An Examination of Volatility Levels of Development Variables in Uyo

T. C. Archibong[1] and O. A. Ogunba[2]

[1]168, Atiku Abubakar Way, Uyo, Akwa Ibom State
[2]Department of Estate Management, Obafemi Awolowo University, Ile Ife, Nigeria
Email: trutharchibong@yahoo.co.uk; segogunba@yahoo.co.uk

Abstract

This study was aimed at examining volatility level of development variables. Data were sourced from Building and Engineering Price Books, Central Bank of Nigeria annual reports and estate surveyors and valuers in Uyo. Price index and linear regression analysis was adopted to analyse the gathered data. The indices constructed for the four variables showed that the variables were constantly changing. Construction costs and rent were constantly changing, though in a consistent upward manner. Lending rates and yields were also constantly changing but in a very inconsistent manner. The study found that construction cost and rent are functions of year and the estimated trend equation can be used to project the desired value and that interest rate and yield are not functions of the year. Therefore, appraisers in modelling interest rate and yield in risk model should be more cautious on their application and analysis.

Keywords: Volatility, Construction Cost, Rent, Lending Rate, Yield, Trend.

1.0 Introduction

Change is the only permanent thing in life and uncertainty a fundamental fact of human life. Thus, every property development project entails the integration of separate but interdependent elements which, because they involved in the future, are by their nature subject to change or uncertainty. A project is at risk because it may not be completed within the period for its development, and the cost of construction, cost of finance, expected net rental income and even yields on property investments may change. These changes could be adverse to the profitability of the project. Thus, the analysis of risk in development appraisal is relevant becauseof these possible variations in the pre-development appraisal (Ogunba, 2002 and Archibong, 2015).

This possibility of variation – risk has adversely affected investors. And many investors and developers in Uyo metropolis have failed to realise their objective

because no proper feasibility and viability studies were carried out. Some of the projects were just embarked upon because the proponents felt there was a market demand and they could get enough fund to execute the project. Eventually, many of these projects were abandoned after plunging in huge amounts of money. Where a feasibility and viability study was conducted, it is also observed that a reasonable number of such projects were abandoned or did not achieve the developer's objective. This is not because the appraiser did not conduct a thorough development appraisal Ogunba (2002) and Xu (2002).

Despite the effort of appraisers in undertaking a thorough market survey and analysing the development variables such as rent, construction cost and finance cost as accurately as conventional deterministic models permit, but volatility in development variables have oftenrendered the development profit estimate inaccurate. For instance construction cost, cost of finance, cost of land and yield may be higher than predicted and rental value may be lower than expected perhaps due to no fault of the appraiser but because of the volatility in these variables. The effect of these variation (changes in cost of construction, rental value etc) include reducing or even wiping out developer's profit, possible bankruptcy, abandoned projects, adverse consequences on the appraiser's reputation as an expert adviser and putting the prospective developer's investments in jeopardy.

The general approach to development appraisal often gives a deterministic value (point estimate) which is inadequate in a highly unpredicted and volatile economy. The net present value (NPV), internal rate of return (IRR), and the residual approach provide only one point estimate whereas the variables (cash flows) are subject to changes. Thus, appraisal based entirely on NPV or IRR without analysis of risk often at times meet failure. In spite of this increasing unpredictability and volatility, and the effort of appraisers in Nigeria to provide development appraisal advice; the problem is still unabated. Therefore, the need for preparation of appraisal reports that can match what operates in a complex property development market cannot be overemphasised.

Thus, the focus of this study to determine the volatility level of development variables in Uyo with a view to developing projection trends to help estate surveyor and valuers project the values of this variable in their appraisal. This paper is structure into five sections in which section one is already the introduction and section two is review of relevant literature. Research methodology and data analysis are presented in sections three and four respectively, while section five, the last has the conclusion/recommendation.

2.0 Review of Literature

Relevant papers on volatility in development appraisal are examined in this section.

Peiser (1984)in the United States examined downside risk as it relates to land development and demonstrated a method for handling inter-correlation among key variables. He reasoned that risk analysis for land development focuses on two main types of uncertainty namely, uncertainty about assumptions for the project itself, and uncertainty about the economic environment. The work adopted sensitivity analysis and MonteCarlo simulation to show volatility of the variables and estimate inter-correlation among the variables. The study found that among the six random variables of sale price inflation rates, construction cost inflation rates, interest rates, sales price multiplier, construction cost multiplier, and sales rate multiplier, that potential changes or error in projected sales price (sales rate multiplier) posed the largest source of risk, while inflation in construction costs and interest rate posed the least risk.

The project returns were significantly more sensitive to changes in sales prices, sales price inflation rates, and sales rates than to changes in construction costs inflation rates, and interest rates. This study was a major finding in the application of risk analysis in the development studies. However, the use of one sample limited the findings of the study, making it not generalisable. Moreover, only 2 models of risk analysis (Sensitivity analysis and Monte Carlo simulation) were employed.

In a study of uncertainty in the economic appraisal of water quality improvement projects, Vaughan, Darling and Rodriguez (2000) made a case for Monte Carlo project risk analysis due to large margins of error in the value of services. In addition, the authors noted that environmental investments are often accompanied by uncertainties about execution timing, divergent interests of stakeholders, the behaviour of the natural world the project operates on, as well as uncertainties about costs and economic prices. It showed that it is important to carry out cost-benefit analysis of projects, particularly multi-stage projects before the first stage is initiated. However, this paper adopted only one sample to illustrate and demonstrate the application of Monte Carlo simulation in the appraisal of environmental good. In addition only two risk techniques were considered – sensitivity analysis and Monte Carlo simulation.

Ogunba (2002) investigated perceptions of risk and the adjustment for such risk in pre-investment appraisals in Nigeria. A cross section of 113 estate surveyors and valuers, 32 lenders and 10 corporate developers were. Systematic sampling

was adopted to distribute the questionnaires to the respondents. The study found that risk analysis in pre-development viability appraisal is almost non-existent or at least does not exist in the vigorous probabilistic format in Nigeria. It also revealed that when surveyors adjusted for pre-development risk, they did so by means of rudimentary adjustments of volatile variables such as construction costs rather than through probabilistic analysis.The study found that Nigeria was not ready for probabilistic risk adjustment and thus advocated for the provision of an enabling environment through training workshops, the development of local risk adjustment software and the speedy implementation of institutionalised data bank. However the studywas based on perceptions of the respondents rather than factual data and it was restricted to the south-western part of Nigeria.

Groom, Koundouri, Panopoulou and Pantelidis (2004) in a study across UK and US assessed how uncertainty about future interest rates requires certainty equivalent forward rates that decline with the time horizon. A series of real market interest rates over a two century period (1800 to 2001) in UK and US were adopted in the analysis. The paper suggested that the future is the source of uncertainty and thus uncertainty naturally requires the determination of certainty equivalent rates.The research found that the path of the certainty equivalent rates differs considerably from one model to another and each places a different weight upon the future. The policy implications of the estimates revealed in the estimation of the value of carbon emissions reduction showed values which were up to 150% higher than when using constant discount rates, and up to 88% higher than the Random Walk Model. However, the area of study was too broad as it coveredthe US and UK for a period of 200 years. This can lead to non-specific treatment of issues thereof and unlimited generalisation.

Firmansyah, Veronika and Trigunarsyah, (2006) discussed risk analysis in construction project feasibility study using a case study of PT Perusahaan Gas Negara (Persero) in Indonesia. Data was collected through questionnaires administered on experts in the construction industry who had good knowledge and experience in risk management. A risk probability matrix was used as the initial analysis to classify risk factors from the highest to the lowest risk. Financial analysis was executed with NPV and IRR. Sensitivity analysis was used to analyse what would happened to the project if there were changes in values. The result of the matrix showed that 12 risk variables were extreme, 13 were high, 18 were moderate and 10 were low. The result also showed that the highest risk variable was the increasing loan interest rate. The sensitivity results indicated that interest rate and sales percentage had high sensitivity in investment while inflation and equity percentage had a low sensitivity. The

study concluded that risk factors that had the highest influence to the construction project were those that had relation with economical and financial aspects. However, the study did not specify the number of respondents sampled nor the sampling technique to reach the stated findings.

In Italy, French and Gabrielli (2006) examined the practical impact of uncertainty in variables using a simulation model (Crystal Ball). The case study was an urban redevelopment plan for an Italian Municipality. The two-dimension simulation result showed that an appraiser using this technique can more accurate reflects the variation in an input due to lack of knowledge (uncertainty) and the variation caused by natural variability in a measurement or population. The study concluded that more work will be required to develop simulation techniques for the real estate profession. However, the paper adopted single case study for the analysis and accordingly the conclusions of the study cannot be generalised. Moreover, only one risk technique, simulation (crystal ball) was considered.

Altherton, French, and Gabrielli (2008) in Italy investigated the practical impact of uncertainty in development appraisal using hypothetical case study. The results from the hypothetical case indicated that rent and yield were the critical variables and their impact highly significant. The study concluded that without knowledge of development risk, developers are unable to determine the anticipated level of return that should be sought to compensate for the risk. However, this study was based on hypothetical rather than empirical case study which limited its conclusions. Moreover, only sensitivity analysis among the risk assessment technique was considered.

3.0 Research Methodology

The data required to fulfil the purpose of this study was data on the 10 year movement (2001 to 2010) of four development variables: rent, yield, construction cost and lending rates. The information on rent and yield were sourced from estate surveyors and valuers. Construction cost data was obtained from published sources – Building and Engineering Price books. The changes in lending rates were sourced from Central Bank of Nigeria (CBN) annual reports.The records from the Akwa Ibom State branch of the Nigerian Institution of Estate Surveyors and Valuers showed that there were thirty-six (36) estate surveying and valuation firms practicing in Uyo metropolis as at 2011, the study area of this research. Therefore, data on rental value and property yield between 2001 and 2010 was sourced their firms' records. The gathered data was first analysed with price index then time series analysis (linear regression) was used determine the trend projection.

4.0 Presentation of Data and Discussion of Findings

The purpose of this study was to examine the volatility level of development variables between the periods of 2001 to 2010. In attempt to achieve this, data were gathered on the movement of development variables, construction cost (cost in naira per square metre), rent (rent in naira per square metre), banklending rate (in percentage), and property yield (in percentage). The data was subsequently analysed by means of indices, with 2001 as the base year to determine the pattern of increase over the years and to detect volatility. Further, the trend in the various variables was captured by means of regression analysis.Table 1 presents the data on the value of variables between 2001 and 2010, while tables 2 to 5 show results of the further analysis obtained from the indices and SPSS.

Table 1: Development Variables from 2001 – 2010 in Uyo.

Year	Cost/ m^2 (₦ / m^2)	Rent/ m^2 (₦ / m^2)	Interest Rate (%)	Property Yield (%)
2001	29785.08	1511.72	31.20	6.00
2002	32026.96	1511.72	25.70	6.00
2003	34437.60	1814.06	21.60	8.00
2004	36250.10	1814.06	20.40	7.00
2005	38158.00	2267.57	19.50	6.00
2006	40829.06	2267.57	18.66	7.00
2007	42053.93	3023.43	18.21	6.00
2008	44181.86	3023.43	21.15	8.00
2009	45713.00	3779.29	23.77	8.00
2010	48912.91	3779.29	21.86	7.00

Sources: Cost figures from Building and Engineering Price Book Biennial Issues; Lending rates from CBN Annual Reports 2005 & 2010; Rent and Property yield from authors' field survey (2014).

An examination of the table 1 reveals that the values of two variables: construction cost and rent vary consistently upwards from year to year while lending rate and yield fluctuate inconsistently. Each of the variables was examined as follows:

The volatility level of construction cost was first examined and table 2 shows the index.

Table 2: Construction Cost Index in Uyo

Year	Construction Cost	Index
2001	29785.08	1.00
2002	32026.96	1.08
2003	34437.60	1.17
2004	36250.10	1.22
2005	38158.00	1.28
2006	40829.06	1.37
2007	42053.93	1.41
2008	44181.86	1.48
2009	45713.00	1.54
2010	48912.91	1.64

2001 is taken as the base year
Regression result for construction cost:
R = 0.996; Beta = 2040.949; and Constant = -4053888.552
Estimated trend equation:
Y = -4053888.552 + 2040.949x + e
Where y = construction cost

The construction cost index in table 2 reveals consistent increase in cost of construction with an average index increment of about 7.1% annually. The regression analysis also shows that there is a strong relationship between cost of construction and year with regression coefficient of 0.996. This means that 99.6% variation in cost of construction is explained by yearly movement. The data indicates that cost of construction fluctuates, moves or varies directly with the year. The construction cost has never dropped within the ten year period rather the index has witnessed a steady increase between 4% and 10%. These consistent increments in construction cost contradicts the pattern of estimated construction cost adopted by development appraisers and only suggest that the appraisers likely employ variable values as at the date the appraisals were carried out. It would be more accurate to project these values to the time of market entry by means of regression or trend analysis. The trend equation of y = -4053888.552 + 2040.949x + e can be used to estimate the likely construction cost for any given year in Uyo.

The volatility level of rental values in Uyo was next examined and table 3 shows the result.

Table 3: Rental Value Index in Uyo

Year	Rental Value	Index
2001	1511.72	1.00
2002	1511.72	1.00
2003	1814.06	1.20
2004	1814.06	1.20
2005	2267.57	1.50
2006	2267.57	1.50
2007	3023.43	2.00
2008	3023.43	2.00
2009	3779.29	2.50
2010	3779.29	2.50

2001 is taken as the base year
Regression analysis result:
R = 0.931; Beta = 278.522; and Constant = -556096.049
Estimated trend equation:
$Y = -556096.049 + 278.522x + e$
Where y = rental value

Table 3 shows that rental values tend to increase every two years revealing a two yearly reviewed pattern in the study area. The movement of rental values shows a strong relationship with the year. The regression coefficient of 0.931 indicates that 93.1% variation or fluctuation in rental values within the study area is explained by increase in year. The price index of rental values reveals an average biennial 37.5% increase in index of rental value. This regular increment in rental values suggest that rental values can be projected through the use of regression analysis or trend equation instead of the adoption rental values as the date of appraisal

Table 4: Lending Rate Index in Uyo

Year	Lending Rate	Index
2001	31.20	1.00
2002	25.70	0.82
2003	21.60	0.69
2004	20.40	0.65
2005	19.50	0.63
2006	18.66	0.60
2007	18.21	0.58
2008	21.15	0.68
2009	23.77	0.76
2010	21.86	0.70

2001 is taken as the base year
Regression analysis result:
R = 0.163; Beta = -0.65; and Constant = 1325.537
Estimated trend equation:
$Y = 1325.537 - 0.650x + e$
Where y = lending rate

Table 4 below shows lending rate index. Thereafter, regression analysis is presented to show the volatility of lending rate.

The index in table 4 shows that, the lending rate is highest in the base year of 2001 such that other years haveindices of less than 1.00, with an average annual fluctuation of 7.3%. The above data shows that interest rate is not a function of year. It means that interest rate does not move in consonant with the year, thus it cannot easily be estimated. Also the regression coefficient of 0.163 shows a weak relationship between lending rate and year. This inconsistent movement of lending rate shows that lending rate cannot be estimated with regression analysis alone successfully, but rather risk analysis is required to further cushion the effect of any the possible variation or fluctuation.

Movement of property yield was next examined and Table 5 detailed the result.

Table 5: Property Yield Index in Uyo

Year	Property Yield	Index
2001	6.00	1.00
2002	6.00	1.00
2003	8.00	1.33
2004	7.00	1.17
2005	6.00	1.00
2006	7.00	1.17
2007	6.00	1.00
2008	8.00	1.33
2009	8.00	1.33
2010	7.00	1.17

2001 is taken as the base year
Regression analysis result:
R = 0.093; Beta = 0.127; and Constant = -248.345
Estimated trend equation
$Y = -248.345 + 0.127x + e$
Where y = property yield

The property yield index in table 5 shows an inconsistent movement ranging between 6% and 8%. The regression coefficient of 0.093 means that only 9.3% variation or movement in yield can be explained or attributed to movement in year. The above result shows that yield is not a function of year and that its values lies between 6% and 8%. Therefore, sensitivity/risk analysis is necessary in appraisal report to ameliorate the possibility of such inconsistent fluctuation.

The movement of development variables between 2001 and 2010 shows consistent increment in cost of construction and rent. Cost of construction had an average annual index increment of 7.1%, while rent had biennial index increment of 37.5%. With these patterns of increment, variation or fluctuation in these variables can be modelled into the risk technique to be adopted for the appraisal. However, the movement in interest rate and yield showed inconsistent movement and weak relationship with year thus, highly volatile. It revealed that interest rate and yield are not functions of the year rather other factor such as changes in government policies, market dynamics among others may be responsible. It shows that interest rate or yield may not necessarily increase with the year and that their determinations do not follow a specified pattern. Therefore, appraisers in modelling interest rate and yield in risk model should be more cautious on their application and analysis.

5.0 Conclusion/Recommendation

It is the conclusion of this study that there is a strong significant relationship between cost of construction and movement in year. It was shown that 99.6% variation in cost of construction in the area could be explained by movement of the year and that the cost increases steadily at an annual average index of 7.1%. The study also concluded that rental values of properties in Uyo metropolis expressed a strong significant relationship with movement of the year. It concluded that 93.1% fluctuation in rental values was caused by increase in year and that the rent increases biennially at an average index of 37.5%. It was further concluded that there was a weak insignificant relationship between movement in year and changes in interest rate and yield of properties. It was concluded that changes or variation in interest rate and yield cannot be attributed to changes in year.

Appraisers should be advised to make trend projections of construction cost and rental value in their appraisal report rather than relying on subjective estimate of construction cost or rental value. For property yields and lending rates which are subjected to more volatility, further risk analysis could be adopted to complement the trend analysis.

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