

## **Micro Factors Causing Fall in Land Price in Mixture Area of Residence and Commerce**

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### **Abstract**

As land price is a value of index for comprehensive land assessment, a fall in the land price refers to a decline in land quality. If we apply counter-measures to prevent this price fall by clarifying the factors causing it, the land quality in urban areas can be maintained and improved. In this study, by analyzing the micro factors in assessing land price in mixture areas in land use for residence and commerce of Tokushima City, we can derive the disincentive factors that lead to a decrease in the land quality in the area. By considering the disincentive level in this analysis, we can suggest a method to control the micro factors in the study area. The clarifications obtained by this analysis can contribute toward improving and creating attractive mixture areas in land use for residence and commerce in the future.

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## 1. Introduction

In the local cities of Japan, along with the increasing suburbanization, many stores face closing or abandonment because of the aging rate of the owners and the absence of successors. Moreover, because of the increasing number of large-scale retail stores in suburban areas, the existing commercial areas in the central cities are declining.

However, in the central areas of these local cities, there are often still spaces for natural environments, such as rivers and hills, which provide not only convenience but also a good quality of living environment. In particular, for seniors with limited mobility, central areas of cities can become a desirable place to live.

In order to revitalize the central areas in local cities, the promotion of the benefits of living in city centers is an important measure. In this sense, it is important for city planners to ensure that the residential property in the central areas of local cities should be developed properly to make efficient use of the existing conditions of the environment.

From this viewpoint, we focused on the composition mechanism of land prices to evaluate the possibility of introducing residential areas into the central areas of cities in our previous study. (Murakami et al. 2015) In that study, we identified different demand trends in the central areas for use as commercial areas and residential areas. We also indicated that, even in central areas, if the conditions were desirable for residential areas, the potential demand for using the area for residences surpassed that for commercial uses. As a result, we determined that land prices would increase if the central areas were improved for residential use.

Because a land price is the overall assessment value for the desirability of a property, we assumed that if the land price is high, consumers regard the land as highly desirable. Conversely, a decrease in land price would signify a lowered desirability and land quality. From these facts, we determined that in order for property in central areas to reach its highest potential in its desirability, it is necessary to develop the property as a residential area to garner a higher land price.

However, the above finding was based purely on the assumption of two land uses, i.e., residential and commercial, and the demand trend of the land developed for mixed uses was not apparent. Because the demand trends for land uses for residential and commercial areas might differ, if the various factors that determine the land price work in the opposite direction for these two areas, some boundary areas between the existing commercial areas and new areas of residence (mixture area of residence and commerce) might lead to locally reduced land price. Moreover, a decrease

in the demand for the boundary areas in land use between residence and commerce can cause a decrease in the demand for the entire residential area that has been created. Therefore, to maintain and increase the land quality in developed central residential areas, it is necessary to minimize the decrease in land prices due to demand decreases in mixture area of residence and commerce.

In this study, we developed a land price model based on quantitative factors for the central area of a local city, Tokushima City. By comparing the estimated and actual land prices of commercial areas and residential areas, we investigated the factors determining the land prices of areas where commercial and residential uses are mixed. In particular, we attempted to reveal the micro factors that cause a decrease in land prices. By doing so, we aimed to provide information that would be useful when developing a residential area that is highly desirable while coexisting with the existing commercial areas.

## 2. Features of this study

### 2.1 Hypotheses

To perform the study, we proposed the following three hypotheses. Using these hypotheses, we attempted to reveal the potential factors particular to mixture areas in land use for residence and commerce.

#### [Hypothesis 1]

The demand trends for commercial and residential uses differ, and factors affecting the land prices and the extent to which they affect the land prices also differ (**Table 1**). Consulting the previous studies, potential for this hypothesis was indicated.

#### [Hypothesis 2]

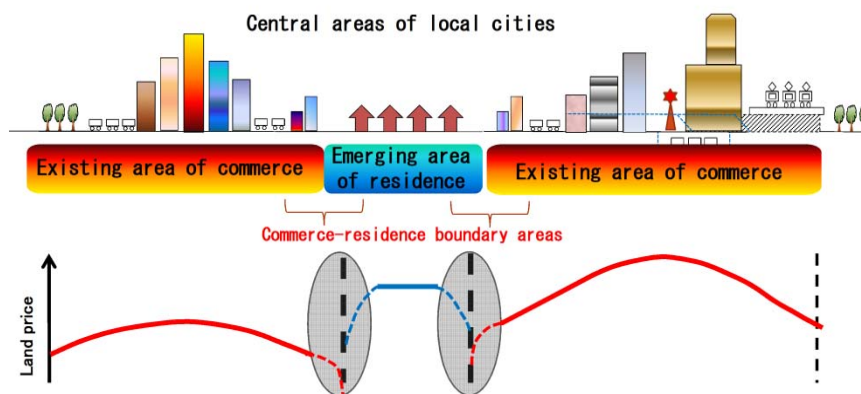
Some of the factors mentioned in [Hypothesis 1] increase the land price of commercial area but decrease land price of residential area, or vice versa. (Ministry of Land, Infrastructure, Transport, and Tourism 2002)

#### [Hypothesis 3]

Due to multiplier effects of the factors in [Hypothesis 2], in boundary areas in land use between residence and commerce, the land prices can fall, as opposed to single use areas (**Figure 1**).

**Table 1.** Main factors that make up land prices of properties for different uses

Main factors that make up land prices		Property use	
		Commercial use	Residential use
Quantitative Factors	Road factor	Road width	Road width
	Distance to each amenity	Train station	Train station
		Main road	Main road
		Economic facility	Stores
		Public office	Elementary school
Administrative factor	Rezoning district	Rezoning district	
Qualitative Factors	Environmental factors	Activity	Tranquility
		Traffic volume	Privacy
		⋮	⋮
		Other beneficial factors for commercial use	Other comfort factors for residential use



**Figure 1.** A case of falling land prices in the boundary areas in land use between residence and commerce

## **2.2 Methodology for revealing the factors for land prices particular to the boundary areas in land use between residence and commerce**

As the core methodology, we first develop a model for estimating land prices of mixture areas in land use for residence and commerce in the central area of Tokushima City. Among the price-affecting factors, we eliminate the micro factors, which consist of the qualitative factors such as environmental factors, and only use the quantitative factors as explanatory variables to develop the model. Next, we use the model to compute the average standard land price (estimated land price) for the mixed-use areas in the central area. The difference between the estimated and actual land prices, namely the deviation, probably depends on the micro factors related to environmental factors. The fact that the deviation value is negative seems to indicate that, in the areas that experienced sequential decreases in land prices, micro factors might have caused the decrease in the desirability of the area. By analyzing the characteristics of the communities, which are obtained from their actual situations, we aim to reveal the micro factors causing the decrease in land prices of boundary areas in land use between residence and commerce.

## **3. Previous studies**

The two main indicators of property value are land price and rent, and they are interrelated. In Japan, much attention is paid to land prices, but elsewhere, there have been active debates about land rents, particularly in Western countries.

Based on Ricardo's theory of differential rent, which defines the land rent as the difference between the product value and the labor value (Kumagai et al. 1979), Thunen explained the distribution of land use by introducing the concept of space and postulating that property was used to maximize the property's rent (Kasuga 1979).

Conversely, in previous studies about land prices, Komiya (1971) did not explicitly focus on property use, but analyzed land price as the balance between demand and supply using the difference in the reserved demand for a certain land mass. Iwata (1977) further developed this idea and derived the demand for property from the maximization of effect. Shinzawa and Kayama (1969) explained land prices of cities by arguing that the rise in land prices was due to the residential development in suburban areas within commuting limits. The concept, "in cities, the land price is set such

that the sum of transportation cost and land price stays constant,” relates to Ricardo’s theory of differential rent on the grounds that it considers the spatial distribution of transportation costs and the idea of land-use maximization by consumers. In addition, Aoyama (1991, 1992) and Hirose et al. (1995) attempted to theoretically reveal speculative actions of the sudden rise of land prices from the trend of invested capitals, and they revealed the spatial ripple effect of land prices.

Also, in order to develop a land use model for Japan’s land problems, Ohashi (1996) studied previous studies related to land problems, land policies, theories of land prices and rents, and land use models. He developed an urban model, based on the balance between demand and supply of property, suited to Japan’s land problems, clarified the actions of both consumers and suppliers of properties, and concluded that it was necessary to reveal the attributed subject of the convenience and inconvenience due to land use policies. Tashiro (2002a, 2002b) attempted to understand the theory behind land use distribution by using a simultaneous equilibrium of all real estate in all the districts of urban cities, assuming that the land and house suppliers’ actions were property selection activities. By specifying a logarithmic linear utility function for consumers’ utility functions, He derived various demand functions, such as lot scale distribution and bid distribution, and investigated their characteristics. From this investigation, He revealed the basic activities of consumers of land and houses from the viewpoint of utility distribution. He also studied the landowner’s activities using the theory of portfolio selection with the mean dispersion approach. He demonstrated that the mean dispersion portfolio theory can be applied to the spatial analyses of urban cities. Then, he derived the land and house supply function and theoretically investigated the portfolio selection activities of landowners.

However, for the decrease of land prices, there have been empirical analyses, which use multivariate analysis based on the hedonic approach assuming that prices are affected by the social capital adjustment effect, to estimate land prices that are spatially distributed (Kawai et al. 1989, Karato 2007, Inoue 2008). This was accomplished as public land price database and is becoming accumulated in recent years. However, during recent years of degeneration in the central areas of cities, the real estate market reveals that property is no longer an investment commodity, but a capital commodity for economic activities by final consumers. In such a situation, where the desired functions of properties are shifting from the owning functions to the utility functions, it will be necessary to theoretically understand the composition of land price from the actual actions based on the original land use purpose as the place of the end-user activities. In particular, in urban cities composed of property meant for various uses, under-

standing the relation among the factors that influence land prices for each use is important in effectively making readjustments to improve desirability, and to increase the asset value of the whole city.

#### 4. Estimation of a land price model and computation of the deviation rate

##### 4.1 Estimation of a land price model

To understand the micro factors related to the environmental factors that affect the land price of boundary areas in land use between residence and commerce, we first developed a land price model using the main quantitative land price factors in residential areas as explanatory variables, and we computed the average standard land price (estimated land price). For the subject areas in the central areas of Tokushima City, we selected 92 locations around the boundaries between areas that were promoted by urban planning policies for commercial and residential uses. The explanatory variables were the width of road in front of house, road distance to the Tokushima station, road distance to a trunk road, road distance to an elementary school, and rezoning districts (used as a dummy variable), and the independent variable was the national roadside land price in 2012. The model is shown in equation (see Eq.1) and the estimation results of the parameters are shown in **Table 2**.

$$R = \alpha \cdot \ln W + \beta \cdot \ln T + \gamma \cdot \ln S + \delta \cdot \ln P + \varepsilon \cdot D \quad (1)$$

$\alpha, \beta, \gamma, \delta, \varepsilon$ : Parameters

$R$ : Actual land price (roadside land price)

$W$ : Width of road in front of house

$T$ : Road distance to Tokushima station

$S$ : Road distance to a trunk road

$P$ : Road distance to an elementary school

$D$ : Rezoning districts (dummy)

**Table2.** Estimation results of the parameters

	Parameter	t value
Width of road in front of house	16.90	3.87
Road distance to Tokushima station	-11.97	-5.46
Road distance to a trunk road	-1.91	-1.00
Road distance to an elementary school	-1.81	-0.79
Rezoning districts (dummy)	15.06	4.61
Intercept	172.12	9.47
Coefficient of determination		0.67
Number of samples		92

## 4.2 Computing the rate of deviation

From the estimated land prices using the model and the actual land prices, we computed the rate of deviation RD in equation (see Eq.2).

$$RD (\%) = \frac{\text{Actual land price} - \text{Estimated land price}}{\text{Estimated land price}} \times 100 \quad (2)$$

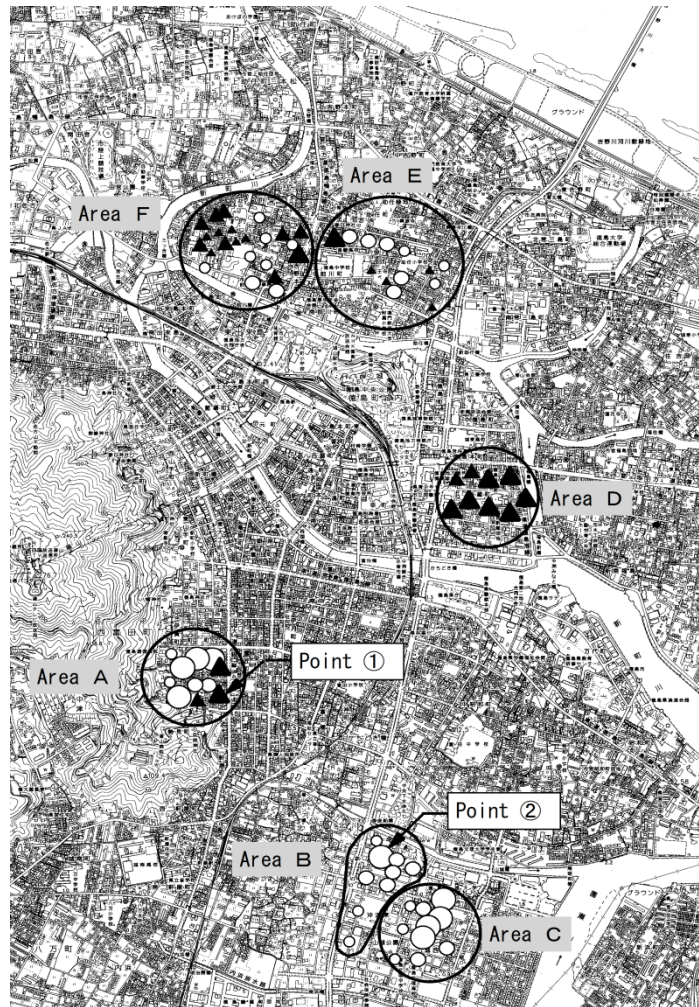
Because the land price estimated by the land price model is the average standard land price value explained by the quantitative land price factors, locations with large deviations can have micro factors, besides the quantitative factors that are related to environmental factors, affecting land prices.

## 5. Micro factors causing a decrease in land prices in the boundary areas in land use between residence and commerce

### 5.1 Results of computing the rates of deviation in the central areas of Tokushima City

We applied the land price model developed in Section4.1 to the property at each location within the both commercial areas and residence in the central areas of Tokushima City. Further, we computed the estimated land prices and the deviation rates from the actual land prices. **Figure 2.** shows the distribution of deviation rates at each location.





**Legend**

$$RD (\%) = \frac{\text{Actual land price} - \text{Estimated land price}}{\text{Estimated land price}} \times 100$$

○	10	≧	RD
○	5	≧	RD ≦ 10
○	0	≧	RD ≦ 5
▲	-5	≧	RD ≦ 0
▲	-10	≧	RD ≦ -5
▲	-10	≧	RD

**Figure 2.** Distribution of the rates of deviation in Tokushima City

**Table 3.** Rate of deviation and characteristics of mixture areas in land use for residence and commerce in Tokushima City.

Area		A	B	C	D	E	F	
Name		Omichi	Oki-nohama	Yama-shiro	Shinku-ra	Kita-maegawa	Naka-maegawa	
RD (%)	Max.	+14.31	+14.84	+12.40	-8.80	+7.94	+7.77	
	Min.	-14.33	+1.57	+3.90	-15.13	-13.65	-16.27	
	Ave.	+2.94	+7.19	+7.94	-12.84	+1.03	-2.93	
1990 ↓ 2012	Land Price	Max.	-15.1	+11.7	+18.0	-23.2	-15.0	+8.1
		Min.	-23.8	+11.7	+18.0	-38.8	-15.0	+8.1
		Ave.	-19.7	+11.7	+18.0	-31.2	-15.0	+8.1
Rate of change* (%)	Population	Max.	+3.7	-4.2	+35.0	-29.9	-42.6	+22.0
		Min.	-42.5	-4.2	+23.1	-35.8	-42.6	+22.0
		Ave.	-23.6	-4.2	+32.0	-33.4	-42.6	+22.0
Rate of change* (%)	Number of houses	Max.	+37.2	+15.6	+42.2	+9.0	-10.2	+49.3
		Min.	-25.4	+15.6	+17.6	-8.2	-10.2	+49.3
		Ave.	-15.6	+15.6	+36.1	+3.1	-10.2	+49.3
Rezoning completed		○	○	○	○			
Characteristics of the areas (Mixed commercial uses Conditions of used properties)								
A	Tranquil and fine areas of residence behind a sub-main road at the foot of Mt. Bizan (Old retail stores)							
B	Behind the national road side (Relatively new retail stores)							
C	School zone with a private university (Relatively new retail stores)							
D	Area of residence with many municipal facilities and the highest land prices (Old retail stores and offices)							
E	Area of residence in a school district for elementary and middle schools and with the second highest standard land prices after area D (Old retail stores and offices)							
F	Old mixture area of residence and commerce (Old retail stores, offices, and medium/small-scale workshops)							

\* The rates of change are shown for locations with the rate of deviation of 10% or higher, or of -10% or lower.

Also, after grouping the locations with equivalent road and traffic/amenity factors into certain areas, we summarized the characteristics of

each area in **Table 3** in which rates of change in the land price, population, and the number of houses in each area are shown. The term of analysis is a time period between 1990 and 2012.

Based on these results, the deviation rates are different for areas with similar quantitative factors, such as road and traffic/amenity factors. This observation can signify that land conditions for these areas have an effect. However, even the locations within areas with similar land conditions had various deviation rates; moreover, some had large positive deviation rates and others had large negative deviation rates. In such areas, the locations with large negative deviation rates are possibly affected by some micro factors because of which the land price falls due to the mixed use of areas for commercial and residential purposes.

On the other hand, in areas with locations with positive deviation rates, there were locations with unique and significantly positive deviation rates. These locations were possibly influenced by micro factors that mediate the fall in the land prices.



## 5.2 Understanding the micro factors causing a decrease in land prices

From *Area A* in **Figure 2**, with similar quantitative land price factors but with a large variety in deviation rate, we selected Location 1, with a large negative deviation rate. From *Area B*, with an overall positive deviation rate, we selected Location 2, which had a large positive deviation rate. We listed their characteristics in **Table 4**.

Based on the data, Location 1 (point 1) of *Area A* is located along a one-way road near the central area of a city and in a community with many old retail stores. Although it is located in a residential area that has had the highest land prices in the prefecture for a long time, it lacks tranquility as an area of residence since it is located behind a secondary prefectural road. Further, it does not have sufficient traffic to secure stable profit as a commercial area, but lacks activity. The average area of a section is about 150 m<sup>2</sup>, and the spaces available for parking are limited. Buildings are constructed close to the road boundaries.

In addition, this location has experienced the largest decrease in the standard land price, population, and number of houses from 1990 to 2012. Currently, the residential area with the highest land prices has shifted to *Area D*. Under these conditions, it is probable that the land price determining factors for areas of residence and commerce are acting as disincentive factors to each other.

**Table 4.** Conditions of the locations with large rates of deviation

<b>Area : A</b>					
LocationNumber		Point 1 in <b>Figure 2</b>		Photograph of current conditions	
2012Actual land price(1000 Yen/1m <sup>2</sup> )		87			
Rate of deviation:RD(%)		-14.33			
Land price factors	1990	Land price	-17.1		Front road width
	↓			Road distance to Tokushima station	1,800 m
	2012	Population	-42.5	Road distance to a trunk road	660 m
	Rate of change (%)	Number of houses	-25.4	Road distance to an elementary school	770 m
				Rezoning district	Applicable
				Average area of one section	150 m <sup>2</sup>
<b>Area : B</b>					
LocationNumber		Point 2 in <b>Figure 2</b>		Photograph of current conditions-	
2012Actual land price(1000 Yen/1m <sup>2</sup> )		105			
Rate of deviation:RD(%)		+14.84			
Land price factors	1990	Land price	+11.7		Front road width
	↓			Road distance to Tokushima station	3,150 m
	2012	Population	-4.2	Road distance to a trunk road	140 m
	Rate of change (%)	Number of houses	+15.6	Road distance to Tokushima station	3,150 m
				Rezoning district	Applicable
				Average area of one section	300 m <sup>2</sup>

On the other hand, Location 2 (point 2) of *Area B* is located along a two-way road behind a main national trunk road and around relatively new retail stores. As an area of residence, it is not quiet; as a commercial area, it lacks activity. However, the average area of a section is about 300 m<sup>2</sup>, and it is relatively easy to find parking spaces. The direct access to the main road allows a smooth customer flow, maintaining a certain profitability. There is enough distance between buildings and road boundaries, resulting in an open feel to the environment.

In this location, the standard land price and number of houses increased from 1990 to 2012, and the population decreased minimally. For this case, despite the mixed commercial and residential uses, the comfort level of the residential area is maintained due to the open environment. Located behind a busy main road, this location can easily allow customer flow to the retail stores, maintaining profitability. It is assumed that the factors of the commercial area are not acting as disincentive factors to the land price of the area of residence.

## 6. Summary

In this study, we investigated the micro factors that can cause a fall in land prices which can be regarded as an index for the desirability of the property in boundary areas in land use between residence and commerce. The price decreases resulted from establishing new residential areas in existing commercial areas in the central areas of local cities, considered desirable from the profitability perspective for a commercial area as well as from a perspective of comfort for a residential area.

Selecting Tokushima City, a local city, for a case study, we estimated the average standard land prices using a land price model that used only the quantitative land price factors, and computed the deviation rate between the estimated and actual land prices. We then extracted and compared sample points with significantly large rates of deviation from areas with similar land conditions that are related to quantitative factors. We then attempted to understand the micro factors causing the decrease in land prices due to the mixed use the areas for commercial and residential purposes.

For a location where the estimated land price, i.e., the average standard land price, was higher than the actual land price, with a large negative deviation rate, the average sectional area was small, leading to an environment where buildings are close together. The time series observation over the past 22 years revealed that the standard land price, population, and

number of houses significantly decreased.

Conversely, in environments with a large average sectional area and with a land area significantly larger than the standard building areas, the actual land price was higher than the estimated land price, indicating a large positive deviation rate. It was also revealed that the temporary decrease in the standard land prices was relatively small.

At the boundary in residential areas with the existing commercial areas, which is formed when creating favorable residential areas in the central areas of local cities, the results of this study can be useful for planning information to maintain the desirability and high land prices for these residential areas in the long term.

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