DECOMPOSING CONSUMER WILLINGNESS-TO-PAY FOR RENEWABLE ENERGY IN TRANSPORT INTO VALUES FOR EMISSIONS REDUCTIONS AND ENERGY TYPES

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Overview

Governments worldwide express the desire to move away from conventional energy use towards the use of renewable energy. Without government intervention, this energy transition is not brought about by energy markets because of the higher costs of renewable energy. An extensive literature has emerged addressing the question how much consumers are willing to pay for renewable energy, with a particular focus on (renewable) electricity markets (Sundt and Rehdzan, 2015). These studies typically apply stated-preference methods and estimate how much consumers are willing to pay extra for renewable energy on top of their current periodical energy bill or per unit of renewable energy. However, while different renewable energy types share the fact that they emit less greenhouse gas emissions compared to conventional energy types, they vary in other aspects such as the type of energy carrier (e.g. molecular or electrical). These different energy characteristics may distort the estimation of the willingness-to-pay (WTP) for renewable energy if one is primarily interested in the WTP for emission reduction, which is the ultimate goal of the energy transition. In addition, this distinction matters for the design of effective renewable energy policies. Depending on preferences (and also energy prices), it may be more cost-effective for governments to promote strongly preferred types of renewable energy.
This project decomposes the willingness-to-pay of consumers for renewable energy into components for greenhouse gas emissions and energy types. In addition, we investigate how the WTP is related to the characteristics of consumers. We apply an internet-based choice-experiment to the passenger-car market. The passenger-car market is suitable for the decomposition of the WTP as consumers in these market are facing many options regarding the fuel type of their new car, including various fuel types based on renewable energy (e.g. renewable compressed natural gas (CNG), hydrogen, electricity). We apply stated-preference methods as a choice-experiment enables including several fuel types for which markets are currently almost non-existent (e.g. hydrogen passenger cars), hindering the use of revealed-preference methods. Our sample consists of two different surveys which is sent out to participants in five different European countries. Participants are selected to represent the adult population in each country. By collecting data from five different European countries we can also explore international differences in the WTP. The first survey was sent out to 2000 participants in Austria, Germany, Italy and Switzerland (evenly distributed over countries) via French conductor Efficience 3. The second survey was sent out to 1750 participants of the LISS panel of CentERdata (University of Tilburg) in The Netherlands. Jointly, the surveys result in a total number of observations of 56,250. Both surveys were sent out in the fourth quarter of 2017. The results from Efficience 3 are already obtained and the results from CentERdata will be obtained by the end of January 2018. Once the data from CenterData is collected we will conduct the data analysis and finalize a first draft of the paper.

Methods

This study applies a discrete-choice experiment to the passenger-car market. In our experiment, respondents are presented with fifteen choice sets. Each choice set consists of 2 profiles that represent passenger cars. For each profile, four car attributes are varied. Respondents are asked to indicate their preferred profile in each choice set. After collection, the choices will be modelled using a mixed logit model, assuming that the utility consumers derive from consuming a good depends on the attributes of the good, based on random utility theory (McFadden 1974). From the parameter estimates it is straightforward to estimate the individual WTP for each attribute. In the second step, we analyse the relationship between the respondents' characteristics and individual WTP.
Participants in our experiment are asked to make trade-offs between four attributes: fuel type, purchase price, fuel cost per kilometre, and CO_2 emissions per kilometre. Participants are explicitly told that the alternatives are identical in any other aspect than the presented attributes and that their decisions should be based only on the four included attributes. This is important as decisions based on other aspects would confound our results. For instance, if participants associate electric vehicles with a short driving range, we would be partly measuring preferences for driving range, confounding the results for the other attributes.

The levels of each attribute are chosen such that we can identify the effects of interest, minimize complexity for, and provide realistic choices to respondents. The levels of fuel type include essentially all fuel types currently available to consumers: gasoline, diesel, hybrid, CNG, biofuel, hydrogen and electric. The levels of purchase price and fuel cost per kilometre will be based on market data. We include absolute values for CO_2 emissions per km, rather than relative emissions to a reference vehicle as appears to be standard in the transportation literature, facilitating estimation of the WTP for a specific reduction in emissions.
In the second step, we explore the heterogeneity in the preferences of consumers by relating individual WTP to the respondents' socio-economic characteristics. We include age, gender, income, education and location (urban vs. rural).

Results

We do not have results yet. While the data collection process has been completed for both surveys, we are currently waiting for the return of data by CentERdata. This should occur no later than the end of January 2018.

The results in our paper include estimates of the WTP (average and distribution over adult population) of energy-related characteristics of passenger cars. Importantly, we estimate the WTP for (reductions in) CO_2 emissions and different fuel types. We also show how the WTP estimates are related to human characteristics and nationality (within 5 European countries).

Conclusions

We do not have conclusions yet for the same reason. While the data collection process has been completed for both surveys, we are currently waiting for the return of data by CentERdata. This should occur no later than the end of January 2018.
The conclusions suggest whether consumers (of passenger cars) merely care about emission reductions or whether they also care about the type of renewable energy that provides these reductions. The decomposition of WTP will also provide some conclusions on the substitutability between different renewable energy types. This is particularly relevant for the scientific literature including economic models with a climate externality, which typically assume that different types of renewable energy are perfect substitutes. Knowledge on the separate WTP of consumers for emission reduction as well as for the type of renewable energy helps governments to improve the effectiveness of policy instruments to reduce carbon emissions

References

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