

# ***HOUSEHOLD ENERGY CONSUMPTION EFFICIENCY AND ITS DETERMINANTS***

David C. Broadstock, Southwestern University of Finance & Economics (China), +86 152 0834 0910, [davidbroadstock@swufe.edu.cn](mailto:davidbroadstock@swufe.edu.cn)  
Jiajia Li, Southwestern University of Finance & Economics (China), 00 86 155 2806 8167, [jiajia\\_li108@hotmail.com](mailto:jiajia_li108@hotmail.com)

## **Overview**

This study focuses on the following research question: “*What are the determinants of energy consumption efficiency in Chinese households?*” The importance of efficiency is obvious in energy saving, pollution reduction, achieving potential health benefits and many other regards. Recent studies, see for example Fillipini and Hunt (2011) and Boyd (2008), develop frontier energy demand models as a way to directly obtain energy consumption efficiency at the same time as describing the nature of the demand function. Due to the general lack of evidence at the household level, it is of great interest to provide an empirical account of the energy consumption efficiency using household data.

## **Methods and Data**

The data used in the study are taken from the China Family Panel Study (CFPS), undertaken by the Institute of Social Science Survey (ISSS) based in Peking University. After cleaning, more than 5000 households across 25 provinces of China remain in the estimation sample. Around 20% of the households are from cities, 20% from towns and the remaining 60% from villages. The dataset contains detailed information on electricity consumption, household income and a range of other household characteristics, including household size, wealth, health, education etc.

Boyd (2008) adopts a desirable theoretical structure in which energy is treated as an input into a production function. In this study it is suggested that for a household the reference point of output is the household wage  $W$ , and that a household will utilize the resources (such as capital,  $K$ , labor,  $L$ , and energy,  $E$ ) at its disposal to maximize this wage. Given the available resources a household will be able to achieve an optimal wage if operating at full efficiency e.g. using all available resources to their maximum potential, or some level of output below this. A slacks based data envelopment analysis is conducted in the first stage to obtain the energy input specific inefficiencies into the household wage function. These estimated efficiency scores are then incorporated into a secondary regression analysis to identify statistically robust determinants of energy efficiency levels, using Bayesian averaging of classical estimators (BACE).

## **Results**

The results reveal a range of significant determinants of efficiency, broadly consistent with factors that might have been considered relevant even before estimation. These include: province/geographical location, family size/structure, ownership of specific household durable items, the scale of inputs into the production function, and lastly wider environmental factors such as socioeconomic homogeneity and the performance of the local economy.

The role of human capital is given special attention, since although it has become a core feature of labor economics and household level studies across many areas of economics, its presence within the energy economic literature appears to be relatively scant. Though intuitive that human capital, measured via years of education, proves a significant determinant of efficiency, this study contributes to the literature by placing an order of magnitude on its importance, as well as demonstrating its important role in both household wage creation and energy consumption efficiency simultaneously.

## **Conclusions**

The analysis provides new evidence on household energy efficiency, with a specific emphasis on the Chinese context. The most immediate information derived from the model is a clear hierarchy of energy consumption efficiency across different household types. What follows from this is a more careful consideration of the true underlying energy consumption efficiency of households than can be found in the existing literature.

## References

- Boyd G., 2008. Estimating the Distribution of Plant level Manufacturing Energy Efficiency with Stochastic Frontier Regression. *The Energy Journal*, **29**, 23-43.
- Filippini M., and Hunt L., 2011. Energy Demand and Energy Efficiency in the OECD Countries: A Stochastic Demand Frontier Approach. *The Energy Journal*, **32**, 59-80.