



THE APPLICATION OF ECONOMETRIC MODELLING TO REAL ESTATE INVESTMENT DECISIONS IN THE ECONOMIC GROWTH OF IKOT EKPENE, NIGERIA

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ABSTRACT: Most public and private wealth lies in landed property and the fortitude of its value is indispensable to the economic well-being of Nigeria. The professional opinion of the valuer is very necessary when a healthy property market and stable economy of a country is to be achieved. The aim of this paper is to examine the application of econometric modeling to real estate decisions in the economic growth of Ikot Ekpene Local Government Area of Akwa Ibom State of Nigeria. This paper focuses on the relationship between regression analysis and property valuation. This study combines a variety of methodological approaches with emphasis on descriptive survey and case study. Residential estates were studied in Ikot Osurua, Ikot Ekpene Local Government Area of Akwa Ibom State. Out of the 97 residential units found in the study area, 19 properties with varying characteristics were sampled from the neighbourhood. The sampled properties were selected, data collected from them using structured questionnaires and the results analyzed. It was found out that econometric models can be used for measuring the attractiveness and the performance of properties with multiple characteristics. The implication of this statement is that properties that are with much varying characteristics can easily be valued through the application of multiple regression models.

Keywords: Econometric modelling, Real estate, Investment, Economic growth, Ikot Ekpene

INTRODUCTION

Given that much private and public wealth lies in landed property, the determination of its value is essential to the economic well-being of Nigeria. It is the job of a professional valuer to determine these values by gathering, analyzing, and applying information pertinent to a property. The professional output of the valuer is vital to a healthy property market and a stable economy of the country, forming the basis for performance analysis, finance decisions, transactional or development advice, dispute resolution, taxation and various statutory applications. Unquestionably, the professional opinion of the valuer, backed by his/her extensive training and knowledge, influences the decisions of people who own, manage, sell, purchase and invest in real estate as security.

Ogunba (2013) posits that valuations require the use of "econometric models to predict the most likely selling price of a property". Statistics plays an important role in real estate analysis ranging from forecast to demand and supply and value of interests in the property as well as planning of land use. In real estate profession, statistics is the language in which real estate analysts read transaction in the property market (both the rural and urban settlement). The primary function of the real estate analyst is the determination of the monetary worth or value of the real property. Investors, Governments, banks, arbitrator and many others at one time or the other would want to know the value of their real property investments, which usually aids them in decision making. Carrying out valuation on all the residential properties in a place like Ikot Ekpene for tax purpose can be

very costly and time consuming. Experiences have shown that real estate thrives mostly on availability of data, techniques of analysis and interpretation. Thus, without existing information or data on all residential properties in Ikot Ekpene, valuation may not be easy. Even though data are available, the processing of the data is another issue. Certain properties are tied to particular jobs and are not placed in the open market for competitive bids, but rent passes through them. Some of them are staff residential quarters, police barracks and other special properties. Most of the aforementioned properties may have different types of accommodation with other varying characteristics. Real properties generally are heterogeneous. In addition, there are other qualitative and quantitative factors that affect property and its value. In carrying out valuation of all the residential properties in Ikot Ekpene, the whole population cannot be used. What will be required are the samples of the population (properties). This requires the use of statistical tools to handle the analysis. Among the statistical techniques Valuers can use in such situations is the application of Econometric modeling.

Aim

The aim of this paper is to examine the application of econometric modelling to real estate investment decisions in the economic growth of Ikot Ekpene Local Government Area.

Objectives

- (a) To explore Econometric Modeling.
- (b) To demonstrate the applications of the Econometric Model to real estate investment decisions.
- (c) To assess the possibility of adopting the model in real estate decisions in the study area.

Review of Related Literature

What is Econometric Modeling?

An econometric model is one of the tools economists use to forecast future developments in the economy. In the simplest terms, econometricians measure past relationships among such variables as consumer spending, household income, tax rates, interest rates, employment, and the like, and then try to forecast how changes in some variables will affect the future course of others. Econometrics is the application of statistical methods to economic data and is described as the branch of economics that aims to give empirical content to economic relations. More precisely, it is "the quantitative analysis of actual economic phenomena based on the concurrent development of theory and observation, related by appropriate methods of inference." An introductory economics textbook describes econometrics as allowing economists "to sift through mountains of data to extract simple relationships." The first known use of the term "econometrics" (in cognate form) was by Polish economist Pawel Ciompa in 1910. Ragnar Frisch is credited with coining the term in the sense in which it is used today.

The basic tool for econometrics is the multiple linear regression models. Econometric theory uses statistical theory and mathematical statistics to evaluate and develop



econometric methods. Econometricians try to find estimators that have desirable statistical properties including unbiasedness, efficiency, and consistency. Applied econometrics uses theoretical econometrics and real-world data for assessing economic theories, developing econometric models, analyzing economic history, and forecasting.

The Theory of Regression Analysis

One of the fundamental statistical methods used by econometricians is regression analysis. Regression analysis includes any techniques for modeling and analyzing several variables, when the focus is on the relationship between a dependent variable and one or more independent variable. More specifically, regression analysis helps us understand how the typical value of the dependent variable changes when any one of the independent variables is varied, while the other independent variables are held fixed. That is to say the theory of regression analysis describes the relationship between one or more independent variables and a single dependent variable. There are two types of regression analysis: a simple and multiple regressions. A simple regression shows the relationship between two variables which are dependent and independent variable. The multiple Regression analysis is a statistical model used to test the relationship between dependent variable and several independent (explanatory) variables. A large body of techniques for carrying out regression analysis has been developed. The general simple linear regression model is given as:

$$Y = a + bx$$

But when error incurred is to be determined, the error term is added and the equation is determined as

$$Y = a + bx + e$$

Where y = the dependent variable

a = the constant term, which is a base value that is adjusted upward and downward by difference in the x 's. in other words, this is the point where the regression line crosses the y axis. Usually, it is added to the equation.

b = the coefficient of the corresponding x

x = the independent variable

e = error term

Multiple linear regression analysis is specially designed for problems in which several characteristics vary. Several x for which measurements are available are selected and the equation becomes $y = a + b_1x_1 + b_2x_2 + b_3x_3 + \dots + b_nx_n + e$, where y is the dependent variable (which may be Sales Price or Value) and $x_1 \dots x_n$ is the independent variables.

Possibility of adopting econometric modeling in real estate decisions

Ifediora (1993) has argued that value is essentially an imputation or creation of the human mind. This means that value is just an opinion or suggestion of the valuers and cannot be the general opinion of the people. This is one of the reasons why two valuers cannot produce the same value for similar properties irrespective of the similarities.

There are several scholars who have shown that multiple regression analysis proves a useful tool in ordinary day-to-day surveying and valuation profession. Mendenhall et al (1989) stress that two residences of equal size may have different characteristics with

respect to total number of rooms, number of bedrooms, number of bathrooms and age. All these variables are important determinants of value and when considered collectively with size in a multiple regression model, this will almost certainly improve our ability to estimate market value accurately. This assertion has shown how statistical tools can be useful in valuation of properties with multiple characteristics. It can therefore be said that multiple regression analysis provides the appraiser with the ability to test the real estate market objectively; to determine which variables are influencing the price paid for the comparable sales of each property. If this happens, it then implies that the attitude of Valuers resorting to subjective approach based on experiences and personal opinion is inadequate in valuing properties with varying characteristics.

In the similar line of argument, Blettner (1969) had previously observed that multiple regressions is a statistical method of identifying relevant factors (independent variable) of significant value when seeking to predict sales price (dependent variable) of a selected group of properties. This means that multiple regressions are used to identify variables, which affect property values. A change in independent variables cannot affect other independent variables because they can be controlled while changes in one independent variable can affect the dependent variable because they cannot be controlled. For instance a change in size of building cannot affect bedrooms bathrooms, type of property and so on. However, it can and will affect the price or the value of property. Case (1972) believes that, for appraiser, the magic equation of the computer which will turn raw data instantly and accurately into market value estimate is regression equation, which has been tested primarily by assessor faced with periodic market value and has been found to be useful. Umeh (1977) and Ogbuefi (2002) have already shown how regression is useful in forecasting trend in development appraisal. This means that multiple regression approach is similar to direct comparison method and is easier and simpler to apply. However, this can only be so when the user knows the principles behind regression and computer application. This implies that multiple regression analysis is another way of analyzing market value.

Like other forms of statistical analysis, badly specified econometric models may show a spurious relationship where two variables are correlated but causally unrelated. In a study of the use of econometrics in major economics journals, McCloskey (1985) concluded that some economists report p-values (following the Fisherian tradition of tests of significance of point null-hypotheses) and neglect concerns of type II errors; some economists fail to report estimates of the size of effects (apart from statistical significance) and to discuss their economic importance. She also argues that some economists also fail to use economic reasoning for model selection, especially for deciding which variables to include in a regression. In some cases, economic variables cannot be experimentally manipulated as treatments randomly assigned to subjects. In such cases, economists rely on observational studies, often using data sets with many strongly associated covariates, resulting in enormous numbers of models with similar explanatory ability but different covariates and regression estimates. Regarding the plurality of models compatible with observational data-sets, Edward (2008) urged that "professionals



... properly withhold belief until an inference can be shown to be adequately insensitive to the choice of assumptions".

Application of Regression analysis to Valuation

Multiple regression as an aid to appraisal is thus a way of estimating how selling price is related to the important factors that influence it. Once the relationships are determined statistically, they may be used to estimate the selling prices for other properties in the population from which the sample was drawn. The methods of valuation are Investment method, Comparison method, Residual method, Profits method, Comparison method (Udechukwu, 2009). The Comparison approach to valuation is a method of estimating the market value of a subject property through an analysis of sales of similar properties. Britton and Johnson (1980) have argued that this method of valuation is the most frequently used by the valuers and it is at the heart of all valuation techniques. That is the determination of the market value of property with the price paid for comparable properties (Ifediora, 1993). The credibility of this approach depend upon the accuracy of the data collected, as well as the degree of comparability between each of the sample property and the subject property. The implication of applying this method of valuation is that there must be a comparable property. However, real property in its logical sense is heterogeneous. This implies that an exact comparable characteristic of real estate is not easily obtained. The reason could be because of the physical differences relating to size, accommodation, and location and structure, quality of covenant, environmental attributes, neighbourhood characteristics and so on. The identified character of real estate above, therefore limits the application of comparison method of valuation in its logical sense. The difficulty of this method is lack of data. If there is availability of data, statistical techniques would enhance the credibility of this method in determining real property value.

There are several statistical techniques such as Time Series, Central tendency regression analysis and other parametric and non-parametric statistics that assists Valuers in property valuation. This paper focuses on the relationship between regression analysis and property valuation. The relationship between regression analysis and property valuation is that of cause and effect. In a cause and effect relationship, the independent variable is the cause and the dependent variable is the effect. The theory of regression analysis as it relates to property valuation states that by observing sample data collected on factors that affect sales or letting and management of property over a period of time, predicted value of the property can be estimated relating to the subject property. Samples of sales are considered to be a good indicator of value and can be relied upon for estimating the value of the subject property. This is because sales or letting price without compulsion express willingness of both buyers and sellers. Price of a property can be written as a function of its structure, neighbourhood and characteristics of environmental qualities of its location. If y is the price of the property, a function can be written as $Y = f(x, n)$. where x represents various characteristics of the property unit such as size, number of rooms, number of floors, availability of garage, garden, year and type of construction; n represents a group of neighbourhood characteristics of the property, including ethical

composition, quality and number of schools in the area, access to parks, stores or working place and criminality rate; and e represents environmental characteristics, for example air quality of the property area.

Regression analysis allows the use of both quantitative and qualitative variables that affect property values. The presumption is that with good data or observations of the trend of real property market inferences and weighting of the intangible factors can be reliable for estimating value. Regression equation provides the valuer with a sophisticated tool in the determination of value of property. It allows the user to employ several variables simultaneously. The essence is to provide the client with a logical and rational way of explaining how the value so arrived was achieved. Regression equation can be applied in several areas of real estate profession, such as Property Rating and Taxation by relating size of each tenement, numbers of room with rental value to determine the assessed value. It can also be used in the Appraisal of projects to predict the revenue generation and viability of the project. Apart from being used in the determination of the sales price or Open Market Values of properties at various locations, it can be employed in the analysis of location decision to determine the factors that influence property values and choice of property in a specific area. It is a major tool used in academic research at all levels.

METHODOLOGY

This study combines a variety of methodological approaches with emphasis on descriptive survey and case study. Residential estates were studied in Ikot Osurua, Ikot Ekpene Local Government Area of Akwa Ibom State. The total number of residential properties in the area is 97 different housing units. The researchers inspected the 97 residential units and found out that there are 19 (nineteen) different types of properties in the community. On this note, the researchers decided to use regression analysis to determine the rental values of the properties with different characteristics. In order to do this, 19 properties were sampled from the neighbourhood. The sampled properties were selected, data collected from them using structured questionnaires and the results analyzed and presented in the table shown below. Out of the several econometric models such as Time Series, Central tendency regression analysis and other parametric and non-parametric statistics that assists Valuers in property valuation, the analysis focuses on the relationship between regression analysis and property valuation.



Table 1: showing the annual rents and their respective property characteristics

Property	Annual Rent (A)'/000 (Y)	Total floor area (m ²) [x 100] (X ₁)	No. of bedrooms (X ₂)	Bath Room (X ₃)	Total rooms (X ₄)	No. of Boys quarters (X ₅)	Age (X ₆)	No. of Garage (X ₇)
A	51.60	26.10	2	1	2	0	40	1
B	67.40	38.88	3	1	3	1	30	0
C	68.90	40.00	3	1	3	1	20	0
D	72.00	42.60	3	2	3	1	30	1
E	75.50	42.00	2	1	4	1	8	1
F	90.30	40.00	3	2	4	1	5	0
G	96.00	46.80	3	2	4	0	5	1
H	120.50	40.40	4	2	6	0	15	0
I	71.60	42.00	3	1	3	0	20	0
J	131.50	44.80	4	2	6	1	35	1
K	135.00	44.20	4	2	6	1	18	0
L	135.60	55.20	5	3	7	0	15	0
M	139.20	50.20	5	3	7	1	14	1
N	136.00	56.90	5	3	7	0	13	1
O	150.00	57.10	5	3	7	1	8	1
P	142.43	55.20	4	2	6	0	34	0
Q	100.50	46.80	3	2	4	0	5	0
R	112.00	39.80	3	2	4	0	15	1
S	110.00	55.80	4	2	4	1	12	0

Field survey, 2017

By using SPSS version 20.0 for the analysis, the following was derived:

Table 2: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.959 ^a	.920	.869	11.26126

R² = 92, adjusted R² is 0.869, Standard Error = 11.2613, F-value = 17.989 at 0.000 significance.

Table 3: ANOVA^a

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	15968.805	7	2281.258	17.989	.000 ^b
	Residual	1394.977	11	126.816		
	Total	17363.782	18			

Table 4: Coefficients^a

Model	Unstandardized Coefficients	Standardized Coefficients	T	Sig.
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	B	Std. Error	Beta		
(Constant)	1.597	20.186		.079	.938
Total floor area	.681	.599	.176	1.137	.280
No. of Bedroom	-6.262	10.017	-.194	-.625	.545
No. of Bathroom	10.254	10.805	.233	.949	.363
Total rooms	15.475	3.943	.828	3.925	.002
Boys Quarters	-.662	5.457	-.011	-.121	.906
Age of property	.268	.321	.094	.835	.422
Garage	-4.896	6.666	-.081	-.734	.478

- Dependent Variable: Annual Rental Value
- Predictors: (Constant), total floor area, No. of bedrooms, No. of bathrooms, total rooms, boys quarters, age of property, No. of garage.

From the above analysis, the result is commendable because $R^2 = 0.920$. Thus, it provides the Real Estate Analysts with a good tool for Valuation and analysis. This means that 92% of the variation or differences in Y are attributed to variable X. This means that 92% of variables X_1, \dots, X_n , which are factors that affect property values are capable of estimating the values of properties. In other words, it means that the relationship between Annual rent and the independent variables is strong. The standard error is 11.2613, which is small, meaning that the point estimate would be correct. What is used in Valuation model is the unstandardized coefficient B. This is because it indicates the relative impacts of each variable on the dependent variable in its natural form of measurement, than the Standardized coefficients Beta that convert all variable into one metric unit. The equation then becomes;

$$Y = 0.681_{TFA} - 6.262_{NOB} + 10.254_{NBEDROOM} + 15.475_{TR} - .0662_{BQ} + 0.268_{AGE} - 4.896_{GARAGE}$$

The equation above can be used to determine the Annual Rental Values of properties that have the same characteristics/features in the study area.

CONCLUSION

From the foregoing, it can be concluded that econometric models can be used for measuring the attractiveness and the performance of properties with multiple characteristics. The implication of this statement is that properties that are with much varying characteristics can easily be valued through the application of multiple regression models. Valuation profession must imbibe a change from its current practice and form a network for the exchange of information by the application of Computer and Information Technology. This would have brought about stepping up and leading ultimately to a more sophisticated approach. Some of this approach is the use of statistical tools in conjunction with the computer. Multiple regression techniques is just a labour-saving shortcut for applying the market data approach where one would not necessarily have the time or



resources to apply it efficiently. Evidences from the studies we have referenced show that regression analysis is a useful tool in real estate practice.

RECOMMENDATIONS

With the complexity of modern-day real estate decisions, most advanced countries of the world have adopted econometric modeling to solve their property problems and this has enhanced their economic growth. Nigeria is yet to adopt such models. This paper examines the possibility of adopting such econometric modeling in real estate decisions and the benefit derivable to the national economic growth. The researchers reviewed literature on the subject matter, treated some case studies and demonstrated a named econometric model. In summary, it is recommended that the emerging field of real estate be given a prime place in the curricula of institutions offering courses in real estate. The Land Use Act of 1978 should be amended to meet with the use of econometric modeling to determine the values of properties instead of stipulating only one method of valuation – Depreciated Replacement Cost method.

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