
Understanding consumer behaviour:

Lessons from the subsidy policy for energy-efficient home appliances in China

Yang Liu

School of Management, Harbin Institute of Technology, China

Department of Economics, Ecole Polytechnique, France

yang.liu@polytechnique.edu

Overview on the program

- A nationwide subsidy program for energy-efficient home appliances
 - **Five categories:** air conditioner, TV, refrigerator, washing machine, and water heater;
 - **One year** duration: June 2012- June 2013;
 - **Cash rebates** ranging from US\$16 to 64;
 - Financed by the central government : about US\$ **2 billion**;
 - Consumer spending : about US\$ **41 billion** on over **65 million** energy-efficient home appliances;
 - Policy objectives:
 - Promote energy-efficient home appliances;
 - Stimulate domestic demand to address economic downturn.



Sample

- Objective: understanding **internal and external influences** on electricity consumption behaviour.
 - Household characteristics: income, education, age, and energy saving awareness
 - Subsidy policy
- We have selected Rizhao city of Shandong province to undertake the survey.
- Two datasets consisting of **urban** and **rural** households, respectively.
 - Each dataset includes **participant** and **non-participant** households in the subsidy program.
- Divide the sample into **homogeneous subgroups** based on per capita electricity consumption level.
- Refer to the publication for more details
 - X.L. Yao, Y. Liu, and Y. Xiao, "A quantile approach to assess the effectiveness of the subsidy policy for energy-efficient home appliances: Evidence from Rizhao, China." Energy Policy (2014), 73(0): 512-518.

Income elasticity to electricity consumption

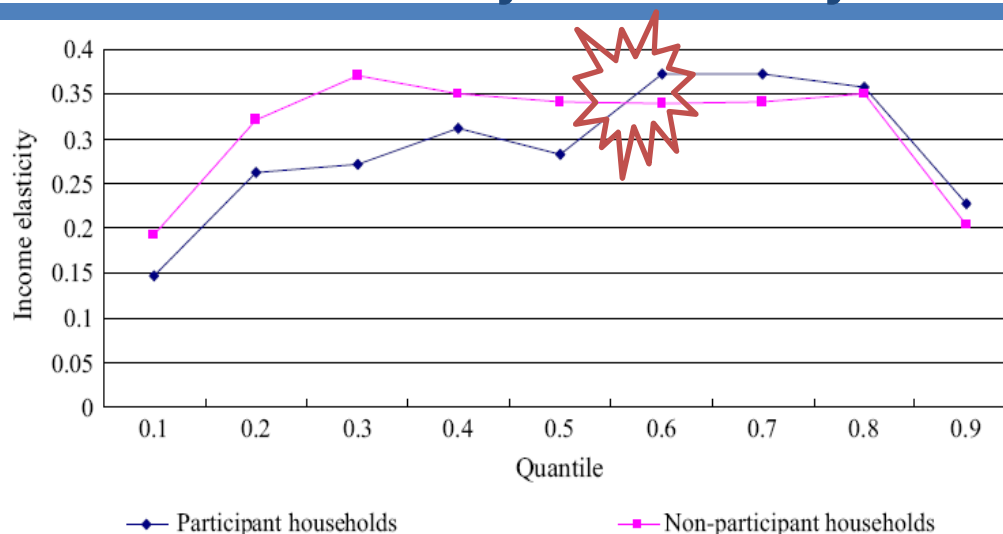


Fig. 1. The elasticity of the income to electricity consumption in urban areas.

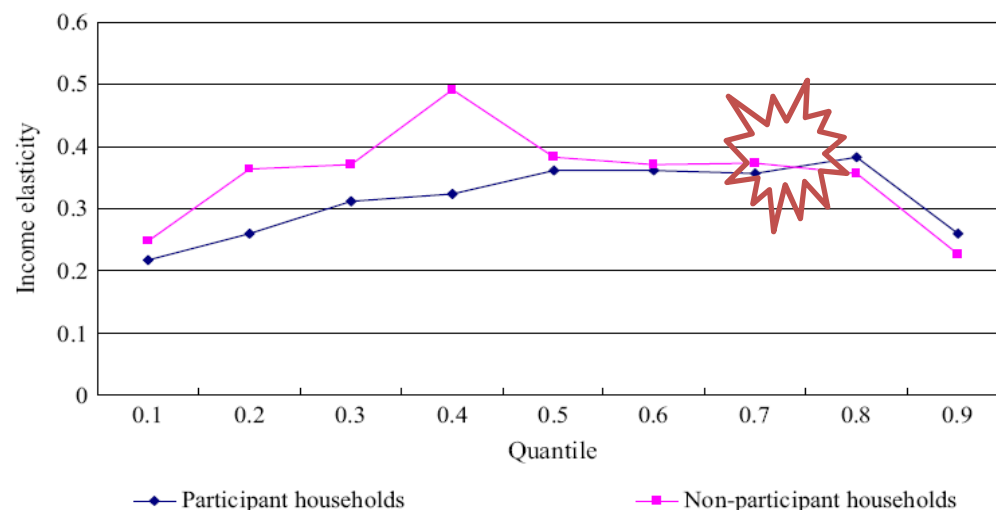


Fig. 2. The elasticity of the income to electricity consumption in rural areas.

➤ Responsiveness of electricity demand to **income variation**:

- **Increases at first and then decreases** along the distribution range.
- The **turning point**: at the 50th quantile for the urban families and 70th quantile for the rural families.

▪ **Income influence** on the participation in the subsidy program:

- At the left of the turning point, **higher income** households participate;
- At the right of the turning point, **lower income** households participate (too rich to be attracted by the subsidy policy).

Impact of education, age and energy-saving awareness

- The responsiveness of electricity demand to the **education level**
 - **increases across the distribution** : higher education contributes to higher income and leads to more electricity consumption.
 - Non-participant households have a higher elasticity than participant households: the education level **does not** play a prominent role in the purchase decision of energy-efficient appliances.
- Responsiveness of electricity demand to the **age variation**
 - In the urban area, **younger population** is more likely to consume more electricity.
 - In the rural area, **aged population** has limited income and thus consumes less electricity.
- Responsiveness of electricity demand to the **energy-saving awareness**
 - Energy awareness helps reduce the demand in the groups of population associated with **low and moderate** electricity consumption.
 - Mostly higher in the non-participant households: counterintuitive but shows that the participation in the subsidy program is probably **not induced** by energy-saving awareness.
 - Energy-saving awareness is more effective (statistically more significant) in the **rural area** than in the urban area.

Household characteristics vs. subsidy policy

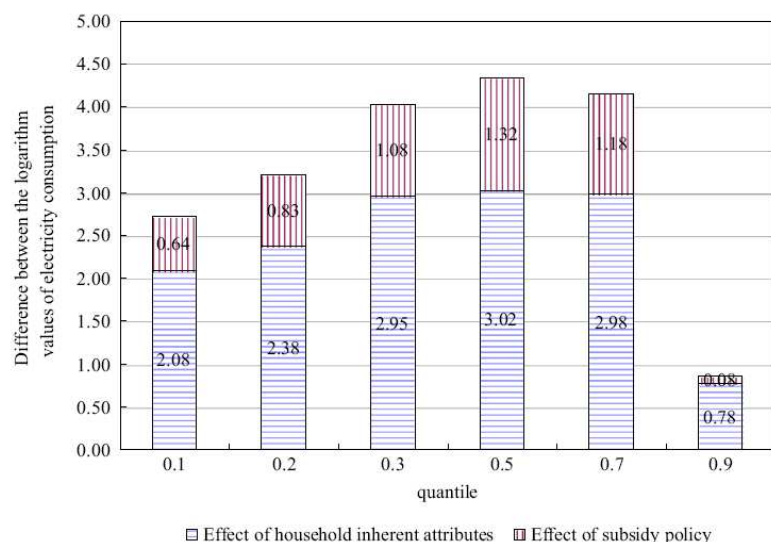


Fig. 3. Impact of household inherent attributes and subsidy policy on electricity consumption in urban areas.

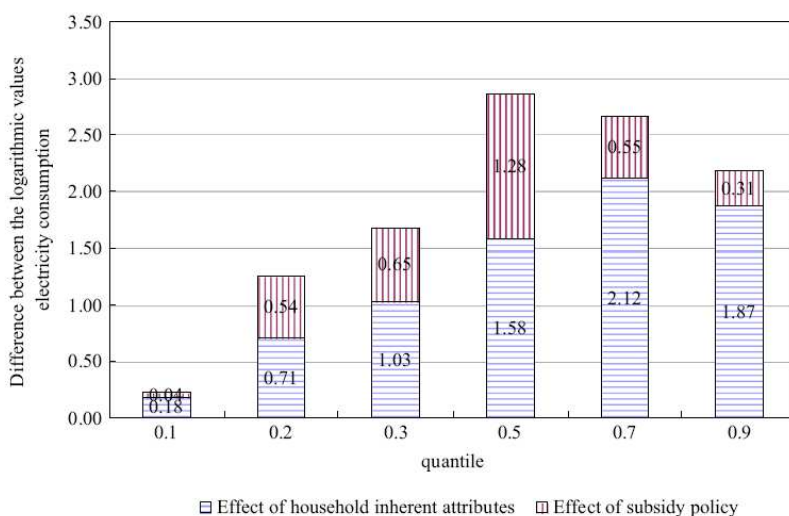


Fig. 4. Impact of household inherent attributes and subsidy policy on electricity consumption in rural areas.

➤ Participant families consume more electricity than non-participant families. With a counterfactual analysis, we disentangle the sources of change in electricity consumption.

- Largely (60%-90%) explained by the **household inherent characteristics**.
- The **impact of the subsidy policy** is more pronounced at the middle.
- Consumer behavior change at the right tail of the urban distribution (rich population) and at the left tail of the rural distribution (poor population) is much less sensitive.

➤ Possible sources of these **rebound effects** associated with the subsidy policy:

- Increasing use of home appliances for a better comfort (direct channel)
- More revenue for indoor entertainment (indirect channel)
- Simply, households are equipped with two TVs! (no replacement condition)

Policy implications

- Energy-efficient policy should **be targeted** to affect different energy consumers :
 - in **urban** and **rural** areas;
 - and **at the tails** of the energy consumption distribution.
- The policy objectives of China's government seem achieved because of increased sales and market share of energy-efficient home appliances.
- However, if not well designed, the subsidy program can lead to an **undesired increase in energy consumption**.
 - An unsatisfied demand on the life comfort can offset the expected energy-savings.
 - Free riding behaviour: subsidize the families that would have purchased appliances anyway.
- Energy-efficiency incentive needs to be complemented with policies aimed at **increasing energy prices**.
 - Ladder electricity price
 - Carbon pricing