

Interest Rate And Housing Prices In Nigeria: A Time Series Analysis

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Abstract: This paper examines the relationship between real interest rates and housing prices in Nigeria using a microeconomic approach. From the literature, it was established the contrary evidences of the relationship between interest rate and housing prices in Nigeria. Based on the contrary results, two hypotheses were formulated. Data were gathered from the Central Bank of Nigeria Statistical Bulletin on interest rate and housing prices. The study used time series data to answer the research questions and time series analysis was done. The study found that there is a significant relationship between housing prices and interest rate in Nigeria. It found that an upward shift in interest rate will bring about an upward shift in housing prices significantly. However, a downward shift in interest rate will bring about stagnant housing prices.

Keywords: Interest rate; Money supply; Housing prices

I. INTRODUCTION

This research studies the relationship between real interest rates and housing prices in Nigeria using a microeconomic approach. The primary impact of interest rates is on the demand side. The partial equilibrium, comparative static model of demand behavior presented is based on intertemporal preference maximization subject to a multiperiod income constraint. The model is always in terms of real prices and interest rates and operates in discrete time. Consumer preferences are represented by a smooth utility function which depends on two kinds of goods, housing and other nondurables. This study is couched in a neoclassical framework with all markets assumed perfect unless otherwise specified. With this approach the theory of housing and interest rates becomes part of standard consumer theory, rather than being based on inappropriate present value considerations. Durables such as housing differ from nondurable consumption goods in that they yield a flow of services from a capital stock throughout time. The demand for a stock of housing is based on the flow of service provided. The supply for the most part is the existing stock. The price of

housing is then determined from the interaction of this demand with supply. On the basis of this stock price, a flow of housing investment is generated that maximizes profits to the producers. Because of its durability, housing is unique among major consumption goods. The impact of interest rates on the housing market is investigated in the light of this particular characteristic. Previous empirical studies of housing markets have examined the impact of monetary policy, either through the availability of credit or interest rates (see Kearl, Rosen, & Swan, 2001; Maisel, 1998; Muth, 1997). However, Meltzer (2009) has challenged the importance of credit availability on housing consumption, so that the dominant role of monetary policy appears to be through interest rates.

The relationship between interest rates and property prices has come under intense scrutiny since the housing boom of the mid-2000s, and the ensuing financial crisis of 2007–09. Two views have emerged from this experience. One is that monetary policy should respond more proactively to asset price rises, and especially to excesses in the property markets. According to this view, by “leaning against the wind” central banks can prevent or attenuate asset price bubbles, and thus promote financial stability. This would represent a retreat from

the Bernanke-Gertler (1999) dictum that monetary policy should respond only to the macroeconomic consequences of asset price fluctuations, rather than to asset prices themselves. A second, stronger view is that overly expansionary monetary policy is itself the cause of asset price bubbles, and in particular that the Federal Reserve deserves blame for the recent house price bubble. Taylor (2007, 2009) has forcefully articulated this view, which often surfaces in the financial press as well. If so, then monetary policymakers need to be extremely cautious about pursuing expansionary monetary policy, lest it eventually precipitate a financial crisis. Both of these views rest on the hypothesis that interest rates have an economically significant effect on real estate prices. The validity of that hypothesis may appear self evident at first glance. Historically, interest rates declines do tend to precede periods of house price appreciation, and that was certainly true over the last decade. A more careful examination of the data yields little support for this hypothesis, however. Surveying a number of recent studies and bringing to bear some new evidence on the question, this paper argues that in the data, the impact of interest rates on house prices appears to be quite modest. In fact, the estimated effects are uniformly smaller than those implied by the conventional user cost theory of house prices, and insufficient to account for the rapid house price appreciation experienced in the U.S. and elsewhere. A link between low interest rates and house price bubbles is especially tenuous. Standard theory says that low interest rates should increase house values (or the value of any long-lived asset, for that matter). Consequently, the observation that house prices rise when interests rates fall is not by itself evidence that low interest rates cause bubbles. To make this case, one would have to argue house prices tend to overreact to interest rate reductions, i.e., that appreciations are larger than warranted by fundamentals. The generally muted response observed in the data suggests this is not the case. The study raised some useful research questions; What is the relationship between interest rate on Housing prices in Nigeria? To what extent does interest rate affect Housing prices in Nigeria? Is there a long run relationship between interest rate and Housing prices in Nigeria?

The essence of these research questions is to establish the statistical, empirical and policy effects of interest rates on house prices in Nigeria. Interestingly, this study will help to establish whether the changes in interest rate over time has impact positively or negatively on the boom in the housing sector which may practically explains the sufficiency state of the housing sector.

This study answers the research questions by taking into precedence some literatures that has been established in recent times. From the literature, it was established the contrary evidences of the relationship between interest rate and housing prices in Nigeria. Based on the contrary results, two hypotheses were formulated. Data were gathered from the Central Bank of Nigeria Statistical Bulletin on interest rate and housing prices. The study used time series data to answer the research questions and time series analysis was done. The study found that there is a significant relationship between housing prices and interest rate in Nigeria. It found that an upward shift in interest rate will bring about an upward shift in

housing prices significantly. However, a downward shift in interest rate will bring about stagnant housing prices.

Section one examines what necessitates the question of what is the effect of interest rate on housing prices in Nigeria. Section two provides an overview of the existing literature on interest rate and housing prices. Section three explains how the data for this study was sourced and the method used in carrying out the analysis. Section four analyses and discusses the findings of this study. Section five presents the summary, implications, limitations, direction for future research and the reflections of this study

II. LITERATURE REVIEW AND THEORY

A. THEORETICAL FRAMEWORK

This study will make use of the convergence theory both on the neoclassical growth model and the technology diffusion. The convergence theory predicts a secular decrease in productivity (capital) growth rate and real interest rate (Barro 1991; Lucas 2000). The study also emphasizes on the demand-supply theory.

Residential housing is a durable good producing service streams that satisfy the basic human need for shelter while simultaneously serving as a store of purchasing power (Zhu, 2003; Barker, 2005). Households have the choice of buying the whole asset (own real estate) or just the service streams it yields (rent). As a result, each real estate property commands two prices; one for the stock of the asset and another for the flow of services it provides over a given period.

Theoretical models of the demand for residential housing emphasize the different margins of substitution involved in the household's optimization problem. In equilibrium (Poterba, 1984; Iacoviello, 2005) the household should be indifferent between owning and renting and between consuming the stream of services from an extra unit of housing, either bought or rented, and an extra unit of the consumption good. In addition, at an optimum, residential housing should have the same marginal rate of return, in terms of contribution to the household's future utility, as the other assets in the household portfolio. This rate of return should equal the marginal rate of substitution between consumption today and in the future.

In the presence of uncertainty, considerations about the relative riskiness of owning versus renting, and of real estate versus other assets enter the household optimization problem (Flavin & Yamashita, 2002; Sinai & Souleles, 2005). The demand for residential housing at the level of individual households is negatively related to the user cost of residential housing and positively related to life-cycle wealth, which includes "initial assets, current income and discounted expected income" (Muellbauer & Murphy, 1997, p. 1709). In deciding on how much housing to own, homeowners choose the amount that equalizes the marginal utility of an additional unit of housing to its marginal user cost. The user cost is the difference between the monetary costs and benefits of home ownership over a period of time. It equals "the sum of after-tax depreciation, repair costs, property taxes, mortgage interest payments, and the opportunity cost of housing equity, minus

the capital gain...on the housing structure” (Poterba, 1984, p. 732).

Most real estate purchases are financed by borrowing, using the value of the property as collateral, or intergenerational transfers. The need for external financing of real estate purchases stems from the fact that the average home price is a multiple of average annual household disposable income and the first-time purchase of a house typically occurs early in the household life-cycle. The importance of external financing in home-ownership decisions makes its characteristics and their changes over time major determinants of the demand for residential housing.

Credit rationing makes the level of initial assets, current income and the mortgage rate relatively more important in determining demand for residential housing than expected future income streams and capital gains. In almost all developed countries there are limits on the proportion of the sale price of a property that can be financed with a mortgage (Blöndal & Girouard, 2001). Prospective homeowners fund the remainder of the sale price (in the form of a down-payment) from their current net equity. In addition, mortgage lenders typically adhere to limits of the ratios between the overall size of the mortgage and/or the size of mortgage installments and the homeowner’s disposable income.

Preferential tax treatment of capital gains from home ownership and tax deductibility of mortgage interest payments are important factors underlying demand for residential housing (Poterba, 1984; ECB, 2003). In most countries tax policies promote homeownership on the premise that it gives rise to positive externalities, such as more active civic involvement and more stable communities with common interests (Leung, 2004).

On the supply side, under perfect competition, the volume of housing construction is determined by the real prices of inputs. In equilibrium, the economic cost of producing an extra unit of housing should equal the price at which it is sold. Therefore, if there are no market imperfections the price of residential housing is fully determined by real construction costs and the real price of land (Hilbers, Lei & Zacho, 2001; Himmelberg, Mayer & Sinai, 2005).

The existence of supply-side rigidities and other market imperfections make real estate prices primarily demand-driven in the short run (more so in large urban areas). In the 20 years through 2005, residential housing prices in developed countries grew, on average, almost twice as fast as the deflator for gross fixed capital formation in housing construction

Zoning regulations, often designed to support property values for current homeowners, and the scarcity of land further limit the supply of residential housing (Case, 2000; Himmelberg, Mayer, and Sinai, 2005). Supply-demand imbalances in the market for real estate manifest themselves in the price of land, on which dwellings are built. Persistent excess demand pressures result in land prices growing faster than the price of structures (Himmelberg, Mayer, and Sinai, 2005).

At the aggregate level, in the face of inelastic supply, the relation between residential housing prices and other economic variables in the short run is given by the inverted aggregate demand function for residential housing. Credit constraints are binding for some but not for other households.

Therefore, the average price of residential housing depends on a mixture of factors that influence the home-ownership decisions of these two segments of the population. Real estate market imperfections open the possibility for housing price bubbles⁴ because the price of owner-occupied housing depends in part on its expected future path. For households not constrained by credit rationing, the expected capital gains on owner-occupied housing lower the user cost of home ownership, encouraging those who already own homes to trade up to bigger houses and creating incentives that bring new entrants in the market. The resulting demand pressures will have an impact on the current price of residential housing, making it prone to deviate from the value implied by fundamentals (Hilbers, Lei, and Zacho, 2001).

B. THEORETICAL MODEL OF THE STUDY

The theoretical model of this study is presented below. The model shows the connection between the variables of measurements; the dependent, independent and control variables.

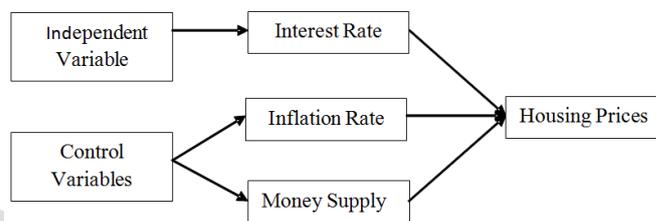


Figure 1: Theoretical Model of the study

C. EMPIRICAL EVIDENCES

Several studies have been conducted on the determinants and relationship between house prices and interest rates across countries (Cho, 2006; Getahun, 2011; Jordà, Schularick & Taylor, 2015; Mayer & Hubbard, 2008; Olanipekun, Alaba & Adegoke, 2015; Otrók & Terrones, 2005; Simo-Kengne, et al., 2013; Zhang, Hua & Zhao, 2012).

Getahun (2011) examined the effect of interest rate on changes in house price in Sweden. The author examined the correlation between interest rate and house price and the multiple regressions to account for changes in house prices. Getahun (2011) also used to examine the pattern of changes in cause-effect relationship in interest rate and house prices. Correlation analysis, multiple regression and distributed lag model were used to achieve the objectives of the study. Interest rate was measured using governmental bond rates, lending rates, mortgage bond rates and rep rates. The authors found that there was an inverse relationship between variables of interest rates and housing price index in Sweden. This indicates that as interest rate increases by one unit, housing price index decreases. Getahun (2011) also revealed that changes in housing price index was attributed to changes in interest rate, inflation, changes in net household disposable income and money supply. The study of Getahun (2011) shows practical implications for home buyers, sellers and investors.

Olanipekun, Alaba and Adegoke (2015) investigated the nexus between lending interest rates in Lagos State area of Nigeria. Data were collected from the Central Intelligent

Agency (CIA) world fact book for a test period of 15 years. Descriptive statistics and inferential statistics were used to analyse data gotten for the variables of measurements in their study. Olanipekun et al. (2015) found that there is a down slide in the trend of lending rate in Nigeria while in the same test period; there was an increasing movement in housing prices. Olanipekun et al. (2015) also revealed that there was a significant negative strong relationship between lending interest rates and house prices in Lagos State area of Nigeria. The implication of the study of Olanipekun et al. (2015) is that monetary author such as the Central Bank of Nigeria should reduce the lending rate to a threshold where housing sector would be profitable for investors.

Zhang, Hua and Zhao (2011) examined the effect of monetary policy i.e. interest rate on housing prices in China. Zhang et al. (2011) adopted the Nonlinear Auto Regressive Moving to examine the effects of broad money supply, real exchange rate and mortgage rate and the extent to which these variables determine housing prices in China. Monthly data was adapted from 1999 Month 1 to 2010 Month 6. Zhang et al. (2011) found that monetary policy variables significantly affect housing prices in China while real economic variables i.e. income were not significant in explaining housing prices in China. Practical implication shows that housing prices formation in China is hinge upon monetary policies and that monetary policies are responsible for the management of asset prices in China.

III. DATA AND METHODS

The longitudinal research survey was used to examine the relationship between interest rates and housing price in Nigeria. Several studies have used the longitudinal research design to examine the relationship between interest rate and housing prices (Cho, 2006; Getahun, 2011; Harris, 1989; Jorda et al., 2015; Kuttner, 2012). The use of longitudinal research design is appropriate for time series data. Occupytheory (2015) stated that the longitudinal research design is helpful to determine patterns. According to the research group, the cause effect relationship between variables and phenomenon can be established using the longitudinal research design. Occupytheory (2015) buttressed that longer periods can be established to have a concise and valid findings.

This study adopted the Positivism paradigm to conduct the research work. The ontology of this paradigm is that the data collected on the variables of measurement will help to examine the reality. This indicates that this study helps to establish the practices of interest rates and housing prices in Nigeria. The findings of this study were true due to the fact that the researcher (I) was objective as I viewed reality from a one-mirror approach. According to Sobh and Perry (2006), the positivism paradigm is suitable for theory testing and that it is valid for the verification of formulated research hypotheses.

Data was collected on variables of housing price, nominal interest rate, inflation and money supply. Data was collected from the National Bureau of Statistics (NBS) and the Central Bank of Nigeria statistical bulletin. Data were collected from 2001 to 2015. The study aims to use quarterly data but if not available, annual data shall be used. The use of large small

size like the quarterly data will help to increase the precision of parameters.

RESEARCH HYPOTHESES

Based on the research questions and the theoretical model presented in chapter two of this study, the formulated research hypotheses of this study are:

H01: There is no relationship between interest rates and housing price in Nigeria.

H02: There is no long run relationship between interest rates and housing price in Nigeria

H03: Changes in interest rate have no impact on changes in housing price in Nigeria.

The test period of this period is 2001 to 2015. The test period covers the period at which the interest rate was not stable and was fluctuating. Importantly, the study could establish the change in variables over time which supports the advantage and assumption of the validity in the use of longitudinal research design. The test period of the study is an improvement of previous test periods of study conducted in China, Sweden, Nigeria and United Kingdom. Olanipekun and Adegoke (2015) used a test period of 15 years in Nigeria from 1996-2010. This study extends to 2015 to also accommodate the changes in interest rate between 2010 and 2015 and how the changes have affected housing prices in Nigeria. Zhang et al. (2011) used a test period from 1999 to 2010 in address interest rate and housing prices in China.

MODEL & VARIABLE SPECIFICATION

The model of the study is adopted from the studies of Getahun (2011). The model is as follows:

$$HP_t = f(IRT, INF_t, M2_t, \epsilon_t) \dots \dots \dots (1)$$

Where HP_t = Housing price

IRT = Nominal interest rate

INF_t = Inflation during period

M2_t = Money supply

ε_t = Error term during period t,

Therefore the model of the study is:

MODEL 1

This model is to establish a multiple regression between interest rate, housing prices and control variables of the study (inflation rate and broad money supply).

$$HP_t = \alpha + \beta_1 IRT + \beta_2 INF_t + \beta_3 M2_t + \epsilon_t \dots \dots \dots (2)$$

Note: the study controlled for inflation rate and money supply

MODEL 2

This model helps to establish the effect of changes in interest rate on changes in housing prices. Thus, the finite distributed lag model was used. This is in line with the study of Hill et al. (2007) and Getahun (2011).

$$Ln(HP)_t = \alpha + \beta_1 IRT + \beta_2 INF_t + \beta_3 M2_t + \epsilon_t \dots \dots \dots (3)$$

MEASUREMENT OF VARIABLES

Housing price was measured using the house price index; interest rate was measured using the lending rate; inflation rate will be measured using the consumer price index and money supply was measured using the broad money as a percentage of gross domestic products.

IV. DATA ANALYSIS TECHNIQUE

Data collected were analysed using regression and correlation analyses. This is in line with the study of Wong (2003) that study nexus between interest rate and housing price in Hong Kong. Cointegration analysis will also be used to establish a long run relationship between interest rates and housing price in Nigeria. The use of cointegration analysis is in line with the study of Kim Hin and Cuervo (1997) that study relationship between lending rate and house prices. According to the study of Getahun (2011), lending rate was also used to proxy interest rate. Wong (2003) adopted the regression and correlation analyses in studying the nexus between interest rates and housing prices in the real estate market in Hong Kong. Multivariate regression analysis was also used in the study of Wong (2003). Using cointegration, Mcgibany and Nourzad (2004) used cointegration to establish the long run effects between mortgage rates and interest rates.

PRELIMINARY TESTS

This section involves the preliminary tests of the study. It involves description of variables using descriptive statistics and examining the stationarity of the variables. For the unit root, both augmented dickey fuller and Phillips-Perron tests were used to ensure consistency of results. Descriptive statistics was done to know the variation and dispersion in variables.

Test	Variables	@ LEVEL	@ 1 ST DIFFERENCE
ADF	HPI	t-stat = -1.81; Prob.= 0.35	t-stat = -3.10; Prob.= 0.05
	INF	t-stat = -2.89; Prob.= 0.07	t-stat = -4.31; Prob.= 0.00
	INT	t-stat = -5.22; Prob.= 0.00	t-stat = -7.00; Prob.= 0.00
	M2	t-stat = -1.93; Prob.= 0.31	t-stat = -3.14; Prob.= 0.04
Phillips-Perron	HPI	t-stat = -1.90; Prob.= 0.31	t-stat = -3.08; Prob.= 0.05
	INF	t-stat = -2.91; Prob.= 0.06	t-stat = -8.75; Prob.= 0.00
	INT	t-stat = -6.17; Prob.= 0.00	t-stat = -17.90; Prob.= 0.00
	M2	t-stat = -1.93; Prob.= 0.31	t-stat = -3.13; Prob.= 0.04

Table 1: Unit root test (Using Augmented Dickey Fuller)

Table 1 shows the unit root of HPI, INF, INT and M2 (Money supply). Using augmented dickey fuller test, it was found that only inflation rate and interest rate were stationary at levels. HPI and M2 were not stationary at levels. The

findings for the ADF test were also the same for the Phillips-Perron test. Both INF and INT were stationary at level at 5% and 1% level of significance respectively. However, other tests such as the Dickey-fuller GLS and Kwiatkowski-Pillips-Schmidt-Shin tests were not used (See Appendix). These two tests confirmed that HPI and M2 were stationary at levels. However, in order to avoid doubt, this study adopts the use of the variables at their first difference. Previous studies such as Feng and Li (2011) have adopted the univariate Markov-switching unit root test in a study of house bubbles in United Kingdom. In almost all results on housing price index (such as Simo-Kengne et al., 2014), the housing price index or real house prices was found not to be stationary at level. Despite the use of ADF, PP, DF-GLS, KPSS, ERS, NP-MZt by Simo-Kengne et al. (2014), all the tests showed that real house prices was stationary at its first difference. Nominal interest rate was however found by the authors to be stationary at level at 10% level of significance. This corroborates with this study as interest rate was stationary at level for both ADF and PP at 1% level of significance.

DESCRIPTIVE STATISTICS

This section presents the descriptive statistics of this study.

	HPI	INF	INT	M2
Mean	2580.153	11.84732	5.501342	23.78636
Median	2358.800	11.57798	8.613594	21.02587
Maximum	6464.000	18.87365	23.83785	43.26613
Minimum	540.4000	5.382224	-42.31018	17.73216
Std. Dev.	1962.387	3.729217	16.25232	7.410746
Skewness	0.884821	0.257145	-1.697613	1.719974
Kurtosis	2.753625	2.453029	6.110940	4.726667
Jarque-Bera	1.995210	0.352294	13.25345	9.259140
Probability	0.368762	0.838495	0.001324	0.009759
Sum	38702.30	177.7098	82.52013	356.7954
Sum Sq. Dev.	53913463	194.6988	3697.929	768.8682
Observations	15	15	15	15

Table 2

TEST OF RESEARCH QUESTIONS

RESEARCH QUESTION 1

What is the relationship between interest rate on Housing prices in Nigeria?

	HPI	INT
HPI	1.00	-0.043
INT	-0.043	1.00

Table 3

Correlation analysis was used to analyse the relationship between interest rate and housing prices in Nigeria. Table 3 shows that there is a weak negative relationship between interest rate and housing prices in Nigeria. Equally, the result denotes that there is an inverse relationship between interest

rate and housing prices in Nigeria. Statistically, given the weak correlation of 0.043, it can be said that 0.43 increase in interest rates lead to a decrease in housing prices in Nigeria and vice versa. This is evidenced in high income areas. For example, despite the increase in interest rate by 2.23% in interest rate in Lagos Island, Nigeria, there was a drop in housing price from 121 to 94 from 2014 to 2015. This also indicates that a decrease in interest rate will result in an increase in housing prices in areas characterized as high income residents or high-tax payment areas. Although, the increase in interest rate resulted in rapid and sharp increase in housing price index in Lagos Mainland-Nigeria were residents can be categorized as average income earners (Rotimi, 2016). The findings of in the table 3 support the study of Levin and Pryce (2009) that a long decline in real interest rate is responsible for a rising house prices in the United States. According to Levin and Pryce (2009), the lack of elastic supply of houses in a declining interest rate has brought about cyclical asymmetries in supply response. This finding in table 3 also supports the study of Kuang and Liu (2015) that a negative relationship was established between interest rate and housing prices among China's 35 major cities.

RESEARCH QUESTION 2

To what extent does interest rate affect Housing prices in Nigeria?

Dependent Variable: D(HPI)
Method: Least Squares
Date: 02/08/17 Time: 22:36
Sample (adjusted): 2002 2015
Included observations: 14 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	120.2331	511.1433	0.235224	0.8180
INT	-5.087805	31.94799	-0.159253	0.8761

R-squared	0.002109	Mean dependent var	98.90714
Adjusted R-squared	-0.081049	S.D. dependent var	1775.185
S.E. of regression	1845.721	Akaike info criterion	18.01069
Sum squared resid	40880249	Schwarz criterion	18.10199
Log likelihood	-124.0748	Hannan-Quinn criter.	18.00224
F-statistic	0.025361	Durbin-Watson stat	1.864832
Prob(F-statistic)	0.876119		

RESEARCH QUESTION 3

Is there a long run relationship between interest rate and Housing prices in Nigeria?

Date: 02/08/17 Time: 22:39
Sample (adjusted): 2003 2015
Included observations: 13 after adjustments
Trend assumption: Linear deterministic trend
Series: HPI INT
Lags interval (in first differences): 1 to 1
Unrestricted Cointegration Rank Test (Trace)

Hypothesized	Trace	0.05	Critical	
No. of CE(s)	Eigenvalue	Statistic	Value	Prob.**
None	0.467627	13.25772	15.49471	0.1057
At most 1 *	0.322547	5.062391	3.841466	0.0244

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

GRANGER CAUSALITY TEST

Pairwise Granger Causality Tests			
Date: 02/10/17 Time: 12:52			
Sample: 2001 2015			
Null Hypothesis	Obs	F-statistic	Probability
DINF does not Granger Cause DHPI	12	3.44936	0.0907
DHPI does not Granger Cause DM2	12	3.59364	0.0844
DINT does not Granger Cause DHPI	12	2.35039	0.0500

Source: EViews Output, 2017.

The results of F statistics received by the Granger Causality test indicate that the explanatory variables are correctly chosen and that there is causality of:

- ✓ interest rates on housing prices index
- ✓ inflation rates on housing prices index
- ✓ housing prices index on money supply

V. EMPIRICAL MODEL

Dependent Variable: D(HPI)
Method: Least Squares
Date: 02/10/17 Time: 00:17
Sample (adjusted): 2002 2015
Included observations: 14 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-117.5531	399.8386	-0.294001	0.7748
D(INT)	-2.517663	20.30529	-0.123990	0.9038
D(M2)	3.593130	72.18233	0.049779	0.9613
D(INF)	-307.4560	103.7824	-2.962506	0.0142

R-squared	0.474110	Mean dependent var	98.90714
Adjusted R-squared	0.316343	S.D. dependent var	1775.185
S.E. of regression	1467.786	Akaike info criterion	17.65585
Sum squared resid	21543960	Schwarz criterion	17.83844
Log likelihood	-119.5910	Hannan-Quinn criter.	17.63895
F-statistic	3.005125	Durbin-Watson stat	1.916912

Prob(F-
statistic) 0.081443

The equation of the model could be written as:

$$D(\text{HPI}) = -117.5531 - 2.5176 * D(\text{INT}) + 3.5931 * D(\text{M2}) - 307.4560 * (\text{INF})$$

Table 6 shows that there is a negative relationship between inflation rate and housing prices in Nigeria. Although, the study of Guo, Wang and Ma (2015) established a positive relationship between inflation rates and housing prices in Nigeria, Guo et al. (2015) stated that the positive nexus between inflation rate and housing prices is in the short term. This means that in the long term, inflation is expected to exhibit a negative relationship on housing prices. This confirms that the relationship between inflation rate and housing prices in Nigeria is in the long term and not the short term. The result of this study contradict that of Kuang and Liu (2015) that established a positive relationship between inflation rate and housing prices in China. According to the authors, they noted that the nexus between inflation rate and housing prices are endogenously determined. Given that the result in the table above exhibits a negative relationship between inflation rate and housing prices (i.e. a proportional change in inflation rate will lead to -307.45 reductions in housing prices), it indicates that housing prices cannot hedge inflation rate in Nigeria and that the finding does not support the theoretical model and submission of Kuang and Liu (2015). Equally, it shows that the relationship between inflation rate and housing prices in Nigeria is symmetric. This practically indicates that policy makers must control for inflation in order to reduce the rising housing prices given that a symmetric pattern exists between the two variables. For house prices to reduce in Nigeria, then policy makers must control for inflation rate in order to reduce the inflationary effects on economic growth. Cho (2006) stated that monetary authorities must control and maintain a housing prices which can be achieved by adjusting the inflation rate to an extent it achieves a target level where interest rate declines and the credit market can be assessable to households. Conclusively, inflation negatively and significantly impact housing prices in Nigeria. Practically, there is no long lasting link between inflation rate and housing prices. Changes in inflation rate will bring about changes in housing prices. That is an increase in inflation changes will bring about a reduction in housing prices index in Nigeria. This practical evidence contradicts the submission of Zhu (2004) that there is a long-lasting nexus between inflation rate and housing price. Zhu (2004) argued that inflation period is meant to increase prices (such as consumer prices, housing and residential property prices). He argued that the prices of building raw materials increase which will reduce housing supply and increase housing prices.

The negative relationship between interest rate and housing prices supports the findings of Kuang and Liu (2015) that also establish a negative relationship between interest rate and housing prices in China. Findings of Iossifov, Cihak and Shanghavi (2008) also shows that interest rate have strong impact on Housing prices among 20 advanced countries. The negative insignificant relationship between interest rates and housing prices also confirms the study of Ong (2013) that interest rate, costs of construction and inflation are not

determinants of housing prices in Malaysia. Ong (2013) however confirmed that gross domestic product, population and real property gains tax are the factors that determine the price of housing in Malaysia. This also confirms the study of Tse (1999) that housing prices rise as a result of imbalance between buyers and sellers.

Bank lending may affect the housing price through various liquidity effects. The housing price is just like the price of any asset. It can be determined by the discounted expected future stream of cash flows. If the financial banks increase the availability of credit, it means that the bank will provide lower lending rates and encourage current and future economic activity. Basically, the better availability of credit will cause the demand for housing to increase when the households are borrowing constrained (Barakova, 2003). The growth in demand will then be reflected in higher housing prices. The relationship between housing prices and household borrowing is two-sided. That is, housing prices may significantly influence household borrowing through various wealth effects. When the housing finance interest rate is low, citizens will be enabled to make some investments, such as buying more houses. The credit cycles have matched the housing price cycles in a number of countries (see e.g. International Monetary Fund, 2000; Bank for International Settlements, 2001). According to Goodhart and Hofmann (2007), mutually reinforcing boom-bust cycles in housing and credit markets may occur, which enhance the probability of a future financial crisis. However, the two researchers cited suggest that the standards of both house prices and credit from their longrun trends are useful indicators for future investors. Moreover, Goodhart and Hofmann (2007) mention three different ways to influence households' credit demand through housing wealth. Firstly, households may be facing borrowing constrictions due to the financial market imperfections. As a result, if the instructors can offer more securities in the house, households will wish to borrow more; in other words, the households borrow basically according to the capacity of their securities' net worth. Since the securities value of housing is quite high, an increase in housing wealth opens up the borrowing constraints faced by households. Second, households' recognized lifetime assets may have a significant influence as a result of changes in housing wealth. An increase in the recognized lifetime assets induces households to spend more today, which will mean smooth consumption over the overall life cycle. Therefore, it will increase the demand for credit. Lastly, the value of bank capital will also have an impact on housing price movements on credit supply. That is, housing estimation increases the value of the dwellings owned by the bank. Besides that, the values of loans are secured by housing loans. Therefore, a fluctuation in the housing price will affect the risk-taking capacity of banks. So, banks are willing to lend more to the public. In the nutshell, for homeowners, focus on changing interest rates because they have a direct influence on real estate prices. However, interest rates also affect the availability of capital and the demand for investment. These capital flows influence the supply and demand for property and, as a result, they affect property prices.

Table 6 also shows that there is a positive relationship between money supply and housing prices in Nigeria. A

proportional unit increase in money supply will bring about 3.59% increases in housing prices in Nigeria. Practically, this indicates that when there is more money in supply, house owners and agents use the opportunity to increase housing prices due to continuous bidding from different households. Kearl (1979) noted that money supply significantly affect housing prices. He argued that when there is an increase in money supply, it causes inflation to increase and thus a rise in housing prices. Kearl (1979) stated that inflation increase brings real payments on a long-term fixed rate which invariably reduces house quantities and thus increases the prices due to imbalance forces between supply and demand. In this situation, supply reduces and demands increases, thus propel high housing prices.

Table 6 shows R-squared, F-statistics, probability of F-statistic and the dur-bin Watson stat. The R-squared shows a value of 0.4741. This indicates that interest rate, inflation rate and money supply explain 47.41% variation in housing prices in Nigeria. Statistically, money supply will positively and significantly affect housing prices while interest rate and inflation rate negatively contribute to housing prices. This indicates that money supply will affect inflation rate which invariably affect interest rate.

After correcting for other variables, the adjusted R-squared showed that interest rate, inflation rate and money supply can explain only 31.63% variation in housing prices in Nigeria. F-statistic showed a value of 3.005 with a probability value of 0.081. This indicates that the model is significant at 10% level of significance and thus valid and can be relied upon. Durbin-watson test has been confirmed and mostly used to determine and test for autocorrelation. According to Stešević (2008: 392), “the Durbin-Watson statistic is a test for first order serial correlation and it measures the linear association between adjacent residuals from a regression model”. The Durbin-watson stat gave a value of 1.86 which is between the threshold of 1 and 3. Based on this value, it indicates that there is no presence or problem of serial correlation or autocorrelation in the model. It equally means that the R-square (Coefficient of determination) is valid given that the housing prices index (dependent variable) is at its first difference. Thom (1983) also confirmed his model of study on house prices, inflation and mortgage market using the durbin-watson. The result in table 6 thus confirms the significance of money supply affecting housing prices. Interest rate and inflation rate negatively affecting housing price index in Nigeria.

DIAGNOSTICS TEST

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.212160	Prob. F(2,8)	0.8132
Obs*R-squared	0.705159	Prob. Chi-Square(2)	0.7029

Table 7

Table 7 presents the Breusch-Godfrey serial correlation LM test. Two statistics were used to determine the results of the LM test; f-statistics and observed R-squared. The LM test is to determine the appropriateness of the empirical model. Table 7 shows that the f-statistics is 0.21216 with probability

value of 0.8132. Given that the probability value is greater than 1%, 5% and 10% level of significance. Equally, the observed R-squared is 0.7051 and the probability is 0.7029. This equally confirms that there is serial correlation test in the model of this study.

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.625065	Prob. F(3,10)	0.6149
Obs*R-squared	2.210721	Prob. Chi-Square(3)	0.5298
Scaled explained SS	3.844865	Prob. Chi-Square(3)	0.2787

Table 8

Table 8 shows the Heteroskedasticity test using Breusch-pagan-Godfrey. The f-statistic, observed R-squared and the scaled explained SS. The F-statistic is 0.62506 given a probability value is 0.6149. The observed R-squared is 2.2107 has a probability value of 0.5298. The scaled explained SS has a t-statistic value of 3.8446 with a probability value of 0.2787. Given that all the probability values are well above 1%, 5% and 10% level of significance, it indicates that that there is no presence of heteroskedasticity in the model of this study. This indicates that the model of the study can be relied upon and used for forest and analysis purposes.

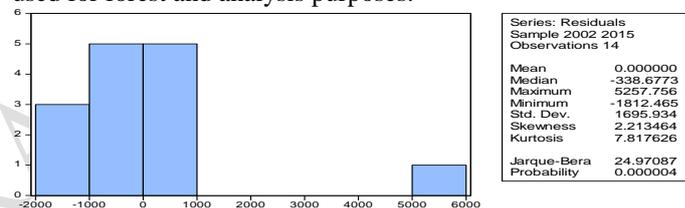


Figure 2: Normality Test

Figure 2 shows the normality test of the empirical model of this study. The mean value is 0.0000. This confirms the normality of the graph and thus the equation of this study. Statistically, the value of mean, median and mode approximately zero indicates that the model is normal. Thus, a normal distribution exists. Equally, figure 2 shows a Jarque-Bera value of 24.97 with a probability value of 0.00 which is significant at 1%, 5% and 10% level of significance. This also confirms the validity of the empirical model of this study. This implies that interest rate and inflation rate negatively affect housing prices in Nigeria. It also indicates that inflation rate statistically affect housing prices while money supply positively affect housing prices in Nigeria.

VI. DISCUSSION AND CONCLUSIONS

Panel data was collected on the variables of interest rate, inflation rate, money supply and housing prices in Nigeria for periods 2005-2015. Several statistical tests were used. It was found that only inflation rate and interest rate were stationary at levels. HPI and M2 were not stationary at levels. The findings for the ADF test were also the same for the Phillips-Perron test. Both INF and INT were stationary at level at 5% and 1% level of significance respectively.

Findings revealed that there is a weak negative relationship between interest rate and housing prices in Nigeria. Equally, the result denotes that there is an inverse

relationship between interest rate and housing prices in Nigeria. The Granger Causality test indicated that there is causality between; interest rates on housing prices index, inflation rates on housing prices index, and housing prices index on money supply. Findings showed there is a negative relationship between inflation rate and housing prices in Nigeria. Although, the study of Guo, Wang and Ma (2015) established a positive relationship between inflation rates and housing prices in Nigeria, Guo et al. (2015) stated that the positive nexus between inflation rate and housing prices is in the short term. The negative relationship between interest rate and housing prices supports the findings of Kuang and Liu (2015) that also establish a negative relationship between interest rate and housing prices in China. It was also revealed that there is a positive relationship between money supply and housing prices in Nigeria. A proportional unit increase in money supply will bring about 3.59% increases in housing prices in Nigeria. Practically, this indicates that when there is more money in supply, house owners and agents use the opportunity to increase housing prices due to continuous bidding from different households.

The R-squared in the model of this study shows a value of 0.4741. This indicates that interest rate, inflation rate and money supply explain 47.41% variation in housing prices in Nigeria. Statistically, money supply will positively and significantly affect housing prices while interest rate and inflation rate negatively contribute to housing prices. This indicates that money supply will affect inflation rate which invariably affect interest rate. The LM test is to determine the appropriateness of the empirical model. The LM test has an f-statistics of 0.21216 with probability value of 0.8132. Given that the probability value is greater than 1%, 5% and 10% level of significance. Equally, the observed R-squared is 0.7051 and the probability is 0.7029. This equally confirms that there is serial correlation test in the model of this study. The Normality test of the empirical model of this study shows a mean value is 0.0000. This confirms the normality of the graph and thus the equation of this study. Statistically, the value of mean, median and mode approximately zero indicates that the model is normal. Thus, a normal distribution exists.

VII. PRACTICAL IMPLICATIONS

The results of this study have some practical implications for relevant stakeholders especially the policy analysts. It has practical implications for the government, the monetary authority, investors in real estate, ministry of housing and the foreign exchange market participants. It is also important for decision on infrastructural developments and the ministry of planning and budgeting. The descriptive statistics of this study established that when interest rate is increasing, housing price index also increases. Naturally, the availability of low interest rate denotes that there would be ripple effect of more spending in the economy. This implies that higher interest rates would restrict housing or real estate investors in providing more housing in Nigeria and which may contribute to the housing or infrastructural deficits in the country. Real estate investors can benefit from buying building materials at lower costs. This study has practical implication for a lower interest rate regime.

Mortgage investors will want to opt for a long term interest rate since as the mortgage loans become affordable, the interest rate bottom out at a very low interest rate even despite the financial crisis that might be ongoing in the country. However, a higher interest rate will raise the average interest on mortgage. That is a percentage increase in interest rate will bring about an additional increase in mortgage over loan duration. This has implication for intending house owners because as the interest rate increase affect mortgage positively, people and the general public are not likely to buy a house. This in the long term may constitute environmental pollution and insecurity in the society as you have many living under bridges and illegal places. The study also has implication for the government and monetary policy authority. Practically, a reduced lending interest rate will bring about a reduced cost of funds and money will flow into the economy system for housing investment. Conversely, an increased interest rate will reduce funds availability. For housing prices index, increase in interest rate will reduce available capital for housing investments and thus would make available houses to be expensive and the housing prices index increasing. Importantly, an increased interest rate regime has positive impact on housing investment capital and cost of capital on housing. This directly affects demand on housing and supply of available funds for real estate purchases and development. This implies that loans are made at lower loan to value ratios, thus reducing leveraged cash flows and property values. These changes in capital flows can also have a direct impact on the supply and demand dynamics for property. The cost of capital and capital availability affect supply by providing additional capital for property development, and also affect the population of potential purchasers seeking deals. These two factors work together to determine property values.

VIII. LIMITATION

One major important limitation of this study is that the study was not able to identify the significant of each of the variables of measurement in this study. The study did not control for other variables that may affect HPI. Although, having a robust data set, time factor and the restriction in word counts could not help this study further in establishing the extent to which M2, INF and INT affect and determine housing price index in Nigeria. Secondly, the estimation done in this study was conducted on Nigeria with insufficient data and observation which can pose a small sample bias on the research process of this study. In addition, the study was limited to descriptive statistics and panel data analyses. Due to the time factor, specific nature of the variables was not done such as industry regression coefficients. Lastly, a more robust result on housing price index was not established. The study only conducted analysis in Nigeria. Analysis should have been based on city-based analysis.

The results of the findings of this study have some recommendations. The result of this study indicates that monetary policy authority should control and management interest rate so that it will not negatively affect mortgage and property prices in the country. It will equally make more funds to be available for real estate and property investors to be able

to make more property and housing available for the people at affordable prices. Real estate's investors should consider the prevailing interest rate in the country and should not embark on a long term property investments where the interest rate will continue to fluctuate and the cost of capital will continue to increase during the life span of the project and will lead to a loss on investment or permanent abandonment of real estate projects.

This study may raise the following future research questions. How is consistency of the result during deflationary periods? Shall the opposite increase in interest rates lead to house price fall? What will be the relationship between mortgage financing and affordability in the forthcoming periods? Alternatively, will it remain consistent for predictable future? Is there any expected risk of house price fall related to changes in interest rates? What is the effect of changes of mortgage rates on household incomes?

REFERENCES

- [1] Baffoe-Bonnie, J. (1998). The dynamic impact of macroeconomic aggregates on housing prices and stock of houses: a national and regional analysis. *The Journal of Real Estate Finance and Economics*, 17(2), 179-197.
- [2] Basten, C., & Koch, C. (2015). BIS Working Papers.
- [3] Cho, D. (2006). Interest rate, inflation, and housing price: With an emphasis on Chonse price in Korea. In *Monetary Policy with Very Low Inflation in the Pacific Rim*, NBER-EASE, Volume 15 (pp. 341-370). University of Chicago Press.
- [4] Cooper, A. (2004). The impact of interest rates and the housing market on the UK economy. *Economic Outlook*, 28(2), 10-18.
- [5] Dorfman, J. (2015). Rising Interest Rates Won't Be Good for Commodity Prices, But It Won't Be Too Bad Either. *Farmdoc Daily*, 5(5): 230.
- [6] Fuster, A., & Zafar, B. (2015). The sensitivity of housing demand to financing conditions: Evidence from a survey.
- [7] Getahun, H. D. (2011). The effect of interest rates on housing prices in Sweden: The case of one and two dwelling buildings.
- [8] Glaeser, E. L., Gottlieb, J. D., & Gyourko, J. (2012). Can cheap credit explain the housing boom?. In *Housing and the Financial Crisis* (pp. 301-359). University of Chicago Press.
- [9] Harris, J. C. (1989). The effect of real rates of interest on housing prices. *The Journal of Real Estate Finance and Economics*, 2(1), 47-60.
- [10] Hizmo, A., & Kung, E. (2013). The Causal Effects of Credit Supply on Housing Prices.
- [11] Jarocinski, M., & Smets, F. (2008). House prices and the stance of monetary policy.
- [12] Jordà, Ò., Schularick, M., & Taylor, A. M. (2015). Interest rates and house prices: Pill or poison?. *FRBSF Economic Letter*, 25.
- [13] Kau, J. B., & Keenan, D. (1980). The theory of housing and interest rates. *Journal of Financial and Quantitative Analysis*, 15(04), 833-847.
- [14] King, R. G., & Watson, M. W. (1996). Money, prices, interest rates and the business cycle. *The Review of Economics and Statistics*, 35-53.
- [15] Kuang, W., & Liu, P. (2015). Inflation and house prices: Theory and evidence from 35 major cities in China. *International Real Estate Review*, 18(2), 217-240.
- [16] Kuttner, K. N. (2012). Low interest rates and housing bubbles: still no smoking gun. *The Role of Central Banks in Financial Stability: How Has It Changed*.
- [17] La Cava, G. D. (2016). Housing prices, mortgage interest rates and the rising share of capital income in the United States.
- [18] Levin, E. J., & Pryce, G. (2009). What determines the responsiveness of housing supply? *The Role of Real Interest Rates and Cyclical Asymmetries*, Centre for Public Policy for Regions Discussion Paper, (20).
- [19] Martin, R. F. (2005). The baby boom: predictability in house prices and interest rates.
- [20] Mayer, C., & Hubbard, R. G. (2008). House prices, interest rates, and the mortgage market meltdown. draft, Columbia Business School, New York.
- [21] Maza, L., & Pages, J. (2007). Analysis of house prices in Spain. In Working Paper No. 0307. Bank of Spain Spain.
- [22] McQuinn, K., & O'Reilly, G. (2008). Assessing the role of income and interest rates in determining house prices. *Economic modelling*, 25(3), 377-390.
- [23] Olanipekun, T., Alaba, O. J., & Adegoke. (2015). Effects of interest rate on housing prices in Lagos Metropolis. *American Journal of Business, Economics and Management*, 3(6), 384-394.
- [24] Otrok, C., & Terrones, M. E. (2005). House prices, interest rates and macroeconomic fluctuations: international evidence. *International Monetary Fund*, mimeo.
- [25] Reichert, A. K. (1990). The impact of interest rates, income, and employment upon regional housing prices. *The Journal of Real Estate Finance and Economics*, 3(4), 373-391.
- [26] Schwab, R. M. (1983). Real and nominal interest rates and the demand for housing. *Journal of Urban Economics*, 13(2), 181-195.
- [27] Simo-Kengne, B. D., Balcilar, M., Gupta, R., & Reid, M., & Aye, G. C. (2013). Is the relationship between monetary policy and house prices asymmetric across bull and bear markets in South Africa? Evidence from a Markova-switching vector autoregressive model.
- [28] Sommer, K., Sullivan, P., & Verbrugge, R. (2013). The equilibrium effect of fundamentals on house prices and rents. *Journal of Monetary Economics*, 60(7), 854-870.
- [29] Thom, D. R. (1983). House prices inflation and the mortgage market. *Economic and Social Review*, 15(1), 57-68.
- [30] Tse, R.Y.C, Ho, C.W. and Gansesan, S. (1999). Matching housing supply and demand: An empirical study of Hong Kong's market. *Journal of Construction management and Economics*, 17, 625-633.
- [31] Yun Joe Wong, T., Man Eddie Hui, C., & Seabrooke, W. (2003). The impact of interest rates upon housing prices: an empirical study of Hong Kong's market. *Property Management*, 21(2), 153-170.

[32]Zhang, Y., Hua, X., & Zhao, L. (2012). Exploring determinants of housing prices: A case study of Chinese

experience in 1999–2010. *Economic Modelling*, 29(6), 2349-2361.

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