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Monetary Policy and Asset Prices: Empirical Evidence from Nigeria

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Abstract

Besides providing enhanced macroeconomic and financial stability, a commitment to optimum monetary policy conduct in a developing economy like Nigeria could better deliver greater long-run stability of both internal and external macroeconomic factors. The need for an ordered monetary policy regime that considers financial assets in its formulation and execution forms the basis for this study. Using the empirical methodology of vector autoregression (VAR), this study sought to determine the effects of monetary policy on asset prices in Nigeria. Quarterly data covering eleven-year period (1990 to 2010) were employed in the analyses.

The principal conclusion of this paper is that monetary policy responds weakly to asset price fluctuations in Nigeria and that the effects of such response take long periods in manifesting. Moreover, monetary policy is actually destabilizing in its effect on real asset prices in Nigeria.

Therefore, the study recommends that monetary authorities adopt flexible inflation targeting as part of a broad reform package that includes improved financial regulation and fiscal reform. This is because changes in the monetary regime alone, without support from the regulatory and fiscal arms of government, are not

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likely to sufficiently address asset price fluctuations in Nigeria and, perhaps, in other developing economies.

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1 Introduction

The basic instruments of monetary policy are the control of aggregate supply of money and the regulation of the level of interest rates in an economy. The issue of monetary policy and its management is vested in the Central Bank, whose objective is to regulate a nation's economic activities and control the level of inflation to ensure economic growth and a stable macroeconomic environment. According to Otmar (2009), Central Banks should maintain price stability by keeping inflation low and stable; and price stability is normally specified in terms of stabilizing the index of consumer prices in one form or another; while money supply is undermined by increases in consumer prices.

In Nigeria, like in most developing countries, there exist acute structural supply constraints that limit the expansion of output even in the face of high demand. Such structural rigidities, according to Todaro and Smith (2009, p. 755), imply that 'any increase in the demand for goods and services generated by rapid money creation will not be matched by increases in supply'. The resultant effect is that such excess demand pushes prices up and leads to inflation. Thus, the assumed direct linkage between lower interest rates, higher investments and expanded outputs may not always exist. Specifically, higher interest rates would probably affect individuals' and institutions' demand for financial assets and credit, with higher interest rates tending to increase asset prices and inhibit credit growth. With conventional monetary policy exerting very little direct influence on developing nation's economic activity and with the level of inflation, what optimum monetary policy options should the Central Bank of Nigeria (CBN) put in place to ensure long-run stability of macroeconomic factors particularly with respect to financial asset prices in the Nigerian economy? In specific terms, what relationship exists between the monetary variable, interest rate, and assets (stocks and real estate) prices? And what implication does the interrelationships between interest rates and asset prices have for monetary policy in Nigeria?

The objective of this paper, therefore, is to examine the relationship between monetary policy and financial and real asset prices in Nigeria. Specifically, the paper seeks to evaluate the causal relationships between the monetary policy variable, interest rate, and financial/real assets' (stocks and real estate) prices, as well as to proffer optimum monetary policy options for the Central Bank of Nigeria (CBN) to ensure stability in the financial and real assets market.

The rest of the paper is organized as follows: section two focuses on the review of related literature, section three deals with the methodology of the study, section four addresses the empirical analysis while the conclusion and recommendations are contained in section five.

2 Literature Review

The 2007-2009 financial crises have reignited the longstanding debate on the appropriate response to asset prices and financial conditions more broadly. Leijonhufvud (2007) argued that central banks' neglect of asset price inflation is dangerous, on the grounds that expansionary monetary policy can create asset price inflation even as prices of goods and services remain stable. A small but growing empirical literature takes a positive perspective and attempts to estimate the monetary policy response to stock market fluctuations. Thus, Campbell and Ammer (1993) decomposed the variance of stock prices into components attributable to interest rates, dividends, and the equity premium, and found that interest rate fluctuations contributed only three percent of the variance. Bernanke & Kuttner (2005) looked specifically at the response of stock prices to unanticipated changes in the federal funds rate in the U.S. Their main finding was that a 100 basis point surprise rate increase would lead to a stock market decline of roughly five percent. This suggests that while monetary policy does have a quantitatively meaningful impact on the stock market, an extended campaign of rate hikes would be required to dampen a sustained, double-digit increase in equity prices like that experienced in the four years leading up to the recent crisis.

More recent contributions argue that previous studies fail to find a significant interaction between monetary policy and asset prices because they do not properly consider the simultaneous interdependence between interest rates and asset prices. This is so in Rigobon and Sack (2003) in a VAR identified through heteroscedasticity; in Castelnuovo and Nistic`o (2010) in an estimated dynamic stochastic general equilibrium (DSGE) model where monetary policy is allowed to respond to fluctuations in the stock market; in Bjornland and Leitemo (2009) in a VAR identified using a combination of short-run and long-run restrictions; and also in Chadha, Sarno, and Valente (2004) in a Taylor-rule estimation with GMM where the authors carefully check the quality of the instruments and use an adjusted labor share as the appropriate, and theoretically grounded, proxy for the output gap. These studies argue that the size of the estimated response is compatible with statements made by central bank officials. Therefore, the estimated response would not reflect an attempt to target asset prices, but just an indirect response to the impact that asset prices have on aggregate demand, in particular on consumption and investment decisions.

Given the role played by the real estate market in the 2007–09 crises, it is not surprising that a large number of recent papers have sought to document a relationship between interest rates and property prices. In a descriptive analysis,

Ahearne et al. (2005) suggests that low interest rates do tend to precede housing price peaks, with a lead of approximately one to three years. Using a vector autoregression (VAR) that included interest rates, credit and money, Goodhart & Hofmann (2008) uncovered a "significant multidirectional link" between these variables and property prices, although the direction of causality was unclear. Focusing more narrowly on the impact of the federal funds rate, Dokko et al. (2009) found that deviations from the Taylor rule explained only a small portion of the pre-crisis rise in property prices. Jaroci´nski & Smets (2008) reached similar conclusions using a Bayesian VAR. Using a dynamic factor model as an alternative to the VAR method, Del Negro & Otrok (2007) attributed a relatively small amount of variance to the aggregate national factor, suggesting a small role for interest rates. And Campbell et al. (2009) found that interest rate fluctuations contributed very little to changes in real estate prices. Finally, Glaeser et al. (2010) employed a user-cost model of house prices, and concluded that only a small portion of the pre-2007 rise in real estate prices was due to low interest rates.

Bernanke and Getler (2001) argued that in the context of short-term monetary policy management, central banks should view price stability and financial stability as highly complementary and mutually consistent objectives, to be pursued within a unified policy framework. In particular, Bernanke and Getler (2001) believe that the best policy framework for attaining both objectives is a regime of flexible inflation targeting, either of the implicit form practiced in countries such as United States or of the more explicit and transparent type that has been adopted in many other countries.

The other possible source of non-fundamental movements in asset prices which has received much attention is irrational behavior by investors, that is, herd behavior - excessive optimism, or short-termism. There is of course a large literature in finance on bubbles, fads, and the like. This literature has gained a measure of credence because of the great difficulty of explaining the observed level of financial volatility by models based solely on economic fundamentals (see for example the recent survey by Campbell et al, 2009).

3 Methodology

Discerning the impact of monetary policy on stock and property prices is not an easy task, in part because asset prices depend heavily on unobserved factors, such as risk premium and expectations. A convenient pattern of considering this relationship for a country is to rely on an economic model or framework such as that of Bernanke and Getler (1999) otherwise known as the BG model. The core of the BG analysis is based on what has become the canonical New Keynesian (NK) macro model with the usual spending ("IS") equation, a dynamic aggregate supply relationship, and a policy rule specifying the central bank's reaction to expected inflation and output. Because asset prices do not appear explicitly in the standard NK model, Bernanke and Gertler augment the model with wealth and

"financial accelerator" effects. These provide channels through which asset market booms and busts could affect aggregate spending: the former by affecting consumption spending, the latter by influencing the cost of external funds through collateral values.

Kurtner (2011) noted that in the BG framework, promoting financial stability has nothing to do with the prevention or attenuation of asset price bubbles, which are exogenous and unaffected by interest rates. Instead, the role of monetary policy is to mitigate bubbles' impact on aggregate demand: appropriately calibrated rate hikes will limit the expansionary effects of asset price rises, while rate cuts will cushion the blow when prices fall. This would be the appropriate policy response to any demand shock, of course. What turns this into a model of financial stability is the inclusion of the financial accelerator, which provides the primary mechanism through which asset prices affect aggregate demand. In this evaluation therefore, the basis of the inter linkages between interest rate and asset prices is manifested.

3.1 The Model

VAR models are the most frequently used tool to measure the interactions between macroeconomic variables. As we are interested in interest rates, stock and real estate prices, the structure of the simplest VAR is the following:

$$A\begin{bmatrix} i_t \\ s_t \\ h_t \end{bmatrix} = C(L)\begin{bmatrix} i_{t-i} \\ s_{t-i} \\ h_{t-i} \end{bmatrix} + B\begin{bmatrix} \varepsilon_t \\ \eta_t \\ \vartheta_t \end{bmatrix},$$

where i_t is the interest rate, s_t is stock returns, h_t is the index of real estate prices, A is a 3 × 3 matrix that describes contemporaneous relationships among the variables, $c(L)$ is a finite-order lag polynomial, and ε_t, η_t and ϑ_t are structural disturbances. B is a 3 × 3 matrix in which non-zero off-diagonal elements allow some shocks to affect both endogenous variables.

The usual assumption to achieve identification in this kind of model is to impose a triangular form to matrix A (Cholesky decomposition) and a diagonal structure to matrix B. In this way the model is exactly identified. However, a triangular matrix A implies that one of the three variables does not react contemporaneously to the others. In the model, it is assumed that innovations in real estate prices do not react contemporaneously to shocks in both interest rate and stock returns. In the application also, each shock to one of the interest rate or stock returns has an immediate effect on the other in the financial markets. According to Furlanetto (2011), realizations of interest rates and asset value can be seen as the intersection between two schedules. The first is the reaction function of asset prices to changes in the interest rate (supposed to be downward sloping because an increase in the interest rate lowers the discounted value of future value of the asset). The second

is the reaction of the interest rate to the evolution of the asset value. In this study, we aim at estimating the slopes of both schedules.

In order to analyze the impact of unanticipated shocks on the macro variables in a more convenient and comprehensive way, Sims (1980) proposed the use of impulse response functions (IRFs) and forecast error variance decompositions (FEVDs). The IRFs trace the reaction of all the variables in the VAR system to innovations in one of the variables and therefore can be used to analyze the effects of structural innovations. FEVDs represent the decomposition of forecast error variances and therefore give estimates of the contributions of distinct innovations to the variances. Thus, they can be interpreted as showing the portion of variance in the prediction for each variable in the system that is attributable to its own innovations and to shocks to other variables in the system. With these estimation tools we would be able to observe the effect or behaviour of monetary policy when output vacillates and when prices are overshooting.

4 Data Analyses

In this section, we perform the analysis that forms the basis for the empirical evaluation of the study. This is done through the presentation and analysis of the estimated results based on the model specified in the preceding section. The first set of analyses involves the estimation of the relationship between asset prices and monetary policy with the use of the vector autoregressive (VAR) methodology. In order to conduct a comprehensive VAR analysis, preliminary unit roots tests are performed on the data. In the procedure for VAR analysis, we begin with the causality tests with respect to the cause-effect relationship that exists among the pertinent variables - stock prices, real estate indices and interest rates using Nigerian quarterly data for a eleven-year period, 1990 to 2010.

4.1 Unit Roots Test

The results of the Augmented Dickey Fuller (ADF) unit roots tests are presented in levels and first difference. This enables us determine in, comparative terms, the unit root among the time series and also to obtain more robust results. Table 1 presents results of ADF test. The result indicates that all of the variables have ADF values that are less than the 95 percent critical ADF value of -2.9006 (in absolute values). The implication of this is that the time series for these variables are non stationary in their levels.

Table 1: Unit Root Test for Variables in Levels

Variable	ADF Test Statistic		95% Critical ADF Value
	Levels	First Difference	
I	-2.4695	-4.5047	-2.9006
S	-2.7448	-6.4539	-2.9006
H	-0.0337	-11.928	-2.9006

Source: *Result extracted from the EViews 7.0 outputs, September, 2012.*

Furthermore, we take the first difference of the respective variables and perform the unit root test on each of the resultant time series. The rationale behind this procedure is that Box and Jenkins (1976) have argued that differencing non stationary time series will make it attain stationarity. From the result shown in Table 1, it is seen that the ADF test statistic for each of the variables is greater than the 95 percent critical ADF values (in absolute terms). This implies that the variables are actually difference-stationary, attaining stationarity after the first difference of the variables. Thus, we would accept the hypothesis that the variables possess unit roots. Indeed, the variables are integrated of order one, I(1).

4.2 Granger Causality Tests

The results of the Granger causality tests are reported in Table 2 below. As is generally the case, the F-test is conducted on the null hypotheses in order to determine the direction of causality between each pair of variables. The rejection of each of the null hypothesis is based on the significance of the F-value for the particular relationship. Only two hypotheses pass the significance test in the result. The null hypothesis that interest rate does not Granger-cause stock prices can be rejected at the 5 percent level. This result shows that interest rate or monetary policy has a significant role in predicting stock price movement in Nigeria. But the null hypothesis that interest rate does not Granger-cause real estate asset prices cannot be rejected, suggesting that monetary policy is rather weak in predicting real estate prices in Nigeria.

The other significant relationship is that between real estate prices and stock prices. The null hypothesis of real estate prices Granger-causing stock prices cannot be rejected; hence, changes in real asset prices seem to determine the pattern of movement of stock prices in Nigeria.

Table 2: Causality Test Results

Direction of Causality	*F*-statistics
S → I	**0.788**
I → S	**3.263***
H → I	**1.428**
I → H	**0.106**
H → S	**3.896***
S → H	**0.270**

***Source**: Result extracted from the EViews 7.0 outputs, September, 2012.*

***F*-statistic significant at the 5% level.

4.3 Impulse Response Functions

In order to further conduct the dynamic analysis of the capital market development model, the Impulse Response Functions (IRFs) are examined. Results are presented in the form of the dynamic impulse responses of the variables in the VAR (I, S, H) to an increase in each relevant variable equivalent to the sample standard deviation. The results of the responses of the asset price variables to changes in monetary policy for a ten-quarter period are presented in Figure 1 below. These charts are designed to provide a visual presentation of the dynamic effects of shocks to the system.

The second and third panels in the chart show the responses of interest rate to shocks to the asset prices. In the initial panel, interest rate seems to drop on impact with the stock price shock. After about 9 quarters, interest rate returns to its normal path. The amplitude of the interest rate response is however very small; this shows that interest rate responds only minimally to shocks from stock prices and it takes a long period before the response is absorbed. The next panel indicates that interest rate also falls on impact with real asset price shock, but the fall is not as severe as that of stock prices. It takes approximately the same length of time for the adjustment to be completed.

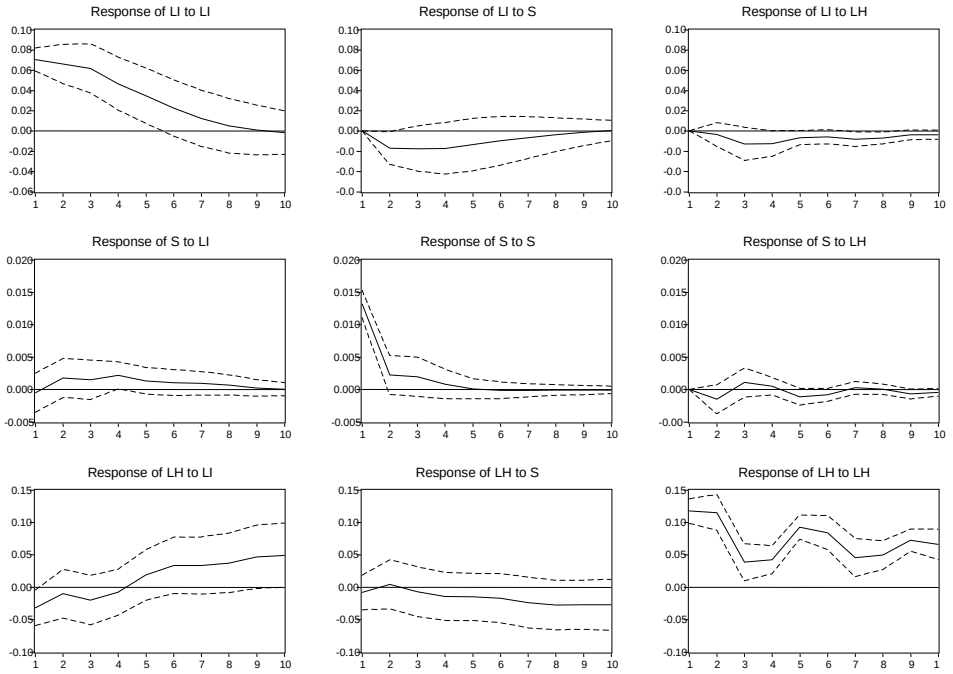

Figure 1: Impulse responses of the variables

In the fourth and seventh panels, the responses of stock prices and real asset prices to shock in interest rate are respectively presented. In the stock market panel, it is seen that after the initial rise in stock prices following the shock to interest rate, the stock price tend to stabilize around the ninth quarter which corresponds to the length of the stock price influence on interest rate. The response of real estate price to interest rate is however clearly destabilizing as shown in the chart. The price immediately falls on impact with interest rate shock, and then it begins to rise and never returns to its normal path. This suggests that monetary policy does not effectively affect real asset prices in Nigeria; rather it tends to intensify any volatility in prices over time.

4.4 Forecast Error Variance Decomposition (FEVD)

The other series of analysis in the VAR methodology is the Forecast Error Variance Decomposition (FEVD). Here we determine the percentage of variances in each endogenous variable that is determined by the other variables. This can help provide the amount of influence the endogenous factors exert on each other. The FEVD results are reported in Table 3 below. The error decomposition of interest rate shows that through the 10-quarter period of the analysis, interest rate variations were mostly explained by itself and, after some time, by the stock prices. The contribution of stock prices reached 6.3 percent in the eighth and tenth

quarters, but the contributions of real estate prices were very low throughout the period. Apparently, monetary policy conduct through changes in interest rate is not usually motivated by asset price motives. In other words, monetary policy does not effectively react to asset prices changes in Nigeria.

In the variance decomposition of stock prices, a large proportion of the variations are explained by its own changes while very slight proportions are determined by interest rate. The role of interest rate changes in stock price variation reaches about 7 percent in the tenth quarter. This proportion is rather weak and small, suggesting that monetary policy targeting of stock has not been effective in Nigeria. Similarly, variances in real estate prices are initially largely self-determined. The proportion of its self determination drops over time while the proportion of interest rate effect expands. Indeed, over 13 percent of variations in real asset prices are due to variations in interest in the tenth quarter. This indicates that monetary policy tends to contribute to real asset estate price changes in Nigeria in the long run. As shown in the impulse responses, this contribution is more destabilizing.

Table 3: Orthogonalized Forecast Error Variance Decomposition in the VAR

Quarter	**I**	**S**	**H**
Variance decomposition of interest rate			
1	100	0	0
4	92.73	5.283	1.983
8	90.90	6.351	2.748
10	90.76	6.349	2.887
Variance decomposition of stock prices			
1	0.139	99.86	0
4	5.255	92.89	1.852
8	7.174	90.02	2.808
10	7.177	89.69	3.133
Variance decomposition of real estate prices			
1	6.712	0.439	92.85
4	4.816	1.054	94.13
8	9.581	3.743	86.68
10	13.30	4.939	81.26

Source: *Result extracted from the EViews 7.0 outputs, September, 2012.*

5 Conclusion

The principal conclusions of this paper may be stated briefly, that monetary policy responds weakly to asset price fluctuations in Nigeria and that the effects of such responses take long periods in manifesting. Moreover, monetary policy is actually destabilizing in its effect on real asset estate prices in Nigeria. Since the goal of monetary policy in Nigeria is primarily inflation management, the results obtained are quite contrary to expectations. Flexible inflation targeting provides an effective, unified framework for achieving both general macroeconomic stability and financial stability. The question then is 'is it necessary or desirable for monetary policy to respond to changes in asset prices at all times? Bernanke and Gertler (2000) have noted that this may not be so, especially 'given a strong commitment to stabilizing expected inflation except to the extent that they help to forecast inflationary or deflationary pressures.' This study therefore suggests that, *where possible,* the monetary authorities adopt flexible inflation targeting as part of a broad reform package that includes improved financial regulation and fiscal reform. The recommendation on conduct of monetary policy in the context of fiscal reforms is very important, especially in a country like Nigeria were fiscal dominance has been a recurrent issue in macroeconomic policy directions. Change in the monetary regime alone, without support from the regulatory and fiscal arms of government, is not likely to be sufficient. This is particularly so in Nigeria were the credit and financial systems are not quite deep. Moreover, we recognize that successful implementation of inflation targeting requires both ample political support from the government and a certain amount of institutional development, for example, the existence of adequate price indices.

Finally, it should be noted that, along with providing enhanced macroeconomic and financial stability, a commitment to optimum monetary policy conduct in a developing economy, like Nigeria, could well deliver greater long-run stability of the both internal and external macroeconomic factors. Much of the stabilizing effect of proper monetary policy arises because investors expect the central bank to raise interest rates when rising asset prices threaten to overheat the economy, and vice versa if declining asset prices threaten to induce an economic contraction. From the standpoint of maintaining both macroeconomic and financial stability in the future, the desirability of increased transparency in Nigeria's monetary policymaking is an issue deserving of close attention in CBN planning.

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