A Hedonic Pricing Model of the Impact of Housing Structural Features on House Rent in the Lagos Residential Property Market

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Abstract
Housing is not a homogeneous commodity, but rather a multidimensional bundle of services. The hedonic price model is employed to model effectively the heterogeneous nature of housing in this paper, based on the Lagos State Housing Survey of 2006, for which a 6000 sample size was used. The results of the hedonic pricing model show that when renting or buying a house, people are willing to pay more for desirable structural traits provided rather than staying away from these facilities. Therefore, if proliferation of urban slums, shanties and squatters' settlements is to be drastically minimized or completely eliminated, it would be more beneficial for government and housing suppliers to provide such basic social amenities and important housing accessories.

Keywords: Housing, Hedonic price model, Structural traits, Lagos State.

Introduction

Housing has been conceptualized in various ways by different researchers and authors. It has been conceived as the structure, design and built-in-equipment (such as the amount of space, the heating, lighting, sanitary and similar facilities) of dwelling (Ogunjumo & Olatubara, 1997; Agboola, 2005). Megbolugbe (1986) submitted that environmental amenities such as water supply, sewage, solid waste disposal, and neighbourhood roadways are all part of the package of services designated as housing. It has also been seen to include the layout and equipment of the neighbourhood such as the open spaces, streets, walkways, utilities, nursery and elementary schools, shops and other neighbourhood facilities. Despite the various conceptualizations, housing is highly complex in nature and characteristics simply because it is a multidimensional bundle of services. Housing is not a homogeneous commodity, but rather a label for a collection that are all distinct to some degree. Conceptually, the rent that is paid on residential property is functionally related to three different housing traits namely structural (e.g. like number of kitchens, rooms, baths, lot size etc), neighbourhood (like crime rate level, availability of waste disposal methods etc) and locational (proximity to children's schools, health centres, market place etc). This in effect implies that, what people actually pay for when renting or buying a house are the multidimensional features inherent in it. Housing exhibits substantial variations in structural features, lot size, characteristics of surrounding neighbourhood, and the quality of public services. It was for this reason, that Ellickson (1977) submitted that housing markets are complex phenomena, not at all well suited to application of the standard tools of price theory. To be able to model the heterogeneous nature of this consumer durable product called 'housing', hedonic pricing model has been introduced in the literature. The hedonic price model posits that goods are typically sold as a package of inherent attributes (Rosen, 1974). The model assumes that households seek to consume not a bundle of undifferentiated housing services , but varying amounts of housing-related traits (such as number of rooms, physical quality, number of kitchens, neighbourhood and locational attributes). The hedonic technique was first suggested by Court (1939) and implemented by Griliches (1961) and further elaborated by Rosen (1974).

There have been many studies on housing employing hedonic pricing methods to examine the impact of non-marketable features associated with housing on the residential property value both in the developed and developing countries. However, in sub-Saharan Africa, the use of hedonic methodology to assess the value of property is still not common. One of the pioneer studies on hedonic models in the sub-Saharan region can be credited to Megbolugbe (1986,1989) where he specifically examined *the Econometric Analysis of Housing Traits Prices in a Third World city* as well as *A Hedonic Index Model: The Housing Market of Jos, Nigeria*. Also, Arimah (1992) investigated *'An Empirical Analysis of the Demand for Housing Attributes in a Third World City'* using Ibadan, Nigeria as a case study. Even those studies that have made use of such methodology have a focus entirely different from the study reported here.

The rest of the paper is organized as follows: Section 2 reviews the literature in which both the theoretical and empirical issues relating to residential choices are discussed. Section 3 describes the theoretical framework, methods as well as data used. Section 4 presents the empirical results and discusses the findings. Section 5 contains the policy implication and concluding remarks.

Review of Previous Studies on Hedonic Pricing Model Applications

Several studies exist on the use of hedonic price models as well as on determinants of residential property value. The majority of such studies concentrate more on the developed countries. The prominent methodology which has been in vogue for capturing the impact of non-marketed good on property value in the housing literature is the hedonic price model. It is a method of estimating demand or price for a good that does not have a traditional economic market (Lipscomb 2007). It decomposes the item being researched into its constituent characteristics, and estimates the value of each characteristic. In the case of housing, which is a heterogeneous bundled good, researchers have been utilizing hedonic pricing analysis to assess the implicit prices for a variety of characteristics associated with the property, such as structure components, environmental factors, public services and urban.

The hedonic price model has found applications in both environmental and non-environmental goods. It has been applied on the impact of air quality on house value. The earliest studies in this regard include Ridker and Henning (1967); Harrison and Rubinfeld (1978); Murdoch & Thayer (1988); Zabel & Kiel (2000); Kim, Phipps and Anselin (2003); and Anselin and Le Gallo (2006). Water quality by Young (1984); Mendelsohn (1992); Leggett and Bockstael (2000); Ara, Irwin and Haab (2006). Those that examined desirable land uses include Blomquist (1974); Nelson (1981); Simons (1999). Neighbourhood variables were examined by Gabriel and Wolch (1984); Farber (1986); Galster and Williams (1994); and Aluko (2011). Multiple environmental pollutants were studied by Blomquist, Berger and Hoehn (1988); Thayer, Albers and Rahmatian (1992); and Clark and Nieves (1994). The list of studies on hedonic pricing applications is in exhaustive as far as developed countries are concerned, but not so for the developing economies, most especially sub-Saharan African countries. In the case of Nigeria, they are countable, but only a few will be cited.

Pioneer studies on the use of hedonic models in Nigeria started with Megbolugbe (1986), which presented the estimates of housing trait prices in a Third World city housing market, Jos, in Nigeria. In the final analysis, he submitted that the information on market price of housing is key to the derivation as well as estimation of other market parameters such as housing demand and supply elasticities. He also maintained that such information on housing trait prices serves as an invaluable input into the analysis of government housing programmes. Megbolugbe (1989) also employed a hedonic model on the housing market in Jos and revealed that variables measuring the quality of housing structure and of public services in various neighbourhoods are the local hedonic structure descriptors for the Jos housing market. Another study in Nigeria which employed hedonic price models is that of Arimah (1992), who explored the methodology to estimate a set of housing attributes, using data from both the renter and owner-occupier housing sub-markets in Ibadan, Nigeria. His results revealed that the most important determinants of the demand for housing attributes are income, price of the attributes in question, household size and the occupational status of the head of the household. The study further revealed that the demand for housing attributes is inelastic since all estimated coefficients are below unity.

Recently, some studies have been conducted in Nigeria, like Adewusi and Onifade (2006), which focused on the effect of urban solid waste on physical environment and property transactions in Surulere Local Government Area of Lagos State. The study found that rents paid on properties adjoining waste dumpsites were lower compared to similar properties further away and that, property transaction rates were very slow and unattractive as one approaches a dumpsite. Bello (2007) used multiple regression analysis to determine the effect of waste dumpsites on property values in Olusosun neighbourhood at Ojota, Lagos State. The study found that property values increase with distance away from dumpsites. Also, Bello and Bello (2008) conducted a research on residents' willingness to pay for environmental amenities in Akure, Nigeria. The study included environmental amenities such as waste water disposal, water and electricity supplies, neighbourhood roads and other locational services. The study used a two-staged hedonic model to examine willingness to pay for better environmental services by residents of two neighbourhoods in Akure. The study identified household income, distance away from refuse dump site and regularity of electricity supply as major factors that influenced the willingness of households to pay for better environmental services. Akinjare et al (2011) examined how solid waste landfills affect residential property value in Lagos, Nigeria. Their results indicated appreciation in residential property values with distance away from landfills unlike when the properties are in close proximity to landfills.

Kemiki (2014) also employed the hedonic pricing model to investigate the impact of noise and dust spewed from a cement factory on a sample of 126 tenements from 11 residential settlements within Ewekoro local housing market in Nigeria. A market-wide hedonic model for all the 126 tenements within 5.5km of the cement factory was estimated. In addition, two separate unrestricted hedonic models were also estimated (the first consisting of 38 tenements within 2.5km of the factory and the other comprising 88 tenements located between 2.5km and 5.5km of the factory). The hedonic models, which take the double log functional form were estimated with house rent (a proxy for house price) as the dependent variable. Generally, the results of the market-wide model revealed that dust level and noise, which are negative externalities from the cement factory, dampened rent by 21.90% (N13815) and 1.49% (N24.8) respectively within the study model. Findings from the unrestricted model further signify that tenement rent tends to decrease with increasing nearness to Lafarge cement factory due to severity of dust and noise. Umeh and Oladejo (2015) ascertained the residential property attributes that contribute most to the rents in the high income residential sub-market of Ikeja GRA, Lagos. They administered a 5-point likert scale on 240 households in the study area, using the Hedonic Model. The results showed that among the attributes considered, number of bedrooms and neighbourhood quality influenced house prices the most in Ikeja GRA. Waste disposal variables also had a positive and significant influence but not as much as the two factors. Proximity to the Central Business District and access to potable water, in contrast, had a negative influence on rent prices.

In view of the above, it is quite clear that a large number of studies have been conducted applying the hedonic pricing methodology, especially in developed economies. But hardly has any of these studies specifically focused on the impact of the structural components of housing on house rents. This represents a gap that this paper intends to fill.

The Study Area

Lagos State is the smallest state in size in Nigeria, with an area of 356,861 hectares, of which 75,755 hectares are wetlands. Yet, it has the highest population, which is 5% of the estimated the national average. The state has a population of 17,552,942 million, representing 12% of the national estimate of 150 million, with a growth rate of between 6% and 8%. The UN estimates that at its present growth rate, it would have become the third largest mega city in the world by the year 2015 after Tokyo in Japan and Mumbai in India. Over 91% of the total population lives in the metropolis with an annual growth of about 600,000 and a density of about 4,193 persons per sq. km. In the built-up areas of metropolitan Lagos, the average density is over 20,000 persons per square km with 72.5% of households occupying one-room apartments at an occupancy ratio of 8 to 10 persons per room. Notably, while the country's and the global population growth rates are 4.5% and 2% respectively, Lagos state's rate is growing ten times faster than that of New York and Los Angeles, with grave implication for urban sustainability and housing delivery. While the population growth rate in metropolitan Lagos has assumed geometrical proportions, the provision of urban infrastructure and housing to meet the concomitant increased demand is not at a commensurate level. This has resulted in an acute shortage of housing in Lagos State, with the state alone accounting for five million dwelling units deficit, representing 31% of the estimated national housing deficit of 18 million. The extent of the housing shortage in Lagos is enormous. The inadequacies are far-reaching and the deficit is both quantitative and qualitative. Even those households with shelter are often inhabiting woefully deficient structures as demonstrated in the multiplication of slums from 42 in 1985 to over 100 by January 2010.

Characterization of the Lagos Residential Market

The Lagos housing market and tenurial arrangement is characterized by renting, which was estimated at 60.7% in 2000 by Aluko (2002), whereas the National Bureau of Statistics (2005) reports put Lagos renting at 60.5%, normal rent 15.3%, free rent 10.5% and subsidized rent 13.7%. By implication, owner-occupied houses are not the predominant form of residential housing in the Lagos Metropolis.

The distribution of population in Lagos State clearly depicts three categories of residential areas namely: high, medium and low. Each of these residential areas has distinctive features that differentiate it from the others.

High Density Residential Areas

In high population density areas, the occupancy ratio and housing density are high. These areas are inhabited by low-income households. Most of the areas are noted for their prevailing conditions such as high density (average ratio 1:2.4) poverty, poorly built and maintained houses, unemployment, reliance on public services, crime, vandalism, delinquency, arson, drug addiction and absolute low standard of living. Nutrition and sanitation problems are magnified and come to dominate the entire environment (Aluko, 2004).

These areas are also referred to as belonging to the informal, unauthorised or illegal sector. They are akin to slums and are usually occupied by migrants from other regions of the country or from neighbouring countries. The residents are mostly engaged in poorly paid jobs. Houses within the sector are largely illegal or unauthorised because their construction contravenes the city's housing construction codes on materials used and technique employed. The ownership structures within the sector are dominated by the extended family system. These areas also display the worst environmental and housing conditions with haphazard distribution of houses that hardly leaves any space between the units. In Lagos State, high density residential areas are mostly found in places like Lagos Island, Mushin, Ajegunle, Oshodi and Okokomaiko.

Medium Density Residential Areas

These are inhabited by some upper but mostly middle-income households. The environments are relatively good with lower density. The average number of rooms is three with average number of persons in the household as 6.2 (ratio 1:2.1). Most of the buildings consist of blocks of flats, 2-3 building floors and some multipurpose/ rooming houses. The buildings are averagely well maintained (Aluko, 2004). In Lagos, these can be found in places like Yaba/Ebute Metta, Ikeja, Isolo, Apapa, Gbagada and Amuwo-Odofin .

Low Density Residential Areas

These comprise high-quality neighbourhoods and community environments. The buildings are usually well-maintained and provided with neighbourhood facilities. In essence, they command high value. The areas are of low density and well-planned. The average number of rooms is 4-6, and the average number of persons in the household is 6.1 (Aluko, 2004). The ratio is about 1:1.3. These area are characterised by decreasing residential density of single family dwellings, occupied by affluent members of the city, essentially the middle-income class of white collar employees and professional people. Low density areas have proper layouts, good infrastructure and sufficient social amenities. The area can be regarded as a high class sector because the housing environment is neat and top-class with neighbourhoods that are dominated by modern single-storey family houses. The sector caters predominantly for top civil and public servants and expatriates. During the colonial era, it used to be the preferred place for Europeans and other foreign settlers. Houses within the high class sector are owned primarily by individuals or nuclear families. These are found in places like Victoria Island, Ikoyi, Lekki and Magodo.

Theoretical Framework and Methodology

There are two possible approaches in the literature in estimating the willingness of households to pay. These are the Contingent Valuation Method and the Hedonic Price Model. The former is the direct approach, operationalised by the Contingent Valuation Method (CVM), which was introduced into the environmental economics literature in the early 1970s. The CVM entails establishing a hypothetical market and asking respondents what they would be willing to pay for varying quantities of the good/facility in question. Respondents then state what they would be willing to pay for, say, improved environmental quality or the minimum compensation they would be willing to accept for a loss in environmental quality. According to Markandya (1992), the essence of the CVM is to obtain valuations or bids that would be as close as possible to what would have existed in the real market. These "bids", according to Hanley and Knight (1992), are then aggregated to obtain a total value figure.

Furthermore, willingness to pay schedules can be estimated by relating the bids to all the variables in the demand function except for the price of the good itself. Aside from its relative simplicity, Whittington *et al.* (1991) note that a key advantage of the CVM is that it can be employed in cases where the good/facility is not available to the household. However, the CVM is plagued by various hypothetical, information and strategic biases which may invalidate the results so obtained. The latter approach is the indirect method and it seeks to elicit the value of an environmental good from the households' behaviour in related markets. This approach is implemented by the hedonic housing price model, and it hinges on the premise that because housing is traded in the open market, and housing values in part reflect variations in the environmental quality of the neighbourhood, it is possible to price these environmental attributes implicitly.

The strategy that this paper adopts in obtaining a more realistic theory of housing market is to place the analysis within the context of the hedonic price theory as formulated by Rosen (1974) and Mas-colell (1975). Housing is not a homogeneous commodity, but rather a label for a collection of services that are all distinct to some degree. It exhibits substantial variations in structural features, lot size, characteristics of surrounding neighbourhood, and the quality of public services. It was based on this, that Ellickson (1977) submitted that housing markets are complex phenomena, not at all well suited to application of the standard tools of price theory. Housing violates two of the most basic requirements for the application of the standard price theory, the homogeneity and divisibility rules. Thus, in its classical form as applied to urban housing markets, the model simply depicts the existence of a relationship between housing prices H^p and a set of traits indexed from 1 to n that characterize the housing units, Z:

$$H^{p}(Z) = H(Z_1, Z_2, -------Z_n) \text{ ---(1)}$$

The traits can further be decomposed into structural, neighbourhood and locational. In the light of this, equation (1) can be rewritten explicitly as follows:

$$H^{p} = H(S, N, L) \text{ --- (2)}$$

The structural traits (S) consist of roofing materials, walling materials, flooring materials, lighting types and water sources while the neighbourhood traits (N) as identified in the survey are waste disposal methods, security services and pollution. The locational traits (L) are distance to workplace, distance to children's schools, public transport, hospitals and water supply. In the light of the above, the empirical model of hedonic pricing was specified as follows:

$$\begin{aligned} Log(H^{p}) = {} & \Phi_0 + \Phi_1 Roofing\_Mat + \Phi_2 Walling\_Mat + \Phi_3 Flooring\_Mat + \Phi_4 Lighting\_Typ + \\ & \Phi_5 Toilet\_fac + \Phi_6 Water\_soc + \Phi_7 Waste\_disp + \Phi_8 Security + \Phi_9 Pollution + \\ & \Phi_{10} Distance\_emply + \Phi_{11} Distance\_chdsch + \Phi_{12} Distance\_pubtran + \\ & \Phi_{13} Distance\_pubtran + \Phi_{14} Distance\_hosp + \Phi_{15} Distance\_watssp + \varepsilon \text{ -(3)} \end{aligned}$$

Each of the explanatory variables is further sub-divided into different levels with each carrying zero and one value as dummy variables. The Φ_1 - Φ_{15}, are the coefficients of the parameters to be estimated.

Data Source

The data were obtained from the Lagos State government housing survey conducted in 2006 in conjunction with the World Bank. The Household survey was state-wide and collected detailed information on a variety of topics including demographic characteristics of the households, education, health, infrastructure, income and expenditure, economic activity, housing conditions, access to social amenities, asset ownership, violence, crime and safety, and other subjective issues. A total of 6000 households were sampled. The 6,000 samples were divided into equal parts .The first half of the sample size was scientifically selected using probability proportional to size (PPS) of the populace and the other half was divided equally (ES) among the entire local government areas. The two values were added to arrive at the actual sample size. In summary, PPS + ES = ACTUAL SAMPLE SIZE. The details of the sample respondents are supplied in table 3.

Empirical Analysis of Results

Analysis of Hedonic Result

Table 3 provides the estimate of the hedonic price model for the entire sample size. From the result, it is clear that most of the housing characteristics variables are highly significant given their t-statistic and probability values. Apart from this, it is also observed that the sign of the coefficients are consistent with the expectations.

Structural Characteristics

The structural characteristics, of which roofing material types are a component, are seen to contribute greatly to the hedonic price of the house. For example, corrugated roof increases house rent by 0.089 units rather than cement roof, tile roof and asbestos which increase the rent by 0.062, 0.013 and 0.026 respectively. What this suggests is that houses roofed with corrugated roofing sheets attract more rent than houses roofed with either tiles or asbestos.

In terms of the walling material types, corrugated wall still increases house rent by 0.0130 than either mud or cement wall. The importance of corrugated wall type is further supported by 1% level of significance as depicted on the Table.

For the flooring material types, it is only earth-mud that appears significant at 10% level of significance. Due to the problem of multicollinearity that characterised the use of the hedonic price model, all other important variables have been dropped from the model in order to avoid dummy trap problems since most of the variables are dummies with either one or zero value.

For the lighting types, generator, candle and gas appear significant at 1%, 10% and 5% respectively. This result is not surprising given the problem encountered through infrequent and erratic power supply by Power Holden Corporation of Nigeria (PHCN), though the coefficient of PHCN is positive but insignificant. All the same, all other lighting types are correctly signed but are insignificant.

The availability of toilet facilities also contributes to increased house rent depending on the degree of sophistication. From the result, it is observed flush to piped sewer system increases house rent more than any other type of toilet facilities available, flush to pipe sewer increases house rent by 0.0177, flush to septic tank by 0.0150, flush to pit by 0.0541, composting by 0.0041, VIP/pit latrine with slab by 0.0096, covered pit by 0.0053, uncovered pit by 0.0038 and pail by 0.0121. House rent tends to reduce by -0.0103 if there are no toilet facilities. What can be said at this point is that the type of toilet facilities available or constructed by house owners will not deter increase in the housing rent. A possible explanation for this lies in the problem of overpopulation in the Lagos metropolis, which constantly reduces the influx of immigrants from other parts of the country.

The source of water is another contributory factor to the price of rented houses. Pipe-borne water is mostly preferred and highly sought after. Hence, it is implicitly accorded a higher worth to the value of a house through increased rents. What can be inferred from the result is that regardless of the source of water, increase in house rent still occurs at different rates depending on the type and location of the house. It is interesting to note that all these water source types have the expected signs and they are all statistically significant.

Neighbourhood Characteristics

This constitutes another important component of the hedonic housing price, of which waste disposal source is an important element. Availability of waste disposal through private sector participation (PSP) adds to house rent by 0.0022 though it is insignificant. This is unlike refuse dumping in unauthorised places, which has a negative sign but is significant at 5% level of significance. This means that having refuse dumped on the ground tends to reduce house rent. The same argument goes for dumping refuse within a compound and other dump sites, which might likely reduce the rent charged.

Provision of either government or community security also has direct relationship with house rent. That is, there is a direct relationship between provision of security services and house rent. Although both have expected signs but only that of government security is significant at 10% level of significance. Pollution of any sort tends to reduce the value charged on houses but the reduction may not be too conspicuous as reflected in the non-significance of all the polluting variables, except for traffic congestion, which has the expected sign and is significant at 10% level of significance.

Locational Characteristics

This constitutes another important element in a hedonic pricing model. It is obvious from the results that distances from households head employment/workplace, to children's schools, public transportation system , health centres (hospitals), market place and water sources exert positive impact on housing rents particularly if such distances lie within 0 to 44 minutes. House rents might get reduced if the distance is more than 45 minutes as can be observed from the results.

For instance, the house rent decreases by 0.0023 where distance coverage to household head workplace is above 60 minutes. Even at that point, it is only significant at about 10% level of significance. This is made possible because there are places in Lagos that are very far from the main city yet this will not prevent such places being labelled as rural area. As such people can live and secure an apartment in any part of the city since they are linked up with good road network and other social amenities. Due to this, rent of accommodations still go for the same price as in the Metropolis but with slight differences.

It is possible to get rebates on house rents for any distance over 30 minutes to children’s schools. This possibility is high given the level of significance which stood at I% for distance coverage of between 30 to 44, 45 to 59 and 60 and above minutes respectively. A different picture emerges in the case of distance to public transportation. A distance of 0 to 14 minutes increases house rent by 0.0048 but this rent declines immediately the distance covered extends beyond 15 minutes. This is confirmed by the value of t-statistics of -2.50 and -3.24 as can be observed from the Table.

The distance from health centres (hospital) is not statistically significant given their probability values with least value of 0.102 to the highest value of 0.223. However, the distance ranging between 0 to 44 minutes convey positive signs which simply depict direct relationship existing between distance to hospital and the house rent. However, declining trends are observed at distances between 45 to 59 and 60 and above minutes respectively. This suggests that once distance to be covered exceeds 45 minutes, declining house rents might likely be experienced.

Proximity to markets is another important factor that people normally accord consideration when taking a decision involving renting an apartment in a particular residential location. Thus, distances involving to and from remain critical in such decisions. From the results presented above, it is clearly discernable that distances from 0 to 30 minutes from one's house could impact positively on the rent payment but this might translate into rent reduction once it exceeds 30 minutes. The interesting observation from the results stem from non-significance of the distance as depicted on Table 6.11. This suggests in effect that distance to market is not an important factor when renting accommodation in Lagos. Even if considered, its effect on the rent is only marginal. Two possible explanations may be offered in this regards: one is that Lagos state is endowed with good roads which makes it easier to access a far- away markets with little or no stress. The second reason may be attributed to excess demand for the available housing units which makes other important factors that could have been considered more attractive when renting an apartment or buying a house.

Locating or renting a house in a particular area for a reason that has to do with proximity to water supply is another important criterion that is often considered before such decision is eventually taken. Proximity to water source is equally as important as it increases house rent for the distance that ranges from 0 to 14 minutes. Beyond this range, a declining house rent may ensue.

Conclusion and Possible Implications for Policy Application

The research findings of this paper reveal the relative importance of each of the housing attributes in the price of houses. It is observed from the results that the structural characteristics (like, roofing materials, walling materials, flooring materials, toilet, lighting and water sources) of the residential houses have strong statistical significance for the amount of house rents charged by house owners. The proportion of the attribute variables that is significant in the model occurred at a 1% level. Thus, an increase in any of the structural attributes is likely to increase the house rents. Among the structural attributes, availability of toilet facilities contributed more significantly to the rising house rents than any other attribute. Neighbourhood and locational characteristics do not seem to be statistically significant in explaining any change that may be observed in the housing price.

The importance of housing in human existence cannot be overemphasized. Consequently, every individual strives to get accommodated. It is equally important that government pay attention to the structural components of residential dwellings as people place more premiums on such housing features than any other traits. The results of the hedonic pricing models show that when renting or buying a house, people are willing to pay more for desirable structural, locational and neighbourhood traits provided in a house in consideration of the opportunity cost of staying away from these facilities. Therefore, if proliferation of urban slums, shanties and squatters' settlements is to be drastically reduced if not completely eliminated, it would pay government and housing suppliers to provide such basic social amenities and important housing accessories. In doing so, however, there is need to consider the peculiarities of each residential density area since willingness to pay for these housing traits differ in varying degrees from one location to another.

Table 1: Description of Hedonic Pricing Methodology Variables

Variables	Definitions and Measurements
STRUCTURAL CHARACTERISTICS	
Roofing materials types	
Corrugated_roof	1 if the house is roofed with corrugated roofing sheet and 0 if otherwise
Cement_roof	1 if the house is roofed with cement and 0 if otherwise
Tile_roof	1 if the house is roofed with tiles and 0 if otherwise
Asbestos	1 if the house is roofed with asbestos and 0 if otherwise
Wooden_roof	1 if the house is roofed with wooden roof and 0 if otherwise
Thatched_roof	1 if the house is roofed with thatched roof and 0 if otherwise
Mud_bricks	1 if the house is roofed with mud bricks and 0 if otherwise
Walling materials types	
Mud_wall	1 if the house is walled with mud wall and 0 if otherwise
Burnt_wall	1 if the house is walled with burnt bricks wall and 0 if otherwise
Cement_wall	1 if the house is walled with cement wall and 0 if otherwise
Wooden_wall	1 if the house is walled with wooden wall and 0 if otherwise
Corrugated_wall	1 if the house is walled with corrugated wall and 0 if otherwise
Cardboard_wall	1 if the house is walled with cardboard wall and 0 if otherwise
Flooring materials types	
Earth_mud_floor	1 if the house is floored with earth mud and 0 if otherwise
Wood_tile_floor	1 if the house is floored with wood/tile and 0 if otherwise
Plank_floor	1 if the house is floored with plank and 0 if otherwise
Concrete_floor	1 if the house is floored with concrete and 0 if otherwise
Dirt_straw_floor	1 if the house is floored with dirt/straw and 0 if otherwise
Lighting Source types	
PHCN	1 if Power Holding Company of Nigeria supplies the light and 0 if otherwise
Generator	1 if the lighting comes from generator and 0 if otherwise
Candle	1 if the lighting comes from candle and 0 if otherwise
Battery	1 if the lighting comes from battery and 0 if otherwise
Gas	1 if the lighting comes from gas and 0 if otherwise
Kerosene	1 if the lighting comes from kerosene /paraffin and 0 if otherwise
Wood_coal	1 if the lighting comes from wood/coal and 0 if otherwise
Toileting facilities	
Flushpipe	1 if the toilet facility is flush to piped sewer and 0 if otherwise
Flush_septic	1 if the toilet facility is flush to septic tank and 0 if otherwise
Flush_pit	1 if the toilet facility is flush to pit and 0 if otherwise
Composting	1 if the toilet facility is composting and 0 if otherwise
VIP_pit	1 if the toilet facility is pit latrine with slab and 0 if otherwise
Covered_pit	1 if the toilet facility is covered pit and 0 if otherwise
Uncovered_pit	1 if the toilet facility is uncovered pit and 0 if otherwise
Hanging	1 if the toilet facility is hanging type and 0 if otherwise
Pail/bucket	1 if the toilet facility is by pail/bucket and 0 if otherwise
No_toilet	1 if there is no toilet facility and 0 if otherwise

Water source types	
Pipebor_water	1 if water source is from pipe borne water and 0 if otherwise
Public_water	1 if water source is from public tap and 0 if otherwise
Borehole	1 if water source is from borehole and 0 if otherwise
Well_water	1 if water source is from the well and 0 if otherwise
SSvendor_water	1 if water source is from small scale vendor and 0 if otherwise
Tanker_truck	1 if water source is from tanker truck and 0 if otherwise
Other_water	1 if water source is from other water sources other than those earlier mentioned and 0 if otherwise
NEIGHBOURHOOD CHARACTERISTICS	
Waste Disposal Methods	
PSP	1 if wastes are being collected by the government through private sector participation and 0 if otherwise
Dump_ground	1 if wastes are dumped in unauthorised places and 0 if otherwise
Truck_push	1 if wastes are being collected by the truck pushers and 0 if otherwise
Comp_dump	1 if wastes are dumped within the house compound and 0 if otherwise
Other_dump	1 if wastes are dumped through other methods and 0 if otherwise
Security services	
Com_pol	1 if security services are provided by the community police e.g. like vigilante group, maid-guards etc and 0 if otherwise
Govt_pol	1 if security services are provided by the government police and 0 if otherwise.
Pollution	
Littering	1 if pollution is mainly in form of littering and 0 if otherwise
Public_urine	1 if pollution is mainly in form of urinating in the public places and 0 if otherwise
Poor_traffic	1 if pollution is in form of poor traffic and 0 if otherwise
Illegal_trad	1 if pollution is in form of illegal trading and 0 if otherwise.
LOCATIONAL CHARACTERISTICS	
Distance to employment	
Distemployd0_14	1 if distance to household head place of employment takes between 0-14 minutes
Distemployd15_29	1 if distance to household head place of employment takes between 15-29 minutes
Distemployd30_44	1 if distance to household head place of employment takes between 30-44 minutes
Distemployd45_59	1 if distance to household head place of employment takes between 45-60 minutes
Distemployd60_abv	1 if distance to household head place of employment takes between 60-above minutes
Distance to children school	
Distschdsch0_14	1 if distance of household head to children schools takes between 0-14 minutes
Distschdsch15_29	1 if distance of household head to children schools takes between 15-29 minutes
Distschdsch30_44	1 if distance of household head to children school takes between 30-44 minutes
Distschdsch45_59	1 if distance of household head to children schools takes between 45-59 minutes
Distschdsch60_abv	1 if distance of household head to children schools takes between 60-above

	minutes
Distance to public transport	
Distpubtrans0_14	1 if distance of household head to public transport takes 0_14 minutes
Distpubtrans15_29	1 if distance of household head to public transport takes 15_29 minutes
Distpubtrans30_44	1 if distance of household head to public transport takes 30_44 minutes
Distpubtrans45_59	1 if distance of household head to public transport takes 45_59 minutes
Distpubtrans60_abv	1 if distance of household head to public transport takes 60_above minutes
Distance to hospital	
Disthosp0_14	1 if distance of household head to the hospital takes 0_14 minutes
Disthosp15_29	1 if distance of household head to the hospital takes 15_29 minutes
Disthosp30_44	1 if distance of household head to the hospital takes 30_44 minutes
Disthosp45_59	1 if distance of household head to the hospital takes 45_59 minutes
Disthosp60_abv	1 if distance of household head to the hospital takes 60_above minutes
Distance to market	
Distmkt0_14	1 if distance of household head to marketplace takes 0_14 minutes
Distmkt15_29	1 if distance of household head to marketplace takes 15_29 minutes
Distmkt30_44	1 if distance of household head to marketplace takes 30_44 minutes
Distmkt45_59	1 if distance of household head to marketplace takes 45_59 minutes
Distmkt60_abv	1 if distance of household head to marketplace takes 60_above minutes
Distance to water supply	
Distwat0_14	1 if distance from household head house to water supply takes between 0_14 minutes
Distwat15_29	1 if distance from household head house to water supply takes between 15_29 minutes
Distwat30_44	1 if distance from household head house to water supply takes between 30_44 minutes
Distwat45_59	1 if distance from household head house to water supply takes between 45_59 minutes
Distwat60_abv	1 if distance from household head house to water supply takes between 60_above minutes

Table 2: Distribution of Selected Households By Local Government Areas (LGAs)

Local Government Area	Population	No of political wards	No of Households listed	No of Households Sampled
Agege	1,180,358	10	1134	379
Ajeromi/Ifelodun	1,588,361	17	980	458
Alimosho	1,175,622	11	947	378
Amuwo/Odofin	560,814	12	833	259
Apapa	432,686	9	750	234
Badagry	332,685	11	614	215
Epe	292,049	18	1401	207
Eti Osa	424,434	9	809	232
Ibeju-Lekki	62,988	16	1054	162
Ifako Ijaiye	645,471	14	924	275
Ikeja	533,237	10	929	253
Ikorodu	558,422	18	1066	258

Kosofe	1,102,661	12	1275	364
Lagos Island	454,714	18	1328	238
Mainland	721,733	10	1005	290
Mushin	1,439,556	15	981	429
Ojo	635,366	13	767	273
Oshodi/Isolo	1,192,652	11	928	381
Shomolu	949,730	8	967	334
Surulere	1,183,886	12	975	380
TOTAL	**15,467,425**	**254**	**19667**	**6000**

Source: Lagos State Government Household Survey (2006)

Table 3: Results of Hedonic Pricing Estimation–Dependent Variable: Monthly House Rent

STRUCTURAL CHARACTERISTICS			
	Coefficient	**T-Statistics**	**Probability value**
Roofing materials type			
Corrugated_roof	0.089(0.0090)	3.62***	0.002
Cement_roof	0.062(0.0081)	2.72**	0.008
Tile_roof	0.013(0.0053)	2.15**	0.020
Asbestos	0.026(0.0060)	2.33**	0.004
Walling materials type			
Mud_wall	0.0073(0.0066)	2.15**	0.040
Cement_wall	0.0109(0.0049)	3.22***	0.007
Corrugated_wall	0.0130(0.0064)	5.03***	0.000
Flooring materials type			
Earth_mud _floor	0.0132(0.0080)	1.66*	0.098
Lighting type			
PHCN	0.0003(0.0050)	0.05	0.959
Generator	0.0110(0.0017)	6.45***	0.000
Candle	0.0018(0.0010)	1.80*	0.072
Battery	0.0025(0.0016)	1.56	0.119
Gas	0.0090(0.0026)	3.42**	0.001
Kerosene	0.0001(0.0009)	0.07	0.940
Toilet Facilities			
Flushpipe	0.0177(0.0028)	6.25***	0.000
Flush_septic	0.0150(0.0028)	5.40***	0.000
Flush_pit	0.0066(0.0027)	2.39**	0.017
Composting	0.0041(0.0021)	2.45**	0.014
Vip_pit	0.0096(0.0030)	3.24***	0.001
Covered_pit	0.0053(0.0027)	1.93*	0.054
Uncovered_pit	0.0038(0.0029)	1.30	0.195
Pail	0.0121(0.0057)	2.11**	0.035
No_toilet	-0.0103(0.0051)	-2.00**	0.046
Water source			
Pipebor_water	0.0561(0.0258)	2.17**	0.008
Public_water	0.0451(0.0255)	1.77*	0.077

Borehole	0.0462(0.0254)	1.82*	0.069
Well_water	0.0455(0.0254)	1.80*	0.071
SSvendor_water	0.0450(0.0254)	1.77*	0.076
Tanker_truck	0.0425(0.0254)	1.72*	0.090
Other_water	0.0440(0.0254)	1.73*	0.083
NEIGHBOURHOOD CHARACTERISTICS			
Waste disposal source			
PSP	0.0022(0.0028)	0.78	0.437
Dump_ground	-0.0102(0.0032)	-3.16***	0.002
Truck_push	0.0017(0.0028)	0.59	0.557
Comp_dump	-0.0017(0.0037)	-0.46	0.646
Others_dump	-0.0029(0.0041)	-0.71	0.480
Security services			
Com_Pol	0.0009(0.0010)	0.83	0.404
Gvt_Pol	0.0027(0.0014)	1.93*	0.054
Pollution			
Littering	-0.0003(0.0008)	-0.42	0.672
Public_urine	-0.0000(0.0007)	-0.03	0.979
Illegal _trad	-0.0002(0.0008)	-0.28	0.776
Poor_traffic	-0.0030(0.0008)	-3.90***	0.000
LOCATIONAL CHARACTERISTICS			
Distance to employment (mins)			
Distemployd 0_14	0.0008(0.0012)	0.64	0.519
Distemployd15_29	0.0015(0.0012)	1.24	0.213
Distemployd30_44	0.0003(0.0013)	0.24	0.808
Distemployd60_abv	-0.0023(0.0013)	-1.74*	0.082
Distance to Children school (mins)			
Dischdsch0_14	0.0009(0.0008)	1.09	0.276
Dischdsch15_29	0.0009(0.0009)	0.92	0.357
Dischdsch30_44	-0.0047(0.0012)	-3.79***	0.000
Dischdsch45_59	-0.0058(0.0017)	-5.67***	0.000
Dischdsch60_abv	-0.0101(0.0024)	-6.87***	0.000
Distance to public transport (mins)			
Dispubtrans0_14	0.0048(0.0025)	1.94*	0.052
Dispubtrans15_29	-0.0078(0.0025)	-2.50**	0.002
Dispubtrans30_44	-0.0091(0.0044)	-3.24***	0.000
Distance to hospital (mins)			
Dishosp0_14	0.0146(0.0120)	1.22	0.223
Dishosp15_29	0.0146(0.0120)	1.22	0.222
Dishosp30_44	0.0158(0.0120)	1.32	0.188
Dishosp45_59	-0.0144(0.0120)	-1.19	0.233
Dishosp60_abv	-0.0196(0.0120)	-1.64	0.102
Distance to market (mins)			
Distmkt0_14	0.0022(0.0027)	0.81	0.420
Dismkt15_29	0.0030(0.0027)	1.11	0.268
Dismkt30_44	-0.0001(0.0029)	-0.03	0.979
Dismkt60_abv	-0.0002(0.0031)	-0.06	0.952

Distance to water supply (mins)			
Diswat0_14	0.0064(0.0049)	-1.31	0.189
Diswat15_29	-0.0062(0.0051)	-1.22	0.224
Diswat30_44	-0.0121(0.0056)	-2.17**	0.030
Diswat60_abv	-0.0235(0.0061)	-4.57***	0.000
Constant	1.9851(0.0302)	65.74	0.000
Lambda(λ)	-0.4818		
S.E	0.5601		
Log likelihood	-1890.75		
LR chi-squared	175.80		

Source: *Computed*

Notes: Standard errors are in parentheses
(*) the coefficient is statistically significant at 10%
(**) the coefficient is statistically at 5%
(***) the coefficient is statistically significant at 1%

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