RESIDENT VALUATION OF TRANSPORT AND OTHER INFRASTRUCTURE USING SUBJECTIVE CRITERIA: A COMPARISON OF TWO JAPANESE CITIES OVER TIME

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Abstract

This research uses resident valuation of transport and other infrastructure with an original survey method using virtual housing prices as the evaluation criteria for two different Japanese cities at roughly 19 year intervals for both cities. The studies were carried out in the Japanese cities of Oyama, Tochigi prefecture in 1982 and 2001 and in Toride, Ibaraki prefecture in 1983 and 2002. A structured questionnaire was distributed to residents asking to assess current housing conditions and the surrounding environment of the respondents. This was combined with the valuation of a hypothetical house in relation to isolated criteria about transport and other infrastructure conditions as well as livability to derive parameters for each of the criteria. The survey results demonstrate possibilities for a unique approach to develop a convenient survey with comprehensive indicators to evaluate transport and other infrastructure. The survey results demonstrate a high degree of stability for each location across an extended period of time.

Keywords: Transport; Infrastructure; Survey; Original methods
Topic Area: E3 Valuation of Internal and External Benefits/ Costs

1. Introduction

Housing prices can serve as useful indicators to reflect the effect of infrastructure development. Although various methods are available to measure the effect of various infrastructure improvements on housing prices, many of the methods are time-consuming and data intensive. This study quantifies the effect of transport and other infrastructure development using a questionnaire asking residents to value virtual houses compared to their current house of residence.

The benefits of infrastructure can be broadly divided into disaster mitigation, economic development, and enhancement of living standards. Infrastructure also includes a variety of categories including roads, dams, and river improvement. The large scale of

infrastructure and the enormous amount of capital investment required for infrastructure projects make it difficult to assess the value of infrastructure investments.

2. Methods

Infrastructure development standards include individual projects and the quantity of existing stock on a material basis. Such information is commonly used to assess infrastructure levels and provide figures to check the progress of infrastructure development against. The benefit of such quantification allows for various comparisons across space (regional, local, national, and international) and time (historical and future projections) and can also easily be translated into monetary terms for financial analysis. Quantification is also convenient for setting various targets as well.

However, such standard methods fail to adequately evaluate aspects such as the economic effects, rate of utilization, satisfaction, and other aspects resulting from infrastructure development. Also, quantification does not allow for easy comparison across various types of infrastructure, such as transport infrastructure and disaster mitigation projects.

This study assumes that the standard of infrastructure development is reflected in the evaluated price of housing. A survey is carried out for respondents to price similar hypothetical houses with different levels of infrastructure development. Respondents price house “A” based on the categories: 1) housing space, 2) proximity to the station, 3) access to shopping facilities, 4) commuting time, 5) surrounding roads, 6) urban landscape, 7) availability of parks, 8) welfare facilities, 9) availability of disaster evacuation areas, 10) environmental pollution risk, 11) proximity to rivers, 12) danger of flooding, 13) proximity to schools, and 14) proximity to hospitals. Respondents are asked to price house “A” which includes ideal conditions for all the categories above. Against this, the respondent is asked to price hypothetical houses “B to O” which are similar to house “A” except that they are lacking in one of the 14 aspects mentioned above. These results are used to come up with a specific monetary value of the above. Cramer’s contingency coefficient is used to establish a connection between the standards of development and the evaluations obtained. The results of the questionnaire were also used to derive parameters for each of the aspects comprising the valuation of a hypothetical house.

The estimation of the individual’s valuation of housing for infrastructure development levels is defined as the function shown in equation (1) below.

$$V = \sum_{l} \theta_l a_l + M \qquad \cdots \quad (1)$$

V : housing value derived from infrastructure development

l : category of infrastructure development

θ_l : parameters for each category

a_l : level of infrastructure development

M : items other than infrastructure that contribute to housing value

When the housing valuation V ' is set as the decline in infrastructure development standards from a_j to a_j'for category j and the decline in housing value is set as $\triangle m$, this relationship can be defined as equation (2).

$$V - V' = \triangle m = \theta_j (a_j - a_j') \quad \cdots \quad (2)$$

This relationship is used to evaluate the parameters. The parameters obtained express the change in housing prices due to changes in infrastructure development and the larger this value is, the larger this category is valued by the evaluation and has a greater effect on the satisfaction with the level of development.

3. Survey

The studies were carried out in the Japanese cities of Oyama, Tochigi prefecture in 1982 and 2001 and in Toride, Ibaraki prefecture in 1983 and 2002. Questionnaires were passed out to residents and retrieved by return mail (see Table 1).

Table 1. Survey Implementation

Location	Oyama, Tochigi		Toride, Ibaraki	
Year	1982	2001	1983	2002
No. Distributed	250	297	569	642
Retrieval rate	100%	54.88%	93.20%	67.10%

Table 2. Survey Results

Improvement Categories	Oyama					Toride				
	Proportion of total value					Proportion of total value				
	1982 (10,000 yen)	2001 (10,000 yen)	1982 (%)	2001 (%)	Proportion 1982 / 2001	1983 (10,000 yen)	2002 (10,000 yen)	1983 (%)	2002 (%)	Proportion 1983 / 2002
Average valuation of hypothetical house	3,496	3,522	100	100	1	4448	4454	100	100	1
Increase of floor space	57.80	50.70	1.65	1.44	1.15	66.70	52.70	1.50	1.18	1.27
Time to station	50.70	36.80	1.45	1.04	1.39	53.60	40.80	1.21	0.92	1.32
Time to shopping area	45.90	29.90	1.31	0.85	1.55	46.70	34.80	1.05	0.78	1.34
Commuting time	21.00	16.20	0.60	0.46	1.31	20.40	14.20	0.46	0.32	1.44
Surrounding roads	623.00	588.00	17.82	16.70	1.07	595.00	542.00	13.38	12.17	1.10
Urban planning	582.00	408.00	16.65	11.58	1.44	549.00	428.00	12.34	9.61	1.28
Recreational parks	472.00	404.00	13.50	11.47	1.18	441.00	333.00	9.91	7.48	1.33
Welfare facilities	-	521.00	-	14.79	-	-	336.00	-	7.54	-
Evacuation facilities	543.00	551.00	15.53	15.64	0.99	534.00	424.00	12.01	9.52	1.26
Waste treatment facilities	-	809.00	-	22.97	-	-	780.00	-	17.51	-
River development	409.00	365.00	11.70	10.36	1.13	410.00	358.00	9.22	8.04	1.15
Flood mitigation	779.00	816.00	22.28	23.17	0.96	805.00	768.00	18.10	17.24	1.05
Proximity to schooling	-	39.70	-	1.13	-	48.70	42.70	1.09	0.96	1.14
Proximity to medical facilities	-	27.80	-	0.79	-	24.70	25.20	0.56	0.57	0.98

The results of the survey are summarized in Table 2 (in constant prices). The results for both cities indicate the relative stability of the method, although new categories were added in the more recent surveys.

For Oyama city, the evaluation of the infrastructure development shows a minor increase. However, the valuation is stable despite the addition of new categories. For accessibility, the valuation relatively increased as a weight of the total in recent years. This also coincides road improvements in Oyama city over the years between surveys. The road extension increased 30% from 920km to 1160km and road improvements increased from 35% to 60%. These investments are likely reflected in the valuation results.

For Toride city, the valuation results are quite similar despite the 18 years between surveys. The relative order and valuation of the various infrastructure critieria is also relatively stable. The individual values attached to each criteria has declined. This may indicate that as infrastructure becomes more developed, residents place a lesser value on its importance or take it for granted.

4. Conclusion

The results of the survey demonstrate a possible approach to the development of integrated evaluation methods for infrastructure development using the pricing of hypothetical housing with varying levels of infrastructure development. The survey method demonstrates a high level of stability over time. However, the two cities examined underwent drastic changes in the level of infrastructure development over the period of roughly two decades. The survey results indicate a shift in values among the criteria applied to the evaluation. Also, for each of the cities, the values varied more

within cities, depending on the proximity to the central business area, rather than between the two cities.

References

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