

# The impact of policy awareness: Evidence from vehicle registration taxes in Switzerland

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# Why do (some) policies fail?

- Some fiscal policies/incentives targeted at individuals perform poorly
- Why?
  - Bad design/insufficient incentives
  - Behavioral explanations: bounded rationality, ability to understand the information...
  - **Lack of awareness:** people are not informed about the existence of the policy

- **What is the importance of policy awareness for the effectiveness of fiscal policies?**
- Our case: Monetary incentives for energy efficient cars in Switzerland
  - Discount/penalty on vehicle registration tax
  - Not cost-effective according to previous literature (Alberini and Bareit 2017)
  - But: **only 42%** of Swiss drivers are correctly informed!
  - What is it then?
    - ① People aware of incentive policy, but not willing/able to change behavior
    - ② People not aware about incentive policy, but would change behavior if were aware
- Main goal: estimate causal effect of policy awareness on vehicle fuel economy with econometric methods

# Vehicle registration tax in Switzerland

- Paid every year a car is owned
- Rate set up by independent administrative units (cantons)
  - Based on: weight, engine size, and/or power
- Some cantons ( "treated" ) have an additional Bonus/Malus (discount/penalty) based on fuel efficiency or CO<sub>2</sub>, applied automatically
  - No Bonus/Malus: 11 cantons
  - Bonus/Malus based on energy efficiency rating: 6 cantons
  - Bonus/Malus based on CO<sub>2</sub> emissions: 6 cantons
  - Bonus/Malus based on both: 3 cantons
- Introduced in different years (2009-2014)
- Many cantons have only Bonus, no canton has only Malus
- Discounts from 40% to 100% for 3-4 years after first purchase
- Average vehicle incentive per year: 209 CHF (25% of average fuel cost)

- Swiss Household Energy Demand Survey (SHEDS), years 2018-2019 (2020-2021 for RCT)
- Comprehensive questions on baseline characteristics, environmental attitudes, vehicle characteristics, and more
- Most respondents (92%) provided fuel consumption information
- About 5000 people interviewed each year
- Other important information: year of purchase, canton of residence
- Main variable of interest: fuel consumption per 100km

- Question on policy awareness:
  - *"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<sub>2</sub> emissions of the cars?"*
  - Possible answers: 1) Yes, it depended on the fuel efficiency or on CO<sub>2</sub> emissions 2) No, it did not depend on the fuel efficiency or on CO<sub>2</sub> emissions 3) I do not know
- Policy aware respondents (**41.80%**):
  - Answers **Yes** if car bought in canton **with** Bonus/Malus in place, OR
  - Answers **No** if car bought in canton **without** Bonus/Malus in place
- All other cases: not policy aware

- Goal: measure the effect of awareness of Bonus/Malus on vehicle choice (fuel consumption)
- Problem: awareness is likely endogenous
- ① Observational evidence
  - Difference in difference model
  - Compare vehicle choice in cantons with and without B/M...
  - ...and aware and unaware respondents within canton
  - Robustness checks, IV
- ② RCT evidence (**main focus of presentation**)
  - Influence ourselves degree of policy awareness
  - Send letter to random sample about presence of B/M
  - Observe choice of vehicle after treatment start
  - Use treatment to instrument for awareness

- In October 2019 we sent a letter to half of our survey sample, randomly selected
- Letter has simple information table on whether the registration tax depends on CO<sub>2</sub> or energy label in all cantons of Switzerland (yes/no)
- Emphasis on potential savings, no environmental nudge (see later for evidence)
- We observe choice of vehicle occurred in 2019-2020 after treatment start (about 300 individuals)
- Use treatment as instrument for awareness



# Treatment effect on awareness

Using only cantons with Bonus/Malus policy

$$y_{ic} = \alpha + \beta Treat_i + \delta X_i + \epsilon_{ic} \quad (1)$$

Using cantons with and without Bonus/Malus policy

$$y_{ic} = \alpha + \beta Treat_i + \gamma Treat_i * BM_c + \theta BM_c + \delta X_i + \epsilon_{ic} \quad (2)$$

- $y_{ic}$  = awareness indicator for individual  $i$  in canton  $c$
- $Treat_i$  = letter treatment dummy
- $BM_c$  = Bonus/Malus presence dummy
- $X_i$  = socioeconomic characteristics (incl. year of vehicle purchase)

# Treatment effect on awareness (only cantons with B/M)

	<i>Only with policy</i>			
	Whole effect		Effect by year	
	(1)	(2)	(3)	(4)
BM x Treat				
Treat	0.138** (0.067)	0.135** (0.067)		
Treat 2019			0.394*** (0.140)	0.398*** (0.138)
Treat 2020			0.088 (0.075)	0.082 (0.076)
Controls	No	Yes	No	Yes
N	221	221	221	221

## LATE-IV estimation of awareness

Using only cantons with Bonus/Malus policy

$$y_{ic} = \alpha + \beta \text{Aware}_i + \delta X_i + \epsilon_{ic} \quad (3)$$

Using cantons with and without Bonus/Malus policy

$$y_{ic} = \alpha + \beta \text{Aware}_i + \gamma \text{Aware}_i * BM_c + \theta BM_c + \delta X_i + \epsilon_{ic} \quad (4)$$

- Dependent variable: log of fuel economy of newly purchased car
- Endogenous variable (awareness) is a dichotomous variable
  - Get fitted values under a probit using treatment dummy and controls
  - Use fitted values as instruments, see Angrist and Pischke (2008)
- Treatment is also split in year 2019 and year 2020 (stronger instruments)

# LATE-IV of awareness on fuel consumption

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

# Treatment effect on environmental attitudes

Score from 1 to 5 (high score = high pro-environment attitude)

	clean env.	↓ elec.	↓ heat.	↓ carb.	↓ flights
<i>Panel A: Whole sample</i>					
Treat	0.020 (0.020)	0.028 (0.030)	0.021 (0.031)	-0.018 (0.031)	0.012 (0.040)
N	4598	4599	4599	4599	4599
<i>Panel B: Car buyers</i>					
Treat	0.067 (0.075)	0.016 (0.111)	0.032 (0.111)	0.036 (0.110)	0.200 (0.143)
N	369	369	369	369	369

## LPM for 2020 survey wave participation

	(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
<i>N</i>	9141	9141

# LPM on car purchase probability

	(1)	(2)	(3)
BM x Treatment			-0.002 (0.019)
Treatment	-0.007 (0.008)	-0.007 (0.008)	-0.005 (0.017)
BM		-0.013 (0.010)	-0.012 (0.014)
<i>N</i>	4475	4470	4470
Controls	No	Yes	Yes

# Conclusion

- Certain fiscal policy measures have little impact because people are not aware of them, or despite people being aware?
- Most people were not informed about Bonus/Malus (and likely similar policies)
- Once aware of B/M, the policy makes people buy more efficient cars compared to unaware individuals
- Relatively cheap and simple information treatments could be very cost-effective...
- ...but effect of information limited over time!
- Awareness should be considered when implementing / evaluating fiscal policies directed to individuals



# Observational evidence: Instrumental variables

- Difference in differences model
- Compare aware vs unaware people, in cantons with B/W vs cantons without, before and after B/M introduction
- Instrumenting awareness using...
  - ① Distance in years from the introduction of B/M in canton
  - ② Voter turnout in Swiss referendums (social capital, willingness to get informed)
  - ③ Newspaper mentions of vehicle tax in a year X Newspaper stands in municipality X Newspaper sales (information availability)
- Instruments: 1+2; 1+3

$$y_{ict} = \beta \text{Aware}_i * \text{BMP}_{ct} + \theta \text{BMP}_{ct} + \psi \text{Aware}_i * \text{BM}_c + \gamma \text{Aware}_i + \delta X_i + \eta_c + \xi_t + \epsilon_{ict} \quad (5)$$

- Car/respondent  $i$ , canton  $c$ , year of purchase  $t$
- Dependent variable: log of fuel consumption per 100 km
- $\text{Aware}_{ict}$ : policy awareness dummy
- $\text{BM}_c$  canton treated dummy
- $\text{BMP}_{ct}$ : dummy for Bonus/Malus in place at year of purchase
- $X_{ict}$ : set of controls
- Robust standard errors (similar results when clustered at cantonal level)

## Instrumental variables

	OLS (1)	IV (Referendum) (2)	IV (Newspapers) (3)
BMP x Aware	-0.141*** (0.027)	-0.336*** (0.119)	-0.247** (0.103)
BMP	0.066*** (0.019)	0.124*** (0.039)	0.118*** (0.034)
BM x Aware	0.072** (0.033)	0.487*** (0.134)	0.450 (0.315)
Aware	-0.010 (0.025)	-0.194* (0.102)	-0.335 (0.307)
<i>N</i>	3433	3421	2311