Purchasing Power Reflecting Movement Data

Abstract
Statistically processed transport IC card data has much potential to improve customer service. However, attempts to combine IC card data with other statistical data are not fully implemented. In this research, we analyzed ability to use IC card data as marketing data by analyzing statistical processing of information such as movement data held by IC cards and various statistical data from outside the company.

In this research, by using statistical processing of IC cards, indexes indicating consumption possibility of individual stations were created.

Keywords: Transport IC card, Consumption potential indicator

1. Introduction
Statistically processed transport IC card data has much potential in areas such as improving customer service. Various analyses using transport IC card data has been implemented up to now, but sufficient attempts have not been made at analysis combining transport IC card data with other data. In this research, we statistically processed transport IC card data and implemented analysis in combination with public data to study use as marketing data.

In this research, we created indicators of consumption possibility of individual stations by using statistically processed transport IC card data. There are various types of indicators, but in this research we developed a prototype model that estimates by time period and weekday/weekend through matching of statistically processed transport IC card data and various statistical data from outside the company using a data fusion method. Specifically, we estimated income distribution of passengers using statistically processed transport IC card data and various statistical data, multiplied that by the number of visits, and identified purchasing power of individual stations to create an indicator of consumption potential. This indicator can be classified by various passenger attributes such as sex and age as well as temporally such as by weekday/weekend and time of usage. In this research, stations were limited to the five stations of Kichijoji, Shinjuku, Nakano, Kokubuji, and Tachikawa on the Chuo Line in order to create the indicator, but by expanding the stations it applies to in the future, we can expect it to be used as a tool for developing business strategies.

2. Definition and Image of Consumption Potential Indicator
In this research, we define consumption potential indicator as “an indicator expressing purchasing power of visitors and residents, accumulated at individual stations”. Specifically, considering the area around a station as a marketing area, it is an indicator that expresses the level of prominence of total income of the area’s residents and visitors compared to that of other stations.

Fig. 1 Definition of Consumption Potential
Fig. 2 Image of Consumption Potential

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3. Steps in Creating Consumption Potential Indicator

A consumption potential indicator was created by the following three steps. In step 1, we extracted from transport IC card data the segment of visitors who stay 15 minutes or more in each station according to their departure station by sex, age, and time period. In step 2, we estimated income expectation value according to station of residence by sex and age for visitor segments extracted by sex, age, and time period in step 1 and for the aforementioned segment of visitors who stay 15 minutes or more extracted from public statistical data. In step 3, we multiplied the visitor segment extracted by sex, age, and time period in step 1 by income expectation value to calculate expected revenue value accumulated in the arrival station and calculate consumption potential indicator with that value for the model station as 100.

3.1 Data Extraction (Step 1)
From statistically processed transport IC card data, we extracted as the data of visitor segments by departure station the departure station information of people who visited the model station and the number of those people, broken down by sex, age, and time period according to their departure station.

3.2 Income Estimation of Visitors (Step 2)
We estimated the income of the segment of visitors to the five applicable stations necessary for calculating consumption potential indicator. That estimation value is calculated as income expected value as shown in Fig. 3.

3.3 Calculation of Consumption Potential Indicator (Step 3)
By multiplying the income estimation values for each visitor segment and departure station calculated in steps 1 and 2, we calculated expected revenue values by individual stations, thereby calculating consumption potential indicators.

\[ I_i = \frac{R_i}{R_{Model}} \times 100 : R_i = \sum c_{a,s,g} r_{a,s,g} \]

- \( I_i \) = Consumption potential indicator of station i
- \( R_i \) = Expected revenue value of station i
- \( R_{Model} \) = Expected revenue value of model station
- \( c_{a,s,g} \) = Number of visitors to station i with a as departure station, s as sex and g as age
- \( r_{a,s,g} \) = Expected income value of visitor segment of sex s and age g with a as departure station
4. Results of Consumption Potential Indicator Calculation and Verification of Consistency

4.1 Calculation Results
Expected revenue was largest at Shinjuku Station with a large visitor segment, and the station’s consumption potential index was 320.5, putting it far ahead of the other four stations.

The index is separated by resident and visitor segments, but Shinjuku has a small number of residents and relies heavily on the visitor segment for consumption. Conversely, the index for Kokubunji was 71.9, the smallest of the five stations, but it has the most consumption by residents of the five stations at 49.6.

4.2 Actual Sales Amount and Verification of Consistency
We verified consistency of the consumption potential indicator with annual sales amount within 1 km of the stations. The indicator expresses potential consumption by station users (visitor and resident segments), so we plotted the relationship between annual sales around the station and the consumption potential indicator. Very high correlation was seen between the two (coefficient of determination (square of correlation coefficient) was 99.3%). We thus assume that the indicator created in this research appropriately reflects purchasing power level of the individual stations.
5. **Classification Analysis of Indicator**

5.1 **Analysis by Time Period**

We demonstrated the results of analysis with the consumption potential indicator separated into the four time slots of morning, afternoon, evening, and night. In general, the visitor segment increased in afternoon or evening for all five stations, with consumption potential becoming the maximum then. Potential was about the same from afternoon to evening for all five stations. While the difference was slight, potential was maximum in the evening at Shinjuku and in the afternoon at the other four stations.

5.2 **Analysis by Station**

Fig. 7 shows a map of the size and location of consumption potential indicators classified by departure station. The individual circle graphs show the share and scale of consumption potential at the five stations. By performing classification analysis by station, it is possible to classify what consumption potential is brought to an arrival station from which departure station.

6. **Conclusion**

In this research, we created a consumption potential indicator that matches transport IC card data with station user income information and the like. This indicator has been created as a prototype, so issues still remain such as improving its accuracy. At the same time, by expanding the applicable stations and periods, we believe that expansion of details analyzed will be possible.

**Reference:**

1) Ministry of Internal Affairs and Communications, 2013 *Housing and Land Survey*.

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