

AN ECONOMIC ANALYSIS OF DETERMINANTS OF HOUSE RENTS IN THE UNIVERSITY ENVIRONMENT

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Abstract

This study investigates the factors determining house rental rates in the university environment. The study applies a Hedonic pricing model, which captures multi-dimensional characteristics of the houses in the sample. The findings provide answers to the research questions after leaving out two variables from the model because of exact collinearity and orthogonality. Variables like age, life span of house, tenement rate charges by the local government, and number of houses built in the university environment are the key determinants of house rent. It is found that people do not obtain mortgage loans to build their houses. The study recommends that policies and strategies like regulatory measures, direct construction of houses, provision of finance, land reforms, rent control and anti-inflation taskforce should be adopted.

Keywords: House rent, Hedonic model, University environment

1. Introduction

Housing is an important basic need of man. It is universally accepted as the second most important essential need after food. This explains the obvious fact why it represents the largest single investment of most families. Shelter is one of the human basic physiological needs (Maslow's Hierarchy of Needs).

Housing is also important to the development of a society and it has both economic and welfare effects. Economically, investment in housing contributes to fixed capital formation, employment and substantial backward

and forward linkages with the rest of the economy. Its welfare effects include shelter for the populace, access to health and educational services as well as employment opportunities may lead to higher productivity and income for poor families.

In this new era, shelter comes in a form of house and it is the most important components of socio-economic sector. This had led to the formulation of many policies and programmes aimed at ensuring that majority if not all Nigerians, particularly, the low-income group, have access to adequate shelter and related facilities.

Housing includes the physical structures provided for living, working and other ancillary services like road, electricity, water, waste management, drainage and even security. Ideally and as it is a common practice in most countries of the world, government is relied upon for the efficient and effective provision of the facility.

By assumption, a house purchase generally requires external financing, since low-income group are the focal point whereby mortgage credits are their main sources of financing. Therefore, the cost of mortgage credit and the conditions under which it becomes available play a major role in shaping the pattern of house rent in the developing countries.

However, a house is seeing as a bundle of multi-dimensional attributes that combine together to give a certain price (rent); it is not possible to break up the house into its component and market them individually. However, if the information on the rents of houses that corresponds to the attributes of house can be obtained, it should be easier to derive the implicit market prices (rents). Thus, house price (rent) reflects the valuation of individual buyer (tenant) of a particular set of attributes of each house unit.

In fact, no two houses are alike, due to their heterogeneity; house differs according to a wide variety of characteristics (attributes), such as location and physical attributes. Therefore, econometric methodology will be utilized (employed) to construct a model that relate the significance of various characteristics which are defined and their influence on rent levels from one house to another, or one time to another, or between one area and another, are allowed simultaneously. This is the concept used in the Hedonic Pricing Model (HPM).

Because low-income earners found it difficult to become house owners, which spurred the government to establish Federal Mortgage Bank of Nigeria whereby mortgage credits will be extended to low-income earners via primary mortgage institutions, the low-income earners still dominate the class of tenants (renters of house).

Secondly, the Central Bank, having charged with the responsibility of price maintenance and financial stability, Nigeria is still characterized by high rate of inflation.

Thirdly, in other countries, house rent is so volatile especially German, Holland, Australia, United State of American (USA). Therefore, it is praise worthy to know the behaviour of house rent in Nigeria.

The rest of the paper is organized as follows: Section two covers the theoretical framework while section three reviews the empirical literature. Section four presents methodological and data issues. Section five presents and discusses the empirical results while section six concludes the paper.

2. Theoretical Framework

This study is based on hedonic model of house prices (rents). Rosen (1974) brought out a theoretical application of the hedonic price model to the residential housing market. Several authors have adopted this technique to construct house price indices and to determine the factors responsible for property prices (Butter, 1982; Margo, 1996; Meese & Wallace, 1997; Kiel & Zabel, 2007). The theory basic observation is that property can be viewed as multi-functionally related characteristics without observable prices because they are not traded in open markets. Nonetheless, the number of housing characteristics can be large and vary from house to house. In contrast, they are usually placed into categories such as structural characteristics and neighbourhood characteristics (Palmquist, 1980; Can, 1990). They referred to structural characteristics as number of rooms, square feet of living space, basement, garage and style of house, while neighborhood characteristics are termed to be accessibility to employment areas, schools, parks and the quality of environment.

For the impact of a property's characteristics for its value to be captured, traditional approach dictates regressing property values on an OLS equation with its various characteristics. Therefore, the derived coefficients in the equation are estimations of the hedonic prices of the characteristics at the market clearing level, and the marginal contribution of each characteristic (Can, 1990). The approach makes it possible to differentiate changes in house prices from changes in property quality by providing quality-adjusted prices indexes, and to investigate the main factors that determines the value of properties within the areas covered.

Despite the fact that hedonic price model is widely used, several authors have their reservations concerning the traditional method for what they call its shortcomings. These issues were empirical in nature and included questions relating to the choice of housing characteristics to be adopted, the correct method to be used therefore is the functional form of the hedonic equations assumes the existence of spatial dependence in the sample selection and specification issues (Can, 1990; Tse, 2002; Hui, Lillan Pun &

Law 2007). Consequently, many studies have attempted to resolve these issues leading to wider variation in the methodology employed using the hedonic price theory.

Traditionally, the hedonic price function is assumed that the structural characteristics of houses are constant in their functional relationships across different neighbourhoods. Those location characteristics are treated independently of housing characteristics, which imply the same marginal contribution despite a change in geographical location. The assumption of no spatial variability in the price model does not recognize the important differences in value consumers place on the same attribute which can lead to over-estimation or under-estimation of that attributes implicit price. That is, an attribute in high demand in one geographical space would not have the same marginal contribution to house value in another location with significantly less demand for the same attribute (Can, 1990). Attempting to incorporate the consequence of neighbourhood effects on property (house) value, Can (1990) took away the assumption of functional stability and utilized a more flexible approach. This allows parameters to drift across spaces and taking into account of spatial spillover effects, the author argued that this approach has led to a more accurate estimation of the changes in house prices in one location. The major finding is that, the study posited that house prices in declining neighbourhoods increased by being located close to other high price homes, despite their structural characteristic. This pinpoints the importance of accounting for the differences in neighbourhood effects related to geographical location.

3. Empirical Literature

Ruivo (2010) examined the determinants of rental rates in major cities in the United States and found that cities with higher incomes are associated with higher rental rates, which implies that there is a positive relationship between the dependent and independent variable (rental rates and income). The study further revealed the existence of a positive relationship between housing costs and population densities which relate to increasing rates. Poverty rates also played a great role in the rental market with increasing percentages equaling increasing rates. Cities with a higher number of units available in the market experience lower rental rates on average, proving basic economic theories of supply and demand. This is also true with housing size. The study concluded that further evidence is needed to ascertain true determinants of rental rates.

Hanink, Cromley and Ebenstein (2010) investigated spatial variation in the determinants of house prices and apartment rents in China using hedonic model specified in two versions (global and local parameters). They found that from the global parameter, house prices are determined by the structural characteristics such as floor space and contextual characteristics

such as level of in-migration are influential in residential prices. Local results however show (indicate) significant spatial variation in the effect of both structural amenities and locational context on housing prices. Put simply, rents are shown to respond positively to both median house prices levels and supply of apartments available at market, but with significant spatial variation across China.

Frunz (2007) studied office rent determinants utilizing hedonic panel analysis. The study found that office rent is determined by vacancy levels, rentable building area; such that average floor area played a significant role in determining office rents, building age shows up significant in a host of studies on offices market rent determinants. Building age is used in its widest sense to mean the year built so that a more recent construction date has a positive impact on rental rates. Number of stories also influences office rental rates. Amenities and in-house services played a vital role in determining the quality of office building other variables like; location, access to economical centers, distance to the nearest subway station and latitude and longitude coordinate office rent rates.

Marco (2006) examined determinants of New York City residential rental prices and found that the premiums charged on rental properties based on location in the following order, State Island, The Bronx, Queens, Brooklyn and Manhattan with Manhattan commanding higher premium. Higher rental prices are also correlated with higher medium household incomes and high crime rates. Increase in rental prices are correlated with increases in rent regulated or rent-subsidized housing. At a certain point, when the level of rent regulated reached its maximum, rental prices fall thereafter.

Godman (2004) investigated determinants of operating cost of multi-family rental housing where he found that housing quality as a strong driver of operating costs; older properties must incur more expense to achieve a level of housing quality; economies of scale in property operations are significant but top out at round 200 apartments; and a property's operating expense/rent ration is influenced by local area input costs and short run apartment market fluctuations.

Sirmans and Benjamin (1991) studied determinants of market rent and revealed that there are some factors that are responsible for apartment rent; these factors include physical attributes to vacancy rates. Firstly, age, amenities, services and physical attributes location factors such as proximity to an economic focal point or college campus and characteristics of rentals and their willingness to pay have several significant effect on rents. Secondly, they found out that variables like rental concessions, property management and length of residency have effects on apartment rent. The first

two variables appear to have positive influence while the latter exhibits negative relationship.

Browne *et al* (2008) examined the developments in Barbados real estate values and its impact on consumers and the macro-economy. The authors utilized a hedonic price index model and a median sales price index. However, the later does not account for heterogeneity of properties but the former accounts for changes in quality. Nonetheless, the findings included that property size; the number of bedrooms and location are the most significant factors that influence the value of property.

Klyuer (2008) studied the evolution of equilibrium real home prices in the United States and found that despite recent declines, single-family homes remained eight to twenty percent (8%-20%) overvalued as of the first quarter of 2008. Also, the study revealed that inventory-to-sale-ratio to be the most important driver of changes in property values in the short-run while analyzing house prices. The findings also included that the bloated inventory-to-sales-ratio, high foreclosures rates, and the large degree of inertia in housing markets imply that recent price declines are likely to continue. Moreover, with the gap between actual and equilibrium home prices playing only a weak anchoring role, the downward momentum could well take home prices considerably below equilibrium.

Zietz, *et al.* (2007) investigated the relationship of particular housing characteristics with the selling price. The study found that characteristics do not have the same price across a given distribution of house prices. The study, therefore, utilized quartile regression analysis to examine the issue and found that purchasers of high-priced homes value certain housing characteristics such as the number of bedrooms differently from buyers of low-priced homes. That other variables such as age also played significant role in evaluating house prices.

Harrison, *et al.*, (2001) examined the valuation of homes located within 100-year flood plains. Using a database of 29,887 property transactions in Alachua County, Florida, the result revealed that homes located within a flood zone sell on average, for less than homes located outside flood zones. More interestingly, the difference in price is less than the present value of future flood insurance premiums. Finally, it appears that owner occupants of flood plain locations may face slightly higher property tax because property assessors have slightly over-assessed properties located in flood prone areas.

Abraham and Hendershott (1992) investigated the substantial movements in real house prices in the United State in the period of 1977-1991. They found out that house prices are determined by employment and real income growth, real construction costs and after- tax financing cost. They posited that empirically, all variables work as expected, with

comfortingly high t-ratios. The main driving forces are the growth variables. However, the variables are able to explain only about two-fifths of real price changes. The explanatory power rises to above one-half when the lagged appreciation rate is added as an explanatory variable, and to three-fifths with the inclusion of time period in the variables.

Peek and Wilcox (1991) examined the measures of house prices in United States of America (USA) in the period of (1950 – 1989). The study focused on determinants of house prices, housing affordability and the investment characteristics of residential real estate and the securities it collateralizes. Investigating the stock of houses over 1950-1989 periods using Freddie Mac upgrade-adjusted, house price measure rose from 5.7% over the past four decades, falling to 7.7% from 1950 through 1970 before rising to 14.5% from 1970 through 1989. The investigation shown that house prices are determined by real after-tax interest rate, permanent income, cost of relative materials and demographic factors like age distribution of the population.

Keng (n.d.) investigated the factors correlated with house price in Malaysia. The study revealed that house prices are determined by the economic and financial factors which are identified as relevant for the demand and supply of housing units in the country (Malaysia). The significant determinants of house prices are real per capital income and unemployment rate, both with four quarters lag, and total loans to housing (1 quarter lead) while KLSE CI with 2 quarters lag. The findings also postulated that the coefficient of determination (R^2) indicates that about 98.7% of the House Price Index variation is explained by this multiple regression model.

Tsatsaronis and Zhu (n.d.) studied the factors responsible for housing price dynamics. They found out that housing prices generally depend on inflation, the yield curve and bank credit, but national differences in the mortgage markets also contributed. Furthermore, that housing prices are sensitive to short-term rates where floating rate mortgages are more widely used and more aggressive lending practices are associated with stronger feedback from prices to bank credit. They postulated that two (2) great lessons can be learnt from the results: the strong and long-lasting link between inflation and normal interest rates, on one hand, and housing prices on the other hand. That long period of elevated inflation followed by a sharp deceleration of price growth which may in the short-run, breed misalignments between house prices and long-run determinants of residential real estate values.

So far, there is no related literature from Nigeria. Meanwhile, the available literatures from abroad are mainly concerned with building (developing) and resell (dispose) of houses.

4. Methodological and Data Issues

4.1 Model Specification

The model for this study is specified as follows:

$$HR = \alpha_0 + \alpha_1 AGE + \alpha_2 WAT + \alpha_3 POW + \alpha_4 TOI + \alpha_5 MBC + \alpha_6 TRA + \alpha_7 UNIRE + \alpha_8 HR * UNIRE + U_i$$

HR = House Rent

AGE = Live span of the house

WAT = Water supply in house

POW = Power (electricity) supply in the house

TOI = Toilet availability in the house

MBC = Mortgage Bank credit

TRA = Tenement rate

UNIRE = Dummy for Proximity to university

HR*UNIRE = Interaction term for house rent around university area.

Note: House Rent (HR) and AGE were captured directly while other variables were coded using dummy variables (“0” and “1”).

A Priori Expectation

$$\alpha_0 > 0, \alpha_1 < 0, \alpha_2 > 0, \alpha_3 > 0, \alpha_4 > 0, \alpha_5 > 0, \alpha_6 > 0, \alpha_7 < 0, \alpha_8 > 0$$

Definition of Dummy variables

Variable	Definition
WAT	If there is water supply in the house = 1, otherwise = 0
POW	If there is power supply in the house = 1, otherwise = 0
TOI	If there is toilet in the house = 1, otherwise = 0
MBC	If the house is financed by mortgage loan = 1, otherwise = 0
TRA	If local government charges tenement rate = 1, otherwise = 0
HR*UNIRE	If the house is built in Girei Local Government = 1, otherwise = 0

Source: Authors’ formulation

4.2 Data Related Issues

Study Area

The study covered Modibbo Adama University of Technology, Yola environment as the sample size choosing Jimeta, Federal Housing Estate; phase I and II, Sabongari, Sangere and Girei. One hundred and fifty (150) houses were targeted but the questionnaires designed were one hundred and seventy (170). Forty (40) questionnaires administered in Jimeta, thirty eight (38) in Sabon-gari, thirty six (36) in Sangere, thirty one (31) in Girei and twenty five (25) in Federal Housing Estate; phase I and II.

Sampling Technique

A random sampling technique was employed to sample the houses in the environment (area) covered in this study. Selection was done by choosing a house after four (4) houses.

Method of Data Analysis

A hedonic Regression Analysis on the bases of OLS was employed to analyze the data through utilization of dummy variables. Several authors have utilized this technique such like; Browne *et al* (2008), to measure how prices of a particular house varies with the characteristics. Keng (n.d.) also employed the method to estimate House price index in Malaysia.

5. Empirical Results and Discussion

The results of the specified model are presented as follows:

$$HR = 67011.4 - 544.651AGE + 4061.05WAT - 1266.53POW + 11398.6TRA$$

$$SE = (8642.05) (212.697) \quad (3915.71) \quad (6326.88) \\ (5611.91)$$

$$p\text{-values} = [0.0001] [0.01148] \quad [0.30143] \quad [0.864162] \quad [0.04409]$$

$$- 62517.6UNIRE + 0.972807 HP *UNIRE$$

$$(5609.4) \quad (0.0511446)$$

$$[0.00001] \quad [0.00001]$$

$$R^2 = 0.763723 \quad \text{Adjusted } R^2 = 0.753809$$

$$F(6, 143) = 77.03685 \quad P\text{-value} (F) 2.48e-42$$

From the multiple regression model results, it is found that four (4) parameters are statistically significant plus the constant. Out of these, two (2) parameters (constant inclusive) are found to be statistically significant at one per cent (1%) level of significance as indicated by their p-values [0.0001, 0.0001 and 0.0001]. Although the parameters of AGE and TRA are found to be statistically significant at five per cent (5%) level of significance as indicated by their p-values [0.01148 and 0.04409]. However, there is no sufficient evidence to show that the parameters of WAT and POW are statistically significant as indicated by their p-values 0.30143 and 0.84162.

In addition, all the coefficients are rightly signed for Age (-544.651) with a negative sign which indicates that the theoretical statement is true such that the older a house becomes, the lesser its rental value. By implication, this means that for every one unit increase in the age of house leads to 544.651 units reduction in the price. TRA coefficient is positive (it is rightly signed); if the tenement rate increases by 5 units, the price of house will increase by 113698.6 units. The coefficient of UNIRE is also rightly signed (negative). It implies that if the number of houses built in the university environment increases by one unit, house rent decreases by 62517.6units. Similarly, HP*UNIRE coefficient shows that proximity to the university area increases the rent of the house increase by 0.972807unit.

The R-squared (R^2) of (0.763723) reveals that about 76% of the total variation in the dependent variable (HR) is explained by the regression equation while the remaining 24% is captured by the error term (μ). Nonetheless, the R^2 dropped to about 75% after adjusting for the degrees of freedom while the remaining 25% is captured by the error term. The

parameters are jointly significant at 1% as shown by the F-statistic (6, 143) with p-value of 2.48e-42.

However, there is no test for autocorrelation since the study utilized cross-sectional data.

It is worthy of note that two (2) variables are omitted from the model specified; TOI and MBC respectively. The TOI is omitted due to *exact collinearity*. On the other hand, MBC was due to *orthogonality*.

6. Conclusion and Policy Recommendations

The study focuses on the determinants of house prices in the university environment. The study employed Hedonic Price Model utilizing dummy variables based on OLS.

The following findings emerged:

- i. Examining the variations in the rent of houses, it is found that, age, tenement rate, number of houses built in the university environment and proximity to the university cause variation in house rent. In addition, it was found that houses built within the university area have higher rents than the ones built outside the university area.
- ii. The study reveals that house rent impacts positively on the economy of the host community (Girei local government) such that if number of houses increased by 5 units, it would increase the revenue sourcing from tenement rate by one million, one hundred and thirty nine thousand, eight hundred and sixty naira only (N1,139,860).
- iii. The impact of mortgage bank credit (MBC) could not be ascertained because no selected houses are financed by mortgage loans. This is subject to further research.

Following the findings, we recommend that

- (i) Policies and Strategies like:
 - Regulatory measures;
 - Direct construction of houses;
 - Provision of finance
 - Land Reforms; and
 - Rent Control and Anti-inflation Taskforce.
- (ii) Aggressive education should be provided such that awareness will be created for the low-income group on how to obtain mortgage loans, financing and of course offsetting the loan.
- (iii) Provision of employment opportunities would go a long way fast in tracking and correcting the imbalances created between the low-income earners and high income group which would short-cut inadequacy of housing provision.
- (iv) Federal Mortgage Bank of Nigeria (FCMB) should be restructured, reorganized and recapitalized. The new form will be able to operate

through two windows, namely, the social and the commercial windows.

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Appendix

Model 1: OLS, using observations 1-150					
Dependent variable: HR					
	<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>	
const	67011.4	8642.05	7.7541	<0.00001	***
AGE	-544.651	212.697	-2.5607	0.01148	**
WAT	4061.05	3915.71	1.0371	0.30143	
POW	-1266.53	6326.88	-0.2002	0.84162	
TRA	11398.6	5611.91	2.0311	0.04409	**
UNIARE	-62517.6	5609.4	-11.1452	<0.00001	***
HR*UNIARE	0.972807	0.0511446	19.0207	<0.00001	***
Mean dependent var	48203.33		S.D. dependent var	42969.17	
Sum squared resid	6.50e+10		S.E. of regression	21320.29	
R-squared	0.763723		Adjusted R-squared	0.753809	
F(6, 143)	77.03685		P-value(F)	2.48e-42	
Log-likelihood	-1704.369		Akaike criterion	3422.737	
Schwarz criterion	3443.812		Hannan-Quinn	3431.299	

Breusch-Pagan test for heteroscedasticity				
OLS, using observations 1-150				
Dependent variable: scaled uhat^2				
	coefficient	std. error	t-ratio	p-value
const	4.84417	1.94403	2.492	0.0138 **
AGE	-0.0278407	0.0660745	-0.4214	0.6741
WAT	0.678404	1.20486	0.5631	0.5743
TRA	-0.395948	1.73892	-0.2277	0.8202
UNIARE	-4.60926	1.73641	-2.654	0.0088 ***
HR*UNIARE	-3.25383e-06	1.58775e-05	-0.2049	0.8379
Explained sum of squares = 540.324				
Test statistic: LM = 270.161962,				
with p-value = P(Chi-square(5) > 270.161962) = 0.000000				