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RESIDENTIAL HOUSING DEMAND IN NAIROBI; A HEDONIC PRICING APPROACH

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Abstract

Purpose*:* The purpose of this study was to asses the residential housing demand in Nairobi using a hedonic pricing approach.

Methodology*:* The study used an OLS regression model to link House rent to various determinants. For the purpose of analysis the population o be sampled was based in Nairobi. The researcher focused on the Nairobi up market residential areas and the Nairobi lower market residential areas. The sampling frame consisted of residential housing facilities in both the up market and lower market Nairobi area. The sample size was specifically fifty five up market and lower market residents in Nairobi. Short and simple questionnaires were the main data collection method used to obtain the primary data of the information.

Results*:* Results revealed that that the HSESIZE (number of bedrooms) were positively and significantly correlated to the VALUE (house rent). This implies that the higher the pollution numbers of bedrooms, the higher the rent. The results also indicate that EXPLEVEL (exposure level to pollution) was negatively and significantly correlated to VALUE (House rent). This implies that the higher the pollution exposure, the lower the rent. The results also indicate that ESLVRS (Level of Ease to Recreational Facilities) was negatively and significantly correlated to VALUE (House rent). This implies that the higher the difficulty of accessing recreational facilities, the lower the rent. The results also indicate that ESLGDF (Level of Ease to Garbage Disposal) was negatively and significantly correlated to VALUE (House rent). This implies that the higher the difficulty of accessing garbage collection facilities, the lower the rent. An R squared of 0.639 indicated that the goodness of fit of the model was satisfactory. An F statistics of 6.917 and a pvalue of 0.000 indicate that the overall model was significant.

Unique contribution to theory, practice and policy: Based on the findings, the study recommended that more effort should be employed to construct a housing price index which can be studied in its own right or be used as an explanatory variable in housing demand equations. Large scale data should also be employed in order to achieve a more detailed analysis.

Keywords: *residential housing, demand, hedonic pricing approach*

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1.0 INTRODUCTION

1.1 Background of the Study

The housing sector is very much associated with the economic health and wealth of a nation. When the demand for housing is high other sectors of the economy will be able to realize tremendous growth. Thus, research into the variables that contribute to property prices is essential because the purchase of a residential property is both an investment decision as well as a consumption decision. In the endeavor to model the housing prices, two approaches have been widely used. The first approach is the monocentric model, where housing price is assumed to be a function of an individual's income. The relative housing prices then reflect the relative savings in commuting costs associated with different locations.

However, unlike other consumption goods, the housing market is unique because it manifests the characteristics of durability and heterogeneity. Thus, to model this differentiation effectively, the second approach of the hedonic price model has been introduced. The hedonic price model posits that goods are typically sold as a package of inherent attributes (Rosen, 1974). Therefore, according to Rosen, (1974) the price of one house relative to another will differ with the additional unit of the different attributes inherent in one house relative to another house. The relative price of a house is then the summation of all its marginal or implicit prices estimated through the regression analysis.

Economic models for hedonic markets characterize the valuation of attributes and characteristics that constitute a good and the demand and supply of these attributes under different assumptions about the market structure, individual preferences and the existing technology. Hedonic regressions have been used to estimate the potential benefits of various public projects. This approach is particularly attractive because unlike most of the other approaches it can be applied to non market interactions such as externalities and public goods. Its theoretical foundations have been discussed by Rosen (1974), Freeman (1979), Polinsky and Sharrell (1976) among others. The hedonic pricing method is used to estimate economic values for ecosystem or environmental services that directly affect market prices. It is most commonly applied to variations in housing prices that reflect the value of local environmental attributes. It can be used to estimate economic benefits or costs associated with: environmental quality, including air pollution, water pollution or noise, environmental amenities, such as aesthetic views or proximity to recreational sites(Kanemoto,1988)

The basic assumption of the hedonic pricing method is that the price of a marketed good is related to its characteristics, or the services it provides. For example, the price of a house reflects the characteristics of that house—age, closeness to social amenities, neighborhood characteristics e.t.c. Therefore, we can estimate the value the individual characteristics of a house or a residential property by looking at how the price people are willing to pay for it changes when the characteristics change. The hedonic pricing method is most often used to when estimating the value of environmental amenities that affect the price of residential properties. The method is based on the assumption that people value the characteristics of a good, or the services it provides, rather than the good itself. Thus, prices will reflect the value of a set of characteristics, including environmental characteristics, which people consider important when purchasing the good. The hedonic pricing method may be used to estimate economic benefits or costs associated with, environmental quality, including air

pollution, water pollution, or noise environmental amenities, such as aesthetic views or proximity to recreational sites among others.

The hedonic approach to benefit evaluation relies on the cross sectional capitalization hypothesis which assumes mobility of households between different locations. Property prices are higher in areas with better amenities or better public services otherwise many households would want to move into an area and bid up the property prices. Perfect mobility between different areas therefore ensues that property prices reflect the benefits of amenities that property prices reflect the benefits of its amenities. This also holds if the amenities are unpriced non market goods. (Kanemoto, 1988).

Markets accommodate diversity by establishing price that tends to make different things relatively close substitutes at the margin. Adams Smith insight that markets tend to equalize their net advantage is fundamental to these problems. If one good has more desirable attributes than another, the less preferred variety must compensate by selling at a lower price. Market prices reflect both the costs and values of underlying attributes of goods. Agents implicitly use cost benefit analysis to choose locations in product spectrum with buyer comparing the market prices of alternative varieties with their relative values in use, and with sellers comparing the market prices with their relative costs. Equality between demand and supply for each variety sustains the market equilibrium price quality structure.(Rosen,2001)

Hedonic price models have long been used to value not only the physical attributes of housing units but also the surrounding location and environmental amenities. The hedonic regression method regresses the product prices on its characteristics .In land and housing markets, prices are regressed on housing attributes such as age, size and on site characteristics, neighborhood characteristics location and public services. Environmental and safety concerns are at the fore front of public policy today. The rhetoric and passions that they arouse make it easy to forget that these goods are costly to produce and that rational decisions require comparing their benefits with their costs, assessing the cost of these kinds of public projects is like finding the cost of any other investment. Assessing benefits requires estimating the willingness of consumers to pay for more safety and clean air. In practice, it is tricky because there no explicit markets where safety and clean air can be directly traded and from which demand values can be directly inferred. Instead safety and environmental quality often are by products of other transactions and their valuation must be imputed from the observed packages in which they play a part.(Herriges,Secchi and Babcock,2005)

In real estate economics, the hedonic pricing approach is used to adjust for the problems associated with researching a good that is as heterogeneous as buildings. Because buildings are so different, it is difficult to estimate the demand for buildings generically. Instead, it is assumed that a house can be decomposed into characteristics such as number of bedrooms, size of lot, or distance to the city center. A hedonic regression equation treats these attributes (or bundles of attributes) separately, and estimates prices (in the case of an additive model) or elasticity (in the case of a log model) for each of them. This information can be used to construct a price index that can be used to compare the price of housing in different cities, or to do time series analysis. As with Consumer Price Index calculations, hedonic pricing can be used to correct for quality changes in constructing a housing price index. It can also be used to assess the value of a property, in the absence of specific market transaction data. It can also be used to analyze the demand for various housing characteristics, and housing demand in general.

The application of the hedonic price model to the housing market rests on several key assumptions. First, homogeneity of the housing product is assumed. This assumption, however, is arguable. It would be more accurate to view housing products as heterogeneous because they can be differentiated in terms of location, structural, or neighborhood attributes, or based on some other criteria as well, such as type of dwelling (bungalow, terrace house, high rise apartment, or condominium).Another underpinning assumption is that the market operates under perfect competition, and there are numerous buyers and sellers. This assumption is justified as there are many buyers seeking housing in the market, and there are also many housing developers that supply the housing. Thus, no individual buyer or supplier can significantly affect the price of the properties because the purchases or sales of each individual unit constitute a negligible portion of the market. (Dusse and Jonnes,1998)

Buyers and developers are deemed to have freedom to enter and exit the market. Unlike some other industries, such as the petroleum and aviation industries that may have to comply with certain requirements, there are neither constraints artificially imposed on the demand and supply of housing, nor restrictions on the resources used to produce the housing product. In practice however, there might be some budget constraints for the buyers. Likewise, for developers, only those with enough capital can contemplate property development.

The assumption that buyers and sellers have perfect information concerning housing product and price is quite reasonable, although one may still contend that perfect knowledge is impossible to achieve in reality. The application of the hedonic pricing technique developed by Rosen in 1974 to the consumer behavior under the conditions of risks and uncertainties where the source of uncertainties is from non market hazards occurring in the natural environment. Buying a house involves a substantial capital outlay. Thus, buyers will endeavor to shop around to acquire as much information about the attributes of the units they desire before making the purchase. Most of the relevant information, such as availability of the housing unit, its price and attributes, is readily available in the newspapers, or can be obtained from brokers and real estate agents. As for suppliers, perfect knowledge of their core business and the market price enables them to increase their profits and utility, too. However, such perfect information may never be fully realized in practice.(Kask and Maani,1992)

Finally, the hedonic price model only works under the assumption of market equilibrium, and that there are no interrelationships between the implicit prices of attributes (Dusse & Jones, 1998). Market equilibrium is not plausible because there are imperfections in the real world property market. It is idealistic to assume that the price vector will adjust instantaneously to changes in either demand or supply at any point in time. The notion that there are no interrelationships between the implicit prices of attributes is also fallacious because it implies that the implicit price of an attribute does not vary throughout all areas and property types. It is not necessarily true that all attributes will give the same level of utility or identical levels of disutility to all buyers.

1.2 Problem Statement

How housing markets accommodate diversity of choice, tastes and productiveness is very important in economic affairs of a nation. Little research and study on the hedonic pricing approach in housing markets has been done in developing countries such as Kenya. Most of the developing countries rely on price theory which focuses on the determination of price and quantities of already defined goods but does little in the evaluation of the extensive

margin by which a good and in this case, a residential property is chosen. It has not incorporated the importance of heterogeneity and diversity of the attributes of a residential property and the role that it plays in the determination of the price and choice of the same. The purpose of this study is to use the hedonic pricing approach to show how differentiated residential properties are valued according to their various attributes and characteristics. Little research and study on the hedonic pricing approach in housing markets has been done in developing countries such as Kenya. Most of the developing countries rely on price theory which focuses on the determination of price and quantities of already defined goods but does little in the evaluation of the extensive margin by which a good and in this case, a residential property is chosen. It has not incorporated the importance of heterogeneity and diversity of the attributes of a residential property and the role that it plays in the determination of the price and choice of the same.

1.3 Research Objectives

To determine the effect of structural attributes of a property (house) on the price of the property

To determine the effect of accessibility characteristics of a property (house) on the price of the property

To determine the effect of neighborhood characteristics of a property (house) on the price of the property

To determine the effect of environmental characteristics of a property (house) on the price of the property

To derive policy recommendation from the study

2.0 LITERATURE REVIEW

2.1 Theoretical Framework

According to economists houses are typically treated as standard financial assets leading to the conventional view that home ownership is quite risky. Since house price are volatile home owners allocate a substantial proportion of their net worth to their housing facilities, fluctuations in house prices can be said to have a sizable effect on home owner balance sheets (Peter and Samwick, 1997). Further studies have shown that changes in housing wealth can lead to significant changes in home owner's consumption (Case, Quilly and Shiller 2003) and the overinvestment in housing can distort their financial portfolio. (Mutwiwa, 2010)

Households that do not own a home must rent, purchasing their housing facilities on a spot market and thus subject themselves to annual fluctuations in rent. Owners by contrast avoid this rent uncertainty by buying a long lived asset that delivers a guaranteed steam of housing services for a known up-front price Linnemann (1986). Rothenberg et al (1991) and Hensen and Skak (2005) provide a theoretical argument for a range of economic determinants for home ownership. They argue that individuals or households choose to own stock for which housing services flow is optimal or welfare maximizing given their specific economic conditions. They further argue that changes in economic conditions and environment may lead to a change in the optimal choice away from ownership or into ownership (Mutwiwa,2010)

Housing characteristics and the process by which housing is constructed and occupied are the key aspects of the living standards of the households in developing countries. In addition housing is important to both the developed and developing economies because it is the largest fixed capital investment that households make. Despite the predominance of the economic determinism in housing demand, it should be noted that a number of factors which are not necessarily economic, also play a role (Mitullah, 1993). These include characteristics of people with respect housing needs. This includes household size, number of rooms occupied, arrangement and the stage of the literature of the household. Adedokun (1989) notes that in a number of political systems the failure of housing policy is related to the problem of the wrong determination. Particular cultural housing values of a nation or people are quite disregarded (Mutwiwa, 2010).

The housing sector is very much associated with the economic health and wealth of a nation. A high demand for housing would trigger growth in many other economic sectors. Thus, research into the variables that impact property prices is essential because the purchase of a residential property is both an investment decision as well as a consumption decision. However, unlike other consumption goods, the housing market is unique because it manifests the characteristics of durability and heterogeneity. Thus, to model this differentiation effectively, the second approach of the hedonic price model has been introduced. The hedonic price model posits that goods are typically sold as a package of inherent attributes (Rosen, 1974). Therefore, the price of one house relative to another will differ with the additional unit of the different attributes inherent in one house relative to another house. The relative price of a house is then the summation of all its marginal or implicit prices estimated through the regression analysis.

Two main approaches contributed greatly towards the theoretical work on hedonic prices. The first approach was derived from Lancaster's (1966) consumer theory, and the second comes from the model postulated by Rosen (1974). Both of these approaches aimed to impute prices of attributes based on the relationship between the observed prices of differentiated products and the number of attributes associated with these products. The Lancastrian model, Rosen's model, and the hedonic price model all surmised that goods possess a myriad of attributes that combine to form bundles of characteristics (or objectively measurable, utility-affecting attributes), which the consumer values; but these models have some fundamental differences. The Lancastrian model presumes that goods are members of a group and that some or all of the goods in that group are consumed in combinations, subject to the consumer's budget. In comparison, Rosen's model assumes there is a range of goods, but that consumers typically do not acquire preferred attributes by purchasing a combination of goods. Rather, each good is chosen from the spectrum of brands and is consumed discretely. The hedonic price approach also does not require joint consumption of goods within a group. Thus, Lancaster's approach is more suited to consumer goods, whereas Rosen's model can be associated with durable goods. Lancaster's theory also assumes a linear relationship between the price of goods and the characteristics contained in those goods. . In contrast, Rosen postulated that unless it is possible for consumers to arbitrage attributes by untying and repackaging them, a nonlinear relationship between the price of goods and their inherent attributes would be more probable.

According to Triplett (1986), hedonic methods were developed and employed in price indices, long before their conceptual framework was understood. Bartik (1987) claimed that the first formal contributions to hedonic price theory were those made by Court in 1941, although there were other informal studies. For instance, Colwell and Dilmore (1999) mentioned that Haas produced a hedonic study more than 15 years prior to Court, who first published the term "hedonic." Etymologically, the term "hedonics" is derived from the Greek word *hedonikos*, which simply means pleasure. In the economic context, it refers to the utility or satisfaction one derives through the consumption of goods and services.

Batra and Ahtola(1990) state that consumers purchase goods and services and perform consumption behaviour for two basic reasons: First,consumatory affective(hedonic) gratification and secondly, instrumental and utilitarian reasons. The first is a hedonic dimension derived from sensations derived from experiencing the product and the second is a utilitarian dimension derived from the functions performed by the product, measurements of these attitudinal dimensions can provide researchers and managers with fresh approaches to modelling marketing and pricing problems.

A review of extant literature reveals that many past studies that employed the hedonic price model focused on location, structural, and neighborhood attributes.

The location of a property has been conceived in most studies in terms of fixed and relative location attributes. The fixed location attributes (Follain & Jimenez, 1985; Oxford, 1988) are quantified with respect to the whole urban area, and pertain to some form of accessibility measure. Relative location attributes are quantified through surrogate measures such as socio-economic class, racial composition, aesthetic attributes, pollution levels, and proximity to local amenities (Dubin & Sung, 1990).

In the traditional view of location, accessibility is measured in terms of access to the Central Business District (CBD). Accessibility, in whatever form it has been measured, has some influence on housing prices (McMillan, Jarmin, & Thorsnes, 1992; Palmquist, 1992; Ridker & Henning, 1968). Transport accessibility is frequently associated with the ease of commuting to and from amenities, and is measured by travelling time, cost of travel, convenience, and availability of different transport modes (Adair, Greal, Smyth, Cooper, & Ryley, 2000; So et al., 1996). Buyers tend to trade-off housing costs against transport costs, but this is not always true because Edmonds (1984) found that costs of commuting (fares) may not be capitalised into site value. His study in Japan found that it is customary for firms to reimburse employees for commuting. Thus, in that case, the only apparent "costs" of commuting were probably time and discomfort.

The positive influence of good public transport services on housing prices has also been empirically examined. So et al.'s (1996) study in Hong Kong on transport accessibility, measured by the distances to the nearest stations of the mass transit railway (MTR), buses, and minibuses, revealed a high dependence on public transport in the territory. Consequently, buyers were willing to pay more for properties with easy accessibility to work. Frequency of transport services is also important. Hence, minibuses were found to be the most influential determinant of house prices because they provide more frequent services than buses. Some even ply twenty four hours on certain routes.

Prices of properties are also frequently related to their structural attributes. As Ball (1973) pointed out, if a house had more desirable attributes than others, the valuation of these attributes would be reflected in higher market prices for this house. However, other researchers have noted that structural attributes preferred by buyers may not always be identical. Kohlhase (1991) found that the significance of structural attributes can change over time, and may vary between nations. While attributes relating to the number of rooms and floor area are relatively important across nations, other attributes change with the tradition of building style or the climate.

Numerous studies reveal that the number of rooms and bedrooms (Fletcher, et al., 2000; Li & Brown, 1980), the number of bathrooms (Garrod & Willis, 1992; Linneman 1980), and the floor area (Carroll, Clauretie, & Jensen, 1996; Rodriguez & Sirmans, 1994) are positively related to the sale price of houses. This is because buyers are willing to pay more for more space, especially functional space. Residential properties with bigger floor areas are desired by big families and buyers who can afford a better standard of living.

Researchers also surmised that building age is negatively related to property prices (Clark & Herrin, 2000; Kain & Quigley, 1970; Rodriguez & Sirmans, 1994; Straszheim, 1975). This is because *ceteris paribus*, older houses are worth less because they incur more costs in maintenance and repair, and also have decreased usefulness due to changes in design, electrical and mechanical systems (Clapp & Giaccotto, 1998). For example, Kain and Quigley's study showed that a new structure sold for more than an identical unit that was old. However, Li and Brown's (1980) study found an opposite effect of age on some buildings. This increase in value was attributed to the historical significance or vintage effects of the buildings. This led Clapp and Giaccotto (1998) to conclude that there are two components to the age coefficient: a pure-cross sectional depreciation and obsolescence component, as well as a demand-side component that changes over time.

Goodman (1989) argued that while neighbourhood attributes cannot be explicitly valued in the market place, they could be implicitly valued through hedonic pricing by comparing houses with differing neighbourhood qualities. Goodman's caveat that failure to model neighbourhood attributes can lead to substantive errors when valuing individual properties and the market in general, was validated by Linneman (1980). Linneman found that between 15 and 50 percent of the standardised variation in site valuations is attributed to neighbourhood attributes, and for structurally identical sites, as much as 100 percent of the differential in site valuations is induced by neighbourhood attributes. Kain and Quigley's (1970) study further demonstrated that higher income households with more education prefer to live in relatively high quality dwelling units located further away from the CBD.

Saphores and Benitez (2005), did a study on residential property values in four orange county cities that were being affected by high levels of pollution. They analysed the micro level impacts of local smelly pollutants emissions on the price of single family homes. By use of the hedonic pricing method they found out that the presence of smelly polluters' decreases property value. Although this could also relate to the presence of other externalities such as noise and congestion.

Ellen and Turner (1997) argue that the social network and crime rates in a neighbourhood affect individual purchasing behaviour of a property (house). Home ownership rates may be the underlying influence of these behaviours. They also suggest that the impact of

neighbourhoods on an individual depends on the characteristics of the individual such as age, gender and ethnicity or race.

Lansford and Jones (1995) use the hedonic price approach to determine the components of the recreation and aesthetic value of a lake in central Texas. Specifically the implicit recreational and aesthetic price placed on the Lake Travis by the home owners living near it was investigated. They use the hypothesis that within certain proximity within the lake residential property values reflect the recreational and aesthetic benefits received from the lake by the residents. The hedonic study of the shoreline and near-a-lake properties captured an important component of the recreational and aesthetic values that are provided by such features and their effect on the property values within its proximity.

Scotchmer (1985,1986) examines the hedonic approach within a general equilibrium framework and points out that even in a homogenous household case, the equilibrium price function does not provide the correct benefit in the lot size since the lot size chosen by the consumer is based on the housing attributes, there is not enough variation in the data to permit full estimation of the hedonic price function. That is a certain lot size chosen for a certain set of attributes and one cannot observe the price which would be established if the lot size were different.

Bartik (1987) argued that the hedonic estimation problem is not the result of the interaction between demand and supply because the individual consumer cannot affect the suppliers. Instead, the hedonic estimation problem is caused by the endogeneity of both prices and quantities of attributes in the context of a non-linear budget constraint. Hence, there is no necessity to model the supply side of the market.

2.2 Empirical Review

Residential properties are multidimensional commodities characterized by durability, structural inflexibility, and spatial fixity (Chau et al., 2001; So et al., 1996). Typically, the housing attributes are classified into location attributes (L), structural attributes (S), and neighborhood attributes (N). These attributes encompass both quantitative and qualitative attributes (Goodman, 1989; Williams, 1991).

The market prices (P) of the property can, therefore, be expressed as:

$$P = f(L, S, N) \quad (1)$$

The partial derivative of the above hedonic function with respect to any attribute is the implicit marginal attribute price, *ceteris paribus* (Rosen, 1974). This implicit price of the housing attribute is revealed in the regression coefficient. All buyers perceive the amounts of attributes embodied in the housing product to be identical, but their subjective valuations of each component attribute may differ. The price of the house, then, is the sum of the implicit prices for the attributes that are contained in it. Thus, the hedonic price approach enables the possible influence of each of the many attributes on the house price to be tested and analyzed.

Numerous studies reveal that the number of rooms and bedrooms (Fletcher, et al., 2000; Li & Brown, 1980), the number of bathrooms (Garrod & Willis, 1992; Linneman 1980), and the floor area (Carroll, Clauretie, & Jensen, 1996; Rodriguez & Sirmans, 1994) are positively related to the sale price of houses. This is because buyers are willing to pay more for more space, especially functional space. Residential properties with bigger floor areas are desired by big families and buyers who can afford a better standard of living. For example, Garrod

and Willis discovered that an additional room increases a property's value by about 7 %, and an extra bathroom collecting twice that premium.

Forrest, Glen & Ward, (1996), These researchers claimed that lot size, the existence of a basement, garage, patio, water heating system, one or more fireplaces, and/or an air heating system are significantly related to the price of the dwelling (Garrod & Willis, 1992; Li & Brown, 1980; Michaels & Smith, 1990). For example, Garrod and Willis noted that a single garage adds a 6.9% differential and a double garage three times this amount, while central heating adds about 6.5% to the price of the house.

Chau et al. (2001) classified the physical conditions of the property such as size, floor level, age, and so forth as tangible attributes, whereas attributes such as accessibility, seaview, environmental quality, and developer's good will are regarded as intangible attributes. According to Chau et al., buyers are willing to pay about 416 USD more per square foot for properties constructed by large reputable developers. This is approximately 7% more than average housing prices.

In terms of local government services, the quality of public schools has been found to have a great impact on real house prices. School quality is more important to local residents (especially those with children) than either crime or environmental quality (Clark & Herrin, 2000; Haurin & Brasington, 1996). The quality of schools has been measured in terms of school input variables, such as expenditures per pupil or average cost per student (Ketkar, 1992), student achievement levels or Standardised Aptitude Test (SAT) scores (Jud & Watts, 1981; Ketkar, 1992; Walden, 1990). Generally, higher test scores have a positive impact on property prices (Clauretie & Neill, 2000; Jud & Watts, 1981).

With respect to the hospitals, Huh and Kwak's (1997) study in Seoul revealed that hospitals exhibit a significant negative effect on property prices. The presence of a hospital is a liability in Seoul because of cultural norms in Korea. When someone dies in Korea, the corpse is placed in the hospital mortuary, and condolences are extended to family members and relatives for three days. Proximity to hospitals and health centres is not desirable due to the commotion that ensues including the nuisance value of ambulance sirens, the general congestion in the vicinity of hospitals, as well as superstitious beliefs.

Places of worship, such as churches, irrespective of denominations and size, are amenities that generally enhance the value of neighbourhood properties (Carroll et al., 1996). However, Do, Wilbur and Short (1994) reported an exception, and suggested that the presence of churches meant increased traffic and noise from church bells. Hence, property values in such "theocratic environments" were reduced.

Undeniably, buyers are wary of areas of high crime and vandalism. Using the percentage of persons aged between 16 and 21 years who are high school dropouts as a proxy measure for crime and vandalism, Li and Brown (1980) found that buyers do not favour areas associated with high rates of crime or vandalism. Clark and Herrin (2000) found that prices of properties in Fresno County, California are 7.28% lower in areas with each additional murder per 10,000 people. Crime has also been measured by other variables such as robbery, rape,

aggravated assault, motor vehicle theft, and arson per 1,000 residents (Haurin & Brasington, 1996).

There are also studies on the externality of noise from traffic and its effect on property values (Palmquist, 1992). However, the reaction towards noise, or quiet, is dissimilar among different groups of people. Palmquist provided evidence that in an upper middle class neighbourhood, property values were reduced by 0.48 % for each additional decibel of highway noise, whereas in a lower middle class neighbourhood, this value was 0.3 % per decibel. In the poorest neighbourhoods, the effect was even lower, only 0.08 % per decibel. This indicates that in the case of the very poor, their marginal willingness to pay for quiet is comparatively very low, or perhaps it is just due to their inability to pay.

Tomkins, Topham, Twomey, and Ward (1998), argue that airport proximity can be both positive and negative. They found that the benefits of easy access to the airport and its associated transport infrastructure outweigh the costs. For instance, a standard dwelling located 2.5 km from the airport terminal commanded a price about 19% above one at the mean distance. Feitelson et al. (1996), however, found that beyond a certain "disturbance" level, buyers' willingness to pay declines to zero, as they are no longer interested in the properties. Espey and Lopez (2000) also found that there is a statistically significant negative relationship between airport noise and prices of properties in proximity to the Reno-Sparks airport, with houses where the noise level has been recorded at 65 decibels selling at USD2400 less than homes in relatively quieter environments.

Proximity to shopping complexes and the size of shopping centres, have both been found to exert an influence on the value of the surrounding residential properties (Des Rosiers et al., 1996; Sirpal, 1994). Proximity to a shopping centre could mean easy access to facilities, and reduced traveling costs, but this also might provide disadvantages in terms of noise pollution and congestion. Shopping centre size affects the utility of centres. Des Rosiers, et al. found that each additional shop adds about USD27 to the market value of the properties in the vicinity of the shopping centre.

Not many of the previous studies have specifically examined the attribute of facilities on the valuation of properties. Only Mok et al. (1995) and Tse and Love (2000) indicated that the provision of facilities in large housing estates, such as a private clubhouse, swimming pool, landscaped garden, gymnasium, and various kinds of sports facilities tend to increase the prices of such properties. The reason could be recreational, since sports facilities are associated with quality living.

Tyrvainen (1997) studied empirically and found that that external benefits, including pleasant landscape, unpolluted air, serenity, quiet atmosphere, and the presence of urban forests,(by using apartment sales data for residents in North Carelia, Finland.) On average, the results showed that the inhabitants appreciate green housing districts and accessibility to forested recreation areas. However, the effect of urban forests on prices of properties is non-linear, as nearby forests may lower housing prices when located too close, while their impact of increasing effect on price is dependent on their distance, size, and quality.

Chattopadhyay (1999), who conducted a study to gauge the willingness of buyers to pay for reduced air pollution, found that residents in Chicago were willing to pay for a reduction in the pollution level of particulate matter (PM-10) and sulphur dioxide. As for the quality of water, Leggett and Bockstael (2000) reported that water quality, which was measured based

on the concentration of faecal coliform bacteria, has a significant effect on property values, too.

In Kenya Wahome (1984) analyzed a random sample of 200 households in Kibera area in Nairobi to find out who benefits from site and service housing projects targeting the urban poor. He found out that the projects benefit the middle and upper income groups. The targeted group fails to benefit due to lack of finance to compete with the middle and upper income groups. He concludes that the site and service projects are not a complete answer to the housing problems in Nairobi. He recommends a matter of general policy that the subsidy provided in public housing project should not be made available to all the classes of prospective land users so that the resources are released to cater for more houses. He however does not mention the importance of housing attributes in determining the house price and the consumers' willingness to pay for the property.

3.0 RESEARCH METHODOLOGY

In this study we employ hedonic pricing which entails people's willingness to pay for a property. The research design adopted will be a survey research to be able to conduct a survey on the prices of residential housing in various parts of Nairobi which will indicate the people's willingness to pay for a given property based on its attributes. It is also both qualitative and quantitative research. For the purpose of analysis the population to be sampled will be based in Nairobi. I will focus on the Nairobi up market residential areas and the Nairobi lower market residential areas. In this study the sampling frame consists of residential housing facilities in both the up market and lower market Nairobi area. The sample size will be specifically fifty five up market and lower market residents in Nairobi. Short and simple questionnaires will be the main data collection method used to obtain the primary data of the information.

4.0 RESULTS AND DISCUSSIONS

4.1 Descriptive Statistics

4.1.1 Normality Tests

Prior to estimation, the data was analyzed for normality. The importance of checking for normality of data lies in the assumptions of OLS regression. The OLS regression assumes that the data (the dependent variable) is normal. Skewness and kurtosis results indicated that the dependent variable was normally distributed. A skewness of 1.082 implied that the data was skewed to the right. As a rule of the thumb, skewness of between -2 and +2 indicates that the distribution of the data is normal. This implies that dependent variable was normally distributed. Kurtosis coefficient of -1.147 indicates that the peakedness of the distribution is flatter than the normal distribution, hence it can be referred to as a platykurtic distribution. However, the rule of the thumb is that kurtosis of between -2 and +2 is acceptable. This further implies that the data can be regressed. A histogram presented in figure 1 also indicates that the data is slightly skewed and platykurtic .

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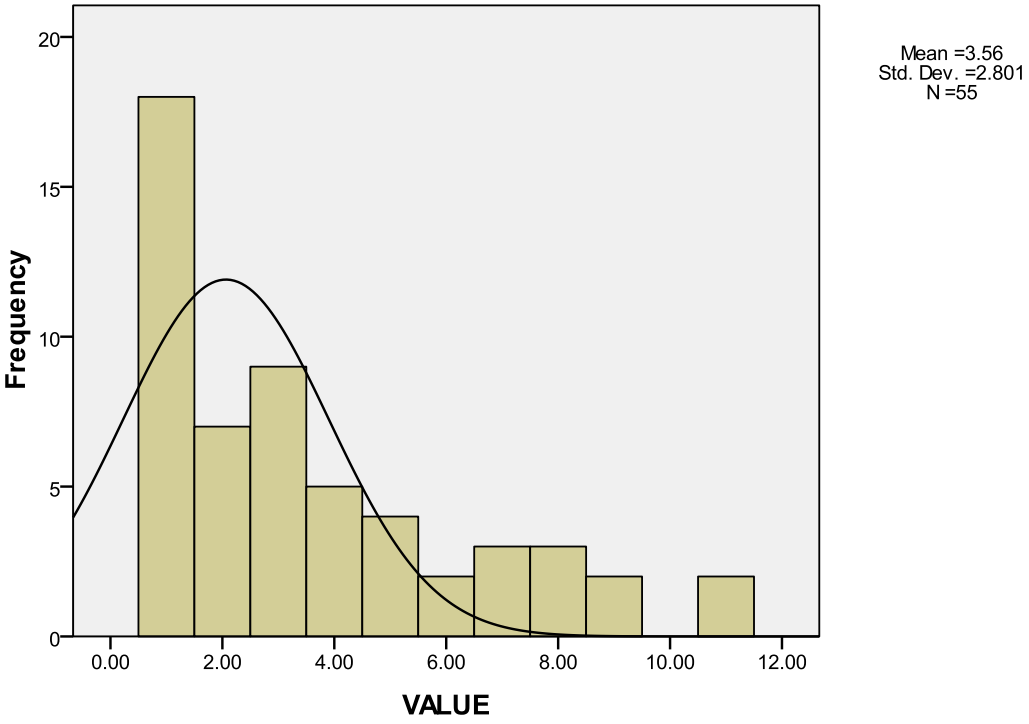

Figure: Normality test

4.1.2 Descriptive results

Descriptive results in table 1 indicate that the mean gender distribution was 0.56. This implies that 56% of the respondents were male. The mean age category was 2.29. This implies that majority of respondents were aged between 20 to 29 years. This implies that majority of those interviewed were youthful. Findings indicate that the mean value of house rent was 3.56. This implies that majority of the houses were rented at ksh 30,000 to ksh 40,000. The findings indicated that the house size was 2.8. This implied that the majority were three bed roomed houses. The mean house age was 1.65. This implies that majority of the houses were aged between 10 to 20 years. Results further reveal that the mean distance to Central Business District (CBD) was 1.78. This implies that majority of the houses were situated 10 to 20 km away from the CBD.

The results indicated that the mean pollution was 2.67. This implies that majority of residents experienced noise pollution probably from matatus. Findings further reveal that the mean exposure to pollution level is 2.53. This implies that the residents were moderately exposed to pollution.

Results also indicate that the mean rating for the ease of access to health centres is 2.67 which implies that the majority of the residents found it easy to access health care. The findings further indicate that mean rating for the ease of access to police station is 2.69 which implies that the majority of the residents found it easy to access the police station. The findings further indicate that mean rating for the ease of access to schools is 2.67which implies that the majority of the residents found it easy to access the schools. The findings also indicate

that mean rating for the ease of access to recreation facilities is 2.84 which implies that the majority of the residents found it easy to access recreation facilities.

The findings also indicate that mean rating for the ease of access to garbage collection facilities is 3.11 which implies that the majority of the residents found it easy to access garbage collection facilities.

The findings also indicate that mean rating for the ease of access to commuter services facilities is 2.75 which implies that the majority of the residents found it easy to access commuter services.

Table 1: Descriptive Results

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
GENDER	55	0	1	.56	.501	-.264	-2.005
AGE	55	2	3	2.29	.458	.947	-1.147
VALUE	55	1	11.	3.5636	2.80055	1.082	.308
HSESIZE	55	1	6	2.80	1.580	.723	-.560
HSEAGE	55	1	4.	1.6545	.75076	.945	.421
CBDDIST	55	1	4	1.78	.686	.667	.796
POLUTION	55	1	5	2.67	1.306	.227	-.950
EXPLEVEL	55	1	4	2.53	.836	.306	-.532
ESLVHC	55	2	4	2.67	.668	.489	-.701
ESLVPS	55	2	4	2.69	.605	.255	-.573
ESLVS	55	2	4	2.67	.610	.310	-.599
ESLVRS	55	2	5	2.84	.834	.719	-.127
ESLVGDF	55	2	5	3.11	.762	.073	-.654
ESLVCS	55	2	5	2.75	.799	.951	.594

4.2 Inferential Statistics

4.2.1 Correlation Results

Before running the regressions, a simple correlation analysis between the dependent and the explanatory variables was carried out. Correlation results at the appendix indicate that the HSESIZE (number of bedrooms) were positively and significantly correlated to the VALUE (house rent)(R=0.398; pvalue=0.003). This implies that the higher the pollution number of bedrooms, the higher the rent. The findings agree with numerous studies that reveal that the number of rooms and bedrooms (Fletcher, et al., 2000; Li & Brown, 1980), the number of

bathrooms (Garrod & Willis, 1992; Linneman 1980), and the floor area (Carroll, Clauretie, & Jensen, 1996; Rodriguez & Sirmans, 1994) are positively related to the sale price of houses. This is because buyers are willing to pay more for more space, especially functional space. Residential properties with bigger floor areas are desired by big families and buyers who can afford a better standard of living. For example, Garrod and Willis discovered that an additional room increases a property's value by about 7 %, and an extra bathroom collecting twice that premium.

The results also indicate that EXPLEVEL (exposure level to pollution) was negatively and significantly correlated to VALUE (House rent) (R= -0.549, p value=0.000) . This implies that the higher the pollution exposure, the lower the rent. The findings agree with Palmquist (1992) who noted that externality of noise from traffic had a negative effect on property values.

The results also indicate that ESLVRS (Level of Ease to Recreational Facilities) was negatively and significantly correlated to VALUE (House rent) (R= -0.285, p value=0.035). This implies that the higher the difficulty of accessing recreational facilities, the lower the rent.

The results also indicate that ESLGDF (Level of Ease to Garbage Disposal) was negatively and significantly correlated to VALUE (House rent) (R= -0.463, p value=0.000). This implies that the higher the difficulty of accessing garbage collection facilities, the lower the rent.

The other variables included in the correlation table were insignificantly correlated to Value (house rent).

4.2.1 Regression results for the models

The model was then estimated using OLS. The goodness of fit was measured by the coefficient of determination (R squared). An R squared of 0.639 indicated that the goodness of fit of the model was satisfactory. This also implied that 63.9% of the variations in VALUE (House rent) is explained by the independent variables. Only 36.1% of variation in House rent are unexplained.

The F statistic in table 4.2 displays the over-all model significance. An F statistics of 6.917 and a pvalue of 0.000 indicate that the overall model was significant. In other words, the independent variables are good joint predictors of house rent.

The regression model is as follows;

$$\begin{aligned} Rent = 10.271 &+ 0.80HSESIZE - 0.43HSEAGE - 0.874CBDDIST + 0.492Polution \\ &- 1.638EXPLEVEL + 0.366ESLVHC - 0.391ESLVPS - 0.785ESLVS \\ &+ 0.564ESLVRS - 0.688ESLVGDF - 0.417ESLVCS \end{aligned}$$

Regression coefficient of 0.80 indicates that an increase in house size (bedrooms) by one unit leads to an increase in house value by 0.8. The relationship is significant since the p value is 0.000 and is less than the critical p value of 0.05.

Regression coefficient of -0.43 indicates that an increase in house age by one unit leads to a decrease of house value by 0.43 units. However, the relationship is not significant since the p value is 0.256 and is more than the critical p value of 0.05.

Regression coefficient of -0.874 indicates that an increase in the distance to Central Business District by one unit leads to a decrease of house value by 0.874. However, the relationship is significant since the p value is 0.039 and is less than the critical p value of 0.05.

Regression coefficient of -1.638 indicates that a increase in Exposure Level to pollution by one unit leads to a decrease of house value by 1.638 units. The relationship is significant since the p value is 0.000 and is less than the critical p value of 0.05.

Regression coefficient of 0.366 indicates that an increase in Level of Ease to Health Centre by one unit leads to an increase of house value by 0.366 units. The relationship is not significant since the p value is 0.449 and is more than the critical p value of 0.05.

Regression coefficient of -0.391 indicates that an increase in Level of Ease of access to Police Station by one unit leads to a decrease of house value by -0.391 units. The relationship is not significant since the p value is 0.479 and is more than the critical p value of 0.05.

Regression coefficient of -0.785 indicates that an increase in Level of Ease of access to schools by one unit leads to a decrease of house value by 0.785 units. The relationship is not significant since the p value is 0.205 and is more than the critical p value of 0.05.

Regression coefficient of 0.564 indicates that an increase in Level of Ease of access to recreation facilities by one unit leads to an increase of house value by 0.564 units. The relationship is not significant since the p value is 0.200 and is more than the critical p value of 0.05.

Regression coefficient of -0.688 indicates that an increase in Level of Ease of access to garbage collection facilities by one unit leads to a decrease of house value by 0.688 units. The relationship is not significant since the p value is 0.139 and is more than the critical p value of 0.05.

Regression coefficient of -0.417 indicates that an increase in Level of Ease of access to commuter services by one unit leads to a decrease of house value by 0.417 units. The relationship is not significant since the p value is 0.322 and is more than the critical p value of 0.05.

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Table 2: Regression Model Results

Dependent Variable: VALUE		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	10.271	2.126		4.830	.000
	HSESIZE	.800	.172	.452	4.650	.000
	HSEAGE	-.430	.373	-.115	-1.151	.256
	CBDDIST	-.874	.410	-.214	-2.134	.039
	POLUTION	.492	.200	.229	2.464	.018
	EXPLEVEL	-1.638	.405	-.489	-4.049	.000
	ESLVHC	.366	.479	.087	.764	.449
	ESLVPS	-.391	.547	-.084	-.715	.479
	ESLVS	-.785	.610	-.171	-1.286	.205
	ESLVRS	.564	.434	.168	1.301	.200
	ESLVGDF	-.688	.456	-.187	-1.508	.139
	ESLVCS	-.417	.416	-.119	-1.002	.322
R Squared		0.639				
F statistic		6.917				0.000

5.0 DISCUSSION CONCLUSIONS AND RECOMMENDATIONS

5.1 Discussion

The main objective of this study was to identify the residential housing demand in Nairobi using a hedonic pricing approach. A hedonic pricing model was used to determine the House and other property prices which are not simply determined by one variable, they are a product

of a number of factors including: Characteristics of the property, characteristics of the location, and characteristics of the environment.

The Hedonic valuation approach was preferable for this research since it's the only technique designed specifically to measure the impact of changes in quality characteristics of a property on its market prices. Hedonic regressions of property values were used to estimate the benefits of various public projects. This approach was particularly attractive because unlike most of the other approaches it can be applied to non-market interactions such as externalities and public goods.

The relationship among variables was analyzed with the help of SPSS and estimated using Simple linear regression technique. Before running the regression for the model, the study checks for normality of the data and a simple correlation analysis between the dependent and the explanatory variables was carried out.

It is found that the coefficients of house age , Distance to CBD, level of exposure to pollution, level of ease to access police station, level of ease to access schools, level of ease to access garbage disposal facilities and the level of ease to access commuter services are negative values as expected. It indicates that the larger the figures the lower the value of the property. For instance if the property is old then the value goes down, if the distance to the CBD is great then the value/house price becomes low. The same applies to the level of ease of access to garbage facilities. If accessing is difficult then the value of the property goes down and vice-versa is true. The values for the coefficient of ease of access to health centers and schools are Positive which is unexpected. Meaning they may not have been sufficient to explain the relationships of the variables. A Durbin Watson statistic of 1.784 also indicates serial correlation of the variables.

5.2 Conclusions

The abundant studies that have employed the hedonic price model tend to indicate that values of residential properties are positively and negatively correlated with desirable and undesirable location, structural, and neighborhood characteristics. This generally applies to all buyers. However, the attributes preferred may not necessarily be identical because of cultural and idiosyncratic factors. This review and the empirical example demonstrate that the hedonic price approach is particularly useful for research studies on the housing market in Nairobi because high-rise properties have proliferated all over the city in the last decade, partly due to high land costs and scarcity of developable land. The hedonic price model could be used to investigate if buyers favor the current development in the property sector. The implicit prices generated from the regression analysis will help give a more accurate portrayal of the value or price of residential property traded in the market.

The hedonic price analysis is also very useful in that the implicit prices generated have the potential to facilitate decision making by urban planners and policy-makers about where to locate residential buildings, commercial buildings, schools, and so on. It is imperative that planning should take into consideration the desired housing attributes valued by the prospective buyers. Thus, the application of the model will help housing developers provide quality housing, as they can better predict buyers' preferences of attributes. Buildings having attributes that align with buyers' needs and preferences will improve the reputation, image, and profit margin of the developers besides enhancing customer satisfaction. The general public also stands to gain indirectly from better planning decisions made by the authorities

and the judicious use of public money for facilities such as public schools, recreational parks, and shopping complexes.

In conclusion, it is apparent that in spite of some inherent limitations, the hedonic price model still holds promise as a very useful tool in the study of housing attributes and their impact on property prices. To date, this approach has not being utilized directly and formally by researchers in developing countries. Perhaps the time has come for this technique to be given serious attention by researchers and all stakeholders in the housing industry in developing countries. The feasibility of applying the hedonic price model to the study of the housing market in Nairobi is justifiable, as buyers and sellers have perfect information on the property market. The properties, too, manifest the characteristic of homogeneity. Hence, the implicit prices for attributes can be established, and this information can be used to improve the planning, development, construction, and management of properties in Nairobi.

5.3 Recommendations for further study

This study focused only on one city Nairobi, further studies can expand the focus to other cities in the country, and also there is need for further research on the use of the hedonic pricing approach in the housing industry by employing more sophisticated econometric models. This will increase the accuracy of the results. More effort could also be employed to construct a housing price index which can be studied in its own right or be used as an explanatory variable in housing demand equations. Large scale data should also be employed in order to achieve a more detailed analysis.

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