Relationship between Rate of Vacant Houses and Rate of Houses below Exemption Point of Fixed Asset Tax in Japan

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Abstract

In recent years, the issue of shrinking cities has been under discussion in many countries. One of the problems caused by urban shrinking is the emergence of vacant houses and vacant land, and this aspect is receiving increasing academic and political attention in Japan. The factor of vacant houses has been underscored in many previous studies, but there has been little analysis of the vacancy rate and its factors from the point of view of maintenance cost. Vacant houses that have reached the end of their life span are abandoned for long periods because of high reconstruction and demolition costs or because of low maintenance costs, including special exemption from the fixed asset tax. Therefore, the vacancy rate may be high in areas with many houses whose assessed value for the fixed asset tax is less than the tax-exemption point. Analysis reveals a positive correlation between the rate of vacant houses and the rate of houses below the tax-exemption point of the fixed asset tax. In addition, a spatial lag model explaining the vacant house rate and the rate of houses below the tax-exemption point is a significant result.

Keywords: urban shrinkage, vacant houses, fixed asset tax, exempted houses, only aged single households

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1. Introduction

In recent years, the issue of shrinking cities has been under discussion in many countries. The causes of urban shrinkage vary by country. For example, in Europe and Australia, the cause is the decline of the coal and steel industries, which were the major industries in cities; in the United States, the cause is the decline of central urban areas due to suburbanization; in Japan, many studies have focused on population decline due to the decreasing birth rate and aging population. One of the problems caused by urban shrinking is the occurrence of vacant houses and vacant land. The existence of unmanaged houses is an undesirable situation in terms of the landscape, crime, and disaster prevention.

Numerous studies have focused on the generation factors behind vacant houses and vacant land. Here Newman et al. argued that the vacant lands in American cities are related to the expansion of the administrative districts of cities, whereas the vacant houses are related to the economic conditions of the cities. Similarly, Newman et al. discussed the relationship between vacant houses and urban elasticity (index of the expansion of urban boundaries). Yoo and Kwon conducted a cluster analysis using social and real estate-related variables, such as the ratio of vacant houses and the ratio of elderly people in 230 local governments in Korea. The results indicated that the ratio of elderly people in rural areas was related intrinsically to the ratio of vacant houses. Park conducted a multilevel logistic regression analysis to clarify the factors that led to the emergence of vacant houses in Daegu City, South Korea. Here, the model for housing factors indicated that the probability of vacancy was related to land prices and the number of vacant houses in the neighborhood. Alternatively, the model for regional factors indicated that only population decline and the ratio of old houses were important variables.

The issue of vacant houses is also receiving increasing attention in Japan from both academics and policy makers. According to the 2018 Housing and Land Survey, the ratio of vacant houses to total houses in Japan was 13.6%. This value was higher than that of other countries, and in 2014, the Promote the Vacant House Property Management Special Measure Act was enacted to initiate measures against unoccupied houses that are managed inappropriately.

Past studies on vacant houses in Japan have analyzed mainly the distribution of vacant houses in specific cities and regions, constructing specific models to estimate the rate of unoccupied houses. For their part, Kanamori, Ariga, and Matsuhashi estimated the rate of vacant houses in the Housing and Land Survey using multiple regression analysis. Other studies used various methods to ascertain the regional distribution of vacant houses, including a study based on the data of closing tap water in Utsunomiya City and another based on the survey data of vacant houses in Utsunomiya City. These studies targeted data held by specific municipalities, which are generally difficult to obtain without the cooperation of the municipality.

Other methods adopted include the use of deep learning methods to predict the occurrence of vacant houses using image data and the nationwide building point data (data covering the use and number of buildings nationwide) provided by Zenrin Co., Ltd., which were used to determine the distribution of vacant houses by defining the difference between the number of households in small areas in the national census and number of houses classified as vacant in the building data. In fact, the method of estimating the ratio of vacant houses using building point data is potentially highly useful as the data are available on a nationwide basis. However, it is difficult
to ascertain or estimate the distribution in terms of whether the vacant houses were generated in the process of a sale or a lease, and to determine which are not being managed properly. Statistics that pertain to the number of vacant houses according to their status must be confirmed by the Housing and Land Survey of the Ministry of Internal Affairs and Communications; however, in these surveys, when no response survey slips can be obtained, the surveyors often judge whether the houses are vacant based on their appearance, and many have proposed that the ratio of vacant houses has been largely overestimated.\textsuperscript{15}

The factor of vacant houses has been highlighted in many previous studies. In a model for estimating the vacant house rate, Kanamori, Ariga, and Matsui\textsuperscript{9} showed that the vacancy rate increases with the number of single-person households of people aged 65 years or older. Moreover, there are many cases in which residents are not appropriately disposed of after moving or dying.

By contrast, there has been little analysis of the vacancy rate and its factors from the point of view of maintenance cost. The housing market model proposed by Goodman\textsuperscript{16} explains that vacant houses that are withdrawn from the market are abandoned when the demand for housing shrinks, and the price level falls below the operation costs. Meanwhile, Yukutake\textsuperscript{17} adopted Goodman’s model and noted that in the housing market in Japan, vacant houses that have reached the end of their life span are abandoned for long periods because of high reconstruction and demolition costs or because of low maintenance costs, including the special exemption from the fixed asset tax. Therefore, the vacancy rate may be high in areas with many houses whose assessed value for the fixed asset tax is less than the tax-exemption point.

For the purpose of imposing the fixed asset tax, each municipality in Japan holds a ledger that describes the location, use, material, age, and appraised value of taxable houses in the municipality. The Ministry of Internal Affairs and Communications publishes the number of houses exempt from the fixed asset tax in each municipality based on this ledger. Here, the tax-exemption point is set at 200,000 yen, and when the remaining amount (tax base) after the depletion due to depreciation and the deduction according to the tax law becomes less than the tax-exemption point from the appraised value at the time of construction, the property is not subject to taxation.

The purpose of this study is to clarify the relationship between the rate of vacant houses and the rate of houses below the tax-exemption point of the fixed asset tax. For this purpose, a spatial lag model (SLM) is used to explain the rate of vacant houses in an area by variables such as the rate of houses that are below the tax-exemption point. In addition, the characteristics of houses (material, age, and area) in places with high rates of houses below the tax-exemption point are clarified.

2. Materials and Methods
2.1 Data description
We targeted the number of tax-exempt houses (appraised value of 200,000 yen or less) in each municipality in 2018 in the survey on fixed asset tax published by the Ministry of Internal Affairs and Communications of Japan. The tax-exempt houses in the survey are classified according to the building structure (wooden or non-wooden) and building use (dedicated housing, combined housing, or condominium). For the number of houses below the tax-exemption point, we used the total number of exclusive houses, apartment houses and dormitories, combined houses and residential parts (wooden houses), and houses and apartments
(non-wooden houses) that were below the tax-exemption point in the survey on fixed asset tax in 2018.

The Housing and Land Survey is administered every five years to obtain official statistics on the vacant houses across Japan, with the most recent survey being from 2018. The classification of vacant houses in the survey includes secondary houses, such as villas, temporarily vacant rental houses, temporarily vacant houses for sale, and “other” vacant houses. The houses in the “other” category are often difficult to classify and are generally categorized according to whether or not they are deteriorated or damaged. Here, the number of vacant houses that are not part of the housing market (for rent or sale) and are left unmanaged is considered the number of decayed or damaged vacant houses. However, the Housing and Land Survey covers only municipalities with populations of 15,000 or more, which means that many municipalities, especially those in Hokkaido, are excluded. In the 2018 survey, 1087 municipalities (about 62.4% of the total) were surveyed.

Fig. 1 shows the number of vacant houses classified by housing and land surveys and the number of tax-exempt houses in the survey on fixed asset tax in 2018. According to Table 35-2 of the Housing and Land Survey (area: nationwide, presence of decay and damage: total number, construction method: total number, structure: total number), in terms of the number of vacant houses, the number of vacant rental houses is the highest, followed by the number of “other” vacant houses. In total, there are about 1.42 million tax-exempt houses nationwide. In the Housing and Land Survey, apartment houses are counted by the number of units, while in the survey on fixed asset tax, they are counted by the number of buildings.

2.2 Methods

This study was conducted using the following methods. First, a choropleth map was created to compare the distribution of the number of “other” vacant houses in the Housing and
Land Survey and the distribution of the number of exempted houses. In addition, the local Moran’s I statistic was calculated to determine the spatial dependence of the ratio of the number of tax exempted houses to the total number of houses by region, and clustering was carried out using a Moran scatter chart to visualize the relationships among neighboring regions.\(^{18}\) The Moran scatter plot—standardized values in the observation area were plotted on the horizontal axis and the standardized values in the vicinity of the observation area were plotted on the vertical axis. The four quadrants divided on each axis in the Moran scatter plot were classified as high-high, low-high, low-low, and high-low. As an example, “high-high” indicates that regions with high values were clustered, whereas “low-high” indicates that regions with low values were clustered around regions with high values. Meanwhile, queen-type weighting was adopted for the weighting between adjacent regions, whereas GeoDa 1.16.0 was used to calculate the local Moran’s I statistic and the clustering using Moran scatter plots. QGIS 2.8.3 was used for the preparation of the choropleth map.

Next, to analyze the relationship between the vacant house rate in the housing and land surveys and the housing rate below the tax-exemption point, we calculated the Pearson’s correlation coefficient.

We also examined the vacant housing rate via regression analysis to determine how the existence of houses below the tax-exemption point affects the vacant housing rate. The adopted explanatory variables were the population variables of municipalities (rate of change in the total population and the elderly single-person household rate) and the rates of tax-exempt houses. Details about response and explanatory variables are given below. (Table 1) Many previous studies show that increases and decreases in the population and the elderly single-person household rate affect the fluctuation of the vacant housing rate. An increase in the population of a municipality will decrease the vacant housing rate due to the resulting increase in housing demand, whereas an increase in the elderly single-person household rate will increase the vacant housing rate because of the considerable possibility of houses becoming vacant after their residents’ move or death. In addition, an increase in the rate of houses below the tax-exemption point will increase the vacant house rate, given that the maintenance cost of vacant houses decreases, and their possibility of being left unattended increases. The source of each variable is given in Table 2.

### Table 1. Details about response and explanatory variables

| Variable                          | Abbreviation | Definition                                                                 |
|-----------------------------------|--------------|---------------------------------------------------------------------------|
| Rate of vacant houses             | -            | In this analysis, the vacant house rate was calculated by dividing the total number of vacant houses classified as “other” vacant houses in the 2018 Housing and Land Survey by the total number of houses in each municipality. |
| Change in total population        | POPULATION   | The change in the total population of each municipality in the national census from 2005 to 2015 was used (%). |
| Rate of elderly single-person households | ELDERSLY SINGLE | Here, the rate (%) of single-person households of people aged 65 years or older to the total number of households in each municipality in the 2015 national census was used. |
| Rate of tax-exempt houses         | TAX          | The rate (%) of tax-exempt houses was calculated by dividing the total number of houses below the tax-exemption point by the total number of houses in the 2018 survey on fixed asset tax. |
Table 2. Sources of each variable

| Data variable                                      | Source                                                                 |
|---------------------------------------------------|------------------------------------------------------------------------|
| Rates of vacant houses (2018, %)                   | The Housing and Land Survey (Ministry of Internal Affairs and Communications, Statistics Bureau, 2018) |
| Changes of total population (2005–2015, %)        | Population census (Ministry of Internal Affairs and Communications, Statistics Bureau, 2005, 2015) |
| Rates of elderly single households (2015, %)       | Statistics on fixed asset tax (Ministry of Internal Affairs and Communications, Local Tax Bureau, 2018) |
| Rates of tax-exempted houses (2018, %)             |                                                                          |

Considering the spatial autocorrelation of the percentage of houses below the tax-exemption point, the SLM expressed by Eq. (1) was used as the spatial regression model.

\[ Y_i = \alpha + \beta X_i + \rho \sum_{j=1}^{n} w_{ij} Y_j + \varepsilon_i \]  

(1)

Here, \( Y_i \) is a response variable (such as the percentage of vacant houses), \( \alpha \) is a constant term, \( \beta \) is a partial regression coefficient, \( \rho \) is a spatial parameter indicating a spatial relationship, \( w_{ij} \) is a spatial weight, and \( \varepsilon_i \) is the error term. For the weighting between the adjacent areas, queen-type weighting was adopted.

Finally, the SLM in Eq. (1) was used to clarify areas with high rates of houses below the tax-exemption point and their building structures. In general, the assessed value of a house for the fixed asset tax depends on its building materials and the quantity of these materials. Moreover, the larger the floor area of a non-wooden building, the higher the assessed value. In addition, the assessed value decreases with the age of a building. These results suggest that the rate of tax-exempt houses is higher in municipalities with many wooden or old houses. In addition, municipalities with many large buildings are expected to have lower rates of tax-exempt houses. In this model, the response variable \( Y_i \) was used for the rate of tax-exempt houses in municipalities, and the explanatory variable was used for the following values. (Table 3)

Table 3. Details about explanatory variables

| Variable                                      | Abbreviation | Definition                                                                                                                                                                                                 |
|-----------------------------------------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rate of houses built before 1970              | 1970         | The rate (%) of the total number of houses built before 1970 in the 2018 Housing and Land Survey was used as a variable.                                                                                   |
| Rate of wooden houses                          | WOOD         | Here, the rate (%) of the number of wooden houses (excluding fireproof wooden houses) and fireproof wooden houses in the housing and land survey in 2018 was used as a variable. |
| Rate of houses with a FL residential floor area of 48 jo (79.2 m2) or more | FL           | The rate (%) of houses sized 48 jo (79.2 m2) or more to the total number of houses in the 2018 Housing and Land Survey was used as a variable. Jo is the number of tatami mats in a Japanese-style room; according to the Housing and Land Survey, two tatami mats are regarded as 3.3 m². |

It should be noted that municipalities in areas where evacuation orders were issued owing to the accident at Tokyo Electric Power Company’s Fukushima Daiichi Nuclear Power Plant (Tomioka Town, Okuma Town, Futaba Town, Namie Town, Katsurao Village, and Iidate Village) were excluded from the study areas because of insufficient data.
3. Results

3.1 Comparison of the number of vacant houses and the number of houses under the tax-exemption point

Fig. 2 shows the nationwide distribution of (a) the number of fixed asset tax-exempt houses (2018) and (b) the number of “other” vacant houses with recorded in the Housing and Land Survey (2018). It is also a common feature that the number of vacant houses and the number of houses below the tax-exempt point is large in metropolitan areas such as Tokyo and Osaka. Meanwhile, in Sapporo City, Hokkaido, the number of “other” vacant houses recorded in the Housing and Land Survey is larger than the number of houses below the tax-exempt point.

As the Housing and Land Survey covers only municipalities with a population of 15,000 or more, many municipalities with insufficient data exist, distributed mainly in the Hokkaido and Tohoku regions, which both have numerous small-scale municipalities, but the overall distribution trend is the same for both.

Fig. 3 shows the ratio of housing below the tax-exemption point to the total number of houses subject to property tax as of 2018. The ratio of the number of exempted houses in large city areas is low, whereas in Shikoku and the southern part of the Kinki region, many local governments reported a large percentage of houses below the tax-exempt point. The ratio of the total number of exempted houses was also found to be relatively high in the Tohoku and Hokkaido regions, with this tendency especially high in northern Hokkaido.

Fig. 4 shows the clustering result of the Moran scatter plot for the ratio of the number of houses below the tax-exemption point as of 2018. Almost the entire area of Shikoku and Kii Peninsula was classified into the high-high quadrant, where municipalities with a high percentage of houses under the tax-exempt point were accumulated. Meanwhile, metropolitan areas, such as the Tokyo metropolitan area, Osaka, Kobe, and Nagoya, as well as municipalities around ordinance-designated cities, such as Sapporo, Sendai, Niigata, and Fukuoka were classified as low-low quadrants, in which municipalities with a low percentage of houses below the tax-exempt point were accumulated. In the eastern part of Hokkaido, many local governments have a low ratio of houses below the tax-exemption point.

Among the ordinance-designated cities, Kyoto City was classified into the high-low quadrant, with a higher percentage of houses below the tax-exemption point than the neighboring municipalities.
Fig. 2. (a) Number of fixed asset tax-exempt houses (2018) and (b) number of “other” vacant houses recorded in the 2018 Housing and Land Survey.
3.2 Correlation of vacant houses and tax-exempt houses

Table 4 shows the correlation coefficient between the vacant house rate and the rate of tax-exempt houses in each municipality, classified by the type and building condition of the vacant houses. There was no clear correlation between the rate of tax-exempt houses and the rates of the secondary houses, temporarily vacant rental houses, and temporarily vacant houses for sale. On the contrary, a relatively high positive correlation was confirmed for the “other” vacant houses of all building conditions. Fig. 5 shows a scatter plot of the rates of the other vacant houses and tax-exempt houses. The vacant house rates were found to increase with the rates of the tax-exempt houses.
Table 4. Correlation coefficient of rates of vacant houses and tax-exempt houses

|                    | Secondary houses | Temporarily Vacant rental houses | Temporarily vacant houses for sale | Other vacant houses |
|--------------------|------------------|----------------------------------|-----------------------------------|--------------------|
| Damaged            | 0.0856           | -0.0298                          | 0.0878                            | 0.6447             |
| Undamaged          | 0.0489           | -0.2196                          | -0.1783                           | 0.6811             |
| Total              | 0.0568           | -0.1896                          | -0.1237                           | 0.7216             |

Fig. 5. Scatter diagram of rates of total other vacant houses and tax-exempt houses (2018).

3.3 Result of regression analysis of rates of other vacant houses

Table 5 shows the results of the regression analysis of the rates of the other vacant houses, which were obtained using the SLM. The results were 0.1% significant for all variables. The coefficient of determination of the model was 0.7515, which explained the other vacant house rates relatively well. The higher the rates of the tax-exempt houses and the ratio of elderly people living alone, the higher the ratio of other vacant houses in local governments. An increase in the population growth rate of municipalities would result in a decrease in the other vacant house rates.
3.4 Relationship between rates of tax-exempt houses and building properties

Table 6 shows the analysis results of the relationship between the rates of tax-exempt houses and the building attributes, which were determined by the SLM. The results were 0.1% significant for all variables. The higher the rates of houses built before 1970 and the rates of wooden houses, the higher the rates of tax-exempt houses in municipalities. An increase in the residential floor area would decrease the rates of tax-exempt houses.

Table 6. Results of the regression analysis, obtained using the SLM, of the rates of tax-exempt houses

| Parameter | Coef.  | Std. error | p value   |
|-----------|--------|------------|-----------|
| ρ         | 0.3709 | 0.0280     | 0.0000*** |
| Constant  | 0.8067 | 0.2199     | 0.0002*** |
| 1970      | 0.4316 | 0.0238     | 0.0000*** |
| WOOD      | 0.0269 | 0.0076     | 0.0004*** |
| FL        | −0.1552| 0.0098     | 0.0000*** |

\[ R^2 = 0.5799 \]
\[ AIC = 5117 \]

Statistically significant: ***0.1%, **1%, *5%.

4. Discussion and Conclusion

The analysis result indicated a positive correlation between the rate of other vacant houses and the rate of houses below the tax-exemption point of the fixed asset tax. In addition, in the SLM, which explained the other vacant house rate in addition to the elderly single-person household rate and population growth rate stated in past research, the rate of houses below the tax-exemption point became a significant result. Regarding the relationship between the rate of houses below the tax-exemption point and the characteristics of houses, findings showed that the higher the rate of wooden houses and old houses, the higher the rate of houses below the tax-exemption point.

A previous study stated that when the management cost of a house is low, the house becomes easily vacant without demolition and similar measures, even after the resident leaves. Therefore, given that exemption from the fixed asset tax leads to a decrease in the management cost of a house, a significant relationship was observed between the rate of other vacant houses and the rate of houses below the tax-exemption point. Moreover, the rate of wooden houses was high, and the rate of houses below the tax-exemption point tended to be high when the rate of relatively old houses built before 1970 was high. This is because non-wooden houses, such as
steel-framed and reinforced concrete houses, have higher assessed values than do wooden houses, and there is a high possibility that the assessed value of a building will not be less than the tax-exemption point even if it is old. In addition, the larger the housing, the higher the appraised value; thus, the larger the residential floor area, the lower the rate of houses below the tax-exemption point.

In a previous study, Baba and Asami\textsuperscript{19} attempted to explain the factors behind the “other” vacant house rate in the Housing and Land Survey according to socioeconomic variables, such as population age and the value of wooden houses assessed in terms of the fixed asset tax, and building environment variables, such as the number of wooden houses and floor area. The variables used were classified according to the population size in the urban employment areas in Japan. The results indicated that the socioeconomic variables were statistically significant in all urban employment area categories, whereas the effects of the architectural environment variables differed among the categories. In addition, it has been clarified that the increase in the younger population and the rise of the evaluation value of wooden houses are related to the lowering of the vacancy rate. Here, Hillier et al.\textsuperscript{20} found that the rate of vacant houses in Philadelphia, USA, was low in areas with high real-estate prices. Another study examined the relationship between the poverty rate and the racial characteristics of the residents in the urban areas of the United States,\textsuperscript{21} while previous studies conducted both in Japan and overseas have noted that the increase in the elderly population is impacting the increase in the ratio of vacant houses.\textsuperscript{22,23}

The relationship between the vacancy rate and the rate of houses below the tax-exemption point revealed in this study confirms that the residual value of buildings and the management cost (fixed asset tax in this study) affect the vacancy rate. This result is consistent with the trend in previous studies indicating that the value of real estate is related to the vacancy rate.

One of the causes of the emergence of vacant houses in Japan is that houses occupied by the elderly are not passed on to heirs.\textsuperscript{24} Ishikawa and Higuchi\textsuperscript{25} conducted a case study involving the Nagaoka city center to examine the possibility of the succession of properties, especially in areas with increasingly aging populations. The results indicated that many individuals who had moved out of their elderly parents’ houses did not plan to return to, and were unlikely to inherit, these properties. In rural areas of Japan, many houses occupied only by elderly people have become vacant because of death or relocation to welfare facilities but have not been subjected to appropriate succession processes, resulting in complicated rights issues and the absence of property management. In a study based on Kure City, Hiroshima Prefecture, Yui et al.\textsuperscript{26} clarified that the number of unmanaged houses increased from 1960 to 1970 because of elderly residents’ death or relocation to detached housing complexes.

This study also showed that the higher the rate of elderly single-person households, the higher the vacancy rate, and the higher the rate of houses below the tax-exemption point. This is because the head of the household is likely to become absent due to moving to a facility for the elderly or due to death. In addition, if a vacant house is inherited, there is a high possibility that the house will be left empty due to the following reasons: there is no fixed asset tax on the house, and it will not be subject to a reduction in the fixed asset tax on land if it is demolished.

In rural areas with low real-estate prices, it is often difficult to sell non-inherited houses on the market. To clarify the management of this type of real-estate, it is crucial to make
it mandatory to register any inheritance and to provide incentives, such as assistance with demolishing vacant houses. In addition, although the Ministry of Land, Infrastructure, Transport and Tourism’s Handbook for the Investigation of Empty Houses for Municipalities (ver.1) stipulates the provision of information from neighboring residents and the status of water supply utilization as part of the investigation method for vacant houses, it would perhaps be desirable to consider the utilization of fixed asset tax ledgers, although there remain certain restrictions under the Local Tax Act.

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