

SOCIAL NORMS AND ENERGY CONSERVATION BEYOND THE US – A REPLICATION

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Overview

The seminal studies by Allcott (2011) and Allcott (2014) show that social comparison-based home energy reports (HER) are a cost-effective non-price intervention to stimulate energy conservation in the US. This note presents findings from a replication of these studies in Germany. Based on a large scale randomized controlled trial, we find that the intervention only has a small effect on energy consumption. We additionally show that lower electricity consumption levels and carbon intensities make home energy reports cost-ineffective in virtually all other industrialized countries than the US.

Methods

We designed the HER for our study in cooperation with the German energy consulting firm Gruenspar and in a way that closely matches the Opower intervention. Households in the treatment group received four quarterly letters. Just as the Opower reports, our HER compare the household's consumption with that of its neighbors and provide tips on how to save energy. Two features of our HER were not contained in the Opower HER: our reports announce an individualized electricity consumption objective for each recipient household (10 percent less than the previous year) and additionally offer rebates for the purchase of energy efficient appliances that are available at the Gruenspar's online shop. We expect this deviation to intensify the HER's effectiveness, but only slightly.

Results

Our results show that the average HER treatment effect is a 0.7% reduction and statistically significant at the 10 percent level. This translates into an absolute average electricity reduction of around 16 kWh per year or 0.04 kWh per day, which is equivalent to turning off a 30 Watt light bulb for some 90 minutes every day. Moreover our estimates show that we can exclude average reductions in electricity consumption greater than around 1.5% with 95% confidence.

Our estimate of a 0.7% reduction is substantially smaller than the treatment effects found for the US. Because of the large differences in average consumption levels, absolute electricity savings diverge even more. The Allcott (2011) treatment effect for quarterly reports of a 1.7% reduction translates into absolute savings of 191 kWh per year (0.52 kWh per day), an effect size that is by far larger than what we observe for our sample.

As HER are a potential instrument to combat climate change, the main cost-effectiveness indicator is the cost per ton of mitigated carbon dioxide (CO₂). In general, the CO₂ abatement potential of electricity conservation depends crucially on the electricity mix in the respective country. For example, power sectors relying on lignite or hard coal are much more carbon intense than those relying on hydropower. For the US and Germany, the CO₂-intensities are virtually on a par at around 0.5 kg per kWh. Dividing the cost estimates of 0.25 US\$ per kWh and 0.01-0.05 US\$ per kWh for Germany and the US by this CO₂-intensity, suggests that the costs per mitigated ton of CO₂ amount to 505 US\$ in Germany and exceed the cost of 25-105 US\$ in the US Opower samples by a factor of five.

The usual yardstick to assess whether a climate change mitigation policy is worth being pursued are the social cost of carbon Greenstone (2013), Nordhaus (2014). Comparing the estimated abatement costs of around 500 US\$ per ton for Germany to those estimates strongly suggests that HER are not a cost-effective climate policy instrument in Germany. In contrast, HER may be a valid policy option in the US, given that abatement cost can be as low as 25 US\$ per ton.

We also use three key parameters to gauge the potential cost-effectiveness of HER in other industrialized countries: the treatment effect of HER on the recipients' electricity consumption, average electricity consumption levels, and the carbon intensity of the electricity mix. Clearly, additional replication studies would be required to identify the exact magnitude of treatment effects in other countries. As such replications are scarce, we use the full range of treatment effects that have been reported in the literature so far. Our effect size is the lower bound at 0.7%, while the highest effect measured in the Opower program is at 3.3% Allcott (2011). Average electricity consumption levels and carbon intensities are available from official data sets. For simplicity, we assume printing and mailing cost to be at 1 US\$ per letter throughout. We consider the ten OECD countries with the largest total residential electricity consumption: Canada, United States, France, Germany, Italy, Spain, United Kingdom, Japan, South Korea, and Australia.

Our cost-effectiveness calculations show that HER are considerably less cost-effective in most of these OECD countries, compared to the US, owing to both lower average consumption levels and carbon intensities. Australia is the only country that reaches comparable CO₂ abatement costs, since both consumption levels and carbon intensities are high. Furthermore, the estimated abatement cost suggest that no country except the US and Australia reaches CO₂ abatement cost that would justify using HER as a policy instrument to combat climate change when social carbon cost of 19-38 US\$ are taken as a yardstick.

Conclusions

This paper has replicated the Opower social comparison-based home energy report (HER) intervention in Germany and scrutinized their potential as a climate policy instrument in a wide range of industrialized countries. Our estimates imply only modest average reductions in electricity consumption of 0.7%, less than half of what was observed in the US. A plethora of factors may explain why HER are not as effective in Germany as in the US. For example, cultural predispositions to respond to social comparisons may be less strong for German households, annual metering cycles (compared to monthly or quarterly metering in the US) may make HER less informative, and not least both behavioral and technical energy efficiency at the baseline might be higher in Germany.

While we cannot distinguish those mechanisms empirically, we can confidently reject that HER are a cost-effective policy instrument to curb carbon emissions in Germany. This finding is not only driven by a smaller effect size, but also by substantially lower electricity consumption levels of German households and would even hold true if we underestimated the treatment effect of HER by far. For other industrialized countries, low carbon intensities of electricity generation can additionally deteriorate the cost-effectiveness of HER, compared to the US. We provide evidence that – even under favourable assumptions on effect sizes and their persistency – lower electricity consumption levels and carbon intensities make HER a cost-ineffective climate policy instrument in the majority of industrialized countries beyond the US.

References

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