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WORKSHOP ON HOUSEHOLD ENERGY CONSUMPTION

Date and Time

2020 March 6th(Friday)9:15~15:45

Location

Presentation Room, 6th floor, 8th Building,
Institute of Economic Research
Aoyama Gakuin University

This workshop is supported by

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THE AIM OF THE WORKSHOP

Household energy saving has been at the top of the energy policy agenda in many countries, and various programs have been introduced to improve the energy efficiency of the residential sector. Despite such efforts, energy saving in the residential sector has not been so successful. According to an estimation by the International Energy Agency (2016), the residential sector accounted for 21% of the final energy consumption worldwide in 2013. One of the main reasons of the slow progress on household energy saving is the lack of knowledge about households' energy use. This workshop is organized to provide a forum for researchers working on the household energy consumption problem to exchange new ideas and discuss recent progresses. We expect that the knowledge available in this workshop is going to be particularly useful for scholars who are aiming to find proposals to improve daily life without increasing energy burden.

ORGANIZER

Shigeru Matsumoto (Aoyama Gakuin University)

Shunsuke Managi (Kyushu University)

Kenichi Mizobuchi (Matsuyama University)

TIME TABLE

2020 March 6

9:15 – 10:00	**Keynote speech by invited speaker** Kenta Tanaka (Musashi University), Shunsuke Managi (Kyushu University) and **Clevo Wilson (Queensland University of Technology)**
10:00 – 10:30	**Kenichi MIZOBUCHI (Matsuyama University)** and Hiroaki YAMAGAMI (Seikei University)
11:00 – 11:30	**Shin KINOSHITA (Ryukoku University)** Economic model of home appliance replacement: Application to refrigerator replacement in Japanese households
11:30 – 12:00	**Jiaxing WANG (Aoyama Gakuin University)** and Shigeru MATSUMOTO (Aoyama Gakuin University)
12:00 – 13:30	Lunch: Restaurant nearby Aoyama Gakuin University
13:30 – 14:15	**Keynote speech by invited speaker** **Professor Jose M. Labeaga (National Distance Education University)**
14:15 – 14:45	Minoru MORITA (Takasaki City University of Economics), Kazuyuki IWATA (Matsuyama University), **Toshi H. ARIMURA (Waseda University)**, Hajime KATAYAMA (Waseda University)
14:45 – 15:15	Shigeru MATSUMOTO (Aoyama Gakuin University) and **Hajime SUGETA (Kansai University)**
15:15 – 15:45	**Mriduchhanda CHATTOPADHYAY (Waseda University)**

Presenters are indicated with **bold font**.

Abstract of the presentation

1. Impact of feed-in-tariff schemes on electricity consumption

Kenta Tanaka (Musashi University), Shunsuke Managi (Kyushu University) and Clevo Wilson (Queensland University of Technology)

Encouraging renewable energy adoption is one of the important and popular policies in developed countries. In particular, feed-in-tariff (FIT) schemes is one of the major policy instruments used to increase the uptake of renewable energy. However, recent studies show that FIT schemes can in fact increase the electricity consumption of households' who have installed solar PV systems. Our study using Australian Bureau of statistics data examines whether FIT does increase electricity consumption. In general, the decision of households to install solar PV is complex. Therefore, we need to pay attention to sample bias issues when estimating the effects of FIT on electricity consumption. In this analysis, we apply the coarsened exact matching technique that controls for endogenous factors which influence the uptake of solar PVs among households. Our results show that FIT schemes indeed increase electricity consumption. We estimate that, on average, when a household selling electricity increases by 1 kWh, the households selling solar increase their total electricity consumption by 0.109 kWhs. The reasons for this are discussed in detail in the paper.

2. Time Rebound Effect in Household's Energy Use: Theory and Evidence

Kenichi MIZOBUCHI (Matsuyama University) and Hiroaki YAMAGAMI (Seikei University)

Time-saving (time-efficient) goods and services are increasingly developed and diffused. Such goods and services increase households' disposable time, and the time saved may be allocated to other activities that consume energy and/or electricity. The present study develops a simple theoretical model and shows a mechanism, called the time rebound effect, by which time-saving goods increase energy consumption through household behaviours. Furthermore, we obtain empirical data for this model through a Japanese household survey. In particular, our analysis shows that the use of dishwashers and Internet order/delivery services for groceries had a significant impact on other household activity time and, moreover, that the time rebound effect occurs for dishwasher use only. However, its impact is very small: the extra electricity usage is at most 2.39% of the daily usage.

3. Conjoint analysis of Japanese households' preferences for renewable energy and the conditions for its diffusion

Shin KINOSHITA (Ryukoku University)

Recently, in Japan and worldwide, renewable energy such as solar power are being promoted as alternative energy instead of nuclear power and fossil fuels. Renewable energy is "green energy," in that it does not emit greenhouse gases and curve global warming.

This research utilizes a conjoint analysis to investigate the conditions that renewable energy is widely used in Japanese households. Especially, this paper examines what kind of renewable energy sources they prefer among four types of renewable energy sources: solar power, wind power, biomass, and fuel cells/private electric generators.

Other conditions are monthly bills, management suppliers, new local employment, benefits for participants (tax credits etc.). Many studies about energy are focused on social norms, which are defined as social behavior, considering sociality and social issues such as climate change. This paper considers non-monetary incentives such as social norms.

A random parameter logit (RPL) model and latent class (LC) model are used for this estimation. RPL model gives the information about the variation of individual preferences. On the other hand, LC model assumes that individuals are divided into several groups, estimates parameters of each group and shows how respondents' attributes and perception cause the variations of individual preferences by a membership function.

From the estimation results, households clearly prefer lower bills. Households evaluate solar power above biomass and do not highly evaluate wind power and fuel cells. They hope that renewable energy electric power plants contribute to local new employment. They prefer major new suppliers to major existing suppliers and do not prefer new small/medium local suppliers. Regarding benefits, households do not respond to monetary incentives and prefer non-monetary incentives. The results conclude that monetary incentives are not always necessary for the diffusion of renewable energy. From a latent class model, preferences are different across households' attributes and perception for energy problems.

4. Economic model of home appliance replacement: Application to refrigerator replacement in Japanese households

Jiaxing WANG (Aoyama Gakuin University) and Shigeru MATSUMOTO (Aoyama Gakuin University)

Energy efficiencies of home electric appliances have been improving year by year, and households can reduce their energy consumption by replacing an old appliance with a new one. Governments have been promoting the replacement of appliances for many years, in order to decrease the energy usage of the residential sector. Indeed, many governments provided subsidies to accelerate the replacement. Nevertheless, previous studies reported that only certain types of households replace their appliances even in the presence of the subsidy program; i.e. other households stick to their old appliances.

If the pattern of use of appliances vary between households, then we expect that the replacement cycle of appliances will vary between households also. Although some households will replace appliances for the sake of energy conservation, other households may pay less attention to energy use during appliance operation and continue to use their old appliances until finally broken. Although many studies attempted to identify early adopters of new energy efficient products, to our best knowledge, no study examines who sticks to old products and how household characteristics are associated with the product replacement. In this study, we propose an economic model to evaluate the impact of household characteristics on the home appliance replacement.

In the empirical section, we use microlevel data from the Survey on Carbon Dioxide Emission from Households (SCDEH). In SCDEH, survey respondents are asked the vintage of their refrigerator (REF). By utilizing information about the vintage distribution of REFs, we examine how family size, age of household's head, and income affect the replacement cycle of REF. Our empirical results reveal that (1) large households replace REF more rapidly, (2) younger households replace REF more slowly, and (3) higher income households replace REF more rapidly.

5. Choice versus non-choice in the demand for energy for residential heating

Professor Jose M. Labeaga (National Distance Education University)

We analyze the discrete-continuous choice that accounts for both the amount of energy used to heat homes and also the choice of fuel with Spanish household data for the period 2006-2008. We depart from the proposal of Dubin and McFadden (1984) and Hanemann (1984) and we make two contributions to the literature on that model. From a theoretical perspective, we prove that there is a subtle but widely overlooked difference between the Dubin-McFadden and Hanemann models, which affects the specification of the continuous choice demand function. From an empirical perspective, while people can continually adjust the amount of heating consumed in their homes if they so wish, for most people most of the time there is no discrete choice of which fuel to use. We develop an approach that implements this observation, and we test the results with those obtained when it is ignored. There are several major innovations in our empirical analysis, which drive to some relevant findings. First, we argue that not everybody is making a choice of fuel and we select the sample accordingly using a proxy for investment to renovate the heating system available in our dataset. This leads us to a sample of those in the market for whom we estimate the discrete choice model and compare it with the models estimated in the full sample and in the sample of those not in the market. We find that individuals in the two subsamples exhibit different preferences and have different sensitivity to prices. Second, we postulate and find inertia is a fundamental determinant of the decision either through unobservables or through observables. All in all, our proposal has important implications for the short and long run price elasticities of energy use.

6. Did the energy efficiency improvements produce the rebound effects in the energy saving behavior?: Evidence from a Japanese household survey.

Minoru MORITA (Takasaki City University of Economics), Kazuyuki IWATA (Matsuyama University), Toshi H. ARIMURA (Waseda University), Hajime KATAYAMA (Waseda University)

Improvements in energy efficiency make the price of energy services cheaper and therefore encourage to increase consumption of energy services. This study estimates the influences of energy efficiency improvements on energy-saving behaviors, using a household survey conducted in a suburb of Tokyo in 2010. Specifically, to test for endogenous problem, the two-stage residual inclusion (2SRI) method, proposed by Terza et al. (2008), is adopted.

In the survey, respondents were asked the extent to which they implement three energy-saving actions regarding room air conditioners: (1) setting the air conditioner temperature at 28 degree Celsius (or higher) in summer, (2) turning off the power when unnecessary, and (3) cleaning the filter at least once or twice a month. We use the answers to those questions as a variable of the energy-saving behaviors. Furthermore, as a variable of the energy efficiency, respondents were asked whether to purchase new air conditioners, which are higher in energy efficiency. The Japanese government has implemented the eco-point program for appliances to promote energy-efficient from May 2009 to March 2011.

The study finds that the households which purchased new air conditioner tend to set the temperature at less than 28 degree Celsius. However, both effects of replacement and additional purchase may be included in a variable of energy efficiency. Thus, we limit a sample size to the household owing only one and perform an estimate again. The result show that there is rebound effect about setting the air conditioner temperature in summer. These findings show the possibility that improvements in energy efficiency inhibit some energy-saving behaviors.

7. Efficiency investment and curtailment action: complements or substitutes

Shigeru MATSUMOTO (Aoyama Gakuin University) and Hajime SUGETA (Kansai University)

Households' energy-saving activities are often categorized into efficiency investment and curtailment action. Although households use these two activities simultaneously, previous studies have analyzed these two activities separately. In this study, we develop an energy-saving model based on a household production framework to show how these two activities are related. We assume that a household allocates time among market work, leisure, and curtailment action. We further assume that the household spends income on purchasing market goods, energy efficiency investment, and energy service. The household receives utility from entertainment activity and energy service but both market goods and leisure time are necessary for entertainment activity. If the household spends time on curtailment action, then leisure time form entertainment activity will be reduced. In contrast, if the household spend money for efficiency investment, then market goods available for entertainment activity will be reduced. With this household production framework, we show that a household can use energy efficiency investment and curtailment action jointly; namely, a household who invest heavily in energy efficiency will spend more time on curtailment action.

In the empirical section, we use microlevel data from the Survey on Carbon Dioxide Emission from Households (SCDEH) to examine the validity of this prediction in a real world setting. SCDDH contains a wide variety of information related to household's energy usage, and both curtailment actions of households and vintage of appliances that households own were surveyed. Using this information, we examine whether the intensity of curtailment action varies between households owning new and old appliances. We show that households using an old television (TV) turn off the main switch of TV more frequently but those using a new refrigerator (REF) adjust the temperature according to the season and avoid overstuffing to maintain cooling efficiency. Furthermore, we show that households installing light emitting diode (LED) lamps control brightness of rooms and those using a new air conditioner (AC) set room temperature higher. Therefore, we observe that respondents jointly use efficiency investment and curtailment action, except in the case of a TV switch-off. This result predicts that the promotion of energy saving products will not hinder the households' voluntary energy saving practice.

8. Valuation of reduced health risks from Indoor Air Pollution and starting point bias: A study of rural Indian households

Mriduchhanda CHATTOPADHYAY (Waseda University)

Health risk related to indoor air pollution caused by the incomplete combustion of dirty cooking energy is salient in households of developing countries especially, in rural areas. Few empirical studies have attempted to estimate the individuals' valuation of reduced health risks related to indoor air pollution in such settings. We contribute to this stream of literature by estimating the individuals' valuation of reduced health risks from hypothetical indoor air quality improvement using the double bounded dichotomous choice model under the contingent valuation method. Concurrently, in this context, we also investigate the potential sources of starting point bias that leads to internal inconsistency in the double bounded dichotomous choice models. For the analysis, we exploit a unique contingent valuation survey data collected from 502 rural Indian households. Our result demonstrates the presence of starting point bias in the form of anchoring effect that leads to internal inconsistency in such models in a developing country setting. In absolute terms, the estimated value of the anchoring effect parameter is approximately 0.22; individuals refer 22% of their willingness to pay to the initially offered bid while responding to the follow-up question. Correcting for this starting point bias and resultant internal inconsistency, the mean willingness to pay per year for the preventive measure from indoor air pollution is estimated to be INR 664.59 (approximately 1% of the annual household income of the surveyed households on average). Assuming that estimated WTP is proportional to the valuation of perceived health risks, this result may denote that rural individuals have a relatively low valuation of reduced health risks from hypothetical indoor air quality improvement; a finding which is validated in the existing literature. Our results further indicate that heterogeneity in the individual-specific factors may result in sufficient variation in estimated mean willingness to pay within the sample.