

Analyzing the energy expenditure function of single-person household

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Overview

Recent increases in income have led to an increase in the number of single-person households, given the high opportunity costs for their lives. In the United States, the number of single-person households, which was only 6.9 million in 1960's, has increased steadily to 34.87 million by 2015. This accounts for more than 10% of the population of the United States, and the increase and change of single-person households is becoming a socio-demographic phenomenon.

The fact that single-person households are composed of diverse classes compared to traditional households and that they have a tendency to pursue convenience and freedom of living means that single-person households show their own consumption behavior. In this study, we tried to provide a policy proposal to the researchers who want to analyze energy policy makers and household types in the residential sector by comparing and analyzing energy expenditure determinants of single-person household and multi-family households.

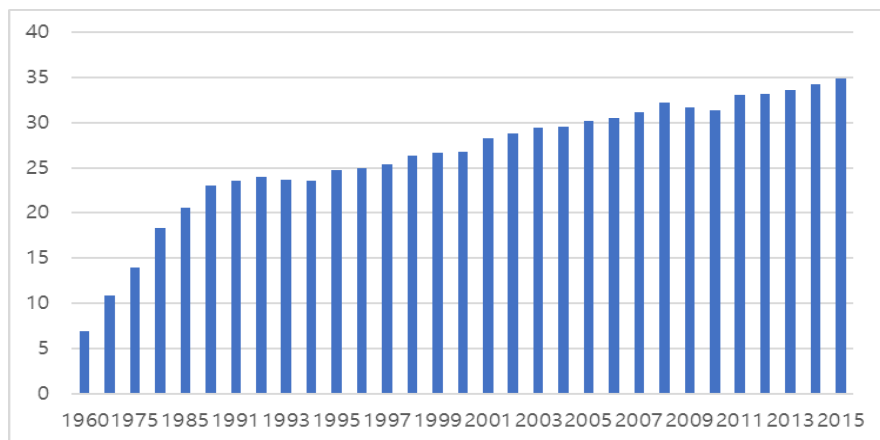


Figure 1. Number of single-person households (in millions)

Methods

In this study, cross-sectional analysis is conducted for factor analysis based on the 2015's 837,499 household statistics provided by IPUMS (Integrated Public Use Microdata Series), then selected socio-demographic factors in previous studies such as education level and age at data extraction as variables. Since each socio-demographic statistic has the potential to interact with each other, the analysis using non-linear binding has been carried out.

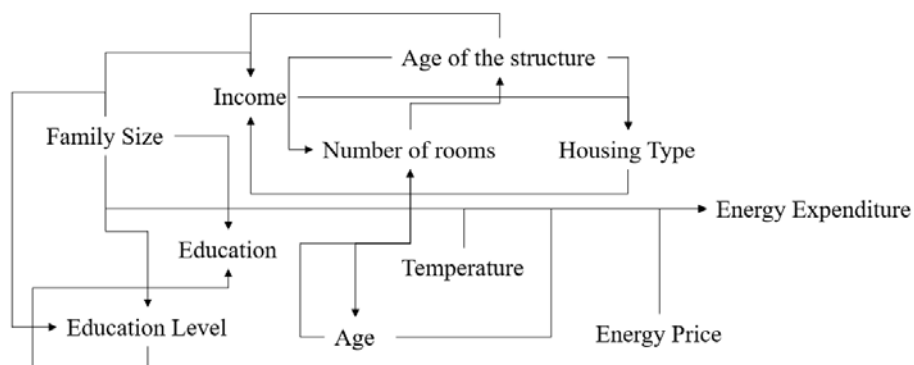


Figure 2. Concept of Non-linear modelling

Energy Expenditure = Age x Education x Income x Age of structure x Rooms x Units in structure x Monthly condominium fee x House value x Heating degree days x Cooling degree days x Gas price x Electricity price x Family size

Equation 1. Non-linear model of single-person household energy expenditure

Results

The results for the nonlinear regression are shown in the table below.

Parameters	Single-Person Household	Multi-Person Household
Intercept	-0.34548	-0.55558
Age	0.02723	0.1078
Education	-0.05154	-0.00567
Income	0.02835	0.04436
Age of structure	-0.04222	-0.04053
Rooms	0.31854	0.29086
Units in structure	-0.14432	-0.11626
Monthly condominium fee	-0.00963	-0.00899
House value	0.05302	0.04167
Heating degree days	0.42841	0.38421
Cooling degree days	0.27948	0.27436
Gas price	0.39008	0.37404
Electricity price	0.0459	0.09048
Family size	0	0.21388

Table 1. Comparison of the parameters between multi-person household and single-person household

There is no significant different trend between single-person households and multi-person households. Except for climate and energy price factors, the number of rooms shows the greatest positive correlation and the housing type such as an apartment / house has a clear negative correlation. However, in the case of single-person households, it can be observed that the age-related factors are considerably lower than those of the multi-family households. It also results in a clearer decline in energy expenditure due to increased education levels and changes in housing types.

Conclusions

The increase in single-person households suggests that energy policy in residential areas will show different patterns in the future. This requires more efficient management for energy policy in residential areas, and the current situation where income is a top priority in the energy assistance policy for the elderly and the poor living alone, such as the Low-Income Home Energy Assistance Program (LIHEAP). In particular, considering the negative correlation between housing types, flexible policy management, such as linking with housing support policies for single-person households, is expected to have a better effect.

Acknowledgement

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