A Hedonic Model for Apartment Rentals in Ikeja Area of Lagos Metropolis

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Abstract The hedonic pricing model has been employed with a degree of success in housing market analysis in developed countries. This paper demonstrates the potentials of the same technique to the study of housing markets in a developing country like Nigeria. The paper used data from Ikeja area of Lagos state, Nigeria, to provide empirical evidence on market parameters that describe the hedonic price structure for apartments (flats) in a typical Nigerian city. Primary data were elicited through structured questionnaire, complemented with selective interviews and personal observations. The results revealed that number of bedrooms, condition of the property, availability of pipe-borne water, average size of bedrooms, and numbers of bath/toilets, in that order, are the main descriptors of apartment rentals in the study area. The results of this empirical investigation are of particular importance to investors, developers, financiers, and real estate valuers operating in the property sub-market under consideration. Among others, adequate knowledge of issues investigated and raised would assist developers to build to consumer tastes and preferences. The resulting model also provides an alternative to traditional valuation techniques and affords greater flexibility in accounting for sustainability in real estate valuation.

Key Words: apartment rentals, hedonic pricing, Nigeria.

1. Introduction

The economic concept of value is not inherent in the commodity, good, or service to which it is ascribed; rather, it is created in the minds of the individuals who make up the market (Appraisal Institute, 2008). Thus, there is no specific or restricted meaning to the word "value" as it may mean different things to different people. Both the academia and real estate professionals have therefore accepted behavioural research as a valid and relevant aspect of real estate market analysis (Gallimore and Wolverton, 2002; Daly et al., 2003; Diaz, 2007; Bello and Bello, 2007).

Much work has been done on the relative impact of factors that influence house prices in the developed countries. The different contextual and cultural settings as well as differences in property market characteristics obviously limit the direct application of these methodologies and their findings to Nigerian situation (Bello and Bello, 2008). In Nigeria, documented empirical studies in this area are scanty. Megbolugbe (1989), Bello and Bello (2007), Bello and Bello (2008), Ajide and Alabi, (2010) and Omoogun (2010) are notable among the limited Nigerian empirical studies. Ajide and Alabi (2010) assessed the most appropriate of the three standard functional forms for the hedonic analysis for an unspecified property sub-market of Lagos State and concluded that the semi-log was the most efficient having the highest coefficient of determination (67%). Bello and Bello (2008) assessed willingness to pay for better environmental services in a loosely defined sub-market that apparently lack homogeneity using the two-stage hedonic model – a model that has been criticized for its simultaneity bias (Arimah, 1996). It is required that the residential area used to model the relationship between property values and their individual characteristics be treated as a single market for housing services, such that home buyers are assumed willing and able to choose from among all available properties in that area. Adair et al.,(1996) empirically demonstrated the need to limit both the extent of the spatial area studied, and the variability of the properties

within it, in order to produce more reliable estimates of property attributes' values. Besides using linear regression to measure the effects of dumpsites on property values in selected parts of Lagos metropolis, Omoogun (2010) adopted variables that were used in previous US (the two countries have marked differences in socio-economic characteristics including market structure and behavior) verbatim making the conclusions doubly suspect. The main shortcoming of Megbolugbe (1988) is that the study employed rating assessment data as surrogate for market value. Though authors have consented to using such surrogates on the grounds that what matters in hedonic modeling is consistency and not pinpoint accuracy; however, rating valuation being statutory, is not often market-determined or based on market transactions and therefore subject to inconsistencies inherent in non-market valuation techniques. This is particularly true of a country like Nigeria where the correlation between valuations and transaction prices has been consistently weak (Aluko, 1998; Ogunba, 2004; Babawale, 2008; Babawale and Ajayi, 2011).

It is apparent from the foregoing that considerable gap exists in the body of knowledge in this important aspect of real estate research in Nigeria. This study is intended to fill part of this gap by investigating the predictive strength and relative importance of the descriptors of apartment (flats) rentals in Ikeja area of Lagos State. This study is timely and desirable, considering the status of Lagos metropolis as the commercial nerve centre of the country with a huge and highly diversified property investment especially in the residential sector.

The paper is structured into five sections. The next section contains the review of literature followed by the description of the study area. The fourth section describes the research method, while the last section covers the conclusions and recommendations.

2. Review of Literature

Over the past three decades, the hedonic-based regression approach has been employed extensively in housing market literature to investigate the relationship between house prices and housing characteristics. Specifically, the technique has been employed to achieve three main goals: (i) to explain the price formation of property assets (mainly residential) by identifying the main determinants of property prices, (ii) to isolate and quantify the impact of different physical, locational and neighborhood characteristics on property prices, and (iii) to account for changes in the price formation process across regions or over time (Lorenz, 2006).

The basic idea of the hedonic approach is associated with Court (1939) who employed the model for the automobile industry. Since then, the method has been applied to other goods like cotton, computers and housing. The theoretical foundations of the hedonic price model were laid by Lancaster (1966) and Rosen (1974). Lancaster (1966) put forward his consumer theory otherwise referred to as Lancaster preference theory, an extension of the consumer theory of classical economics while Rosen (1974) established the modeling foundation for the hedonic price theory by his equilibrium model of market supply and demand based on product characteristics. Lancaster's (1966) theory argued that demand for a product is not based on the product itself, but on the product's utility generating characteristics. A specific functional relationship is therefore assumed to exist between the characteristics and the prices of commodities. Subject to this relation and a standard budget constraint, maximization of utility gives rise to a hedonic function relating the price of a commodity to the characteristics embodied in it (Wen et al., 2005).

The hedonic model relates the property price P to a vector x of structural, neighborhood and locational characteristics. Then the marginal cost of an additional unit of a given characteristic x_i is calculated as the partial derivative of P(x) with respect to that characteristic, i.e.,

$$dp_{xt} = \frac{dp}{d_{xt}} = \ldots\ldots\ldots (i)$$

Parameter estimation is usually based on a multiple regression model and results in the marginal value that the consumer is willing to pay for each of the considered characteristics. The general form of the regression model is:

$$P = f(X, \beta) + \varepsilon \ldots\ldots\ldots\ldots (ii)$$

Where, P denotes the vector of observed transaction prices, x the matrix of exogenous variables, β the vector of coefficients and ε the error term. With respect to apartment rental, the hedonic function/model can therefore be expressed as:

$$R = f(A_i, L_i, N_i) \ldots\ldots\ldots\ldots (iii)$$

Where, R, is the apartment rental (actual or appraisal data); A_i, is the vector of the structural attributes – number of bedrooms, number of toilet/baths, condition, age, floor area etc.; L_i is a vector of the location attributes – distance from CBD, school, recreation etc.; N_i is a vector of the characteristics describing the neighborhood – proximity to places of worship, to forest, lake, traffic/airport noise, crime rate etc.

If this relationship is true and if the relationship is linear, for instance, the estimated regression coefficients are interpreted as implicit or hedonic prices of each of the characteristics which determine rent or value.

3. Model Specification

(i) Hedonic variables specified

A hedonic price model involves first the specification of a housing price function which relates the observed housing expenditure to the selected structural, neighborhood and accessibility characteristics that are considered to influence prices in a given sub-market and then to construct price indexes (Can and Megbolugbe, 1997). Rosen (1974) viewed housing market as consisting of implicit markets for each of the attributes of housing. That is, each housing market or sub-market produces its own set of hedonic prices. Schnare and Struyk (1976) suggest that housing market segmentation occurs when households' demand for particular structural or neighborhood characteristics is highly inelastic and the preference is shared by a relatively large number of households. Tse and Love (2000) also observed that housing prices are determined by the demand for attributes, not only for the dwelling units themselves, but also of the region in which the units are located. Only those tenant characteristics which affect the prices paid for housing, or the supply prices in the surveyed sub-market are therefore included in the hedonic equation.

(ii) Functional form

The choice of functional form that most appropriately explains the relationships between the explanatory variables and the property prices is critical in determining accurate and consistent econometric model. In particular, the problem of heteroskedasticity can be mitigated by choosing the most appropriate functional form. There is however, no strong a priori notion of the correct functional form. Janssen et al., (2001) observed that there is no agreement in the literature as to what is an appropriate functional form for the effect of property attributes. Selim (2008) also observed that there is little guidance from economic theory about the proper functional relationship between housing price and its attributes. As neither economic theory nor previous studies provide clear guidance regarding the choice of functional form, this study employed the three models that have been most widely used in studies of similar nature - the linear, semi-log, and the log-linear. These three standard functions are reputed as being easily interpretable, and the estimated parameters as possessing a direct economic meaningfulness (Maurer et al., 2004). In strictly linear model which implies constant partial effects, the coefficients of a variable are equal to absolute prices for the unit of the respective property characteristic. In a semi-log (log-linear/translog) model, the coefficients can be interpreted as the approximate percentage change in the property price relative to a per-unit change in the given variable. With double-log function, the price elasticity of the properties is displayed in terms of a relative change in the respective characteristic amounts. Parameter estimates are therefore mostly undertaken on the basis of one or a combination of these standard functions - see appendix 1. The three models are of the form:

$P = \alpha_o + \alpha_i z_i + \varepsilon$ (linear)……(iv)

$\text{Log } P = \beta_o + \beta_i Z_i + \varepsilon$ (semi – log or log-linear) ……(v)

$\text{Log } P = \varphi_i + \varphi_i \log Z_i + \varepsilon$ (double – log)……(vi)

Some housing structural attributes exhibits diminishing marginal returns. As such, recent studies have challenged the assumption of linearity in favor of semi-log function for housing market analysis. The law of diminishing marginal utility states that an economic agent's marginal utility falls when one consumes more units of the commodity, ceteris paribus. For example, residential lot price per square meters diminishes as lot size increases. This is similarly true of floor level, age and possession of view.

Appendix 1 contains highlights on a number of previous empirical studies on hedonic pricing model including, for each study, the sample size and characteristics, adopted functional form and major findings, among others. In all cases, ordinary least squares regression (OLS) is used to estimate the hedonic price function.

4. Study Area

The study area is Ikeja. Ikeja is the capital of Lagos State, South West Nigeria. In spite of the fact that the seat of Federal Government has moved from Lagos to Abuja, Lagos metropolis has remained the nerve centre of the nation's commercial, industrial, and property investment activities. Lagos metropolis has the most active property market in Nigeria with the highest average property value and stock of investment (Babawale & Koleoso, 2006). More than 90% of the head offices of post-consolidation banks and insurance companies (notable end users of valuations) are located

within the metropolis. Lagos population is estimated at over 17 million which confers on it the status of a mega city. Lagos population is projected to be the third largest city in the world by the year 2015.

Originally, Ikeja area used to be predominantly residential area until the population explosion and economic boom which followed the oil boom of the 1980s brought about a radical transformation of its economic and social characteristics and status which in turn has affected the mix and quality of its property stock. The area under reference is dotted with a number of notable institutional, commercial and industrial landmarks including the Murtala Mohammed International and the Local airports, Ikeja Army Cantonment (one of Nigeria's biggest military Barracks), the Nigerian Airforce base, Lagos state government main secretariat at Alausa, the headquarters of the Lagos State Police Command, the computer village and many more. Ikeja also has one of the largest industrial concentrations in Nigeria. It is also the home of leading hotels in the country including Sheraton hotel and Towers, Protea hotel, Airport hotel, White house hotel and Lagos travel inn. Majority of these prominent commercial, industrial, and institutional centres are located within the area's extensive Central Business District (CBD).

Residential uses in the area under consideration comprise of high, medium, and low density neighborhoods. Notable residential neighborhoods include Ikeja GRA, Maryland, Ogba, Agidingbi, Opebi, Oregun, Alausa, Akiodu and Ojodu. Apartments (flats) are to be found mainly in the medium and high density parts of the study area and constitute the bulk of rented accommodation occupied by the upper middle and lower upper income brackets. Apartments are often built on two or three floors. Blocks of flats on five floors are scarce. Lift is a rarity as none of the sampled blocks of flats is provided with a lift. Flats are mainly 3-bedrooms, with limited 2- and 4-bedroom.

More recent developments have all their bedrooms en-suite bath/toilet with separate guest toilet; while older buildings have only master bedroom en-suite bath/toilet while the remaining two bedrooms share a toilet/bath. There are few samples of much older buildings, where the 3-bedroom flat has only one toilet/bath with or without a guest toilet. Provision of security/perimeter fence improves a property's identity, security and privacy besides providing a relatively safe place for children to play and for safe parking of vehicles, among others. Although crime rate is dropping in Ikeja, there exist "unsafe" spots where pick pockets, muggers and touts constitute nuisance and security risk. As a result of low compliance with planning regulation generally, schools, hotels, places of worship, and even markets are cited indiscriminately and often to the detriment of adjacent residential users. Given the downturn in the economy, poor maintenance culture, and poor yields on property investment, property maintenance is at its lowest ebb generally so that most houses are in dire need of both structural and decorative repairs, particularly the latter.

Comparatively, Ikeja is well served with modern off site facilities, especially road networks, overhead bridges and telecommunications facilities and services, though most roads are in deplorable condition. Poor roads and/or absence of culverts lead to stagnation of foul water, flooding and related environmental hazards, and traffic congestion. Less than 20% of houses in the study area are served with pipe-borne water from the public mains. House rent and overall costs of living in the study area is above Lagos metropolis average and only lower than in areas such as Ikoyi, Victoria Island, and some parts of Lekki.

5. Research Method

This study employs a standard hedonic model to test the hypothesis that house prices are influenced by a combination of housing attributes. Primary data for the study is based on the sample of 250 apartments let within 12 months prior to the survey (August 2009 to August 2010). Using purposive sampling technique, primary data were elicited through a questionnaire survey which sought information on housing attributes and the corresponding rentals from apartment occupiers in the study area. This is complemented with selective interviews and personal observations. The questionnaires were administered to heads of households or their representatives who are 18 years of age or above.

The sample size of 250 tenants is considered adequate given of cross sectional homogeneity of the respondents. Furthermore, the socio-economic profile of occupiers of apartments in Ikeja and its environs is comparable as occupiers of apartments usually belong to the upper middle segment and the lower upper segment of the population income brackets that are supposed to have homogenous tastes such that the net effects of neighbourhood attributes are similar. Secondary data were obtained from journals, technical reports, and previous studies.

Given the nature of the data available for this study, the semi-log function was considered best fit and therefore employed. Additional reasons for choosing the semi-log is that the model, unlike the linear model, allows the value added to vary proportionately with the size and quality of the house. Furthermore, the coefficients of a semi-log have simple and appealing interpretation, while the model minimizes the common statistical problem known as heteroskedasticity. The semi-log model uses the natural log of the hedonic price, which is regressed on untransformed independent variables thus:

$$LnAR_{it}\ _{j=1}^{k} = \alpha_0 + \sum \alpha_{jt} z_{ijt} + \varepsilon_{it} \ldots\ldots\ldots (vii)$$

Where,
i = property, t = time, ARit = apartment rental at given time t; Zijt = vector of characteristics; α_{jt} = implicit prices of the k characteristics; εit = error term.

6. Data

The data analysis has been structured into two sections. In the first section is the analysis of the data on the characteristics of the respondents and housing characteristics which were presented using descriptive statistics. The second is the analysis of the relationship between locational, neighbourhood, and structural attributes on the one hand, and apartment rentals on the other which are presented inferentially using the hedonic price model. All analyses were carried out with the aid of SPSS.17.

Table 1 describes the dependent and independent variables used in the hedonic model analysis with their respective codes and measurements - continuous and dummy variables. Due to paucity of data on construction and accommodation details of apartments in the study area; the uphill task of getting majority of the respondents either to provide accurate measurement of their accommodation or to allow field staff to do the same; and for lack of GIS information that cover these areas; a number of variables that should ordinarily be measured as continuous variables were measured as dummy variables – in the best way permitted by circumstances and in a way respondents can readily relate with. For instance, it was relatively easy for respondents to relate effectively with the size of their accommodation when described as 'standard' or otherwise. Distances are also approximated as 'walking' or 'driving' distance.

A number of rules of thumb were used to test for the presence of collinearity. Heteroskesdasticity has long been recognized as a potential problem in hedonic price equation. Wallace and Silver (1988) opined that "it is probably a good idea to use the White heteroskedasticity test option routinely, perhaps comparing the output with regular OLS output as a check to see whether heteroskedasticity is a serious problem in a particular set of data". We have followed this advice in this study.

Table 1: Definition of Housing Hedonic Variables for Ikeja Area, Nigeria.

S/No	Variable Code	Variable Definition	Variable Measurement
1	RTVAL	Rental value (net) of the apartment (flat) per annum = dependent variable.	Amount in Naira[a]
2	BDRM	Number of bedrooms in the flat	Number of bedrooms available.
3	SIZKITCH	Size of the kitchen	If standard(≥8 m^2) = 1 Otherwise = 0
4	SIZBDRM	Average size of bedrooms	If standard (≥10 m^2) = 1 Otherwise = 0
5	SIZSTRM	Size of the sitting room	If standard (≥20 m^2) = 1 Otherwise = 0
6	BATOILET	Number of bath/toilet	Number of bath/toilet available.
7	FENCE	Availability of security fence	If available = 1, Otherwise = 0
8	WATAVL	Availability of pipe-borne water in the block of flats	If available = 1, Otherwise = 0
9	COND	Structural and decorative state of the house.	If good = 1, Otherwise = 0
10	SECURITY	Perceived neighbourhood security.	If good = 1, Otherwise = 0
11	DISCH	Linear distance from apartment to quality school for children.	If less than 10 minutes walking distance = 1, Otherwise = 0.
12	DISCBD	Linear distance from apartment to Ikeja Central Business District (CBD).	If less than 15 minutes driving distance = 1.Otherwise = 0
13	DISMKT	Linear distance from apartment to nearest neighbourhood market	If less than 15 minutes walking distance = 1, Otherwise = 0
14	ROADS	The state of neighbourhood roads/culverts.	If good = 1,Otherwise = 0

For the purpose of this study (modeling apartment rental) and for the sub-market under consideration, plot size is unimportant. Possession of view, such as water, Sea or Mountain View, is also not applicable. Floor level is equally irrelevant as earlier explained, because the market showed no price differential between flats on different floors even in the few cases where the number of floors were 4 or even 5. Age of property is excluded from the variables because rental values (unlike sale values) respond more to the physical condition of the property rather than the chronological age. Thus, in the model, the condition of the property (COND) is used.

7. Data Analysis and Discussions

Table 2 summarises certain characteristics of the respondents. From Table 2 (a), 78% of the respondents are male, 84% are university or polytechnic graduates (Table 2(b)), about 70% are either civil servants or white-collar workers (Table 2(c)). Over 60% earn in excess of N2 million in a year which is far above the national average (Table 2(d)).

Table 2: Major Characteristics of Respondents

Variable	Frequency	Percentage (%)
(a) Gender Distribution of the Respondents.		
Male	196	78
Female	54	22
Total	**250**	**100%**
(b) Distribution of the Respondents by Educational Qualification		
National Diploma or below	35	14
Tertiary (BSc./HND)	142	57
Post Draduate	68	27
Others	5	10
Total	**250**	**100%**
(c) Distribution of Respondents by Job Classification		
Traders	42	17
Civil Servants	45	18
Corporate Organisations	67	27
Private Consultancy	60	24
Students	25	10
Others	11	4
Total	**250**	**100%**
(d) Distribution of Respondents by Income Brackets (Per Annum).		
Below N1,000,000	29	12
N1,000,000 – N2,000,000	60	24
N2,000,000 – N3,000,000	69	28
N3,000,000 – N5,000,000	52	20
N5,000,000 – N10,000,000	28	11
Above N10,000,000	12	5
Total	**250**	**100%**

Source: Field Survey 2010

Respondents are mainly professionals and civil servants with a minimum academic qualification of secondary school certificate which guarantee a measure of rationality, objectivity and reliability in their responses.

Table 3 presents the descriptive statistics of the dependent and independent variables. The minimum rental value for flats in the study area is N350, 000 and the maximum N1, 800,000. The mean rent is N608, 000 while the standard deviation is N425, 000. The minimum number of bedroom is 2, a maximum of 4 and a mean of 3.40. For the number of bathroom, the range is between 2 and 4 while the mean is 2.30 and the standard deviation is 0.88.

Table 3: Descriptive Statistics of the Continuous Variables

Variables	Minimum	Maximum	Mean	Std. Dev.
RENTVAL	N350, 000	N1, 800,000	N608, 000	N425,000
BDRM	2	4	3.3	0.97
SIZKICH	0	1	0.449	0.39
SIZBDRM	0	1	0.447	6.14
SIZSTRM	0	1	0.724	0.469
BATOILET	1	4	2.3	0.88
FENCE	0	1	0.330	0.470
WATAVL	0	1	0.267	0.443
COND	0	1	0.292	0.455
SECURITY	0	1	0.129	0.301
DISCH	0	1	0.423	0.427
DISCBD	0	1	0.623	0.565
DISMKT	0	1	0.494	0.500
ROADS	0	1	0.095	0.294

8. Results

Table 4 contains the summary of the results of the hedonic price model estimates using the three functional forms. A casual look at the results would suggest the existence of collinearity problem given the high R^2 value for each of the three functional forms. However, the correlation matrix (not included) revealed that a large percentage of the pair wise correlations are quite low suggesting that there is no collinearity problem. Further, applying Klein's rule of thumb, it is observed that most R^2 values obtained from the auxiliary regressions of the three models are quite lower than the overall R^2 value (that is, the one obtained from the regression of rental value on the explanatory variables), again confirming there is no collinearity problem. The several low VIF and the closeness of their respective TOL to 1 in another confirmation that no collinearity among the variables.

Due to the nature of the study, unequal variances among the variables could be expected and heteroskedasticity may likely to be encountered. Thus, the logistic modeling was done in order to express the regression coefficients as elasticity estimates. The semi-log and double log forms were included because this will not only reduce the occurrence of heteroskedasticity but also allow for interdependence among variables.

Evaluating the model, the semi-log provides the best fit with the highest R^2 statistics of 84.5%. This corroborates several previous studies (Selim, 2008; Ajide and Alabi, 2010). Both the explanatory and predictive performance of the model is good as indicated by R^2 and adjusted R^2 statistics of 84.5% and 83.1% respectively –this is particularly good for the present study giving the sample size. This suggests that about 85% of the variation in apartment rentals in the study area is explained by the thirteen explanatory variables employed. The computed F-statistics (F=58.82) indicates that the fitness of the model is high; while Durbin Watson = 2.024, depicts non-serial autocorrelation. Therefore the model appears adequate for predicting rental value of apartment in the study area.

Table 4: Hedonic model estimates for linear, semi-log and log-log functional forms

Independent	Linear		Semi-log		Log-log	
Variables	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Constant	-17049.785	-0.307	6.243	38.785	5.851	43.403
BDRM	53905.044	0.344**	0.22	1.751**	0.027	2.012*
SIZKTCH	28572.644	2.039 *	0.020	1.933	0.098	2.131
SIZBDRM	84211.822	3.992**	0.006	3.630**	0.273	4.022*
SIZSTRM	3264.395	0.466*	0.000	0.504*	-0.022	-0.028
BATOILET	111706.352	1.421*	0.031	6.525*	0.074	1.499*
FENCE	776889.044	4.804**	0.025	4.081*	0.057	3.758**
WATAVL	687521.352	8.626	0.050	7.792**	0.091	6.965**
COND	541881.573	2.587**	0.074	4.358**	0.064	3.758**
SECURITY	182750	1.416*	0.018	0.807*	0.10	0.853
DISCH	-0.088	- 0.651	-0.0001	-0.702	-0.015	-0.928
DISCBD	-9.823	-1.073	-0.009	-1.008	-0.009	- 0.563*
DISMKT	-39.472	- 0.723	-0.0004	-1.072	-0.006	- 0.532
ROADS	344, 477	1.949*	0.014	2.859*	0.32	2.077*
R^2	0.824		0.845		0.841	
ADJUSTED R^2	0.808		0.831		0.823	
F- STATISTICS	50.574		58.818		48.135	
DURBIN-WATSON	2.074		2.024		1.990	
N	250		250		250	

*Sig. at 0.05 level of significance, **Sig. at 0.01 level of significance -

WHITE'S TEST			
F-statistic (prob)	1.3335(0.07866)	1.098(0.3113)	0.808(0.5399)
Obs*R-squared(prob)	30.0911(0.09044)	23.962(0.3061)	12.305(0.5231)

Evaluating the independent variables presents interesting and useful picture about the relative importance of housing characteristics in the valuation of apartment rental in the study area. All parameter estimates display signs and magnitude that are in line with theoretical expectations and corroborate previous research. Structural attributes – number of bedrooms, perceived state of security in the locality, condition of the property, average size of bedrooms, availability of demarcating/security fence, availability of pipe-borne water, condition of access roads, number of toilet/baths - entered the model with significant coefficients; making structural attributes the most significant group of factors above neighborhood and locational characteristics.

As expected, the number of bedroom was the strongest apartment price predictor, followed by the condition of the property, and availability of pipe-borne water - all the three presented significant t-values contribution at 99% confidence level. Other structural attributes with significant unique contribution at 95% level of confidence are average size of bedroom, number of toilet/baths, while the size of the kitchen had positive but statistically insignificant impact on apartment rentals at the required levels of significance. The two neighbourhood variables - security and infrastructure (neighborhood roads) - entered the model with a priori signs, and significant coefficients at 95% level of confidence but were 7th and 8th respectively on the priority list suggesting a low impact of these factors on rent. Reasons for this may include the general lack of security and poor infrastructure (especially roads) over the entire study area. The location or accessibility attributes have their expected negative correlation but none made statistically significant contribution. This could be explained by the fact that a good number of the respondents are traders while schools, and especially private school that majority of children attend today, are to be found within reasonable distance all over the study area.

The functional form of the model is the semi-logarithmic, thus the coefficients generated from the model becomes the approximate percentage change in apartment rental relative to a per-unit change in a given characteristics of a house. The resultant hedonic regression equation is therefore:

RENTVAL = 6.243 + 0.220(BDRM) + 0.02(SIZKITCH) + 0.094(SIZBDR) + 0.053(BATOILET) + 0.0001(SIZSTRM) + 0.025 (FENCE) + 0.050(WATAVL) - 0.074(COND) – 0.0001(DISCH) – 0.0003(DISMKT) – 0.009(DISCBD) + 0.081(SECURITY) + 0.140(ROADS) …..…… (viii)

The model predicted that the annual rent of an apartment in the study area is made up of a basic sum plus adjustments reflecting number of bedroom, size, condition and other property characteristics. In particular, the model suggested that additional bedroom adds approximately 22 percent while an extra bathroom increases it by 5.3 percent. The state of repairs of the property and availability of portable water increases apartment rental value by appropriately 7.4 percent, and 5 percent, respectively. The average size of bedrooms, condition of access roads, and availability of demarcating/security fence increase property value by 9.4 percent, 14 percent and 2.5 percent, respectively.

9. Conclusions and Recommendations

The study recognizes residential property as a multi-dimensional product comprising of locational, structural and neighbourhood attributes. Extant literature accepted these attributes as the main determinants of residential property values (capital or rental). The study employed the hedonic price model to determine both the predictive and relative impact of these explanatory variables on apartment rentals in the study area. The results identified the number of bedroom, number of bath/toilet, availability of pipe-borne water, size of bedrooms, and availability of security fence, in that order, as the principal descriptors of apartment rentals in the study area. This result is largely consistent with previous studies in hedonic residential property market analysis in more advanced economies.

Hedonic price theory is not without its shortcomings arising from potential problems relating to fundamental model assumptions and estimation such as the identification of supply and demand, market disequilibrium, the selection of independent variables, the choice of functional form of hedonic equation and market segmentation (Selim, 2008).

In spite of the inherent conceptual limitations of the theory, and the general paucity of data in the right quality and quantity as required by the hedonic pricing theory for reliable results, the results of the study illustrate the feasibility of applying the technique as a framework for housing market analysis even in a developing country like Nigeria; at least in the apartment sub-market where majority of players possess a reasonable level of market information and the property type exhibits a measure of homogeneity.

By establishing the right rent at which property owners are prepared to supply and tenants are willing to pay, the model potentially promises numerous benefits. It would provide developers with essential information on tenants' taste and preferences, in terms of housing attributes. The pricing model also offers great benefits to the real estate valuation profession. Besides providing an alternative valuation methodology, the model could enhance the reliability of apartment rental valuation by cutting down on valuers' idiosyncrasies and subjectivity in the valuation process which Babawale (2008) identified as contributory factors to inaccuracy in residential property valuation in Lagos metropolis. Such a scientific way of establishing property values will ensure that the valuation process is more rationale, consistent and transparent; the hallmark of reliable asset pricing. Well priced properties generate competitive offers; stimulates demand, and give birth to a healthy and functional market. These attributes had particularly endeared the technique to the valuation profession especially in the analysis of the housing market as well as in mass valuation like property rating.

Given socio-economic similarity, the results on Ikeja apartment rental market analysis should provide a base for extrapolation to the remainder part of Lagos metropolis as well as cities of comparable socio-economic characteristics not only in Nigeria but in most developing countries.

Currently, the potentials of this versatile tool of analysis are begging to be harnessed by Nigerian researchers and practitioners. The required skill and array of data remain a challenge. The challenge must however be confronted frontally. Nigerian valuers cannot afford to be isolated from ongoing paradigm shifts in valuation practice standards driven by factors such as globalization, developments in information technology and market dynamics.

The application of the hedonic pricing model for housing market analysis in the study area calls for further research. First, the validity of resultant model need be tested with samples of new transaction prices. The model also needs to be further refined with increased sample size; improved quality and quantity of property transaction data; and more precise measurement of the structural and location attributes as GIS resource becomes more cheaply available in the country.

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Appendix 1: Samples of Empirical Studies in Hedonic Price Modeling

S/ No	Author(s), Year, Country	Classification of Variables	Methodology/Model Specification	Results/Findings

1	Magbelugbe I.F. Jos Urban Area, Nigeria, 1989. 1,310 appraisal data from property tax assessment; made up of 1124 multifamily and 186 single family units– occupied mainly by low–income and moderate – income households.	*Dependent variable:* Appraised annual value(rating assessments) *Independent variables:* – Building age, roof cover, ceiling material, nature of area and the building floor (earth or clay), building wall (sand or concrete), roof type; number of kitchens, floors; building floor area, building gross area; if building contain flats, has fence, share essential facilities; use zoning, zoning density.	Hedonic pricing model; Box – Cox transformation; separate analysis for single family, multi – family and both combined; market segmentation based a prior on the type of design of the houses.	Box-Cox λ transformation parameter is 0.2 for the multi-family and -0.1 for the single-family submarket. The hedonic parameters of these functional forms are significantly different from log-linear and linear functional forms, and those most commonly found in literature. The author justifies this claim by making comparison with results of similar studies in a number of other developing countries.
2	M.O. Bello & V.A. Bello, Lagos metropolis, 2007. Survey involved buyers and valuers which participated in the sale of some properties within Lagos metropolis.	*Dependent variable* = transaction prices *Dependent variables*: (1)Location (2) Security (3) Plot size (4) State of repairs (5) Age (6) Number of bedrooms (7) Size of room (8) Electricity (9) Number of toilet/bath (10) Nearness to work (11) Water (12) Finishes (13) Parking space (14) Telephone.	Relative Importance Index employed to assess the significance of each housing attributes; while the Kendall's Coefficient of Concordance (W) was used to measure the level of agreement between the rankings of buyers and sellers at each variable level and when the variables are combined. Tested at .05 level of significance using chi-square approximation.	Study revealed that both valuers and buyers agree that prices of blocks of flats are influence principally by location, state of repairs and water supply. For duplex there is both partial and high level of agreement between buyers and valuers. Regressing the attributes of each property against the actual price paid, the significance of each attribute was determined; which was then compared with the ratings of both the valuers and the buyers. Study concluded that the valuation methods used by Nigerian valuers do not take into consideration the buyers preference.
3	M.O. Bello and V.A. Bello, 2008, Akure, Nigeria. Sample survey of 190 households living in rented houses in randomly selected from two communities of Akure.	*Dependent variables*: Annual rent *Independent variables*: Wall, ceiling, roof, window, room size; availability of kitchen, toilet, water, fence, conditions of access, electricity drainage, crime, number of approved private schools and number of public schools, income of household heads, number of dependents, number of years spent on formal education, gender, length of stay in the developing and distance away from offensive refuse dump.	Study used a two-stage hedonic model. First stage to model property values as a function of housing attributes, while the second stage model willingness to pay.	The study identified households income, distance away from waste dump site and regularity of electricity supply as the major significant factors influencing household willingness to pay for better environmental services.
4	Ajide K. B. and Alabi, M. Lagos, Nigeria. 2010. Sample of 983 households through survey using Lagos statae Household Survey as sample frame.	*Dependent variable*: Monthly rent. *Independent variables*: Room size, age, floor level, kitchen, wall material, toilet facilities, ceiling, fencing, window, water, drainage, crime rate, pollution level, accessibility to employment,	Hedonic price model using the three functional forms - linear, semi-log and double-log – for purpose of comparison. The study showed that semi-log is the best of the three.	Of the three functional forms, semi-log gives the best fit with R^2 = 0.67, while the linear and double-log is 0.56 and 0.63, respectively. This confirms the number of earlier studies that a non-

		children school, hospital, market, recreational centre, and public transport.		linear functional form performs better than a linear form. Furthermore, structural attributes were found to be more statistically more significant than locational and neighborhood attributes in influencing house prices in Lagos, Nigeria.
5	Tse R.Y.C. & Love, P.E.D., Hong Kong, 2000. 139 sale prices selected from Class B (40-70 sq.m.) huoses. covering four housing estates (70%) and several non-estate type properties (30%).	*Dependent variable* = Transaction prices *Independent variables* = Floor area; age; availability of car park, shopping centre, sport facilities, cemetery view, whether estate type housing units.	Log -linear with (log) house prices In order to improve efficiency of the model in the face of heteroscedasticity, the study employ both heteroscedascity consistent convenience matrix estimator and weighted least squares method.	All variables except shop are significant. The explanatory power of the model is approx. 85% which decreased to 47% when location variables were removed. All the signs of the coefficients are usual except for SPORT. Estate type housing units and neighbourhood amenities have considerable influence on house prices in the study area.
6	Lennon H.T., Stephen W.K., Winky K.O., Hong Kong , 2007. 749 samples from Quarry Bay District made up of several small & one mega – scale housing estate occupied mainly by middle-income earners.	*Dependent variable* = Inflation adjusted transaction prices. *Independent variables* = total gross floor area, age, floor level, garden view, sea view, bad view, transport accessibility, luck number	Linear form; White's test used to detect possible heteroskedasticity; used Newey – West Heteroskedasticity consistent conveniences to correct observed heteroskedacity and correlations among observations in cross sectional data. Prices adjusted using the "Monthly Price Indices for Selected Popular Private Domestic Developments".	Most variables are statistically significant at conventional levels: and exhibited conventional signs. R^2 = 85% approx. Larger size, higher floor level, and better view commands a higher transaction prices. Property closer to the mass transit railway station commands a premium. Non-linear effect of floor level exerts an impact on prices. Feng Shui (luck number) also has influence on house prices.
7	Mishra , S.K. & Ngullie M.C., Kohima, capital city of Nagaland, India, 2008. Sample survey of 109 households living in rented houses randomly selected from residents of 19 wards(11 from each ward) in Kohaima capital city of Nagaland, India In 2008	*Dependent variable*: House rent *Independent variables*: House type, plot size, floor area, No of rooms, no of occupants, nature of ownership, distance from the nearest building, receiving enough sum share, parking space, waste disposal, facilities, drainage, public garden/ park nearby, water supply, regularity and source of water supply, nature of toilet, power connection, load-shedding or power failure, noise pollution, air pollution, water pollution, nature of water pollution, respondents feeling of satisfaction with the house, safety, income, family size and rent.	All variables (dependent and independent) are transformed into their (natural) logarithmic values.	Study suggests that consumers of rented house consider floor area, water supply and power supply complimentary to each other while other characteristics of house as substitutes of the floor area. Rented house is an inferior commodity and its income elasticity for the overall sample is negative, though statistically insignificant.