, S. and Manoli, D. (2015), 'Psychological Frictions and the Incomplete Take-Up of Social Benefits: Evidence from an IRS Field Experiment', *American Economic Review* **105**(11), 3489–3529.

Blasch, J., Boogen, N., Daminato, C. and Filippini, M. (2018), 'Empower the Consumer! Energy-Related Financial Literacy and its Socioeconomic Determinants', *CER-ETH Economics Working Paper Series* **18/289**.

Cerruti, D., Alberini, A. and Linn, J. (2019), 'Charging Drivers by the Pound: How Does the UK Vehicle Tax System Affect CO2 Emissions?', *Environmental and Resource Economics* **Article in press**.

Chetty, R. (2015), 'Behavioral Economics and Public Policy: A Pragmatic Perspective', *American Economic Review* **105**(5), 1–33.

Chetty, R., Friedman, J. N., Leth-Petersen, S., Nielsen, T. H. and Olsen, T. (2014), 'Active vs. Passive Decisions and Crowd-Out in Retirement Savings Accounts: Evidence from Denmark', *The Quarterly Journal of Economics* **129**(3), 1141–1219.

Chetty, R., Friedman, J. N. and Saez, E. (2013), 'Using Differences in Knowledge Across Neighborhoods to Uncover the Impacts of the EITC on Earnings', *American Economic Review* **103**(7), 2683–2721.

Chetty, R., Looney, A. and Kroft, K. (2009), 'Salience and Taxation: Theory and Evidence', *American Economic Review* **99**(4), 1145–1177.

Chetty, R. and Saez, E. (2013), 'Teaching the Tax Code: Earnings Responses to an Experiment with EITC Recipients', *American Economic Journal: Applied Economics* **5**(1), 1–31.

Congdon, W. J., Kling, J. R. and Mullainathan, S. (2009), 'Behavioral Economics and Tax Policy', *National Tax Journal* **62**(3), 375–86.

DellaVigna, S. (2009), 'Psychology and Economics: Evidence from the Field', *Journal of Economic Literature* **47**(2), 315–372.

D'Haultfœuille, X., Givord, P. and Boutin, X. (2014), 'The Environmental Effect of Green Taxation: The Case of the French Bonus/Malus', *The Economic Journal* **124**(578), 444–480.

Finkelstein, A. (2009), 'E-ztax: Tax salience and tax rates', *The Quarterly Journal of Economics* **124**(3), 969–1010.

Gillingham, K., Newell, R. G. and Palmer, K. (2009), 'Energy Efficiency Economics and Policy', *Annual Review of Resource Economics* **1**(1), 597–620.

Grigolon, L., Reynaert, M. and Verboven, F. (2018), 'Consumer Valuation of Fuel Costs and Tax Policy: Evidence from the European Car Market', *American Economic Journal: Economic Policy* **10**(3), 193–225.

Guiso, L., Sapienza, P. and Zingales, L. (2004), 'The Role of Social Capital in Financial Development', *American Economic Review* **94**(3), 526–556.

Heckman, J. J., Ichimura, H. and Todd, P. (1998), 'Matching As An Econometric Evaluation Estimator', *Review of Economic Studies* **65**(2), 261–294.

Klier, T. and Linn, J. (2015), 'Using Taxes to Reduce Carbon Dioxide Emissions Rates of New Passenger Vehicles: Evidence from France, Germany, and Sweden', *American Economic Journal: Economic Policy* **7**(1), 212–242.

Kling, J. R., Mullainathan, S., Shafir, E., Vermeulen, L. C. and Wrobel, M. V. (2012), 'Comparison Friction: Experimental Evidence from Medicare Drug Plans', *The Quarterly Journal of Economics* **127**(1), 199–235.

Levi, M. D. (1973), 'Errors in the Variables Bias in the Presence of Correctly Measured Variables', *Econometrica* **41**(5), 985–986.

Liebman, J. B. and Luttmer, E. F. P. (2015), 'Would People Behave Differently If They Better Understood Social Security? Evidence from a Field Experiment', *American Economic Journal: Economic Policy* **7**(1), 275–299.

Lusardi, A. and Mitchell, O. S. (2014), 'The Economic Importance of Financial Literacy: Theory and Evidence', *Journal of Economic Literature* **52**(1), 5–44.

Madrian, B. C. (2014), 'Applying Insights from Behavioral Economics to Policy Design', *Annual Review of Economics* **6**(1), 663–688.

Mastrobuoni, G. (2011), 'The Role of Information for Retirement Behavior: Evidence Based on the Stepwise Introduction of the Social Security Statement', *Journal of Public Economics* **95**(7-8), 913–925.

Rosenbaum, P. R. and Rubin, D. B. (1983), 'The Central Role of the Propensity Score in Observational Studies for Causal Effects', *Biometrika* **70**(1), 41–55.

Rosenbaum, P. R. and Rubin, D. B. (1984), 'Reducing Bias in Observational Studies Using Subclassification on the Propensity Score', *Journal of the American Statistical Association* **79**(387), 516–524.

Simon, H. A. (1955), 'A Behavioral Model of Rational Choice', *Quarterly Journal of Economics* **69**(1), 99–118.

Swiss Federal Statistical Office (2017), Comportement de la Population en Matière de Transports: Résultats de Microrecensement Mobilité et Transports 2015, Technical report, OFS, Neuchâtel.
URL: *https://www.bfs.admin.ch/bfs/fr/home/statistiques/catalogues-banques-donnees/publications.assetdetail.1840478.html*

A Description of cantonal bonus systems

We reconstructed the criteria and the evolution of the vehicle registration tax and the Bonus/Malus system for each canton by looking at the official legislation between 2005 and 2018. We have information on thresholds of CO_2 emissions and/or efficiency rating necessary to be eligible to the bonus, the maximum age of the car, the size of the discounts and the penalties (in most cases a percentage discount on the baseline registration tax), and the years in which the Bonus/Malus was implemented. To be eligible for a bonus, some cantons require a vehicle to be registered for the first time only after a certain date. Seven cantons also implemented a malus - that is, an increase in the baseline tax if a car has low energy rating or high CO_2 emissions. Table 8 and figure 4 show the characteristics of the Bonus/Malus system in each canton.

Some cantons have also benefits for hybrid electric vehicles, plug in battery electric vehicles, or other alternative fuel vehicles. Those vehicles represent a very small share of the SHEDS sample and therefore those incentives are not considered in our analysis.

Figure 4: Current Bonus/Malus systems in Swiss cantons

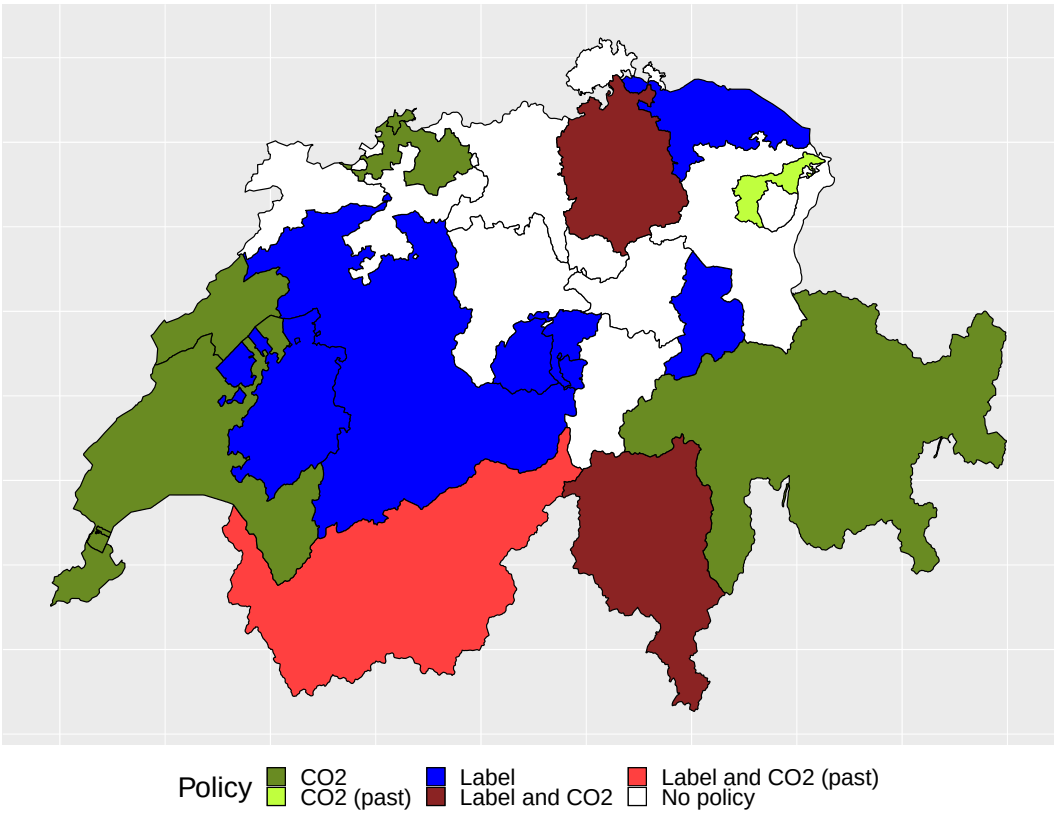


Figure 5 illustrates the information contained in the vehicle energy label available to

Table 8: Summary Bonus/Malus systems

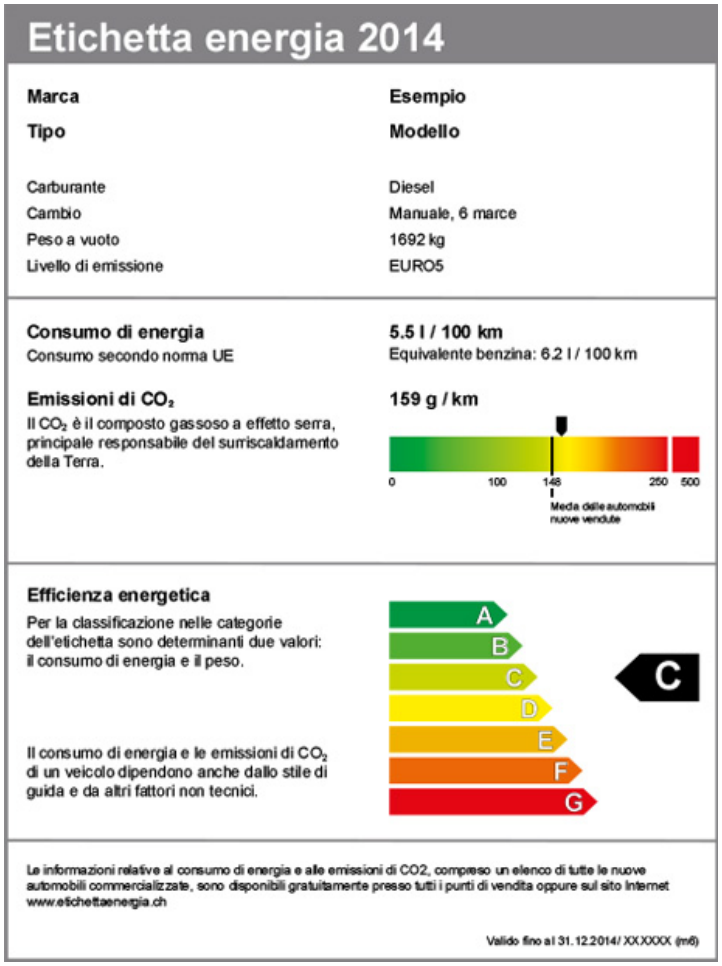
Canton	**Implemented**	**Efficiency rating**	**CO_2**	**Max age (bonus)**
AR	2011-2014	No	Yes	No limit
BE	2013-2018	Yes	No	4 years
BL	2014-2018	No	Yes	4 years
BS	2013-2018	No	Yes	4 years
FR	2011-2018	Yes	No	3 years
GE	2010-2018	No	Yes	Some*
GL	2012-2018	Yes	No	3 years
GR	2009-2018	No	Yes	Some*
NE	2014-2018	No	Yes	Some*
NW	2009-2018	Yes	No	3 years
OW	2009-2018	Yes	No	3 years
SG	2009-2018	Yes	Yes	3 years
TG	2009-2018	Yes	No	4 years
TI	2009-2018	Yes	Yes	Some*
VD	2005-2018	No	Yes	No limit
VS	2010-2015	Yes	Yes	No limit
ZH	2014-2018	Yes	Yes	4 years

Description of main characteristics of Bonus/Malus schemes in Swiss cantons. Only cantons with policies are reported. Some cantons have special eligibility limits. GE: only cars first registered after 2009; GR: thresholds for bonus change every 3 years; NE: no age limit, but size of bonus is based on age; TI: only cars first registered after 2008.

consumers when buying a car: baseline vehicle characteristics, fuel consumption per 100 km, CO_2 emissions per km, and energy efficiency rating. Therefore the label reports two clear indicators on the level of energy efficiency of a car - fuel consumption and efficiency rating - and an environmental indicator - CO_2 emission rate. Estimates of fuel costs per km or vehicle registration taxes are not shown.

The efficiency rating is a relative measure of efficiency, and the the thresholds used to assign the efficiency rating are recalculated each year. All recent vehicle types on the market are ordered according to an evaluation coefficient which depends on both absolute fuel consumption per 100 km and fuel consumption per 100 km over vehicle weight. Based on this coefficient, vehicle types are assigned to seven equally sized groups from A to G.

Figure 5: Example of the Swiss vehicle energy label



B Fuel consumption variable

The main outcome of interest in our analysis is self-reported information on vehicle fuel consumption. In this Appendix we provide descriptive evidence on the accuracy of our self-reported data, and then on the strong relationship between actual fuel consumption, efficiency rating, and CO_2 emissions.

To do so, we use data from the Swiss vehicle registration database, containing information on all vehicles registered in Switzerland at the end of 2015. While, due to data confidentiality reasons, we cannot match each individual vehicle in SHEDS with its corresponding vehicle in the registration data, we can compare the fuel consumption distribution between the two databases. Figure 6 plots the percentile of fuel consumption using SHEDS data and the registration data. In both datasets, we limit the sample to cars bought in 2015 or earlier, excluding the canton of Ticino. We observe a good overlap between the self-reported SHEDS fuel consumption and the actual fuel consumption through all percentiles, suggesting a limited presence of measurement error issues.

Figure 7 shows fuel consumption distribution by efficiency rating using the registration data. We group vehicles in two categories: ratings A and B (which can benefit from a bonus) and ratings from C to G (which cannot receive a bonus). Despite some overlap, we see that most vehicles belonging to worse efficiency ratings have higher fuel consumption.

Finally, in Figure 8 we illustrate the almost linear relationship between CO_2 emissions and fuel consumption. For visibility sake, we include only vehicles registered for the first time in 2015. The graph clearly shows an almost perfect linear relationship among cars with the same fuel type.

Figure 6: Fuel consumption distribution of SHEDS and Registration data

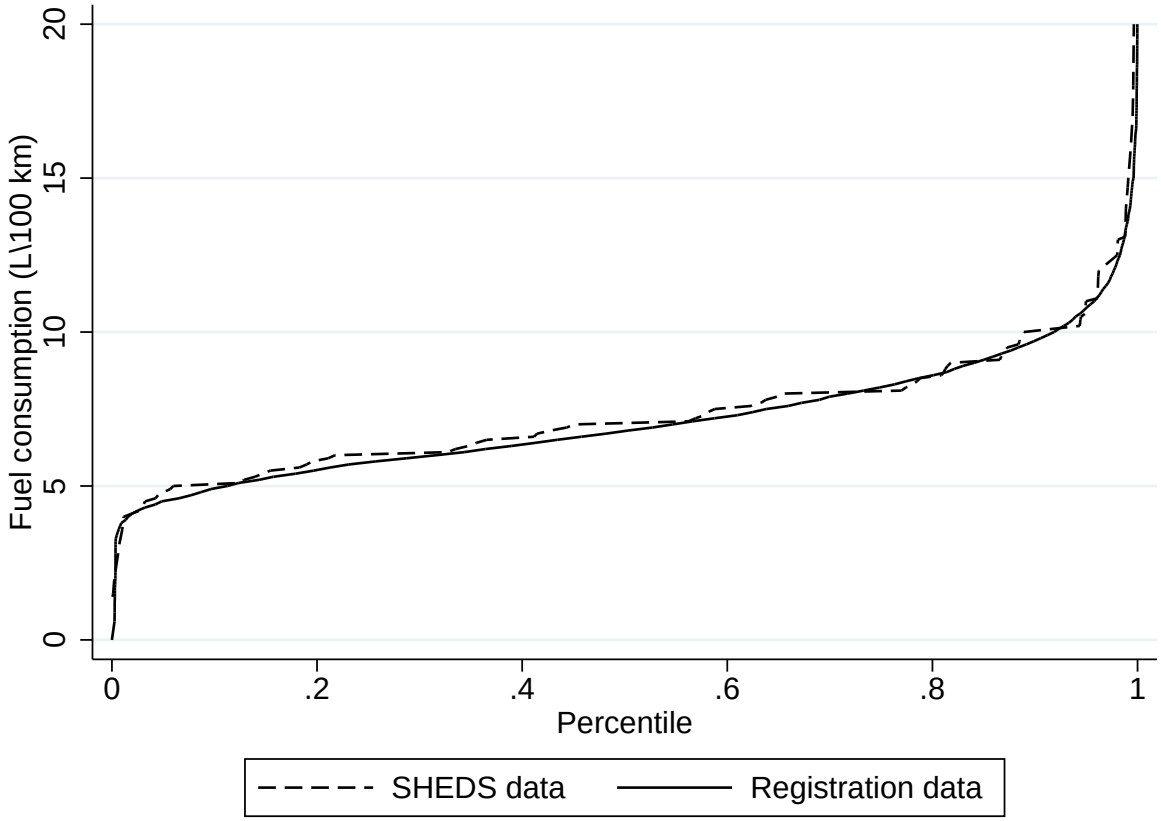


Figure 7: Fuel consumption distribution and efficiency rating, registration data

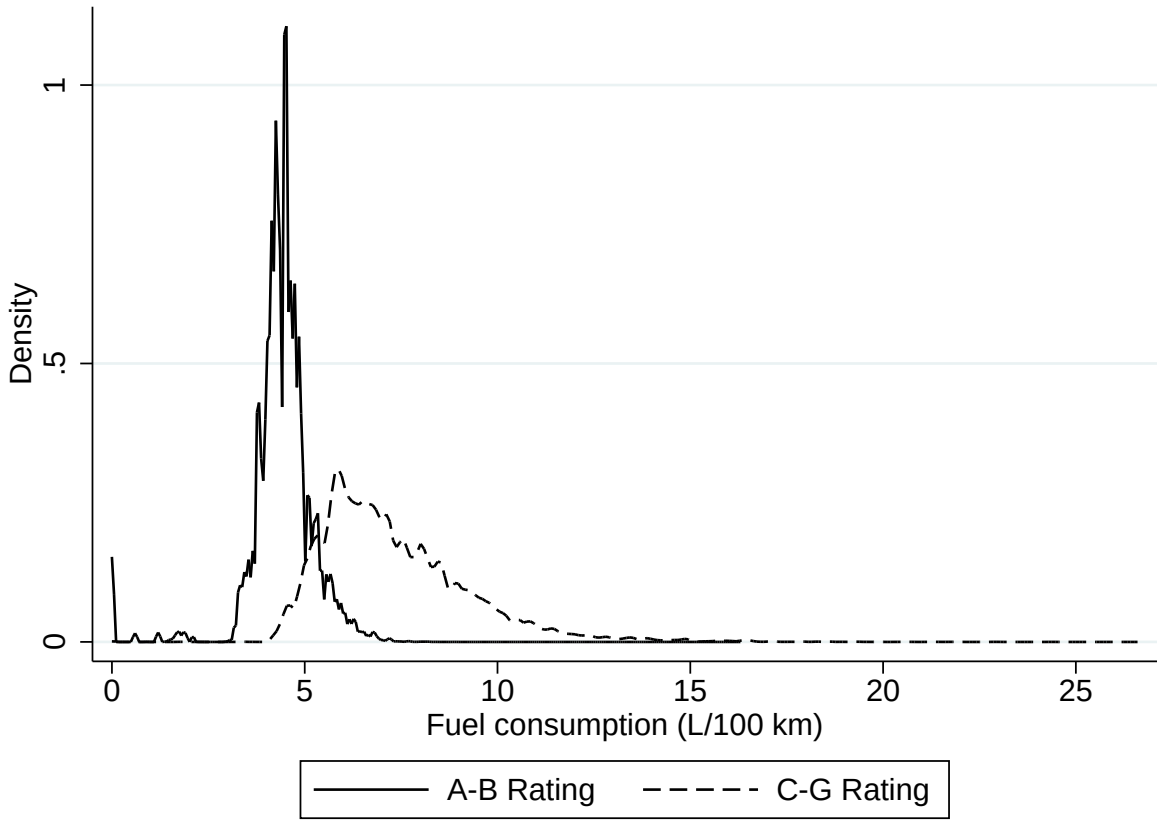
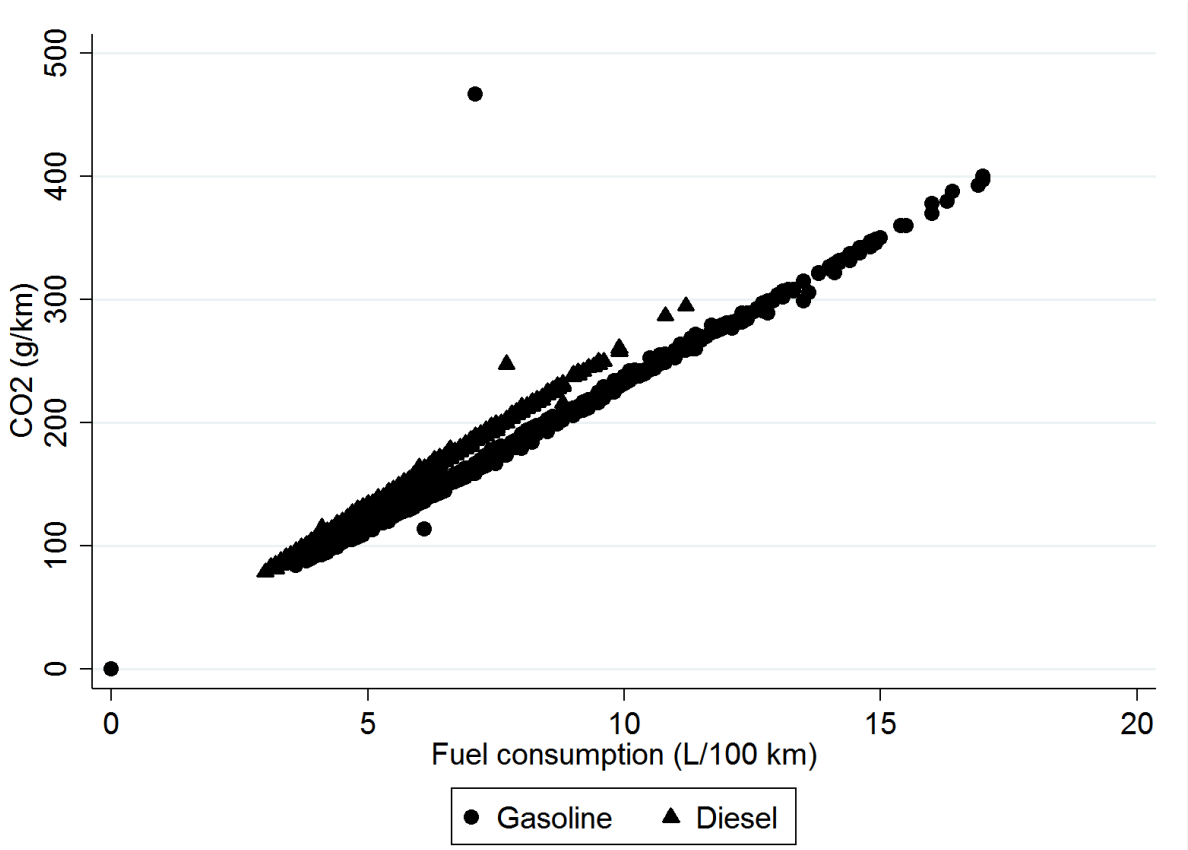


Figure 8: Fuel consumption and CO_2 emissions, 2015 registration data



C Information on SHEDS questionnaire

SHEDS is organized in multiple waves, from 2016 to 2020, carried out by the survey company Intervista. Participants are taken from a larger pool of potential respondents, and some individuals are surveyed in multiple waves. Each wave, the pool of respondents is selected to be representative of the French and German Swiss population. People living in the canton of Ticino are not surveyed.

Our main dataset comes from the 2018 wave. Baseline respondent characteristics, like income, education, and household size, are collected by Intervista each year outside the questionnaire. In our survey some questions are asked only to new respondents i.e. individuals who were never interviewed in the previous waves. We use data from the 2016 and 2017 waves to collect the answers in case of recurring respondents.

The 2018 wave of SHEDS contains 5011 individuals. Among those, 3621 (72.26%) own at least a car in their household. Due to the presence of missing variables, the final sample used in the baseline analysis contains 2504 respondents. Table 9 shows how many observations have been omitted among respondents with a car.

Table 9: Missing observations

Variable	**Missing**	**Percentage**
Fuel consumption	198	5.47%
Year first registration	171	4.72%
Year of purchase	100	2.76%
HH monthly income	541	14.94%
Financial literacy	405	11.18%
Other	26	0.72%

Statistics on numbers of missing observations among variables used in the analysis. Percentages are over the number of respondents owning one or more vehicle. Some respondents have multiple variables missing.

The majority of missing observations comes from two variables: financial literacy and household monthly income. Many values from financial literacy are missing simply because all respondents surveyed in waves 2016 and 2018, but not in 2017, were not asked the two questions that compose the financial literacy indicator used in the analysis. We argue that whether a respondent participated to a specific wave is essentially exogenous to our phenomenon of interest. Some other respondents were reluctant to provide information on

their household's income. Nevertheless, repeating our main analysis either excluding these two variables or including the missing variables under a separate index does not change our results.

We also trim the top and bottom 0.5% fuel consumption percentiles (24 observations), to exclude patently wrongly reported values. That means dropping values of fuel consumption (L/100 km) lower than 2 and higher than 40. As in the previous case, including those observations in the analysis does not affect our conclusions.

In the analysis we include a rich set of controls to take into account factors related to the fuel consumption of the car respondents bought.[35] These are summarized in tables 10, 11, 12, 13 and 14. While some of the questions were asked in wave 2018, others were not asked again in case of participation to multiple waves. For what concerns vehicle information, many questions were not asked every wave unless the respondent told she changed vehicle between waves.

Besides baseline questions on respondents and household and vehicle characteristics, we have also questions on energy and financial literacy (table 10). Financial literacy measures whether respondents answered correctly to two standard questions to measure the understanding of interest rates and inflation. For energy literacy, we have indicators for the correct answer to four questions: electricity cost for running a desktop computer for one hour; electricity cost for running a washing machine at 60°C with 5 kg load; knowledge that vehicle energy efficiency rating is a relative measure of efficiency rather than absolute; which has higher energy cost per 100 km between a gasoline car consuming 5 L/100 km and an electric car consuming 20 kWh per 100 km.

Another set of controls represent general attitudes towards life. We ask respondents how important certain values or lifestyles are for them using a scale from 1 (*Not at all important*) to 5 (*Very important*), and we create indicators equal to 1 for those who indicated 4 or 5, and zero otherwise. The list of values and lifestyles are summarized in table 11.

The first set of environment-related controls used in the paper are shown in table 12. They represent statements about feelings towards the environment, to which respondents are asked to indicate their degree of agreement with a scale between 1 and 5 (from *totally disagree* to *totally agree*). We then create indicators on whether people answered 4 or 5.

We also have a second set controls about environmental activism, and behavior and expectations towards the environment (table 13). The latter are once more based on a scale of agreement between 1 and 5, and they are transformed into binary indicators under the same criteria as before.

[35]The exact phrasing of all questions used can be found in the complete questionnaire text: https://www.sccer-crest.ch/research/swiss-household-energy-demand-survey-sheds/

Table 10: Variables used - Main

Variable	**Wave**
Baseline	
Age	2018
Age squared	2018
Gender	2018
Education	2018
Profession	2018
Language	2018
HH monthly gross income	2018
HH size	2018
HH living area	2018
Policy awareness	2018
Vehicle	
Year of purchase	When car changed
Year of first registration	When car changed
Fuel consumption (L/100 km)	2018
Efficiency rating	When car changed
Literacy	
Financial literacy	Earliest
Efficiency rating	Earliest
Energy cost: computer	Earliest
Energy cost: washing machine	Earliest
Vehicle fuel cost	Earliest
Prone to financial risks	Earliest

Table 11: Variables used - Life attitudes

Variable	Wave
Life values	
Equality	2018
Respecting the earth	2018
Social power	2018
Pleasure	2018
Unity with nature	2018
A world at peace	2018
Wealth	2018
Authority	2018
Social justice	2018
Enjoying life	2018
Protecting the environment	2018
Influence	2018
Helpfulness	2018
Preventing pollution	2018
Self-indulgent	2018
Ambitious	2018
Important things in life	
Good health	2018
Good relations	2018
Freedom	2018
Safety	2018
Own identity lifestyle	2018
Privacy	2018
Clean environment	2018
Job access	2018
Free time	2018
Comfort	2018
Enjoy nature and culture	2018
Pleasant experiences	2018
Appreciation and respect	2018
Nice possessions	2018

Table 12: Variables used - Feelings towards environment

Variable	Wave
Sentiment towards environmental actions	
Proud when environmentally friendly	Earliest
Happy when conserving resources	Earliest
Guilty when harming environment	Earliest
Appreciation towards those acting environmentally friendly	Earliest
Warm towards those conserving resources	Earliest
Content when acting environmentally friendly	Earliest
Indignant towards those acting environmentally unfriendly	Earliest
Regret when wasting resources	Earliest
Ashamed when acting environmentally unfriendly	Earliest
Disgusted when others waste resources	Earliest
Positive towards those acting environmentally friendly	Earliest
Feeling when pushed to act environmentally friendly/unfriendly	
Frustrated when can't act environmentally friendly	Earliest
Angry when my freedom constrained to protect environment	Earliest
Annoyed when others try to convince me to act environmentally friendly	Earliest
Dissatisfied when can't conserve resources	Earliest
Hostile when forced to act environmentally friendly	Earliest
Angry when forced to act environmentally unfriendly	Earliest
Feelings towards environment and environmental change	
Grateful for planet and nature	Earliest
Worried for future of nature	Earliest
Awe for planet and nature	Earliest
Anxious about future of planet	Earliest
Sad about how mankind treats nature	Earliest
Overwhelmed by beauty of nature	Earliest

Table 13: Variables used - Environmental behavior and expectations

Variable	Wave
Expectations towards environmental actions	
HH expects I behave environmentally friendly	2018
Acquaintances behave environmentally friendly	2018
Acquaintances expects I behave environmentally friendly	2018
Personally obliged to behave environmentally friendly	2018
Swiss society expects people behave environmentally friendly	2018
Opinions towards environmental actions	
Know how to behave environmentally friendly	Earliest
It is easy to conserve resources	Earliest
Able to protect the environment when I want so	Earliest
I behave environmentally friendly despite daily inconveniences	Earliest
Acting environmentally friendly protects planet and nature	Earliest
Acting environmentally friendly prevents consequences of global warming	Earliest
Acting environmentally friendly saves resources	Earliest
Environmental activism	
Green party voter	2018
Member of environmental club	2018

Finally, we control whether people trust energy saving information coming from various groups and institutions (scale from 1 to 5, converted in binary indicator). Those are reported in table 14.

Table 14: Variables used - Trust about energy saving information from selected subjects

Variable	**Wave**
Trust about energy saving information	
From family, friends, colleagues	Earliest
From neighbors	Earliest
From Swiss Federal Office of Energy (SFOE)	Earliest
From local authorities	Earliest
From local energy supply utility	Earliest
From scientists	Earliest
From consumer organizations	Earliest
From environmental organizations	Earliest
From technical experts	Earliest
From property management company	Earliest
From associations/clubs	Earliest

D Summary statistics and awareness

Table 15: Baseline statistics

	Not Aware			**Aware**		
	No Policy	Policy	T-test	No Policy	Policy	T-test
Age	47.810	46.049	* (2.19)	50.955	47.036	*** (4.25)
Female	0.489	0.520	(-1.20)	0.384	0.393	(-0.28)
Educ.: compulsory	0.077	0.078	(-0.12)	0.048	0.074	(-1.71)
Educ.: apprenticeship	0.342	0.303	(1.59)	0.342	0.281	* (2.09)
Educ.: high school/vocat.	0.159	0.155	(0.18)	0.103	0.158	* (-2.51)
Educ.: university	0.423	0.464	(-1.57)	0.508	0.487	(0.64)
Job: employee	0.653	0.658	(-0.22)	0.636	0.653	(-0.55)
Job: self-empl.	0.063	0.042	(1.81)	0.080	0.091	(-0.59)
Job: retired	0.155	0.141	(0.75)	0.198	0.144	* (2.31)
Job: other	0.129	0.159	(-1.62)	0.085	0.112	(-1.40)
HH income: <6000	0.285	0.277	(0.36)	0.216	0.264	(-1.75)
HH income: 6000-9000	0.281	0.325	(-1.79)	0.307	0.308	(-0.05)
HH income: >9000	0.433	0.399	(1.34)	0.477	0.428	(1.57)
German speaker	0.822	0.732	*** (4.13)	0.894	0.478	*** (14.99)
HH size: 1	0.199	0.206	(-0.30)	0.216	0.202	(0.55)
HH size: 2	0.443	0.436	(0.24)	0.455	0.432	(0.71)
HH size: 3	0.147	0.158	(-0.60)	0.138	0.146	(-0.34)
HH size: 4	0.153	0.142	(0.60)	0.146	0.168	(-0.98)
HH size: 5	0.058	0.058	(0.01)	0.045	0.052	(-0.46)
Area: city	0.392	0.422	(-1.14)	0.354	0.396	(-1.36)
Area: agglomeration	0.332	0.304	(1.11)	0.349	0.322	(0.92)
Area: countryside	0.276	0.274	(0.09)	0.296	0.282	(0.50)
Green party	0.083	0.112	(-1.82)	0.123	0.108	(0.76)
Env. club	0.037	0.032	(0.53)	0.033	0.024	(0.81)
N	757	690	1447	398	659	1057

Table 16: Baseline statistics

	Policy ever in place			**Policy aware**			
	No	Yes	T-test	No	Yes	T-test	Tot
Age	46.446	47.998	* (-2.22)	46.970	48.512	* (-2.54)	47.621
Female	0.442	0.460	(-0.75)	0.504	0.390	*** (5.69)	0.456
Educ.: compulsory	0.061	0.075	(-1.21)	0.077	0.064	(1.25)	0.072
Educ.: apprenticeship	0.342	0.306	(1.65)	0.323	0.304	(1.05)	0.315
Educ.: high school/vocat.	0.132	0.154	(-1.35)	0.157	0.137	(1.37)	0.149
Educ.: university	0.465	0.464	(0.06)	0.442	0.495	** (-2.60)	0.464
Job: employee	0.673	0.645	(1.27)	0.655	0.646	(0.47)	0.651
Job: self-empl.	0.069	0.067	(0.18)	0.053	0.087	*** (-3.34)	0.067
Job: retired	0.137	0.161	(-1.44)	0.148	0.165	(-1.14)	0.155
Job: other	0.122	0.128	(-0.38)	0.144	0.102	** (3.10)	0.126
HH income: <6000	0.237	0.276	(-1.89)	0.281	0.246	* (1.97)	0.266
HH income: 6000-9000	0.286	0.310	(-1.12)	0.302	0.307	(-0.29)	0.304
HH income: >9000	0.477	0.414	** (2.73)	0.417	0.447	(-1.49)	0.429
German speaker	0.939	0.647	*** (14.49)	0.779	0.635	*** (8.01)	0.718
HH size: 1	0.184	0.211	(-1.42)	0.202	0.207	(-0.29)	0.204
HH size: 2	0.414	0.448	(-1.46)	0.440	0.441	(-0.07)	0.440
HH size: 3	0.163	0.143	(1.17)	0.152	0.143	(0.64)	0.148
HH size: 4	0.173	0.147	(1.55)	0.148	0.160	(-0.82)	0.153
HH size: 5	0.066	0.051	(1.43)	0.058	0.049	(0.97)	0.054
Area: city	0.289	0.429	*** (-6.18)	0.406	0.380	(1.32)	0.395
Area: agglomeration	0.372	0.309	** (2.87)	0.319	0.332	(-0.71)	0.324
Area: countryside	0.339	0.262	*** (3.70)	0.275	0.288	(-0.69)	0.280
Green party	0.097	0.106	(-0.63)	0.097	0.114	(-1.36)	0.104
Env. club	0.031	0.032	(-0.05)	0.035	0.027	(1.01)	0.032
N	608	1896	2504	1447	1057	2504	2504

Table 17: Energy and financial literacy

	Not Aware			**Aware**		
	No Policy	Policy	T-test	No Policy	Policy	T-test
Financial literacy	0.650	0.623	(1.06)	0.751	0.654	*** (3.33)
Efficiency rating	0.520	0.538	(-0.65)	0.540	0.461	* (2.49)
Energy cost: computer	0.328	0.314	(0.53)	0.405	0.317	** (2.89)
Energy cost: washing mach.	0.136	0.129	(0.40)	0.138	0.120	(0.87)
Vehicle fuel cost	0.390	0.354	(1.42)	0.435	0.405	(0.94)
Risk taker	0.107	0.104	(0.16)	0.136	0.131	(0.24)
N	757	690	1447	398	659	1057

Table 18: Energy and financial literacy

	Policy ever in place			**Policy aware**			
	No	Yes	T-test	No	Yes	T-test	Tot
Financial literacy	0.720	0.640	*** (3.64)	0.637	0.691	** (-2.79)	0.660
Efficiency rating	0.561	0.497	** (2.73)	0.529	0.491	(1.86)	0.513
Energy cost: computer	0.375	0.320	* (2.50)	0.321	0.350	(-1.50)	0.333
Energy cost: washing mach.	0.146	0.125	(1.36)	0.133	0.127	(0.43)	0.130
Vehicle fuel cost	0.416	0.383	(1.46)	0.372	0.416	* (-2.22)	0.391
Risk taker	0.122	0.116	(0.41)	0.106	0.132	* (-2.05)	0.117
N	608	1896	2504	1447	1057	2504	2504

Table 19: Life values

	Not Aware			**Aware**		
	No Policy	Policy	T-test	No Policy	Policy	T-test
Equality	0.707	0.726	(-0.81)	0.671	0.741	* (-2.43)
Respect Earth	0.757	0.735	(0.97)	0.714	0.783	* (-2.56)
Social power	0.096	0.110	(-0.86)	0.098	0.114	(-0.80)
Pleasure	0.687	0.713	(-1.08)	0.681	0.780	*** (-3.59)
Unity w/nature	0.675	0.661	(0.57)	0.643	0.659	(-0.51)
World peace	0.816	0.828	(-0.55)	0.789	0.812	(-0.91)
Wealth	0.313	0.335	(-0.88)	0.362	0.363	(-0.03)
Authority	0.120	0.148	(-1.54)	0.126	0.188	** (-2.66)
Social justice	0.686	0.706	(-0.83)	0.676	0.684	(-0.29)
Enjoying life	0.707	0.761	* (-2.33)	0.734	0.794	* (-2.25)
Protect env.	0.775	0.793	(-0.80)	0.751	0.788	(-1.37)
Influence	0.285	0.326	(-1.68)	0.322	0.311	(0.36)
Helpfulness	0.573	0.533	(1.53)	0.487	0.546	(-1.86)
Prevent pollut.	0.775	0.777	(-0.06)	0.749	0.780	(-1.17)
Self-indulgence	0.509	0.551	(-1.60)	0.465	0.619	*** (-4.95)
Ambition	0.328	0.425	*** (-3.83)	0.387	0.379	(0.25)
N	757	690	1447	398	659	1057

Table 20: Life values

	Policy ever in place			**Policy aware**			
	No	Yes	T-test	No	Yes	T-test	Tot
Equality	0.688	0.724	(-1.74)	0.716	0.714	(0.09)	0.715
Respect Earth	0.734	0.756	(-1.13)	0.746	0.757	(-0.60)	0.751
Social power	0.089	0.110	(-1.50)	0.103	0.108	(-0.39)	0.105
Pleasure	0.678	0.730	* (-2.52)	0.699	0.743	* (-2.38)	0.718
Unity w/nature	0.625	0.674	* (-2.20)	0.668	0.653	(0.81)	0.662
World peace	0.785	0.823	* (-2.14)	0.822	0.803	(1.17)	0.814
Wealth	0.344	0.339	(0.23)	0.323	0.362	* (-2.03)	0.340
Authority	0.113	0.157	** (-2.65)	0.133	0.165	* (-2.18)	0.147
Social justice	0.663	0.698	(-1.62)	0.695	0.681	(0.75)	0.689
Enjoying life	0.725	0.756	(-1.53)	0.733	0.771	* (-2.20)	0.749
Protect env.	0.765	0.784	(-1.01)	0.784	0.774	(0.58)	0.780
Influence	0.298	0.313	(-0.70)	0.305	0.315	(-0.55)	0.309
Helpfulness	0.528	0.546	(-0.77)	0.554	0.524	(1.49)	0.542
Prevent pollut.	0.740	0.783	* (-2.21)	0.776	0.768	(0.46)	0.773
Self-indulgence	0.475	0.564	*** (-3.82)	0.529	0.561	(-1.60)	0.542
Ambition	0.367	0.381	(-0.62)	0.374	0.382	(-0.42)	0.377
N	608	1896	2504	1447	1057	2504	2504

Table 21: Important things in life

	Not Aware			**Aware**		
	No Policy	Policy	T-test	No Policy	Policy	T-test
Health	0.962	0.975	(-1.48)	0.967	0.971	(-0.35)
Relations	0.847	0.874	(-1.49)	0.852	0.883	(-1.48)
Freedom	0.902	0.922	(-1.30)	0.915	0.941	(-1.63)
Safety	0.878	0.894	(-0.94)	0.884	0.900	(-0.79)
Identity	0.696	0.712	(-0.64)	0.661	0.798	*** (-5.03)
Privacy	0.888	0.907	(-1.22)	0.927	0.926	(0.09)
Clean env.	0.877	0.916	* (-2.41)	0.884	0.927	* (-2.37)
Job	0.797	0.820	(-1.14)	0.804	0.824	(-0.81)
Free time	0.882	0.883	(-0.01)	0.882	0.873	(0.45)
Comfort	0.666	0.700	(-1.40)	0.686	0.792	*** (-3.90)
Nat./cult. beauty	0.687	0.732	(-1.88)	0.711	0.777	* (-2.41)
Experiences	0.777	0.780	(-0.14)	0.756	0.841	*** (-3.40)
Respect	0.762	0.758	(0.19)	0.744	0.733	(0.39)
Possessions	0.324	0.338	(-0.57)	0.332	0.322	(0.33)
N	757	690	1447	398	659	1057

Table 22: Important things in life

	Policy ever in place			**Policy aware**			
	No	Yes	T-test	No	Yes	T-test	Tot
Health	0.949	0.975	** (-3.24)	0.968	0.970	(-0.22)	0.969
Relations	0.836	0.874	* (-2.41)	0.860	0.871	(-0.84)	0.865
Freedom	0.898	0.927	* (-2.26)	0.912	0.931	(-1.76)	0.920
Safety	0.880	0.892	(-0.85)	0.886	0.894	(-0.64)	0.889
Identity	0.655	0.743	*** (-4.25)	0.704	0.746	* (-2.37)	0.722
Privacy	0.906	0.910	(-0.31)	0.897	0.926	* (-2.51)	0.909
Clean env.	0.872	0.912	** (-2.91)	0.896	0.911	(-1.28)	0.902
Job	0.827	0.806	(1.14)	0.808	0.816	(-0.54)	0.812
Free time	0.887	0.878	(0.59)	0.883	0.876	(0.49)	0.880
Comfort	0.666	0.726	** (-2.85)	0.682	0.752	*** (-3.83)	0.712
Nat./cult. beauty	0.671	0.745	*** (-3.56)	0.708	0.752	* (-2.43)	0.727
Experiences	0.762	0.801	* (-2.07)	0.778	0.809	(-1.87)	0.791
Respect	0.763	0.746	(0.84)	0.760	0.737	(1.32)	0.750
Possessions	0.362	0.318	* (2.03)	0.330	0.325	(0.26)	0.328
N	608	1896	2504	1447	1057	2504	2504

Table 23: Sentiment towards environmental actions

	Not Aware			**Aware**		
	No Policy	Policy	T-test	No Policy	Policy	T-test
Proud	0.655	0.659	(-0.17)	0.613	0.646	(-1.09)
Happy	0.724	0.719	(0.21)	0.666	0.754	** (-3.11)
Guilty	0.559	0.536	(0.86)	0.477	0.539	(-1.93)
Appreciation	0.715	0.681	(1.39)	0.681	0.710	(-1.00)
Warm	0.600	0.555	(1.72)	0.565	0.577	(-0.36)
Content	0.803	0.809	(-0.27)	0.754	0.804	(-1.94)
Indignant	0.444	0.446	(-0.10)	0.425	0.454	(-0.92)
Regret	0.581	0.548	(1.28)	0.518	0.598	* (-2.56)
Angry	0.450	0.406	(1.72)	0.402	0.439	(-1.16)
Ashamed	0.446	0.414	(1.23)	0.422	0.408	(0.44)
Disgusted	0.399	0.378	(0.81)	0.354	0.458	*** (-3.33)
Positive	0.769	0.748	(0.93)	0.739	0.728	(0.37)
N	757	690	1447	398	659	1057

Table 24: Sentiment towards environmental actions

	Policy ever in place			**Policy aware**			
	No	Yes	T-test	No	Yes	T-test	Tot
Proud	0.641	0.649	(-0.35)	0.657	0.634	(1.21)	0.647
Happy	0.709	0.725	(-0.78)	0.721	0.721	(0.03)	0.721
Guilty	0.513	0.541	(-1.20)	0.548	0.516	(1.61)	0.534
Appreciation	0.702	0.698	(0.21)	0.699	0.699	(-0.02)	0.699
Warm	0.590	0.571	(0.84)	0.578	0.572	(0.30)	0.576
Content	0.763	0.808	* (-2.40)	0.806	0.785	(1.26)	0.797
Indignant	0.431	0.448	(-0.75)	0.445	0.443	(0.11)	0.444
Regret	0.539	0.575	(-1.53)	0.565	0.568	(-0.12)	0.566
Angry	0.444	0.422	(0.96)	0.429	0.425	(0.22)	0.427
Ashamed	0.456	0.414	(1.83)	0.431	0.413	(0.89)	0.424
Disgusted	0.363	0.414	* (-2.21)	0.389	0.419	(-1.51)	0.402
Positive	0.763	0.743	(1.01)	0.759	0.732	(1.51)	0.748
N	608	1896	2504	1447	1057	2504	2504

Table 25: Feeling when pushed to act environmentally friendly

	Not Aware			**Aware**		
	No Policy	Policy	T-test	No Policy	Policy	T-test
Frustrated	0.494	0.526	(-1.22)	0.523	0.533	(-0.32)
Angry if const.	0.202	0.241	(-1.76)	0.266	0.217	(1.83)
Annoyed	0.339	0.358	(-0.74)	0.399	0.296	*** (3.47)
Dissatisfied	0.538	0.562	(-0.94)	0.558	0.552	(0.17)
Hostile	0.196	0.236	(-1.88)	0.266	0.185	** (3.12)
Angry if forced	0.425	0.443	(-0.69)	0.465	0.410	(1.75)
N	757	690	1447	398	659	1057

Table 26: Feeling when pushed to act environmentally friendly

	Policy ever in place			**Policy aware**			
	No	Yes	T-test	No	Yes	T-test	Tot
Frustrated	0.492	0.526	(-1.46)	0.509	0.529	(-0.97)	0.518
Angry if const.	0.212	0.232	(-0.99)	0.220	0.236	(-0.89)	0.227
Annoyed	0.352	0.340	(0.56)	0.348	0.335	(0.70)	0.343
Dissatisfied	0.521	0.561	(-1.72)	0.549	0.554	(-0.25)	0.552
Hostile	0.229	0.211	(0.92)	0.215	0.216	(-0.05)	0.215
Angry if forced	0.438	0.431	(0.29)	0.434	0.430	(0.18)	0.433
N	608	1896	2504	1447	1057	2504	2504

Table 27: Feeling towards environment and environmental change

	Not Aware			**Aware**		
	No Policy	Policy	T-test	No Policy	Policy	T-test
Grateful	0.840	0.826	(0.72)	0.829	0.812	(0.71)
Worried	0.765	0.730	(1.51)	0.726	0.748	(-0.79)
Awe	0.720	0.738	(-0.76)	0.739	0.778	(-1.47)
Anxious	0.522	0.510	(0.44)	0.407	0.552	*** (-4.62)
Sad	0.711	0.703	(0.33)	0.691	0.741	(-1.74)
Overwhelmed	0.803	0.812	(-0.41)	0.849	0.756	*** (3.64)
N	757	690	1447	398	659	1057

Table 28: Feeling towards environment and environmental change

	Policy ever in place			**Policy aware**			
	No	Yes	T-test	No	Yes	T-test	Tot
Grateful	0.842	0.822	(1.13)	0.833	0.818	(0.99)	0.827
Worried	0.752	0.743	(0.44)	0.748	0.740	(0.49)	0.745
Awe	0.709	0.754	* (-2.23)	0.728	0.763	* (-1.99)	0.743
Anxious	0.479	0.518	(-1.69)	0.516	0.498	(0.92)	0.508
Sad	0.686	0.722	(-1.72)	0.707	0.722	(-0.81)	0.713
Overwhelmed	0.831	0.791	* (2.15)	0.807	0.791	(1.01)	0.800
N	608	1896	2504	1447	1057	2504	2504

Table 29: Pressure towards environmental actions

	Not Aware			**Aware**		
	No Policy	Policy	T-test	No Policy	Policy	T-test
From HH	0.538	0.472	* (2.48)	0.563	0.519	(1.38)
acquait. behavior	0.464	0.464	(-0.00)	0.410	0.446	(-1.16)
From acquait.	0.398	0.348	(1.96)	0.362	0.431	* (-2.22)
Obliged	0.744	0.700	(1.86)	0.731	0.681	(1.71)
From society	0.575	0.616	(-1.60)	0.573	0.633	(-1.94)
N	757	690	1447	398	659	1057

Table 30: Pressure towards environmental actions

	Policy ever in place			**Policy aware**			
	No	Yes	T-test	No	Yes	T-test	Tot
From HH	0.508	0.522	(-0.60)	0.507	0.535	(-1.43)	0.519
acquait. behavior	0.441	0.454	(-0.55)	0.464	0.432	(1.56)	0.450
From acquait.	0.354	0.398	(-1.94)	0.374	0.405	(-1.58)	0.387
Obliged	0.729	0.708	(0.96)	0.723	0.700	(1.24)	0.713
From society	0.554	0.616	** (-2.71)	0.594	0.610	(-0.80)	0.601
N	608	1896	2504	1447	1057	2504	2504

Table 31: Opinions towards environmental actions

	Not Aware			**Aware**		
	No Policy	Policy	T-test	No Policy	Policy	T-test
Know how	0.783	0.754	(1.34)	0.814	0.760	* (2.05)
Easy	0.427	0.399	(1.09)	0.417	0.469	(-1.64)
Can	0.712	0.726	(-0.59)	0.683	0.760	** (-2.74)
Able	0.523	0.510	(0.49)	0.475	0.590	*** (-3.67)
Protection	0.724	0.728	(-0.15)	0.668	0.748	** (-2.80)
Prevention	0.635	0.628	(0.31)	0.535	0.646	*** (-3.60)
Saving	0.771	0.764	(0.35)	0.739	0.750	(-0.39)
N	757	690	1447	398	659	1057

Table 32: Opinions towards environmental actions

	Policy ever in place			**Policy aware**			
	No	Yes	T-test	No	Yes	T-test	Tot
Know how	0.793	0.768	(1.27)	0.769	0.781	(-0.67)	0.774
Easy	0.439	0.425	(0.61)	0.413	0.449	(-1.80)	0.429
Can	0.709	0.729	(-0.96)	0.719	0.731	(-0.70)	0.724
Able	0.485	0.544	* (-2.52)	0.517	0.547	(-1.48)	0.530
Protection	0.701	0.729	(-1.38)	0.726	0.718	(0.42)	0.722
Prevention	0.587	0.631	(-1.93)	0.632	0.605	(1.38)	0.620
Saving	0.753	0.760	(-0.34)	0.768	0.746	(1.29)	0.758
N	608	1896	2504	1447	1057	2504	2504

Table 33: Trust about energy saving information from selected subjects

	Not Aware			**Aware**		
	No Policy	Policy	T-test	No Policy	Policy	T-test
Family	0.485	0.501	(-0.63)	0.442	0.490	(-1.51)
Neighbors	0.214	0.200	(0.66)	0.156	0.194	(-1.58)
SFOE	0.639	0.619	(0.81)	0.580	0.656	* (-2.45)
Local auth.	0.489	0.496	(-0.26)	0.435	0.548	*** (-3.58)
Local energy	0.528	0.499	(1.13)	0.475	0.528	(-1.68)
Scientists	0.550	0.552	(-0.10)	0.565	0.601	(-1.14)
Consum. org.	0.519	0.507	(0.45)	0.535	0.601	* (-2.10)
Envir. org.	0.510	0.465	(1.70)	0.452	0.527	* (-2.34)
Experts	0.526	0.554	(-1.06)	0.550	0.572	(-0.69)
Property man.	0.161	0.145	(0.86)	0.133	0.167	(-1.47)
Clubs	0.110	0.106	(0.24)	0.098	0.147	* (-2.32)
N	757	690	1447	398	659	1057

Table 34: Trust about energy saving information from selected subjects

	Policy ever in place			**Policy aware**			
	No	Yes	T-test	No	Yes	T-test	Tot
Family	0.485	0.484	(0.07)	0.493	0.472	(1.02)	0.484
Neighbors	0.207	0.192	(0.82)	0.207	0.180	(1.72)	0.196
SFOE	0.599	0.638	(-1.75)	0.630	0.627	(0.12)	0.629
Local auth.	0.482	0.503	(-0.89)	0.492	0.505	(-0.65)	0.498
Local energy	0.490	0.518	(-1.22)	0.514	0.508	(0.30)	0.512
Scientists	0.558	0.569	(-0.50)	0.551	0.588	(-1.83)	0.566
Consum. org.	0.505	0.551	* (-1.99)	0.513	0.576	** (-3.11)	0.540
Envir. org.	0.480	0.497	(-0.71)	0.489	0.499	(-0.49)	0.493
Experts	0.539	0.553	(-0.57)	0.539	0.564	(-1.23)	0.550
Property man.	0.168	0.149	(1.10)	0.153	0.154	(-0.05)	0.154
Clubs	0.115	0.117	(-0.13)	0.108	0.129	(-1.61)	0.117
N	608	1896	2504	1447	1057	2504	2504

E First stage results from propensity score matching

Table 35: Bonus/Malus treatment and awareness status, selected Probit coefficients

	Bonus/Malus system (1)	Policy Awareness (2)
Age	0.015	0.036**
	(0.017)	(0.015)
Age^2	-0.000	-0.000**
	(0.000)	(0.000)
Female	0.004	-0.223***
	(0.071)	(0.062)
Job: Employee	0.106	0.097
	(0.105)	(0.094)
Job: Self-Employed	-0.075	0.396***
	(0.156)	(0.137)
Job:Retired	-0.091	0.364**
	(0.176)	(0.150)
Income: <6000 CHF	0.157*	-0.066
	(0.093)	(0.083)
Income: 6000-9000	0.136*	-0.015
	(0.076)	(0.067)
Language: German	-1.226***	0.048
	(0.108)	(0.144)
Area: City	0.515***	-0.070
	(0.077)	(0.074)
Area: Agglomeration	0.148*	-0.002
	(0.077)	(0.075)
Investment literacy	-0.181**	0.081
	(0.071)	(0.062)
N	2504	2504

Notes: The Table reports selected coefficients estimated from Probit models. Dependent variable in Column (1) is a dummy that indicates whether a respondent lives in a canton that has introduced a Bonus/Malus scheme. Dependent variable in Column (2) is a dummy that indicates whether the respondent is aware about the presence of the policy. Regressions also control for respondents' education, household size, indicators for energy literacy, preferences towards the environment, life attitudes and values.
Standard errors in parentheses. */**/*** indicate statistical significance at the 10, 5, and 1 percent level, respectively.

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