EFFECTS OF EXCHANGE RATE VOLATILITY ON MEDIUM/HIGH INCOME RESIDENTIAL REAL ESTATE INVESTMENT RETURNS IN NIGERIA

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Abstract
This paper investigated the effects of Naira/Dollar exchange rate volatility on medium and high income residential real estate investment returns in Nigeria using EGARCH model. It used time series data for an 11 year period between 2000 and 2010. The findings of the study reveal that exchange rate volatility has a significant negative effect on medium income and high income residential real estate investment returns in Nigeria within the study period. Magnitude of volatility and volatility persistence measured as β and α respectively were found to be low and insignificant at 5% level of testing. Leverage effect measured as γ was insignificant. However being insignificant means that they were not pronounced within the study period.

Keywords: Exchange rate volatility, Residential property, Leverage effect, Investment returns.

Introduction
All over the world, investors, especially real estate investors have started to think globally and have become more willing and eager to diversify across countries. Real estate investors are now expanding globally so as to accommodate their international real estate requirements as well as reduce their portfolio risk. This has necessitated the need to examine the link between exchange rate movement and real estate returns. Exchange rate volatility (risk) can significantly affect investments such that a country with a high degree of exchange rate volatility will have a more volatile stream of profits than a country with a low degree of exchange rate volatility.

Osinubi and Amaghionyeodwe (2009) opined that Nigeria is one of the countries with a high degree of currency risk. This exchange rate instability especially after the discontinuation of exchange rate control policy is a major factor to optimal investment in Nigeria. This high exchange rate volatility in Nigeria, among others have led to a precarious operating environment which can be attributed to the reason why Nigeria was not only unable to attract foreign investment to its fullest potentials but also has had a limited domestic investment.

According Adjasi, Harvey, and Agyapong (2008), the openness of a country’s economy is recognized as a cause of volatility in its market. Nigeria is an example of an open economy that engages in international trade transactions; hence its market is susceptible to exchange rate volatility. A historic examination of foreign exchange movement in Nigeria shows a considerable level of volatility, thus necessitating the need to determine its effect on real estate returns. Incorporating exchange rate fluctuations into real estate investment analysis can have a considerable effect on its risk-return characteristic.

Despite the vast investment opportunities in residential real estate investment (considering the shortfall of housing supply in Nigeria relative to increase in demand) very little foreign investment capital have been attracted to it. Hence it has become relevant for a study like this to investigates if there exists any relationship between exchange rate volatility and medium/high income residential real estate investment returns in Nigeria.

The volatility of real estate investments had been of concern to property investors all over the world who desire to make gains by diversifying their real estate investment across countries. High volatility of residential real estate is attributable to high risk, since most investors are risk averse, they tend to shy off from the market due to uncertainty in expected returns. (Olweny and Omondi, 2011).

Exchange rate volatility therefore have implications on the economy of a country especially on the real estate sector as it can alter the diversification benefits associated with real estate investments. According to Liu and Mei (1998) diversification benefits are found to be primarily driven by unanticipated returns which are partially driven by changes in exchange rate risks. Nigeria as an emerging economy with great opportunities in real estate investment into the residential sector (considering shortfall in housing supply) offer great diversification benefit which could be affected by currency risk. The advent of floating exchange rate, the mass surge into real estate investment as an alternative asset class (especially during this downturn in the Nigerian stock exchange), increase in foreign direct real estate investment, have prompted the need to determine the link between these two market (i.e. foreign exchange and property market).
As Nigeria is seeking and implementing strategies to boost its economic development, there is therefore the need to determine the effect of exchange rate volatility on real estate values. Thus it will be expedient to find out if exchange rate volatility increases or reduces the returns from real estate investments in Nigeria, increases or decreases residential property risk or does not have any effect at all.

Olowe (2009) posits that the Nigerian foreign exchange market is characterized by high volatility persistence, hence there is the need to determine how this volatility of exchange rate (US Dollar to Naira) affects residential real estate investment returns in Nigeria.

The aim of the study is to investigate the effects of exchange rate volatility on medium income and high income residential property returns in Nigeria from 2000 to 2010. The objectives of this study are three fold namely: (a) to determine the effects of US/Naira exchange rate volatility on medium income residential property investment returns in Nigeria, (b) to determine the effects of exchange rate volatility on high income residential property investment returns in Nigeria, and (c) to determine the pattern of correlation between medium/high income residential property returns and exchange rate movement.

The scope of this study will be limited to medium income residential (Detached bungalow and block of 3 bedroom flat) property returns, high income residential (Detached building on two floors) property returns and exchange rate movement from 2000 to 2010 using Naira US Dollar exchange rate. The property markets that were chosen for this work are Lagos, Port Harcourt and Abuja because a lot of real estate transactions in Nigeria occur in these cities. This study utilized direct real estate investment data over the study period.

The rest of the paper is divided into four sections. Section two follows this introduction with the review of the existing literature, section three describes the research methodology, section four describes the data presentation and analysis while section five concludes the study.

**Literature review:**

Residential real estate refers to properties built solely for dwelling purposes. Residential real estate account for the largest investment in the world (Kalu, 2005). A large portion of real estate investment in Nigeria is apportioned to residential real estate. Kalu (2007) observed that more than 80% of real estate investment in Nigeria constitute of residential real estate. Residential real estate investment include all sorts of private and public housing i.e. the various dwelling units of single family residences (such as bungalow, duplexes and meisonnattes, flats and other apartment blocks). Igboko (1992) found out that residences make up the single largest category of real estate investments found in urban and rural areas of Nigeria. Despite the fact that residential real estate account for the largest property investment in Nigeria, very little work has been done in areas of its quantity or stock, returns and risks — while no study has looked at the effects of exchange rate volatility on residential real estate returns in Nigeria.

An exchange rate constitute the price of one currency in terms of another. Exchange volatility refers to the fluctuation of the exchange rate of a currency relative to others. It represents a measure of uncertainty that investors must face about the future which makes it an important factor that investors should take into consideration in their decision to invest. Osinubi and Amaghionyeodie (2009) identified exchange rate and its volatility as one of the factors that affect the inflow of investment into developing countries of economics.

Aghion, Philippe, Romain and Kenneth (2009) found out that exchange rate volatility has a negative effect on economic growth. Peter Wareja, Shian, Azin and Li (2004) also confirmed this finding by stating that currency crisis in emerging market economies are special examples of high exchange rate volatility. Bleaney and Greenerway (2001), Larran and Vergara (1993) Cushman (1988) caballero and Corbo (1989) also found a negative effect of exchange rate on investment.


According to Patrick (2008), there has been limited empirical work on the effects of exchange rate in
relation to property market. Some of the studies include. Newell and Webb (1996) who examined the effects of exchange rate volatility for five property markets (UK, US, Canada, Austria and New Zealand) between 1985 and 1993 using bi-annual data and identified impacts similar to the stock and bond market. Their findings are consistent with Tarbert and McAllister (1998), who examined the similar markets over a longer period. On the contrary, Quin and Titman (1997) examined the relationship between changes in annual property values and rents from 17 urban centers in different countries and found out that exchange rate changes did not severely distort the relative average returns in these countries. Joseph and Akhanonu (2011) opined that the instability of exchange rate can cause a negative distortion in any economy. In their research on the link between exchange rate volatility and trade in Nigeria, volatility was measured using the Generalized ARCH (GARCH) as introduced by Bollerslev (1986). This methods of measuring volatility is one of the best measures because it is useful in capturing non constant, clustered time varying variance in the higher moments, which represents stochastic process by which risk terms are generated (Bollerslev, 1992).

**Research Methodology**

**Research Design**

This study undertook exploratory survey research in order to give answer to the puzzle on the effect of exchange rate volatility on residential (medium and high income) property investment returns volatility in Nigeria.

**Data Collection**

Data was collected from 398 firms of Estate Surveyors and Valuers within the study area who supplied data on rental trends of the various residential property classes from 2000 to 2010 from the different property markets (Abuja, Lagos and Port Harcourt) in Nigeria.

**Data Analysis Technique**

Real estate returns for the different property classes were calculated using

\[ R_t = (C_{t} - C_{t-1}) + NI_{t} \]

\[ CV_{t} \]

Where:

- \( R_t \) = Return at time \( t \)
- \( CV_{t} \) = Capital value at time \( t \)
- \( CV_{t+1} \) = Capital value at time \( t+1 \)
- \( NI_{t} \) = Net income at time \( t \)

The correlation analysis is expressed as:

\[ p = \frac{COV(X,Y)}{\sigma_x \sigma_y} \]

Where: \( p \) = correlation value (a measure of linear association between two variables and lies between -1 and 1, +1 indicates perfect positive association while -1 indicates perfect negative association)

\[ COV(X,Y) = \text{Co-variance of variable } X \text{ and } Y \]

\[ \sigma_x = \text{Standard deviation of variable } X \]

\[ \sigma_y = \text{Standard deviation of variable } Y \]

Econometric model was used in the study to analyze the results so as to ensure accurate result. One of the variants of the GARCH models the Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) was used in determining the effects of exchange rate volatility on medium income and high income residential property investment return volatility in Nigeria.

The EGARCH is most often preferred to the GARCH model in studying financial markets. Koulikidis, Papasyriopoulos and Molyneux (2006) opined that the GARCH (Generalized Autoregressive Conditional Heteroskedasticity) is relatively weaker than the EGARCH in studying financial markets phenomenon. The weaknesses of the GARCH according to them include; (i) it assumes that there is a negative correlation between current returns and future volatility; (ii) it imposes parameter restrictions that are often violated by estimated coefficients which may unduly restrict the dynamics of the conditional variance process; (iii) it is difficult to interpret whether shocks to conditional variance persist or not in GARCH. Statistical software (Eviews 7.0) was used in the analysis of the EGARCH models. The models are:

\[ Y_t = \beta_0 + \beta_1 (\Delta R_{t-1}) + \beta_2 (AMIRPR_{t-1}) + \beta_3 (AHIFPR_{t-1}) + \beta_4 (AMIRPR_{t-1}) + \beta_5 (AHIFPR_{t-1}) + \mu_t \]

\[ \ln(\sigma_t^2) = \omega + \beta \ln(\sigma_{t-1}^2) + \gamma \frac{u_{t-1}}{\sqrt{\sigma_{t-1}^2}} + \alpha \left( \frac{u_{t-1}}{\sigma_{t-1}} - \frac{1}{\sqrt{\pi}} \right) \]

Where in equation (3)

- \( Y_t \) = Residential property returns
\( \Delta \text{ER}_t \) = Changes in exchange rate at time \( t \) of first differencing

\( \text{AMIRPR} = \) Aggregate medium income residential property returns

\( \text{AHIRPR} = \) Aggregate high income residential property returns

\( \beta_{1,2,3} = \) Model coefficient parameters

\( \mu_t \) = Random Error which is assumed to be \( N(0, \sigma^2) \)

Where in equation (4)

\[ \sigma^2_t = \text{The conditional variance at time } t. \]

\( \omega = \) Constant.

\[ \sigma^2_{t-1} = \text{Lag 1 conditional variance.} \]

\( u_{t-1} = \) Lag 1 of Random Error.

\( \beta = \) Magnitude of volatility

\( \alpha = \) Volatility persistence

\( \gamma = \) Asymmetry or Leverage Effect.

The model specification for aggregate medium income residential property returns and aggregate high income residential property returns are specified below

\[ \text{AMIRPR} = \beta_0 + \beta_1(\Delta \text{ER}_t) + \beta_2(\Delta \text{ER}_{t-1}) + \beta_3(\text{AHIRPR}_{t-1}) + \mu_t, \ldots, \ldots, (5) \]

Where:

\( t = 1, 2, \ldots, 10 \)

\[ \ln(\sigma^2_t) = \omega + \beta \ln(\sigma^2_{t-1}) + \gamma \frac{u_{t-1}}{\sigma^2_{t-1}} + \alpha \left[ \frac{\ln(\sigma^2_t - \sigma^2_{t-1})}{\sigma^2_{t-1}} \right] \]

\[ \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (4) \]

Where in equation (6):

\( \text{AHIRPR} = \) Aggregate high income residential property returns

\( \beta_0 = \) constant or the regression intercept

\( \mu_t = \) the error term at time \( t \)

\( \Delta \text{ER}_t \) = exchange rate at time \( t \) of the first difference

\( \Delta \text{ER}_{t-1} = \) exchange rate of the first difference at lag 1

\( \beta_{1,2,3} = \) The model parameters of equation (5), the mean equation

Other variables and parameters are as defined in equations (4).

The instruments that were used to determine the effects of exchange rate volatility on residential real estate return include descriptive statistics, the unit root Augmented Dickey Fuller (1979, 1981); EGARCH (Nelson, 1991).

**Test for Stationarity**

Testing for stationarity is usually done in time series data so as to ascertain if the series is stationary because inferences cannot be made on non-stationary data. In order to address the issue of non stationarity and also avoid the problem of spurious regression, the researcher used a qualitative analysis known as the Augmented Dickey - Fuller test (ADF).

**Decision Rule for Augmented Dickey-Fuller Test**

If \( \text{ADF} > \text{ADF (Augmented Dickey-Fuller)} \) critical value do not reject null hypothesis this implies that unit root exist which indicates non-stationarity.
relation to property market. Some of the studies include. Newell and Webb (1996) who examined the effects of exchange rate volatility for five property markets (UK, US, Canada, Austria and New Zealand) between 1985 and 1993 using bi-annual data and identified impacts similar to the stock and bond market. Their findings are consistent with Tarbert and McAllister (1998), who examined the similar markets over a longer period. On the contrary, Quin and Titman (1997) examined the relationship between changes in annual property values and rents from 17 urban centers in different countries and found out that exchange rate changes did not severely distort the relative average returns in these countries. Joseph and Akhanonu (2011) opined that the instability of exchange rate can cause a negative distortion in any economy. In their research on the link between exchange volatility and trade in Nigeria, volatility was measured using the generalized ARCH (GARCH) as introduced by Bollerslev (1986). This method of measuring volatility is one of the best measures because it is useful in capturing non constant, clustered time varying variance in the higher moments, which represents stochastic process by which risk terms are generated (Bollerslev, 1992).

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\[ R_t = (C_{V_t} - C_{V_{t-1}}) + NI_t \]

Where:

- \( R_t \) = Return at time \( t \)
- \( C_{V_t} \) = Capital value at time \( t \)
- \( C_{V_{t-1}} \) = Capital value at time \( t-1 \)
- \( NI_t \) = Net income at time \( t \)

The correlation analysis is expressed as:

\[ p = \frac{\text{COV}(X,Y)}{\text{SD}_X \cdot \text{SD}_Y} \] ..........................(2)

Source: Gujarati, (1995)

Where:

- \( p \) = correlation value (a measure of linear association between two variables and lies between +1 and -1. +1 indicates perfect positive association while -1 indicates perfect negative association.)
- \( \text{COV}(X,Y) \) = Co-variance of variable X and Y
- \( \text{SD}_X \) = Standard deviation of variable X
- \( \text{SD}_Y \) = Standard deviation of variable Y

Econometric model was used in the study to analyze the results so as to ensure accurate result. One of the variants of the GARCH models the Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) was used in determining the effects of exchange rate volatility on medium income and high income residential property investment return volatility in Nigeria.

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\[ Y_t = \beta_0 + \beta_1 A E R_t + \beta_2 (A M I R P R_t) + \beta_3 (A H I R P R_{t-1}) + \mu_t \] ..........................(3)

\[ \ln(\sigma^2_t) = \alpha + \beta \ln(\sigma^2_{t-1}) + \gamma \frac{u_t - \mu_{t-1}}{\sqrt{\sigma^2_{t-1}}} + \alpha \left[ \frac{u_t - \mu_{t-1}}{\sqrt{\sigma^2_{t-1}}} \right] \] ..........................(4)

Where in equation (3)

\( Y_t \) = Residential property returns
Table 4 above shows the Pearson correlation matrix analysis of all the aggregate variables. The values show the relationship between aggregate medium income residential property returns with high income residential property returns and Exchange rate were 0.242 and 0.244 respectively. The correlation between high income residential and Exchange rate is 0.074. The negative correlation between AMIRPR and AHIRPR indicate that combining them in a portfolio will offer a good diversification benefit while the negative correlation between AMIRPR and ER indicates that when foreign exchange increases, medium income residential aggregate returns volatility decreases.

Table 5 : Result of the EGARCH model on the effect of exchange rate on medium income residential property returns (mean equation).

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.386385</td>
<td>0.0000</td>
</tr>
<tr>
<td>D(ER)</td>
<td>-0.001292</td>
<td>0.0003</td>
</tr>
<tr>
<td>D(ER(-1))</td>
<td>-0.003803</td>
<td>0.0003</td>
</tr>
<tr>
<td>AMIRPR(-1)</td>
<td>-1.001464</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Table 6 : Result of the EGARCH model on the effect of exchange rate on medium income residential property returns (variance equation).

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>α</td>
<td>-5.017836</td>
<td>0.7694</td>
</tr>
<tr>
<td>γ</td>
<td>-0.712795</td>
<td>0.9451</td>
</tr>
<tr>
<td>α</td>
<td>-2.940180</td>
<td>0.7116</td>
</tr>
<tr>
<td>α</td>
<td>0.527749</td>
<td>0.7749</td>
</tr>
</tbody>
</table>

From the mean equation in Table 5, there is a negative relationship between medium income residential return and exchange rate volatility. This implies that when exchange rate increases, medium income residential property market activities decreases. When exchange rate reduces, real estate investors participate more on medium income residential property market.

Table 8 shows that the magnitude of volatility measured by β is low at 0.039830. Volatility persistence measured as α is low at 0.677011 but higher than that of medium income residential properties. The insignificance of the variance equation parameters indicates that they were not pronounced within the study period.

Conclusion
Exchange rate volatility was found to have a negative impact on medium and high income residential real estate investment aggregate returns such that depreciation in the local currency dampens residential property returns i.e. higher exchange rate volatility has a negative effect on medium and high income residential property returns in Nigeria. Volatility of returns was not highly persistent. Leverage effect was not significant. The findings of negative effects of exchange rate volatility on real estate investment returns in this study confirm the findings of Lee & Thomas (2006), Addae-Dapaah & Goh (1998), Addae-Dapaah & Loh (2005), Addae Dapaah & Young (1988), Lee (2001), Newell & Webb (1996). This implies that investors and would be investors in real estate market in Nigeria may use macro economic data such as exchange rate to forecast property market volatility.

The negative correlation between AMIRPR and AHIRPR indicate that combining them in a portfolio will offer a good diversification benefit while the negative correlation between AMIRPR and ER indicates that when foreign exchange increases, medium income residential aggregate returns volatility decreases. The study found a significant relationship between exchange rate volatility and residential (medium and high income) real estate investment returns in Nigeria.

Recommendations
Based on the findings and conclusions made in this study, the following recommendations have been made.

For a better property market performance in Nigeria, policy makers should put in place measures that will seek towards stability in exchange rate, since any disturbance in exchange rate will affect residential real estate investment returns.

Property investors seeking exchange rate risk...
If $t^* < ADF$ (Augmented Dickey-Fuller) critical value reject null hypothesis this means unit root do not exist which indicates stationarity.

In this analysis the researcher is testing at $t^* = 5\%$ level, where $t^*$ refers to MacKinnon critical values.

<table>
<thead>
<tr>
<th>Year</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium Income Residential Property Returns</td>
<td>-</td>
<td>0.1313</td>
<td>0.1451</td>
<td>0.1732</td>
<td>0.2304</td>
<td>0.1321</td>
<td>0.2480</td>
<td>0.1601</td>
<td>0.2597</td>
<td>0.1151</td>
<td>0.1540</td>
</tr>
<tr>
<td>High Income Residential Property Returns</td>
<td>-</td>
<td>0.0819</td>
<td>0.1724</td>
<td>0.1089</td>
<td>0.1135</td>
<td>0.1895</td>
<td>0.1028</td>
<td>0.1501</td>
<td>0.1386</td>
<td>0.1181</td>
<td>0.1317</td>
</tr>
</tbody>
</table>

Source: Diala O.A (2015)

The data on exchange rate in table 2 were reported as seen from the CBN. The data on exchange rate were used in determining the correlation between exchange rate volatility and medium/high income residential property returns as well as in the EGARCH analysis of the effect of exchange rate on medium/high income residential property returns in Nigeria.

Result of the Analysis

Table 3: Result of the Augmented Dickey-Fuller unit root test analysis.

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>LEVEL($t^*$)</th>
<th>ADF</th>
<th>FIRST DIFF(-1)</th>
<th>ADF</th>
<th>DECISION</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMIRPR_{t}</td>
<td>-3.259808</td>
<td>-4.427325*</td>
<td></td>
<td></td>
<td>Stationary</td>
</tr>
<tr>
<td>AHIRPR_{t}</td>
<td>-3.259808*</td>
<td>-6.823638*</td>
<td></td>
<td></td>
<td>Stationary</td>
</tr>
<tr>
<td>ER_{t}</td>
<td>-3.259580**</td>
<td>-1.452181**</td>
<td>-1.995865*</td>
<td>-2.827286*</td>
<td>Stationary</td>
</tr>
</tbody>
</table>

* Stationary at 5%  
** Not stationary at 5%

According to the statement of Augmented Dickey-Fuller decision rule, it is indicated in the Table 3 above that AMIRPR, AHIRPR are all stationary at $t^*$ while ER became stationary after the first differencing. The researcher ascertained that the series is stationary. Having ascertained the stationarity of the variables, the Exponential Generalized Conditional Autoregressive Heteroscedasticity Model (EGARCH) was now used to determine the effect of exchange rate volatility on medium/high income residential property returns.

Table 4 Result of the Correlation Analysis of Exchange Rate and Medium/High Income Residential Property Returns

<table>
<thead>
<tr>
<th>Exchange rate</th>
<th>Aggregate high income residential returns</th>
<th>Aggregate medium income residential property returns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exchange rate</td>
<td>1</td>
<td>0.74</td>
</tr>
<tr>
<td>Aggregate high income residential returns</td>
<td>0.74</td>
<td>1</td>
</tr>
<tr>
<td>Aggregate medium income residential property returns</td>
<td>-0.244</td>
<td>-0.242</td>
</tr>
</tbody>
</table>
reduction should critically look at its effect on property investments in Nigeria before adding it to their property portfolio. A vigorous pursuit of a stable exchange rate system in Nigeria is highly recommended so as to attract foreign direct real estate investment, especially now that there is the urgent need to address the current deficit in housing supply.

There should also be regular policy maker’s intervention in times of abnormal fluctuations so as to boost investor’s confidence.

Firms that import raw materials or finished products for housing construction in Nigeria should make use of forward contract for hedging purposes. This will enable them go round the problem of exchange rate volatility.

Adequate policy regulations should be put in place. The government should ensure that all the market players comply with the policies and regulations so as to ensure efficiency and effectiveness.

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References
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