
Study on the Factor Analysis for the Decline of the Central City Area

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ABSTRACT

To investigate reasons of urban decline issue in Uto city, Kumamoto Prefecture Japan, as well as to confirm the influence of large-scale stores on this affair, a survey on shopping trends was operated from January 2001 until December 2014. Numbers of potential customers coming to the two large-scale retail stores (P store and U store) have been calculated by using Huff model formula. On the other hand, boundary of business regions of both mentioned stores was determined by Gravity model formula. The results show that the center of central shopping area is no longer stayed on the shopping street of the city but shifted about several meters to the side of U store in the South East area. This outcome confirmed the propriety of the hypothesis in which large-scale stores has a considerable affection on urban decline issue.

Keywords: Large-Scale Retail Stores Location Law, Huff model, Gravity model

INTRODUCTION

Together with development of a city, bigger retail store are built on its suburbs to satisfy customers' demands. Undeniably, this benefits suppliers in more profits, as well as brings various selections with reasonable prices to consumers. Nevertheless, opening large-scale retail stores in suburb not only caused environmental problems but also pulled customers out of city center. Since this matter continuously happens for years, it has become one of the reasons of urban decline issue. In order to revitalize activities of city center, Large-Scale Retail Stores Location Law has been enforced since May, 1998. However, there is no evidence showed that shopping street in Uto city, Kumamoto Prefecture Japan, has been prospered even once.

In 1987, the first large-scale retail store with the area of 2,656 m² opened in the North West of Uto city central area, while the second one with 42,321 m² area in the South East was first launched 8 years later. Before the operation of these two stores, about 157 stores in the central shopping area of Uto city have been opened and went on business prosperously. However, after the appearance of the two large-scale stores, number of customers who leave the central shopping area increased over time. Regardless of the implement of Large-Scale Retail Stores Location Law, the potential of central shopping area's revival is still very small. As a result, number of store in Uto city central area now decreased to 104, with downturn business circumstance.

In order to figure out the influence of two large-scale stores on city central areas trading activities, the brief analytical process is as follows: (1) Investigate the number and a distribution of closed down shop in central area by dividing this area in seven blocks. (2) Questionnaire survey on shopping trends of the citizens. (3) Estimate the number of potential customers and business regions boundary of these two stores by using the Huff model and Gravity model formula.

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The result of this study will be used as data for Uto city policy in urban engineering. The analyzed data promises to figure out whether reason of this deny was caused by the operation of two large-scale retail stores or not. Moreover, it possibly becomes a case study for further researches in other city where has similar situation.

METHOD

General Information of Uto City

Figure 1 shows a map which demonstrates geographical positions of this city central area. Uto is a city located in Kumamoto Prefecture on the island of Kyushu, Japan. The total area is 74.17 km². According to the population census implemented in March, 2000, total population of Uto city is 7,048 people, including 3,349 male and 3,699 female, resulting in a density of 28 people/ha. Recent survey in May, 2014, reveals the total population has raised 1.5 times to 11,135 people, including 5,257 male and 5,878 female. After 14 years, the population density here has increased to 44.5 people/ha.

The area covered by dotted line in Figure 1 is a central area with the area of 250 ha. The black line is the position of shopping street and two black circles indicate two large-scale stores which are objects of this study. Distribution of shop in shopping street is shown in Figure 2 and the number of shops in the city from 1987 to 2014 is shown in Table 1.

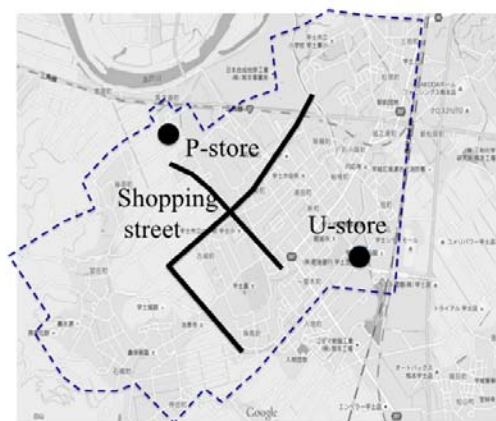


Figure1. Geographical positions Uto city central area

Method of Analysis

In order to figure out the influence of two large-scale stores on city central area's trading activities, number of potential customers and boundary of business regions of these two stores were investigated based on data of a survey on shopping trends was operated in January, 2001. To calculate number of potential customers coming to large-scale retail stores, Huff model formula was used while boundary of business regions was determined by Gravity model formula.

After achieving the outcome of influence level of the two large-scale stores on city central area, factor analysis and Characteristic Analyzing method were also done to figure out reasonable policies for revitalizing activities of Uto city shopping street.

RESULTS

Results of Survey on Vacant Store in Uto City Central Shopping Area

Around 1987s, about 157 stores in the central shopping area of Uto city have been opened and went on business prosperously. However, after two large-scale stores opened in 1987 and 1995, percentage of vacant store increased over time. The rate jumped from 15.0% in 1997 to 22.5% in 2001.



Figure 2. Distribution of the shops in the shopping street

Table 1. Socio-demographic data of Uto city

Time of surveys	Population	Density	Male	Female
March, 2000	7,048	28/ha	3,349	3,699
May, 2014	11,135	44.5/ha	5,257	5,878

Result of Survey on Shopping Trends

As regards the survey on shopping trends in 2001, a number of questionnaire sheets were distributed to residents of Uto city. Among total of 1,704 sheets, 753 of them were collected as reliable responses, resulting in the response rate of 44.12%. The results are shown in Table 2.

As indicated in Table 2, 73.70% ~ 78.10% people in Uto city chose large-scale stores as places to buy daily stuffs. Albeit there are only two large stores, they apparently dominate over 100 stores in the city central areas.

Table 2. Shopping trend in Uto city

Category	Where to buy		
	Large-scale stores	Uto city's central area shopping street	Out of Uto
Fresh food	73.70%	12.50%	4.60%
Clothes	70.50%	3.50%	17.00%
General merchandise	78.10%	6.80%	4.40%

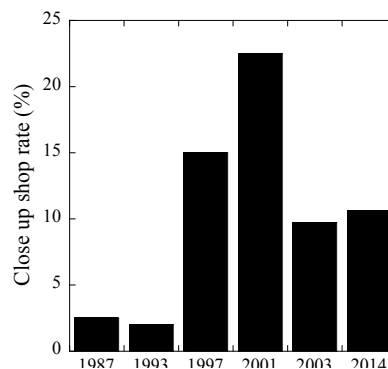


Figure 3. Close up shop rate in the city from 1987 to 2014.

Close up shop rate in the city from 1987 to 2014 is shown in Figure 3. Around 1987s, about 157 stores in the central shopping area of Uto city have been opened and went on business prosperously. However, after two large-scale stores opened in 1987 and 1995, percentage of vacant store increased year after year. The rate jumped from 15.0% in 1997 to 22.5% in 2001.

Calculation of Potential Customers Coming to Large-Scale Stores

To understand more about customers' shopping trend between the two large stores, Huff model formula was used to calculate ratio of potential customers coming to each store. The Huff model formula is described as follow:

$$P_{ij} = \frac{S_j}{T_{ij}^\lambda} / \sum_{j=1}^n \frac{S_j}{T_{ij}^\lambda} \quad (1)$$

$$E_{ij} = P_{ij} \times C_{ij} \quad (2)$$

In which

P_{ij} : Percentage of potential customers from city central area coming to P store and U store

S_j : Floor area of each store

T_{ij}^λ : Distance from the city central area where has the highest population density to each store

λ : Fixed coefficient of Ministry of International Trade and Industry for Huff model formula ($\lambda=2$)

E_{ij} : Number of potential customers from city central area coming to P store and U store

C_{ij} : Percentage of potential customers of P store and U store

Therefore, the percentage of potential customers and the number of potential customers from city central area coming to P store are

$$P_{iP} = \frac{\frac{S_P}{T_{iP}^\lambda}}{\frac{S_P}{T_{iP}^\lambda} + \frac{S_U}{T_{iU}^\lambda}} = 0.27 \quad (3)$$

$$E_{iP} = P_{iP} \times C_i = 2,225 \quad (4)$$

where $S_P=5,656$, $S_U=41,321$, $T_{iP}^\lambda=11^2$, $T_{iU}^\lambda=18^2$

Similarly, the percentage of potential customers and the number of potential customers from city central area coming to U store are

$$P_{iU} = \frac{\frac{S_U}{T_{iU}^\lambda}}{\frac{S_P}{T_{iP}^\lambda} + \frac{S_U}{T_{iU}^\lambda}} = 0.73 \quad (5)$$

$$E_{iU} = P_{iU} \times C_i = 6,015 \quad (6)$$

Calculated results showed that proportion of potential customers coming to P store was 27% while 73% potential customers coming to U store. The number of potential customers from city central area coming to P store and U store are 2,225 people and 6,015 people, respectively.

Next, the business region of two stores were computed based on the gravity model formula derived from Newton's law of gravity as follows:

$$I_p = k \frac{B_p}{X^2} \quad (7)$$

$$I_U = k \frac{B_U}{(m - X)^2} \quad (8)$$

In which

I_p : force of P store

I_U : force of U store

k : constant

B_p : floor area of P store

B_U : floor area of U store

m : distance between P store and U store

When $I_p = I_U$ the follow relation is obtained

$$X = m \frac{\sqrt{B_p}}{\sqrt{B_p} + \sqrt{B_U}} \quad (9)$$

From Eq. (9), the business regions boundary of P store and U store are 482m and 1168m, respectively.

CONCLUSION

According to the shopping trend survey in Uto city, two large-scale stores overwhelmed over hundred stores in the city central shopping area in attracting consumers with approximately 74% people willing to choose these two stores as their regular shopping places. Between these stores, U store seemed to draw more attention than P store since potential customers ratio were 73% and 27%, respectively.

In order to revitalize trading activities of Uto city shopping street, it is necessary to replace some obsolete buildings by modern ones, as well as increase the population density here. Building some new JR stations is also a suitable solution since they help attracting more visitors and enhancing convenience of travelling for customers.

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