N-003

Analysis of Household Accounts : Regional Characteristics of Household Expenditures

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1. Introduction

The character of household expenditures varies regionally throughout Japan, which is important for policy makers to consider when allocating funds. The model of industrial localization proposed by Krugman is one of the representative studies in economic geography [1]. Studies of characteristics of regional economies in Japan can be improved by data including the national census[2].

However, there are two main problems in the national census of Japan: it is only conducted once every five years, and it is very costly. As a complement to the national census, this paper aims to identify the characteristics of regional economies through the analysis of data from approximately 200,000 families. The data was obtained from the user logs of *Cocomane*[3], a Japanese web service for managing household accounts.

In this study, the prefecture of residence is chosen as the regional variable. For the categories of expenditures, we have focused on transportation expenditures and heating and lighting expenditures, which are expected to best reflect the regional condition.

2. Material and Method

The data from *Cocomane* consists of mainly two parts: the data about the user families and the data of household accounts. For the attribute of the *Cocomane* users, the prefecture of residence is used for analysis. The data of household accounts contains records from February 2009 to April 2012. From each record, user ID, date, item name and price are used as variables.

In *Cocomane*, users categorize the purchased items according to their own classification. “Food expenses,” “daily necessities” and “hobby” are examples of frequently observed categories. In this study, we have automatically extracted transportation expenditures and heating and lighting expenditures using the following keywords: “traffic,” “car,” “fuel,” “heat and light,” “electricity,” “gas” and “water”. Since water bills are included in the category “heating and lighting expenditures” by many users, we also followed this classification.

After extracting records from household accounts, the amount of monthly expenditure in each category is aggregated. Then, the average monthly expenditure of each family is calculated. Finally, the average monthly expenditure in each prefecture is calculated, resulting in the statistic showing the characteristics of the prefecture.

However, there are some problems in the household account data. First, the classification by each user is sometimes unsuitable for analysis in this paper. For example, one user categorized the cost for purchasing a car as “transportation expenditures.” Also, not all users are keeping transportation expenditures or heating and lighting expenditures in their household accounts.

To exclude these cases, records where the price exceeds a threshold 200,000 yen, set in advance, are excluded. On calculating the average monthly expenditures of each prefecture, families which do not keep expenditures in each category are excluded. Since these processes do not still exclude all irregular values, the upper 5% and the lower 5% families in each prefecture are excluded as outlying values.

In addition, relationship between heating and lighting expenditures and temperature is examined. From data published by Japan Meteorological Agency[4], monthly average temperature of a specified month in a city can be obtained. In this paper, temperature of prefectural capital is used as the representative value for each prefecture. Then, these data are connected to the average monthly expenditures of a certain month in each prefecture. Pairs of temperature and expenditure are plotted on a graph.

3. Result

3.1 Transportation Expenditures

The average monthly transportation expenditure of each prefecture is visualized in Figure 1. As shown in the map, monthly transportation expenditure in Tokyo, Osaka and Kyoto are particularly smaller than other prefectures. This map indicates that traffic expenditures in urban areas are smaller than that in the non-urban areas.

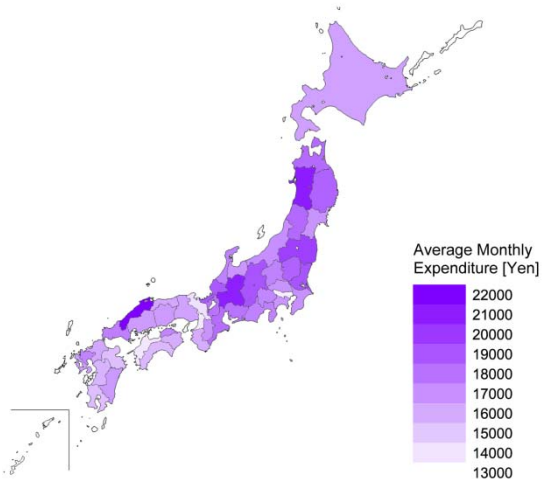

Fig. 1 Average monthly transportation expenditure in each prefecture (created by the author)

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3.2 Heating and Lighting Expenditures

The relationship between monthly average temperature in a prefecture and average monthly expenditure for heating and lighting is shown in Figure 2. The curved line on the graph is the trendline, approximated by a quadratic function.

The graph shows that in low temperature, heating and lighting expenditures increase as it gets colder. In high temperature, expenditures increase as it gets hotter, but not as much as the increase in low temperature. According to the equation of the trendline, heating and lighting expenditures become smallest in 23.87 ℃.

Also, the average monthly expenditure for heating and lighting throughout the year is calculated for each prefecture. The correlation coefficient between expenditure and annual average temperature in each prefecture is -0.601, which indicates that annual heating and lighting expenditures get larger in colder regions.

In summer, it takes more cost for cooling in hotter regions, while in winter, it takes more cost for heating in colder regions. The result of analysis in this paper suggests that the effect of heating cost in winter is significantly stronger than cooling cost in summer.

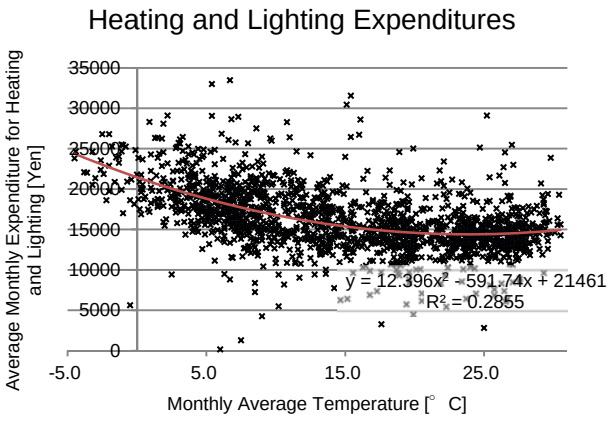

Fig. 2 The relationship between temperature and heating and lighting expenditures (created by the author)

4. Discussion

The result shows that transportation expenditures in non-urban areas are larger than those in urban areas. We will try to explain this by population density.

In a model where population is distributed in lattice, the relationship between population density d and lattice distance l can be expressed by the following equation:

$$l = \frac{1}{\sqrt{d}}$$

In this paper, population density d of each prefecture is obtained from data published by Geospatial Information Authority of Japan[5], and lattice distance l is calculated. The correlation coefficient between l and transportation expenditures is 0.429, which indicates that the cost becomes lower in densely populated areas. Possible explanation for this is that people do not have to move far away in their daily activities.

For heating and lighting expenditures, data from national census also indicates that total annual expenditures in colder prefectures are larger than those in hotter prefectures. To validate the result of analysis in this study, annual heating and lighting expenditures calculated from the analysis and data from the national census are compared. Correlation coefficient is 0.642, which shows the validity of the analysis.

Finally, we will discuss how these results in two categories of expenditures can be used in policy making. First, transportation expenditures of households can be used as a good evidence to decide the allocation of funding in public transportation development. It is expected that the benefit of public transportation for each family would be larger in regions with large transportation expenditures.

Second, the result in heating and lighting expenditures offers significant implication in energy conservation. Heating cost in winter consists greater part in annual expenditures than cooling cost in summer. When we assume that expenditures reflect energy consumption, improvement of energy efficiency in heating is the key to reduce annual energy consumption.

5. Conclusion

In this paper, household accounts of *Cocomane* users are analyzed to identify the characteristics of prefectural economies. First, transportation expenditures in urban areas are smaller than those in non-urban areas. This can be explained from population density. Second, heating in low temperature has more effect on heating and lighting expenditures than cooling in high temperature. As a result, the annual cost in cold regions is larger than hot regions.

Finally, the result of analysis for heating and lighting expenditures is compared with data from the national census. Significant correlation between them proves the validity of the analysis. This suggests that analysis of household accounts, which costs little and reflects the real time condition of the economy, can be a useful complement to the national census.

Acknowledgement

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Reference

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