

INSPIRING IDEAS AND TALENT

Discriminatory subsidies for energy-efficient technologies and the role of social preferences

**Valeria Fanghella^a, Corinne Faure^a,
Marie-Charlotte Guetlein^a, Joachim Schleich^{a,b}**

^a Grenoble Ecole de Management, Grenoble, France

^b Fraunhofer Institute for Systems and Innovation Research, Karlsruhe, Germany

^c

**FSR Climate Annual Conference 2020
Florence
26 November 2020**



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Motivation

Subsidy schemes to spur adoption of energy efficient technologies are prevalent

Problems

- Free riding (e.g. Groesche & Vance, 2009; Olsthoorn et al., 2017, Houde & Aldy, 2017)
- Rebound (e.g. Alberini, et al., 2016)

Discriminatory subsidies are usually more efficient

- Target tenants, low-income, environmentally-unaware (Allcott et al., 2015)

In practice, subsidies also differ by country/region/municipality



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AVIS AUX PME

Bon pour **la trésorerie**

Bon pour **l'écologie...**

- 1 500€*

Subvention Ile-de-France

- 360€

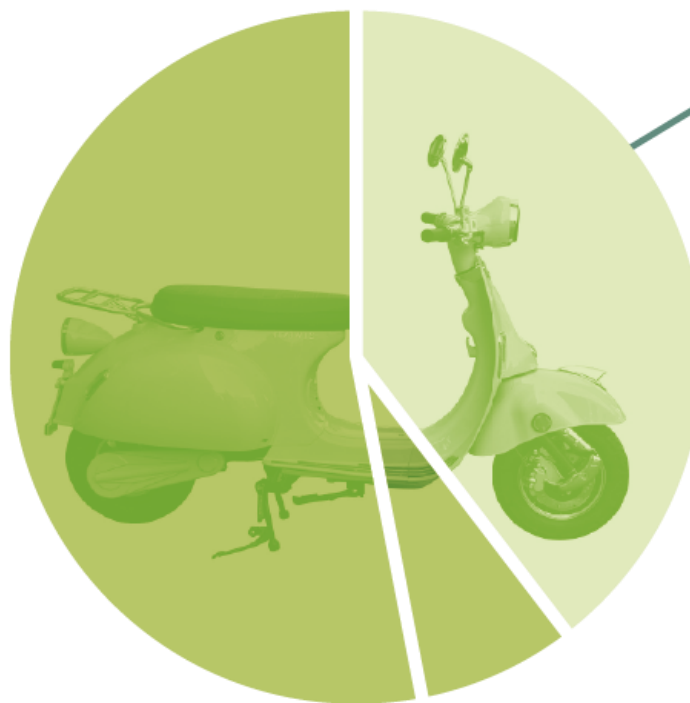
Bonus écologique national

= - 1 860€**

** Total pour un scooter avec 2 batteries,
1685€ pour un scooter avec 1 batterie

Votre scooter
électrique
à partir de

1205€
TTC



* Pour les PME,
auto-entrepreneurs et
professions libérales
d'Ile de France

Motivation

Standard economic theory: no difference in adoption behaviour between discriminatory and uniform subsidies

Behavioural economics: because of social preferences, discriminatory nature of subsidy may moderate effectiveness compared to uniform subsidy

- **Non-eligible households** (experience *negative discrimination*): **may** react negatively (Cohn et al., 2014; Güth et al., 1982; Ho & Su, 2009) → lower adoption of subsidized product
- **Eligible households** (experience *positive discrimination*): may perceive subsidized price as a reference point (Leibbrand 2020) → higher adoption of subsidized product (unless strong fairness preferences)



Objectives

Analyze household response to discriminatory subsidies

- Distinguish between **negative and positive discrimination**
- Distinguish between **eligibility criteria** (household characteristics vs. location)
- Explore moderating effect of **envy**



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Methodology

Discrete choice experiment on adoption of **smart thermostats** for demographically representative sample of households in France

Incentivized **envy game**



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Contribution

Effect of **discriminatory subsidies** on household behavior has not been analyzed before

Effects of **envy as a social preference** has drawn little attention in energy (efficiency) literature

- Fischbacher et al. (2021): envy negatively associated with stated past and planned retrofit measures, but no effect when controlling for demographics
- Schleich et al. (2020): more envious individuals purchase lower quality appliances when appliances convey if dwelling was sold (but no effect on energy performance)

Add to **broader literature on price discrimination** by companies – typically perceived as unfair (Destan & Yilmaz, 2020; Rotemberg, 2011)



Conceptual model

Captures discriminatory subsidies, appliance choice and social preferences (envy) in a random utility framework for consumer choices of durable goods (McFadden, 1974)

Details presented in the paper



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Methodology

Online survey of households in France in 2018

Household panel of professional survey institute (Norstat)

Demographically representative

- Quota sampling (age, gender, income, region)

Discrete Choice Experiment (DCE)

Mixed Logit Models



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Subsidy

Control group: You may receive a subsidy of 20€, 40€ or 60€ when you purchase the heating control device. The purchase price does not include this subsidy.

T1: Your municipality is one of the few municipalities that does not participate in a public financing programme for heating control devices. Thus, **no subsidies are available to you.** (Participating municipalities offer subsidies that amount to 20€, 40€, or 60€.)

T2: Some households can receive subsidies for heating control devices through a public financing programme. Your household is not eligible to participate in this programme and thus **no subsidies are available to you.** (Eligible households can receive subsidies that amount to 20€, 40€, or 60€.)

T3: Your municipality is one of the few municipalities that participates in a public financing programme for heating control devices. Thus, **you may receive a subsidy** that amounts to 20€, 40€, or 60€.

T4: Some households can receive subsidies for heating control devices through a public financing programme. Your household is eligible to participate in this programme. Thus, **you can receive a subsidy** that amounts to 20€, 40€, or 60€.



Discrete Choice Experiment (DCE)

*“Heating control devices are devices that **allow users to control the temperature of their home throughout the day**, for example by setting a different temperature at night. Moreover, some of those devices can be **connected to the Internet and allow users to easily adjust the temperature remotely**, for example by using a smartphone.”*



*On the following pages, we will describe different heating control devices. We would like to know **which heating control device you would choose, if you were making a purchase and these were your only options.***

Please assume that all heating control devices shown to you are of good quality and are compatible with your current heating system. The heating control devices shown to you are for the living/dining areas and only differ on the following attributes:

Levels of different attributes considered in the choice experiment

Attribute	Levels
Heating bill	1% less, 5% less, 10% less
Remote temperature control	Yes, No
Display of changes in energy consumption	Yes, No
Recommendations	Independent energy experts / your energy provider/friends (= reference category)
Purchase price	€150, €180, €210, €240, €270, €300
Subsidy	0€, €20, €40, €60

Typical choice card


Quel appareil de contrôle du chauffage préféreriez-vous ?

	Option A	Option B
Facture de chauffage	réduite de 5 %	réduite de 1 %
Contrôle de la température à distance	Non	Oui
Affichage des variations de consommation d'énergie	Non	Oui
Recommandations	Par votre fournisseur d'énergie	Par des spécialistes d'énergie indépendants
Prix d'achat	270 €	210 €
Subvention disponible pour les autres foyers	40 € (non disponible pour vous)	20 € (non disponible pour vous)

Je préfère : Option A Option B



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Instructions for envy game

*One out of every 100 survey participants will be selected at random to receive **an additional amount between €0 and €100**. The exact amount will be **determined by another randomly selected participant** who will not receive this additional payment him- or herself.*

In other words, you could be selected to win an additional amount or be selected to determine the amount that another participant will receive.

Please indicate how much another participant should receive in case that you are selected to determine this amount.

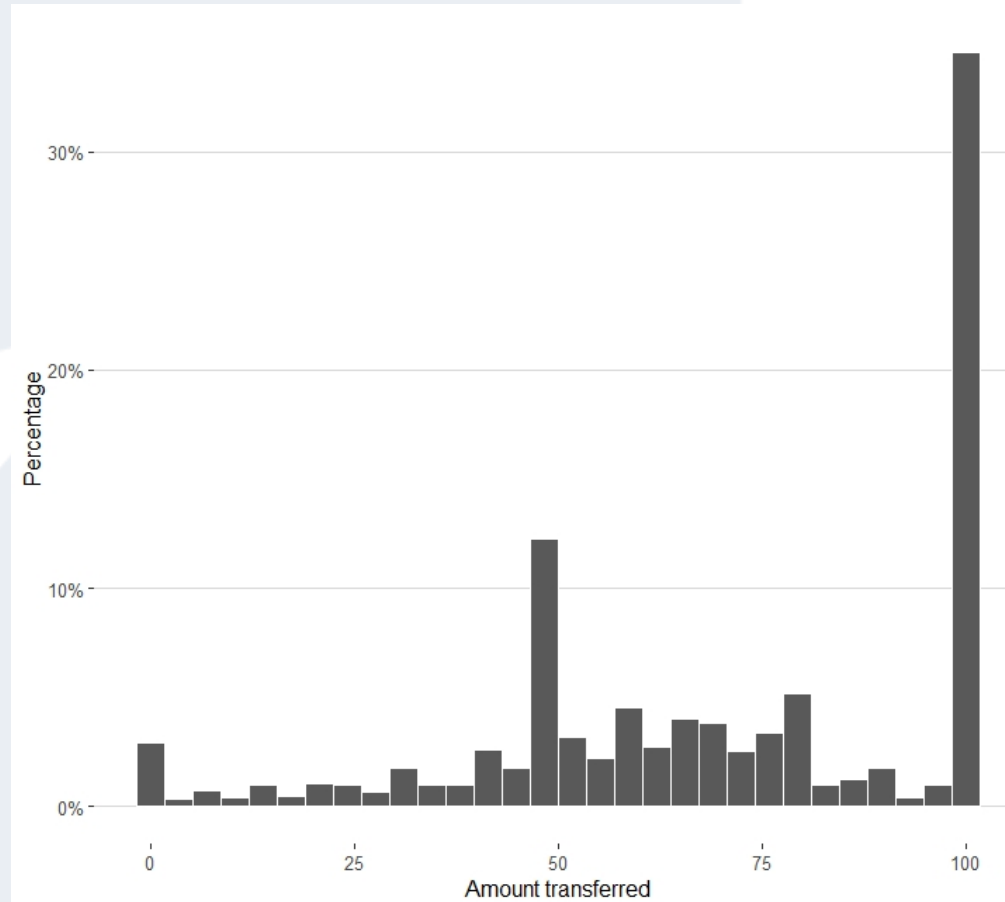
*(Please note that your answer to this question is **binding and anonymous**. If you are selected, the amount you chose in this question will automatically be paid to another participant. Your own payment for participation in this study will not be affected by your decision.)*

The amount in € that another participant should receive if you are selected at random to determine this amount. (0 – 100)



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Distribution of amounts chosen in the envy game



Median amount: 70 € - use median to split groups in highenvy and lowenvy individuals



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Empirical methodology – 3 types of models

1) Base Model

- Includes attributes and interaction of subsidy with dummies for negative and positive discrimination

2) Eligibility criteria model

- Base model plus interaction of subsidy with dummies if negative and positive discrimination based on household criteria

3) Envy models

- Base model plus interaction of *highenvy* with subsidy-interaction terms for negative and positive discrimination
- Eligibility criteria model plus interaction of *highenvy* with subsidy-interaction terms for negative and positive discrimination based on household criteria



Results: Base and eligibility criteria model

	Base Model	Eligibility criteria model
Estimated means		
<i>price</i>	-0.0066*** (0.000)	-0.0066*** (0.000)
<i>subsidy</i>	0.0058*** (0.000)	0.0057*** (0.000)
<i>sub_positive</i>	-0.0007 (0.665)	-0.0001 (0.961)
<i>sub_pos_hh</i>		-0.0013 (0.554)
<i>sub_negative</i>	-0.0031*** (0.008)	-0.0001 (0.949)
<i>sub_neg_hh</i>		-0.0060*** (0.008)
<i>savings</i>	0.2186*** (0.000)	0.2179*** (0.000)
<i>remote</i>	0.2251*** (0.000)	0.2230*** (0.000)
<i>display</i>	0.2007*** (0.000)	0.1999*** (0.000)
<i>recom_prov</i>	0.4135*** (0.000)	0.4118*** (0.000)
<i>recom_exp</i>	0.2400*** (0.000)	0.2400*** (0.000)
Loglikelihood	-4426.289	-4422.559
Number of participants	1244	1244
Sample size	14928	14928

No evidence for additional behavioral effect of positive discrimination compared to uniform subsidy

Negative discrimination lowers propensity to adopt if discrimination is based on household criteria

Summary of other findings and robustness checks

No evidence that envy affects valuation for subsidies

Findings (incl. 'no-finding' for envy model) are robust to

- Dropping speeders (taking < half the median time)
- Dropping participants who failed manipulation check
- Alternative coding of envy dummy for envy model
- Forcing the price parameter to follow a log-normal distribution
- Including tenants in sample (findings are driven by owner-occupiers!)



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Conclusions

Subsidy

- In line with thrust of literature: subsidy found to increase household propensity to adopt energy efficiency measure
- **New:** discriminatory subsidy reduces non-eligible households' propensity to adopt the subsidized smart thermostats if discrimination is based on household characteristics
 - Social preferences affect effectiveness of subsidy
 - Welfare analysis may need to account for possible 'negative spillover' of discriminatory subsidy schemes
- Findings extends findings from behavioral IO literature on negative effects of price discrimination for non-eligible customers when discrimination is implemented by benevolent public entity rather than a profit-seeking private company
- Differential effects of eligibility criteria may be explained by preferences for procedural fairness
 - "tough luck of living in the 'wrong' municipality" more acceptable because of randomness of criteria
 - ambiguity/lack of transparency about eligibility criteria



Conclusions

Envy

- ‘No result’ consistent with Schleich et al. (2020), and Fischbacher (2021)
 - energy means ‘low involvement’ decisions
 - consequences of envious behavior might be the public entity responsible for discriminatory subsidy, not recipients of subsidy (i.e. a third player);
 - Other types of social preferences reflecting e.g. distributional fairness and reciprocity may matter more



Thank you!



Fraunhofer Institute Systems-
& Innovation Research
Breslauer Straße 48
76139 Karlsruhe
Germany
joachim.schleich@isi.fraunhofer.de



Grenoble Ecole de Management
12 Pierre Sémard
38000 Grenoble
France

joachim.schleich@grenoble-em.com

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