Advancing a Method of Predicting Returns on Residential Investment Real Estate in Owerri Nigeria.

Nwankwo, Chidiuto Victoria
Department of Estate Management, Abia State University, Uturu

Abstract
Real estate investment decisions are often made with the primary objective of financial return but most investors in Nigeria attach little importance to the level of return on their investment. Unfortunately, the contemporary models for measuring returns originally developed for financial assets cannot predict future returns of investment real estate due to the peculiar nature of real estate investments. This study therefore aimed at advancing a method of predicting returns on investment real estate, a case study of Owerri, Nigeria. The study determined the returns on investment and performance of investment real estate in the study area from year 2000 to 2016 and examined the effect of location, tenant and market risks, exchange rate and social unrest on real estate investment returns in the study area. A total number of 48 estate surveyors and valuers were used for the study and they supplied data on annual value of the various types of residential properties under their management. Holding period return method was used to calculate the returns, standard deviation was used to calculate the risk, ordinary least square regression analysis was used to analyze the effect of the independent variables on returns and a predictive model was developed with the aid of C-NIKBRAN Data Analytical Memory. From the study it was discovered that location, tenant risk, market risk, exchange rate and social unrest affect return on investment positively and negatively in different locations of the study area. The study successfully developed a method of predicting return on investment real estate in Owerri R_O (Model) = $0.0024(x^2 + \gamma^2 + \alpha^2 + \beta^2 + \delta^2 + \theta^2) - 0.0865(x + \gamma + \alpha + \beta + \delta + \theta) + 15.79$ It was recommended that surveyors should use the model to predict returns on investment real estate.
Keyword: Investment, Real Estate, Method, Predicting Returns

I.   Introduction

The primary aim of most real estate investment is the future return in terms of income flow or a return of capital or both. Kalu (2001) sees investment as placing a risk on capital with the hope the hope of a reward in form of returns on the investment. Therefore, the basic nature of an investment is that it is an act of faith. The sacrifice or risk takes place in the present and is certain but the reward or return comes later, if at all, and the quantity is generally uncertain.

Real property investment is regarded as a specialized form of investment that involves the highest risk, and so requires the greatest skills to provide the highest return in an economic and optimal manner. It therefore means that when one makes an investment, it is important to consider the characteristics of real estate because the performance of those characteristics will have an impact on the performance of one's investment. When an investor is looking at the characteristics of real estate generally, one of the most important criteria aside from location is the type of property. In considering a purchase, an investor needs to ask himself the type of property to buy, for example, residential properties, shopping malls, warehouses, office blocks or a combination of any of these. Each type of real estate has a different set of factors influencing its performance and so; an investor cannot simply assume one type of property will perform well in a market where a different type is performing well. Likewise, he cannot assume one type of property will continue to be a good investment simply because it has performed well in the past (Ryder, 2012).

In spite of the economic fluctuations the world has experienced in recent times, investment in real estate has continued to offer the greatest and most consistent opportunities to build wealth and financial security. In the most basic manner the most advantageous benefit of investment in real property is that it is a tangible and insurable asset which could provide a hedge against inflation (Nwankwo, 2017). In Owerri, there is an increase in real estate investment and this is evidenced in the acquisition of undeveloped plots of land by both individuals and corporate bodies and development of properties across the nation. Many investors have acquired and developed many residential estates which they either let out or sell to others. Apart from new developments, one would notice renovations and remodeling of existing buildings to suit the investors' purpose.

It is not all about investing; rather every sound investment strategy demands that investment performance measurement should be made on a regular basis (Kalu, 2001). It is pertinent for every investor to stop and ask questions regarding his past achievements and future strategies therefore two objectives common to all investors are: (a) high returns are expected (b) returns are expected to be stable, dependable and not subject to uncertainty. According to Ajayi (1998), the ultimate goal of all rational investors is to achieve maximum returns and minimize risks therefore; investment performance is seen as the degree of achievement of this aim measured against a set of objectives and targets.

Forecasting, predicting and modeling commercial rents are now seen as necessary and explicit processes in real estate investment. Decisions on the prospects of specific property investments, the real estate portfolio and multi-asset portfolio are made as a result of these processes therefore; it is the accuracy of these forecasts, predictions and models in capturing future movements in rents that are implicitly tested in the market place (Chaplin, 2000).

The problem here is that while the contemporary models can adequately be used to determine returns and price financial investments, the contemporary models cannot adequately predict future returns on real estate investment due to the peculiar nature of real estate investments.

This study therefore sought to develop a model that would accurately predict the returns of investment real estate. 3 bedroom /block of six flats, single family detached/semi-detached bungalows and single family 5 bedroom detached houses which are mostly invested in by investors in Owerri were used for the study. The study considered the past returns of these investments from 2000-2016 and thereafter, a model was developed for predicting future returns.

II. Literature Review

Before embarking on an investment, an investor analyzes what is required of the investment and the analysis is best done as a check list of questions and answers, which ranges from security of capital and regularity of income to liquidity, opportunity for growth etc. According to Hwa (2013), a potential investor before making an investment decision would like to know its past performance and related risk-return characteristics. Similarly, an investor who has made an investment would like to how the investment has performed in comparison with similar assets and with different types of investment options.

According to Bodie, Kane and Marcus (2004), the productive capacity of a society's economy, ultimately determines the material wealth of that society and by implication, the goods and services members of that society can create. This capacity is a function of the real assets of the economy: land, buildings, machines and knowledge that can be used to produce goods and services. This is unlike financial assets such as shares and bonds which are no more than paper backed investments or, more likely, computer entries and do not contribute directly to the productive capacity of the society. Bodie et al (2004) was of the opinion that while financial assets simply defined the allocation of wealth or income among investors o estate generated net income to the economy.

Kalu (2001) compared real estate investment with financial investments and opined that bank deposit has very low risk and government stock is risk free, non-equity in nature and optimally inflation prone. On the other hand, shares and real estate investments are risk prone, equity based and inflation proof.

In terms of management, Bodie et al (2004) was of the opinion that financial assets are structured is such that the owners and managers are different parties. In other words, a shareholder who decides to sell his shares in a company can sell the shares to another investor, with no impact on the management of the company. Thus, financial assets and the ability to buy and sell those assets in the financial market allows for easy separation of ownership and management.

On the other hand, real estate investment though possessing attributes of other investment types earlier mentioned has peculiar characteristics which distinguish it from other investments. Kalu (2001) opined that without an in-depth understanding of the nature and characteristics of real estate investment, there would be the danger of directly comparing it with other types of investment. These characteristics according to Sirota (2004) and Kalu (2001) include: heterogeneity, risk, fixity, illiquidity, longevity, indivisibility, high cost of transfer, holding cost, imperfect knowledge, capital and income growth, financial leverage or gearing, constant maintenance and management.

Return is the principal motivating force that drives an investment. It represents the reward for taking on an investment and can be seen as that minimum rate of return which is necessary to induce an investor to invest Nwankwo, (2017), and Kalu (2001) sees it is a measure of how successful or otherwise an investment has been. It has to do with such things as how much the capital has grown since the investment was made, what the income is like, what the capital appreciation has been and so on. Mfam (2015) stated that return from an investment is made up of the income component of the return (dividend yield) and the capital appreciation (or loss) component of the return. Thus total return is equal to dividend yield plus capital gains yield.

One of the beneficial features of real estate investment is that it produces total returns that are a hybrid of income and capital growth. When real estate is compared with stocks and bonds it has a coupon paying bond like component in that it pays a regular, steady income stream and it has a stock - like component in that its value has a propensity to fluctuate or be volatile (Diala, 2015). Income return from real estate is directly linked to the rent payments received from tenants. Capital appreciation or growth of a property can be determined by having the property appraised. This is done by using actual sale transaction that have occurred and other market information to estimate what the property would be worth if it were to be sold (open market value).

Real estate investors would want to ensure that the expected return is worth the risk being taken therefore real estate return measures are useful tools for property investors when evaluating the viability and profitability of real estate investment opportunities. Types of real estate return measures include: Periodic Returns, Holding–Period Return, Appreciation return (Nwankwo, 2017)

Good investment strategy requires investment performance measurement to be made on a regular basis. By measuring performance, the degree of achievement against set objectives and targets can be expressed in quantitative terms. Analysis of performance is a very crucial component of the decision-making process. According to Kalu(2001), it would be extremely difficult to make rational decision at all levels without quantitative evidence of past performance and a reasonable assessment of likely future performance of an investment.

In the recent times, considerable attention has been given to achieving a reliable performance measurement of property investments and according to Hargitay and Yu (1993) property investment performance measurement was initially considered too complex and specialized to be analyzed alongside other investment assets because of the special investment characteristics of property and the property investment market. Also the measurement of risk in the property medium is even more complex than in other investment media therefore, Kalu (2001) opined that the appropriate methodology for property performance was still in its early stages of development..

Udoetuk (2008) was of the opinion that the evaluation of property performance is difficult as the evaluation is based on the changes in the capital value of the investment flow, the income generated by the investment. Udoetuk (2008) and Kalu (2001) assert that real estate, unlike other types of investment is unique in nature and location; real estate may not be regularly revalued and if the property has not been tested in the market, there will be no specific evidence in terms of rental value, yields, capital value, etcetera. The figures so obtained are usually based on historic cost data from which comparable evidence can be drawn.

Based on the unique nature of real estate, it is difficult to assess future trends from historic data and estimate changes in the real estate investment market. Udoetuk (2008) opined however that a careful analysis of the past can equip an investor with an idea of the future returns from an investment, the type of property to invest in and in what location to invest in.

Hall (1981) suggested that real estate performance measurement can be examined on the basis of the following: income/cost, income/value, value/cost, income growth, rental value growth, time weighted total return and money weighted total return. Hargitay and Yu (1993) opined that approaches to performance measurement fall into two approaches: (1) approaches derived directly from the portfolio theory and (2) pragmatic approaches. They suggested that performance measurement required a lot of computations and required the availability of a considerable amount of data, but that the availability of computer technology has made the computational load much easier. Hargitay and Yu (1993) concluded that because of the presence and involvement of risk and uncertainty and a considerable degree of subjectivity, the whole process can never be regarded as absolutely correct and totally reliable.

Kalu (2001) opined that the data required for property performance measurement include: rental value, income and outgoings, details of leases, capital value, and property market indicators. He further opined that the most fundamental unit of performance measurement is the holding period return (HPR) which is the amount of money earned over the investment period in relation to the amount of money invested, plus capital appreciation. The HPR is mathematically represented as:

$$HPR = \frac{(CV_t - CV_{t-1}) + RV_t}{CV_{t-1}} \times 100 \quad \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots \quad (1)$$

Where CV_t = Capital value for the current year
CV_{t-1} = Capital value for the previous year
RV_t = Rental value for the current year

Kalu (2001) concluded that the three measures of performance are: Money Weighted Rate of Return, Geometric Mean Return or Time Weighted Average Return and the Arithmetic Mean Return.

Many firms of practicing surveyors in the United Kingdom (UK) have set up systems for measuring property performance using basically, capital and rental indices. According to Kalu (2001) these firms also publish UK market statistics from data gathered from institutional portfolios but on the basis of confidentiality.

Kalu (2001) made a comparative study of four property measurement services available in the UK; and concluded that there is no standard form of measurement set by the professional body for property performance.

Several studies related to this study have been conducted particularly in the UK and USA and some developed and emerging economies. These studies examined the performance of real estate investment from different perspectives. Among the studies that have helped to explain the performance of real estate are the studies of Bruggman, Chen and Thibodeau (1984), Nwankwo and Kalu (2008) and Udobi, Ugonabo and Kalu (2013). These studies compared the performance of real estate with the performance of non-real estate investments. The main conclusion from the studies is that real estate performed better than other investments and acts as an overall risk reducer when included in a portfolio.

Newell, Chau and Wong (2004), Hoseli and Lizieri as quoted in Oyewole (2013) compared the performance of direct real estate investment with that of indirect real estate investment represented by listed companies and REITs returns in the UK and USA. The outcome of their studies suggested that direct real estate produced lower returns and lower risk, while indirect property investment behaves partly like shares and partly like real estate investment.

National Council of Real Estate Fiduciaries (1984) used the index of income producing properties generated by the Frank Russel Company to determine the return on different types of real estate investments. The outcome of their study which considered the performance between 1978 and 1983 showed that residential property performed better than commercial property in terms of return. The result also showed that residential property was riskier than commercial property.

Lorenz and Truck (2008) in a European study considered the risk and return performance of properties in European markets. Their study compared different property types across France, Germany, Ireland, Netherlands and UK. The outcome of their study showed that commercial property outperformed residential property in France and Germany while residential property outperformed commercial property in Netherland. The data for residential property was not available for UK and Ireland.

Plazzi, Torous and Valkano (2010) studied the expected returns and growth rent of commercial real estate across the U. S. The result of the study showed that in the case of offices, whose rent growth rate is the most highly correlated with expected returns; the capitalization rate is not able to forecast expected returns even though expected returns on offices are themselves time-varying.

Many of the studies relating to real estate performance carried out in many parts of the world were done in social, political and economic situations different from the Nigerian situation. Adopting these situations to the Nigerian situation cannot provide a perfect explanation to the Nigerian property market situation. The outcome of such research can only be used as a guide to solving problems in Nigeria. To solve problems of real estate investment in Nigeria, there is a need for local researchers to unravel the peculiarity of our country's situation.

In the Nigerian context, some research works have been carried out by some scholars on the performance of real estate. For example, Olaleye (2000) examined portfolio management and performance of property portfolio in Lagos. This study showed that while portfolio in Ikeja performed better in terms of their mean return when compared to the free risk rate for the same period, portfolio in Yaba performed below the investor's target rate. Apart from the fact that the study did not focus on residential property, it has other short comings. In the first place, the emphasis of the study was essentially on the performance of management and not on investment. Secondly, the small sample size has the potential of distorting results by allowing the peculiar characteristics of the properties and their market to have significant effect. The study centered on portfolio rather than on single investment.

Oyewole (2006) did a comparative study of the performance of direct and indirect real estate in Lagos. He examined the performance of direct property investment of eight listed property companies and UACN property development company shares between the periods of 1999 to 2004. Oyewole used relative importance index, coefficient of variation measure and Sharp ratio to estimate mean return, income appreciation and capital appreciation. The study showed that while indirect property performed better in terms of rate of return in absolute term and capital growth, the direct property performed better in terms of risk adjusted return. This study however did not focus on residential property investment and the study concentrated on the past performance of these investments.

Bello (2003) evaluated the relative performance of residential property and securities in Lagos in terms of mean returns, risk adjusted return, income and capital growth. He concluded that investment in ordinary shares performed better than that of residential property in absolute term and risk adjusted return. The study also showed that the risk associated with residential property is lower than that of ordinary shares. However, the study only considered historic performance of residential property but not the future performance.

Udoetuk (2008) did a comparative study of the performance of residential properties in selected areas of Lagos. A survey was taken on the rental and capital values of properties in Victoria Island, Lekki Phase 1, Ikeja and Agege from 1990 to 2004. From the survey, the capital and rental values and returns on investments on flat,

detached and semi-detached houses in the selected areas were established for the period under study. The study however considered only the past performance of these residential properties.

Oyewole (2013) carried out a comparison of residential and retail commercial property investments performance in Illorin. He examined the performance of residential and retail commercial properties from 2000 to 2011; focusing on average return, risk adjusted return, income growth and capital. The results showed that retail commercial property investments performed better than residential property investments with a mean annual return of 14.2% as against 11.8%. However, the study just compared the past performance of residential and retail commercial real estate in the study area.

Bello (2012) considered performance of residential properties in selected areas in Akure, Nigeria between 2001 and 2011. Trend analysis and regression models were employed to compute the growth rate of the residential properties under review. This study also is based on past performance of the properties under review.

Diala, Kalu and Igwe-Kalu (2017) studied the effects of exchange rate volatility on low income residential real estate investment returns in Nigeria; using an eleven year period time series data between year 2000 and 2010. Low income residential real estate located within Port-Harcourt, Lagos and Abuja were used for the study. The result of the study showed that exchange rate volatility had a significant positive effect on low income residential real estate investment returns in Nigeria.

The theoretical framework that formed the basis of this study are The Capital Asset Pricing Model (CAMP), The Efficient Market Hypothesis and the Random Walk Hypothesis which are all asset pricing models. The CAPM goes further to provide a usable measure of risk that helps investors determine the expected return for putting their money at risk. However there is no model in existence for predicting future returns on investment real estate. This is the gap this work wants to fill by developing a method that can be used to predict returns of investment real estate.

III.   Research Methodology

The study population comprised income producing residential properties (residential properties that yield income to their owners in the form of rent) managed by estate surveyors and valuers in Owerri. The estate surveyors supplied information on the annual rental values of the properties managed by them. 3 locations in Owerri were selected for the study. The residential properties included 2, 3 and 4 bedroom bungalows, blocks of 4and 6 flats and 5 bedroom detached houses. A total of 100 properties were used for the study. Only estate surveyors ad valuers in private practice in Owerri were used for the study. A total of 48 surveyors listed the Nigerian Institution of Estate Surveyors and Valuers' directory was used.

The variables (location, tenant risk, market risk, social unrest and exchange rate) used have been investigated by other researchers in others settings and the researcher wanted to know the effect of these variables on returns in the study area.

The time series data represent annual returns on investment in different property types from year 2000-2016. Sources of data for this time series are databases on average gross annual rental values of the different properties from 1999-2016 obtained from the estate surveyors and valuers, while the annual capital values were calculated since the properties do not change hands(are not sold) on regular basis. Questionnaires were distributed to the estate surveyors in the study area from whom data for the study were obtained.

Return no investment was analyzed using the Holding Period Return (HPR) method. The yearly returns on investment data were computed from the appraised capital values and annual rental vales of the various types of residential properties in the study area between 1999 and 2016. Using HPR method, annual returns were calculated for year 2000-2016. As earlier stated, the formula for HPR is $\frac{(CVt - CVt-1) + RVt}{CVt-1} x 100$ (1)

Performance of the investments was analysed by finding the risk- return ratio (coefficient of variation) of the various property investments. Risk was calculated by finding the standard deviation of the yearly returns from the mean HPR.

Mean HPR ($\overline{HPR}$) = $\sum$HPR/n ……………………………… (2)
Where n is the number of periods.
Variance (σ^2) = (HPR- $\overline{HPR}$)^2/n ….……………………......... (3)
Standard deviation (σ) = $\sqrt{\sigma^2}$ ……………………………….. (4)
Coefficient of variation = σ/MHPR …………………….......... (5)

Model Development: The model for predicting returns was developed with the aid of C-NIKBRAN Data Analytical Memory. The software is just like the SPSS and the SAS, but advanced for determining two sets of relationships: 1. Any empirical relationship between one dependent variable and one independent variable, irrespective of the variance in their range of values.2. Any empirical relationship between the dependent

variable and up to seven independent variables, irrespective of their ranges of values. Its empirical evaluation does not combine first order variables with second order variables.

The choice of this analytical tool is because of its ability to determine empirical relationship between the dependent variable and up to seven independent variables, irrespective of their ranges of values.

IV.   Data Analysis

As earlier stated the returns were calculated using data on annual rental values collected from the surveyors and appraised capital values from 1999 to 2016

Table 1: Returns on 2 Bedroom Bungalow at Aladinma

Year	Return On Investment (%)
2000	14.30
2001	12.89
2002	11.76
2003	10.84
2004	10.07
2005	17.23
2006	8.37
2007	14.30
2008	18.16
2009	13.16
2010	10.43
2011	9.73
2012	12.89
2013	8.43
2014	10.77
2015	7.07
2016	9.49

Table 2: Returns on 3 Bedroom Bungalow at Aladinma

Year	Return on Investment (%)
2000	10.5
2001	17.69
2002	8.8
2003	8.37
2004	8.0
2005	12.89
2006	12.2
2007	11.27
2008	14.75
2009	12.89
2010	11.76
2011	10.89
2012	12.89
2013	14.3
2014	8.37
2015	10.07
2016	8.46

Table 3: Returns on 4 Bedroom Bungalow at Aladinma

Year	Return on Investment (%)
2000	8.0
2001	10.20
2002	7.43
2003	9.42
2004	11.09
2005	13.65
2006	9.10
2007	11.88
2008	11.05
2009	13.05
2010	9.59
2011	13.65
2012	12.51
2013	11.58
2014	7.4
2015	7.53
2016	10.08

Tables 1to 3 above show the returns on 2 bedroom, 3 bedroom ad 4 bedroom bunalows I Aladinma withi the study period.The return on investent of the three property types has varied in these years with each toping the other at various periods. Generally, 2 bedroom bungalows had the highest returns.

Table 4: Returns on Block of 4 Flats at Ikenegbu

Year	Return on Investment (%)
2000	11.05
2001	17.85
2002	19.78
2003	10.48
2004	11.71
2005	17.39
2006	11.48
2007	16.01
2008	14.57
2009	13.43
2010	12.49
2011	11.71
2012	11.05
2013	10.48
2014	9.33
2015	12.1
2016	11.27

Table 5: Returns On Block Of 6 Flats At Ikenegbu

Year	Return On Investment (%)
2000	19.25
2001	17.78
2002	20.13
2003	10.03
2004	14.27
2005	17.16
2006	16.10
2007	15.21
2008	14.48
2009	16.45
2010	13.07
2011	16.4
2012	14.57
2013	10.32
2014	10.04
2015	12.29
2016	16.45

Tables 5 and 6 show the returns on block of 4 flats and block of 6flats in Ikenegbu. The return on investment in Ikenegbu within the study period varied in these years. However, returns on block of 6 flats were generally higher.

Table 6: Returns on Block of 6 Flats at Works L/out

Year	Return On Investment (%)
2000	16
2001	15.09
2002	14.83
2003	22.31
2004	20.13
2005	24.71
2006	16.60
2007	14.33
2008	19.25
2009	17.78
2010	13.06
2011	15.94
2012	15.09
2013	17.16
2014	12.28
2015	11.79
2016	13.53

Table 7: Returns on 4 Bedroom Detached House at Works layout

Year	Return on Investment (%)
2000	7.29
2001	11.23
2002	13.78
2003	9.22
2004	15.68
2005	9.06
2006	13.78
2007	10.08
2008	14.30
2009	15.85
2010	14.44
2011	11.58
2012	10.92
2013	17.03
2014	10.8
2015	10.42
2016	14.04

Table 8: Returns on 5 Bedroom Detached House at works layout

Year	Return on Investment (%)
2000	13.66
2001	12.72
2002	19.77
2003	10.70
2004	10.55
2005	15.13
2006	14.07
2007	11.93
2008	11.21
2009	11.27
2010	10.21
2011	16.24
2012	20.51
2013	18.09
2014	11.21
2015	10.56
2016	10.99

Tables 6 to 8 show returns on investment in Works Layout from 2000 to 2016. The return on investent of the three property types has varied in these years with each toping the other at various periods. Generally, block of 6 flats had the highest returns.

Table 9: Performance of Investment Real Estate in the Study Area from 2000 - 2016

Location	House Type	Mean HPR	Mean Variance	Risk/Standard Deviation	Covariance
Aladinma, Owerri	2 bedroom bungalow	11.76%	8.74	2.96%	0.25
Aladinma, Owerri	3 bedroom bungalow	11.48%	6.46	2.54%	0.22
Aladinma, Owerri	4 bedroom bungalow	10.48%	3.97	1.99%	0.19
Ikenegbu,Owerri	Block of 4 flats	13.07%	8.46	2.91%	0.22
Ikenegbu,Owerri	Block of 6 flats	14.35%	7.96	3.0%	0.21
Works L/out, Owerri	Block of 6 flats	16.46%	9.02	3.4%	0.21
Works L/out, Owerri	4 bedroom detached hse.	12.32%	9.17	3.03%	0.23
Works L/out, Owerri	5 bedroom detached	13.52	11.22	3.22%	0.24

Table 9 above shows the performance of the different property types in Owerri from 2010 to 2016.The MHPR for 2 bedroom bungalow in Aladinma, Owerri was 11.76%, riskwas 2.96% and COV was 0.25. Therefore, 0.25 unit of risk was taken for every unit of return earned. The MHPR for 3 bedroom bungalow was

11.48%, risk is 2.54% and COV was 0.22. Therefore, 0.22 unit of risk was taken for every unit of return earned. The MHPR for 4 bedroom bungalow was 10.48%, risk was 1.99% and COV is 0.19. Therefore, 0.19 unit of risk was taken for every unit of return earned.

MHPR for block of 4 flats in Ikenegbu, Owerri was 13.07%, risk is 2.91% and COV was 0.22. Therefore, 0.22 unit of risk was taken for every unit of return earned. MHPR for block of 6 flats was 14.35%, risk was 3% and COV was 0.21. Therefore, 0.21 unit of risk was taken for every unit of return earned.

MHPR for block of 6 flats in Works Layout, Owerri was 16.46%, risk was 3.4% and COV was 0.21. Therefore, 0.21 unit of risk was taken for every unit of return earned. MHPR for 4 bedroom detached house is 12.32%, risk was 3.03% and COV was 0.23. Therefore, 0.23 unit of risk was taken for every unit of return earned. MHPR for 5 bedroom detached house is 13.52%, risk was 3.22% and COV was 0.24. Therefore, 0.24 unit of risk was taken for every unit of return earned.

Model development: assumption for the model was that location, tenant risk, market risk, social unrest and exchange rate are independent and were the only factors that affected returns on real estate investment. The CAPM predicts that no explanatory variable exists for predicting returns of assets. From the literature review, it was revealed that the above could affect returns on real estate investments.

Table 10: Prediction of Return on Investment in Owerri

Year	R_O (Exp)	POI (x)	LOI_O (γ)	SU_O (α)	TR_O (β)	MR_O (δ)	ER_O (θ)	RF_O	R_O (Model)	Dv (%)	Cf (%)
2000	12.51	0	2.95	2.97	2.91	2.98	3.00	2.96	13.07	+4.48	-4.48
2001	14.43	1	2.54	2.52	3.53	2.55	2.56	2.74	13.00	-9.91	+9.91
2002	14.45	2	2.03	1.99	1.95	2.01	1.97	1.99	13.14	-9.07	+9.07
2003	11.42	3	2.93	2.89	2.91	2.88	2.94	2.91	12.87	+12.70	-12.70
2004	12.69	4	3.50	2.80	3.20	2.60	2.90	3.00	13.27	+4.57	-4.57
2005	15.89	5	3.50	3.20	3.70	3.45	3.55	3.48	14.0512.57	-11.58	+11.58
2006	12.71	6	3.00	3.05	3.04	2.99	3.07	3.03	12.59	-1.10	+1.10
2007	13.13	7	3.22	3.20	3.18	3.26	3.24	3.19	13.25	-4.11	+4.11
2008	14.71	8	3.60	3.30	3.40	3.20	3.50	3.40	12.89	-99.93	+99.93
2009	14.24	9	3.2	2.60	3.50	3.90	2.80	3.20	12.70	-9.48	+9.48
2010	11.88	10	2.97	2.95	3.00	2.91	2.98	2.96	13.44	+6.90	-6.90
2011	13.16	11	3.05	3.04	3.07	3.00	2.99	3.03	13.07	+2.13	-2.13
2012	13.80	12	3.00	2.91	2.95	2.97	2.98	2.96	13.67	-5.29	-5.29
2013	13.42	13	2.52	2.54	2.55	2.56	2.53	2.54	12.46	+1.86	-1.86
2014	10.03	14	1.98	2.04	2.01	1.97	1.95	1.99	13.38	+24.23	-24.23
2015	11.86	15	2.91	2.93	2.89	2.94	2.88	2.96	12.76	+6.61	-6.61
2016	11.91	16	2.55	2.53	2.56	2.54	2.52	2.54		+7.14	-7.14

Table 10 Above Shows The Calculations For Predicting Returns On Investment Real Estate In Owerri. Using The C-NIKBRAN Data Analytical Memory The Following Model Was Formulated:

R_O (Model) = A $(X^n + \Gamma^n + A^n + B^n + \Delta^N + \Theta^n)$ - B$(X^{n-1} + \Gamma^{n-1} + A^{n-1} + B^{n-1} + \Delta^{N-1} + \Theta^{n-1})$ + C   (6)

Introducing The Values Of A, B And C And N Into Equation (6)

Where A = 0.0024; B = 0.0865; C = 15.79 And N = 2

R_O *(Model) = 0.0024$(X^2 + \Gamma^2 + A^2 + B^2 + \Delta^2 + \Theta^2)$ - 0.0865$(X + \Gamma + A + B + \Delta + \Theta)$ + 15.79*   **(7)**

Also Equation (7) Is A Frame Work For Periodic Prediction Of Performance Return On Investment In Owerri. In A Period Of Investment X , Any Variations In The Risk Factors Such As Location Of Investment Γ, Social Unrest A, Tenant Risk B, Market Risk Δ, And Exchange Rate Θ Will Significantly Affect The Return R_O.

Table 11: Showing the year and period of investment

Year of Investment	Period of investment
2000	0
2001	1
2002	2
2003	3
2004	4
2005	5
2006	6
2007	7
2008	8
2009	9
2010	10
2011	11
2012	12
2013	13
2014	14

2015	15
2016	16

SYMBOLS

$R_{ALO\,2}$ = Return on investment from Aladinma Owerri; 2 Bedroom Bungalow

$R_{ALO\,3}$ = Return on investment from Aladinma Owerri; 3 Bedroom Bungalow

$R_{ALO\,4}$ = Return on investment from Aladinma Owerri; 4 Bedroom Bungalow

$R_{IKO\,4}$ = Return on investment from Ikenegbu Owerri; Block of 4 flats

$R_{IKO\,6}$ = Return on investment from Ikenegbu Owerri; Block of 6 flats

$R_{WLO\,6}$ = Return on investment from Works layout Owerri; Block of 6 flats

$R_{WLO\,4}$ = Return on investment from Works layout Owerri; 4 Bedroom Detached House

$R_{WLO\,5}$ = Return on investment from Works layout Owerri; 5 Bedroom Detached House

$\sum OC_{i=8}$ = Total no. of considered Housing locations in Owerri

$R_{O(Exp)}$ = Average Return on investment in Owerri as obtained from field work

$R_{O\,(Model)}$ = Average Return on investment in Owerri as predicted by derived model

POI = Period of investment

LOI_O = Average value of Location of investment in Owerri

SU_O = Average value of Social Unrest in Owerri

TR_O = Average value of Tenant Risk in Owerri

MR_O = Average value of Market Risk in Owerri

ER_O = Average value of Exchange Rate in Owerri

RF_O = Overall Average Risk factors in Owerri for each year of investment

x = Period of investment

γ = Location of investment

α = Social Unrest

β = Tenant Risk

δ = Market Risk

θ = Exchange Rate

Dv (%) =   Deviation of predicted values from field work values

Cf (%) = Correction factor to predicted values

A, B, C are empirical constants predicted by C-NIKBRAN Data Analytical Memory.

V.   Conclusion

Block of 6 flats had the highest MHPR and the highest risk while 4 bedroom bungalow in Aladinma had the lowest MHPR and the lowest risk.

Location, tenant risk, market risk, exchange rate and social unrest affect return on investment positively and negatively in different locations of the study area.

The study successfully developed a method of predicting returns on investment real estate in Owerrri Nigeria:
$R_O (Model) = 0.0024(x^2 + \gamma^2 + \alpha^2 + \beta^2 + \delta^2 + \theta^2) - 0.0865(x + \gamma + \alpha + \beta + \delta + \theta) + 15.79$ which could be used as a model for predicting returns on investment real estate in Owerri and other parts of Nigeria.

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