Quantitative Analysis of Parking Advantage on Retail Stores in Rural Areas in Japan

Suguru TSUJIOKA [a], Akio KONDO [b], Kojiro WATANABE [c]

[a] *Fuculty of Management and Information Science, Shikoku University, Furukawa, Ohjin-cho, Tokushima, 771-1192, Japan; E-mail: tsujioka@keiei.shikoku-u.ac.jp*
[b,c] *Institute of Technology and Science, The University of Tokushima, Minamijosanjima 2-1, Tokushima,770-8506, Japan;*
[b] *E-mail: kondo@eco.tokushima-u.ac.jp*
[c] *E-mail: kojiro@ce.tokushima-u.ac.jp*

Abstract: Availability of parking is an important factor related to choosing stores when shopping for consumers in Japanese rural areas. The influence of availability of parking on sales power of retailers was measured in this study. In detail, we analyzed the relationship between "the availability of parking of retailers", "car ownership of consumers" and "sales power of retailers". These analyses are based on various national surveys of 32 prefectures which were selected as rural areas from 1997 to 2007. For the analysis, we defined an index of parking advantage as advantages for sales of stores with parking lot compared to stores without parking lot. Comparative analyses were carried out using this index in this study. As a result, we clarified that the parking advantage of retailers decreases year by year. The reason for this tendency is related to the demand for parking which is sufficient in many prefectures.

Keywords: Parking advantage, Sales power on retailers, Motorization

1. INTRODUCTION

1.1 Aim of this study

In recent years, the ratio of cars in modal choice has increased in Japan (Traffic-related Statistical Data, 2011). Therefore, both the location of stores and availability of parking are important for the sales power of retail stores (Goto et al. (1997)). In Japanese rural areas, due to inconvenience of public transportation, consumers tend to select cars as a transportation mode for shopping (Wake et al. 2003). Therefore, availability of parking is important as one of the factors to choose stores for consumers in such areas.

In this study, we measure the influence of availability of parking on sales power of retailers in rural areas of Japan. In particular, we analyze the relationship between "availability of parking of retail stores", "car ownerships of consumers" and "sales power of retail stores" quantitatively. Thus, we can suggest the first guide for retailers to cope with moterization in such areas, if the relationship described above is clarified.

1.2 Previous Studies

There have been a number of studies related to the analysis of car parking and sales power in Japan. For example, Imamura(1994) proposed various methods to calculate the optimal number of parking lots from the point of view of resource efficiency. Izumi et al. (1996) proposed a model to explain the relationship between amount of consumer's purchase and the parking time. Peter et al. (1998) estimated the impact of parking situation in shopping centers

on consumers' store choice behavior. They carried out an on-street interview survey for estimating this. Nakamura et al. (2004) focused the trade-off between the store space and the parking space for retailers. Then, they derived a land use and transportation model to consider this problem.

There have been several studies related to the theme of this study as mentioned above. However, we could not find any study that analyzes the influence of availability of parking on the sales power of retail stores quantitatively. Therefore, we analyze the problem described above. In particular, the purpose of this study is to understand the relationship between parking spaces and sales, which is not a regional case but a general phenomena.

2. ANALYSES DATA, METHOD AND RESULTS

2.1 Target Data

As described above, we analyze the influence of availability of parking on sales power of retail stores in Japanese rural areas. For this analysis, we need a cross-tab table which includes availability of parking and sales figures of retail stores. In this study, we used information from a table of a commerce establishment survey issued by Japanese Ministry of Economy, Trade and Industry. The survey is conducted every 5 years. Therefore, the target years of this study are 2007(the latest survey), 2002 and 1997.

Influence of availability of parking on sales power in rural areas is considered to be stronger than that of urban areas. In rural areas, it can be said that the cohesions of both shopping zones and inhabitable zones is weak. Therefore, motorization in rural areas has increased significantly more than that of urban areas. The cohesion of inhabitable zones can be approximated by the population ratio of DID (Densely Inhabited District). DID is defined as a group of areas which have a population density of 4,000 people per square kilometer. The population ratio of DID in target area R^i is formulated as follow.

$$R^i = \frac{p^i_{DID}}{p^i} \tag{1}$$

where, p^i_{DID}: Population of DID in target area *i*.
p^i : Total population in target area *i*.

Figure 1 shows a correlation between the population ratio of DID and the number of cars owned per person (Hereinafter called *NCP*) in all prefectures of Japan in 2005. As shown in figure 1, prefectures with a small population ratio of DID, where the low cohesion of inhabitable zones can be seen show a large value of *NCP*. Prefectures having low population ratio of DID are crowded at the upper left part of figure 1. These prefectures belong to rural areas, which are the target of this study.

We calculate the national average of the population ratio of DID for the purpose of distinguishing between rural areas and urban areas. Then, we choose prefectures, where the population ratio of DID are less than the value of national average, as target prefectures in this study. Although, the population ratios of DID in prefectures are calculated based on Japanese national census data (1995, 2000 and 2005), the year of the latest census is 2005, unlike the

commerce establishment survey. Due to this situation, we use census data from 2005, 2000 and 1995 in this study.

As a result of the selection process described above, 15 prefectures with a population ratio of DID larger than the value of national average are clarified at 3 points in time in this study. Therefore, we exclude these prefectures and adopt the remaining 32 prefectures as a target of the analysis (Table 1).

Additionally, the sales forms in which people do not need to visit stores (e.g. door-to-door sales, mail-order sales, online sales) are confusing factors for discussion of the relationship between availability of parking and sales power. Therefore, only over-the-counter sales forms are targets of analysis in this study. Sales forms in which people do not need to visit stores flourish in prefectures having a low rate of over-the-counter sales. Therefore, we calculate the rate of over-the-counter sales in the total sales of each prefecture, in order to exclude sales forms with the exception of over-the-counter sales from the targets of this analysis. Then, we calculate the average(μ) and the standard deviation(σ) of the rate of over-the-counter sales for all prefectures. We exclude prefectures which have a rate of over-the-counter sales under ($\mu - \sigma$) from the targets of this analysis. These processes are executed at 3 years (1995, 2000 and 2005) in this study (Table 1).

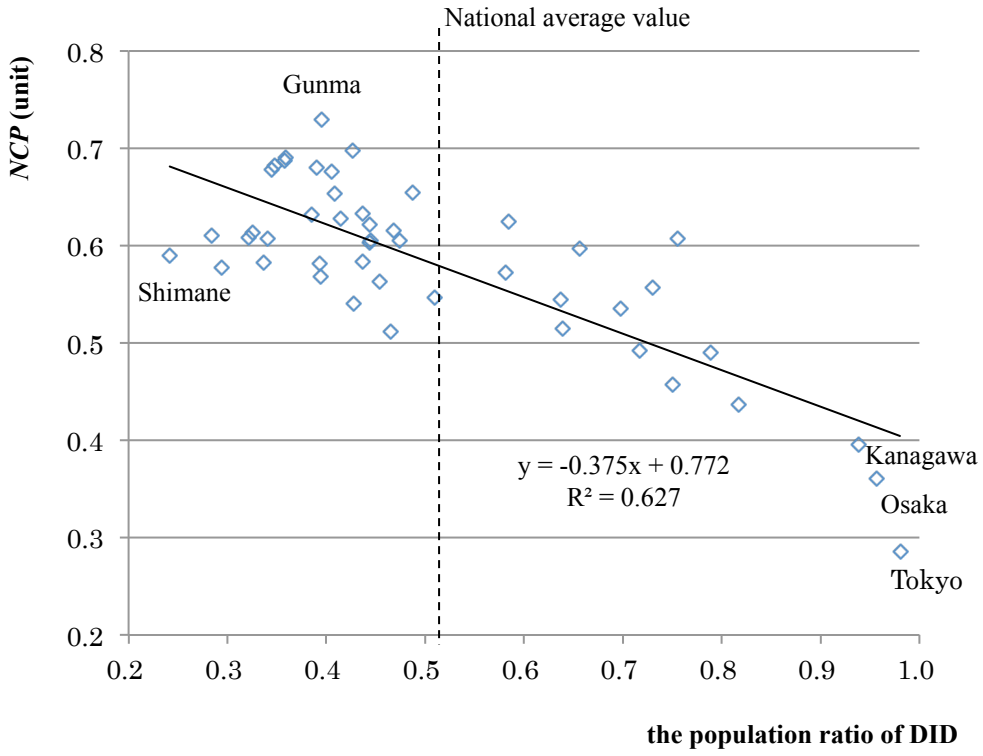

Figure 1. Correlation between
population ratio of DID
and number of cars per person (*NCP*)
of all Japanese prefectures in 2005

Table 1. Population ratio of DID and ratio of over-the-counter sales for each prefecture in Japan.

Note: Prefectures excluded from the analysis are shaded.

(e.g. Tottri is an exclusion from analysis in 2002, but it is target of analysis in 1997 and 2007.)

	Population ratio of DID (%)			Ratio of over-the-counter sales (%)				Population ratio of DID (%)			Ratio of over-the-counter sales (%)		
Prefecture	**1995**	**2000**	**2005**	**1997**	**2002**	**2007**	**Prefecture**	**1995**	**2000**	**2005**	**1997**	**2002**	**2007**
01 Hokkaido	72.2	72.7	73.0	77.4	80.5	82	**26 Kyoto**	81.8	81.5	81.7	73	77.1	76.8
02 Aomori	44.5	45.1	45.4	78	79	82	**27 Osaka**	95.7	95.7	95.7	82.1	80.4	80.8
03 Iwate	29.5	29.5	29.4	79.7	84.6	86.8	**28 Hyogo**	73.4	74.3	75.1	78.8	82.4	85.4
04 Miyagi	56.1	57.2	58.1	81.6	84.5	86.3	**29 Nara**	62.2	62.9	63.9	81	81.7	84
05 Akita	33.2	33.5	33.7	80.5	88.2	86.7	**30 Wakayama**	42.3	39.8	39.4	79	80.3	81.3
06 Yamagata	41.4	41.4	41.5	77	81.5	85.4	**31 Tottri**	30.0	32.1	34.1	75.5	78.6	82.4
07 Fukuoka	37.1	37.6	38.5	82.8	84	85.4	**32 Shimane**	24.7	24.8	24.2	75.3	76.4	77.1
08 Ibaraki	35.0	35.8	35.9	83.3	85.5	85.3	**33 Okayama**	40.9	42.3	43.7	76.8	78.8	79.5
09 Tochigi	40.4	41.2	42.6	78.2	82.6	84.7	**34 Hiroshima**	62.4	62.8	63.7	80	80.8	80.3
10 Gunma	40.6	39.6	39.6	75.5	83.3	83.3	**35 Yamaguchi**	48.1	47.5	47.4	77.9	79.3	84.3
11 Saitama	77.7	78.2	78.9	83	84.4	85.1	**36 Tokushima**	31.5	31.6	32.1	78.8	82.2	83.7
12 Chiba	70.4	70.8	71.7	83.2	84	83.2	**37 Kagawa**	33.9	32.8	32.6	65.2	72.1	77
13 Tokyo	97.9	98	98.0	78.9	82	80	**38 Ehime**	48.5	49.8	50.9	84.5	81.2	83.6
14 Kanagawa	93.3	93.6	93.8	85.3	85.8	85.9	**39 Kochi**	41.9	42.1	42.8	76.5	83.7	81.5
15 Niigata	45.7	46.4	46.8	76.8	79.4	83	**40 Fukuoka**	68.4	69.2	69.8	75.2	80.4	80.8
16 Toyama	39.8	38.3	35.8	78.2	81.7	83.1	**41 Saga**	29.9	27.9	28.4	76.1	80.8	85.6
17 Ishikawa	49.4	48.9	48.8	77.4	88.3	82.4	**42 Nagasaki**	46.4	46.8	46.5	81.4	78.3	80.6
18 Fukui	40.8	40.6	40.6	76.6	84.2	80.4	**43 Kumamoto**	41.2	42.3	43.7	82.2	79.7	82.4
19 Yamanashi	35.3	34.7	34.4	78.6	85.2	86.1	**44 Oita**	44.8	44	44.4	78.8	82.8	84.1
20 Nagano	34.3	34.4	34.8	78.2	79.7	82	**45 Miyazaki**	42.9	43.7	44.4	80.4	82.9	81.8
21 Gifu	41.1	40.1	39.0	81.9	81.6	84.7	**46 Kagoshima**	38.9	38.6	39.3	81.9	83	87.8
22 Shizuoka	57.1	58.1	58.4	75.7	79.9	83.5	**47 Okinawa**	64.7	64.7	65.6	87.6	88.5	92.5
23 Aichi	73.8	74.8	75.5	81	82.8	83.7	**Average (μ)**	50.2	50.4	50.8	79.1	81.9	83.2
24 Mie	40.4	40.4	40.8	77.7	81.1	82.1	**Standard deviation (σ)**				3.7	3.1	2.9
25 Shiga	37.6	42.2	44.5	83.1	82.1	84	**μ -σ**				75.4	78.8	80.3

2.2 Index of Parking Advantage

We define the index of parking advantage (*PA*) as the measure that influences availability of parking on sales power of retail stores. Firstly, for calculating *PA*, we standardize the sales of retail stores in all prefectures. Therefore, we define annual sales per employee (*SpE*) based on the number of total employees and annual total sales of each prefecture. We calculate *PA* using *SpE*. *PA* is formulated as follows.

$$PA^i = \frac{SpE_p^i - SpE_n^i}{SpE_p^i + SpE_n^i} \tag{2}$$

where,

SpE_p^i : Annual total sales per employee of retail stores where parking is available in prefecture *i*.

SpE_n^i : Annual total sales per employee of retail stores where parking is unavailable in prefecture *i*.

Retail stores with a parking lot have an advantage over stores without a parking lot in prefectures with high *PA*. On the other hand, availability of parking is not a cause of advantage for sales in prefectures with low *PA*.

2.3 Relationship between Parking Advantage and the Number of Cars per Person

Figure 2 shows time series variations of *PA* and *NCP*. The values in this figure are average of target prefectures of our analysis. *NCP* has increased year by year. It shows progress of motorization in Japan. On the other hand, *PA* has decreased year by year. In 2007, *PA* shows quite low value of 0.028. Figure 3 shows correlations between *PA* and *NCP* in each year. Contrary to general conception, It shows they are not positively correlated with each other for any year.

It is considered that the need for parking lots at stores by consumers has increased due to progress of motorization. However, these figures show that *PA* doesn't tend to follow progress of motorization.

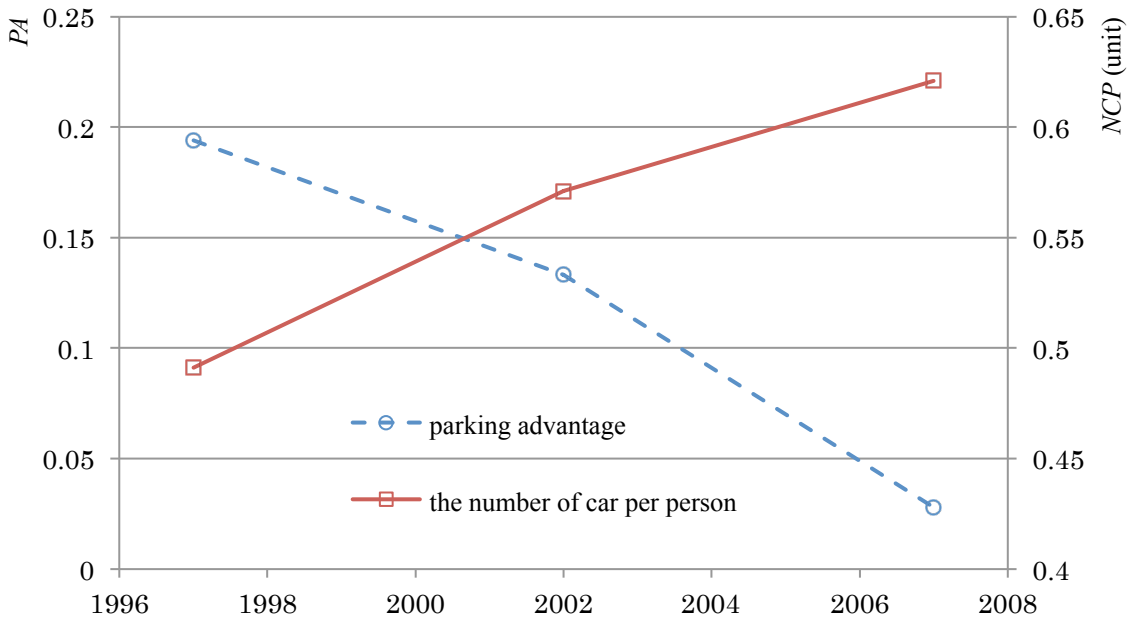

Figure 2. Time series variations of parking advantage(*PA*) and the number of cars per person(*NCP*)

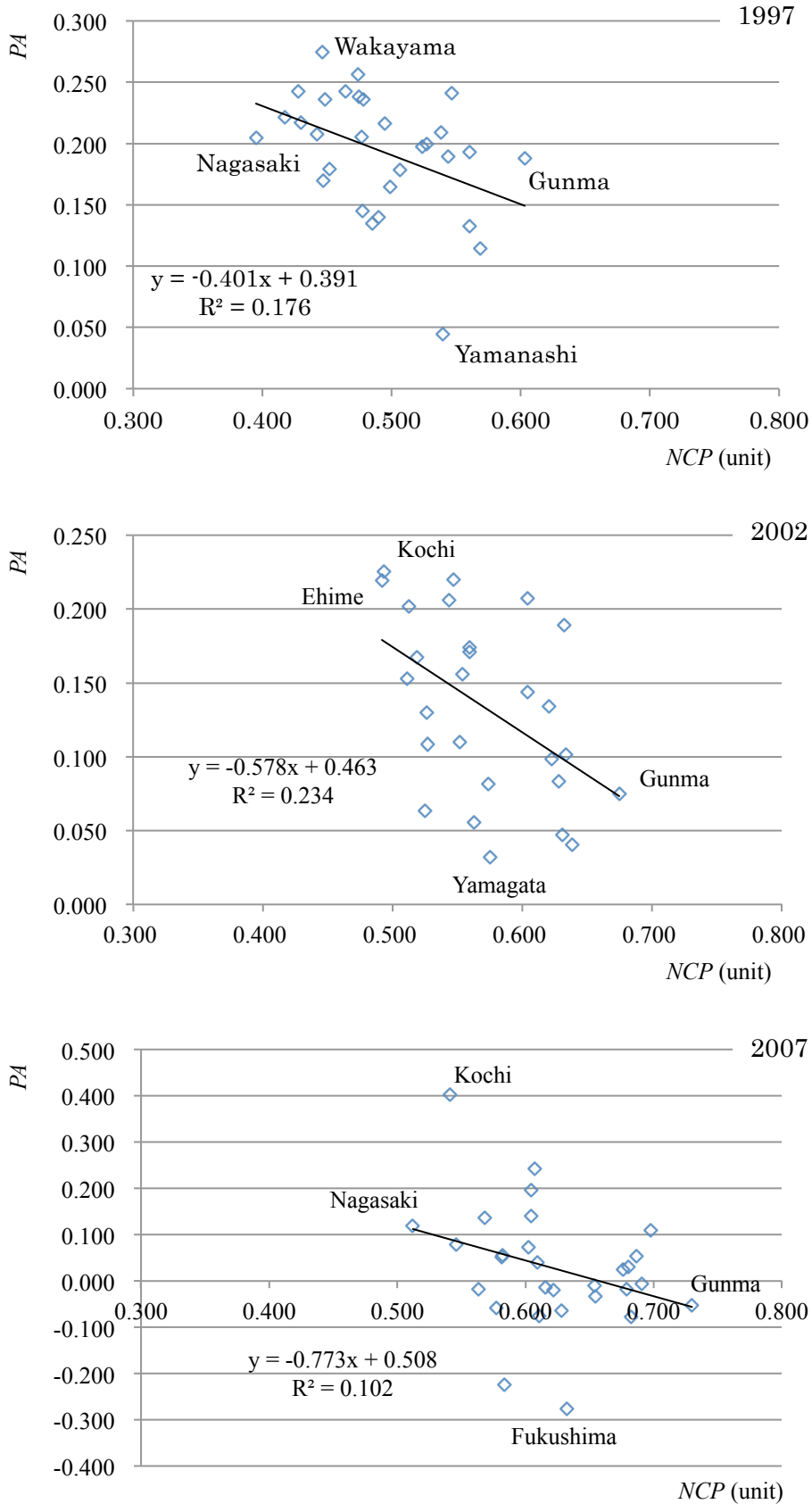

Figure 3. Correlation between parking advantage (*PA*) and the number of cars per person (*NCP*) in each year. (From the top, it is based on survey in 1997, 2002 and 2007.)

2.4 Relationship between Parking Advantage and Prevalence Rate of Parking Lot

It is considered that *PA* is small in prefectures where retail stores have enough parking lots for the *NCP*. We calculate the prevalence rate of parking lots (hereafter called *PRP*) in prefectures for each year. Then, the relationship between *PRP* and *PA* is analyzed. Table 2 shows correlation coefficients of the *NCP*, *PRP* and *PA* in 1997, 2002 and 2007.

Table 2. Correlation coefficients of number of cars per person (*NCP*), rate of parking lots (*PRP*) and parking average(*PA*).

1997	***NCP***	***PRP***	***PA***
NCP	1.000		
PRP	0.686	1.000	
PA	-0.419	-0.666	1.000

2002	***NCP***	***PRP***	***PA***
NCP	1.000		
PRP	0.609	1.000	
PA	-0.486	-0.842	1.000

2007	***NCP***	***PRP***	***PA***
NCP	1.000		
PRP	0.663	1.000	
PA	-0.319	-0.560	1.000

Table 2 shows positive correlations between *NCP* and *PRP* for every year. *PA* is negatively correlated with *NCP* and *PRP*. In particular, *PRP* is stronger than *NCP* in negative correlations with *PA*. Therefore, they suggest that negative correlations between *PA* and *NCP* are caused by *PRP* as an intervening variable. This mechanism can be described as shown in Figure 4. Figure 5 shows correlations between *PA* and *PRP* in 1997, 2002 and 2007.

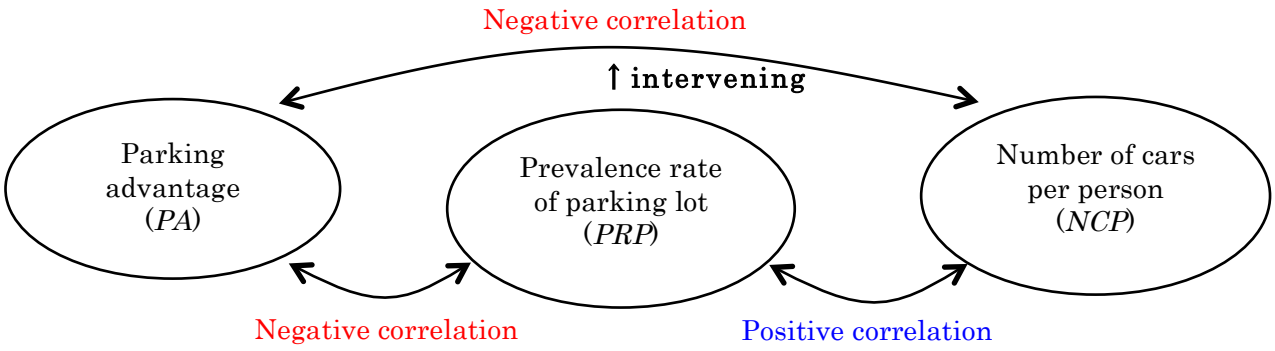

Figure 4. Linkage between indicators

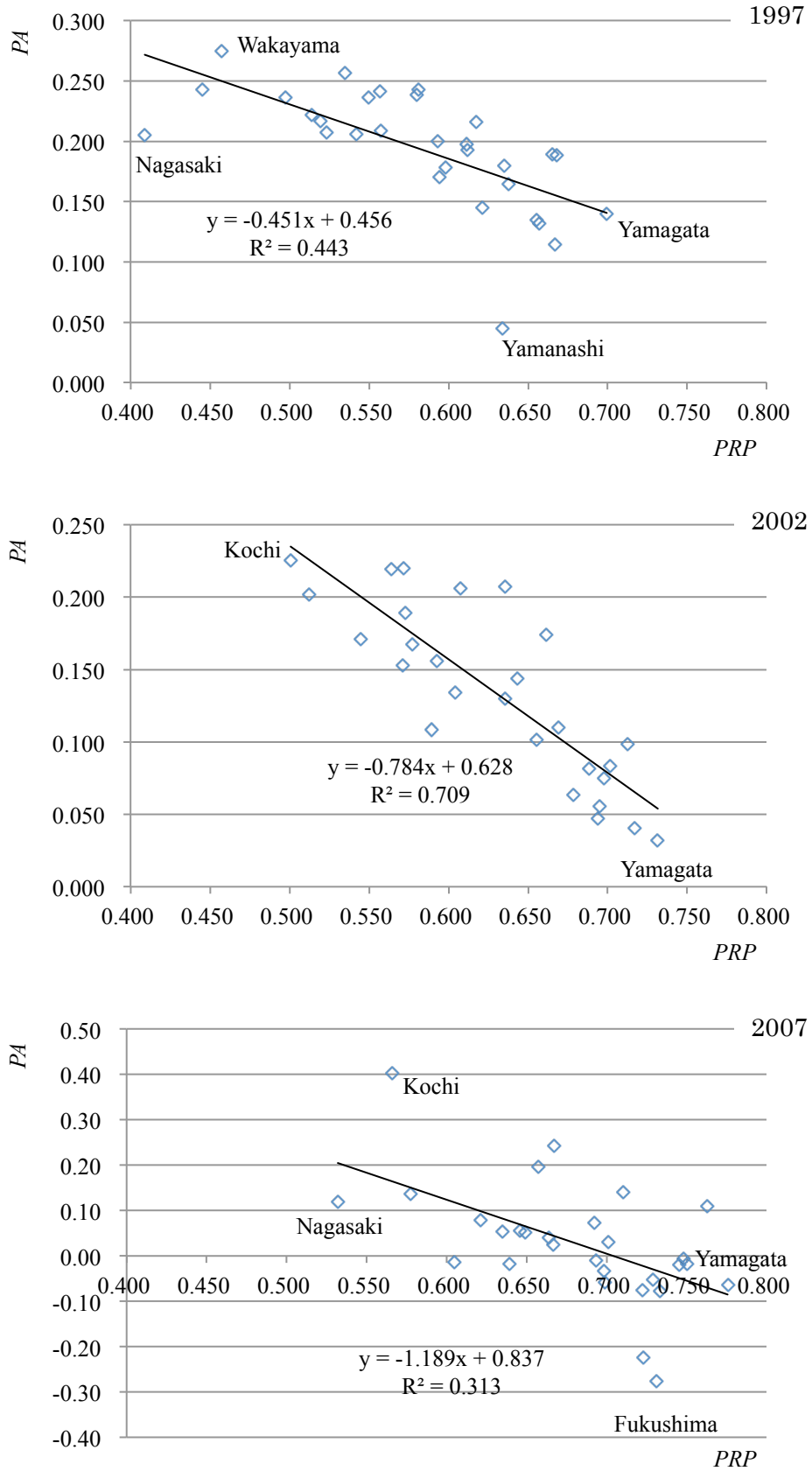

Figure 5. Correlations between parking advantage (*PA*) and prevalence rate of parking lot (PRP) for each year. (From the top, it is based on survey in 1997, 2002 and 2007.)

From Figure 5, following comments can be described. *PRP* is negatively correlated with *PA*, as is the case with *NCP*. Coefficients of *PRP* decrease year by year. Therefore, negative correlation between *PA* and *PRP* grows stronger year by year. Determination coefficients in this figure are larger than those in figure 3 in the 3 years. Therefore, the regression formulas between *PA* and *PRP* have better fitness than that between *PA* and *NCP*.

In conclusion from the results of this study, we can suggest the following.

(1) When a regression analysis for describe *PA* is carried out, *PRP* is more suitable than *NCP* as a predictor in the analysis.

(2) When *PRP* increases, *PA* decreases. If the total space of parking lots in the prefecture is not enough for *NCP*, a retail store with parking lots gains additional sales power. If the total number of parking lots in the prefecture is enough for *NCP*, a retail store with parking lots obtains little additional sales power.

(3) In the analysis based on surveys in 2007 (the lowest chart as seen in Figure 5), many prefectures have a negative *PA* value. In these prefectures, additional sales power due to *PA* is little. Consumers decide the retail store to shop at depending on other factors (e.g. variety of goods, service quality, etc). Therefore, the situation tends to turn from stores with parking lots have advantage to stores without parking lots.

(4) If there is timing divergence between progress of motorization (i.e. increasing *NCP*) and adaptation of retail stores to motorization (i.e. increasing *PRP*), it is considered that *PA* will be high values. *PRP* increases in a similar way as that of *NCP* for every 5 years from 1997 to 2007 (Table 2). Therefore, we can see that there is a tendency that retail stores with parking lots obtain little additional attractiveness due to availability of parking. From an economical point of view, this can be said to be “the efficient situation”. This trend improves year by year. Almost half of the prefectures in Japan (48%) lost parking advantage in 2007.

3. CONCLUSION

In this paper, the influence of parking availability on sales power of retailers was analyzed in Japanese rural areas. For the analysis, we proposed an index of parking advantage. Using the index, advantages of sales of stores with parking lots compared to stores without parking lots were analyzed. As a result, we found that parking advantage of retailers decreased year by year. In addition, about half of retail stores lost parking advantage for sales in 2007. The reason for this situation is because the parking needs in many prefectures are sufficient. Quantitative analysis of the relationship between parking lot and sales power was carried out and discussed. This is main result of our study.

In future research, we need to consider policies and specific actions for parking lots. For example, parking lots are essential to stores near the roadside. In the future, we aim to consider policies to use communal parking lots and ascertain a calculation method of optimum the number of parking lots.

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