CHOOSING TO PAY MORE FOR ELECTRICITY AN EXPERIMENT TO TEST THE LEVEL OF RESIDENTIAL CONSUMER COOPERATION IN INCREASING ELECTRICITY PRICE

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Overview

This paper investigates the choice to pay more for electricity in a regulated context where the state owns the primary energy source and where prices are set according to average production costs principles – as it is still the case in many US states, Canadian provinces and other jurisdictions around the world. This is the situation, for instance, in hydropower-dominated jurisdictions such as Washington and Oregon in the US and British Columbia, Manitoba and Quebec, in Canada. In these jurisdictions, increasing the electricity price would result in a greater provision of two public goods: additional income for the government and lower greenhouse gas (GHG) emissions. The latter would be obtained from the reduced energy consumption following higher electricity prices, leading to the ability to export more energy, lowering thermal production in exports markets.

The economic literature on contributions to public goods shows that there exist conditions under which consumers voluntary contribute. How do consumers react in the presence of two public goods? Are there some initial endowment effects influencing voluntary contributions? These are the main research questions guiding this paper.

Methods

In order to study the propensity to pay more for electricity under different initial endowments and in the presence of a second public good (the environment), two different treatments were applied to participants. The first one is an assignment to one specific type of households with a given electricity consumption. The second one, to control for the influence of the environmental public good, is the uncertainty characterizing the presence of the environmental benefit.

Electricity consumption is mostly influence by the size of the residence and by the type of heating technology, in cold climate as the one of Quebec (Canada), where the experiment took place. Four types of households were used, to which participants have been randomly assigned:

- Type A households, living in detached houses with electric heating (with the highest annual electricity consumption; 35,472 kWh).
- Type B households, living in detached houses without electric heating (with the third highest annual electricity consumption; 11,440 kWh).
- Type C households, living in apartments with electric heating (with the second highest annual electricity consumption; 17,806 kWh).
- Type D households, living in apartments without electric heating (with the lowest annual electricity consumption; 7,775 kWh).

The type of household specified a distinct endowment to participants. Indeed, the larger their electricity consumption, the more they would be affected by an electricity price increase because it would negatively affect their disposable income. We expected participants with larger electricity consumption to choose the higher electricity price in lower proportions.

The second, environmental, public good is introduced in the experiment by increasing the level of certainty with which GHG emission reduction happens. How these reductions materialized in the experiment is described in the next section. Three levels of uncertainty were created:

- Ambiguity. Participants were told that GHG emission reductions resulting from their choices would happen according to an unknown probability.
- Risk. GHG emission reductions resulting from their choices would have a 0.5 probability to be realized, and a 0.5 probability to not be realized.
- Certainty. Their choice would result in specific GHG emission reductions with a probability of 1.

With this experimental design, we are able to answer the research question "Are consumers willing to pay more for electricity?", controlling for their initial endowment and for an additional, environmental, public good. Table 1 summarizes the experimental design.

Table 1. Experimental design

		Level of uncertainty second public good		
		Ambiguity	Risk	Certainty
Initial Endowment	**A**	$Group_{A\text{-}Amb}$	$Group_{A\text{-}Risk}$	$Group_{A\text{-}Certain}$
	B	$Group_{B\text{-}Amb}$	$Group_{B\text{-}Risk}$	$Group_{B\text{-}Certain}$
	C	$Group_{C\text{-}Amb}$	$Group_{C\text{-}Risk}$	$Group_{C\text{-}Certain}$
	D	$Group_{D\text{-}Amb}$	$Group_{D\text{-}Risk}$	$Group_{D\text{-}Certain}$

The experiment involved 200 participants and was held at the CIRANO's Experimental Economics Laboratory during the Fall 2009 in Montreal (Quebec, Canada). The random assignment of participants into a household type was made by the selection of a card with seat numbers (1 to 16, or 1 to 20, depending on the number of participants in a run of the experiment). Seats were pre-assigned to a specific household type. By being of a specific household type, participants were given a different initial endowment, because it came with a given electricity consumption. All participants started with $300 of experimental money (which value was set to ten times the real Canadian dollar value), from which they had to pay a monthly electricity bill, based on a price they could choose. This is indeed the focus of the experiment: participant could either select the "Current Price Option" (same electricity price as in reality) or the "Alternative price option" (a 50% price increase over the Current Price Option).

Results

The table below presents the combined results from the 12 runs of the experiments (three runs per level of uncertainty). A majority of participants, 52%, chose the alternative price option – the higher price option. By doing so, they deliberately chose to decrease their payoff compared to the current price option.

This majority of participants choosing to pay more was observed in all sub-groups, except for type A participants (44% chose to pay more) and for participants in the ambiguity sub-group (42.65% chose to pay more). These results illustrate a high percentage of participants volunteering to reduce their individual payoff for the common good.

Table 2. Number of participants choosing the Alternative option, summary results, all treatment groups

Type and consumption	Certainty	Risk	Ambiguity	# alternative choice	n=	
A (35,472 kWh)	7	8	7	22	50	44.00%
C (17,806 kWh)	8	11	8	27	50	54.00%
B (11,440 kWh)	10	9	9	28	50	56.00%
D (7,775 kWh)	11	11	5	27	50	54.00%
# alternative choice	36	39	29	104	200	
n=	64	68	68	200	**52%**	
	56.25%	57.35%	42.65%			

Conclusions

The literature on experimental public good games has focussed so far on single public goods and abstract experimental contexts. In the electricity sector, experiments have been dedicated almost exclusively to the study of market designs. Even if many valuation studies have assessed the willingness to pay for green electricity, no research explored the propensity to pay more in a strategic context involving two public goods: an economic and an environmental one. The experiment reported in this paper provides some very encouraging results on the voluntary decision to pay more for electricity when economic and environmental returns are clearly presented to participants and shared. Even more encouraging is the fact that initial endowments (high or low exposure to electricity prices) and uncertainty on the environmental outcome were not found to be significantly connected to the choice of paying more. A majority of participants (52%) chose to pay more for electricity, even if that meant that it would reduce their individual payoff. Only the sub-group exposed to ambiguity on the environmental benefit was found to have a significantly lower participation rate in the higher price option.

Future research could focus on various types of design that could encourage even higher participation rate. This could help design better electricity policies, where the use of scarce clean hydropower would be optimized, both increasing the wealth of its owners and lowering GHG emissions from the electricity sector.