COMPOSITE HEDONIC LAND PRICE MODEL FOR OSAKA PREFACTURE, JAPAN

Shamim M. HAQUE
Doctor Course Student
Department of Social and Environmental Engineering, Hiroshima University
1-4-1 Kagamiyama Higashi-Hiroshima, 739-8527 Japan
Tel: +81-824-24-7849
Fax: +81-824-24-7849
E-mail: haque@hiroshima-u.ac.jp

Makoto OKUMURA
Associate Professor
Department of Social and Environmental Engineering, Hiroshima University
1-4-1 Kagamiyama Higashi-Hiroshima, 739-8527 Japan
Tel: +81-824-24-7827
Fax: +81-824-24-7827
E-mail: mokmr@hiroshima-u.ac.jp

ABSTRACT

Although being inflated for asset evaluation, urban land price can be considered as result of the evaluation of usage value of land parcels. Therefore, large varieties of hedonic models have been applied to model the land price formation process. In the present paper, two types of households are assumed; one evaluates local amenities within short reach, and the other minds availability of services in a wider region. Switching model was applied to formulate a composite model, which assumes that the bid rent of the winner in the competition between two types can be observed as land price. Application to the land price data in Osaka Prefecture, Japan for the year 2002 showed better fit than ordinary single hedonic price model. Compared to the estimated result on data for 1997, land price points evaluated with wider regional accessibilities and amenities has been found increased, being associated with the motorization process of Osaka region.

Key Words; Hedonic price, Switching model, Land price, Accessibility, Motorization

1 INTRODUCTION

Price of urban land mainly depends on its valuation as asset in financial market. Land is a particularly important asset to Japanese households, accounting for 40% of total household assets (Sato, 2002). Overwhelming importance of land as asset is one of the main characteristic features of Japanese economy. Due to such overwhelming importance the asset price inflation, which was later identified as an asset price bubble started to form in Japan during the mid-1980s. Consequently, in 1990 Japan's urban land prices reached at their highest, and the aggregate value of urban land was estimated at 4.8 times the GDP and 57 percent of national wealth (Sato, 1995). In mid-1989 the Bank of Japan started to raise interest rates to arrest this asset price inflation, which was driving the economy significantly above the output, and as a result, stock and land prices started falling rapidly. A significant drop in land prices in the early 1990s had been observed which is prominently different than any of such drops during any previous post-war recessions in Japan. There had been discussions for pretty long time whether these declines reflected a genuine change in the economic outlook of investors or an unwinding of speculative increases in asset prices during the "bubble economy" of the late 1980s (Brunner and Kamin, 1995).

Though decline in land price is evident in many Japanese cities, land price in city core is considerably higher than fringes. This situation can be attributed to the attitude of land owners in city core, who bought lands at high price during the bubble economy, are reluctant to sell their land at lower price now incurring heavy financial loss. Besides, land price is also dependent on speculative behavior of land owners. Due to high land value in city core, developers find it difficult to develop there and as a result increase of vacant land lots in the city cores and expansion of urban development in city fringes have been observed in recent years in many Japanese cities. Increased use of gasoline, decrease in population density in urban areas are the direct environmental impacts of such ‘doughnut type’ developments. Amount of land in urban usage is increasing every year even though actual demand is not increasing. It is therefore, important for landowners, land demanders and land policy analysts to recognize what factors drive land value in urban context. Though there is a significant difference between land price and actual usage value, expressed as bid rent by buyers, these two quantities are strongly correlated.

In this research, hedonic price approach has been adopted to understand the land value formation mechanism. In urban areas, where value of particular parcel of land is a function of not only features related to the geographic position but also to the features of wider geographic regions where the parcel is located. Moreover, different buyers may evaluate a particular land parcel differently depending upon the mobility pattern or more specifically usage of personal automobiles. Some may consider that accessibility to various amenities in local neighborhood is important, while others may think that such availability of amenities in wider regional scale is important. In this research, urban land value has been modeled assuming existence of two types of households mentioned above. They are assumed to have differently specified bid rent functions for same piece of land —one group emphasizing on accessibility on foot to local facilities, while the other on the availability of such facilities at wider regional level based on automobile usage. Realized land price is assumed to be the maximum of these two bid rents. This paper also demonstrates the use of GIS in creating different attributes of urban lands. Composite model of two different types of bid rent functions has been formulated by adopting the idea of switching model by Fair and Jaffee(1972). Application of the model to land price data in Osaka Prefecture, Japan for year 2002 and 1997 showed that land price points evaluated with wider regional accessibilities and amenities increased from 1997 to 2002 which is associated with the motorization process of Osaka region.

Specifically, our research objectives are as follows:

To Estimate a composite hedonic land price model as a function of local accessibility to facilities, planning restrictions, infrastructure availability, site characteristics and wider regional characteristics of the area.

To characterize two types of evaluators with different mobility in urban context, and

To demonstrates the use of GIS in creating different attributes of urban land.

2. RELATED RESEARCHES

Traditional theoretical mono centric city models developed by Alonso (1964), Mills (1967), and Muth (1969) assume distribution of land uses on a featureless plain around a central business district (CBD). Land rent in these models follows declining gradient from CBD and land price can be easily related to land rent by simple constant, time discount rate (interest rate), which is assumed to be common for all market participants (Fujita,1989). In more recent times, these models have been modified more realistic and complicated by incorporating polycentric cities, different expectations concerning the future, etc. (Anas et al., 1998). Other group of models, known as the public finance/spatial amenities models (Mieszkowski and Mills, 1993) are derived from the Tiebout (1956) model, where individuals choose their residences based on location-specific public goods. That is, individuals "vote with their feet" for a package of housing services, as well as local fiscal and non-fiscal amenities in their choice of residential location (Hoyt and Rosenthal, 1997). However, in applied field, dominated by hedonic approach and largely based on aggregate spatial data such as census data, both strands of theoretical models, for example, by including explanatory variables such as distance measures and neighborhood measures, has been tried to incorporate (Dubin, 1988; Dubin, 1992; Can, 1990; Can, 1992; McMillen, 1974 and McMillen, 1995). Garrod and Willis (1992) examined neighborhood or environmental characteristics of countryside parcels in the UK using a hedonic price model. The view (of woodlands, for example), as well as the presence of water, were important amenity attributes in their research. McLeod (1982) used a bid-price approach to determine marginal willingness-to-pay for urban residential properties in Perth, Australia. River view, in addition to water and park access, was found to be important. Spahr and Sunderman (1995) used Wyoming ranchland sales data to model the contribution of scenic and recreational quality to agricultural land price**.** Low, medium and high quality amenity levels, based on the judgment of area appraisers, were represented by indicator variables in their statistical model. These variables were statistically significant with high scenic quality contributing to higher sale price. Bockstael (1996) estimated a hedonic model in order to predict probabilities associated with converting undeveloped land to developed lands. Important variables included lot size, public services, zoning, proximity to population centers and variables associated with the percent of agricultural use, forest lands and open space in the Patuxent watershed. This model contributes to understanding land use behavior and parcel value.

Though effects of urban and rural amenity attributes on land price are analyzed in several articles, but few to date have incorporated the spatial specificity afforded by GIS measurement. A hedonic rural land study using GIS was provided by Kennedy et al (1996). The analysis identified rural land markets in Louisiana based on economic, topographic and spatial variables. GIS was used for defining distance to market as well as soil type variables. Geoghegan et al. (1997) developed GIS data for two landscape indices and incorporated them in a hedonic model for Washington, DC, suburban properties. Their measure of fragmentation is defined as perimeter to size ratio. They also used land cover measure as an index of land use type, which is a surrogate for flora and fauna habitat. Their study provides a perceptive selection of landscape indices. Bastian et al., (2002) used GIS data in a hedonic price model to estimate impact of amenity and agricultural production characteristics of land on price per acre for a sample of Wyoming County of USA. They specified several functional form of bid rent function and showed concluded that land price could be reasonably explained by both amenity and agricultural production characteristics. Sengupta and Osgood (2003) used ranchette sales data as dependent variable and satellite greenness indices as explanatory variables along with access to roads, cities and neighboring ranchettes to estimate the value of remoteness for ranchettes in Yavapai County, USA. However, most of the applied models referred so far used ordinary least square method to estimate the parameters of models. Moreover, single bid rent or land value function has been used in most of those models. But in reality in urban context, land price is determined by the competition of different buyers having different bid rent functions even for same time of land use.

3. THE MODEL

Individual's preference of locations relate to several spatial attributes of each location, such as commuting distances to city core, accessibility to and existence of various public facilities in immediate neighborhood and/or at wider region. The usage value of land is, therefore, considered to be made up of evaluation on different bundles of such attributes or characteristics of the land parcel, following the hedonic technique based on the premise that goods traded in the market are made up of different bundles of attributes or characteristics. It is further assumed that in urban context, two types of households exist having two different compositions of bid rent functions. One type (referred hereafter as Type 1) evaluates a particular land parcel putting emphasis on walking accessibility to various public facilities, especially those located in the immediate neighborhood. On the other hand, the other type (referred hereafter as Type2) emphasizes on existence of public facilities at comparatively wider regional scale, based on automobile use. Realized land price for any particular piece of land is the bid rent proposed by the winner of the competition between Type1 and Type2. We used published land price data as a dependent variable i.e., realized bid rent, to simultaneously estimate parameters of two types of bid rent functions.

Let V_{1n} and V_{2n} be proposed bid rents by Type1 and Type 2 households respectively for any land lot n, and these bid rent functions are expressed by following equations,

$$V_{1n} = f_{1n} + \varepsilon_{1n} = C_1 + \alpha_1 A1_n + \alpha_2 P_n + \alpha_3 I_n + \alpha_4 L_n + \varepsilon_{1n} \quad (1)$$

$$V_{2n} = f_{2n} + \varepsilon_{2n} = C_2 + \beta_1 A2_n + \beta_2 P_n + \beta_3 I_n + \beta_4 L_n + \beta_5 R_n + \varepsilon_{2n} \quad (2)$$

where,

C_1 and C_2 are constants

$\mathbf{A1_n}$ and $\mathbf{A2_n}$ are two accessibility vectors for Type1 and Type 2 respectively, expressed as shortest distances in meter from each price point of to various facilities.

$\mathbf{P_n}$ is a vector of planning restriction variables, composed of dummy variables, 1 if there is any restriction, and 0 otherwise, for residential use, commercial use, residential and commercial type of use and fire prevention requirement.

$\mathbf{I_n}$ is a vector of infrastructure availability dummy variables: 1, if infrastructure exists, 0 otherwise, used for gas and sewerage facilities.

$\mathbf{L_n}$ is a vector of lot characteristics, lot size in square meters, buildable area in percentage, and permitted floor area ratio.

$\mathbf{R_n}$ is a vector of wider regional characteristics, used for type 2 only, expressed by the number of various facilities within 2km from the sample points.

$\alpha_1, \alpha_2, \ldots, \beta_1, \beta_2, \ldots$ are parameters to be estimated.

$\varepsilon_{1n}, \varepsilon_{2n}$ are independent and identically normally distributed error terms.

As it is not known for sure which of the above bid rent functions would win the competition between them at each location, so we used switching model to estimate parameters of bid rent functions. Let $P_n(1)$ be the probability that $V_{1n} > V_{2n}$ and the observed land price $Y_n = V_{1n}$. This event can be rewritten by $V_{2n} < Y_n$ and $V_{1n} = Y_n$, furthermore, by $\varepsilon_{2n} < Y_n - f_{2n}$ and $\varepsilon_{1n} = Y_n - f_{1n}$. Due to the normal distribution assumption for $\varepsilon_{1n}, \varepsilon_{2n}$, The joint probability is given by multiplication of cumulative probability function of ε_{2n} and probability density function of ε_{1n}, as follows,

$$P_n(1) = \Psi(Y_n - f_{2n})\psi(Y_n - f_{1n}), \qquad (3)$$

where, $\Psi()$ and $\psi()$ are cumulative normal probability function and normal density function, respectively.

Conversely, $P_n(2)$, the probability that $V_{2n} > V_{1n}$ and $Y_n = V_{2n}$, can be given as follows,

$$P_n(2) = \Psi(Y_n - f_{1n})\psi(Y_n - f_{2n}). \qquad (4)$$

Logarithm of the joint probability for the observed land price can therefore, be derived as follows,

$$L = \sum_n \ln\left[P_n(1) + P_n(2)\right] \qquad (5)$$

Equation (5) is used for maximum likelihood estimation by Newton-Raphson method to get parameter estimates for equations (1) and (2). Ordinary least square estimates of parameters for equation (1) and equation (2) were used as the starting values for maximum likelihood estimation. Logarithmic transformations of the independent variables, other than accessibility variables which are measured by shortest distances from sample points, were not pursued due to the potential for zero values. Spatial correlation is an efficiency issue in estimation that may lead to incorrect test of hypotheses results. It occurs due to omitted unobserved land characteristics that are spatially correlated both to the dependent variables and to each other (Bockstael and Bell, 1998). A pair wise correlation matrix of all variables has also been conducted in this research.

4. THE STUDY AREA

Osaka, 2nd most populous prefecture in Japan, situated in the Kansai region, has been selected as study area for this research. Osaka region is considered as the gateway of foreign culture and trade in Japan. Osaka led Japan's economic development from the 17th through 19th centuries. Basically cotton industries had been the heart of Osaka’s industrial activity in those days. For instance, by the 1890s Osaka was turning out 90% of national spun cotton production. After The First World War a shift from spinning and other light industries towards heavy and chemical industries had been observed in this region. In the main these were located in reclamation areas lying alongside Osaka Bay (Takahashi, 1981). Such land reclamation projects, together with new town developments in Senri (in the north) and Senboku (in the south), road and rail networks, helped Osaka to play a role as an engine of Japan's post-war economic boom. Industrial employment and the number of enterprises in Osaka Prefecture began to decline from the late 1960s, and this process accelerated thereafter (Daiwa Bank, 1996). In 1970, Osaka was responsible for 36.5% of Japan's exports, 23.3% of its manufacturing output, and 15.2% of its new factories. But by 1993, Osaka was generating only 4.3% of national exports, 7.7% of manufacturing output, and <1% of new factories (Edgington, 2000). Land price in the region also showed a declining trend since 1992. But still the price of land in Osaka Prefecture is considerably higher, regardless of land category, compared to the average price of land in other prefectures in the Kansai region. On the other hand, in comparison to Osaka Prefecture, the average price of land is 1.5 times more expensive in Tokyo in residential areas, 2.0 times more expensive in business areas, and 1.4 times more in industrial areas.

In comparison to Tokyo, where land use demands in city core and downtown area have recovered in late 1990's, downtown Osaka is still experiencing lost demands concurrent with spatial expansion of suburban area.

5. DATA AND VARIABLES

Geographic information systems (GIS) permit a quantitative means of affixing land characteristics to their location. Geographical Survey Institute of Japan distributes the official database regarding location of various public facilities across Japan. This spatial database contains geographic coordinate of all public facilities. Osaka prefecture portion of this database was used in this research. Different shape files were prepared for different types of facilities. Official land price database of Japan's Ministry of Land, Transport and Infrastructure has been used for land price data. This database contains in total 1985 points for price information. These points contain coordinate information, land price information from 1984 till 2002, information regarding planning restrictions, information regarding infrastructure availability and lot characteristics of price points. This database was exported as event theme in Arcview 3.2 to prepare a point shape. All shape files were re-projected to UTM zone 53N, by using 'projection utility' extension of GIS in order to convert map units to standard metric units. Buffer function was used to create 500 meter and 2 km buffers from each of the price points. Number of each type of facilities in these regions was calculated by using 'points in polygon' extension. Shortest distances to nearest facilities were calculated by using 'spatial join' function. Shop statistics database which is available at 1km x 1km resolution, provided by Japan's Ministry of Industry and Economy was used to calculate number of shops in each of 500m and 2 km buffer zones from price points. By 'Geo-processing' extension, intersections of 1km x 1km meshes with the 500m and 2km buffer zones were produced. Shop statistics was derived by aggregating the number of shops in the intersections for each buffer zone. Variables regarding planning restrictions and infrastructure availability in price point database were converted from binary coding to simple dummy variables of 1 and 0. Detail explanation of variables can be found in Table1.

Table1. Variable identification, associated parameter and description

Variable names	Associated parameter	Explanation
Accessibility Variables(**A1n,A2n**)		
DIS_HOS	P1DHO,P2DHO	Distance to nearest hospital
DIS_ESC	P1DES	Distance to nearest elementary school
DIS_JSC	P1DJS	Distance to nearest junior school
DIS_PBLD	P1DPB	Distance to nearest public building
DIS_RL_ST	P1DRS, P2DRS	Distance to nearest railway station
DIS_C_H	P2DCH	Distance to Osaka city office
SHPNO_500m	P1SN	Number of shops within 500m buffer
Planning restrictions Variables (**Pn)**		
RES	P1RES, P2RES	Dummy: 1-residential use permitted, 0-otherwise
RESCOM	P1RESCOM, P2RESCOM	Dummy:1-residential and commercial use permitted, 0-otherwise
COMM	P1COMM, P2COMM	Dummy: 1-Commercial use permitted, 0-otherwise
FIRE	P1FIRE,P2FIRE	Dummy: 1-Fire safety arrangement required, 0-otherwise
Infrastructure variables (**In)**		
GAS	P1GAS	Dummy: 1-gas network exists,0-not exists
SWAG	P1SWAG,P2SWAG	Dummy: 1-Sweage network exists,0-not exists
Lot characteristics variables (**Ln)**		
FAR	P1FAR,P2FAR	Permitted floor area ratio
BLDG_T	P1BLDG, P2BLDG	Permitted buildable area of the lot in%
Wider regional characteristics variables (**Rn)**		
SHPNO_2km	P2SN	Number of shops within 2km buffer
HOS_2km	P2HOS	Number of hospitals in 2km buffer
POL_2km	P2POL	Number of police station in 2km buffer
P_BULD_2km	P2PBD	Number of public buildings in 2km buffer

6. RESULTS OF ESTIMATION

Table2 shows parameter estimates, standard error (SE), t-value and level of significance (p-value) of the parameters of the model. It can be observed that most of the parameters have expected sign and are statistically significant. Among the accessibility variables, number of shops in 500m buffer and distance to nearest schools were evaluated high by type 1 households, while distance to the nearest railway station and Osaka city hall had strong effect on the evaluation of type 2 households. However, in case of type1, parameter value for other accessibility variables such as distance to nearest hospital, to public building and railway station were found negative but insignificant.

Besides, for accessibility parameters, wider regional characteristics such as number hospitals and number of police stations in 2km buffer were found to have strong positive effects for type 2 evaluators, but number of public buildings in 2km buffer had weak insignificant effect. This suggests that type 2 evaluators are relatively younger who expects to get rather wider variety of health services. Since automobiles are usually available to them for personal or private use, therefore, they evalute regional availability of health facilities strongly than short distance accessibility to health facilities. Planning restriction variables which permit residential use had significant positive effects on the evaluation of both types, but permission of commercial use gave different effects; positive for type 2 but negative for type 1 evaluators. As shown in the next section, type 1 price points include old densely developed areas, therefore, in such a busy districts, commercial activities can cause negative environmental impacts such as noise, traffic congestion. In type 2 locations, typically low intensity is observed, commercial use provides convenience for daily life without serious sacrifice of surrounding atmosphere. Permitted floor space ratio had also positive effect, because it indicates the possibility of high volume buildings there. On the contrary, permitted building area ratio in the lot earned negative evaluations. Lower building area ratio promises green buffer spaces between buildings, which improve atmosphere, especially in residential districts composed by detached houses. Fire proof building code showed positive effect for type 1, but negative for type 2. For densely built districts, fire proof code may decrease the risk of fire catch from the surrounding buildings, but for sparsely built areas, they cannot expect the effect to exceed the additional building costs. As shown in the next section, type 2 households prefer loosely built area, then, they did not evaluate the fire proof building code. Lot size were found to be insignificant for

Table 2. Parameter estimates of the model

Parameter	Estimate	SE	t-statistic	P-value
P1CON	8.0836	59.7721	0.1352	0.8920
P2CON	16.2167	0.4172	38.8667	0.0000
P1DHO	-0.0158	0.0130	-1.2176	0.2230
P1DES	-0.0701	0.0157	-4.4721	0.0000
P1DJS	-0.0629	0.0135	-4.6685	0.0000
P1DPB	-0.0153	0.0163	-0.9421	0.3460
P1DRS	-0.0140	0.0148	-0.9455	0.3440
P1SN	0.0002	0.0000	9.2351	0.0000
P2DHO	-0.0381	0.0188	-2.0289	0.0420
P2DRS	-0.1020	0.0191	-5.3521	0.0000
P2DCH	-0.4621	0.0340	-13.580	0.0000
P2SN	-0.0001	0.0000	-6.2469	0.0000
P2HOS	0.0577	0.0084	6.8280	0.0000
P2POL	0.1008	0.0192	5.2439	0.0000
P2PBD	0.0022	0.0016	1.3789	0.1680
P1RES	0.0890	0.0684	1.3011	0.1930
P1RESCOM	-0.0018	0.0268	-0.0653	0.9480
P1COMM	-0.0020	0.0481	-0.0412	0.9670
P1FIRE	0.4520	0.0265	17.0437	0.0000
P2RES	0.5414	0.0601	9.0112	0.0000
P2RESCOM	0.1697	0.0468	3.6267	0.0000
P2COMM	0.3072	0.0982	3.1275	0.0020
P2FIRE	-0.3895	0.0767	-5.0811	0.0000
P1FAR	0.0006	0.0002	2.9777	0.0030
P1BLDGT	-0.0006	0.0012	-0.5359	0.5920
P2FAR	0.0027	0.0002	14.5501	0.0000
P2BLDGT	-0.0038	0.1068	-3.5796	0.0000
P1SWAG	0.1797	0.0293	6.1419	0.0000
P1GAS	4.4926	59.7718	0.0752	0.9400
P2SWAG	0.1796	0.0373	4.8103	0.0000
SIG1	0.2053	0.0063	32.3885	0.0000
SIG2	0.3643	0.0103	35.5381	0.0000

Log likelihood=-21.92, Number of observations 1978 both type of evaluators. Finally, among infrastructure availability variables, availability of sewage system was strongly evaluated by both types, but evaluation was not so much strong for gas supply system for type 2 households.

Among 1978 points, in 1011 points, considered as type 1 evaluation, exceeded type 2. Goodness of fit of this model to the observed price is sufficiently high, as observed by correlation coefficient 0.889. When single independent regression was carried out to all samples using the same independent variables for f_{1n} and for f_{2n}, correlation coefficients were found to be 0.586, 0.847, and the log likelihoods -147.1, -402.7, respectively. These log likelihood values are much smaller than -21.9, log likelihood of the proposed composite model. For land price in 1997, the same composite model was estimated and 1824 among 1876 samples were classified into type 1. The transition between the types is shown in Table 3, which reveals remarkable transition from type 1 to type 2.

Table 3. Evaluation change matrix between 1997 and 2002

		Year 2002		
		Type1	Type2	Total
Year 1997	Type1	940	884	1824
	Type2	17	35	52
	No data	54	48	102
	Total	1011	967	1978

7. CHARACTERIZATIONS OF TWO TYPES OF EVALUATION

In order to characterize two types of evaluations, typical characteristics of each types are shown by average values of independent variables for year 2002 and 1997 in Table 4. Accessibility indices of type 1 locations usually mark better value than type2, but the difference between the types become smaller from 1997 to 2002. Wider regional aspects, such as number of shops, hospitals in 2km buffer are not different between two types, especially for year 2002. Average lot size of type 2 locations is larger than type 1. Figures for year 2002 show that type 1 evaluations are typically seen in the old developed districts along railway lines, provided with several types of urban facilities within walking distance. On the other hand, type 2 points are considered as low developed area left between old development axis along railway lines. Due to the recent motorization, households are able to manage their daily life in low developed area, if they use private cars to use facilities within wider buffer area.

Table 4: Characterization of spatial behavior of evaluators

Indices	2002		1997	
	Type1	Type2	Type1	Type2
Number of observed price points	1011	967	1824	52
Average distance to nearest hospital	913.28	934.59	893.89	1694.35
Average distance to nearest elementary school	408.67	454.44	426.57	528.19
Average distance to nearest junior high school	623.44	702.29	654.19	890.08
Average distance to nearest public building	233.91	261.85	242.79	316.44
Average distance to nearest railway station	829.57	850.81	823.71	1515.60
Average distance to Osaka city office	16205	14601	15112	22335
Average number of shops in 500m buffer	472	440	469	126
Average number of shops in 2km buffer	2174	2085	2192	508
Average number of hospitals in 2km buffer	4.62	4.78	4.74	3.54
Average number of police station in 2km buffer	0.19	0.33	0.25	0.90
Average number of public buildings 2km buffer	48	47	48	23
Average Floor Area Ratios	211	254	234	196
Average Area	5.16	5.35	5.24	5.54
Average Price	215610	275814	270491	699316

All distance units are in meter, areas in sq. meter, and price in '000yen/sq.m.

8. CONCLUSIONS

In this paper a composite hedonic price model has been proposed. In contrast to traditional approach of hedonic price model, land price has been evaluated considering the existence of two competing types of households for same type of use in urban context.

Characterization of spatial behavior of two types of evaluators has been made which is expected to have far reaching implications in city planning as city's spatial pattern will depend on their spatial behavior. The GIS data development ushered in the possibilities of more explicit variables and model specifications than qualitative representations such as ordinary ranking of land attribute levels or indicator variables signaling the presence of amenities. Estimation of hedonic models using such techniques is expected to provide more accurate value estimates of both local and regional determinants of land value.

REFERENCES

Alonso, W., 1964, *Location and Land Use*, Harvard University Press, Cambridge.

Anas,A., Arnott,R., and Small,K., 1998, Urban spatial structure, *Journal of Economic Literature* **36,** 3, pp. 1426–1464.

Bastian, C. T., Donalad, M.M., Matthew, J.G., William, A. R., and Benedict, J.B.,2002, Environmental amenities and agricultural land Values: a hedonic model using geographic information systems data, *Ecological Economics*, **40,** 3, pp. 337-349.

Bockstael, N. E., 1996, Modeling economics and ecology: the importance of a spatial perspective. *American Journal of Agricultural Economics* **78,** 5, pp. 1168–1180.

Bockstael, N.E., and Bell, K., 1998, The effect of differential land management controls. Conflict and cooperation on trans-boundary water resources. In: R. Just and S. Netenyahu, Editors, *Land Use Patterns and Water Quality*, Kluwer, Boston.

Brunner, A. D. and Kamin, S.B., 1996, Determinants of the 1991–1993 Japanese recession: Evidence from a structural model of the Japanese economy, *Japan and the World Economy*, **8,** 4, pp. 363-399.

Can, A., 1990, The measurement of neighborhood dynamics in urban house prices. *Economic Geography*, **66,** 3, pp. 254–272.

Can, A., 1992, Specification and estimation of hedonic housing price models, *Regional Science and Urban Economics* **22,** 3, pp. 491–508.

Daiwa Bank, 1996, Industrial Location in the Kansai with a View to Increasing International Competitiveness, Monthly Research Report No. 139, Daiwa Bank, Osaka.

Dubin, R.,1988, Estimation of regression coefficients in the presence of spatially autocorrelated error terms, *Review of Economics and Statistics* **70,** 3, pp. 466–474.

Dubin, R., 1992, Spatial autocorrelation and neighborhood quality, *Regional Science and Urban Economics* **22,** 3, pp. 433–452.

Edgington, D.W., 2000, City Profile: Osaka, *Cities*, **17**,4, pp. 305-318.

Fair, R. C. and H. H. Kelejian, 1974, Methods of Estimation for Markets in Disequilibrium : A Further Study, *Econometrica,* **40**, 2, pp.343-360.

Fujita, M., 1989, *Urban economic theory*, Cambridge University Press, Cambridge.

Garrod, G., and Willis, K.,1992, The amenity value of woodland in Great Britain: a comparison of economic estimates. *Environmental and Resource Economics* **2,** 4, pp. 415–434.

Geoghegan, J., Wainger, L., and Bockstael, N., 1997, Spatial landscape indices in a hedonic framework: an ecological economics analysis using GIS. *Journal of Ecological Economics* **23**, pp. 251–264.

Hoyt,W.H., and Rosenthal, S.S.,1997, Household location and Tiebout: do families sort according to preferences for locational amenities? *Journal of Urban Economics* **42,** 2, pp. 159–178.

Kennedy, G., Dai, M., Henning, S., Vandeveer, L., 1996., A GIS-based approach for including topographic and locational attributes in the hedonic analysis of rural land values. *Paper presented at the annual meetings of the Am. Agric. Econ. Association, San Antonio, TX. July 28–31;* abstract in Am. J. Agric. Econ. 78, pp.1419.

McLeod, P., 1982, Demand for local amenities, *Environment and Planning A* **16**, pp. 389–400.

McMillan, M., 1974, Open space preservation in developing areas: an alternative policy, *Land Economics,* **50**, 4, pp. 410–417.

McMillen ,D.P. 1995 , Selection bias in spatial econometric models. *Journal of Regional Science,* **35**, 3, pp. 417–436.

Mieszkowski, P., and E.S. Mills, 1993, The causes of metropolitan suburbanization, *The Journal of Economic Perspectives,* **7**, 3, pp. 135–147.

Mills, E.S., 1967, An aggregative model of resource allocation in a metropolitan area. *American Economic Review,* **57**, 2, pp. 197–210.

Muth, R., 1969, *Cities and Housing,* University of Chicago Press, Chicago.

Sato, K., 1995 Bubbles in Japan's urban land market: An analysis, *Journal of Asian Economics*, **6**, 2, pp. 153-176.

Sato, K., 2002, From fast to last: the Japanese economy in the 1990s, *Land Use Policy,* **9**, 1, pp.91-98.

Sengupta, S., and Osgood, D.W., 2003, The value of remoteness: a hedonic estimation of

ranchette prices, *Ecological Economics,* **44**, 1, pp.91-103.
Spahr,R,, and Sunderman , M., 1995, Additional evidence on the homogeneity of the value of government grazing leases and changing attributes for ranch values. *J. Real Estate Research.* **10**, pp. 601–616.
Takahashi, M., 1981, Vitality of cities and industries, Paper presented to an OECD–Japan Seminar on Urban Growth Policies in the 1980s, Tokyo (mimeo).
Tiebout, C.M., 1956, A pure theory of local expenditure. *Journal of Political Economy,* **64,** 5, pp. 416–424.