AN HEDONIC PRICE MODEL OF NEW HOUSING IN INDONESIA

SUPARDI SAMAPATTI
Chan Kok Hong Property Consultants, Singapore

and

LINDA TAY
National University of Singapore

ABSTRACT

This study investigates the prices of new housing in the Greater Jakarta Metropolitan Area, Indonesia. Based on the average sale prices of 149 new housing projects launched between January and June 1997, the ANOVA statistical tool is used to test whether different sizes of development adopt the same hedonic pricing model. Following this, multiple regression analyses are conducted to identify the hedonic factors and their impacts on the new house prices in small, medium and large developments. The study concludes that small, medium, and large-sized developments do not adopt the same hedonic pricing model. With the exception of small-sized developments hedonic model in which structural, locational and neighborhood characteristics are important determinants of prices, the medium and large-sized development hedonic models showed that only locational attributes have significant impact on house prices.

Keywords: Hedonic pricing model, housing attributes, the Greater Jakarta metropolitan area.

INTRODUCTION

In developing countries, a high percentage of the population tends to be concentrated in a few cities (Aryeetey-Attoh, 1992). Similarly, as the centre of economic activities in Indonesia, Jakarta faces a high rate of urbanization, which in turn accelerates the housing demand. While the need for housing remains high, the supply of land in Jakarta is relatively limited. To provide for more housing, the city is forced to expand its periphery to cities nearby, viz. Bogor, Tangerang and Bekasi, which is known as the Greater Jakarta Metropolitan Area (GJMA). The GJMA is the largest urban housing market in Indonesia. An estimate of 21 million people (or 25% of people living in cities) are now residing in GJMA (Indonesian Real Estate Directory, 1997).

Although Indonesia is one of the most populous countries in the world with vast amounts of land, very little is known about its housing market. This study aims to conduct an empirical investigation into the pricing of new houses in the GJMA by developing a hedonic pricing model that focuses on the demand factors and through this to shed some light on a hitherto unknown housing market. Since the supply factor in the GJMA housing market is relatively fixed due to the scarcity of land in the city, the estimation of house prices can be largely explained by demand factors, such as spatial

and housing characteristics that yield benefit to households for which households are willing to pay for the desired housing attributes.

One potential contribution of this study is the building up of empirical evidence for hedonic pricing theory by comparing the findings of this study with those of existing studies on other housing markets. The practical relevance of this study is that the findings may assist investors in the Indonesian housing market to ascertain the housing attributes that consumers desire to acquire and are willing to pay for. With this understanding, investors are thus able to package these attributes in their housing products to meet consumers' preferences.

Following this introduction, a literature review will be conducted to lay the conceptual foundation for this study. The research methodology is discussed next. This is followed by the presentation of the results and finally, the paper concludes with a discussion of the implications for investors as well as some suggestions for future research.

LITERATURE REVIEW

The term "hedonic", when used in relation to an urban residential market, refers to the non-financial attributes of a housing product. Hedonic price refers to the value of a set of attributes or characteristics of a product that consumers are willing to pay due to its benefit or utility (Bajic, 1983; Rosen, 1974).

The conceptual justification for using hedonic price functions has been provided by Rosen (1974). He estimated the parameters of an explicit utility function of demand and supply of a product. These parameters estimated are then used to measure the willingness to pay, as the amount of consumption of non-housing commodities that a household would be willing to give up to acquire another unit of each housing characteristic.

The basic hedonic pricing model establishes a relationship between house prices and traits. The traits can generally be classified into three categories: structural traits; locational traits and neighborhood traits (Mok et al., 1995). Thus, the market price of a property, denoted by P, could be expressed as:

$$\mathbf{P} = \beta_0 + \beta_1\mathbf{S} + \beta_2\mathbf{L} + \beta_3\mathbf{N} + \varepsilon \qquad (1)$$

where: P = Market price of a property per square meter of building area
β = Market determined parameters in the model
ε = The vector of error terms with standard properties
S = Vectors of structural traits
L = Vectors of locational traits
N = Vectors of neighborhood traits.

In regard to structural attributes, variables such as size of lot, floor area, age of building, number of rooms, number of storeys, level of unit and housing fixtures (roof, wall and floor) are often used. To represent the locational traits, variables such as accessibility to CBD, social and civic center, amenities and/or facilities, train station and other public

transportation are widely studied. Neighborhood traits can be explained by variables such as: amenities and/or facilities quality; road quality; environment quality (air, water and noise); and view or orientation.

The partial derivative of the above hedonic function with respect to any traits in equation (1) is interpreted as implicit marginal traits prices (Rosen, 1974). These marginal trait valuations measure the implicit prices of traits as a result of equilibrium of demand and supply for the housing attributes. When empirically tested by hedonic regression, the regression coefficients will measure the implicit price of the housing attributes.

The hedonic model not only requires appropriate specification of dependent and independent variables, but also suitable functional form (Megbolugbe, 1989). However, there is currently a lack of established theory for the choice of hedonic functional specification. Freeman (1979) utilized eight different functional forms, but found that the true relationships amongst housing characteristics are much more sophisticated and none of these were deemed as the "correct" form of hedonic functional specification.

Mendelsohn (1984) found that using linear versus non-linear hedonic price functions in his analysis had little effect on the estimation result for the demand functions. Similarly, many researchers have also used the linear form in their studies (e.g., Palmquist, 1984; Parson, 1986). Therefore, the linear specification will be used in this study, given the ease of estimation and its robustness as suggested by past researchers.

Mok et al. (1995) used an hedonic pricing model to explore the effects of structural, locational and neighbourhood traits on the price structure of private properties in Hong Kong. An important finding of Mok et al.'s study is that size of development has an effect on property prices. They suggested that big estates usually provide better amenities and/or facilities which would have a positive effect on property value. Similarly, observations of transacted property prices in GJMA suggest the house prices vary with the size of project. For example, the mean of new house prices for small-sized developments was 865,635 Rupiah per square meter, while the mean for medium and large-sized developments were 733,570 and 771,471 Rupiah per square meter of building area respectively. This study will test if size of development is a significant factor influencing house prices. If so, further tests will be conducted to examine the hedonic factors that significantly affect the house prices of these developments. Thus, the key hypotheses in this study are:

H1: Size of development is a significant factor influencing new house prices.

H2: Different sizes of development have different hedonic models for new house prices.

METHODOLOGY

The sample employed in this study includes the average property sale prices of 149 new housing projects launched between January 1997 and June 1997. This period is chosen as it represents a stable period prior to the Asian Financial Crisis and therefore differences in new house prices between housing projects are not influenced by macro-economic factors. The stability of the house prices is important to reduce the bias of the study, which may affect the final result estimated by the hedonic pricing model. Ideally,

the actual transacted prices for individual housing units should be used in the study. However, the lack of organized information such as a centralized database of housing sale transactions limits the study to use average property sale prices of new housing projects obtained directly from developers as a measure for new house prices.

The focus of this study will be new houses in the price range of 50 - 200 million Rupiah as they have the highest demand in the GJMA housing market. Interviews with developers suggest that small developments are those less than 50 ha, while medium developments are those ranging from 50 to 199 ha and large developments consist of projects that are 200 ha and above.

Statistical analyses for this study are conducted on two levels. Firstly, the one-way ANOVA test will be employed to establish whether there is a significant difference in the mean of new house prices between different sizes of developments. If so, this implies that different sizes of developments may not adopt the same hedonic pricing model. Separate multiple regression analyses will thus be employed to identify the hedonic factors of each type of development and measure the effect of each variable in the model on house price.

The hypothesized relationships between the independent variables and dependent variable are presented in Table 1 and the descriptive statistics are described Table 2.

Table 1: Hypothesized Direction of Relationships

Variables	Variable Code	Variable Definition	Expected Relationship
Dependent	PRICE	Selling price of property per square meter of building area, in Rupiah.	
Independent			
a) Structural	SLAND	Land area, in square meters.	-
	SFLOOR	Total floor area, in square meters.	+
	SSTOR	Dummy Variable, 1 if the house has 2 stories or more; 0 otherwise.	+
	SWIDTH	The width of road, in meters.	+
b) Locational	LCBD	Distance to the center of CBD, in kilometers.	-
	LTOLL	Proximity to the nearest toll road, in kilometers.	-
	LTRANS	Dummy variable, 1 if there are public transportation to and from the subject site; 0 otherwise.	+
c) Neighborhood	NFACIL*	Dummy variable, 1 if developers provide range of facilities more than those required; 0 otherwise.	+
	NROADQ	Dummy variable, 1 if the road condition to and from the subject site is good; 0 otherwise.	+

* Note: Under the Indonesian government regulation for local investment Number 5 Article 5, 1974, developers are required to provide a minimum range of facilities for any housing development consisting of sport center, playground, open space or park, supermarket and/or shophouses, religious facilities, school and health center.

Table 2: Descriptive Statistics

Variables	Minimum	Maximum	Mean	Standard Deviation
PRICE	406,389	1,958,333	810,028	287,958
SLAND	80	340	124.72	29.85
SFLOOR	42	130	65.58	18.62
SWIDTH	6	10	7.40	1.11
LCBD	14	64	37.03	9.52
LTOLL	1	14	4.38	2.83

EMPIRICAL RESULTS AND ANALYSIS

Table 3 presents the results of the one-way ANOVA test which determines if there is a significant difference in the mean of new house prices between different sizes of developments. Using a 5% level of significance, the result of the one-way ANOVA test shows an F-value of 4.72, greater than F-critical of 3.06. This implies that the mean house prices (dependent variable) are significantly different between the different sizes of housing development (independent variable). As such, H1 is supported.

Table 3: One-Way Anova Test Result

Size of Development	Mean Price/sq.m
SMALL MEDIUM LARGE	Rp 882,425 Rp 727,948 Rp 771,471
F-Value 4.72 F Critical 3.06	

Separate hedonic models for each size of development are then structured to identify its hedonic factors and measure the effect of each attribute in the model on house price. The empirical results of hedonic pricing models for the different sizes of developments are presented in Table 4.

Table 4: Summary of Regression Results

Explanatory Variables	Small-sized Devt.		Medium-sized Devt.		Large-sized Devt.	
	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
INTERCEPT	383,548.43	1.3358	960,771.56	4.4129	641,272.86	1.3757
SLAND	198,343	1.0210	-206,763	-1.1010	-267,355	-1.1260
SFLOOR	9,479.49	5.0738	3,185.66	1.9067	1,108.94	0.2441
SSTOR	10,617.03	0.1599	107,851.29	1.6379	77,018.44	0.7252
SWIDTH	21,490.79	0.9190	7,727.11	0.3730	62,285.86	1.3318
LCBD	-7,505.84	-2.9726	-9,555.21	-4.4514	-11,770.61	-2.1018
LTOLL	-13,192.83	-1.5757	-8,599.89	-1.1939	-8,183.65	-0.6321
LTRANS	108,553.60	0.5940	164,811.54	2.3973	50,512.98	0.2266
NFACIL	54,419.76	0.2898	808,128.20	6.6211	31,955.44	0.3871
NROADQ	212,600.99	3.4049	54,877.38	0.7652	73,503.27	0.5272
R-square	0.6839		0.8588		0.6503	
Adjusted R^2	0.6373		0.8263		0.4847	
F-statistic	14.6649		26.3638		3.9260	
Significant F	0.0000		0.0000		0.0058	
Observations	71		49		29	
VIF tests						
Low	1.098 (LTRANS)		1.109 (NFACIL)		1.239 (LTRANS)	
High	2.736 (SFLOOR)		4.547 (SFLOOR)		3.124 (SFLOOR)	

The R-square for all three hedonic models indicate a good fit between the data and the linear functional form used. A physical examination of the residuals, however, showed that the variable SLAND exhibits heteroscedasticity. To overcome this problem, log values were used for SLAND (Di Pasquale and Wheaton, 1996).

Using the F-test for overall model adequacy, all three hedonic pricing models are statistically significant at the 1% significance level. The results suggest that the hedonic models are adequate and appropriate for measuring house price structure in the GJMA, Indonesia. Finally, the VIF analyses suggest that there are little evidence of collinearity amongst the set of explanatory variables for all hedonic pricing models, since the VIF is less than 5 (Snee, 1973).

For small-sized developments, there are 3 variables that are statistically significant, i.e. total floor area, distance to CBD and road condition. This indicates that for smaller developments, all three categories of housing attributes, namely structural, locational and neighborhood characteristics are important determinants of the new house prices.

For medium-sized developments, the variables that significantly influence price are distance to CBD, access to public transportation and type of facilities. The results show that for medium-sized developments, structural attributes are not significant price determinants. Rather, buyers of new houses in medium-sized developments place more

emphasis on locational attributes, such as distance to CBD and access to public transportation.

Results from the large-sized developments hedonic model indicate that only distance to CBD has a significant influence on house prices. This is intuitively reasonable because larger developments require big plots of land and this is only available further from the CBD and hence, distance from the CBD becomes an important attribute that determines the house prices in large developments

In essence, the results suggest for different sizes of development, the factors that influence new house prices vary. In small developments, structural, locational and neighborhood characteristics are important price determinants. In medium-sized developments, locational attributes appear significant as a price determinant and lastly in large developments, only distance to CBD is a determinant of new house prices. Thus, hypothesis H2: "Different sizes of development have different hedonic models for new house prices" is supported.

CONCLUSION

The results of this study have several implications for players in the urban housing market in the GJMA. First of all, the results show that small, medium, and large-sized developments have different hedonic factors that influence house prices. Thus, for developers of small-sized developments, developing closer to the CBD, increasing the total floor area and improving the road condition will enhance the prices of the new houses. Similarly, for the larger developments, proximity to the CBD is a desirable attribute. However, it would be easier for smaller developments to locate near the CBD rather than larger developments, as such large parcels of land would only be available further from the CBD area. The developer of medium-sized developments should focus on locational variables, such as access to public transportation and CBD.

Secondly, property appraisers can use the hedonic model to determine the market value of a property by utilizing the implicit prices of each housing attribute. Thirdly, the knowledge of hedonic models could be used by marketers in developing their marketing plan guided by attributes that appeal to the target group, given the size of development.

While the results of this study may provide some useful perspectives, the discussion above must be tempered with the limitations of this study. First of all, a major limitation of this study is the problem of availability of a comprehensive data set. This is a common problem for studies on developing countries. As such, future studies may use actual sale transactions as a measure of house prices and include other useful variables such as crime level, accessibility to health, educational and cultural to improve the predictability of hedonic specifications. Secondly, the study assumes a monocentric model of employment centre i.e., the Jakarta CBD. Thirdly, the choice of measuring distance by length instead of time may not give a complete picture. Due to traffic congestion, the relatively equal distance from the development site to the employment centre may result in different time distances. Finally, the small sample size of large-sized developments has reduced the degrees of freedom and hence the explanatory ability of the model has been somewhat limited.

REFERENCES

Aryeetey-Attoh, S. (1992). "An Analysis of Household Valuations and Preference Structure in Rio de Janeiro, Brazil", Growth and Change 23, pp. 183-197.

Bajic, V. (1983). "The Effect of a New Subway Line on Housing Prices in Metropolitan Toronto", Urban Studies 20, 1983, pp. 147-158.

DiPasquale, D. and Wheaton, W. (1996). "Urban Economics and Real Estate Markets", Prentice Hall, Englewood Cliffs, New Jersey, U.S.A.

Mendelsohn, R. (1984). "Estimating the Structural Equations of Implicit Markets and Household Production Function", Review of Economics and Statistics 66 (August), pp. 673-677.

Megbolugbe, I. (1989). "A Hedonic Index Model: The Housing Market of Jos, Nigeria", Urban Studies 26, pp. 486-494.

Mok, H., Chan, P. and Cho, Yiu-Sun. (1995). "A Hedonic Price Model for Private Properties in Hong Kong", Journal of Real Estate Finance and Economics 10, pp. 37-48.

Palmquist, R. (1984). "Estimating the Demand for the Characteristics of Housing", Review of Economics and Statistics 66 (August), pp. 394-404.

Parsons, G. (1986). "An Almost Ideal Demand System for Housing Attributes", Southern Economic Journal 53(2), pp. 347-363.

Indonesian Real Estate Directory (1997), Property Magazine, Jakarta.

Rosen, S. (1974). "Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition", Journal of Political Economy 82, pp. 34-55.

Snee, R. (1973). "Some Aspects of Nonorthogonal Data Analysis, Part I. Developing Prediction Equations", Journal of Quality Technology 5, pp. 67-79.