Jurnal Perspektif Jil. 6 Bil. 1 (70-80)
ISSN 1985 - 496X

The Determinants of House Prices in the Klang Valley, Malaysia

Penentu Harga Rumah di Lembah Klang, Malaysia

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Abstract

This paper investigates the determinants of house prices. The Klang Valley, Malaysia is chosen as the case study in this paper. Hedonic house price modelling is employed to determine the effects of the structural and location attributes on the prices of the house. Selling prices, structural and location attributes were collected from the database of Department of Valuation and Services of Malaysia, selected maps and reports. Fifty-five factors that are likely to influence a house price were identified and used to determine the overall effects of the structural and location attributes on house prices. However, only significant variables were included in the final model and these were identified by using correlation analysis and modified step-wise procedures. The outcome of this paper shows a positive relationship between structural and location attributes and house prices.

Keywords House prices, hedonic price method, the Klang Valley

Abstrak

Kertas ini menyiasat penentu kepada harga rumah. Lembah Klang, Malaysia dipilih sebagai kajian kes dalam kertas ini. Pemodelan harga rumah hedonik digunakan untuk menentukan kesan ciri-ciri struktur dan lokasi ke atas harga rumah. Harga jualan, ciri-ciri struktur dan lokasi dikumpulkan daripada pangkalan data Jabatan Penilaian dan Perkhidmatan, Malaysia, peta terpilih dan laporan. Lima puluh lima faktor yang mungkin mempengaruhi harga rumah dikenal pasti dan digunakan dalam menentukan kesan keseluruhan ciri-ciri struktur dan lokasi ke atas harga rumah. Walau bagaimanapun, pemboleh ubah yang signifikan sahaja dimasukkan dalam model akhir dan ia dilakukan dengan menggunakan analisis korelasi dan prosedur berlangkah (step-wise) yang diubahsuai. Dapatan daripada kertas ini menunjukkan terdapat hubungan yang positif antara ciri-ciri struktur dan lokasi dan harga rumah.

Kata kunci *Harga rumah, kaedah harga hedonik, Lembah Klang*

Introduction

"Location, location and location" is the mantra of the real estate practitioners' when it comes to identifying the most important factor in determining house prices. As a result, over the past four decades, many studies have been carried out to determine the relationship between house price and location. The classical urban land economic model (Alonso, 1964; Muth, 1969; Mills, 1972) makes the monocentric assumption that all economic activities and employment are located in the Central Business District (CBD). Hence, there is a distance decay relationship between house price and distance from the CBD. Following this, distance to the CBD has frequently been used as a measure of location-house price relationship.

However, it is important to note that location from CBD is not the only variable used to determine the relationship between house price and location. This is because each unit of a house has an exclusive package of attributes such as its structural (physical) and location attributes (Powe et. al., 1995; So et al., 1997; Irwin, 2002; Tse, 2002; Cohen and Coughlin, 2008; Anderson *et al*., 2009; Dziauddin *et al*., 2013). By regressing the transaction prices of houses against structural and location attributes, the effects of these attributes upon house prices can be determined. An important question to ask is upon what factors do premiums depend? Through exploring what factors do premiums depend insights can be gained 'in helping sellers set asking prices, in helping buyers set offering prices, and in bringing buyers and sellers together toward an agreed transaction price' (Tse and Love, 2000).

Structural attributes of the house include floor area, the age of the house, the number of rooms (bedrooms and bathrooms), the house style (terraced, semi-detached, detached and high rise units), the presence of central heating, air conditioning, hot water, garage, attic, full insulation, storey height and the quality of a house, whilst location attributes may be pure or impure and include, among others, CBD, rail transit systems, roadways, highways, parks, schools, universities, museums, open spaces, woodlands, commercial areas, industrial areas, worship places, cemetery, air quality, water quality, and neighbourhood quality.

It is worth mentioning that the relationship between house prices and location attributes is determined by externalities generated by location attributes. Externalities can be positive (beneficial) and negative (disadvantageous). For example, the existence of rail transit systems can generate positive externalities (improve accessibility from one place to another) whereas racial composition (some white people may have a prejudice against living near black people) can add costs for people in the locality. It has to be noted that each type of externality may have an influence on property values. However, most externalities are local in their impact, with a distance decay effect in their extent and intensity (Johnston *et al.* 2000; Grether and Mieszkowski, 1980). For instance, externalities such as noise created by crowded major roads; the further people are from its source, the less it affects them.

Johnston *et al.* (2000) postulates that, people compete through the pricing system in the property market to be near positive externalities such as the CBD, rail transit systems, major roads, highways, schools, parks, and so on in order to obtain benefits from it (as shown in studies of the effects of location attributes on house prices) and

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ISSN 1985 - 496X

may become involved in political action in order to exclude negative externality generators from their neighbourhood. For example, neighbourhood activists known as 'not-in-my-back yard' (NIMBY) in the United States (US) often oppose the proposal of building a new sports facility. They argue that the construction and operation of the sports facility would bring about traffic congestion, air and noise pollution, thus cause property values to decline. The NIMBY attitude exists across the US and has delayed the development of many new sport facilities (Tu, 2005).

The aim of this study is to estimate the effects of structural and location attributes on house prices in the Klang Valley, Malaysia. As structural and location attributes are not directly traded, a number of techniques are available to measure their effects on house prices. The literature has shown that there are two broad categories of non-market techniques: stated preference techniques on the one hand and revealed preference techniques on the other. In the context of this study, hedonic pricing is used to measure the effects of structural and location attributes on house prices.

The hedonic price method (HPM) is a well-established method used to analyse a market for a single commodity with many attributes, in particular that of housing. In other words, HPM is based on the idea that properties are not homogeneous and can differ in respect to a variety of attributes. These various attributes will determine the value of the house. For example, since recreational lake is an important source of recreational amenity and pleasant landscape of the neighbourhood, house buyers may pay a premium in order to be located nearby a recreational lake. As a result, price differentials should develop among the neighbourhoods due to differences in distance from the recreational lake. These price differentials are signals about the value that residents place on living in a neighbourhood where recreational lakes exist. HPM will capture the value of recreational amenity and pleasant landscape generated by recreational lake only if the benefits from the accounts for those residential properties that are located nearby recreational lake.

Data and Methodology

The literature has shown that hedonic data can be obtained from two sources; primary and secondary data sources. In the context of this study most of the data were collected from secondary data sources. These data can be grouped into three categories; the selling price of a house (dependent variable), structural and location attributes (explanatory variables). House price transactions for 2005 were chosen to be the sample for this study. In total, 2338 units of housing selling prices were collected. However, after going through several steps to clean the sample dataset by eliminating the unsuitable data and updating the unavailable data[1], the study was left with 1,580 observations. The selling price of an individual house and its structural attributes were collected from the Department of Valuation and Property Services, Malaysia.

The data on the base map, land parcel and location attributes (type of land use) were obtained from the Department of Survey and Mapping of Malaysia, Centre of Spatial Analysis, Science University of Malaysia, Kuala Lumpur City Hall and Department of Agriculture of Malaysia. Land use or location attributes data were collected for the year of 2005.

In order to measure the distance to location attributes from a given house, the Geographical Information Systems (GIS) was used in this study. GIS was used to organise and manage large spatial datasets (that is, units of residential properties) and of course their structural and location attributes too, and most importantly GIS was used to position each observation and location attribute accurately on a local map by using the geographical coordinates. Moreover, the combination between GIS and spatial analysis has been particularly useful in this study in which the distance and proximity were measured accurately by measuring the distance from one point to another using network distance.

In order to measure the effects of structural and location attributes on house prices, this paper uses a standard HPM where house price is a function of structural and location variables. The general form of a HPM can be presented as:

$$P_i = f\,(S, L,) + \varepsilon \qquad (1)$$

Where,
P_i = the market price of property i,
S and L = the vectors of structural and location variables,
ε = a vector of random error terms.

Results and Analysis

The next stage of the estimation process using HPM is to choose the functional form which best portrays the relationship between a property's market price and each of the variables describing its characteristics. In other words, the functional form is the exact nature of the relationship between the dependent variable (a vector of house) and the explanatory variables (such as structural and location attributes). There were four common functional forms used in HPM; linear, semi-log, double-log and Box-Cox linear (Garrod and Willis, 1992; Cropper et al., 1988; Palmquist, 1984). Unfortunately, economic theory does not generally give clear guidelines on how to choose a particular functional form for property attributes (Tu, 2000; Garrod and Willis, 1992). However, Cropper et al. (1988) suggest that linear, semi-log, double-log and Box-Cox linear perform best, with quadratic forms, including the quadratic Box-Cox, faring relatively badly. Based on the advice given by Cropper et al. (1988), double-log specification was used to measure the effects of the LRT system on house prices in this study. The model is regressed on a set of determinants as follows,

$$\begin{aligned} \ln P_i = {} & \beta_0 + \beta_1 \ln FLRAREA_i + \beta_2 \ln BED_i + \beta_3 \ln TYPCLUSTER_i + \beta_4 \ln TYPSEMID_i + \\ & \beta_5 \ln TYPDETCH_i + \beta_6 \ln TYPFLAT_i + \beta_7 \ln TYPCONDO_i + \beta_8 TYPNETDIST_i + \\ & \beta_9 \ln TIMESAVING_i + \beta_{10} \ln CBD_i + \beta_{11} \ln MJRROAD_i + \beta_{12} \ln PRIMARYSCH_i + \\ & \beta_{13} \ln SECONDARYSCH_i + \beta_{14} \ln HOSPITAL_i + \beta_{15} \ln INSTITUTE_i + \\ & \beta_{16} \ln MOSQUE_i + \beta_{17} \ln LAKE_i + \beta_{18} \ln INDUSTRY_i + \beta_{19} \ln FOREST_i + \\ & \beta_{20} \ln COMMERCIAL_i + \varepsilon \end{aligned} \qquad (2)$$

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ISSN 1985 - 496X

where *i* is the subscript denoting each property; P_i is the price of property *i* in Malaysia Ringgit (MYR); ln is natural logarithm; FLRAREA is the floor area of the property in square foot; BED is the number of bedrooms of the property; TYPxxx is a set of dummy variables that illustrate the type of residential properties which are further described as follows:

TYPCLUSTER is 1 if the property is terraced, 0 otherwise;
TYPSEMID is 1 if the property is semi-detached, 0 otherwise;
TYPDETACH is 1 if the property is detached, 0 otherwise;
TYPFLAT is 1 if the property is flat, 0 otherwise;
TYPCONDO is 1 if the property is condominium, 0 otherwise.

NETDIST, TIMESAVING, CBD, MAJRROAD, PRIMARYSCH, SECONDARYSCH, HOSPITAL, INSTITUTE, MOSQUE, LAKE, INDUSTRY, FOREST and COMMERCIAL are the network-distance of the property to an LRT station, travel time savings to the CBD when people travel with the LRT system, Kuala Lumpur city centre, major roads, primary schools, secondary schools, hospitals, institutional areas, mosques, lakes, industrial areas, forests and commercial areas respectively. These explanatory variables are all measured in metres except for variable TIMESAVING where it is measured in minutes. Finally, β_0, ... β_{20} denotes a set of parameters to be measured associated with the explanatory variables (including the intercept term), and ε denotes standard error of the estimation, which is assumed to be independently and identically distributed. The descriptive statistics of the model's variables are shown in Table 1.

Table 1 Descriptive statistics of the model's variables

Variable	Type[a]	Description	Units	Minimum	Maximum	Mean
Dependent variable						
SELLING	C	House price transactions	Malaysia Ringgits (MYR)	50000	1850000	327926.94
Explanatory variables						
Structural variables						
FLRAREA	C	Size of floor area	Square foot	121.19	5116.44	651.35
BEDS	C	Number of bedrooms	Number	1	6	3.01
TYPCLUSTER	D	Cluster house	Dummy (0 or 1)	0	1	
TYPSEMID	D	Semi-detached house	Dummy (0 or 1)	0	1	
TYPDETCH	D	Detached house	Dummy (0 or 1)	0	1	
TYPFLAT	D	Flat	Dummy (0 or 1)	0	1	
TYYCONDO	D	Condominium	Dummy (0 or 1)	0	1	
Location variables						
CBD	C	Proximity to CBD	Metre	2734.83	12398.10	9090.47
NETDIST	C	Proximity to LRT station	Metre	113.92	3243.38	1587.84
TIMESAVING	C	Travel time savings to CBD	Minutes	-6.66	29.32	12.19
MJRROAD	C	Proximity to major road	Metre	1	2275.16	572.16
PRIMARYSCH	C	Proximity to primary school	Metre	4.27	2566.96	999.43
SECONDARYSCH	C	Proximity to secondary school	Metre	15.32	2777.77	914.39
HOSPITAL	C	Proximity to hospital	Metre	70.10	8414.89	3564.24
INSTITUTE	C	Proximity to institutional areas	Metre	13.38	5212.38	1770.22
MOSQUE	C	Proximity to mosque	Metre	4.09	5599.93	1568.32
LAKE	C	Proximity to recreational lake	Metre	1.69	8413.00	3180.69
INDUSTRY	C	Proximity to industrial area	Metre	73.16	2805.79	1498.84
FOREST	C	Proximity to forest	Metre	71.51	10060.44	5150.66
COMMERCIAL	C	Proximity to commercial area	Metre	9.67	2803.77	1099.72

[a]C = continuous; D = binary

Table 2 presents the summary of the parameter estimates associated with the 'best' model for double-log specification (OLS1). In general, the model fits the data reasonably well and explained close to 82 per cent of the variation in the dependent variable. Within the final model all of the explanatory variables that influenced house prices were significant at the 1 per cent level and have the anticipated positive and negative signs. Note that the parameter estimates of explanatory variables without the location variables (i.e. using only floor area, number of bedroom and type of residential properties) decreases to 69.1 per cent (OLS).

Note that structural and location variables were incorporated in the final model on the basis of significant coefficient values. The implicit prices of the continuous explanatory variables were calculated by holding all other variables at their mean level.

Table 2 Global regression statistics

Predictor	OLS			OLS1		
	Coefficient	**t-ratio**	**Implicit price (MYR 2005)**	**Coefficient**	**t-ratio**	**Implicit price (MYR 2005)**
Intercept	9.44	66.60	12851.72	13.12	33.79	498819.10
Structural variables						
FLRAREA	0.40	15.97	201.38	0.62	26.84	312.14
BEDS	0.52	13.23	56651.83	0.22	6.54	23968.08
TYPCLUSTER	-0.52	-9.36	-170522.01	-0.48	-9.87	-157404.93
TYPSEMID	0.25	3.44	81981.74	0.29	5.12	95098.81
TYPDETCH	0.44	9.05	144287.85	0.43	10.85	141008.58
TYPFLAT	-0.45	-2.97	-147567.12	-0.61	-4.83	-200035.43
TYYCONDO	0.43	18.38	141008.58	0.49	17.29	160684.20
Location variables						
CBD	-	-	-	-0.37	-8.53	-13.35
NETDIST	-	-	-	-0.14	-7.40	-28.91
TIMESAVING	-	-	-	0.09	7.69	2421.12
MJRROAD	-	-	-	-0.03	-2.95	-17.19
PRIMARYSCH	-	-	-	0.06	5.51	19.69
SECONDARYSCH	-	-	-	-0.06	-5.03	-21.52
HOSPITAL	-	-	-	0.06	3.76	5.52
INSTITUTE	-	-	-	0.03	2.65	5.56
MOSQUE	-	-	-	-0.02	-3.65	-4.18
LAKE	-	-	-	-0.01	-2.24	-1.03
INDUSTRY	-	-	-	0.06	3.64	13.13
FOREST	-	-	-	-0.14	-12.23	-8.91
COMMERCIAL	-	-	-	-0.03	-2.82	-8.95
	R^2 (adj.) = 69.1 per cent			R^2 (adj.) = 81.5 per cent		

Value of structural attributes

The parameter estimate associated with the size of the floor area (FLRAREA) is highly significant, indicating that the size of the floor area has a strong and positive influence on house prices. For every square-foot increase in the floor area, the house prices increases by an average of around MYR312.14 (OLS1). The greater magnitude of the effect of floor area was expected since floor areas are always associated with the size of the property – this is consistent with the most of the hedonic house price literature. The positive effect of number of bedrooms (BEDS) on house prices is also to be expected. The implicit price for one additional bedroom of a property is measured at an average of MYR23, 968.08.

As for property-type attribute, its role is only to indicate the price for different types of housing in the study area. As to be expected, the price for a detached or semi-detached house would be higher than a cluster house and flat. After examining the results, the conclusion that can be made is; there are significant differences in price between different types of housing. The implicit prices of detached (MYR141,008.58), semi-detached (MYR95,098.81) and condominium (MYR160,684.20) should all have reflected some value-added by the attributes that they possess.

In the case of a condominium property, the explanation that could be given is; since a condominium property has various facilities such as swimming pool, sauna, club house, sport facilities, landscape and security, it can be expected that a condominium property has a positive effect on house price. The same thing can be expected from a detached property, since it stands exclusively on its own and normally it comes with a bigger plot of land with lower density – these attributes will definitely contribute to the positive effect on house price.

Value of location attributes

The results of the estimation have also confirmed the importance of location attributes in determining house prices. Distance from the CBD is significant with the anticipated sign of the estimated parameter. The model suggests that for every metre away from the CBD (Kuala Lumpur city centre), the property value decreases around MYR13.25. This can be interpreted as a distance decay relationship between land rent and the distance from the CBD. The results of Table 2 also show that the parameter estimates of proximity to the nearest light rail transit (LRT) station (NETDIST) is found to be statistically significant with the anticipated sign. Evidently, it can be seen that the house price decreases as one moves further away from the LRT station – for every metre away from an LRT station, the value of a house decreases by MYR28.91. In the case of travel time savings commuting to the CBD by the LRT system (TIMESAVING), a house with better accessibility (one minute or less) to the CBD by the LRT system can add MYR2421.12 to house price. This is indeed in accordance with the findings of Dziauddin et al. (2013) in the Klang Valley, Malaysia who claim that residential properties were sold at higher price for those properties that are located within close proximity to the nearest LRT station.

With respect to proximity to major roads junctions (MJRROAD), house price was expected to decrease for every metre away from major road junctions. The implicit price for proximity to major road junctions indicates that for every metre away from a major road junction, house price would decrease around MYR17.19. The parameter estimates for proximity to a secondary school (SECONDARYSCH) also shows

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statistical significance with the anticipated sign. The implicit price for proximity to secondary schools suggests that for every metre away from secondary schools, house price would generally decrease by about MYR21.52.

With regards to the proximity to primary schools (PRIMARYSCH), the result is statistically significant, however, with unexpected signs. The model suggests that for every metre away from primary schools, there is a degree of increment in housing values. It clearly shows that on average, for every metre away from primary schools, the house price experiences an increase by about MYR19.69. This supports the results of study the impact of school on house prices carried out by Cheshire and Sheppard (2004). The logical reason for the decreasing house price by being located too close to the primary schools is due to negative externalities such as noise, traffic and parking congestion that are typically associated with car transportation of children to and from school (*see*, for instance study carried out by La Vigne, 2007).

The other possible reason is that house price would normally respond positively (increase) when located in the neighbourhood where the school is regarded to perform well in major examinations (in practice most of the major examinations take place in secondary schools). In other words, the quality of schools assessed by their performance in major examinations is found to be more important than just being located near to an ordinary school. Thus, it is reasonable to expect house prices to increase for every metre away from primary schools after considering the explanation that has been given above.

Proximity to hospital (HOSPITAL) is also found to be statistically significant in determining house prices with the anticipated signs – traffic congestion and noise from ambulance are always associated with the condition around hospital, and therefore, potentially will bring down the value of a house. The model suggests that for every metre away from hospital, the house price experiences an increase by about MYR5.52. Similarly, proximity to institutional areas (INSTITUTE) is also found to be significant in determining house prices. For the proximity to institutional areas, the parameter estimates indicate that for every metre away from institutional areas, the house price increases at the rate of MYR5.56.

In the case of proximity to the mosques (MOSQUE), the model suggests that for every metre away from the mosque, the house price experiences decrease by about MYR4.18. In other words, having a place of worship for Muslims has indeed added premium to the value of a house at least in the context of this study. This finding is somewhat surprising because traffic and parking congestion, and noise are always being associated with the mosque, in particular during Friday prayers or when some community activities are organised. Traffic and parking congestions that occurs can potentially cause residential properties located around a mosque may become less favourable among buyers, hence will bring down the value of the residential properties. Similarly, the use of loudspeakers in the mosques when calling to prayer by 'muezzin' is also perceived as an annoyance to some people and residential properties around a mosque may also become less favourable among buyers. For example, home owners in The Meadows, Dubai are pointing the finger at a very loud new mosque near to Meadows 4 as one cause for the 12 per cent fall in their house prices. Thus, further study need to be carried out in order to understand the motivation behind willingness to pay for a house at a higher price among buyers in the study area to be located closer to the mosques.

Another location attribute that also show significant contribution to the house price is the proximity to recreational lake (LAKE). For every metre away from recreational lake, house price decreases at the rate of MYR1.03. Continuing the observation of the study, the price-distance function for proximity to industrial areas (INDUSTRY) shows positive signs. The estimated parameter indicates that there is an increase in house price at the rate of MYR13.13 for every metre away from industrial areas. The rationale behind this observation is that being located adjacent to industrial areas means that house price is prone to suffer from traffic congestion and air and noise pollution. In addition, the norm of industry workers is to populate surrounding areas close to factories for example, resulting in social problems and hence, results in the perceived value of properties in the area to go down. Therefore, it is very understandable at least in the context of this study (where house price increases for every metre away from industrial areas) since people tend to avoid negative externalities caused by the industry, the associated community and its activities.

As shown by the coefficient on the variable FOREST in Table 2, the value of a house located within close proximity to the forested areas were sold at higher price than a house located further away. This is in line with the study carried out by Tyrväinen and Miettinen (2000) on the effects of urban forests on house prices in Finland where it was found that residential properties located nearby urban forests have increased in value. The other location attribute that also show significant contribution to the house price is the proximity to commercial areas (COMMERCIAL). The interpretation that can be made is that for every metre away from the commercial areas, house price decreases at the rate of MYR8.95.

Conclusion

The study concludes that there is an empirical evidence of the determinants of house prices in the Klang Valley, Malaysia that is contributed by structural and location attributes. The key findings of this paper are; firstly, structural attributes of the house played a greater role in determining house prices in the paper. As discussed above, the size of the floor area have shown to contribute more greatly to the house prices. This is of course in line with most of the hedonic house price analysis. Secondly, most location attributes that have been used in determining house prices in this paper are local in their impact, with a distance decay effect in their extent and intensity. Thus, it can be concluded that studies concerning the structural and location attributes of a property can be regarded as useful inputs to the basic valuation procedure.

Finally, it is worth mentioning that although HPM is useful and widely employed to study the relationship between house prices and its determinant factors, it has been argued in the literature HPM is a global model which naturally has a tendency to assume that the relationship between house prices and housing attributes are stationary over space, and therefore may hide some very interesting and important local differences such as different types of residential properties and areas may respond differently in terms of prices towards structural and location attributes. Therefore, several other local models such as geographically weighted regression (GWR), multilevel modelling and spatial expansion method need to be considered in identifying the determinants factors of house prices. By employing these techniques, it allows local rather than global parameters to be measured, and thus provides a way of accommodating the local geography of house prices-housing attributes relationships.

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[1] The following criteria were implemented for the purpose of sales transactions data cleaning; non year 2005 transactions, non house use, incomplete information and suspected error in data entry.

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