Journal of Scientific Research & Reports
3(23): 2998-3017, 2014; Article no. JSRR.2014.23.007
ISSN: 2320–0227

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Inflation Correlation with Commercial Real Estate' Investment Returns in Akure, Nigeria

Daniel Ibrahim Dabara[1*]

[1]Department of Estate Management, Federal Polytechnic, Ede, Osun State, Nigeria.

Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

Article Information

DOI: 10.9734/JSRR/2014/12918
Editor(s):
(1) Nidal Rashid Sabri, Ex. Dean of College of Economics (2005-2011), Birzeit University, Palestine.
Reviewers:
(1) Anonymous, California State University, USA.
(2) Emmanuel I.S. Ajuzie, Economist/marketing, Lincoln University, Missouri, USA.
Complete Peer review History: http://www.sciencedomain.org/review-history.php?iid=664&id=22&aid=6137

Original Research Article

Received 23rd July 2014
Accepted 8th August 2014
Published 16th September 2014

ABSTRACT

This study aims at investigating the relationship between inflation and commercial real estate' investment returns with a view to determining the inflation-hedging characteristics of commercial property investments in Akure metropolis, Nigeria. Questionnaire survey was conducted to obtain primary data on rental and capital values of commercial properties from branch managers of Estate Surveying and Valuation Firms in the study area. This was subsequently translated to the income, capital and total returns. Similarly, secondary data with respect to the Nigerian Consumer Price Index (CPI) which was used as a proxy for actual inflation and the 90-day Treasury bill rates (used as proxy for unexpected inflation) for the period between 2002 and 2012 were also collected from the National Bureau of Statistics (NBS) and the Central Bank of Nigeria (CBN), respectively. The unexpected inflation was calculated as the difference between the actual and expected inflation. The 3 groups of data sets obtained for the study were subjected to the Phillip-Perron unit root test as well as the Odinary Least Square Regression analysis. The

**Corresponding author: E-mail: dabara2000@yahoo.com;*

study revealed that the inflation-hedging characteristics of commercial property investments in Akure metropolis vis-à-vis the actual inflation provides a perverse hedge (with betas -0.464,-0.360 and -0.609 for the income, capital, and total returns, respectively), similarly, vis-à-vis the expected inflation also provides a perverse hedge (with betas -0.595,-0.147 and -0.597 for the income, capital, and total returns, respectively). However, vis-à-vis the unexpected inflation component provides a partial hedge (with betas 0.183, 0.134 and 0.079 for the income, capital, and total returns, respectively). The results of this study can be useful for investment forecasts as well as investment decisions on asset types to include in portfolios as a measure for protecting investors' earnings from erosion by inflation most especially in an emerging property market like Akure, Nigeria.

Keywords: Hedge; inflation; investment; investor; office properties; portfolio.

1. INTRODUCTION

The successful operation of any real estate market depends upon many factors among which includes the investment of resources in such a way as to bring in benefits or best possible returns to such investment. An investment can be defined as expenditure in cash or its equivalent during one or more time periods in anticipation of enjoying a net inflow of cash or its equivalent in some future time period or periods [1,2]. From the foregoing, rational investors always seek to protect the purchasing power of their investment fund so as to continue enjoying the expected future stream of income. However, it has been observed that during periods of inflation, certain financial instruments rather exhibit perverse hedging behavior thereby devaluing the purchasing power of such investments [3,4]. Hence, the need for investors to ascertain the inflation-hedging characteristics of an asset class before investing in such asset.

An asset is said to be a hedge against inflation if it provides certain degree of immunization (protection) against a rise in the general price level of goods and services in an economy (inflation) over a period of time [5,6]. The term 'inflation' used in such studies usually comprise of the actual, expected and unexpected inflation. Most commonly, the Consumer Price Index (CPI), which is an official measure of inflation worldwide [7,8], is adopted as a proxy or benchmark for measuring actual inflation. Similarly, the 90-days Treasury bill rates, Livingston survey and Autoregressive Integrated Moving Average (ARIMA) are often used as a proxy for expected inflation [9,10]. The third inflation component i.e. the unexpected inflation is usually derived by obtaining the difference between the actual inflation and the expected inflation [11,8].

The inflation-hedging characteristics of real estate investments all over the world are of special interest to individual or portfolio investors because investors who do not give careful consideration to the inflation-hedging characteristics of their investments risk inflation eroding their investments' real income streams. Inflation hedging studies in emerging countries are of increasing interest to investors and researchers because of the globalization of investment practices and the fact that emerging markets are characterized by a highly speculative nature, economic instability and dearth of literature. Nigeria is presented in this paper as a case study of an African emerging country where there is a dearth of literature on hedging capabilities of commercial property for prospective investors.

Generally, the Fama & Schwert's regression model [7] is the most widely applied method for assessing the inflation-hedging characteristics of asset classes. Fama & Schwert' approach boils down to an empirical test of the earlier Fisher hypothesis. Fisher in a pioneering study in this field 'Theory of Interest Rates', which is the foundation for much of the analysis of the effects of inflation on asset returns, holds that expected nominal return on an asset is equal to its expected real return plus expected rate of inflation. This theory was modified by Fama & Schwert [7] in their study 'Asset Returns and Inflation' which later became the theoretical framework for most subsequent studies on the relationships between asset returns and inflation.

Studies in the field of inflation-hedging were conducted in both developed and developing economies. The results obtained from studies conducted in developed economies were observed to be far from having consensus. Fama & Schwert [7] for instance, submitted that private residential estates in the U.S. were the only form of investments that provided a complete hedge against expected and unexpected inflation when compared with government debt instruments and returns on human capital. In Singapore [12], commercial properties were found to be an effective hedge against inflation. Quingping [13] found that in Taiwan, residential property investments were able to hedge against inflation in the long-run. Voigtlander & Demary [14] studied the inflation hedging performance of real estate in Canada, USA, Finland, France, Germany, Ireland, the Netherlands, Sweden and the UK. The authors found that investment in real estate equities did not protect the investors against inflation. Similar tests had been conducted in other developed economies such as: Hong Kong [15,16,8], Switzerland [17], China [18], Sweden [19] and Korea [20]. All these studies, showed divergent findings with respect to real estates' performance as an inflation-hedge. Similarly, in developing economies particularly Nigeria, such studies were conducted by: Bello [21], Odu [4], Akinsola [22], Oluwasegun & Dabara [9] and Ogunba, Obiyomi & Dugeri [23]. The results obtained from these studies were also observed to be far from having consensus. While some studies showed that real estate performed excellently as an inflation-hedge, others revealed that it did not. In fact, in some studies it was even demonstrated that real estate serves as a perverse hedge. The inflation-hedging characteristics of real estate across inflation components (actual, expected and unexpected) were also observed to differ considerably. Odu [4] asserted that this disparity can be attributed to various factors including 'varying timeframes, fluctuating economic conditions, and differences in microeconomic and macroeconomic indicators among other things'.

Research work on the subject of inflation-hedging capabilities in Nigeria primarily focused on Lagos and Ibadan property markets. This study expanded the scope of the inflation-hedging literature by empirically investigating the inflation-hedging characteristics of commercial real estate investments in Akure, Nigeria. Therefore, this study aims at investigating the relationship between commercial real estate investment returns and inflation with a view to determining its inflation-hedging characteristics in Akure metropolis, Nigeria. To this end, the researcher intends to find answers to the following questions: What was the return profile of commercial real estate investments in Akure metropolis, Nigeria between 2002 and 2012? What was the inflationary trend in Nigeria within the study period? And what is the inflation hedging-characteristics of commercial real estate investments in the study area? The remaining part of the study is presented as follows: the next section presents review of related literature, section three presents the methodological approach adopted for the study, the result/discussion is presented in section four, while section five presents summary of findings and conclusion.

1.1 Literature Review

The earliest empirical study of the relationships of asset returns and inflation was carried out by Fama & Schwert [7] in the US. The authors examined the extent to which various assets (US treasury bills, long term Treasury bonds, private residential real estate, human capital and common stocks) were hedges against the expected and unexpected components of the inflation rates between 1953 and 1971. They used conventional Ordinary Least Square (OLS) regression model to analyze the inflation hedging characteristics of these assets. The US Consumer Price Index (CPI) was used as a proxy for actual inflation rate while the nominal return of the US Treasury bill rate was used as a proxy for the expected inflation rate. Findings from this study showed that only private residential real estate was a complete hedge against both expected and unexpected inflation, while government debt instruments were only complete hedges against expected inflation, human capital was seen to be at best a partial hedge against expected and unexpected inflation, while common stocks were shown to be perverse hedges to both expected and unexpected inflation. However, the study did not test for the stationarity properties (using the unit root test) of the return data, hence the results from this study should be treated with caution as recent studies such as Wang, Lee & Nguyen [24], have shown that the test for stationarity properties of time series is important so as to avoid producing spurious regression results.

In Singapore, Sing & Low [12] empirically tested the inflation hedging characteristics of both property and non property assets. The returns data employed in this study comprised the Urban Redevelopment Authority's (URA) all-property price index. The authors used CPI as a benchmark to measure actual inflation, for the expected inflation, the lagged period 3-month Treasury bill was used as a direct proxy. The unexpected inflation was determined as the difference between the actual inflation and expected inflation. The Pearson rank correlation coefficients between the asset returns and the inflation rate were determined. Findings from the study showed that property provides better hedge against inflation than non-property assets. Industrial property was found to be the most effective hedge against both expected and unexpected inflation, whereas shop property type offered only significant hedge against the expected inflation. In the sub-period analyses involving four different 5- yearly periods, it was found that more assets established significant hedges against both expected and unexpected inflation in the sub-period from 1993 to 1998. When the tests were extended to examine the inflation hedging characteristics of assets in the high and low inflation environments, residential property was found to be a good hedge against unexpected inflation in the low inflation period, whereas industrial property showed a better hedge against inflations during the high inflation period. The transaction based returns indices used in this study was obtained from an existing data. This is however unavailable in a developing nation like Nigeria, hence return data for such nations have to be obtained from surveys of valuation based indices.

In Nigeria, Bello [21] empirically investigated the inflation hedging characteristics of residential properties in Lagos Nigeria between 1996 and 2000. For actual inflation rate data, the author used the Nigerian CPI as a proxy, while for the expected component of inflation; the Nigerian three months Treasury bill rates was used as a proxy. The unexpected inflation rate was derived by subtracting expected inflation from actual inflation. The data on returns on residential properties was obtained from valuation based indices of residential property returns. Data for the study was analyzed by regressing the inflation rates and rate of returns using the Fama & Schwert [7] model. Result from the findings indicated that residential properties have a strong inflation hedging characteristics against expected inflation but not

against actual and unexpected inflation. However, the time frame used for this study was observed to be short (five years).

In Taiwan Wang, Lee & Nguyen [24] empirically investigated the inflation hedging ability of Taiwan housing investment. The Taiwanese CPI was used as a proxy for actual inflation while the return data was obtained from Taiwanese monthly housing returns. The housing index was obtained from Taiwan Sinyi Realty Commercial Brokerage, and the consumer price index was obtained from Taiwan AREMOS database for the period between 1991 and 2006.The study used inflation as the threshold variable to create the nonlinear vector correction model that divides the inflation rates into high and low regime. The Augmented Dikey Fuller (ADF) unit root test and Johensen cointegration analysis were used in analysis of the returns and inflation data. The study revealed that when inflation rates are higher than 0.83% threshold value, housing returns were able to hedge against inflation, and, otherwise, they were unable. The study was restricted to income returns of housing in Taiwan neglecting the capital return aspect of the Taiwanese housing sector. In an emerging economy like Nigeria, taking to cognizance the income, capital and total returns components is imperative.

In Australia, Leung, [25] carried out a study titled 'Commercial Property as an Inflation Hedge: An Australian Perspective'. The study was aimed at establishing the inflation hedging capability of shops, office spaces and industrial properties in Australia between 1984 and 2008. Returns data on commercial properties were sourced from the PID (Property Investors Digest) formerly Property Council of Australia indexes. Data from 31 December 1984 to 31 December 2008 were used. The index was based on valuations on properties provided by 23 of Australia's leading investors and managers. It covered over 1,000 retail, office and industrial properties of total value $88 billion as at December 2008. The properties were also value-weighted to produce a composite index. PID also provided property returns in terms of their income and capital components separately. For actual inflation, the CPI published by the Australian Bureau of Statistics was used as a proxy. For expected inflation, the difference in nominal and indexed bond yields for 10 year bonds issued by the Commonwealth Government was used. Unexpected inflation was taken as the difference between actual inflation and expected inflation. The author adopted the Fama & Schwert's [7] regression model to analyze data. The study found that Australian property at an aggregate level can provide a good hedge for both expected and unexpected inflation. However, this study focused on a developed economy, the emerging property market of developing economies like Nigeria, possesses different property market characteristics and should also be studied intensively.

Zhe [8] investigated the inflation hedging capability of domestic real estate, factory real estate, office spaces and shops in Hong Kong in the short-run between 1993 and 2009. The author used the Hong Kong's CPI as a benchmark to measure actual inflation rate. Adaptive expectations or ARIMA (Auto Regressive Integrated Moving Average) approach was used as a proxy for expected inflation while the unexpected component of inflation was obtained by getting the difference between actual and expected inflation rates. The data on real estate returns was obtained from the Rating and Valuation Department (HKSAR) in Hong Kong. The Ordinary Least Square regression model as proposed by Fama & Schwert [7] was used to regress the rate of returns on real estate in the study area against actual, expected and unexpected inflation rates. The rental index and the price index of the returns were both used in the study. Through empirical test, the study revealed that in Hong Kong, between 1993 and 2009, private domestic and office property were better in hedging against both expected and unexpected inflation, than retail and industrial property. Meanwhile, rental

income from leasing properties out, contributes more in inflation-hedging than price difference earned from buy-and-sell. With regard to income return, the author found that domestic and office properties were generally complete hedges against inflation on quarterly basis, while on annual basis, retail and industrial properties were nearly complete hedges. It was observed that the availability of both rental and capital returns data in the Hong Kong database gave more credence to the reliability of the data set used in this study. However, such database for valuation or transaction based indices is completely unavailable in Nigeria.

In China, Zhou & Clements [18] investigated the inflation hedging ability of real estate for the period between 2000 and 2008. The variable used to estimate the return on direct real estate investment was a real estate price index from Chinese economic database. For inflation rates the Chinese CPI was used as a proxy, ARIMA was used as a proxy for the expected inflation and the unexpected inflation was the difference between actual and expected inflation. Before analyzing the relationship of Chinese real estate prices and inflation, the stationarity of the variables was first examined using the unit root test, Engle and Granger cointegration techniques were further used to test the hedging ability of the Chinese real estate. The study found that Chinese real estate was not an effective inflation hedging asset. The study looked at real estate generally, ignoring the unique characteristics of each real property type such as commercial, agricultural, industrial, etc.

In Nigeria, Odu [4] examined the relative hedging capacities of prime commercial properties (office spaces) in Lagos between 1999 and 2010. The research was aimed at empirically establishing the inflation hedging potential of commercial properties in prime locations of Lagos. To achieve this, the Ordinary Least Square model as proposed by Fama & Schwert (1977) was used to regress real estate rates of returns against actual, expected and unexpected inflation rates. Data on the rental and capital values of the sampled commercial properties were obtained from selected practicing Estate Surveyors and Valuers in Lagos. The data on actual inflation was obtained from the Nigerian Consumer Price Index. The author computed the expected and unexpected components of inflation using the 90-day Treasury bill rates within the study period (1999 to 2010) and the difference between the actual and expected inflation rates respectively. Results from the study indicated that for prime locations around Victoria Island and Ikoyi, commercial properties (office spaces) provided a perverse hedge against actual inflation, whereas, commercial properties (office spaces) within Ikeja and environs presented a complete hedge against actual inflation. However, the study did not cover shop properties and the study was restricted to Lagos.

Park & Bang [20] examined the effectiveness of direct commercial real estate as an inflation hedge in Korea. The authors used autoregressive integrated moving average (ARIMA) to compute the expected inflation rate. For actual inflation, the Korean CPI and GDP data were used. The return data was obtained from Korean appraisal database. The authors used three cointegration tests (Johansen cointegration tests, Dynamic Ordinary Least Squares (DOLS) cointegration tests and two-step Engle and Granger cointegration tests). The study found that Korean commercial real estate showed short-run positive co-movement with both expected and unexpected inflation, indicating that commercial real estate serves as both short-run inflation and long-run inflation hedge. The study concentrated on only commercial real estate.

Terahni, Zarei & Parirokh [11] investigated the short term and long-term inflation hedging effectiveness of residential properties in Third World Countries between 1980 and 2011. The annual data series for this study on inflation rate, common stock price, and time deposit rate

were extracted from the Third World Countries monthly digest of statistics, while the data series of various residential real estate returns were collected from the Third World Countries property review. The study used the consumer price index A (CPIA) to measure actual inflation because it consists of the smallest weight of private housing cost among all series of Third World Countries CPI Using ARDL Co-integration approach. The study employed the co-integration model for data analysis. Findings from the study showed that the Third World Countries' small and medium size residential property provides an effective hedge against inflation. The study also revealed that small and medium size residential properties in Third World Countries have been a better short term and long term inflation hedge than large and luxury residential properties, stock and time deposit. However, a presentation of the impact of both expected and unexpected inflation on real estate investments was not considered in this study.

Ogunba et al. [23] tested the hedging characteristics of office/shop property investments in Ibadan metropolis Nigeria between 2000 and 2010. The authors used the Nigerian CPI as a proxy for actual inflation, the Nigerian 90-day T-bill rates as a proxy for expected inflation and the difference between the two was calculated as the unexpected inflation. Property return data was obtained from Estate Surveying and Valuation Firms in the study area, which was subsequently decomposed into the income, capital and total return components. The OLS regression model as proposed by Fama & Schwert [7] was adopted for analysis of the collated data. Findings from the study indicated that investments in office/shop properties were found to be a poor hedge against actual inflation, a partial hedge against unexpected inflation and a complete hedge against expected inflation. Like all the earlier Nigerian studies, this study also did not undertake an initial unit root analysis to test the stationarity properties of the data series used for the study.

2. METHODOLOGY

Unlike many studies in this field, which simply investigated the relationship between real estate investment returns and actual inflation in terms of the correlation coefficient between the two variables, this study followed the Fama & Schwert [7] model of regressing real estate' investment returns. This model breaks inflation into three basic components (actual, expected and unexpected) thereby revealing the different reactions of investments returns to each of the three inflation components. However, the study improved on both the Fama & Schwert' [7] study as well as prior Nigerian studies by first testing for the stationarity properties of the data series used and by breaking the returns variable into three components (income, capital and total returns).

The research method adopted involved five basic steps. First, primary data on the average rental and capital values of office properties (per square meter) in prime commercial areas of Akure (Oba Adesida area, Oluwatuyi/Ijoka axis, Oke Aro/Oshinle axis, Alagbake and Arakale areas) were obtained through questionnaire survey administered on the 20 Private Estate Surveying and Valuation Firms in Akure Metropolis through a total enumeration survey (this is because the Estate Surveyors and Valuers are the only professionals in Nigeria that are empowered by the law i.e Decree No 24 of 1975 to determine the value of properties and their interest). Each of the firms have an average of 78 office properties in their management portfolios making an average total of 1,560 office properties in the management portfolios of all the estate surveying firms in study area. However, only 14 questionnaires were correctly filled by the respective partners/branch managers of the firms and returned for analysis covering an average of 1,092 office properties (representing 70% response rate). The

response rate was considered adequate by the researcher since it's the aggregate averages of the respondents' responses that will be used for the study.

Second, the valuation based indices of the average rental and capital values for the 1,092 office properties per square meter obtained from the estate surveying and valuation firms were used to calculate income, capital and total returns from investments in office properties in the selected commercial areas of Akure metropolis (Oba Adesida road, Oluwatuyi/Ijoka road, Oke Aro/Oshinle road, Alagbaka area and Arakale road). The income, capital, and total return values were obtained using equations 1, 2 and 3 respectively as presented below.

The income return is expressed as follows

$$IR_t = \frac{NI_t}{CV_{t-1}} \quad (1)$$

Where:

IR_t = income return for period t
NI_t = Net income received in period t (rent)
CV_{t-1} = CV at the end of period t-1

The capital return is expressed as

$$CR_t = \frac{CV_t - CV_{t-1}}{CV_{t-1}} \quad (2)$$

Where:

CR_t = Capital return for period t
CV_t = CV at the start of measurement period
CV_{t-1} = CV at the end of period t-1

The total return is expressed as

$$Total\ Return = \frac{NI_t + (CV_t - CV_{t-1})}{CV_{t-1}} \quad (3)$$

TR_t = Total return
CV_{t-1} = Capital value of direct property at the beginning
CV_t = Capital value of direct property at the end
NI_t = Income of direct property received during the holding period

Third, the secondary data on inflation required for the study was obtained from the records of Nigerian National Bureau of Statistics (NBS) and the Central Bank of Nigeria (CBN), respectively. In line with previous studies such as Bello [19] and Ogunba et al. [23], the actual inflation rates were derived from the Nigerian Consumer Price Index (CPI) which was computed by the NBS. The 90-day Treasury bill rate was used as a proxy for expected inflation. This was obtained from the records of the CBN, while the unexpected inflation was calculated as the difference between the actual and expected inflation. Furthermore, trend lines were used to graphically display trends in the inflation and returns data series used for this study to help analyze problem of future predictions. Also, the moving average of the trend line was used to smooth out fluctuations in the data and show the pattern or trend

more clearly. The R^2 value was used to determine the reliability of the trend and the accuracy of the forecast or predictions made. A trend line is said to be most accurate when its R-Squared value is at or near 1. Similarly, least square linear regression equations were generated for prediction of future rental, capital, returns (income, capital, and total), and inflation values. These are the equations of a straight line that best fits the points on the chart. The method used to determine these equations involves finding the line that produces the least value for the sum of the squares of the vertical differences between data points and the line.

The equation is in the form:

$$y = mx + b \tag{4}$$

where:

y is the dependent variable (rental, capital or returns values as the case may be)
m is the slope of the line, which equals the change in the *y* value divided by the change in the *x* value;

x is the dependent variable (year in this case); and
b is the *y*-axis intercept of the line.

Fourth, an initial test for the stationarity properties of the data sets (using the Philip-Perron unit root test) was undertaken. This was important so as to avoid spurious results in subsequent analysis and to efficiently capture the long-run information or relationship of the data sets.

The Philip-Perron unit root test equation used is expressed as

$$\Delta Y_t = \alpha + bY_{t-1} + \varepsilon_t \tag{5}$$

where

ε_t is a zero-mean *k*-variate stationary time series process
α is a *k*-vector of drift parameters,
ΔY_t is (trend) stationary.

The hypothesis is:

$$H_o: \delta = 0 \text{ (Unit Root)}$$
$$H1: \delta \neq 0$$

The decision rule for this analysis is that:

If t* >PP critical value, = not reject null hypothesis, i.e., unit root exists.
If t* <PP critical value, = reject null hypothesis, i.e., unit root does not exist.

The test confirmed that the data sets used in the study are all stationary data series.

Finally, following the determination of the stationarity properties of the data sets, the dependent variable (office returns) was regressed against the independent variables (actual,

expected and unexpected inflation rates) using the Fama & Schwert [7] regression model. The regression equation is expressed as:

$$R_{jt} = \alpha_j + \beta_j E(\Delta_t \mid \varnothing_{t-1}) + y_j[\Delta_t - E(\Delta_t \mid \varnothing_{t-1})] + \varepsilon_{jt} \quad (6)$$

Where:

R_{jt} *is* the nominal return (could be measured in income return or capital return term) on real estate type j from period t-1 to t;
α_j is the intercept term in the regression model, it reflects the real return on real estate type j from period t-1 to t;
β_j is the slope coefficients for expected inflation for real estate type j with respect to income return or capital return;
$E(\Delta_t \mid \varnothing_{t-1})$ is best estimation of the expected value of inflation rate in time t Δ_t based on the information set available up to time t-1, denoted as $\varnothing_{t-1}$;
Δ_t is the true value of observed inflation rate from period t-1 to t;
y_j is the slope coefficients for unexpected inflation for real estate type j with respect to income return or capital return;
$\Delta_t - E(\Delta_t \mid \varnothing_{t-1})$ is used to measure shocks after acknowledgement of true inflation rate Δ_t, or rather the unexpected or unanticipated inflation rate, which is known in time t;
ε_{jt} is the error term for return of real estate type j from period t-1 to t.

The regression equation was further broken down into actual inflation, expected inflation and unexpected inflation components as income, capital and total returns reacted differently to different inflationary phenomenon. Thus,

The regression equation for actual inflation is given as:

$$R_t = \alpha + \beta\ (AI_t) \quad (7)$$

The regression equation for expected inflation is given as:

$$R_t = \alpha + \gamma\ (EI_t) \quad (8)$$

The regression equation for unexpected inflation is expressed as:

$$R_t = \alpha + \gamma\ (EI) + \delta\ (AI - EI)_t \quad (9)$$

Where:

R_t is the mean nominal return on commercial properties at time *t*;
α is the intercept term in the regression model, which also reflects the real rate of return on the property asset;
β is the coefficient for actual inflation for the property asset, with respect to income return, capital return or total return;
AI_t is the observed inflation rate from period *t – 1* to *t;*
γ is the coefficient for expected inflation
EI_t is the expected inflation estimate for period *t*;
δ is the coefficient of unexpected inflation for the property asset with respect to income, capital or total return;
$(AI - EI)_t$ is the unexpected inflation estimate for period *t*;
er is an error term.

2.1 Decision Rule

An asset is considered a complete hedge against inflation if the value of β is not significantly less than 1 (i.e. between 1 and 0.5). An asset is a partial hedge against inflation if the value of β is significantly less than 1 (i.e. between 0.4 and 0.1). An asset has zero hedge against inflation if the value of β is not significantly different from zero. An asset has a perverse hedge against inflation if the value of β is negative.

3. RESULTS AND DISCUSSION

This section presented the results from analysis of data obtained for the study and subsequently discusses the results accordingly. First, the respondents' profile was analyzed; second, the rental/capital values of office property investments were presented and used to calculate the income, capital and total returns obtained from the study area between 2002 and 2012. Third, the inflation trend in the study area within the study period was presented and analyzed accordingly. Fourth, the unit root test conducted was presented and discussed and finally, regression results which revealed the inflation-hedging characteristics of the selected commercial property were accordingly presented and discussed.

Table 1 presents the profile of respondents who supplied primary data on rental and capital values in terms of their: position in the Estate Firm, educational qualification, professional qualification, and years of professional practice as Estate Surveyors and Valuers. This was done in order to ascertain the validity and reliability of the data collected for the study. Twenty one percent (21%) of the respondents were principal partners, 14% were associate partners while 65% were branch managers of the respective Estate Surveying Firms. This shows that all the respondents held high positions in the respective firms, which give more credence to the reliability of the data provided. Similarly all the respondents were either polytechnic or university graduates with different category of degree, the HND (Higher National Diploma) being the highest (50%). In the same vein, all the respondents are in different membership cadre of the Nigerian Institution of Estate Surveyors and Valuers (NIESV), they all have professional experience of above 10 years. This showed that all the respondents are academically and professionally qualified to supply reliable data for this study.

The data provided by the respondents consisted of mainly the rental and capital values of office properties in Akure metropolis from 2002 to 2012. The data are presented in Table 2.

The rental and capital values in Table 2 were arrived at by calculating for each year respectively, the aggregate total averages of all the respondents' responses with respect to the 1,092 office properties in their management portfolios per square meter. Both the rental and capital values were observed to be highest in Alagbaka area and lowest in Oke Aro/Oshinle road.

Fig. 1 presents the trend analysis of both the rental and capital values of office properties in the study area.

Fig. 1 shows that both the rental and capital values of office properties in Akure kept increasing at a gradual but consistent basis from 2002 to 2012. This is congruent with the findings of earlier Nigerian studies such as Bello [19] and Ogunba et al. [23] which indicated that rental and capital values are rather increasing in Lagos and Ibadan respectively. In the same vein, foreign studies such as Leung [25] in Australia and Zhe [8] in Hong-Kong also

asserted that rental and capital values in the respective study locations kept increasing within the respective study periods.

Table 1. Analysis of respondents' profile

Respondents' characteristics	Status	Frequency	Percentage
Position In the firm	principal partner	3	21
	associate partner	2	14
	branch manager	9	65
	head of Department	0	0
	Total	14	100
Educational qualification	OND	0	0
	HND	7	50
	B.Sc/B. Tech	6	43
	MSc/M. Tech	1	7
	PhD	0	0
	Total	14	100
Professional qualification	FNIVS	0	0
	ANIVS/RSV	5	36
	ANIVS	7	50
	Probationer	2	14
	Total	14	100
Years of professional practice	1-11yrs	10	71
	12-21yrs	3	22
	22-31yrs	1	7
	above 31yrs	0	0
	Total	14	100

Source: Field Survey, 2013

From the trend lines, a future forecast or prediction with respect to rental and capital values of office properties in the study area for additional three years, from 2012, was made. The analysis indicated continues steady increase for the next three years. The level of reliability of the trend and accuracy of the forecast or predictions as determined by the R^2 value for both rental and capital values are as follows: For the rental values, the level of reliability and accuracy of the forecast is 96.5%, while that of the capital values is 97.62%.The least square regression equation in the analysis can be used to generate rental and capital values in the study area for years beyond the study period for the purpose of forecast or predictions. 'Y' in the equation represents rental/capital values accordingly while 'X' represent the year.

Table 3 presents the income, capital and total returns obtained from investments in office properties in the study area within the study period. The income, capital, and total returns were accordingly calculated from the rental and capital values presented in Table 2 using Equations 1, 2 and 3 respectively. The highest income return was obtained in the year 2011 (20.42%) and the least was recorded in the year 2002 (11.45%). Similarly, the highest capital return was obtained in the year 2007 (8.26%) and the least was recorded in the year 2011 (1.35%). In the same vein, the total return was seen to be highest in the year 2005 (25.57%) and the least was recorded in the year 2003 (15.82%).

Fig. 2 presents the trend analysis of the income, capital and total returns of investments in office properties in Akure metropolis.

Table 2. Average rental and capital values in ₦ (per m2) of office properties in Akure

Rental/capital values	Property location	Year											
		2001	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Rental values	Oba Adesida Rd.	1224	1289	1300	1633	1800	2400	2400	2400	2565	3222	3889	3372
	Oluwatuyi/Ijoka Rd.	821	855	900	990	990	1490	1498	1523	1633	1821	1933	2124
	Oke Aro/Oshinle Rd.	389	402	440	564	677	887	900	1233	1241	1367	1537	1547
	Alagbaka Area	2002	2111	2233	2456	2511	3333	3423	3543	3876	4582	4742	5037
	Arakale Rd.	1200	1298	1352	1363	1444	1778	1921	1944	2417	2583	3102	3145
Average		**1127**	**1191**	**1245**	**1401**	**1484**	**1978**	**2028**	**2129**	**2346**	**2715**	**3041**	**3045**
Capital values	Oba Adesida Rd.	11038	11987	12090	12234	12356	12378	14567	15882	16922	17811	18109	18976
	Oluwatuyi/Ijoka Rd.	8000	8765	9958	9965	10378	10432	11324	12675	13556	14008	14289	14567
	Oke Aro/Oshinle Rd.	4900	4998	5400	5675	5998	6012	6543	7869	8333	8654	8700	8978
	Alagbaka Area	13700	13998	14009	14987	15781	16500	16987	17898	17998	18325	18399	18659
	Arakale Rd.	12142	12323	12625	12825	12987	13254	13987	14005	14879	15679	15987	16758
Average		**9956**	**10414**	**10816**	**11137**	**11500**	**11715**	**12682**	**13666**	**14338**	**14895**	**15097**	**15588**

Source: Field Survey, 2013

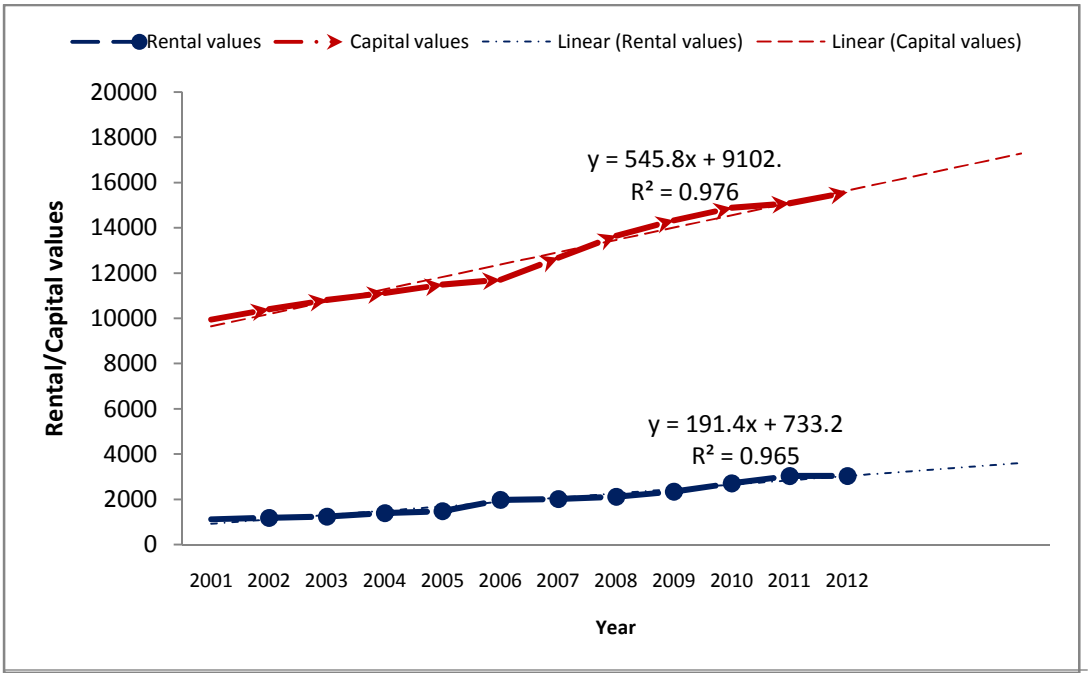

Fig. 1. Presents the trend analysis of both the rental and capital values of office properties in the study area

Table 3. Income, capital and total returns of investments in office properties in Akure metropolis

Year	Income return (%)	Capital return (%)	Total return (%)
2002	11.45	4.60	16.05
2003	11.96	3.86	15.82
2004	12.95	2.97	15.92
2005	13.32	3.24	16.56
2006	17.20	1.87	19.07
2007	17.31	8.26	25.57
2008	16.79	7.76	24.55
2009	17.17	4.92	22.09
2010	18.94	3.88	22.82
2011	20.42	1.35	21.77
2012	20.17	3.25	23.42

Source: Analysis of survey data, 2014

Fig. 2 shows that for all the three return components, the trend lines indicated a consistent and steady increase in the returns from 2002 to 2012. A future forecast with respect to the returns in the study areas for additional three years, from 2012, was also made. The analysis indicated continues steady increase of returns for all the three returns components for the next three years. The level of reliability of the trend and accuracy of the forecast as determined by the R^2 value for the three return components are as follows: For the three return components, the level of reliability and accuracy of the forecast are 62.18%, 92.22%, and 65.00% for the income, capital, and total returns respectively. The least square

regression equation in the analysis can be used to generate returns in the study areas for years beyond the study period for the purpose of forecast or predictions. 'Y' in the equation represents returns in the study area while 'X' represent the year selected for the desired analysis. From the analysis above, it can be inferred that the income, capital, and total returns in Akure metropolis have a steady and consistent increase over the study period and this increase is likely to be maintained over the next three years as seen from the predictive trend lines.

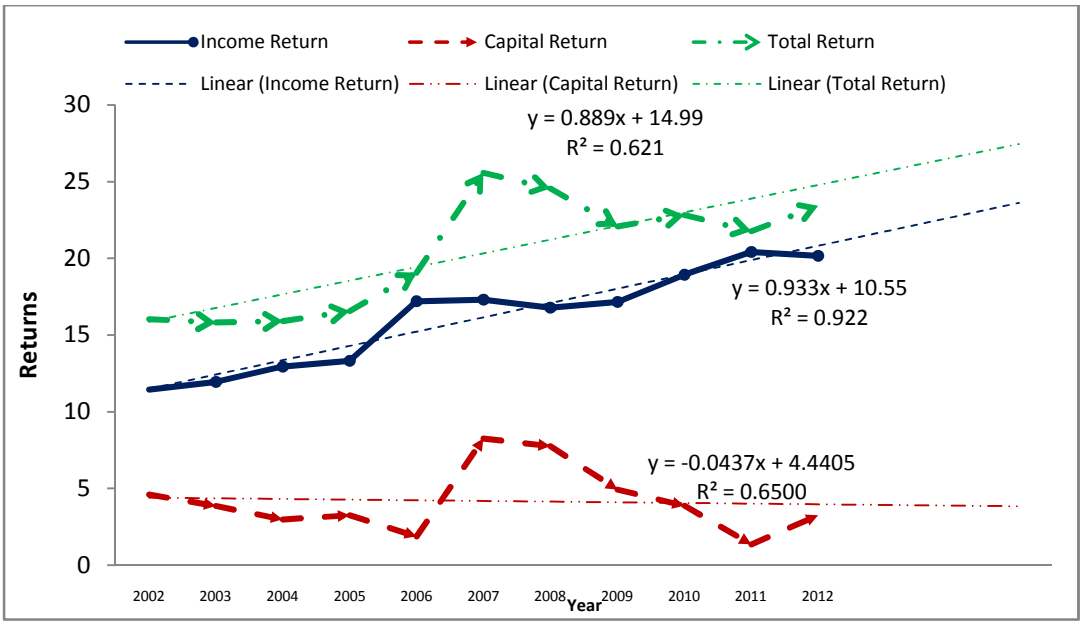

Fig. 2. Trend analysis of income, capital and total returns in Akure metropolis

Table 4 presents the inflationary trend in the study area from 2002 to 2012. Following the study conducted by Fama & Schwert [7], inflation in this study was decomposed into 3 components (actual, expected and unexpected). Data on inflation were obtained through secondary sources. The decomposition of inflation into the various components was necessitated by the fact that real estate' returns reacts differently to the individual inflation components. Actual inflation was obtained by using the Nigerian Consumer Price Index as a proxy; this was sourced from the records of the Nigerian National Bureau of Statistics. For the expected inflation component, the Nigerian 90-dayTreasury bill rates were used as a proxy this was sourced from the CBN Statistical Bulleting and Official Report found on the CBN database on the internet. The unexpected inflation was calculated as the difference between the actual and expected inflation rates.

Table 4 showed that throughout the study period, the actual inflation had been in the double digit range with the exception of 2006 and 2007. The inflation rates were observed to have kept fluctuating indicating some inflation volatility. Fig. 3 graphically presents the trend relationship between the actual, expected and unexpected inflation rates in Nigeria between 2002 and 2012.

Fig. 3 showed that inflation is somewhat high in Nigeria (mostly within the double digit range) and that while the actual and expected inflation rates have kept decreasing with time within

the study period, the unexpected component kept increasing with time within the study period.

Table 4. Inflation rates (actual, expected and unexpected) between 2002 and 2012

Year	Inflation components		
	Actual inflation	Expected inflation	Unexpected inflation
2002	12.90	18.90	-6.00
2003	14.00	15.02	-1.02
2004	15.00	14.21	0.79
2005	17.90	7.00	10.90
2006	8.20	8.80	-0.60
2007	5.40	6.90	-1.50
2008	11.60	9.00	2.60
2009	12.50	9.20	3.30
2010	13.70	6.60	7.10
2011	10.80	8.90	1.90
2012	12.20	12.90	-0.70

Source: Nigerian bureau of statistics/cbn statistical bulletin and official report

Before proceeding with the regression analysis of return/inflation relationships, the Philip-Perron Unit root test was carried out to determine the stationarity properties of the returns and inflation data using equation 5. This test has been found necessary in recent tests across the world to help in the determination of the most appropriate methodology for ascertaining the hedging characteristics of investment assets [9,26,27]. The results of the Philip-Perron Unit root test are presented in Table 5.

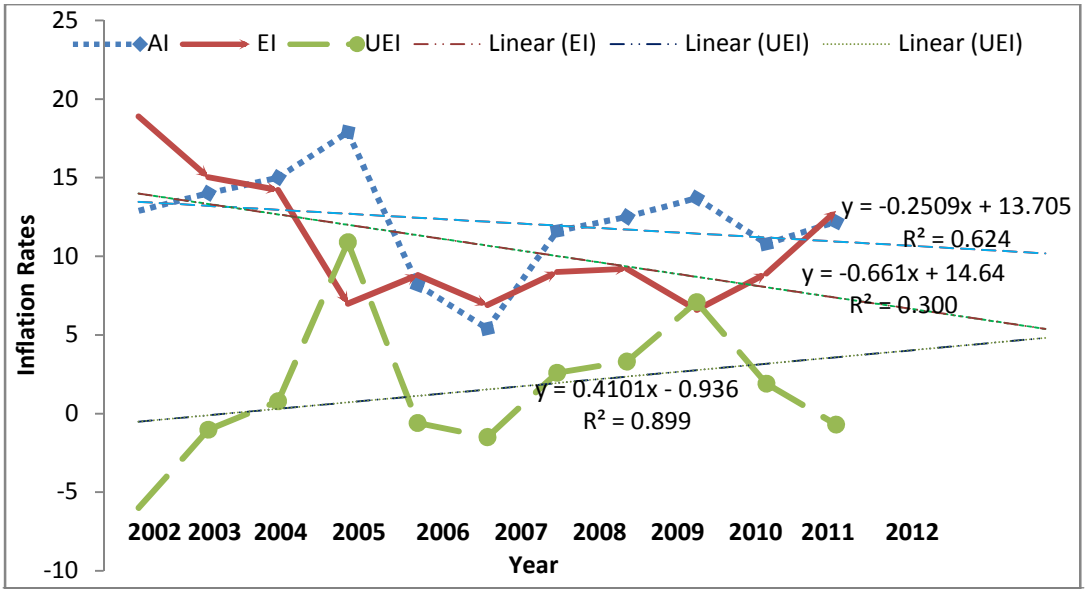

Fig. 3. Trend analysis of inflation rates in Nigeria between 2002 and 2012

Table 5. Philip-perron unit root test for returns/inflations data sets (2002- 2012)

Unit root test	Returns			Inflation rates			Sample period
	IR	CR	TR	AI	EI	UEI	
Level	-2.2576	-2.0298	-1.1474	-1.462	-2.998	-2.428	2002 to 2012
PP test statistic	-4.4328**	-5.4127**	-2.3084*	-3.4491*	-9.0833**	-5.2389*	
1% critical value	-2.9677	-4.4056	-2.0975	-3.2875	-6.1252	-4.8875	
5% critical value	-1.989	-3.335	-1.9835	-2.4239	-4.3535	-3.4239	
10% critical value	-1.6382	-2.8169	-1.6357	-2.864	-3.628	-2.864	

*Source: Analysis of survey data, 2014; Note: * 1st difference,** 2nd difference, IR (income return), CR (capital return), TR (total return), AI (actual inflation), EI (expected inflation) UEI (unexpected inflation)*

The computed Phillips-Perron test-statistics as seen in Table 5 are integrated of order I (1) and I (2). From Table 5, the computed Phillips-Perron test-statistic for both the returns and inflation series after first and second differencing accordingly were observed to be smaller than the critical values - "tau" at 10%, 5%, and 1% significant levels respectively; therefore we can reject Ho for both returns and inflation series. Therefore, the data series are all stationary series at 10%, 5% and 1% significant levels. This suggests that the most appropriate model for further analysis of the data set in determining the hedging characteristics of the asset class in question is a regression model.

From the foregoing, Equation 6 which expressed the Ordinary Least Square Regression as proposed by Fama & Schwert [7] was used in the determination of the hedging characteristics of office property investments in the study area between 2002 and 2012. Table 6 presents the result of regressing the office investment returns (income, capital, and total returns) against inflation rates in the study area using Equations 7, 8 and 9 for the actual, expected, and unexpected inflation rates respectively.

Table 6. Inflation-Hedging characteristics of office properties in Akure metropolis (2002–2012)

Inflation	Returns	Standardized coefficient			Type of hedge
		Constant	Beta	R square	
Actual inflation	Income return	19.950	-0.464	0.216	Perverse
	Capital return	14.510	-0.360	0.129	Perverse
	Total return	23.208	-0.609	0.371	Perverse
Expected inflation	Income return	22.592	-0.595	0.354	Perverse
	Capital return	11.810	-0.147	0.022	Perverse
	Total return	23.630	-0.597	0.356	Perverse
Unexpected inflation	Income return	-2.642	0.183	0.034	Partial
	Capital return	2.700	0.134	0.018	Partial
	Total return	-0.422	0.079	0.006	Partial

Source: Analysis of survey data, 2014

Table 6 shows that the inflation-hedging characteristics of office property investments in Akure metropolis vis-à-vis the actual inflation provides a perverse hedge (with betas -0.464, -0.360, and -0.609 for the income, capital, and total returns respectively), similarly, vis-à-vis the expected inflation also provides a perverse hedge (with betas -0.595, -0.147, and -0.597

for the income, capital, and total returns respectively). However, vis-à-vis the unexpected inflation component provides a partial hedge (with betas 0.183, 0.134, and 0.079 for the income, capital, and total returns respectively). The findings of this study is congruent with similar studies conducted by Mei-ling [16] and Zhe [8], but refuted the findings of Zhou & Clement [18] and Leung [25].

4. SUMMARY AND CONCLUSION

The study investigated the inflation-hedging characteristics of investments in office properties in Akure metropolis from 2002 to 2012. Findings from the study revealed that investments in office properties in the study area provide a perverse hedge vis-à-vis both the actual and expected inflation for the income, capital, and total returns respectively but provide a partial hedge vis-à-vis the unexpected component of inflation for the income, capital, and total returns respectively. This is congruent with the findings of earlier Nigerian studies conducted by Akinsola [22] and Oluwasegun & Dabara [9]. However, the study disagreed with some findings of foreign studies conducted by Fama & Schwert [7], Liu [15], Park & Bang [20], and Terahni et al. [11]. The conflict of results makes it obvious that inflation hedging capability varies from place to place, even within the same country. This could be attributed to the highly localized nature of direct property markets, most especially in emerging property markets of developing nations like Nigeria.

Study of this nature has significant implications for both local and foreign investors (individual and institutional) desiring to invest in the Nigerian property market. The results of the study can be useful for investment forecasts as well as investment decisions on the asset types to include in portfolios as a measure for protecting the value of investors' earnings from erosion by inflation. The result will also be a good and updated reference for academics and researchers in studying the Nigerian property market.

COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES

1. Ballantine J, Stray S. Financial appraisal and the ICT investment decision makingprocess. Journal of Information Technology. 1998;(14):3-15.
2. Koen M, Monique S, Raf H. Evaluation of the applicability of investment appraisaltechniques for assessing the business value of IS services. 2010; Accessed 30 June 2012.
   Available: https://lirias.kuleuven.be/bitstream/123456789/247210/1/KBI_0910.pdf.
3. Jack HR, Micheal TB, James RW. The inflation-hedging effectiveness of real estate. 1989; Accessed 5th May 2013.
   Available:http://aux.zicklin.baruch.cuny.edu/jrer/papers/pdf/past/vol04n02/v04p045.pdf
4. Odu T. Analysis of relative inflation hedging capacities of prime commercial properties in Lagos. Global Journal of Human Social Science. 2011;11(10):42-51. Accessed 7 July 2013. Available: https://globaljournals.org/GJHSS_Volume11/8-An-Analysis-of-Relative-Inflation-Hedging-Capacities.pdf.

5. Arnason O, Persson S. Swedish real estate as a hedge against inflation- with comparison stocks, bonds and gold. A Master of Science thesis submitted to the Department of Real Estate and Construction Management. KHT Architecture and the Built Environment. 2012. Accessed 19 June 2013.
   Available: http://www.kth.se/polopoly_fs/1.340467!/Menu/general/column-content/attachment/174.pdf
6. Fraundorf S. The real assets alternative: An investor's guide. 2012; Accessed 7th May 2013.
   Available:https://www.wilmingtontrust.com/repositories/wtc_sitecontent/PDF/Real_Assets_White_Paper_June_2012.pdf.
7. Fama EF, Schwert GW. Asset returns and inflation. Journal of Financial Economics. 1977;5(2):115–146. Accessed 13 April 2013.
   Available: http://schwert.ssb.rochester.edu/ari_jfe77a.pdf.
8. Zhe L. Short-term inflation-hedging characteristics of real estate in Hong Kong. A dissertation submitted to the faculty of Architecture for the award of Bachelor of Science in Surveying, The University of Hong Kong. 2010; Accessed 9 May 2013. Available: http://hub.hku.hk/bitstream/10722/130987/1/ft.pdf.
9. Oluwasegun A, Dabara ID. Inflation-hedging capability and risk-return strategies of commercial real estate investment in Nigeria. In: Esekumenu VC, Joseph EE, Damian MG, Agundu PU, John AP, Omole FK (Eds). Proceedings of African Regional Conference on Sustainable Development. February 11-14, 2013, Conference Centre, University of Lagos, Nigeria. 2013;8(2):54-68.
10. Wurtzebach CH, Mueller GR, Machi D. The impact of inflation and vacancy of real estate returns. Journal of Real Estate Research. 1991;6(2):153-168.
11. Terahni R, Zarei S, Parirokh. An approach in market residential using co-integration traditional model. Australian Journal of Basic and Applied Sciences. 2012;6(8):112-114.
12. Sing TF, Low SH. A comparative analysis of inflation-hedging characteristics of property and non-property assets in Singapore. 2000; Accessed 8 July 2013. Available: http://www.rst.nus.edu.sg/staff/singtienfoo/Inflation%20hedging%20-%20Singapore.pdf.
13. Quingping NT. Can real estate returns hedge against inflation? China: Feng Chia University Business School Research Institute PhD thesis; 2008.
14. Voigtlander M, Demary M. The inflation hedging properties of real estate: A comparison between direct investments and equity returns; 2009. ERES Conference 2009. ; Accessed 25 April 2013.
   Available: http://www.eres2009.com/papers/5Dvoigtlaender.pdf.
15. Liu W, Zhou Z. Inflation-hedging behavior of a securitized real estate market: empirical evidence from Hong Kong. International Real Estate Review. 2009;12 3):221–251.
16. Mei-ling N. The performance and inflation-hedging characteristics of hotel investment in Hong Kong. A Phd thesis submitted to the University of Hong Kong; 2003. Accessed 13 April 2013. Available: http://hdl.handle.net/10722/31234.
17. Liu CH, Hartzell DJ, Hoesli ME. International evidence on real estate securities as an inflation hedge. Real Estate Economics. 1997;25(2):193-221.
18. Zhou X, Clements S. The inflation hedging ability of real estate in China. Journal of Estate Portfolio Management. 2010;16(3):267-277.
19. Bello MO. The inflation-hedging attributes of investments in real estate, ordinary shares and naira denominated deposits between 1996 and 2002. Journal of Banking. 2005;1-28.
20. Park YW, Bang DW. Direct commercial real estate as an inflation hedge: Korean evidence. Journal of Real Estate Portfolio Management. 2012;18(2):187-203.

21. Bello MO. The inflation hedging characteristics of Nigerian residential property investment. Journal of Property Research and Construction. 2004;1(1):40-52
22. Akinsola BN. Comparative analysis of commercial property and stock-market investments in Nigeria World Academy of Science, Engineering and Technology. 2012;(70):1143-1151. Accessed 6th May 2013.
Available: https://www.waset.org/journals/waset/v70/v70-212.pdf.
23. Ogunba OA, Obiyomi OO, Dugeri T. The inflation hedging potential of commercial property investments in Ibadan, Nigeria In: Laryea, S. and Agyepong, S. (Eds) Procs 5th West Africa Built Environment Research (WABER) Conference, 12-14 August 2013, Accra, Ghana. 2013;1101-1111.
24. Wang K, Lee Y, Nguyen TT. Asymmetric inflation hedge of housing return: A non-linear vector error correction approach. International Real Estate Review. 2008;11(1): 65–82.
25. Leung A. Commercial property as an inflation hedge: An Australian perspective. Pacific Rim Research Property Journal. 2010;16(1):97-115.
26. Thambiah Y, Foscari N. Real assets: Inflation hedge solution under a modified risk framework. 2011; Accessed 22 May 2013. Available: https://www.credit-suisse.com/asset_management/doc/thought_leadership/real_assets_white_paper_20 1109_en.pdf.
27. Zhou TT, Gunasekarage A, Power D. Do real estate assets hedge inflation better than financial assets? Some New Zealand Evidence. Briefings in Real Estate Finance. 2005;5(2):39-46.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sciencedomain.org/review-history.php?iid=664&id=22&aid=6137