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

Davide Cerruti[*], Claudio Daminato[*], Massimo Filippini[*†]

July 6, 2022

Abstract

Isolating the role of limited knowledge, psychological frictions and policy characteristics is key when evaluating a public program and designing future policies. We document limited awareness about the presence of fiscal incentives towards fuel efficient vehicles. Exploiting a direct measure of awareness at the individual level, we first provide quasi-experimental evidence suggesting policy awareness has a large effect on vehicle choices. We next leverage a field experiment randomizing information about the mere existence of these fiscal incentives. We show the simple intervention substantially increases the probability vehicle buyers are aware of the presence of the fiscal program. Further, we find increased awareness induces consumers to purchase vehicles that consume around 32 percent less fuel. Together, our findings highlight that limited awareness represents 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

[*]ETH Zürich, Center of Economic Research, 8092 Zürich, Switzerland.
[†]Università della Svizzera Italiana, Faculty of Economics, 6900 Lugano, Switzerland.
Send correspondence to Davide Cerruti, ETH Zurich, Zürichbergstrasse 18, 8092 Zürich, Switzerland. Cerruti: cerrutid@ethz.ch, Daminato: dclaudio@ethz.ch, Filippini: mfilippini@ethz.ch
The trial was registered at the AEA RCT registry under the identification number AEARCTR-0006270. Declarations of interest: none.

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 anomalies. The role of these factors has 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 fiscal incentives in determining individuals choices response. Clearly, only those individuals in the target population that are aware of 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 induce policy makers to conclude that the low effectiveness of a program is related to limitations in its design or other behavioral failures of its recipients, while it is adequate knowledge among the target population that is simply lacking. 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 most European countries, drivers in Switzerland have to pay each year a tax on car ownership - also known as registration tax. In addition, some of the regional administrative areas (cantons) introduced a Bonus/Malus system based on vehicle energy efficiency or CO_2 emissions. For instance, a bonus applies to very energy efficient cars and provides a sizable percentage discount, ranging from 40 to 100 percent, to the baseline registration tax. The monetary savings from these fiscal incentives are substantial, corresponding to around 25 percent of the annual vehicle fuel cost on average. 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.

To obtain a measure of policy awareness at the individual level, we ask a representative sample of Swiss drivers 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.[1] We document that only 42 percent of Swiss drivers are correctly informed about the presence of fiscal incentives for the purchase of efficient cars.

The Bonus/Malus system provides consumers with incentives for the purchase of efficient vehicles.[2] To estimate the causal effect of individuals' awareness about the existence of these fiscal incentives on vehicle choices, we take two complementary approaches. First, we consider a natural experiment that introduced the Bonus/Malus system across cantons and over time. Second, we leverage a randomized field experiment providing information about the mere presence or absence of these fiscal incentives in the individuals' canton of residence.

The first setting exploits then the quasi-experimental variation in the introduction of the Bonus/Malus system across cantons and over time, as well as the availability of the direct measure of policy awareness at the individual level both in the presence and in the absence of the policy. This allows us to use aware (unaware) individuals in cantons *without* the Bonus/Malus system as a comparison group for the behavior of aware (unaware) individuals in cantons *with* the Bonus/Malus system in a difference in differences (DiD) approach. This strategy deals with time(and policy)-invariant unobserved heterogeneity. Further, to make some progress in dealing with measurement error in awareness and the presence of unobserved heterogeneity influencing individuals' awareness (and vehicle choices) differently depending on the Bonus/Malus treatment status, we combine the DiD approach with an instrumental variable (IV) approach. As instruments for individuals' policy awareness we use the distance in years from the introduction of the incentives in a specific canton; the voting participation rates to national referendum days held in Switzerland between 2016 and 2017 at the municipality of respondents residence level; the intensity in the diffusion of information about the Bonus/Malus system through the local newspapers. Using our preferred specification that combines the DiD approach with the IV strategy, we find suggestive evidence that policy awareness induces individuals to buy vehicles consuming around 25 percent less fuel after the introduction of the Bonus/Malus system, relative to aware individuals who cannot access these fiscal incentives. Further, we find supportive evidence that awareness interacts with financial sophistication in determining the response to the fiscal incentives.

[1] We devised the awareness question to be included in the Swiss Household Energy Demand Survey (SHEDS), carried out in 2018 and in 2019 and collecting data on a representative sample of Swiss individuals.

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

To obtain a clear exogenous variation in individuals' policy awareness, and to test whether a simple informational campaign can increase individual awareness, we then conduct a field experiment. A representative sample of the Swiss population was randomized between a treatment group, receiving information about the mere presence or absence of fiscal incentives for the adoption of energy efficient vehicles in the canton of residence, and a control group that did not receive any information. We show the treatment assignment is unconfounded.

We first exploit the random treatment assignment to estimate the intent-to-treat effects of the intervention on individual awareness and vehicle choices. We find the information treatment increases the probability respondents are policy aware by 13.5 percentage points on average. Further, we show that providing information about the mere presence of the Bonus/Malus system induces those who can access these fiscal incentives to purchase vehicles that consume around 10 percent less fuel. To provide an estimate for the causal effect of policy awareness on vehicle choices, we then use treatment assignment as an instrument for individual awareness. To address potential concerns over our intervention affecting vehicle choices by enacting also pro-environmental attitudes, we show our intervention had no effect on several measures of environmental values and planned behavior. The latter provide therefore additional support to the validity of the exclusion restriction. The LATE-IV estimates indicate that becoming aware of the presence of the fiscal incentives due to the informational intervention induces to purchase vehicles that consume around 32 percent less on average. Together, our results show that, while ignoring policy awareness would lead to conclude that the fiscal incentives introduced by the Bonus/Malus system are ineffective, awareness about the presence of the incentives has a relevant effect on individuals' vehicle choices.

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 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. Our main contribution is to isolate the causal effect of awareness about the mere presence of a fiscal program on individuals' responses from that of other potential behavioral factors or policy characteristics influencing individual choices.[3] Isolating the effect of individual

[3]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. Low policy awareness has also been suggested as one of the possible explanations for limited participation to financial aid programs for low income students (Barr and Turner, 2018) and low

awareness is also important as the effectiveness of an information treatment in influencing behavioral responses depends on whether the intervention affects the actual level of individuals' awareness or knowledge about the policy. Indeed, the process through which this knowledge is shaped is largely unknown (Chetty and Saez, 2013), and may be hindered by several factors, including the initial level of understanding of the policy, the program's complexity, the financial literacy of treatment recipients, and the type and framing of the information provided.

This work is also complementary to the paper by Chetty et al. (2013), who estimate the impacts of the Earned Income Tax Credit on labor supply in the US exploiting variation of knowledge at the local level even though they argue that, ideally, one would want to use a direct measure of knowledge at the individual level. To our knowledge, we are the first to use an explicit, direct measure of awareness at the individual level 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.[4]

Finally, we contribute to the growing literature on the effects of environmental taxation and information on vehicle choices (D'Haultfuille et al., 2014; Klier and Linn, 2015; Alberini and Bareit, 2017; Huse and Koptyug, 2017; Grigolon et al., 2018; Allcott and Knittel, 2019; Cerruti et al., 2019; Van den Bijgaart and Cerruti, 2020). Specifically, we are the first to study the role of awareness about the presence of an environmental policy measure in determining its effects. We document a large lack of consumers' awareness about the presence of tax incentives for the purchase of an energy efficient vehicle. We estimate a substantial consumers' valuation of yearly tax by policy aware consumers and provide an explanation for the limited average effects of vehicle taxes on vehicle choices estimated in the literature. Our findings highlight that low awareness represents 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 and our measure of policy awareness. Section 4 presents the identification strategy we exploit to estimate the effect of awareness exploiting quasi-experimental policy variation, the data, and the results we find. In Section 5 we report on the experimental results. Section 6 concludes.

response to financial incentives for reusable bags (Homonoff, 2018).

[4]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), they may 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.

2 Fiscal incentives, policy awareness and vehicle choices

This section sketches a simple theoretical framework to highlight how limited awareness about the presence of tax incentives can affect consumers' vehicle choices. We consider the decisions of consumers with respect to the purchase of a new vehicle in the presence of limited policy awareness in a framework that is similar to DellaVigna (2009) and Allcott et al. (2014). A consumer draws utility $u(.)$ 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.

A 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 consumer j as follows:

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

where r is a constant discount factor which we assume to be equal to zero for simplicity in what follows. Assume now 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 (i.e., $u(m_A, X^A) = u(m_B, X^B)$) such that the decision of purchase only depends on the comparison of total life-cycle costs.[5]

Let us consider a policy maker introducing a discount D^A to the registration tax of a car with fuel efficiency f^A, aiming to increase the adoption of efficient vehicles. In the presence of the fiscal incentive, an optimizing consumer chooses the fuel efficient car A only if $L(cf^B m_B - cf^A m_A) + L\tau D^A > P^A - P^B$, that is if the savings in driving costs and taxes over the vehicle's lifetime associated with greater fuel efficiency more than compensate the larger upfront costs. We define $v = L(cf^B m_B - cf^A m_A) + L\tau D^A$ as the "gross utility gains" from energy efficiency in the presence of fiscal incentives for the adoption of efficient vehicles.[6] We indicate with $\xi = (f^B, f^A, c, \tau, D^A)$ the parameters determining v.

Several behavioral and psychological biases can influence individuals' valuation of the savings from fuel efficiency, and then the effectiveness of the discount to the registration tax in affecting vehicle choices. In particular, individuals can correctly evaluate the total savings from the adoption of a vehicle with fuel efficiency A if: (i) they have the energy-related

[5] Clearly, vehicle i's utilization by consumer j in each period l $m_{j,i,l}$ 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.

[6] These are equivalent to the "gross utility gains" defined by Allcott et al. (2014) if we set $D^A = 0$.

knowledge (i.e., they can correctly evaluate fuel efficiency - $f^A \neq f^B$ - and fuel prices c) and skills to perform an investment calculation (Blasch et al., 2021); (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 of the existence of the policy measure.

A misoptimizing consumer will then choose the efficient vehicle A only if:

$$\Gamma(v,\xi)\left(L(cf^B m_B - cf^A m_A) + L\tau\eta^P D^A\right) > P^A - P^B \tag{2}$$

where, as in Allcott et al. (2014), $\Gamma(v,\xi)$ is the 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 of the presence of the discount ($\eta^P = 1$), or not ($\eta^P = 0$).

Although only the consumers that are aware of 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. It is important to underline that in this framework the presence of policy awareness may interact with other behavioral anomalies, such as imperfect information about fuel efficiency or limited attention. Aware consumers might still, for instance, undervalue the yearly vehicle registration tax. Specifically, 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.

3 Institutional context and methodology

3.1 Vehicle registration tax and the Bonus/Malus system

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, with the average annual

registration tax on a vehicle purchased in 2015 that is around 435 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 regional governments of Switzerland (known as cantons) are free to introduce their own scheme. Each canton - similarly to US states - enjoys vast freedom in setting up policies over a series of areas, including fiscal issues.[7] Thus, there are considerable differences in the vehicle registration tax schemes between different cantons.

In addition to the regular vehicle tax, some cantons have introduced a Bonus/Malus incentive system, mostly between 2009 and 2014.[8] 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).[9] Among the 26 cantons in Switzerland, seventeen introduced some vehicle registration tax incentives based on fuel efficiency, CO_2 emissions, or both. Appendix A provides details about the incentive scheme, and its differences across cantons. In addition, in most cantons, the vehicle cannot be more than 3 or 4 years old to benefit from a registration tax discount. Therefore, older vehicles are typically not eligible for the tax incentives regardless their fuel efficiency or CO_2 emissions.

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. The incentives associated with the Bonus/Malus system are substantial. The discounts to the baseline vehicle tax range from 40 to 100 percent, while the penalties range from 10 to 50 percent. For the population of vehicles registered in Switzerland in 2015, these incentives amount to around 209 CHF on average per year. This figure corresponds to around 25 percent of the annual vehicle fuel cost.[10]

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

[7]Switzerland is a federal state, with four different official languages and with three distinct levels of government: Federal, Cantonal (26 cantons), and Local (about 2500 municipalities). Each cantonal and local government is entitled with specific functions and large autonomy to impose taxes.

[8]The only exception is canton Vaud, which introduced a Bonus/Malus scheme in 2005.

[9]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. In one canton the tax is based on a function of the vehicle CO_2 emissions.

[10]The annual vehicle fuel cost has been computed using the registration database of the whole vehicle fleet in Swizerland. We used as average annual mileage of km driven by Swiss drivers the value reported by the Swiss Federal Office of Statistics (11,828 km) (Swiss Federal Statistical Office, 2017).

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 A2 in Appendix A). Both CO_2 emission rate and energy efficiency rating are strongly correlated with vehicles' fuel consumption, as shown in Figures B1 and B3.

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.

The registration tax is paid every year through a bill sent by the cantonal authority and separately from other taxes. Many cantons send the tax bill on a fixed date and allow for the possibility of automatic payment. Generally, information on the amount and the features of the registration tax are not advertised at the point of sale. Importantly, any discount or penalty to the registration tax is applied automatically by the canton. 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 measure allows to rule out the role of transaction costs in the consumers' decision making process when studying the impact of policy awareness.

3.2 Methodology

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. In this paper we aim to estimate 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 other consumers in the same areas. That is, if individuals' awareness was determined exogenously, we could estimate the causal effect of being aware of 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.

To properly identify the effect of awareness about the presence of these incentives on vehicle choices, we adopt two complementary strategies. We first rely on the quasi-experimental variation in the presence of the Bonus/Malus system across cantons over time, and the availability of a direct measure of policy awareness at the individual level for a representative sample of Swiss drivers, to provide evidence about the heterogeneous vehicle choices response to the fiscal incentives of aware and unaware individuals. In this setting, we address the endogeneity of policy awareness with an IV approach. Secondly, we conduct a randomized controlled trial to exogenously alter the level of individuals' policy awareness.

3.3 Measuring policy awareness

We elicit information on respondents' policy awareness about the presence of the registration tax incentives for efficient cars using a survey question that we have devised for the annual Swiss Household Energy Demand Survey (SHEDS), starting from 2018. 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 details of the registration tax scheme. 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.

[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.

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.

This survey question may potentially capture different mechanisms other than actual respondents' awareness. First, some respondents may answer correctly by mistake or by guessing (false positive). Similarly, some respondents might have been informed about features of the registration tax at the time of purchase, but then answered wrongly or 'don't know' to our question (false negative). Second, because the survey asks respondents about a purchase in the past and elicits knowledge *today* about the features of a tax *in the past*, respondents' memory may intervene in a nonrandom way. Specifically, two issues may arise: (i) respondents not aware of the features of the tax at the time of purchase could be later negatively or positive surprised when receiving the yearly tax bill; (ii) the probability that respondents who were aware of the features of the tax at the time of purchase forget about it is lower if they did not enjoy the tax benefits. In both cases, the error in the measurement of awareness would be correlated with past vehicle choice. This raises an endogeneity bias when using this awareness measure to study the consequences of low program awareness on vehicle choices. In the next sections we discuss how we deal with these potential issues.

4 Evidence from quasi-experimental policy variation

4.1 A difference in differences strategy

Our first strategy to study the role of policy awareness exploits 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. Specifically, we use aware (and unaware) individuals in cantons *without* the Bonus/Malus system as a comparison group for the behavior of aware (and unaware) individuals in cantons *with* the Bonus/Malus system, in a difference in differences (DiD) framework with multiple treatment groups and treatment periods.[12] This approach allows to deal with time (and

[12]In practice, with this strategy we exploit two double differences. The first is the difference in the before/after change in behavior of aware consumers between cantons with the Bonus/Malus system and those without the fiscal incentives. The second is the difference in the before/after change in behavior of unaware consumers between cantons with the Bonus/Malus system and those without the fiscal incentives.

policy)-invariant unobserved heterogeneity.

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 plausibility 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. Further, 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. Regardless, we wish to stress that individual awareness about the presence of the Bonus/Malus system is likely to be endogenous. We discuss how we address this issue and other threats to the validity of this DiD strategy in Section 4.6.

4.2 Data

Our main data source is the Swiss Household Energy Demand Survey (SHEDS), an annual survey collecting data on a sample of about 5000 households each wave, representative of the French and German speaking Swiss population of 25 cantons (excluding the Italian-speaking canton of Ticino).[13] Most of the information we use comes from the 2018 and 2019 waves of the SHEDS survey, while some additional data comes from waves 2016 and 2017.[14] The 2018 wave contains information on 5011 households. We complement those with 2051 households who were part of SHEDS in 2019 but not in 2018, for a total of 7062 households.[15] Among the whole sample, 5130 (72.64 percent) owned at least one car. Car ownership distribution

[13]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/.

[14]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 and 2019 waves. In particular, because the key question about policy awareness has been asked only from 2018, we restrict the sample to individuals that have been interviewed either in 2018 or in 2019.

[15]We consider information given in the 2018 wave for respondents who participated in SHEDS both in 2018 and 2019.

in our data looks very similar to the official statistics from the Swiss government.[16]

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 (such as neighbours, government institutions, environmental organizations), voting preference for the green party, energy literacy and financial literacy (as in Blasch et al. 2021 and Lusardi and Mitchell 2014).[17] 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 respondents (92.33 percent) 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 (39.66 percent) provided information on the energy efficiency category of their main vehicle.

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 data on the whole Swiss passenger vehicle fleet, we show that the distribution of actual fuel consumption is matched well by that of the self-reported fuel consumption, and we 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 5130 respondents of our sample with at least one vehicle, we further drop 33.08 percent of the observations with missing values for any of the variables used in the empirical

[16] In our sample, 27.36 percent of households do not have a car, 45.55 percent have one, 22.27 percent have two and 4.81 percent have three or more. A 2015 survey by the Swiss Federal Statistical Office found these shares to be 22 percent, 49 percent, 23 percent and 6 percent respectively (Swiss Federal Statistical Office, 2017, p. 11).

[17] Specifically, in the remaining of the paper we indicate with 'financial literacy' an indicator that is based on the understanding of the concepts of interest rates and inflation. We measure 'energy literacy' with a set of indicators based on whether the respondents understand the vehicle energy labels and know the energy costs of certain products. A detailed description of these variables is included in Appendix C. 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 either in the 2018 or 2019 wave.

analysis. Details about the information used in the main analysis, and the construction of the final sample are provided in Appendix C.[18] The final sample used in the analysis includes 3433 observations.

Policy awareness in the data A substantial share of respondents could not answer our policy awareness question correctly. We find that about 41.76 percent of the individuals in our sample are classified as "policy aware" according to our definition. About 39.54 percent of respondents answered "don't know", while 18.69 percent gave the wrong answer.

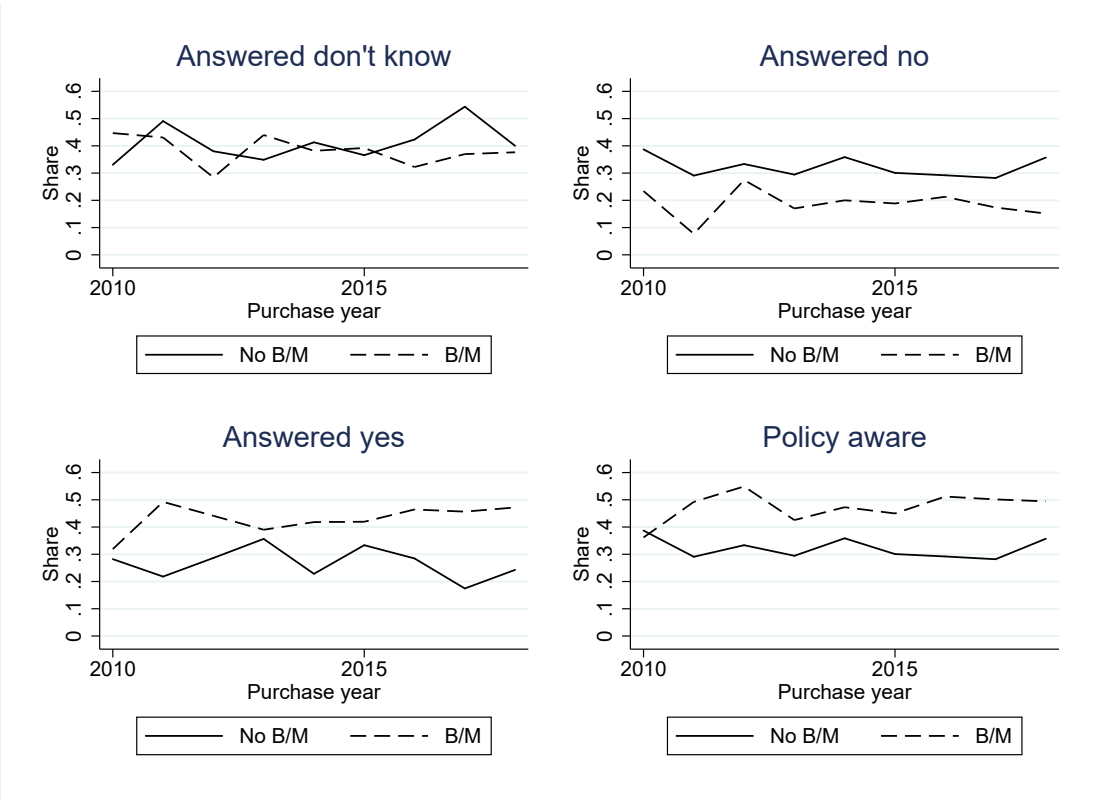


Figure 1: Answers to policy awareness question

Notes: Graphs in Figure report the share of answers to the awareness questions over year of vehicle purchase. Statistics are presented separately for respondents living in a canton with a Bonus/Malus and without. Top-left: Share of individuals answering "Don't know". Top-right: Share of individuals answering "No". Bottom-left: Share of individuals answering "Yes". Bottom-right: Share of policy aware individuals (answering correctly).

Figure 1 reports the answers to the policy awareness question and the implied share of

[18] Appendix C reports in particular details about the sample selection. The number of missing values is especially relevant for household income (15.81 percent). All the results in this paper hold when omitting household income from the set of controls or when adding a "missing answer" category and including the missing observations in the analysis.

policy aware individuals, by year of vehicle purchase and presence of the Bonus/Malus.[19] 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. Overall, the data show a higher probability for respondents to be aware of the presence of the fiscal incentives when these are actually present.

To illustrate differences in vehicle fuel consumption among our groups of interest, in Figure E1 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 criteria. When a Bonus/Malus is in place, we observe a shift towards the left of fuel consumption distribution for the group of aware respondents. Further, because in many cantons eligibility to discounts to the registration tax depends also on the age of the car, aware consumers might buy newer cars on to access the benefits. Figure E2 in Appendix E shows that the distributions of vehicle age at the time of purchase of aware and non aware individuals are almost overlapping in the absence of fiscal incentives, while we observe a much higher frequency of new cars purchased by policy aware individuals in the presence of a Bonus/Malus system.[20]

We are also interested in investigating the presence of compositional differences between groups of individuals defined by their policy treatment and awareness status, since these might be informative of possible selection patterns. Appendix D contains several tables reporting mean values of the variables used in the empirical analysis, by groups of respondents characterized by different awareness and treatment statuses.[21] We find no statistically significant differences between 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 in terms of several characteristics such as age, gender, income, household size or environmental attitudes.[22] Instead, we do find that respondents in cantons that have introduced a Bonus/Malus scheme are more likely to live in urban areas, and are less likely to be German speakers. In the Appendix D, we show a comparison of the characteristics of policy aware and policy unaware respondents.[23] While we find many characteristics to be balanced, we observe policy aware respondents are more likely to be male, with a university

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

[20] 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.

[21] In Appendix D we also show a comparison of individual characteristics between respondents who bought their car when the fiscal incentives were in place and those who bought it when there were no incentive.

[22] The tables reporting these comparisons are shown in Appendix D: tables D2, D4, D6, D8, D10, D12, D14, D16, D18, D20

[23] The comparison of characteristics between policy aware and unaware respondents is reported in tables D2, D4, D6, D8, D10, D12, D14, D16, D18, D20).

education, older and self-employed and French speakers. They are also more likely to provide the correct answer to our financial and energy literacy questions.

4.3 Baseline DiD specification

Our baseline identification strategy leads us to the following empirical specification to quantitatively estimate the effect of policy awareness on vehicle choices:

$$\begin{aligned} y_{ict} =& \beta Aware_i * BMP_{ct} + \theta BMP_{ct} \\ &+ \psi Aware_i * BM_c + \gamma Aware_i + \delta X_i + \eta_c + \xi_t + \epsilon_{ict} \end{aligned} \tag{3}$$

where y_{ict} is an outcome of the vehicle choice of 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 4.2 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.[24] The coefficient of interest β indicates the reduced form effect of the fiscal incentives on vehicle choices for policy aware consumers, relative to that for unaware consumers. 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. The term $Aware_i * BM_c$ controls then for the possibility aware individuals living in a canton that introduced a Bonus/Malus system are different (besides what we control for) to aware individuals living in cantons that never introduced such incentives. 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

[24] 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. We show that our findings are largely unaffected when applying the more conservative clustering at the cantonal level.

decision of purchase of an efficient vehicle and the probability to be aware of the presence of the fiscal incentives. Moreover we include characteristics of the area of respondents' residence.[25] To investigate the importance of considering policy awareness when studying the consequences of the Bonus/Malus system on vehicle choices, we also estimate equation 3 setting β, ψ and γ equal to zero. In this case, θ indicates the average effect of the Bonus/Malus system on the treated.

Our baseline 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 fiscal incentives to promote energy efficient cars. In order to provide some evidence supporting the validity of this assumption, we show that the fuel economy of the vehicles purchased by aware individuals in cantons that introduced a Bonus/Malus system was the same as that of unaware consumers in those cantons prior to the introduction of the fiscal incentives, and changed in correspondence to the introduction of the policy. We then estimate our baseline specification allowing for time(-to-treatment)-specific awareness and Bonus/Malus system effects:

$$\begin{aligned} y_{ict} = & \sum_j \beta_j (Aware_i * BM_c * TtT_j) + \sum_j \theta_j (BM_c * TtT_j) \\ & + \psi Aware_i * BM_c + \gamma Aware_i + \delta X_i + \eta_c + \xi_t + \epsilon_{ict} \end{aligned} \tag{4}$$

where all variables are defined as in equation 3 and TtT indicates the distance in years from the implementation of the Bonus/Malus system ($j = -4, -3, ... + 4$, with -1 being the omitted category).[26] The coefficients β_j indicate how the difference in vehicle choices between aware and unaware individuals in cantons where a Bonus/Malus system has been introduced evolve over time. The absence of statistically significant differences in the fuel consumption of vehicles purchased by aware and unaware consumers before the introduction of the Bonus/Malus system, in cantons that eventually introduced such incentive scheme, would support the validity of the common trend assumption in this context.

[25] 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, a set of indicators for energy and investment literacy, preferences towards the environment, life attitudes, type of living area (city, agglomeration, countryside) and a second-order polynomial in population size at the municipality of respondents' residence level in 2016. See Appendix C for a detailed description of the control variables used in the analysis.

[26] To focus on the period around the treatment, we aggregate in a unique indicator all the observations with time to treatment ≥ 4, and we do the same for the observations with time to treatment ≤ -4.

4.4 Graphical evidence

To gauge the extent of heterogeneity in the vehicle choices response of aware and unaware individuals around the time of introduction of the fiscal incentives, we start providing descriptive evidence about the evolution of fuel consumption of the vehicles purchased by aware and unaware consumers, separately for cantons that have introduced a Bonus/Malus system and for those that have not introduced such incentives.

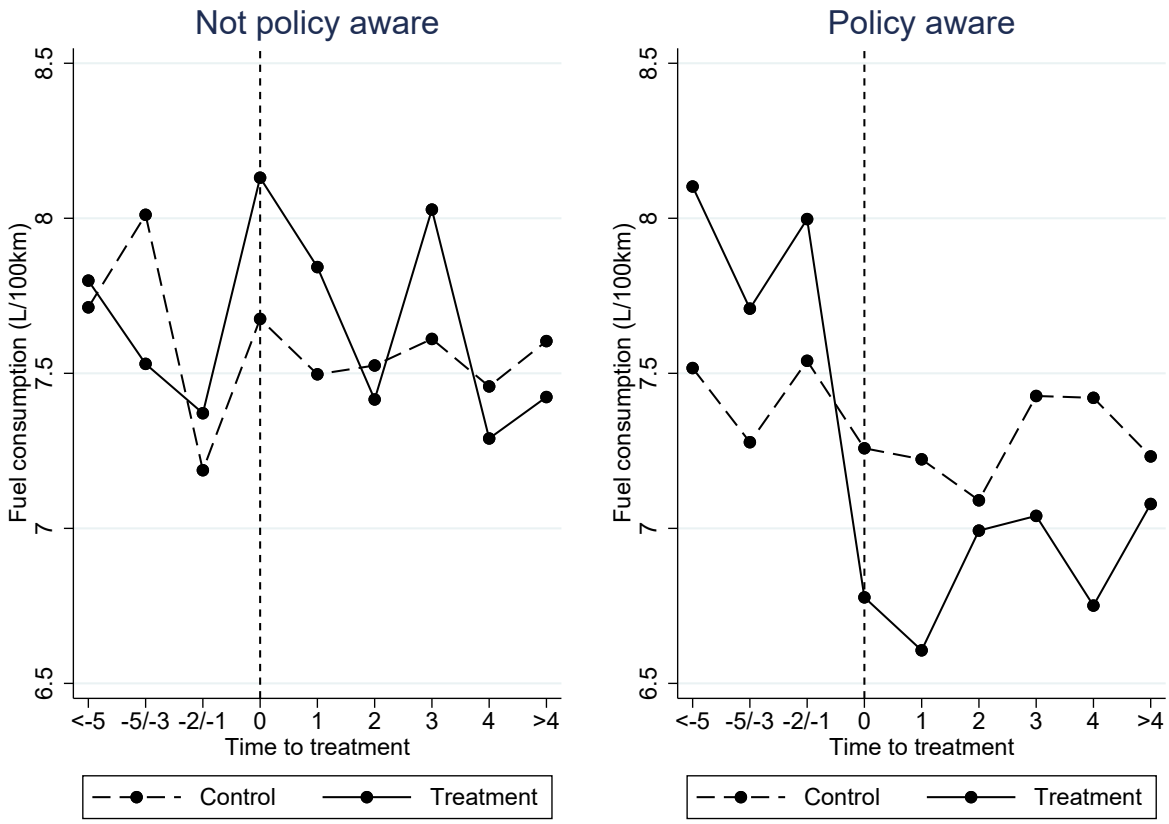


Figure 2: Effect of fiscal incentives on vehicle fuel consumption: aware vs unaware consumers

Notes: Difference in differences event study graph. The vertical axis shows the average vehicle fuel consumption (L/100 km) of purchased vehicles. The horizontal axis shows the distance in years from the introduction of the treatment. Zero is the initial year of treatment. Vehicles in cantons that adopted the fiscal incentives (Treatment) are indicated with a solid line, while a dashed line indicates vehicles in cantons that never adopted incentives (Control). The left panel considers vehicles bought by policy unaware individuals, while the right panel considers vehicles purchased by policy aware individuals.

The difference in differences event study graph is presented in Figure 2.[27] The graph on the left panel reports the average fuel consumption of the vehicles purchased by unaware

[27]For consumers living in treated cantons, we simply plot the average fuel consumption of the vehicles purchased against the distance in years from the introduction of the Bonus/Malus system (i.e., zero repre-

individuals in treated (solid line) and control (dash line) cantons, around the introduction of the fiscal incentives. The graph on the right panel reports the same DiD representation for policy aware individuals.

The graph provides clear evidence about the heterogeneous response of aware and unaware individuals to the fiscal incentives. While we do not observe, at the time of treatment, a clear change in the vehicle choices of unaware individuals between treated and control cantons, we observe a stark divergence in the average fuel consumption of the vehicle purchased by the aware individuals living in treated cantons, compared to those living in cantons that have not introduced any fiscal incentives. Overall, the DiD event study graphs provide compelling evidence about the role of awareness in determining the impact of the fiscal incentives on individuals' choices. Importantly, before the introduction of the fiscal incentives, the average fuel consumption of the vehicles purchased by aware respondents in treated cantons evolved in parallel to that of the cars purchased by aware consumers in cantons that never introduced a Bonus/Malus system. This provides first evidence in support of the necessary condition to identify the impact of policy awareness exploiting a DiD strategy.

4.5 DiD estimation results

To highlight 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 consumers were policy aware or not (estimate eq.3 setting $\beta = \psi = \gamma = 0$). Column (1) of Table 1 reports the results of this analysis. When we do not consider the role of policy awareness, we do not find evidence of an average effect of the Bonus/Malus system on vehicle fuel consumption. This result is consistent with previous evidence (Klier and Linn, 2015; Alberini and Bareit, 2017) showing small or zero effects of vehicle registration taxes on fuel economy or emission rates.

To gain insights about the association between individuals' awareness and vehicle choices, we start considering only individuals that purchased a vehicle in a treated canton. 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 (this implies setting

sents the first year of treatment). We group the number of periods to treatment so that the average fuel consumption is computed using at least 5 percent of the observations of each subgroup defined by treatment and awareness status. The time to treatment is assigned to the individuals in the control cantons to replicate the distribution of the treatment periods observed in the treatment cantons. To avoid arbitrary allocations of placebo treatment years in the control group, we assign individuals in the control group a placebo year of treatment using the following algorithm: (i) each individual in the control group is assigned an initial treatment period with a probability value based on the distribution of initial treatment years for individuals in treatment cantons; (ii) we calculate the average fuel economy of the vehicle purchased for each point of the support of the time to placebo treatment; (iii) we repeat (i) and (ii) two hundred times and, for each point of the time to treatment, average through the distribution of the resulting fuel consumption averages.

Table 1: Effect of policy awareness on vehicle choices, OLS-DiD estimates

	DiD	Only policy	DiD	
	No awareness		*Awareness*	
	(1)	(2)	(3)	(4)
BMP x Aware			-0.141***	-0.141***
			(0.026)	(0.027)
BMP	0.013		0.059***	0.066***
	(0.016)		(0.018)	(0.019)
BM x Aware			0.073**	0.072**
			(0.033)	(0.033)
Aware		-0.083***	-0.004	-0.010
		(0.016)	(0.025)	(0.025)
Controls	Yes	Yes	No	Yes
Purchase year FE	Yes	Yes	Yes	Yes
Canton FE	Yes	Yes	Yes	Yes
N	3433	1899	3433	3433

Notes: Dependent variable is the log of vehicle fuel consumption per 100 km. *BM* indicates respondents living in cantons who adopted a Bonus/Malus at some point; *BMP* indicates respondents buying a vehicle with a Bonus/Malus in place; *Aware* indicates policy aware respondents. Column (1): Effect of Bonus/Malus without considering awareness; Column (2): OLS estimate of awareness coefficient, only years and cantons with Bonus/Malus in place; Column (3): Main specification (equation 3), without controls; Column (4): Baseline specification (equation 3), that controls for individual and regional characteristics described in the text. Standard errors in parenthesis, clustered at the canton by time of purchase level. Three stars, two stars and one star indicate statistical significance at the 1 percent, 5 percent and at the 10 percent confidence level, respectively.

$\beta = \theta = \psi = 0$ in equation 3). 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 8 percent less than unaware individuals. However, we cannot interpret this result as a causal effect because individuals' awareness about the presence of the fiscal incentives is endogenous.

We start our investigation of the effect of individuals' awareness on vehicle choices by exploiting the DiD strategy that uses aware consumers in cantons that did not introduce the Bonus/Malus system as control group for the behavior of aware consumers living in cantons that introduced such fiscal incentives. We then estimate our baseline DiD specification (3) using OLS. The results are reported in Column (3) and (4) of Table 1. Estimation results in Column (3), obtained omitting individuals' characteristics, show that the introduction of the

Bonus/Malus system reduces the fuel consumption of the vehicles purchased by individuals that are aware of the features of the registration tax scheme by around 14.0 percent, significant at the 1 percent confidence level. Interestingly, we find that the introduction of the Bonus/Malus system increases the fuel consumption of the vehicle purchased by unaware consumers by around 6 percentage points. The might perhaps reflects short-term rigidities in the supply of energy efficient vehicles in a local market following the introduction of Bonus/Malus system, with aware consumers purchasing the more efficient vehicles to take advantage of the fiscal incentives, and unaware consumers that are left with a reduced (less efficient) vehicles choice set. Another possible explanation would be a change in relative prices due to dealers increasing the retail prices of energy efficient vehicles in response to the introduction of the fiscal incentives. Therefore, results in Table 1 imply the policy leads to a reallocation of efficient vehicles to aware consumers. These results are almost unaffected when we include a large set of respondents' characteristics (Column 4).[28] However, because policy awareness is endogenous, we wish to be cautious in interpreting these estimates as causal. We discuss how we address this identification issue in Sections 4.6 and 5.

Robustness We conduct several robustness checks to our baseline DiD estimation: adding canton by year fixed effects; restricting the sample to vehicles purchased only in 2010 or after; including interactions between the awareness indicator and indicators for the groups of years in which cantonal incentive policies did not change; interacting the awareness indicator with dummies for the the specific type of incentive (based on CO_2 emissions or fuel efficiency rating); removing respondents who gave the wrong answer to the awareness question; removing respondents who answered "Dont know" to the awareness question; using alternative dependent variables (efficiency rating and CO_2 emissions). The results of these analysis, reported in Appendix F, largely confirm those obtained with the baseline estimation strategy. Further, estimating eq.(4), we show the trend in vehicle choices between aware and unaware consumers was parallel in the pre-treatment periods (see details in Appendix F and results in Figure F1). We next conduct two falsification tests. First, using a series of placebo tests, we show there were no differences in the trend of vehicle choices between aware and unaware consumers before the introduction of the Bonus/Malus system. Second, we find no significant effect of policy awareness on the fuel consumption of vehicles that were not eligible to receive the fiscal incentives at the time of purchase. Additional details on these falsification tests are reported in Appendix F.

[28] The complete list of the controls used is detailed in Appendix C.

Vehicle age and fuel consumption As discussed in Section 3.1, 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 introduced by the Bonus/Malus system can then induce a behavioral response of consumers through at the least two mechanisms: (i) incentives might be accessed through the purchase of a more efficient vehicle of the same age (*efficiency channel*); (ii) consumers could buy newer cars to receive the registration tax discount for a longer period of time (*vehicle age channel*). We wish to check what is the importance of these two channels in explaining our main results.

In column (1) of table F4 we report estimation results of equation 3 obtained using vehicle age at the time of purchase as a dependent variable. Results show that aware consumers buying a car under a Bonus/Malus scheme choose vehicles around 1.2 years younger on average. In columns (2) to (4) we report results obtained using fuel consumption as dependent variable, but estimating equation 3 for new vehicles, second-hand cars still eligible to the Bonus (maximum 4 years old) at the time of purchase and second-hand cars not eligible (more than 4 years old), respectively.[29]

We find that policy awareness induces consumers to purchase vehicles with lower fuel economy when the newly purchased vehicles are up to four years old at the time of purchase. In contrast, when the vehicle purchased is not eligible to the Bonus/Malus due to age limits, we do not find an effect of policy awareness. Thus, these results seem to suggest a more prominent role for the *efficiency channel* in determining the overall effect of policy awareness on vehicle choices.

Heterogeneous effects To gain some insights into the potential distributional impacts of policies that aim at increasing awareness, we also wish to explore whether aware consumers are heterogeneous in terms of their response to fiscal incentives for efficient cars.[30]

As shown in Table F5, we find substantial heterogeneity in the effect of awareness between individuals with different levels of literacy and trust in environmental groups (we estimate eq.(3) separately for each subgroup).[31] In particular, aware respondents react more strongly to a Bonus/Malus scheme when they are financially literate and when they under-

[29] 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.

[30] Several potential mechanisms motivate such investigation. For instance, perspective vehicle buyers with lower income might be more prone to switch to a more efficient vehicle when aware of the presence of the fiscal advantages if their budget constraint was binding 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.

[31] Interestingly, the results reported in Table F5 show essentially homogeneous vehicle choices response to the fiscal incentives of aware consumers between female and male respondents, younger and older individuals, and high and lower income earners.

stand energy efficiency ratings. Moreover, the effect of policy awareness on vehicle choices is substantially larger when respondents declare to trust the energy savings advice from environmental groups. 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 which these factors induce aware respondents to react differently to the fiscal incentives. These results suggest (lack-of) awareness may interact with other behavioral mechanisms in determining the effectiveness of fiscal measures. Specifically, the heterogeneity in the effect of policy awareness between individuals with low and high investment and energy literacy suggests that policy awareness enters the vehicle buying decision process mainly through the expected reduction in the vehicles' life cycle costs and not through the use of heuristics.

4.6 Threats to the validity of the DiD strategy

The validity of our baseline identification strategy for the impact of policy awareness relies on whether consumers that are aware of the features of the registration tax system, living in cantons without a Bonus/Malus system, are comparable to aware consumers in cantons where a Bonus/Malus system has been introduced. Some potential issues might undermine the validity of this identifying assumption: (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 and control group comparable? Although the statistics presented in Section 4.2 show respondents living in treated and control cantons, as well as aware and unaware individuals, are comparable with respect to several observable dimensions that may influence vehicle choices, some compositional differences emerge. This might determine a selective introduction of the Bonus/Malus incentives.[32]

To overcome this potential threat to our baseline strategy, we combine it with a propensity score matching approach that addresses the 'common support problem' (Heckman et al., 1998). While the matching procedure takes care of the selection into treatment (or awareness status) based on observables, the DiD deals with selection on unobservables under the

[32]In particular, administrative areas that have introduced a Bonus/Malus system are typically more urban and have a larger share of French speakers among their population. In fact, urban areas might have different incentives than rural areas to introduce fiscal incentives to promote the adoption of energy efficient vehicles. In addition, cultural differences between French and German speaking cantons may also determine a selective introduction of the Bonus/Malus incentives, as well as drive selection into awareness status, conditional on treatment status.

assumption that the bias is time-invariant, conditional on the set of controls. Details on this empirical strategy are described in Appendix G. Tables G1 and G2 report selected coefficients from the estimation of the propensity score and the estimation results of the propensity score matching-DiD approach, respectively. The propensity score matching-DiD estimate for the effect of policy awareness on fuel consumption (-16.2 percent) is close to that obtained with our basic DiD estimation. (see Column (4) of Table G2).[33] This evidence suggests that issues related to selection on observables into treatment do not represent a relevant threat to our main identification strategy.

Addressing the endogeneity of policy awareness A crucial assumption we take to identify the effect of policy awareness exploiting the baseline DiD strategy is that all control variables are exogenous. However, if the process determining individuals' awareness differed in the presence and in the absence of the Bonus/Malus system, the exogeneity assumption would not be met. This may be the case if, for instance, in the presence of the Bonus/Malus system individuals were exposed to information about the introduction of the policy (e.g., advertisement in the local media) that, depending on unobservable individual-specific factors (e.g., attention to fuel efficiency, opportunity cost of the time spent in accumulating information), were then incorporated in the determination of the knowledge about the features of the vehicle registration tax scheme.[34] In this case, also the conditional independence assumption of the matching-DiD would not be met. Further, as discussed in Section 3.3, an endogeneity bias might arise if respondents' memory about the features of the tax in the past is nonrandom and correlated with vehicle purchase decisions.

Our main strategy to address the endogeneity of policy awareness and hence identify its effect on vehicle choices response to fiscal incentives is to experimentally vary the level of awareness among individuals. We describe this approach in detail in Section 5. Further, we make some progress in addressing the endogeneity issue of awareness by combining the DiD strategy with an instrumental variable (IV) approach. We use three instruments for policy awareness: (i) the distance in years from the introduction of the incentives in a specific canton; (ii) the voting participation rates to the seven national referendum days held in Switzerland between 2016 and 2017 at the municipality of respondents' residence level, interacted by canton of residence dummies; (iii) the intensity in the diffusion of information

[33]We focus on the results obtained when correcting for compositional differences between treated and control cantons because the compositional differences between aware and unaware individuals that emerge as a result of the propensity score matching are less relevant. Online Appendix G reports the full set of first and second step estimation results and discusses some relevant associations between observable characteristics and Bonus/Malus treatment status or awareness status.

[34]The presence of advertisement about the fiscal incentives is consistent with the descriptive evidence in Section 3.3 showing a higher probability for respondents to be aware when the incentives are in place.

about the Bonus/Malus system through the local newspapers. Instrument (i) exploits the idea that advertisement and promotion of the Bonus/Malus system in the local media might be higher immediately after its introduction. While the exogeneity of the timing of introduction of the Bonus/Malus system from an individual perspective ensures the validity of the exclusion restriction, this instrument is only defined in the cantons that introduced the fiscal incentives. Instrument (ii) assumes that within-canton variation in voter turnout influences the evolution of individuals' vehicle choices over time only through their policy awareness, conditional on the large set of controls. However, this instrument relies on voter turnout not influencing vehicle choices at the local level directly (e.g., through cultural preferences towards the local affairs and the environment at the community level), in a different way between treated and control cantons. Instrument (iii) relies on the temporal variation in the presence of Bonus/Malus system-related information in several Swiss newspapers, the heterogenous coverage of these newspapers in the respondents' canton of residence, and the number of newspaper stands in the individuals' municipality of residence. Although the identifying assumption of the latter instrument is milder than (ii), as it exploits variation across municipalities over time, it relies on a partial representation of the population of Swiss newspapers. In Appendix H we describe how these instruments are constructed, provide evidence on the extent of instrument variation and discuss the validity of the exclusion restrictions in greater detail.

The IV-DiD estimates for the effect of policy awareness on fuel consumption, obtained combining instruments (i) and (ii), and instruments (i) and (iii), are reported in Columns (2) and (3) of Table H1 in Appendix H, respectively.[35] The IV-DiD estimates are larger (though just significantly) than the OLS-DiD estimates, and provide additional evidence supporting the finding that policy awareness has an important effect on the vehicle choices response to fiscal incentives. Using our preferred specification that combines instruments (i) and (iii), we find that policy awareness induces individuals to buy vehicles that consume around 25 percent less fuel following the introduction of the Bonus/Malus system (see column 3 of Table H1). Nevertheless, we recognize the limitations (outlined above) of these instruments to isolate the impact of policy awareness in this context. For this reason, to obtain a clear exogenous variation in awareness, we further conduct a randomized controlled trial.

[35]The results of the F-tests of excluded instruments, reported in Table H1 largely reject the null for both sets of instruments.

5 Experimental evidence

5.1 Experimental Design

We designed and implemented a randomized controlled trial that introduced information about the *presence* of fiscal incentives for the adoption of energy efficient vehicles. The experiment was conducted in collaboration with the marketing company (Intervista) that fields the SHEDS survey. We administered our experimental intervention to the sample of its panelists who had previously taken part to the survey at least once in the years 2016 to 2019 and who were still part of the panel on September 2019. This allows us to have an experimental sample that is representative of the French and German speaking Swiss population and detailed pre-treatment socio-economic characteristics on the participants. Our sample includes both individuals who previously owned a car and individuals who did not own a car. Further, we also include panelists living in a canton where a Bonus/Malus incentive system has not been introduced. The experimental sample consists of 9141 individuals who we randomized between the treatment group and the control group.

The intervention In October 2019, the 4600 members of the treatment group received an informational brochure enclosed in an email sent by Intervista. The email provided information about the existence, or not, of fiscal incentives for the adoption of energy efficient vehicles in the canton of residence. The information content was kept purposely extremely simple, aiming to merely raise awareness about the *presence* of the fiscal incentives while omitting any details about the eligibility rules, how much the incentives are worth or any message that may enact pro-environmental behavior. This is important because, consistently with the spirit of this work, we wish to leverage exogenous variation in policy awareness, and not detailed knowledge about how the fiscal incentives work or warm glow effects.

The object of the email reads "Do you know whether in your canton there are fiscal incentives for energy efficient vehicles?". The main text of the email writes recipients that "we would like to inform you about the presence of fiscal incentives for energy efficient diesel and gasoline vehicles in your canton of residence in September 2019." and suggests that such fiscal incentives "allow to save money on the annual vehicle registration tax". Following this short text, a table is included indicating, for each canton, whether the annual vehicle registration tax is based on CO_2 emissions and/or fuel efficiency. A green "V" (a red "X") was used to indicate that the registration tax depends (does not depend) on the vehicle's energy efficiency. The full email is included in Appendix I.

The email informed recipients they received the email because they took part in a "scientific study conducted by Intervista" (i.e., the SHEDS survey study). We do not know

the share of recipients who opened the email and read the attached brochure. However, the panelists are rewarded to be part of the panel and to participate in the activities proposed by Intervista, and are thus incentivized to check its mailings. The members of the control group in the panel did not receive any informational intervention.[36]

Follow-up and attrition patterns The last two waves of the SHEDS survey were carried out in May 2020 and May 2021. These served as experimental follow-up surveys and collected information on whether and when participants purchased a vehicle, its characteristics and the individual awareness about the presence of fiscal incentives for the adoption of energy efficient vehicles in the canton of residence.

Out of the experimental sample of 9141 individuals, 3769 and 3159 completed the 2020 and 2021 follow-up surveys, respectively, for a total of 4604 individuals who completed at least one survey. The substantial attrition rate (58.77 and 65.44 percent, respectively in 2020 and 2021) is not surprising since the experimental sample includes all panelists who had previously participated to at least one SHEDS survey.[37] However, the attrition rate is extremely similar for the treated (59.07 and 65.00 percent, in 2020 and 2021 respectively) and the control group (58.47 and 65.89 percent, in 2020 and 2021 respectively). Formally, in Table J1 in the Online Appendix we show there is no evidence of differential attrition between treatment and control groups.

5.2 Data and sample characteristics

We link information from the experimental allocation to data from the SHEDS survey 2016-2021 to carry out the empirical analysis. 4604 individuals who were originally allocated to either control or treatment groups took at least one of the 2020 and 2021 SHEDS surveys. As already discussed above, the SHED survey is administered by Intervista such that respondents are broadly representative of the Swiss adult population. We find our sample is fairly representative of the national population with respect to gender, age, location, and household size, though we do observe a larger share of individuals with a university degree in our sample (see Table J2 in Appendix J).[38]

[36]The panelists of Intervista receive several communications and requests to participate in different studies during the year. For this reason, we did not administer a placebo treatment to this group.

[37]While administering the survey, Intervista contacts previous SHEDS participants starting from the most recent wave to reach the target of 5000 respondents. First-time respondents are enrolled only if the target of 5000 participants per wave is not reached. Despite members of the panel are compensated for answering the survey, they are not obliged to do so.

[38]This might occur in part because individuals with a university degree are more likely to participate to the survey, and in part because our data refer to the reference person in the household, instead of the whole population. Table J2 in Appendix J reports selected statistics in the sample and in the national population.

Further, to test the assumption of unconfoundedness, we check that treatment and control groups are balanced with respect to observable characteristics. Table 2 shows a comparison of selected demographic characteristics between respondents who completed the follow-up survey in control and the treatment groups.[39] We find that the two groups are balanced with respect to age, gender, education, household size and living area. Importantly in this context, also the share of households living in a canton that introduced a Bonus/Malus system is balanced between the two groups. The standard F-test fails to reject these characteristics are jointly uncorrelated with the treatment status (p-value equal to 0.6930).[40]

Table 2: Balance on observables

	Control	Treatment	T-test
Age	48.313	48.665	(-0.77)
Female	0.485	0.486	(-0.10)
Educ.: high school or more	0.629	0.637	(-0.60)
Area: countryside	0.223	0.227	(-0.33)
HH size	2.319	2.341	(-0.61)
Bonus/Malus: Yes	0.726	0.736	(-0.76)
N	2289	2315	4604
p-value F-test		0.6930	

Notes: The Table reports summary statistics and tests of equality of means, between treatment and control groups, for selected controls. The first two columns show the sample averages for the control and the treatment groups, respectively. The third column shows the t-statistics for the t-test of equality of means. The last row reports the p-value for the F test of joint significance.

The 2020 (2021) follow-up survey asks our policy awareness question (as formulated in Section 3.3) to the respondents who purchased a new vehicle after the 2019 (2020) wave of the survey, and to those that did not participate to neither the 2018 nor the 2019 (nor 2020) surveys. In the analysis, we focus on the vehicle choice response in the year following our informational intervention. In the period November 2019 - December 2020, 368 respondents purchased a vehicle among the 4604 who completed the follow-up surveys. We have information on post-intervention policy awareness for all the 368 respondents who purchased a vehicle. The proportion of individuals purchasing a new vehicle by Bonus/Malus and information treatment statuses are reported in Table J4. Further, in Table J5, we show there is

[39]When available, we use socio-demographics information collected in wave 2020. We use information from wave 2021 only for those who did not participate to the 2020 wave.

[40]Full results of the linear probability model are reported in Table J3.

no differential selection into buying a car between treatment and control groups. Therefore, we study the effect of our treatment focusing on the subgroup of participants who purchased a new vehicle.

As for the quasi-experimental evidence presented in Section 4, to analyse individual responses to our intervention, we use self-reported vehicle fuel consumption. In this experimental setting, potential issues of measurement error in vehicle fuel consumption would represent a threat to identification to the extent that misreporting is correlated with treatment status. We wish to stress that our informational intervention was purposely designed to only raise awareness about the presence of the Bonus/Malus system, whereas no information on eligibility rules or fuel economy was provided. For this reason, we believe that we can rule out selective misreporting between respondents in the treatment and control groups due to differential changes in fuel economy-related knowledge or wishful thinking reporting behavior. Among the 368 respondents who purchased a vehicle between November 2019 and December 2020, 303 reported its fuel consumption.[41] In Table J6 we show no statistically significant difference between respondents in treatment and control groups in terms of age, gender, household size, education, and presence of the Bonus/Malus policy. To corroborate the hypothesis that potential measurement error in self-reported vehicle fuel consumption is not correlated with treatment status, we show there is no difference in the probability to report missing vehicle fuel consumption between treatment and control groups (results in Table J7 in Appendix J).

5.3 Experiment results

The informational intervention we administered has the primary purpose of varying individual awareness about the presence of fiscal incentives for the adoption of fuel efficient vehicles. Our main goal is then to exploit the field experiment as a credible source of identification for the causal effect of policy awareness on vehicle choices. We first test to what extent our informational intervention actually affected the individual level of awareness about the presence of the Bonus/Malus system, i.e., the intention-to-treat (ITT) effect on policy awareness. We further explore whether our simple intervention affected vehicle choices.

5.3.1 Intent-to-treat effects

To estimate the effects of the informational brochure, we use variation from the treatment allocation at the individual level. We start by focusing on the response to our intervention

[41] People who bought a battery electric vehicle (fully electric) and other alternative fuel vehicles are also treated as non-reporting. Without taking them into account, 338 individuals purchased a hybrid, gasoline or diesel vehicle between November 2019 and December 2020.

among respondents who lived in cantons where some fiscal incentives for energy efficient and/or low carbon conventional fuel vehicles were present. Our baseline specification for the ITT effect is then simply:

$$y_{ic} = \alpha + \beta Treat_i + \delta X_i + \epsilon_{ic} \tag{5}$$

where y_{ic} is either our policy awareness indicator or the log of vehicle fuel consumption per 100 km, $Treat_i$ is an indicator for whether the respondent received the information treatment - the email - or not. A set of individual characteristics X_i is also included to increase the precision of the estimates. When we estimate eq.(5) when the fiscal incentives are present, β indicates the ITT effect of the informational intervention.

Specification (5) assumes homogeneous treatment effects over time. However, the intervention may affect policy awareness status at the time of vehicle purchase and vehicle choices differently depending on the distance between treatment exposure and vehicle purchase. Therefore, we also estimate (5) allowing for the treatment effect to vary by year of car purchase (2019 vs. 2020). In this case, we include the interaction of indicator $Treat_i$ by year of car purchase and year of car purchase dummies.

Further, we are interested in exploring how information about the lack of fiscal incentives affected policy awareness and vehicle choices. To do this, we also include individuals living in cantons without a Bonus/Malus system in the estimation sample, and exploit variation in the presence of the Bonus/Malus system at the cantonal level. Our specification for the ITT effect becomes:

$$y_{ic} = \alpha + \gamma Treat_i * BM_c + \beta Treat_i + \theta BM_c + \delta X_i + \epsilon_{ic} \tag{6}$$

where, as above, BM_c is an indicator for whether the canton has in place fiscal incentives for energy efficient and/or low carbon conventional fuel vehicles and all other variables are as in eq.(5). When we let the ITT effect vary across individuals living in cantons with different Bonus/Malus policy status, β indicates the effect of the informational intervention on individuals living in cantons that did not introduce a Bonus/Malus system, while γ captures the information treatment effect on individuals actually facing a Bonus/Malus system, relative to that on those who do not face such incentives. The treatment effect on individuals who can access the fiscal incentives is then given by $\gamma + \beta$.

ITT on policy awareness We start estimating eq.(5) using our measure of individual awareness as dependent variable, and a linear probability model, for those individuals living in cantons where a Bonus/Malus system was in place.[42] Results are reported in Columns

[42]Results in Table J8 show the results are largely unaffected using a Probit model.

(1)-(4) of Table 3.

We find a large information treatment effect on individuals' policy awareness: the intervention increases the probability that respondents are policy aware by around 14 percentage points on average (based on column 1), corresponding to an increase of around 35 percent. Further, our results point towards the intervention being mostly effective in raising awareness about the presence of the fiscal incentives in the short-run. While the intervention increases policy awareness by around 39.4 percentage points among those who buy a vehicle in 2019 (see column 3), the effect becomes substantially smaller and not statistically significant among those who buy a vehicle in 2020.

When we estimate eq.(6) on the full experimental sample, we find that the process of knowledge accumulation was affected by the intervention differently in the presence and in the absence of the fiscal incentives (results in Columns (5)-(8) of Table 3). Interestingly, the results show the information about the presence of the fiscal incentives was less effective in increasing individual policy awareness than that about their absence. However, we still find a positive treatment effect on policy awareness for individuals who can access the fiscal incentives (estimated $\gamma + \beta$, based on column 5) equal to 0.138, significant at the 5 percent confidence level. This evidence is confirmed when we allow for heterogeneous treatment effects by both Bonus/Malus policy status and year of car purchase: the intervention increases policy awareness more among those individuals who purchase a vehicle in 2019 in a canton without fiscal incentives for the adoption of energy efficient vehicles (as reported in Column 7). The results are little affected when we include a set of controls (see columns 2, 4, 6 and 8).

ITT on vehicle choices The ITT estimates on log fuel consumption are reported in Table J9. The results show that our simple informational intervention had a sizable impact on vehicle choices. Our intervention induced consumers to purchase vehicles consuming around 10 percent less fuel in the presence of a Bonus/Malus system (as reported in Column 1). When we allow the ITT to vary by the presence of a Bonus/Malus policy, we find substantially heterogeneous vehicle choices response to our intervention (columns 3 and 4). First, we find a positive but not significant treatment effect on vehicle fuel consumption among individuals living in cantons that did not introduced a Bonus/Malus system. Second, relative to the consumers living in cantons without fiscal incentives, we find that providing information about the mere presence of the Bonus/Malus system (to those who live in cantons with such policy) induces individuals to purchase vehicles that consume around 20 percent less fuel. Therefore, we find a treatment effect on individuals who can access the fiscal incentives equal to -9.95 percent, significant at the 5 percent level (estimated $\gamma + \beta$, based on column 3).

Table 3: Experimental results: Treatment effect on policy awareness

	Only with policy				*Full sample*			
	Whole effect		Effect by year		Whole effect		Effect by year	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
BM x Treat					-0.163	-0.172		
					(0.119)	(0.119)		
Treat	0.138**	0.135**			0.301***	0.309***		
	(0.067)	(0.067)			(0.098)	(0.098)		
BM x Treat 2019							-0.027	-0.045
							(0.229)	(0.227)
Treat 2019			0.394***	0.398***			0.445**	0.458**
			(0.140)	(0.138)			(0.211)	(0.212)
BM x Treat 2020							-0.194	-0.201
							(0.126)	(0.126)
Treat 2020			0.088	0.082			0.275***	0.279***
			(0.075)	(0.076)			(0.106)	(0.105)
BM					0.214***	0.206***	0.221***	0.212***
					(0.076)	(0.076)	(0.076)	(0.076)
Controls	No	Yes	No	Yes	No	Yes	No	Yes
N	221	221	221	221	303	303	303	303
Mean dep. var. (control)	0.3894				0.3333			

Notes: Treatment effect on awareness, using only the sample of individuals living in cantons with Bonus/Malus (columns 1-4) or using the full sample (columns 5-8). Dependent variable is column (1) is a dummy taking value of one if the individual is policy aware. Treatment effect is split by year (2019 vs. 2020) in columns 3-4 and 7-8. Robust standard errors in parenthesis. Three stars, two stars and one star indicate statistical significance at the 1 percent, 5 percent and at the 10 percent confidence level, respectively. Linear hypothesis test: BM x Treat + Treat = 0.138 p-value 0.038 (column 5), 0.136 p-value 0.042 (column 6); BM x Treat 2019 + Treat 2019 = 0.418 p-value 0.002 (column 7), 0.413 p-value 0.002 (column 8); BM x Treat 2020 + Treat 2020 = 0.081 p-value 0.274 (column 7), 0.078 p-value 0.293 (column 8).

These results are consistent with the evidence obtained with the DiD analysis. They show that a simple informational intervention about the mere absence or presence of fiscal incentives for the adoption of energy efficient vehicles can induce substantial vehicle choices response. Importantly, they also highlight possibly unintended consequences of untargeted informational campaigns: informing individuals that no fiscal incentives for the adoption of energy efficient vehicles are available induces them to purchase vehicles with higher fuel intensity. Further, these ITT estimates would represent a lower bound for the effect of policy awareness on vehicle choices in case our intervention did not fully translate into knowledge about the presence of the fiscal program.

5.3.2 LATE of awareness

To address the issue of endogeneity of awareness discussed in Section 4.6 and obtain an estimate for the causal effect of policy awareness on fuel economy, we use treatment assignment as an instrument for individual awareness. The results presented thus far have shown strength of our treatment assignment as an instrument for individual policy awareness. They also support the hypothesis that the treatment assignment is unconfounded. Therefore, we are confident that our instrument for individual awareness is exogenous with respect to unobservables influencing vehicle choices. To address potential concerns over our intervention affecting vehicle choices by enacting pro-environmental attitudes rather than through enhanced awareness, we explore the ITT effect of our intervention on a series of proxies for environmental values and behaviors.[43] As shown in Table J10, we find our intervention had no effect on any of these measures. These results provide additional support to the validity of our exclusion restriction. Our approach yields then estimates for the causal effect of awareness on *compliers*, i.e, people who would have been unaware of the presence of the Bonus/Malus system without treatment, but who became aware upon receipt of the email.

LATE-IV on vehicle choices We then estimate the following equation using two-stages least squares:

$$y_{ic} = \gamma Aware_i * BM_c + \beta Aware_i + \theta BM_c + \delta X_i + \epsilon_{ic} \tag{7}$$

where all variables are as in eq.(3). We first estimate eq.(7) for individuals who purchased a vehicle in the presence of a Bonus/Malus system (setting $\gamma = \theta = 0$). To this end, we simply use eq.(5) as first stage regression where either $Treat_i$ or $Treat_i$ by year of purchase

[43] After the intervention, we ask respondents to assign a score from 1 to 5 to the importance or likelihood of the following environmental aspects and planned behavior: (1) Importance to have access to a clean environment; (2) Plans on reducing electricity consumption; (3) Plans on reducing heating consumption; (4) Plans on reducing carbon footprint; (5) Plans on reducing number of airplane flights.

are used as instruments for $Aware_i$.[44] In this case, β represents the LATE of awareness on vehicle fuel consumption.

Table 4: LATE of awareness on vehicle fuel consumption

	Only with policy		*Full sample*	
	(1)	(2)	(3)	(4)
BM x Aware			-0.622*	-0.416
			(0.356)	(0.328)
Aware	-0.324*	-0.310*	0.218	0.087
	(0.195)	(0.182)	(0.279)	(0.260)
BM			0.290*	0.213
			(0.164)	(0.156)
Controls	No	Yes	No	Yes
N	221	221	303	303
Aware + BM x Aware			-0.404*	-0.329
			(0.238)	(0.146)
p-value F-test (Aware)	0.003	0.003	0.000	0.000
p-value F-test (BM x Aware)			0.000	0.000

Notes: The Table reports the IV-LATE of awareness on the log of vehicle fuel consumption per 100 km obtained using random treatment assignment as instrument for awareness. *BM* indicates respondents living in cantons who adopted a Bonus/Malus system; *Aware* indicates policy aware respondents. Results are obtained using only the sample of individuals in cantons with Bonus/Malus (columns 1-2) or using the full sample (columns 3-4). The linear test of the sum of the coefficients *Aware* and *BMxAware*, and the p-value of the F-test / Sanderson-Windmeijer test for weak instrument, are also reported. Robust standard errors in parenthesis. Three stars, two stars and one star indicate statistical significance at the 1 percent, 5 percent and at the 10 percent confidence level, respectively.

Second, we estimate eq.(7) on the entire experimental sample. β captures now the LATE of awareness on individuals living in cantons that did not introduce a Bonus/Malus system, while γ indicates the LATE of awareness on individuals actually exposed to the fiscal incentives for energy efficient vehicles, relative to the awareness effect when such incentives are not available. The LATE of awareness on individuals who can access the fiscal incentives is then given by $\gamma + \beta$.[45] Because of the large treatment effect heterogeneity on policy awareness by year of purchase documented in Section 5.3.1, our preferred specification for the first stage uses $Treat_i$ by year of purchase as instruments for $Aware_i$. In Table J11, we show our main

[44] As described above for our DID-IV approach, we deal with the presence of a binary endogenous variable by applying the three steps approach suggested by Angrist and Pischke (2008).

[45] When we estimate eq.(7) on the entire experimental sample, we use both $Treat_i$ (or $Treat_i$ by year of purchase) and $Treat_i * BM_c$ as instruments for $Aware_i$ and $Aware_i * BM_c$.

results are confirmed (though more noisy) when we use only $Treat_i$ (or $Treat_i * BM_c$) as instrument for $Aware_i$.

Our LATE estimates of awareness on log fuel consumption are reported in Table 4 (results of the first stage are reported in Tables J12 and J13). Columns (1) and (2) present the results obtained for individuals purchasing a vehicle in the presence of the Bonus/Malus system (without and with controls, respectively), while columns (3) and (4) report the results obtained using the entire experimental sample. These results show that, in the presence of the fiscal incentives, policy awareness induces a substantial vehicle choices response (column 1 and 2). Specifically, we find that policy awareness induces compliers to purchase vehicles that consume around 32 percent less on average. The estimates for the effect of awareness on fuel economy are similar in magnitude (-40 percent) and statistically equivalent, when we estimate eq.(7) on the full sample (result based on column 3, computing $\gamma + \beta$).

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.

Exploiting a direct measure of individual awareness about the presence of fiscal incentives for the adoption of fuel efficient vehicles, a natural experiment and a field experiment, in this paper we have explored the role of awareness on consumers' vehicle choices. We show that ignoring policy awareness might lead to conclude the fiscal incentives are little effective in influencing vehicle fuel consumption and CO_2 emissions, consistently with previous estimates in the literature (Klier and Linn, 2015). Both quasi-experimental and experimental settings show strong evidence that policy awareness plays a crucial role to understand consumers' response to the fiscal incentives set by the Bonus/Malus system. The LATE-IV estimates for the effect of policy awareness are not statistically different than those obtained with the IV-DiD approach. However, because the former should be interpreted as the effect on those individuals becoming aware due to our informational intervention, they cannot be directly compared to neither our OLS-DiD nor the IV-DiD estimates. Nonetheless, together our results show that, while ignoring policy awareness might lead to conclude the fiscal incentives are little effective (consistently with previous estimates in the literature), policy awareness induces individuals to purchase more efficient vehicles. Hence, we find a substantial valuation of the yearly vehicle taxes by aware consumers. 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 show that a simple and relatively inexpensive information treatment (sending a brochure within an email with disclosure of the presence of tax incentives), makes consumers aware of the existence of the fiscal incentives at the time of purchase and induces a significant vehicle choice response. This policy implication is not only relevant for Switzerland, as vehicle registration taxes based on vehicle fuel efficiency are widespread across European countries. More generally, the evidence we present prompts policy makers to complement the design and introduction of public policies with simple informational campaigns about their existence. 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.

Another implication of our results is that the tax burden of fiscal measures disproportionally affects unaware individuals. While aware individuals could modify their behavior to access the monetary incentives, unaware consumers cannot benefit, even though they would potentially be better off when doing so. Moreover, our finding about the larger effect of policy awareness on vehicle choices among financially sophisticated individuals suggest policy makers should complement information campaigns with literacy programs that allow policy aware consumers to better understand the role of the fiscal incentives when taking investment decisions.

Our findings have 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 additional 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.

We have provided evidence about the impact of individuals' awareness about the presence of fiscal incentives on their vehicle choices. This is a reduced form estimate which might depend on the specific vehicle market conditions. Future research should investigate to what extent supply responses play a role, potentially influencing the effect of information treatments that aim to increase awareness among the population. Future work should also explore whether alternative types of intervention are better suited to foster the relevant individuals' awareness in different contexts.

Acknowledgments

We thank Michele Baggio, Daniel Brent, Ron Chan, Sébastien Houde, Takahiko Kiso, Henrik Kleven, Lucija Muehlenbachs, Edson Severnini, and participants at the World Congress of Environmental and Resource Economists, the Annual Conference of the International Association of Applied Econometrics, the Swiss Society of Economics and Statistics Annual Meeting, Annual Workshop in Empirical Methods in Energy Economics, the Annual Conference of the Italian Association of Environmental and Resource Economists, the Mannheim Conference on Energy and the Environment, and the Seminar Series at Yale University, University of La Laguna, University of Gothenburg and University of Manchester for helpful comments and suggestions. All the errors are our own. This research is part of the activities of SCCER CREST, which is financially supported by the Swiss Commission for Technology and Innovation (CTI) / Innosuisse.

References

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

Alberini, A. and M. Bareit (2017, April). The Effect of Registration Taxes on New Car Sales and Emissions: Evidence from Switzerland. *Resource and Energy Economics 56*, 96–112.

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

Allcott, H. and C. Knittel (2019). Are consumers poorly informed about fuel economy? evidence from two experiments. *American Economic Journal: Economic Policy 11*(1), 1–37.

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

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

Angrist, J. D. and J.-S. Pischke (2008). Mostly harmless econometrics. In *Mostly Harmless Econometrics*. Princeton university press.

Barr, A. and S. Turner (2018). A letter and encouragement: Does information increase postsecondary enrollment of ui recipients? *American Economic Journal: Economic Policy 10*(3), 42–68.

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

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

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

Van den Bijgaart, I. and D. Cerruti (2020). The effect of information on market activity: Evidence from vehicle recalls. *The Review of Economics and Statistics*, 1–45.

Blasch, J., N. Boogen, C. Daminato, M. Filippini, et al. (2021). Empower the consumer! energy-related financial literacy and its implications for economic decision making. *Economics of energy & environmental policy 10*(2), 149–181.

Cerruti, D., A. Alberini, and J. Linn (2019). Charging Drivers by the Pound: How Does the UK Vehicle Tax System Affect CO2 Emissions? *Environmental and Resource Economics 74*(1), 99–129.

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

Chetty, R., J. N. Friedman, S. Leth-Petersen, T. H. Nielsen, and T. Olsen (2014, August). 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., J. N. Friedman, and E. Saez (2013, December). Using Differences in Knowledge Across Neighborhoods to Uncover the Impacts of the EITC on Earnings. *American Economic Review 103*(7), 2683–2721.

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

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

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

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

D'Haultfuille, X., P. Givord, and X. Boutin (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., R. G. Newell, and K. Palmer (2009, October). Energy Efficiency Economics and Policy. *Annual Review of Resource Economics 1*(1), 597–620.

Grigolon, L., M. Reynaert, and F. Verboven (2018, August). 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., P. Sapienza, and L. Zingales (2004). The Role of Social Capital in Financial Development. *American Economic Review 94*(3), 526–556.

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

Homonoff, T. A. (2018). Can small incentives have large effects? the impact of taxes versus bonuses on disposable bag use. *American Economic Journal: Economic Policy 10*(4), 177–210.

Huse, C. and N. Koptyug (2017). Taxes vs. standards as policy instruments: Evidence from the auto market. *Working Paper*.

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

Liebman, J. B. and E. F. P. Luttmer (2015, February). 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 O. S. Mitchell (2014, March). The Economic Importance of Financial Literacy: Theory and Evidence. *Journal of Economic Literature 52*(1), 5–44.

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

Mastrobuoni, G. (2011, August). 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.

Meier, W. A. (2014). Politikberichterstattung in gemeinden und bezirken eine übersicht zu regionalmedien. *Zürich: Universität Zürich: Swiss Centre for Studies on the Global Information Society*.

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

Rosenbaum, P. R. and D. B. Rubin (1984, September). 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.

Stockemer, D. (2017). What affects voter turnout? a review article/meta-analysis of aggregate research. *Government and Opposition 52*(4), 698722.

Swiss Federal Statistical Office (2017). Comportement de la Population en Matière de Transports: Résultats de Microrecensement Mobilité et Transports 2015. Technical report, OFS, Neuchâtel.

Appendix - For Online Publication

A Description of cantonal Bonus/Malus 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 for the bonus or the malus to apply, 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. Table A1 and Figure A1 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 before 2019 and therefore those incentives are not considered in our analysis.

Figure A1: Current Bonus/Malus systems in Swiss cantons

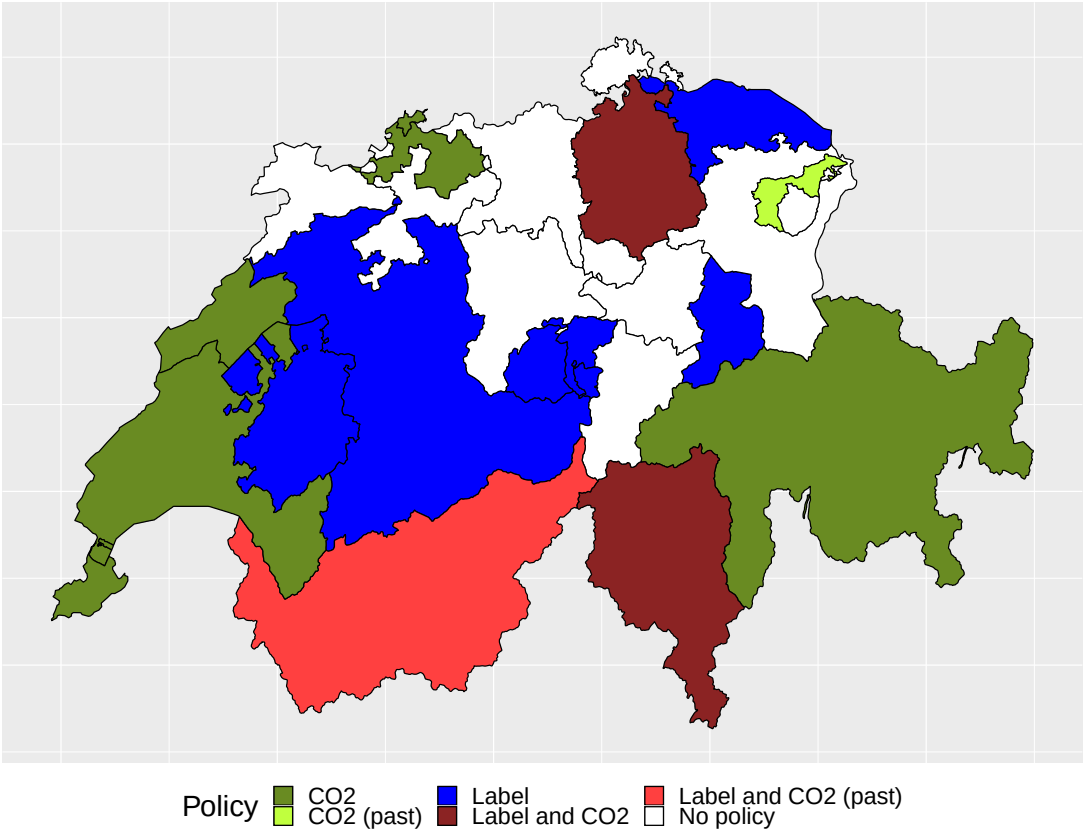


Figure A2 illustrates the information contained in the vehicle energy label available to

Table A1: Summary Bonus/Malus systems

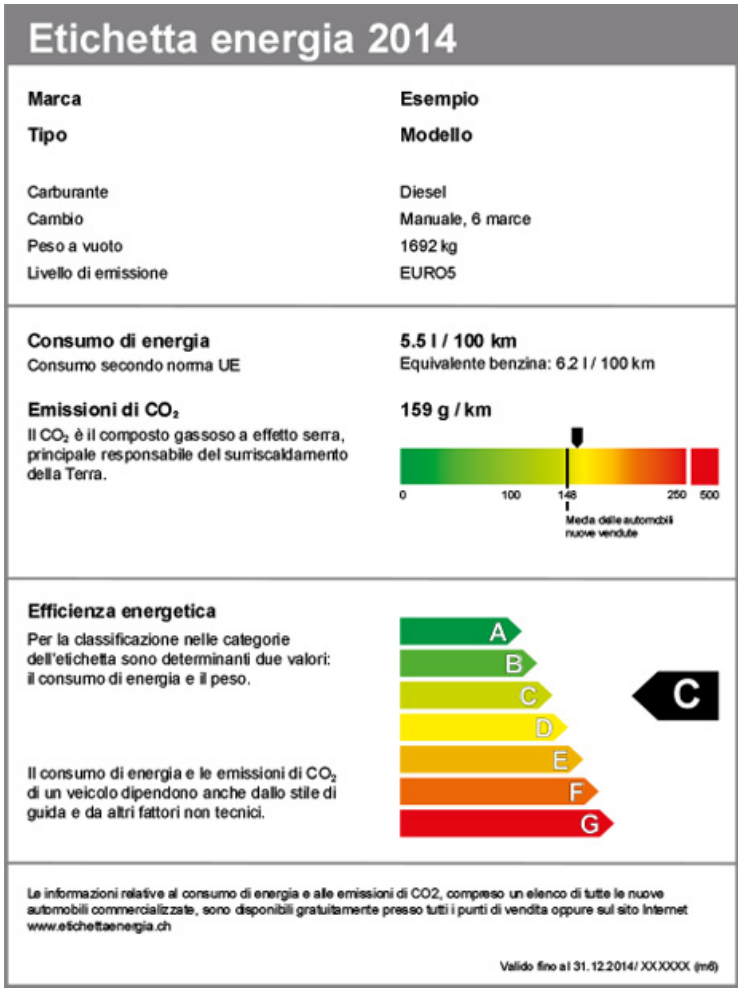
Canton	**Implemented**	**Efficiency rating**	**CO_2**	**Max age (bonus)**
AR	2011-2014	No	Yes	No limit
BE	2013-2018	Yes	No	4 years
BL	2014-2018	No	Yes	4 years
BS	2013-2018	No	Yes	4 years
FR	2011-2018	Yes	No	3 years
GE	2010-2018	No	Yes	Some*
GL	2012-2018	Yes	No	3 years
GR	2009-2018	No	Yes	Some*
NE	2014-2018	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

Notes: 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 thresholds used to assign the efficiency rating are recalculated each year by the federal government, rather than the individual cantons. 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 A2: 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 per 100km. 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.

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 B1 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 of our dependent variable.

Figure B2 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 B3 we illustrate the almost linear relationship between CO_2 emissions and fuel consumption. To make the graph easier to understand, we include only vehicles registered for the first time in 2015. The graph clearly shows an almost perfect linear relationship among cars of the same fuel type.

Figure B1: Fuel consumption distribution of SHEDS and Registration data

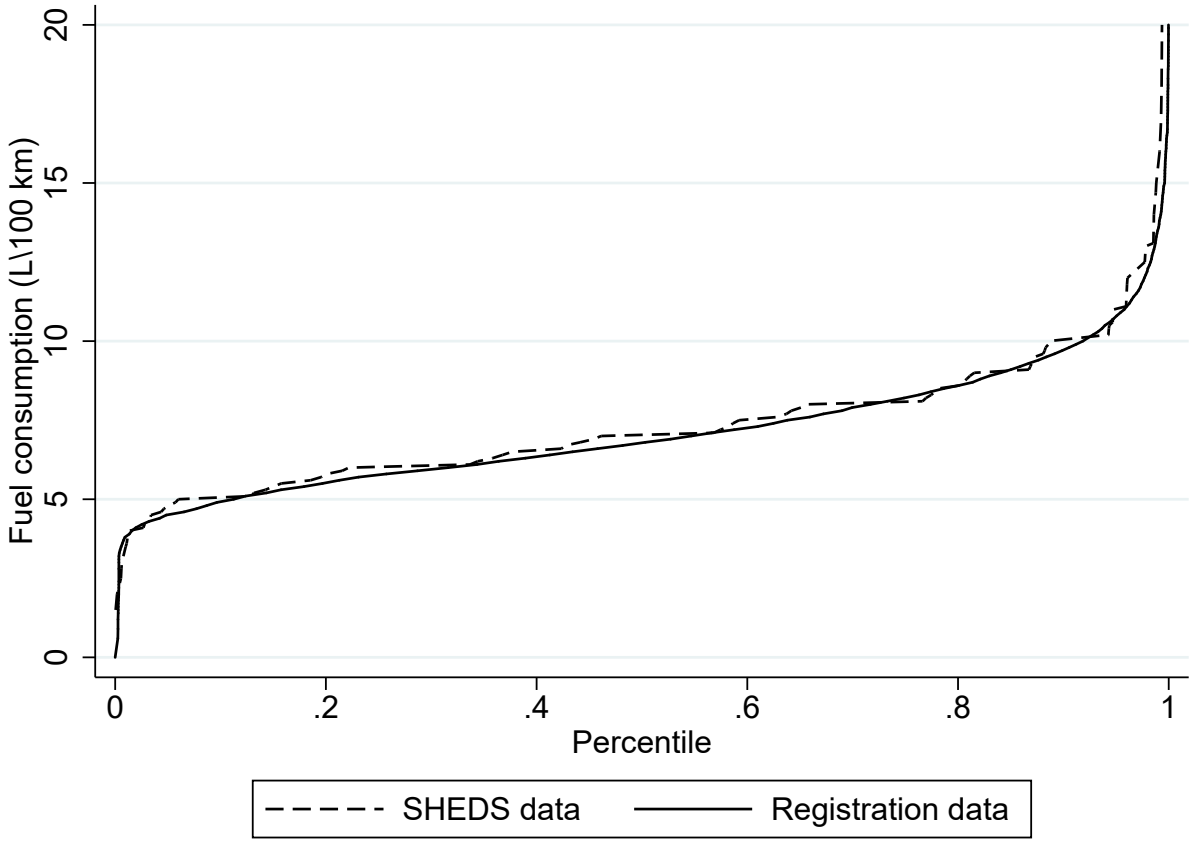


Figure B2: Fuel consumption distribution and efficiency rating, registration data

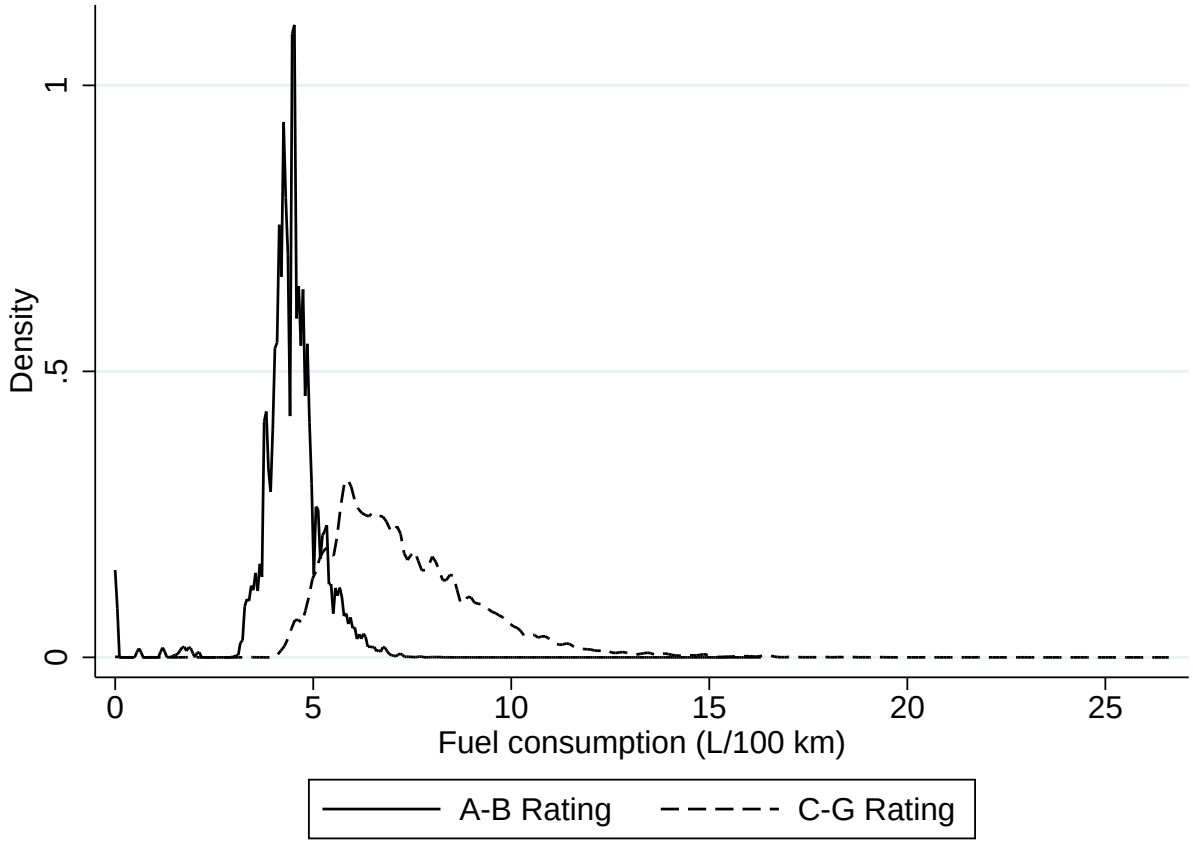
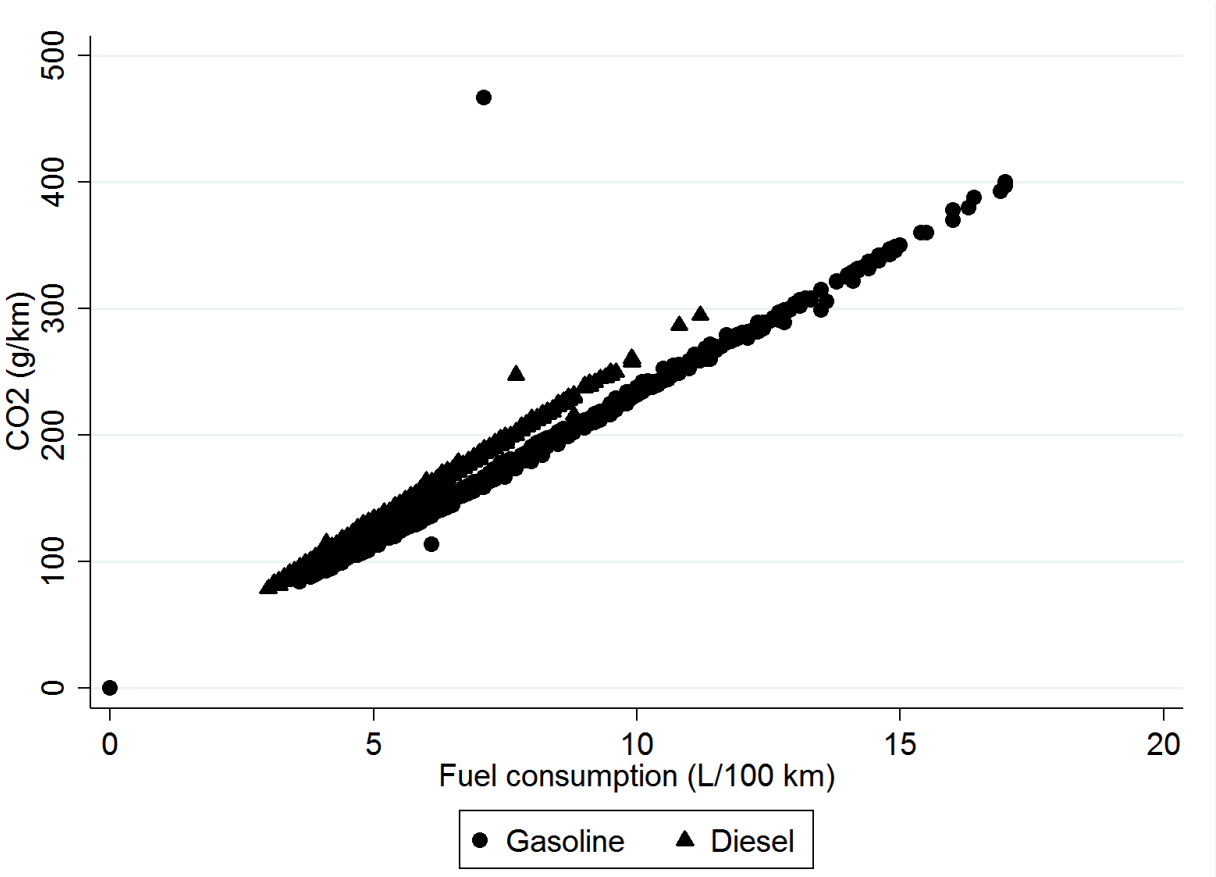


Figure B3: Fuel consumption and CO_2 emissions, 2015 registration data



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 Italian-speaking canton of Ticino are not surveyed.

Our main dataset comes from the 2018 and 2019 wave. We include respondents who answered the questionnaire at least once either in 2018 or 2019. When a respondent participated to both waves, we consider the answers given in 2018. 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.

Combined, the 2018 and 2019 waves of SHEDS contain 7062 individuals (5011 interviewed in 2018 and 2051 interviewed in 2019 but not in 2018). Among those, 5130 (72.64 percent) own at least a car in their household. Due to the presence of missing variables, the final sample used in the baseline analysis contains 3433 respondents. Table C1 shows how many observations have been omitted among respondents with a car.

Table C1: Missing observations

Variable	**Missing**	**Percentage**
Fuel consumption	393	7.66%
Year of purchase	155	3.02%
HH monthly income	811	15.81%
Financial literacy	227	4.42%
Other	340	6.63%

Notes: 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 come from household monthly income. In fact, some 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 drop individuals who bought a car in 2019 (55 observations) and we also trim the top

and bottom 0.5 percent fuel consumption percentiles (32 observations), to exclude patently wrongly reported values. That means dropping values of fuel consumption (L/100 km) lower than 1.5 and higher than 50. 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.[46] These are summarized in tables C2, C3, C4, C5 and C6. 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 C2). 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 distinct indicators for answering correctly to four questions: electricity cost for running a desktop computer for one hour; electricity cost for running a washing machine at 60řC 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 represents 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 answered 4 or 5, and zero otherwise. The list of values and lifestyles are summarized in table C3.

The first set of environment-related controls used in the paper are shown in table C4. 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 of controls about environmental activism, and behavior and expectations towards the environment (table C5). 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.

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 C6.

[46]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 C2: Variables used - Main

Variable	**Wave**
Baseline	
Age	2018-2019
Age squared	2018-2019
Gender	2018-2019
Education	2018-2019
Profession	2018-2019
Language	2018-2019
HH monthly gross income	2018-2019
HH size	2018-2019
HH living area	2018-2019
Policy awareness	2018-2019
Population size in 2016 at municipality of residence	2018-2019
Wave (2018 or 2019)	2018-2019
Vehicle	
Year of purchase	When car changed
Year of first registration	When car changed
Fuel consumption (L/100 km)	2018-2019
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

Notes: List of the main control variables used in the quasi-experimental analysis.

Table C3: Variables used - Life attitudes

Variable	Wave
Life values	
Equality	2018-2019
Respecting the earth	2018-2019
Social power	2018-2019
Pleasure	2018-2019
Unity with nature	2018-2019
A world at peace	2018-2019
Wealth	2018-2019
Authority	2018-2019
Social justice	2018-2019
Enjoying life	2018-2019
Protecting the environment	2018-2019
Influence	2018-2019
Helpfulness	2018-2019
Preventing pollution	2018-2019
Self-indulgent	2018-2019
Ambitious	2018-2019
Important things in life	
Good health	2018-2019
Good relations	2018-2019
Freedom	2018-2019
Safety	2018-2019
Own identity lifestyle	2018-2019
Privacy	2018-2019
Clean environment	2018-2019
Job access	2018-2019
Free time	2018-2019
Comfort	2018-2019
Enjoy nature and culture	2018-2019
Pleasant experiences	2018-2019
Appreciation and respect	2018-2019
Nice possessions	2018-2019

Table C4: 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 C5: Variables used - Environmental behavior and expectations

Variable	Wave
Expectations towards environmental actions	
HH expects I behave environmentally friendly	2018-2019
Acquaintances behave environmentally friendly	2018-2019
Acquaintances expects I behave environmentally friendly	2018-2019
Personally obliged to behave environmentally friendly	2018-2019
Swiss society expects people behave environmentally friendly	2018-2019
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	2018-2019

Table C6: 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

In this appendix, we present baseline summary statistics on all the controls used in the baseline analysis. We compare mean values between respondents who live in cantons that ever introduced a Bonus/Malus systems and those living in cantons that never did so (Tables D2, D4, D6, D8, D10, D12, D14, D16, D18, D20). In the same set of tables we compare aware and not aware respondents as well. We comment these results in Section 4.2.

We also 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 (Tables D1, D3, D5, D7, D9, D11, D13, D15, D17, D19). 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.

Table D1: Baseline statistics

	Not Aware			**Aware**		
	No Policy	Policy	T-test	No Policy	Policy	T-test
Age	46.676	44.778	(2.78)	50.193	46.145	(5.11)
Female	0.503	0.523	(-0.91)	0.380	0.407	(-1.00)
Educ.: compulsory	0.073	0.074	(-0.12)	0.050	0.073	(-1.71)
Educ.: apprenticeship	0.345	0.311	(1.64)	0.333	0.271	(2.49)
Educ.: high school/vocat.	0.168	0.157	(0.72)	0.112	0.154	(-2.23)
Educ.: university	0.413	0.458	(-2.03)	0.505	0.502	(0.12)
Job: employee	0.665	0.666	(-0.01)	0.672	0.670	(0.10)
Job: self-empl.	0.060	0.047	(1.32)	0.069	0.087	(-1.21)
Job: retired	0.139	0.120	(1.26)	0.170	0.132	(1.93)
Job: other	0.136	0.168	(-1.99)	0.089	0.110	(-1.30)
HH income: <6000	0.284	0.289	(-0.21)	0.225	0.263	(-1.60)
HH income: 6000-9000	0.278	0.318	(-1.98)	0.293	0.296	(-0.13)
HH income: >9000	0.438	0.393	(2.03)	0.482	0.440	(1.51)
German speaker	0.822	0.718	(5.54)	0.894	0.481	(17.08)
HH size: 1	0.193	0.210	(-0.97)	0.206	0.199	(0.33)
HH size: 2	0.440	0.419	(0.96)	0.443	0.419	(0.90)
HH size: 3	0.141	0.161	(-1.24)	0.137	0.160	(-1.16)
HH size: 4	0.166	0.153	(0.79)	0.168	0.163	(0.23)
HH size: 5	0.060	0.057	(0.30)	0.046	0.060	(-1.11)
Area: city	0.373	0.409	(-1.63)	0.347	0.388	(-1.55)
Area: agglomeration	0.330	0.306	(1.14)	0.353	0.322	(1.17)
Area: countryside	0.297	0.286	(0.57)	0.301	0.290	(0.44)
Population in municipality	28233.421	35396.176	(-2.25)	29879.609	33808.275	(-0.98)
Green party	0.099	0.119	(-1.40)	0.119	0.117	(0.14)
N	1016	984	2000	519	915	1434

Table D2: Baseline statistics

	Policy ever in place			**Policy aware**			
	No	Yes	T-test	No	Yes	T-test	Tot
Age	45.767	46.759	(-1.65)	45.743	47.610	(-3.60)	46.522
Female	0.451	0.469	(-0.87)	0.513	0.397	(6.78)	0.464
Educ.: compulsory	0.060	0.073	(-1.30)	0.073	0.065	(0.98)	0.070
Educ.: apprenticeship	0.356	0.301	(2.99)	0.329	0.294	(2.18)	0.314
Educ.: high school/vocat.	0.137	0.158	(-1.46)	0.163	0.139	(1.91)	0.153
Educ.: university	0.448	0.469	(-1.06)	0.436	0.503	(-3.91)	0.464
Job: employee	0.695	0.659	(1.91)	0.665	0.671	(-0.33)	0.668
Job: self-empl.	0.057	0.067	(-1.02)	0.053	0.081	(-3.22)	0.065
Job: retired	0.120	0.142	(-1.60)	0.130	0.146	(-1.37)	0.136
Job: other	0.128	0.132	(-0.29)	0.152	0.103	(4.21)	0.131
HH income: <6000	0.257	0.275	(-1.02)	0.286	0.250	(2.40)	0.271
HH income: 6000-9000	0.284	0.300	(-0.88)	0.297	0.295	(0.16)	0.296
HH income: >9000	0.459	0.424	(1.73)	0.416	0.455	(-2.30)	0.432
German speaker	0.944	0.640	(17.52)	0.771	0.630	(9.08)	0.712
HH size: 1	0.185	0.207	(-1.32)	0.202	0.202	(-0.00)	0.202
HH size: 2	0.420	0.432	(-0.61)	0.429	0.427	(0.12)	0.429
HH size: 3	0.150	0.151	(-0.08)	0.150	0.151	(-0.07)	0.151
HH size: 4	0.177	0.157	(1.33)	0.160	0.165	(-0.36)	0.162
HH size: 5	0.068	0.054	(1.59)	0.059	0.055	(0.42)	0.057
Area: city	0.283	0.415	(-6.81)	0.391	0.373	(1.04)	0.383
Area: agglomeration	0.372	0.309	(3.34)	0.318	0.333	(-0.95)	0.324
Area: countryside	0.345	0.276	(3.81)	0.291	0.294	(-0.13)	0.292
Population in municipality	12457.737	38156.748	(-9.02)	31757.497	32386.394	(-0.25)	32020.117
Green party	0.107	0.114	(-0.56)	0.109	0.118	(-0.81)	0.113
N	820	2614	3434	2000	1434	3434	3434

Table D3: Energy and financial literacy

	Not Aware			**Aware**		
	No Policy	Policy	T-test	No Policy	Policy	T-test
Financial literacy	0.638	0.601	(1.71)	0.751	0.644	(4.24)
Efficiency rating	0.508	0.523	(-0.69)	0.539	0.458	(2.98)
Energy cost: computer	0.325	0.321	(0.18)	0.424	0.315	(4.17)
Energy cost: washing mach.	0.142	0.129	(0.83)	0.152	0.131	(1.11)
Vehicle fuel cost	0.403	0.369	(1.55)	0.455	0.416	(1.41)
Risk taker	0.109	0.103	(0.48)	0.135	0.127	(0.44)
N	1016	984	2000	519	915	1434

Table D4: Energy and financial literacy

	Policy ever in place			**Policy aware**			
	No	Yes	T-test	No	Yes	T-test	Tot
Financial literacy	0.695	0.630	(3.38)	0.620	0.683	(-3.83)	0.646
Efficiency rating	0.548	0.490	(2.88)	0.515	0.487	(1.62)	0.504
Energy cost: computer	0.373	0.324	(2.58)	0.323	0.354	(-1.91)	0.336
Energy cost: washing mach.	0.151	0.132	(1.37)	0.136	0.139	(-0.28)	0.137
Vehicle fuel cost	0.433	0.396	(1.90)	0.386	0.430	(-2.61)	0.404
Risk taker	0.123	0.114	(0.75)	0.106	0.130	(-2.14)	0.116
N	820	2614	3434	2000	1434	3434	3434

Table D5: Life values

	Not Aware			**Aware**		
	No Policy	Policy	T-test	No Policy	Policy	T-test
Equality	0.723	0.728	(-0.21)	0.682	0.737	(-2.20)
Respect Earth	0.761	0.732	(1.50)	0.723	0.774	(-2.17)
Social power	0.095	0.110	(-1.05)	0.091	0.119	(-1.67)
Pleasure	0.686	0.712	(-1.29)	0.663	0.768	(-4.35)
Unity w/nature	0.682	0.647	(1.65)	0.642	0.650	(-0.33)
World peace	0.825	0.828	(-0.20)	0.803	0.817	(-0.65)
Wealth	0.301	0.320	(-0.91)	0.329	0.356	(-1.02)
Authority	0.121	0.143	(-1.47)	0.114	0.173	(-3.00)
Social justice	0.680	0.700	(-0.97)	0.688	0.685	(0.10)
Enjoying life	0.715	0.762	(-2.42)	0.728	0.791	(-2.72)
Protect env.	0.785	0.778	(0.38)	0.769	0.795	(-1.14)
Influence	0.290	0.328	(-1.83)	0.306	0.313	(-0.24)
Helpfulness	0.554	0.546	(0.38)	0.507	0.550	(-1.57)
Prevent pollut.	0.773	0.774	(-0.09)	0.751	0.785	(-1.44)
Self-indulgence	0.496	0.554	(-2.59)	0.464	0.605	(-5.21)
Ambition	0.345	0.399	(-2.50)	0.368	0.396	(-1.03)
N	1016	984	2000	519	915	1434

Table D6: Life values

	Policy ever in place			**Policy aware**			
	No	Yes	T-test	No	Yes	T-test	Tot
Equality	0.700	0.729	(-1.60)	0.726	0.717	(0.56)	0.722
Respect Earth	0.738	0.754	(-0.94)	0.747	0.755	(-0.58)	0.750
Social power	0.091	0.109	(-1.46)	0.102	0.109	(-0.59)	0.105
Pleasure	0.671	0.725	(-2.99)	0.699	0.730	(-1.99)	0.712
Unity w/nature	0.643	0.662	(-1.03)	0.665	0.647	(1.09)	0.658
World peace	0.799	0.827	(-1.87)	0.827	0.812	(1.06)	0.821
Wealth	0.320	0.327	(-0.42)	0.311	0.347	(-2.23)	0.326
Authority	0.111	0.149	(-2.75)	0.132	0.151	(-1.61)	0.140
Social justice	0.668	0.695	(-1.43)	0.690	0.686	(0.24)	0.688
Enjoying life	0.724	0.759	(-2.00)	0.738	0.768	(-2.04)	0.751
Protect env.	0.780	0.784	(-0.23)	0.782	0.785	(-0.23)	0.783
Influence	0.289	0.316	(-1.46)	0.309	0.310	(-0.08)	0.310
Helpfulness	0.517	0.552	(-1.73)	0.550	0.534	(0.92)	0.543
Prevent pollut.	0.750	0.780	(-1.81)	0.773	0.773	(0.06)	0.773
Self-indulgence	0.460	0.561	(-5.10)	0.524	0.554	(-1.73)	0.537
Ambition	0.366	0.381	(-0.80)	0.372	0.386	(-0.81)	0.378
N	820	2614	3434	2000	1434	3434	3434

Table D7: Important things in life

	Not Aware			**Aware**		
	No Policy	Policy	T-test	No Policy	Policy	T-test
Health	0.967	0.973	(-0.78)	0.975	0.972	(0.38)
Relations	0.863	0.883	(-1.34)	0.871	0.884	(-0.74)
Freedom	0.910	0.925	(-1.17)	0.927	0.944	(-1.32)
Safety	0.880	0.892	(-0.87)	0.892	0.899	(-0.44)
Identity	0.697	0.726	(-1.42)	0.640	0.800	(-6.77)
Privacy	0.889	0.905	(-1.23)	0.927	0.916	(0.73)
Clean env.	0.890	0.918	(-2.12)	0.898	0.928	(-1.98)
Job	0.814	0.837	(-1.38)	0.827	0.845	(-0.90)
Free time	0.886	0.885	(0.05)	0.898	0.867	(1.74)
Comfort	0.679	0.718	(-1.92)	0.690	0.795	(-4.47)
Nat./cult. beauty	0.702	0.736	(-1.69)	0.711	0.779	(-2.89)
Experiences	0.781	0.798	(-0.89)	0.750	0.836	(-3.99)
Respect	0.766	0.767	(-0.08)	0.748	0.750	(-0.09)
Possessions	0.327	0.341	(-0.70)	0.341	0.322	(0.72)
N	1016	984	2000	519	915	1434

Table D8: Important things in life

	Policy ever in place			**Policy aware**			
	No	Yes	T-test	No	Yes	T-test	Tot
Health	0.959	0.975	(-2.41)	0.970	0.973	(-0.57)	0.971
Relations	0.855	0.882	(-2.07)	0.873	0.879	(-0.56)	0.876
Freedom	0.911	0.931	(-1.89)	0.917	0.938	(-2.26)	0.926
Safety	0.884	0.893	(-0.67)	0.886	0.897	(-1.00)	0.891
Identity	0.640	0.750	(-6.18)	0.711	0.742	(-2.00)	0.724
Privacy	0.911	0.905	(0.50)	0.897	0.920	(-2.27)	0.907
Clean env.	0.889	0.915	(-2.30)	0.903	0.917	(-1.36)	0.909
Job	0.846	0.826	(1.36)	0.826	0.838	(-0.98)	0.831
Free time	0.898	0.878	(1.55)	0.885	0.878	(0.68)	0.882
Comfort	0.674	0.738	(-3.55)	0.699	0.757	(-3.76)	0.723
Nat./cult. beauty	0.679	0.751	(-4.04)	0.719	0.755	(-2.36)	0.734
Experiences	0.756	0.808	(-3.24)	0.789	0.805	(-1.09)	0.796
Respect	0.766	0.757	(0.51)	0.766	0.749	(1.19)	0.759
Possessions	0.357	0.324	(1.77)	0.334	0.329	(0.30)	0.332
N	820	2614	3434	2000	1434	3434	3434

Table D9: Sentiment towards environmental actions

	Not Aware			**Aware**		
	No Policy	Policy	T-test	No Policy	Policy	T-test
Proud	0.656	0.671	(-0.72)	0.622	0.649	(-1.02)
Happy	0.719	0.711	(0.35)	0.694	0.738	(-1.79)
Guilty	0.582	0.544	(1.71)	0.480	0.550	(-2.55)
Appreciation	0.719	0.673	(2.22)	0.696	0.701	(-0.20)
Warm	0.601	0.562	(1.79)	0.576	0.579	(-0.12)
Content	0.810	0.798	(0.69)	0.767	0.797	(-1.32)
Indignant	0.448	0.446	(0.08)	0.420	0.468	(-1.75)
Regret	0.585	0.547	(1.71)	0.534	0.617	(-3.10)
Angry	0.462	0.417	(2.03)	0.389	0.448	(-2.17)
Ashamed	0.462	0.436	(1.15)	0.426	0.410	(0.59)
Disgusted	0.401	0.391	(0.43)	0.355	0.463	(-4.03)
Positive	0.775	0.736	(2.02)	0.738	0.739	(-0.03)
N	1016	984	2000	519	915	1434

Table D10: Sentiment towards environmental actions

	Policy ever in place			**Policy aware**			
	No	Yes	T-test	No	Yes	T-test	Tot
Proud	0.652	0.653	(-0.05)	0.663	0.639	(1.43)	0.653
Happy	0.718	0.718	(0.03)	0.715	0.722	(-0.43)	0.718
Guilty	0.538	0.550	(-0.60)	0.563	0.524	(2.24)	0.547
Appreciation	0.716	0.691	(1.34)	0.696	0.699	(-0.17)	0.697
Warm	0.595	0.576	(0.98)	0.582	0.578	(0.23)	0.580
Content	0.785	0.800	(-0.90)	0.804	0.786	(1.30)	0.796
Indignant	0.439	0.451	(-0.62)	0.447	0.450	(-0.20)	0.448
Regret	0.560	0.580	(-1.00)	0.566	0.587	(-1.24)	0.575
Angry	0.451	0.429	(1.13)	0.440	0.427	(0.74)	0.434
Ashamed	0.463	0.426	(1.88)	0.449	0.416	(1.95)	0.435
Disgusted	0.359	0.423	(-3.29)	0.396	0.424	(-1.65)	0.408
Positive	0.777	0.739	(2.15)	0.755	0.738	(1.13)	0.748
N	820	2614	3434	2000	1434	3434	3434

Table D11: Feeling when pushed to act environmentally friendly

	Not Aware			**Aware**		
	No Policy	Policy	T-test	No Policy	Policy	T-test
Frustrated	0.511	0.504	(0.30)	0.536	0.532	(0.12)
Angry if const.	0.200	0.237	(-2.00)	0.241	0.209	(1.41)
Annoyed	0.331	0.350	(-0.89)	0.387	0.305	(3.19)
Dissatisfied	0.549	0.548	(0.07)	0.582	0.556	(0.94)
Hostile	0.188	0.214	(-1.48)	0.250	0.186	(2.90)
Angry if forced	0.424	0.434	(-0.44)	0.459	0.417	(1.51)
N	1016	984	2000	519	915	1434

Table D12: Feeling when pushed to act environmentally friendly

	Policy ever in place			**Policy aware**			
	No	Yes	T-test	No	Yes	T-test	Tot
Frustrated	0.512	0.520	(-0.40)	0.507	0.533	(-1.50)	0.518
Angry if const.	0.213	0.221	(-0.44)	0.218	0.220	(-0.17)	0.219
Annoyed	0.338	0.338	(0.00)	0.340	0.335	(0.32)	0.338
Dissatisfied	0.551	0.557	(-0.29)	0.548	0.566	(-0.99)	0.556
Hostile	0.215	0.201	(0.83)	0.201	0.209	(-0.59)	0.204
Angry if forced	0.438	0.428	(0.49)	0.429	0.432	(-0.20)	0.430
N	820	2614	3434	2000	1434	3434	3434

Table D13: Feeling towards environment and environmental change

	Not Aware			**Aware**		
	No Policy	Policy	T-test	No Policy	Policy	T-test
Grateful	0.847	0.830	(1.04)	0.840	0.815	(1.18)
Worried	0.780	0.741	(2.03)	0.732	0.751	(-0.78)
Awe	0.728	0.742	(-0.68)	0.755	0.774	(-0.79)
Anxious	0.536	0.516	(0.90)	0.414	0.549	(-4.93)
Sad	0.732	0.705	(1.34)	0.694	0.736	(-1.70)
Overwhelmed	0.807	0.805	(0.12)	0.852	0.760	(4.16)
N	1016	984	2000	519	915	1434

Table D14: Feeling towards environment and environmental change

	Policy ever in place			**Policy aware**			
	No	Yes	T-test	No	Yes	T-test	Tot
Grateful	0.857	0.825	(2.15)	0.839	0.824	(1.14)	0.833
Worried	0.765	0.750	(0.84)	0.760	0.744	(1.10)	0.754
Awe	0.728	0.755	(-1.54)	0.735	0.767	(-2.14)	0.748
Anxious	0.480	0.526	(-2.30)	0.526	0.500	(1.53)	0.515
Sad	0.710	0.723	(-0.72)	0.719	0.720	(-0.09)	0.720
Overwhelmed	0.843	0.787	(3.47)	0.806	0.793	(0.95)	0.801
N	820	2614	3434	2000	1434	3434	3434

Table D15: Pressure towards environmental actions

	Not Aware			**Aware**		
	No Policy	Policy	T-test	No Policy	Policy	T-test
From HH	0.527	0.471	(2.51)	0.541	0.519	(0.81)
acquait. behavior	0.446	0.449	(-0.15)	0.401	0.435	(-1.26)
From acquait.	0.376	0.357	(0.89)	0.341	0.417	(-2.86)
Obliged	0.739	0.687	(2.58)	0.732	0.689	(1.74)
From society	0.573	0.602	(-1.31)	0.557	0.612	(-2.04)
N	1016	984	2000	519	915	1434

Table D16: Pressure towards environmental actions

	Policy ever in place			**Policy aware**			
	No	Yes	T-test	No	Yes	T-test	Tot
From HH	0.516	0.509	(0.33)	0.499	0.527	(-1.63)	0.511
acquait. behavior	0.433	0.438	(-0.28)	0.448	0.423	(1.45)	0.437
From acquait.	0.341	0.387	(-2.36)	0.366	0.390	(-1.39)	0.376
Obliged	0.740	0.700	(2.21)	0.714	0.704	(0.58)	0.710
From society	0.557	0.599	(-2.12)	0.587	0.592	(-0.30)	0.589
N	820	2614	3434	2000	1434	3434	3434

Table D17: Opinions towards environmental actions

	Not Aware			**Aware**		
	No Policy	Policy	T-test	No Policy	Policy	T-test
Know how	0.785	0.742	(2.30)	0.800	0.760	(1.74)
Easy	0.425	0.409	(0.76)	0.397	0.440	(-1.60)
Can	0.709	0.717	(-0.44)	0.688	0.756	(-2.82)
Able	0.524	0.499	(1.10)	0.487	0.587	(-3.65)
Protection	0.731	0.712	(0.94)	0.690	0.748	(-2.36)
Prevention	0.644	0.623	(0.96)	0.547	0.661	(-4.30)
Saving	0.770	0.758	(0.61)	0.748	0.756	(-0.37)
N	1016	984	2000	519	915	1434

Table D18: Opinions towards environmental actions

	Policy ever in place			**Policy aware**			
	No	Yes	T-test	No	Yes	T-test	Tot
Know how	0.788	0.762	(1.52)	0.764	0.774	(-0.69)	0.768
Easy	0.430	0.417	(0.68)	0.417	0.425	(-0.45)	0.420
Can	0.709	0.725	(-0.89)	0.713	0.732	(-1.19)	0.721
Able	0.484	0.542	(-2.88)	0.511	0.551	(-2.28)	0.528
Protection	0.716	0.726	(-0.59)	0.722	0.727	(-0.30)	0.724
Prevention	0.606	0.635	(-1.48)	0.633	0.620	(0.81)	0.628
Saving	0.760	0.759	(0.02)	0.764	0.753	(0.73)	0.759
N	820	2614	3434	2000	1434	3434	3434

Table D19: Trust about energy saving information from selected subjects

	Not Aware			**Aware**		
	No Policy	Policy	T-test	No Policy	Policy	T-test
Family	0.507	0.522	(-0.69)	0.437	0.498	(-2.22)
Neighbors	0.212	0.201	(0.57)	0.168	0.198	(-1.41)
SFOE	0.650	0.618	(1.47)	0.603	0.677	(-2.81)
Local auth.	0.491	0.493	(-0.08)	0.447	0.550	(-3.76)
Local energy	0.531	0.500	(1.41)	0.503	0.538	(-1.27)
Scientists	0.558	0.556	(0.10)	0.578	0.621	(-1.59)
Consum. org.	0.529	0.514	(0.64)	0.551	0.620	(-2.55)
Envir. org.	0.509	0.471	(1.71)	0.461	0.528	(-2.46)
Experts	0.529	0.550	(-0.95)	0.543	0.567	(-0.87)
Property man.	0.163	0.146	(1.05)	0.129	0.163	(-1.72)
Clubs	0.124	0.106	(1.28)	0.087	0.154	(-3.66)
N	1016	984	2000	519	915	1434

Table D20: Trust about energy saving information from selected subjects

	Policy ever in place			**Policy aware**			
	No	Yes	T-test	No	Yes	T-test	Tot
Family	0.494	0.500	(-0.30)	0.514	0.476	(2.21)	0.499
Neighbors	0.206	0.196	(0.64)	0.206	0.187	(1.42)	0.198
SFOE	0.618	0.648	(-1.53)	0.634	0.650	(-0.96)	0.641
Local auth.	0.487	0.505	(-0.92)	0.492	0.513	(-1.19)	0.501
Local energy	0.501	0.526	(-1.22)	0.516	0.525	(-0.53)	0.520
Scientists	0.571	0.579	(-0.43)	0.557	0.605	(-2.83)	0.577
Consum. org.	0.522	0.562	(-1.99)	0.521	0.595	(-4.27)	0.552
Envir. org.	0.495	0.496	(-0.03)	0.490	0.503	(-0.78)	0.496
Experts	0.546	0.547	(-0.05)	0.539	0.559	(-1.14)	0.547
Property man.	0.160	0.151	(0.60)	0.155	0.151	(0.35)	0.153
Clubs	0.115	0.123	(-0.65)	0.115	0.130	(-1.30)	0.121
N	820	2614	3434	2000	1434	3434	3434

E Additional descriptives: Policy awareness and vehicle choices

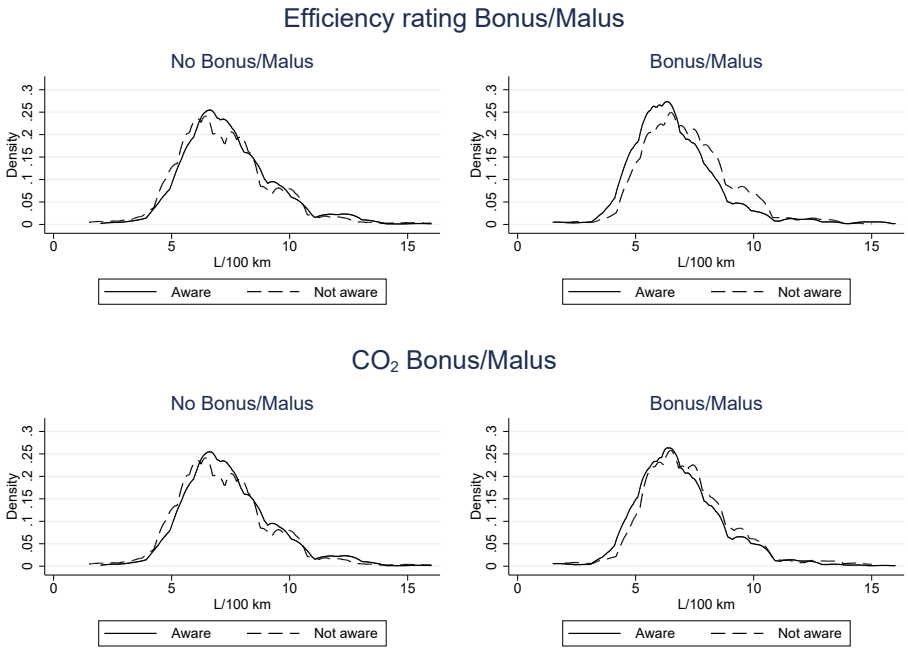


Figure E1: Policy awareness and fuel consumption distribution

Notes: The Figure compares vehicle fuel consumption 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 criteria.

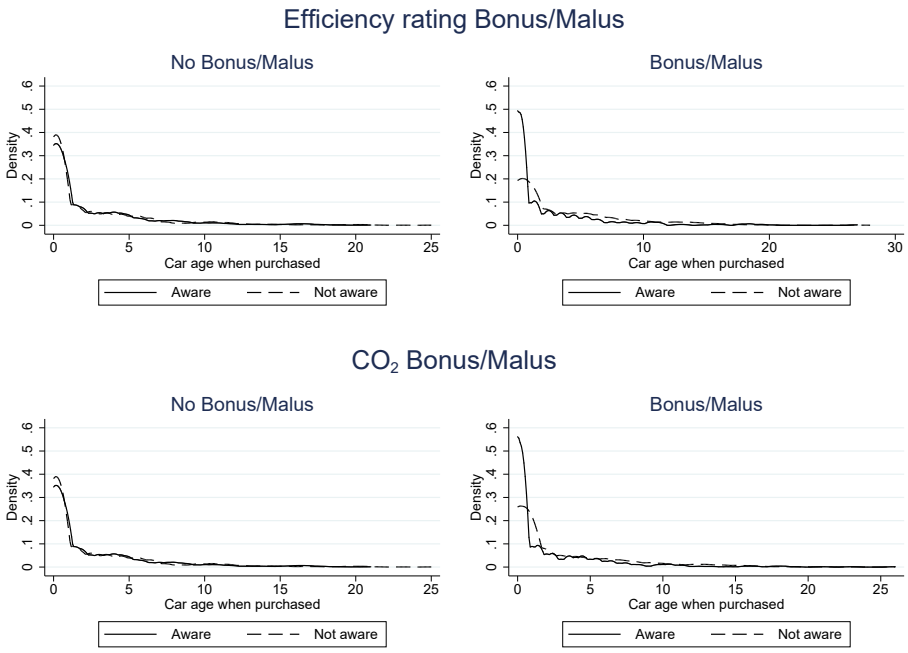


Figure E2: Vehicle age (in years) distribution

Notes: The Figure plots the distribution of the vehicles age (in years) at the time of purchase by groups defined by awareness status and presence of a Bonus/Malus incentives.

F Additional results from the quasi-experimental policy variation

In this section we discuss additional robustness analysis to the baseline empirical strategy and present the results. As mentioned in the main text, we conduct several robustness checks to our baseline DiD estimation strategy. 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 3 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.[47] 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)

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

over time. To address this possible issue, we estimate equation 3 including the interaction of the awareness dummy with year of purchase dummies.[48] 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.[49] Finally, we take into account that in the baseline analysis we classify as unaware both respondents who answered wrong and those who answered 'don't know'. Thus, in the last two columns we consider only one of these groups as unaware and we drop the other from the sample. Table F1 reports the results of these additional analysis, that largely confirm the findings of the baseline specification.

In table F2 we present results of our baseline model using three alternative dependent variables: a dummy on whether the car purchased has efficiency rating 'A', whether the car has efficiency rating 'A' or 'B', or the CO_2 emissions per 100 km (derived from fuel consumption).[50] The results show that policy awareness increases the probability of buying a high efficiency vehicle when a fiscal incentive is present, and decreases the average CO_2 emission rate of the car, in line with the results obtained with fuel consumption as dependent variable.

To interpret these DiD estimates as valid effects of policy awareness on vehicle choices, we need to show some evidence supporting the assumption that the trends in vehicle choices would have been parallel for aware individuals, with and without the Bonus/Malus system, absent its introduction. Figure F1 displays point estimates for the coefficients β_j from equation 4 and the corresponding confidence intervals. The estimated differences in vehicle choices between aware and unaware consumers in cantons that eventually introduced a Bonus/Malus system are reported relative to the pre-treatment period. The graph shows that the trend in vehicle choices of the two groups was parallel in the pre-treatment periods. It thus complements the illustrative evidence in Figure 2, further supporting the validity of the identifying common trend assumption.

To provide additional evidence in support of the validity of our findings, we conduct two falsification tests. The first consists in a series of placebo tests where we set the introduction

[48] 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.

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

[50] Because within fuel type there is a linear relationship between fuel consumption and CO_2 emissions per 100 km, we use the data from the Swiss vehicle registration database, which contains both values, to recover such relationship and apply to the fuel consumption data in the SHEDS data.

Table F1: Robustness checks

	Canton x Year FE	Year≥2010	Aware x Post	Aware x policy type	Drop wrong	Drop "Don't know"
	(1)	(2)	(3)	(4)	(5)	(6)
BMP x Aware	-0.109	-0.151	-0.130	-0.154	-0.127	-0.175
	(0.031)	(0.029)	(0.029)	(0.026)	(0.029)	(0.039)
BMP		0.061	0.061	0.069	0.045	0.079
		(0.022)	(0.021)	(0.019)	(0.025)	(0.030)
BM x Aware	0.025	0.079	0.063		0.069	0.061
	(0.038)	(0.037)	(0.033)		(0.038)	(0.041)
Aware	0.004	-0.009	-0.023	-0.010	-0.024	0.006
	(0.028)	(0.028)	(0.029)	(0.025)	(0.028)	(0.029)
N	3433	2958	3433	3433	2701	2076

Notes: Robustness checks to baseline specification. Column (1) includes canton by year of purchase fixed effects. Column (2) considers only vehicles bought from 2010. Column (3) includes the interaction between the awareness dummy and year of purchase dummies. Column (4) includes the interaction between the awareness dummy and type of Bonus/Malus dummies. Column (5) drops respondents who answered wrong to the awareness question. Column (6) drops respondents who answered 'don't know' to the awareness question. Standard errors in parenthesis, clustered at the canton by time of purchase level.

Table F2: Baseline regression with alternative dependent variables

	'A' rating	'A'+'B' rating	CO_2/100 km
	(1)	(2)	(3)
BMP x Aware	0.273	0.308	-0.100
	(0.060)	(0.072)	(0.026)
BMP	0.005	-0.027	0.061
	(0.053)	(0.058)	(0.021)
BM x Aware	-0.138	-0.127	0.055
	(0.065)	(0.079)	(0.035)
Aware	-0.030	-0.058	-0.015
	(0.044)	(0.051)	(0.026)
N	1446	1446	2983

Notes: Column (1): Dependent variable is an indicator on whether the car has efficiency rating 'A'. Column (2): Dependent variable is an indicator on whether the car has efficiency rating 'A' or 'B'. Column (3): Dependent variable are CO_2 emissions per 100 km. Standard errors in parenthesis, clustered at the canton by time of purchase level.

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. In the second placebo test, we exploit the fact that in several cantons vehicles older than 3 or 4 years are not eligible to the bonus.[51] We then run our baseline specification using only observations corresponding to vehicles that were more than 4 years old at the time of purchase.[52] As the bonus is the most relevant component of the Bonus/Malus system, finding no difference in the fuel consumption of the vehicles older than 4 years purchased by aware and unaware consumers in the presence of the policy would support the validity of our baseline strategy. Results of the falsification tests are reported in Table F3, 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 $Aware * BMP$ and BMP are statistically equal to zero in all three cases, providing additional evidence that there were no differences in the trend of vehicle choices before the introduction of the

[51] Only three cantons have no implicit or explicit limits to the eligibility to the bonus. A few other cantons have limitations correlated with the age of the car. Appendix A shows the details of the policies in each canton.

[52] We restrict the sample to treated cantons where cars older than 3 or 4 years are not eligible to receive the bonus.

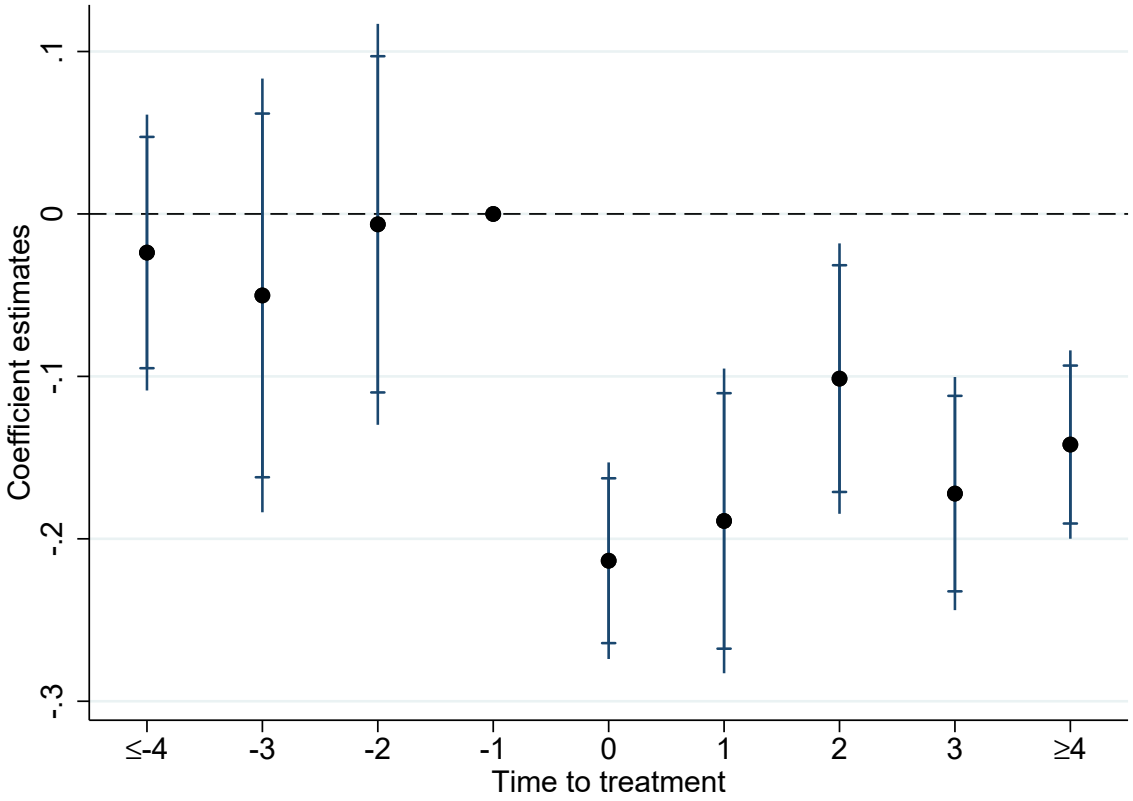


Figure F1: Parallel Trend Test

Notes: Graphical illustration of the results of the parallel trend test (equation 4). The vertical axis shows the coefficient estimates for β_j, with β_{-1} the coefficient associated to the exclude time to treatment period. The horizontal axis shows the distance in years between the purchase of the vehicle and the introduction of the Bonus/Malus, with 0 indicating the first year of treatment. 95% and 90% confidence intervals are displayed.

Bonus/Malus system. Column (5) of Table F3 shows instead the results of our baseline model when we restrict the sample only to vehicles older than four years at the time of purchase. We do not find a significant effect of policy awareness on the fuel consumption of vehicles that were not eligible to receive the fiscal incentives at the time of purchase. These results lend further support to our findings not being driven by confounding factors.[53]

Finally, table F3 reports the results of the falsification tests based on placebo Bonus/Malus starting 2, 3 or 4 years before its introduction (columns 1-3), and a falsification test in which we consider only cantons that exclude from benefiting the bonus any vehicle older than 3 or

[53]Notice that our results on the effect of policy awareness are confirmed when we estimate equation 1 excluding cantons where cars older than 3 or 4 years are not eligible to receive the bonus (see Column (4) of Table F3). A more detailed analysis on the effect of policy awareness in the context of vehicle age is presented on Table F4 and in the related paragraph.

4 years. In column (4) we show that the baseline results hold when considering only these cantons, while in column (5) we consider only vehicles older than 4 years. The falsification tests show no effect of awareness when the Bonus/Malus was not present or when the vehicles were ineligible.

Table F3: Falsification tests

	Placebo treatment			Baseline	Car age at purchase
	-2 years	-3 years	-4 years		Age>4 years
	(1)	(2)	(3)	(4)	(5)
BMP x Aware	0.046	0.023	0.057	-0.150	0.017
	(0.047)	(0.050)	(0.052)	(0.034)	(0.076)
BMP	0.019	-0.002	-0.009	0.048	-0.056
	(0.034)	(0.037)	(0.038)	(0.024)	(0.067)
BM x Aware	0.053	0.058	0.035	0.055	0.029
	(0.047)	(0.049)	(0.053)	(0.038)	(0.087)
Aware	0.002	0.002	0.002	-0.005	-0.039
	(0.027)	(0.027)	(0.027)	(0.026)	(0.064)
N	1452	1452	1452	2521	652
Controls	Yes	Yes	Yes	Yes	Yes
Purchase year FE	Yes	Yes	Yes	Yes	Yes
Canton FE	Yes	Yes	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. Column (4): Only cantons allowing a bonus to cars 4 years old at most. Column (5): Only cantons allowing a bonus to cars 4 years old at most, only vehicles more than 4 years old at the time of purchase. In Columns (1)-(3), years in which the Bonus/Malus was in place are dropped. Standard errors in parenthesis, clustered at canton by year of purchase level.

Table F4: Effect of awareness on vehicle choices: age of the vehicle at purchase vs. fuel consumption by age at purchase

	Vehicle age	Fuel consumption by car age at purchase		
	OLS	OLS		
		New	Used ($\leq$ 4yrs)	Used ($>$ 4yrs)
	(1)	(2)	(3)	(4)
BMP x Aware	-1.191	-0.127	-0.218	0.011
	(0.357)	(0.034)	(0.069)	(0.052)
BMP	0.557	0.089	0.089	-0.045
	(0.222)	(0.026)	(0.055)	(0.043)
BM x Aware	0.468	0.023	0.024	0.067
	(0.411)	(0.038)	(0.074)	(0.070)
Aware	-0.131	0.016	0.044	-0.076
	(0.281)	(0.025)	(0.051)	(0.056)
N	3355	1805	574	976
Controls	Yes	Yes	Yes	Yes
Purchase year FE	Yes	Yes	Yes	Yes
Canton FE	Yes	Yes	Yes	Yes

Notes: Column (1): Baseline DID specification, vehicle age in years at time of purchase as dependent variable; Column (2): Baseline DID specification, only vehicles purchased new; Column (3): Baseline DID specification, only vehicles purchased when 1-4 years old; Column (4): Baseline DID specification, only vehicles purchased when older than 4 years. Standard errors in parenthesis, clustered at canton by year of purchase level.

Table F5: Heterogeneity in the effect of awareness

	Panel A: Demographics					
	Gender		Age		Income	
	Male	Female	≤ 45	>45	$\leq$ 9000 CHF	> 9000 CHF
	(1)	(2)	(3)	(4)	(5)	(6)
BMP x Aware	-0.153	-0.141	-0.151	-0.117	-0.131	-0.146
	(0.036)	(0.059)	(0.057)	(0.034)	(0.042)	(0.047)
N	1838	1595	1627	1806	1948	1485

	Panel B: Other characteristics					
	Investment literacy		Understands energy rating		Trusts environmental groups	
	No	Yes	No	Yes	No	Yes
	(1)	(2)	(3)	(4)	(5)	(6)
BMP x Aware	-0.066	-0.168	-0.122	-0.168	-0.071	-0.236
	(0.067)	(0.031)	(0.039)	(0.040)	(0.041)	(0.042)
N	1216	2217	1704	1729	1732	1701

Notes: Results disaggregating the effect of awareness by selected respondents' characteristics. Dependent variable is the log of vehicle fuel consumption per 100 km.
Standard errors in parenthesis, clustered at canton by year of purchase level.

G Propensity score matching results

The aim of this procedure is to construct comparison groups that reproduce as closely 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).

We perform a regression version of the propensity score matching DiD 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 probability that an individual lives in areas with a Bonus/Malus system and for the probability that an individual is aware of the presence of the fiscal incentives. We estimate the propensity score using Probit models that use a large number of respondents' and cantons' characteristics and then perform a kernel matching.[54] In a second step, we run regression 3 applying the kernel-based weights and restricting the estimation sample to the common support defined by the propensity score.

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 DiD 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, proxies for environmental values and attitudes and characteristics of the living area (urban/rural and population size of the municipality).

Table G1 reports selected estimated coefficients from the estimation of the propensity score matching.

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 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 4.2. 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

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

of investment literacy and have a lower probability to be German speakers. The propensity score matching procedure based on the Bonus/Malus treatment status identifies 185 individuals in the treatment group that are not comparable in terms of observable characteristics to those in the control group. 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 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.[55] For this reason we focus on the results obtained when correcting for compositional differences between treated and control cantons.[56]

Table G2 reports the results of the propensity score DiD strategy for the effect of awareness on fuel consumption, when the matching is conducted on the probability to be aware and the probability of the presence of the Bonus/Malus.

[55]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.

[56]Results obtained performing the matching for awareness status are reported in Table G2.

Table G1: First stage, Bonus/Malus treatment and awareness status, selected Probit coefficients

	Only policy	Whole sample	
	Policy Awareness (1)	Bonus/Malus system (2)	Policy Awareness (3)
Age	0.062	0.008	0.029
	(0.019)	(0.013)	(0.013)
Age^2	-0.001	-0.000	-0.000
	(0.000)	(0.000)	(0.000)
Female	-0.274	0.022	-0.218
	(0.083)	(0.058)	(0.057)
Job: Employee	0.366	0.101	0.155
	(0.083)	(0.098)	(0.070)
Job: Self-Employed	0.739	0.053	0.361
	(0.141)	(0.153)	(0.104)
Job:Retired	0.741	-0.005	0.343
	(0.177)	(0.139)	(0.129)
Income: <6000 CHF	-0.008	0.004	-0.042
	(0.100)	(0.082)	(0.072)
Income: 6000-9000	-0.082	0.087	-0.025
	(0.079)	(0.063)	(0.056)
Language: German	-0.176	-1.231	-0.041
	(0.160)	(0.190)	(0.118)
Area: City	0.048	0.440	-0.030
	(0.087)	(0.099)	(0.064)
Area: Agglomeration	0.088	0.094	0.022
	(0.084)	(0.096)	(0.066)
Investment literacy	0.066	-0.116	0.096
	(0.071)	(0.060)	(0.051)
N	1899	3433	3433

Notes: The Table reports selected coefficients estimated from Probit models. Dependent variable in Columns (1) and (3) is a dummy that indicates whether the respondent is aware of the presence of the policy. Dependent variable in Column (2) is a dummy that indicates whether a respondent lives in a canton that has introduced a Bonus/Malus scheme. Regressions also control for respondent's wave, education, household size, indicators for energy literacy, preferences towards the environment, life attitudes and values. Standard errors in parenthesis, clustered at the canton by time of purchase level.

Table G2: Second stage, propensity score matching

	Only policy		Baseline DID		
	OLS	Awareness matching	OLS	Awareness matching	Policy matching
	(1)	(2)	(3)	(4)	(5)
BMP x Aware			-0.141	-0.137	-0.162
			(0.027)	(0.028)	(0.031)
BMP			0.066	0.048	0.062
			(0.019)	(0.022)	(0.023)
BM x Aware			0.072	0.060	0.138
			(0.033)	(0.034)	(0.044)
Aware	-0.083	-0.071	-0.010	0.004	-0.048
	(0.016)	(0.016)	(0.025)	(0.025)	(0.035)
N	1899	1898	3433	3431	3222

Notes: Results of the propensity score matching on awareness status. Column (1): OLS specification, only cantons and years of purchase when the Bonus/Malus was in place. Column (2): Propensity score matching, only cantons and years of purchase when the Bonus/Malus was in place. Column (3): Baseline specification. Column (4): Propensity score matching on awareness. Column (5): Propensity score matching on Bonus/Malus. Standard errors in parenthesis, clustered at the canton by time of purchase level.

H Instrumental variable approach

In this section, we provide more details on the instrumental variable (IV) approach outlined in Section 4.6 in the main text.

The IV-DiD approach 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 DiD 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 implement such incentives only through individuals' awareness, conditional on the set of controls.

We use three instruments for policy awareness: (i) the distance in years from the introduction of the incentives in a specific canton; (ii) the voting participation rates to the seven national referendum days held in Switzerland between 2016 and 2017 at the municipality of respondents' residence level, interacted by canton of residence dummies;[57] (iii) the intensity in the diffusion of information about the Bonus/Malus system through the local newspapers.

Distance in years between the introduction of the policy and the purchase of the car 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 of 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.

Voter turnout At the municipality level, higher voter turnout might be related to higher individual policy awareness through the presence of higher social capital.[58] We assume

[57] Because in our DiD 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 indicator for the presence of the Bonus/Malus system BMP with (i) and (ii). Allowing for canton-specific participation rate effects is important because Switzerland is a federal State with different political systems and institutional characteristics in each canton, as described in Section 3.1.

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

that within-canton variation in voter turnout influences the evolution of individuals' vehicle choices over time only through their policy awareness, conditional on the large set of controls.[59] To assess the validity of this exclusion restriction, we then need to ask what are the factors influencing voter turnout at the local level. The bulk of the political behavior literature (see, e.g., Stockemer 2017 for a review) has shown that electoral participation depends on factors related to the institutional setting such as the presence of permissive institutions (e.g. proportional representation), decisiveness of the elections and population size. While we control for population size, this discussion seems then to suggest voter turnout is uncorrelated with the fuel economy of the vehicles purchased at the municipality level. To be clear, the validity of voter turnout at the local level as an instrument for awareness relies on two things: (i) it proxies social capital at the municipality level rather than at the individual level and (ii) any unobserved time-invariant factors at the local level that might influence both social capital and vehicle choices are taken care of by the DiD approach as long as the effect is the same between cantons with and without the policy.

However, from points (i) and (ii) follows that we still need to assume that voter turnout does not influence vehicle choices at the local level directly (e.g., through cultural preferences towards the local affairs and the environment at the community level), in a different way between treated and control cantons.[60] To lend support to this assumption, we test for the presence of a relation between voter turnout and the average fuel consumption at the municipality level for the population of vehicles purchased in Switzerland. Failing to reject the null of no correlation would provide supporting evidence that our IV-DiD estimation strategy yields unbiased estimates for the effect of policy awareness on vehicle choices.

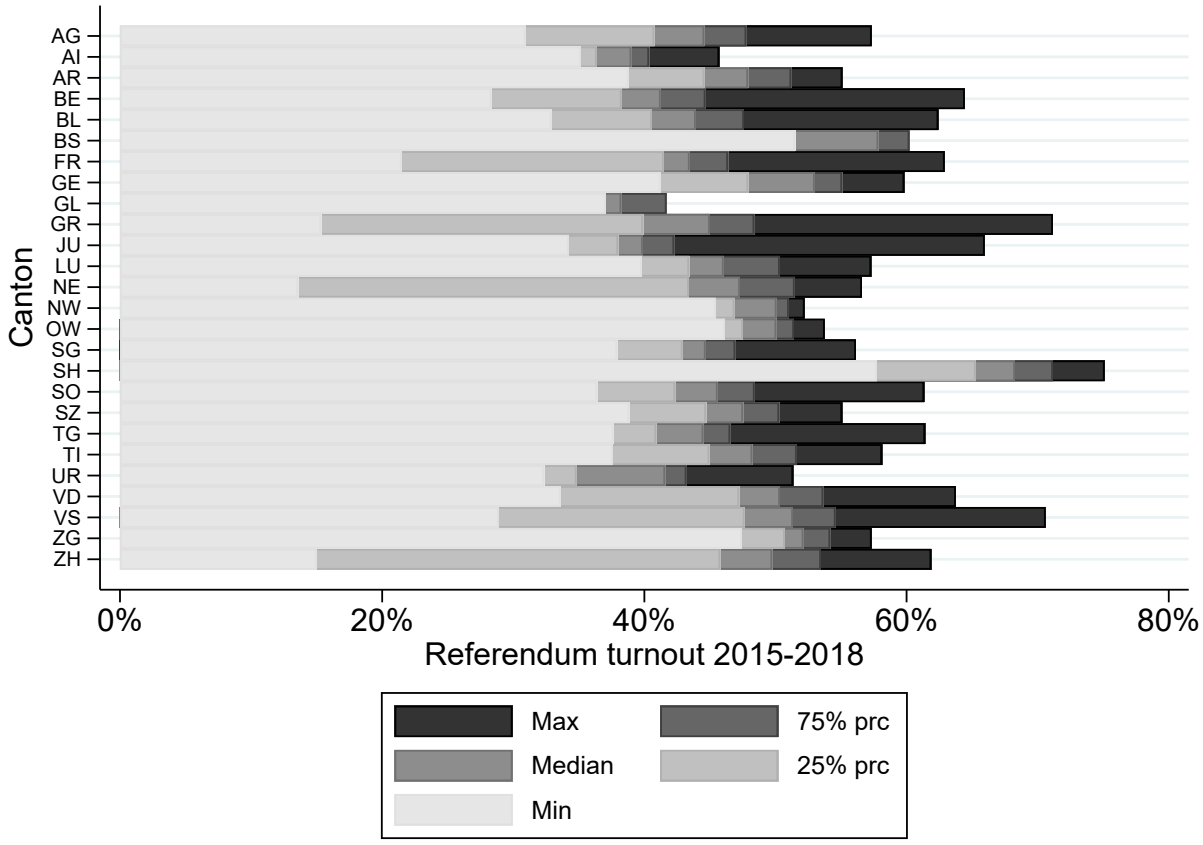
Figure G1 shows the large extent of within-canton variation in voter turnout for the seven referendum dates in the years 2015-2018 that we exploit to instrument policy awareness.

As discussed in section 4.6, we argue that with-canton variation in voter turnout at the municipality level influences vehicle choices only through individual policy awareness, conditional on our large set of controls. Figure H1 provides some support for the validity of our exclusion restriction, by showing no relation between the average voter turnout in the years 2015-2018 and the average vehicles fuel consumption at the municipality level using

[59] As stated above, the identifying assumption is slightly stricter when we adopt the IV-DiDstrategy to compare vehicle choices of aware and unaware respondents in treated cantons after the introduction of the fiscal incentives since we cannot get rid of time-invariant differences between aware and unaware respondents: our assumption is that within-canton variation in voting participation influences vehicle choices only through individuals' awareness.

[60] This would be problematic because an individual's vehicle choices might be influenced by the average choices of her neighbours (especially in small municipalities) through for instance the effect of social norms or stigma.

Figure G1: Municipal within-canton variation in voter turnout in referenda



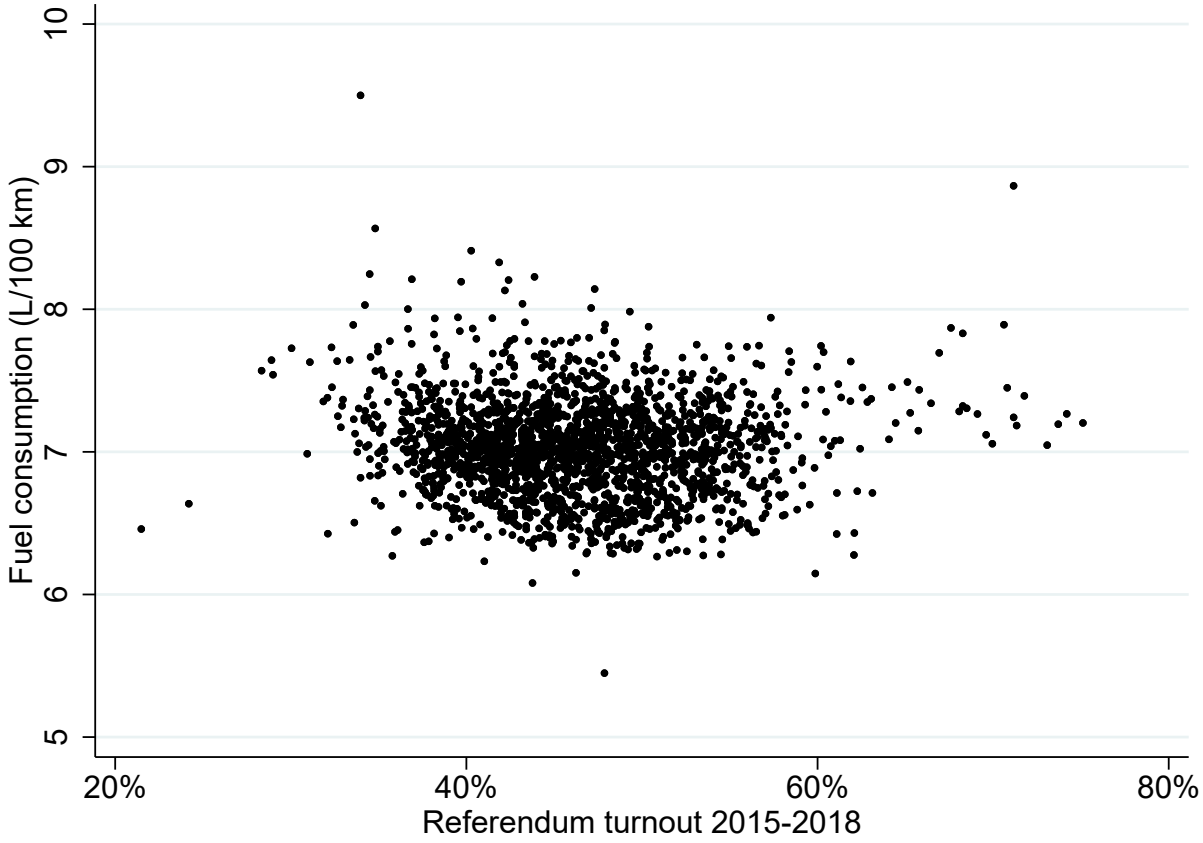
the population of Swiss vehicles.[61]

Referendum turnout in 2015-2018 is one of the sets of instrumental variables we rely upon for our analysis of the effect of policy awareness. In this section we present some statistics about turnout data in the different Swiss municipality and their relationship to the respective average vehicle fuel economy.

Another important assumption for the validity of our instrument is that voter turnout in referenda is uncorrelated with vehicle fuel consumption - except than through our independent variables. Here we present some illustrative evidence supporting this assumption. We use Swiss vehicle registration data from October 2016 to plot the relationship between average voter turnout and average vehicle fuel economy for each municipality (Figure H1). There is no clear relationship between the two variables. This is confirmed also by the correlation coefficient (-0.0503), and by regressing average fuel economy with voter turnout and cantonal dummies (turnout coefficient estimate -0.00021, p-value 0.886).

[61] We use Swiss vehicle registration data from October 2016.

Figure H1: Relationship between municipal referendum turnout and average vehicle fuel economy



Policy-related information in local media This third instrument we use relies on the temporal variation in the presence of Bonus/Malus system-related information in several Swiss newspapers, the heterogeneous coverage of these newspapers in the respondents' canton of residence, and the number of newspaper stands in the individuals' municipality of residence. The idea is to leverage the variation across municipalities (through the information on the number of newspaper stands) and over time (through the time-varying number of times vehicle-tax related information is mentioned in the local newspapers) to isolate an exogenous component of specific policy awareness. In particular, the instrument is constructed as follows. First, for each newspaper distributed in Switzerland and available on the online database Nexis, we collected data on the number of times selected keywords were mentioned. These keywords, in french and german (e.g., "l'impôt sur les véhicules" and "Motorfahrzeugsteuer"), were chosen because they are used in the different cantonal vehicle tax legislation. These data were collected for 19 local Swiss newspapers, for each year starting from 1997.

The instrument is then obtained multiplying the number of keywords mentioned by a given newspaper in a given year by the number of copies sold by that newspaper in 2013 and the number of newspaper stands in the respondent's municipality of residence normalized by the municipality's population.[62]

It is important to stress that, even though this instrument exploits both temporal and spatial variation in the distribution of vehicle tax-related information through the local media, we need to be cautious in interpreting the resulting IV-DiD estimates due to some caveats. First, we still need to assume that any variation in this instrument affects vehicle choices only through its effect on individuals' awareness. A violation of this exclusion restriction would come from unobserved heterogeneity in human capital (beyond educational attainment) across municipalities affecting both the number of newspaper stands and the vehicle choices of their residents.

H.1 IV-DiD results

Columns (2) and (3) of Table H1 report the IV-DiD estimates of equation 3, obtained using instruments (i) and (ii), and (i) and (iii), respectively, for $Aware$ (and its interaction with the policy variables $Aware*BMP$ and $Aware*BM$). Notice that we cannot use instrument (i) alone as this is not defined for individuals living in cantons that have not introduced the Bonus/Malus system. The results of the first stage regressions for policy awareness lead us to reject the null of weak instruments at the 1 percent confidence level, with both sets of instruments.[63]

Using the first set of instruments (results in Column 2), 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 around 25.8 percent less than unaware individuals living in those cantons. The IV-DiD estimate increases to -0.523 using the second set of instruments (Column 3). These IV-DiD estimates for the impact of policy awareness are substantially larger (though just statistically different) than the DID OLS estimate, confirming the issue of attenuation bias in the OLS estimate for the effect of policy awareness. A possible explanation for this finding is that a lower fuel consumption of the vehicle purchased increases the probability to become policy aware. As discussed in Section 4.6, this may occur in case an individual's memory about the vehicle registration tax incentives at the time of purchase of the vehicle intervenes in a nonrandom way. Further, standard measurement error in policy

[62]The data about the number of copies sold by the newspapers are taken from Meier (2014). The number of newspaper stands by municipality has been obtained using the online tool in: https://www.kkiosk.ch/de/allover/standortsuche/.

[63]Because we have multiple endogenous variables, we use the test of Sanderson-Windmeijer. As shown in Table H1, the p-value of the Sanderson-Windmeijer F-test of excluded instruments is (0.0000).

awareness could also explain the bias towards zero of the OLS estimates.

Table H1: Effect of policy awareness: OLS-DiD, IV-DiD

		DiD	
	OLS	IV (Referendum)	IV (Newspapers)
	(1)	(2)	(3)
BMP x Aware	-0.141***	-0.336***	-0.247**
	(0.027)	(0.119)	(0.103)
BMP	0.066***	0.124***	0.118***
	(0.019)	(0.039)	(0.034)
BM x Aware	0.072**	0.487***	0.450
	(0.033)	(0.134)	(0.315)
Aware	-0.010	-0.194*	-0.335
	(0.025)	(0.102)	(0.307)
N	3433	3421	2311
p-value F-test first stage			
BMP x Aware		0.000	0.000
BM x Aware		0.000	0.000
Aware		0.000	0.020
Controls	Yes	Yes	Yes
Purchase year FE	Yes	Yes	Yes
Canton FE	Yes	Yes	Yes

Notes: Dependent variable is the log of vehicle fuel consumption per 100 km; Column (1): Baseline DiD specification; Column (2): Estimate for the effect of awareness from the combination of DiD and IV-DiD strategy using the referendum instrument, instrumenting awareness and its interactions with the policy variables; Column (3): Estimate for the effect of awareness from the combination of DiD and IV-DiD strategy using the referendum instrument, instrumenting awareness and its interactions with the policy variables;
Standard errors in parenthesis, clustered at canton by year of purchase level. The p-values reported in columns (2) and (3) are from the Sanderson-Windmeijer weak instrument F-test.

I Additional material experiment

cepe
Centre for Energy Policy and Economics
Swiss Federal Institutes of Technology

intervista

Email subject:

DO YOU KNOW WHETHER IN YOUR CANTON THERE ARE FISCAL INCENTIVES FOR ENERGY EFFICIENT VEHICLES?

Dear «Name» «Surname»,

You took part in a scientific study conducted by intervista in the last years. In this e-mail we would like to give you some information related to this study.

A recent research study conducted by CEPE at ETH Zürich has shown that only 42% of the Swiss population is aware about the presence of fiscal incentives for the purchase of energy efficient vehicles.

To help you take an informed decision, as a member of the intervista panel, we would like to inform you about the presence of fiscal incentives for energy efficient diesel and gasoline vehicles in your canton of residence in September 2019. These fiscal incentives allow to save money on the annual vehicle registration tax.

In the following table we indicate for each canton in Switzerland whether the annual registration tax depends (✓) or does not depend (✗) on CO_2 emissions (g/km), on fuel efficiency rating (from the energy label), or both.

Canton	***Annual vehicle registration tax based on CO2 emissions and/or fuel efficiency***
Aargau	✗
Appenzell Innerrhoden	✗
Appenzell Ausserrhoden	✗
Bern	✓
Basel-Landschaft	✓
Basel-Stadt	✓
Fribourg	✓
Genève	✓
Glarus	✓
Graubünden	✓

Jura	✗
Luzern	✗
Neuchâtel	✓
Nidwalden	✓
Obwalden	✓
Schaffhausen	✗
Schwyz	✗
Solothurn	✗
St. Gallen	✓
Thurgau	✓
Ticino	✓
Uri	✗
Valais	✗
Vaud	✓
Zug	✗
Zürich	✓

This initiative is organized in cooperation with researchers at CEPE-ETH Zürich. If you have any questions about this study, feel free to contact us at **cepe_auto@ethz.ch**[1].

Best Regards

CEPE-ETH Zürich Team and your intervista Team

[1] Contacting the researchers directly would likely expose your identity to those conducting the study. For any questions related to your selection and participation in this panel, please **write an email to contact@intervista.ch**

J Additional experimental results

Table J1: Attrition analysis

	(1)	(2)
Treat	-0.002	
	(0.010)	
Treat x Age		-0.000
		(0.000)
Treat x Female		0.004
		(0.019)
Treat x Educ:HS or more		0.003
		(0.020)
Treat x HH size		0.003
		(0.007)
Controls	Yes	Yes
N	9141	9141

Notes: The Table reports results for the linear probability model of the probability to take part in the SHEDS survey. The dependent variable is a dummy indicating whether the individual participated to either the 2020 or the 2021 wave of the survey. The sample includes individuals in our experimental sample, i.e., participating in at least one wave of the SHEDS survey between 2016 and 2019. Controls include: individual's age, indicator for female respondent, indicator for high education, and high household size.

Table J2: Selected household characteristics in the sample and in the national statistics.

	Sample	Population
Share female	0.4857	0.507
Average age over 18	48.49	49.77
Share university degree holders	0.477	0.210
Average household size	2.33	2.21

Notes: Sources census data (1) Gender: Demographic balance, status 1.1.2019, calculated average age for all people over 18 years, (2) Age: Demographic balance, status 1.1.2019, calculated average age for all people over 18 years, (3) Share degree holders: Federal Statistical Office, Formation achevée la plus élevée en Suisse (2019) (4) Household size: Federal Statistical Office, Private households by canton and household size (2019)

Table J3: LPM for the probability to be treated

	(1)	(2)
Age	0.000	0.001
	(0.000)	(0.002)
Female	0.005	0.031
	(0.015)	(0.059)
Educ.: high school or more	0.015	-0.078
	(0.016)	(0.062)
Language: DE	0.024	-0.111*
	(0.017)	(0.065)
HH size	0.005	-0.008
	(0.006)	(0.022)
Bonus/Malus: Yes	0.015	-0.048
	(0.017)	(0.067)
N	4599	303
F-test joint significance	0.72	0.92
(*p-value*)	0.634	0.483

Notes: Linear probability model for treatment assignment. The dependent variable is a dummy variable for the treatment assignment. The sample in column 1 includes the whole 2020 and 2021 follow-up survey sample. The sample in column 2 includes the sample of those purchasing a vehicle and reporting its fuel consumption between November 2019 and December 2020.

Table J4: Experimental sample details

	No policy	Policy	**Total**
Control	40	113	153
Treatment	42	108	150
Total	82	221	303

Notes: Breakdown of the experimental sample used in the analysis. The sample includes respondents assigned to either the control or the treatment group who participated to the 2020 and/or 2021 wave of SHEDS and who bought a car between November 2019 and December 2020.

Table J5: Experimental results: probability of car purchase

Panel A: Linear probability model			
	(1)	(2)	(3)
BM x Treatment			-0.002
			(0.019)
Treatment	-0.007	-0.007	-0.005
	(0.008)	(0.008)	(0.017)
BM		-0.013	-0.012
		(0.010)	(0.014)
N	4475	4470	4470
Controls	No	Yes	Yes

Panel B: Probit marginal effects			
	(1)	(2)	(3)
BM x Treatment			-0.003
			(0.018)
Treatment	-0.007	-0.007	-0.004
	(0.007)	(0.008)	(0.015)
BM		-0.012	-0.011
		(0.009)	(0.013)
N	4470	4470	4470
Controls	No	Yes	Yes

Notes: Effect of the information treatment on the probability of purchasing a vehicle. The dependent variable is a dummy on whether the respondent bought a car between November 2019 and December 2020. Panel A: Estimates using a linear probability model. Panel B: Marginal effects of a probit model. Robust standard errors in parenthesis.

Table J6: Summary statistics for sample respondents who replaced their vehicle (Nov 2019-Dec 2020)

	Control	Treatment	T-test
Age	46.961	48.040	(-0.66)
Female	0.386	0.420	(-0.61)
HH size	2.569	2.487	(0.54)
Educ.: high school or more	0.667	0.600	(1.20)
Bonus/Malus: Yes	0.739	0.720	(0.36)
N	153	150	303

Notes: Summary statistics and tests of equality of means for selected controls. The first two columns shows the sample averages for the control and the treatment group respectively. The third column shows the t-statistics for the T-test of equality of means.

Table J7: LPM for unreported fuel consumption

	(1)	(2)	(3)
BM x Treatment			0.022
			(0.070)
Treatment	0.013	0.012	-0.003
	(0.027)	(0.026)	(0.064)
BM		-0.082	-0.093
		(0.038)	(0.043)
N	338	338	338
Controls	No	Yes	Yes

Notes: Linear probability model for the effect of the information treatment on the probability of reporting the fuel consumption of the vehicle. The dependent variable is a dummy on whether a respondent did not report the fuel consumption of the vehicle. The sample size includes individuals who purchased a new vehicle between November 2019 and December 2020. Battery electric and other alternative fuel vehicles are not included in the sample.

Table J8: Probit marginal effects of the treatment effect on awareness

	Only with policy				Full sample			
	Whole effect		Effect by year		Whole effect		Effect by year	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
BM x Treat					-0.196	-0.208		
					(0.129)	(0.127)		
Treat	0.137**	0.134**			0.327***	0.337***		
	(0.064)	(0.064)			(0.109)	(0.107)		
BM x Treat 2019							-0.050	-0.065
							(0.235)	(0.233)
Treat 2019			0.404***	0.411***			0.466**	0.480**
			(0.153)	(0.150)			(0.206)	(0.206)
BM x Treat 2020							-0.225*	-0.234*
							(0.132)	(0.130)
Treat 2020			0.086	0.079			0.298***	0.304***
			(0.072)	(0.072)			(0.114)	(0.112)
BM					0.245**	0.238**	0.249***	0.242***
					(0.095)	(0.094)	(0.093)	(0.092)
N	221	221	221	221	303	303	303	303
Controls	No	Yes	No	Yes	No	Yes	No	Yes
Mean dep. var. (control)	0.3894				0.3333			

Notes: Probit marginal effects of the treatment effect on awareness only using sample in cantons with Bonus/Malus (columns 1-4) or using the full sample (columns 5-8). Dependent variable is 1 if individual is policy aware. Treatment effect is split by year in columns 3-4 and 7-8. Robust standard errors in parenthesis.

Table J9: Intention to treat effect on fuel consumption

	Only with policy		Full sample	
	(1)	(2)	(3)	(4)
Treat	-0.099**	-0.101*	0.115	0.107
	(0.050)	(0.051)	(0.099)	(0.103)
BM x Treat			-0.214*	-0.206*
			(0.111)	(0.114)
BM			0.142	0.141
			(0.089)	(0.092)
N	221	221	303	303
Controls	No	Yes	No	Yes

Notes: Intention to treat effect of the information letter on fuel consumption. The dependent variable is the log of vehicle fuel consumption. The sample includes respondents who bought a car between November 2019 and December 20202. Columns 1-2 use only respondents living in cantons with a Bonus/Malus policy; Columns 3-4 use the full sample. Robust standard errors in parenthesis.

Table J10: Treatment effect of information treatment on environmental attitudes

	Panel A: Whole sample				
	(1)	(2)	(3)	(4)	(5)
Treat	0.020	0.028	0.021	-0.018	0.012
	(0.020)	(0.030)	(0.031)	(0.031)	(0.040)
N	4598	4599	4599	4599	4599
Controls	Yes	Yes	Yes	Yes	Yes
	Panel B: Car buyers				
	(1)	(2)	(3)	(4)	(5)
Treat	0.067	0.016	0.032	0.036	0.200
	(0.075)	(0.111)	(0.111)	(0.110)	(0.143)
N	369	369	369	369	369
Controls	Yes	Yes	Yes	Yes	Yes

Notes: Treatment effect of the information treatment on various measures of environmental values and planned behavior. Panel A shows the results using the whole set of respondents in SHEDS waves 2020 and 2021. Panel B shows the results using respondents who bought a car between November 2019 and December 2020. The dependent variables are: (1) Importance to have access to a clean environment; (2) Plans on reducing electricity consumption; (3) Plans on reducing heating consumption; (4) Plans on reducing carbon footprint; (5) Plans on reducing number of airplane flights. The dependent variables are represented as a score from 1 to 5, where a high score represents pro-environment attitudes. Robust standard errors in parenthesis.

Table J11: LATE-IV estimates, unique treatment variable

	Only with policy		Full sample	
	(1)	(2)	(3)	(4)
BM x Aware			-1.099*	-0.773
			(0.616)	(0.535)
Aware	-0.719	-0.746	0.380	0.193
	(0.507)	(0.525)	(0.350)	(0.317)
BM			0.489*	0.360
			(0.272)	(0.240)
N	221	221	303	303
Controls	No	Yes	No	Yes
Aware + BM x Aware			-0.719	-0.605*
			(0.507)	(0.335)
p-value F-test (Aware)	0.039	0.168	0.002	0.003
p-value F-test (BM x Aware)			0.000	0.031

Notes: The Table reports the IV-LATE of awareness on the log of vehicle fuel consumption per 100 km obtained using random treatment assignment as instrument for awareness. The first stage probit uses a unique treatment variable i.e. not differentiated by year of vehicle purchase. Results obtained using only the sample of individuals in cantons with Bonus/Malus (columns 1-2) or using the full sample (columns 3-4). The linear test of the sum of the coefficients on *Aware* and *BMxAware*, and the p-value of the F-test / Sanderson-Windmeijer test for weak instrument, are also reported. Robust standard errors in parenthesis.

Table J12: Probit first stage LATE-IV, treatment variable by year

	Only with policy		Full sample	
	(1)	(2)	(3)	(4)
Treat 2019	1.052**	1.079***	1.108***	1.124***
	(0.416)	(0.412)	(0.355)	(0.355)
Treat 2020	0.224	0.207	0.359**	0.358**
	(0.190)	(0.191)	(0.163)	(0.164)
BM			0.376**	0.344**
			(0.168)	(0.170)
N	221	221	303	303
Controls	No	Yes	No	Yes

Notes: Probit estimates of the first stage of the LATE-IV, using a treatment variable differentiated by year of vehicle purchase. The dependent variable is the policy awareness indicator. Robust standard errors in parenthesis.

Table J13: Probit first stage LATE, homogeneous treatment

	Only with policy		Full sample	
	(1)	(2)	(3)	(4)
Treat	0.351**	0.344**	0.479***	0.483***
	(0.170)	(0.171)	(0.147)	(0.148)
BM			0.361**	0.329*
			(0.167)	(0.168)
N	221	221	303	303
Controls	No	Yes	No	Yes

Notes: Probit estimates of the first stage of the LATE-IV, using a unique treatment variable i.e. not differentiated by year of vehicle purchase. The dependent variable is the policy awareness indicator. Robust standard errors in parenthesis.