GOVERNMENT POLICY AND ENERGY EFFICIENCY – LEARNINGS FROM A PUBLIC GOOD GAME

Roland Menges, Clausthal University of Technology, Germany, +49 (5323) 727652, rme@tu-clausthal.de
Gregor Beyer, Clausthal University of Technology, Germany, +49 (5323) 727684, gb11@tu-clausthal.de

Overview

Governments worldwide commit significant resources to combat the so-called energy-efficiency-gap (Prindle et al. 2010). Private households in particular are targeted with a broad variety of programs and instruments incentivizing or forcing investments. A large body of economic literature examines and evaluates different energy efficiency programs aiming to improve policy understanding and design. In the case of energy efficiency subsidies, there is much theoretical (Filippini et al. 2014) and empirical (Gómez et al. 2014) support for the claim that subsidies increase energy efficiency investments. However, not many studies draw conclusions on the cost-effectiveness of such programs, which may in fact be low (Alberini & Tower 2015).

The presented work contributes to the discussion of the cost-effectiveness of energy efficiency subsidies empirically. We report an economic experiment that is financed by the German Federal Ministry of Education and Research. The research approach adds to the literature on energy efficiency subsidies in two regards. Methodologically, we interpret the energy efficiency gap as a social dilemma in a public good game, employing a method that has not achieved much attention in the assessment of energy efficiency programs. We establish the utilitarian welfare as a measure of efficiency and relate changes of welfare directly to energy efficiency subsidies. Seconds, we address the role of two design parameters of energy efficiency subsides for welfare changes and evaluate the impact of subsidy volume (Hassett & Metcalf 1995, Alberini & Bigano 2015) and the "tagging and targeting" of subsidies (Alcott et al. 2015).

Methods

Results are drawn from an incentivized, non-linear public good experiment with a strong energy efficiency framing. We model individual investments as contributions to an impure public good (Cornes & Sandler 1996) giving rise to both private and public benefits. The underlying model accounts for heterogeneous endowments and preferences for energy efficiency. The model is a derivative of the model used in a previous study by the authors (Menges & Beyer 2014) and features three core attributes of individual energy efficiency investments:

- opportunity costs of energy efficiency in terms of reduced private consumption,
- private benefits of efficiency investments that result from reduced future energy expenditures
- public benefits reflecting the positive spillovers of efficiency investments such as climate protection.

Participants are recruited from the general public in an artificial field experiment in Germany. Each participant is assigned one of three heterogeneous household types that are described by homogenous endowments and preferences. Groups or "Societies" consist of three individuals and contain every household type exactly once. Every participant makes one investment decision in unique treatments using slightly modified model variants that reflect different policy settings. Energy efficiency subsidies are modelled to be with (respectively without) effect on individual investment optima, and differ in subsidy volume. Government spending on subsidization are endogenous and financed by compulsory redistribution of endowments between all members of a society. Exogenous costs of energy efficiency subsidies (such as the costs of administration) are not regarded. The assessment of energy efficiency subsidies is based on between-subject analysis, and measures of welfare are derived from a complete combination of individual observations to establish representativeness of results (Neugebauer & Traub 2012).

Results

A total of 306 independent individual investment decisions are used to construct 29,418 societies distributed evenly among six treatments. Welfare achieved in these societies is used to test hypothesis on the welfare effects of different energy efficiency subsidies. A first result is that all types of subsidies examined lead to significant and meaningful welfare increases compared to a non-policy treatment. Notably, welfare increases even when no significant changes in individual behaviour are found. A second result is that in ceteris paribus environments, the magnitude of welfare

effects is explained by different subsidy volumes. The larger a subsidy and consequently the redistribution of endowments, the larger the welfare gains achieved with said subsidy. However, the subsidy volume is not the only determinant of subsidy effects. Subsidies that feature stimuli for subsidized individuals to increase investments beyond initial optima (such as subsidized loans) lead to the highest welfare gain even though the subsidy volume is smallest. This results highlights that while welfare gains may be obtained by any type of subsidy, subsidies differ in program efficiency in regards to financial volumes.

Regarding the tagging and targeting of energy efficiency subsidies, a first result is that limiting subsidy eligibility to low-income households does not affect the investment behaviour of remaining, not-subsidized households. Whether subsidization of all households is preferable to discriminating subsidization of only poorest households depends on the type of subsidy. In the case of efficient subsidies, the tagging and targeting results in welfare losses. Regarding inefficient subsidies that provide no investment stimuli (such as lump-sum subsidies), a limitation of subsidy eligibility leads to welfare increases. We thus relate to the argument offered by Alcott et al. (2015) that "tagging becomes more valuable when existing subsidies are more poorly-targeted", and provide evidence that tagging becomes more valuable when existing subsidies are poorly-designed.

Conclusions

Acknowledging the restrictions to external validity associated with economic experiments in general and the model used in this experiment in particular, we conclude that energy efficiency subsidies are a suitable instrument to increase welfare. We find that the success of energy efficiency subsidies may be attributed to subsidy volume and the individual investment stimuli inherent to subsidy design. We also conclude that while the tagging and targeting of subsidies seems socially accepted, the impact of such (positive or negative) discrimination may reduce the potential welfare gains of subsidies. Adopting a political perspective, the results motivate a recommendation for subsidies with investment stimuli such as subsidized loans over lump-sum subsidization. Another political implication is that limiting the eligibility for energy efficiency subsidies to low-income households may be an legitimized method of achieving the social goal of lowering income inequalities.

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