Using Insights from Behavioural Economics: Electricity tariff design and acceptance

Jasmin Mahmoodi, Stefanie Hille, & Tobias Brosch, The University of Geneva

This study tests electricity tariff designs that penalise overconsumption. In line with prospect theory[1], these tariffs are more effective in mobilising energy savings[2]. Yet, little is known about their implementation in energy markets, where consumers freely choose a tariff. A choice experiment conducted online shows consumers are averse towards tariffs that penalise overconsumption, while the acceptance of such tariffs can be increased when in combination with a reward (i.e. Bonus rewarding conservation). Furthermore, consumer clusters can be identified that reveal different preference structures and differ with respect to cognitive-affective biases (e.g. loss aversion).

Loss aversion & Tariff Design

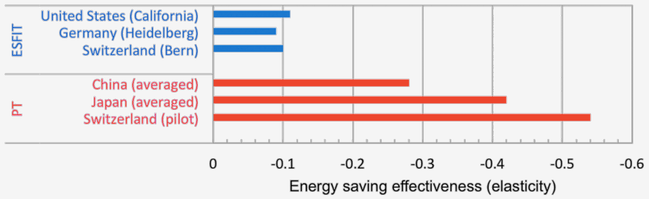
Loss aversion describes that people prefer gains to losses[1], while people also make more effort to avoid losses[3,4].

Why and how is this relevant for tariff design and energy savings?

Two electricity tariffs of main interest:

- ESFIT ("Bonus" tariff) ***reward*** conservation
- PT ("Malus" tariff) ***penalise*** overconsumption

Fig 1. Energy saving effectiveness of ESFIT ("Bonus") and PT ("Malus").



In line with prospect theory, our review[2] shows PT ("Malus") are more effective in promoting energy savings (Fig 1).

Challenge is to overcome loss aversion in moment of choice, while harnessing it as a potential to mobilise energy conservation.

Methods

Choice experiment (CBC) in nationwide online study to determine consumers' acceptance of tariffs with differing incentive schemes and the importance ascribed to different attributes of tariffs (e.g. Bonus):

Fig 2. Choice task example.

	Tariff 1	*Tariff 2*	*Tariff 3*
Bonus	No Bonus	15% Bonus	No Bonus
Malus	No Malus	10% Malus	5% Malus
Electricity Mix	100% Solar	60% Hydropower 40% Nuclear	55% Nuclear 45% Fossil fuels
Location of generation	Europe	Unknown	Switzerland
Monthly Price	CHF 75	CHF 85	CHF 65
	○	○	○

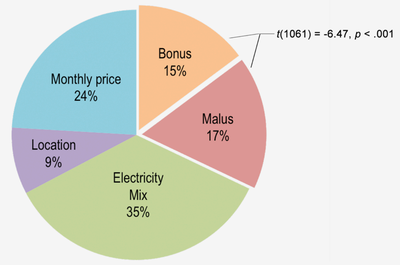
Additional test battery assessing cognitive-affective biases loss aversion[3], general risk aversion, and comparative optimism bias.

N = 1062; Ø age = 44.25 years, *SD* = 14.5; 52.2% females

Results 1

1. How do Bonus and Malus attributes impact overall electricity products?

Fig 3. Attribute importance scores (*N* = 1062).

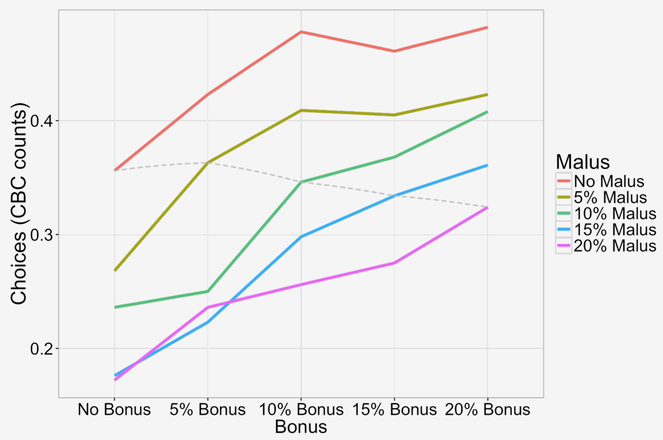


<u>Conclusion 1:</u> HB estimation shows that overall, attribute Malus has significantly higher importance than Bonus.

Results 2

2. How can Malus tariffs be made attractive?

Fig 4. Choice counts for different tariff designs and combinations.



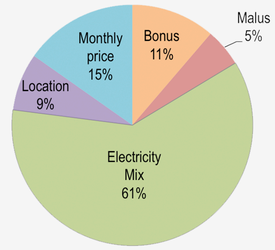
<u>Conclusion 2:</u> Malus can be made attractive when offered in combination with Bonus.

Results 3

3. Can consumer clusters be identified based on choice patterns and do they differ with respect to certain biases?

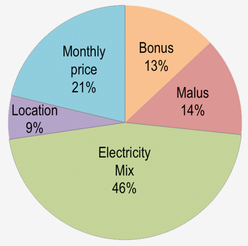
Fig 4. Attribute importance scores and biases per consumer cluster.

Consumer cluster 1
"Environmentalists" (*n* = 258)



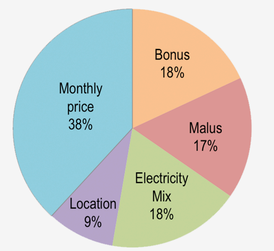
Lowest loss aversion: λ = 1.00
(Lottery acceptance: Ø = 4.55 (3.15))
Lowest risk aversion: Ø = 4.04 (1.39)
Highest optimism bias: Ø = 0.61 (1.67)

Consumer cluster 2
"Loss sensitive Environmentalists" (*n* = 269)



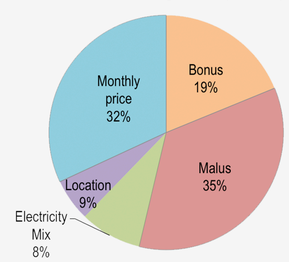
Highest loss aversion: λ = 1.40
(Lottery acceptance: Ø = 3.61 (2.55))
Higher risk aversion: Ø = 4.34 (1.40)
Higher optimism bias: Ø = 0.59 (1.50)

Consumer cluster 3
"Bargainers" (*n* = 315)



Low loss aversion: λ = 1.16
(Lottery acceptance: Ø = 4.17 (3.16))
Lower risk aversion: Ø = 4.14 (1.46)
Lower optimism bias: Ø = 0.37 (1.59)

Consumer cluster 4
"Loss sensitive Bargainers" (*n* = 220)



High loss aversion: λ = 1.29
(Lottery acceptance: Ø = 3.41 (2.74))
Highest risk aversion: Ø = 4.50 (1.41)
Lowest optimism bias: Ø = 0.23 (1.54)

Note. Loss aversion parameter λ for *n* = 620.

<u>Conclusion 3:</u> LC analysis reveals clusters that can be described in terms of cognitive-affective biases including loss aversion, risk aversion, optimism bias about personal energy saving potential.

Implications & Future Steps

Study tests novel tariff designs (and acceptance thereof) that are more effective in mobilising savings and more cost-effective for utility companies. This research can support endeavours to combat global climate change[5] by changing environmental decisions and behaviours[6].

Future steps: Further evaluate market potential of Malus tariffs (i.e. PT) and test nudging strategies, e.g. status-quo.

References

[1]Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica: Journal of the econometric society*, 263-291.
[2]Prasanna, A., Mahmoodi, J., Brosch, T., & Patel, M., (submitted).
[3]Imas, A., Sadoff, S., & Samek, A. (2016). Do People Anticipate Loss Aversion?. *Management Science*, 1-15.
[4]Fryer Jr, R. G., Levitt, S. D., List, J., & Sadoff, S. (2012). *Enhancing the Efficacy of Teacher Incentives through Loss Aversion: A Field Experiment* (No. 18237). National Bureau of Economic Research, Inc.
[5]UNFCCC. *Adoption of the Paris Agreement.* Report No. FCCC/CP/2015/L.9/Rev.1, http://unfccc.int/resource/docs/2015/cop21/eng/l09r01.pdf (UNFCCC, 2015).
[6]Dietz, T., Gardner, G. T., Gilligan, J., Stern, P. C., & Vandenbergh, M. P. (2009). Household actions can provide a behavioral wedge to rapidly reduce US carbon emissions. *Proceedings of the National Academy of Sciences*, 18452-18456.

FNSNF Swiss National Science Foundation
71 NFP Managing Energy Consumption National Research Programme
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UNIVERSITÉ DE GENÈVE SWISS CENTER FOR AFFECTIVE SCIENCES

Comments welcome!
Jasmin.Mahmoodi@unige.ch