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Examining the Derivatives Market Response Under Monetary Policy Regimes: Empirical Evidence from Nigeria

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Abstract

The study examines the response of the derivative market under the monetary policy regimes in Nigeria, Markov-Switching VAR (MS-VAR) approach was employed. The period of investigation spanned 1990q1 to 2023q4. Findings from the study suggest that the internal factors within the financial system have a much greater impact on interest rates than external factors such as inflation, exchange rates or real gross domestic product in the first regime. In the second regime, results suggest that interest rate shocks significantly impact the consumer price index (CPI, or inflation) and the forward exchange rate (FEXR, a proxy for the derivatives market) in the short term, but its effect on RGDP is negligible. This suggests that inflation and forward exchange rates are primarily influenced by changes in monetary policy stance. Suggesting that regulatory agencies minimize their interventions in the market during crises and allow market forces to stabilize fluctuations. This is because such interventions tend to reduce volatility in the short term, without producing lasting effects.

Keywords: Markov switching, Interest rate, Exchange rate

Introduction

Monetary policy is a macroeconomic tool commonly used by central banks and other leading financial institutions to normalize the amount and velocity of money in an economy, which effectively affects interest rates. A reduction in the amount of money available also raises the risk premium required to pay investors for retaining hazardous assets because it signals a slowdown in economic activity and may have an impact on the dynamics of unemployment Bernanke and Kuttner

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(2005). Financial markets and monetary policy are inextricably intertwined. In order to implement monetary policy, central banks affect financial market prices both directly and indirectly. Markets naturally pay great consideration to the words and actions of central banks since the goal of financial market players is to benefit from the purchase and sale of assets. However, there is no one-way interaction between financial markets and monetary policy. Financial market pricing reflects market participants' predictions for future monetary and economic developments. These expectations, in turn, provide central banks with crucial data that aids in their decision making on future monetary policy.

The effect of monetary policy on stock market fluctuations has been thoroughly studied in the context of industrialized economies. Chen & Clements (2007), Farka (2009), Konrad (2009), Lobo (2002), Bomfim (2003), Vahamaa and Aijo (2011), and Chatziantoniou, Duffy, and Filis (2013) are a few examples. There is broad agreement in the literature that central banks' monetary policy actions can affect stock market volatility. Numerous studies have shown that stock returns and volatility respond differently to monetary policy. Asymmetries pertaining to shocks were studied by Lobo (2000), and Zare, Azali and Habibullah (2013).) in relation to stock returns. However, there is no scientific proof to validate the notion that volatility in stock market responds asymmetrically to monetary policy during bull and down-market periods. Numerous studies have already noted that stock markets in emerging nations provide an accurate picture of the financial health of an economy. As a result, each nation has a number of measures to encourage the flow of private wealth from abroad through portfolio investments.

Over the years, several African nations have experienced ongoing economic difficulties that have been made worse by numerous changes in macroeconomic and monetary policy. This calls into question whether monetary policy is having the intended effect on the economy, especially when it comes to the financial market. Views regarding the efficacy of monetary policy vary widely. Monetarists contend that economic activity is significantly impacted by monetary policy, because abrupt shifts in the money supply directly disturb output and growth. In particular, they think that the apex bank must unexpectedly expand the money supply in order to stimulate economic growth (Adeolu, Sunday and Abike, 2012). Despite the literature's discussion of the connection between the two variables, finding a coherent empirical framework that can account for this relationship across various economies and monetary regimes continues to be a difficulty (Laopodis, 2013).

Notably, Sesan, Adenijia, Obansa, David, and Okoroafor,(2018) used the ARDL and EGARCH models to find a robust, positive correlation between fluctuations in Nigeria's stock market prices and monetary policy shocks. They found that whereas money supply (M1) was only significant in the short term, interest rates were important in both medium and long term for explaining stock market price volatility among the monetary policy variables taken into consideration.

While enforcing monetary policy, the central bank must keep a careful eye on financial markets, according to economists and financial professionals. It is clear that monetary policy needs suitable transmission channels to accomplish its objectives of price stability and welfare enhancement. Without a question, financial markets offer essential conduits for the efficient dissemination of monetary policy (Bangura, 2011). The lack of a standard examination of the connection between the two variables is a substantial research gap that demands attention given the increasing attention of emerging markets and developing nations in the global financial system. This could be the missing piece in understanding why monetary policy occasionally falls short of its primary objectives. Thus, analyzing the derivative market's reaction to monetary policy positions is crucial.

Review of the Literature

According to Okigbo (2008), monetary policy is a collection of actions meant to controlling economic factors surrounding credit and the money supply. For the majority of apex bank, the main goal of monetary policy is to ensure price stability, with associated objectives including stable economic growth and full employment, as well as stable long-term interest and exchange rates. Central banks acknowledge the need for trade-offs and the existence of tensions between these goals as they pursue them. This mechanism, which is usually characterized by lengthy, fluctuating, and unclear time lags, describes the economic impact of monetary policy, especially the price level (ECB, 2023). According to this study, monetary policy is a collection of measures taken by a nation's central bank to regulate interest rates and the money supply in order to eventually accomplish more general economic goals like price stability, keeping inflation rates low and steady, fostering economic stability by keeping the economy as a whole stable, and guaranteeing stable exchange rates with other currencies.

The monetary policy is directed to stabilize the prices. Similar to other countries, the central bank in Nigeria has a duty to take care of other macroeconomic objectives, to attain the objectives, the financial markets play a role in a chain reaction between the financial markets and the monetary check-in in other words, financial markets are the avenue, through which the monetary policy acts on the real economy. The monetary policy affects financial markets in many ways. However, monetary policy's channel of transmission to financial markets and, ultimately, to the actual economy originates only from the monetary policy instrument. The "world" long-term interest rate has become increasingly important in determining the financial situation of emerging markets (Ems). As a result of established countries' monetary policies pushing it lower (Sobrun and Turner, 2015). A monetary policy tool is usually a financial market price that is directly set or strictly regulated by the central bank. Brunnermeier and Pedersen (2009) model postulate that initial losses may cause a "liquidity spiral" that includes forced sells, prices that diverge from fundamentals, additional margin calls, and funding problems for traders. In a similar circumstance, a negative monetary policy shock (a decline in interest rates) might have the same immediate repercussions as a devaluation of the native currency. On the other hand, if limited funding constraints make speculators buy the home currency in large quantities. Another closely related mechanism is that during times of crisis, market participants may find it more difficult to profit from price deviations from fundamental pricing due to huge bid-ask spreads. Burnside, Eichenbaum, Kleshechlski, and Rebelo (2006) state that order flow's effect on buy-sell spreads in foreign exchange markets might make it unprofitable to profit from departures from UIP in comparison to the risk assumed. According to Hui, Genberg, and Chung (2009), the crisis upset the tight connection between interest rate variations among nations covered by interest parity and the futures market of foreign currencies. This shows that the processes connecting interest rates and exchange rates act differently during a crisis, even if it is impossible to say whether this enhances or weakens the efficacy of monetary policy. Bachelier (1900) is credited with conducting the first formal research of stock market efficiency based on theory. His research on commodity pricing in France provided persuasive evidence that commodity speculation is a fair game, with a commodity's present price equal to its projected future price based on history and current prices. His research indicated the existence of cyclical patterns while also confirming the soundness of the fair game theory for stock prices fluctuations. Neither practitioners nor scholars took notice of this effort. Working (1934) conducted a third independent investigation on commodities prices using a less stringent version of

the random walk model. Suggesting the effectiveness of speculative markets. In 1937, the Cowles Commission for Research and Economics put up a proposal that appeared to contradict the random walk theory (Cowles & Jones, 1937). The bulk of technical market analysts' intuition was confirmed by this study, which revealed that stock prices follow predictable tendencies.

The results largely reversed when it was revealed that many of the original statistical approaches were invalidated. Price averages are used by the researchers spanning periods of interest (Cowles, 1960). However, it appears that for a long time, the Commission study deterred additional research on the efficiency of the US despite the occurrence of market volatility. The literature differentiates the pure expectations hypothesis (PEH) which is that (a) the yield term premia, (b) the forward term premia and (c) there is no extra return expected on long-term bond as opposed to short-term bonds. In Norwegian PEH the long-term bonds expected excess returns were zero relative to the short-term bonds and the expected returns of one-period (short-term) bond and n-period (long-term) bonds were the same.

$$\left(1 + Y_t^{(1)}\right) = E_t^P\left[1 + R_{t\to t+1}^{(n)}\right] = \left(1 + Y_t^{(n)}\right) \cdot E_t^P\left[(1 + Y_{t+1}^{n-1})^{-n+1}\right] \quad (1)$$

A second variant of the PEH, which compares one-period and n-period bonds' n-period expected returns have zero yield term premia:

$$(1 + Y_t^{(n)})^n = E_t^P\left[\left(1 + Y_t^{(1)}\right)\left(1 + Y_{t+1}^{(1)}\right) \ldots \ldots (1 + Y_{t+n-1}^{(1)}\right] \quad (2)$$

The forward term premia are zero in a third version of the PEH, which compares the present forward rate for that future period with the anticipated future one-period spot rate:

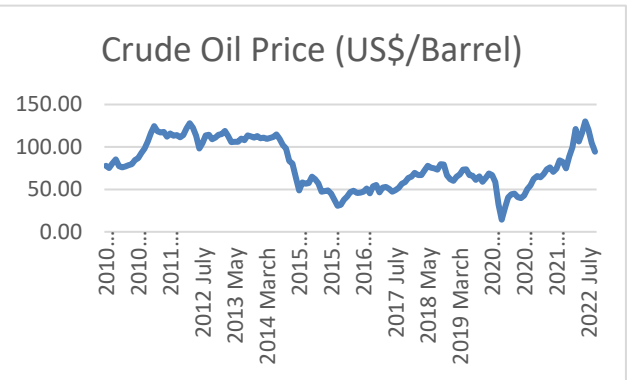
$$1 + \mathrm{F}_t^{(n-1,n)} = \frac{(1 + Y_t^{(n)})^n}{(1 + Y_t^{(n-1)})^{n-1}} = E_t^P\left[1 + Y_{t+n-1}^{(1)}\right] \quad (3)$$

The PEH's final form compares the return on an n-period bond to that on an on-one-period bond and a n ¡ one-period bond:

$$(1 + Y_t^{(n)})^n = \left(1 + Y_t^{(1)}\right)E_t^P\left[(1 + Y_{t+1}^{(n-1)})^{n-1}\right] \quad (4)$$

Despite describing distinct versions of the PEH, the aforementioned terms are not interchangeable. It can be demonstrated that, assuming the aforementioned formulas hold true for every t and n, equation (1) (2) is equivalent to (2), (3), (4) implies (2) (therefore (4)), but the opposite is not true unless we make the additional assumption that $(1 + Y_{t+j}^{(1)})_{j=1}^{\infty}$ are uncorrelated, thus equations (1) and (4) are incompatible as, generally speaking, the expected value of a random variable's inverse is not equal to its expected value.

Theoretical and empirical studies have shown that financial time series, such as stock market data, exhibit certain common characteristics, often referred to as stylized facts. Oil is a major source of energy for Nigeria and the rest of the world. Nigeria's economy depends heavily on oil and it has a big influence on the country's political and economic future. Oil prices dropped sharply between 2014 and 2015, ending a four-year run of comparatively stable prices. The past episodes of sharp declines in oil price over the years coincided with significant changes in inflation and activity. Due to circumstances that put significant downward pricing pressure, the total drop in oil prices between 2014 and 2015 was the third greatest in the previous 30 years (since oil started trading on futures exchanges). These revisions were neither exceptional nor unusually big, despite the fact that shifts in supply and demand expectations were a significant factor, they did however, occur at the same time as three other key developments: a substantial change in policy of OPEC goals, unexpected geopolitical risk spillovers, and a notable growth in the US dollar's value. The trends of transactions in the bonds market is shown in figure 1.



Empirical literature

Many studies have examined the connection between monetary policy stance and the stock market. Using the TGARCH-M model, Mishra and Rahman (2010) investigated the characteristics of return volatility in the stock markets of Japan and India. Results indicate that Japan's stock market is comparatively more efficient than India's. Additionally, there is proof that the returns on the Indian and Japanese stock markets are asymmetrically affected by both positive and negative news. The stock market seems to be more affected by positive news in India, whereas bad news appears to have a greater impact on the stock market in Japan. It was also clear that volatility persisted in both markets. Similarly, Using the well-known pooled mean group (PMG) technique, Zare et al. (2013) examined the asymmetric response of stock market volatility to monetary policy throughout bull and bear market periods in ASEAN5 countries (Malaysia, Indonesia, Singapore, the Philippines, and Thailand). The rule-based non-parametric method and Markov-switching models are used to distinguish bull and bear markets. Using monthly data from 1991:1 to 2011:12, the findings demonstrate that, in line with the predictions of finance constraints models, Interest rate hikes, or bear markets as opposed to bull ones, the volatility of the stock market is more affected over the long run by contractionary monetary policy.

Yoshino Taghizadeh-Hesary, Hassanzadeh, and Danu Prasetyo, (2014), analyzed the reaction of the Tehran stock markets to exogenous shocks in the monetary policy direction which is introduced into the system using a vector error correction model over the period 1998Q1-2013Q2.He has explained how monetary policy can influence the prices of stock markets in a number of ways. According to Bjornland and Leitemo (2009), the stock market responds by depreciating when monetary policy rises the FED funds rate. Chen (2007) also noted the impact of monetary policy. Their conclusions indicate that when monetary policy is loosened exogenously, stock values rise steadily. They contend that a natural response of stock prices to changes in monetary policy can explain the evidence of variance decomposition. In a related study, Atis & Deniz (2018) examined how both bull and bear markets, Turkey's stock market volatility and returns reacted asymmetrically to monetary policy, between 2002:1 and 2016:12. The Markov switching model was used to determine whether markets were bull and bear. It employed the policy rate as a tool for monetary policy. The empirical findings led to the conclusion that bull market times are when monetary policy works best. Using a two-stage methodology,

Tchereni & Mpini (2020) investigated how Stock markets in emerging nations, particularly South Africa, were impacted by monetary policy decisions. The study's findings indicate that monetary policy shocks are responsible for 5.2% of the Johannesburg Stock Exchange's (JSE) volatility.

Once more, Si, Zhao, and Xiao-Lin, (2021) looked at the dynamic volatility connectivity between sectoral markets and various forms of policy uncertainty in China in both the temporal and occurrence domains. Applying the link between time and frequency, the study found that, primarily over medium and long periods, there is a very high level of connectivity between china's policy uncertainty and sectoral stock markets. In particular, monetary policy uncertainty has the lowest impact on spillovers out of the four policy concerns. The impact of institutions on industrialization in Nigeria has been the subject of very few researches. Lawal, Russell, Babajide, and Nwanji, (2018) investigated how the Nigerian stock market was affected by the volatility of the interconnections between fiscal and monetary policy as well as how these interactions affected stock market behavior, the study used the ARDL and EGARCH models to analyses monthly data. The All Share Index and monetary-fiscal policies have a long-term link, according to the ARDL data, the volatility estimates' findings demonstrate that the ASI's volatility is significantly influenced by the volatility of the two policy instruments' interactions. Osakwe and Chukwunulu (2019) investigated how Nigerian stock market performance was impacted by monetary policy. The OLS regression methodology was the statistical method used, and the time period covered was 1986 to 2015. The findings demonstrated that Changes in the money supply and exchange rate have a significant positive influence on stock market price movement, while interest rates have a very small negative impact. Overall, suggesting that 94% of changes in Nigeria's stock market performance are heavily impacted by monetary policy variables. According to the study, monetary policy has a significant impact on stock market performance, suggesting that it can be utilized to regulate stock market activity in Nigeria (Aliyu, 2021).

By analyzing how Nigeria's monetary policy stance has affected the derivatives market, this research adds to the body of empirical knowledge already in existence. The limited evaluation of the derivative market's reaction to various monetary policy regimes is a significant weakness in earlier empirical research on Nigeria. Therefore, by investigating the derivative market response under monetary policy regimes in Nigeria, this study adds to the body of previous work. According to the models of

financial limitations, monetary policy works better during bad markets than during bull ones. These models suggest that borrowers may act as though they are financially constrained when information in the financial markets is asymmetric (Chen, 2007; Mumtaz & Smith, 2019). One obvious gap in earlier research is that studies on developed and emerging economies have mostly concentrated on the stock market, neglecting other financial market sectors to examine how monetary policy dynamics impact market volatility. Therefore, this study is unique in that it examines the financial market (derivatives market) in connection with the dynamics of monetary policy in Nigeria.

Methodology

The study's time frame is 1990 Q1–2023 Q4. The Central Bank of Nigeria (CBN) Annual Reports and the Nigeria Stock Exchange (NSE), the World Bank, International Financial Statistics (IFS), and the National Bureau of Statistics (NBS) were among the pertinent secondary sources from which time series data with numerical values for the variables under study were obtained. Theory-based Markov-Switching (MS) autoregressive time series models developed by Hamilton (1989) have emerged as a strong substitute for encapsulating unique business cycle features. Consequently, Models that transition between regimes have been used in an increasing amount of empirical research to explain the asymmetries and nonlinearities found in different macroeconomic variables (Goodwin, 1993; Boldin, 1996; Krolzig, 1996; Krolzig & Toro, 2000; Kim, Nelson, and Startz, 1998). The Markov Switching model's basic assumption is that the dependent variable's departures from its mean follow a p-th order autoregressive process:

$$\Delta y_t - \mu(s_t) = \alpha_1(\Delta y_{t-1} - \mu(s_t-1)) + \ldots, \alpha_2(\Delta y_{t-p} - \mu(s_t-p)) + \varepsilon_t \quad \ldots\ldots(5)$$

A latent variable determines the process mean st, whereas the errors εt are considered to have a mean constant variance and be independently and identically distributed. Given that the dependence suggests that distinct regimes correspond to distinct conditional distributions of yt. The business cycle's current state is reflected in the latent variable st. Model (5)'s autoregressive parameters may depend on the Markov chain's state st:

$$\Delta y_t - c(s_t) = \alpha_1(s_t)\Delta y_{t-1} + \ldots + \alpha_p(s_t) + \varepsilon_t \quad \ldots\ldots(6)$$

Regime 1 is classified as a recessionary economy and can be depicted as:

$$\Delta y_t - c_1(s_t) = \alpha_{11}\Delta y_{t-1} + \ldots + \alpha_{p1}\Delta y_{t-p} + \varepsilon_t \quad \ldots\ldots(7)$$

Regime 2 is classified as an economy in expansion and can be represented as:

$$\Delta y_t - c_2(s_t) = \alpha_{12}\Delta y_{t-1} + \ldots + \alpha_{p2}\Delta y_{t-p} + \varepsilon_t \quad (8)$$

Specifically, an irreducible transition matrix and an ergodic M-state markov process are assumed for st. But when it comes to explaining stock market performance, fixed or constant transition probabilities are too constrictive. Therefore, According to Filardo (1994) and Diebold et al. (1999), time-varying transition probabilities are possible by an extension of Hamilton (1989). The time-varying transition probability in the Markov Switching model is superior to fixed transition probabilities as it provides more flexibility. In order to capture more complicated temporal persistence and for the predicted length to vary over time, it can, for example, identify systematic variations in transition probabilities prior to and following turning points. The time-varying volatility that is a crucial feature of financial markets can be captured by the applied Markov model since it takes into account variations in volatility across regimes. In this framework, Filardo's (1994) model is incorporated.

$$P_{ij,t} = P_r[R_t = j/R_t = i, Z_{t-1} = \frac{exp(\lambda_{i,j,0} + Z'_{t-1}\lambda_{i,j,1})}{1 + exp(\lambda_{i,j,0} + Z'_{t-1}\lambda_{i,j,1})} \quad (9)$$

To look into how the stock market is affected by shocks to the price of oil is governed by two distinct regimes, with switches between them based on a probability process, the study modifies Filardo's (1994) time-varying probabilities.

$$\text{Regime 1: } P_r[R_t = 1/R_{t-1} = 1] = \frac{\exp(\lambda_{10} + \sum_{j=1}^{n} Z'_{t-1}\lambda_{1j})}{1 + \exp(\lambda_{10} + \sum_{j=1}^{n} Z'_{t-1}\lambda_{1j})} \quad (10)$$

$$\text{Regime 2: } P_r[R_t = 2/R_{t-1} = 2] = \frac{\exp(\lambda_{20} + \sum_{j=1}^{n} Z'_{t-1}\lambda_{2j})}{1 + \exp(\lambda_{20} + \sum_{j=1}^{n} Z''_{t-1}\lambda_{2j})} \quad (11)$$

Where, $P_r[R_t = 1/R_{t-1} = 1]$ is the probability of remaining in low stock performance regime, considering that the former administration is distinguished by a low and high stock performance and $P_r[R_t = 2/R_{t-1} = 2]$ represents the probability of high stock performance regime preceded by a low and high stock performance the model of the study is specified as:

$$FEXRATE = \alpha^{\circ}_{0,Rt} + \beta^{\circ}_{1,Rt} IR_{t-1} + \beta^{\circ}_{2,Rt} RGDP_{t-1} + \beta^{\circ}_{3,Rt} CPI_{t-1} + \varepsilon_{t,Rt} \quad \text{..... (12)}$$

Where: $RGDP = Real\ Gross\ Domestic\ Product, ASI_{t-1} = All\ Share\ Index\ (stock\ market\ index), IR_{t-1} = Interest\ Rate, CPI = Consumer\ Price\ Index, FEXRATE = Futures\ Exchange\ Rate, R_t = Regime\ at\ time\ t,\ \varepsilon_t = Residual\ vect$

Result and Discussion

Table 1: Descriptive statistics

Variable	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probability
FEXRTE	158.4973	146.2230	371.5764	18.58980	101.1799	0.291659	1.892393	8.357612	0.015317
INTR	15.56273	99.84167	30.23000	7.598570	57.55625	0.000729	2.086669	4.448939	0.108125
CPI	36.5921	31.3900	72.9400	14.3600	13.6186	0.67260	2.55418	10.7110	0.00472
RGDP	6,260,372	10,608.48	20,670,113	5,395.864	8,178,243	0.571960	1.400814	2,061,838	0.000033

Sources: Authors' Computations

Table 2 displays the autoregressive model of Markov switching vectors in regime 1. The result shows that the lag of CPI has significant effect on CPI, likewise the lag of FEXR significantly impacts FEXR. Also, the lag of INTR and RGDP has significant effect on INTR and RGDP respectively all in regime 1. In regime 2, the lag of CPI has no significant effect on CPI, but the lag of FEXR has significant effect on FEXR. Just like regime1, the lags of INTR and RGDP have significant effects on INTR and RGDP respectively.

The descriptive statistics presented in table 1 reveal considerable variations across all variables, as indicated by the substantial differences between the minimum and maximum values, with the exception of INTR, which exhibits less variation. The study employed skewness, kurtosis, and Jarque-Bera tests to assess the normality of the data series. The skewness test shows that all variables are positively skewed, with INTR being the least skewed. This suggests that the data for INTR has a longer tail in the negative direction. The kurtosis analysis indicates that all variables are leptokurtic, highlighting the asymmetry in their distributions. The Jarque-Bera statistic, which is a comprehensive normality test, reinforces the previous results, indicating that the null hypothesis of normality can be rejected for all variables, as the test statistic for each variable deviate significantly from zero. The mean values for most variables exceed their standard deviations, except for INTR and REALGDP, which suggests that most observations are close to the mean, with INTR and

REALGDP being exceptions. It's crucial to remember that the descriptive statistics provide a historical perspective on the behavior of the time series data, and therefore, the information obtained should not be used to make general inferences.

Table 2: VAR Estimation

Regime 1

Variable	CPI	FEXR	INTR	RGDP
CPI (coef)	0.262581***	0.375262	-0.014881	0.046182
CPI (stderr)	0.153983*	0.043337	-0.161681	-0.224782
FEXR (coef)	-0.041863**	0.391158***	0.001677	-0.004361
FEXR (stderr)	0.031743*	0.208872**	-0.000214	-0.020603
INTR (coef)	0.051606*	-0.061819	0.323189***	-0.011543
INTR (stderr)	-0.032324	-0.275913**	-0.118747*	0.026638
RGDP (coef)	-0.002722	-0.156163	0.045714	-0.073087
RGDP (stderr)	-0.033858	-0.002014	-0.017448	-0.752017***

Regime 2

Variable	CPI	FEXR	INTR	RGDP
CPI (coef)	-3.159804	-2.519616	71.74235**	1106.027***
CPI (stderr)	-0.570384	-24.66424**	-17.04320***	-148.4795***
FEXR (coef)	0.081138	-2.563169***	-2.756429***	-30.55493***
FEXR (stderr)	0.088086	-3.996308***	-3.634708***	-34.32110***
INTR (coef)	5.331868	138.0227	-1.971605	-836.4971
INTR (stderr)	-1.939105	-38.58255	7.487112	266.8764*
RGDP (coef)	-0.003302	-0.103276	-0.013277	-0.059333
RGDP (stderr)	-0.087956	-2.059346	0.084164	13.41199

Transition Matrix Parameters

Parameter	Coefficient	Std. Error	z-Statistic	Probability
P11-C	3.348095	0.509115	6.576303	0.0000
P21-C	0.015510	0.701880	0.022098	0.9824

Model Diagnostics

Statistic	Value
Determinant Residual Covariance	0.000754
Log Likelihood	895.4074
Akaike Information Criterion	-13.04652
Schwarz Criterion	-11.23640
Number of Coefficients	80

Source: Author's computation

Transition Probabilities

The constant Markov transition probabilities for sample is presented below.

Note that P(i,k) $= P(s(t)) = k|s(t_{-1} = i)$

Where row = i and column = k

$$P_{ij} = \begin{bmatrix} P_{11} & P_{12} \\ P_{21} & P_{22} \end{bmatrix} = \begin{bmatrix} 0.966042 & 0.033958 \\ 0.503877 & 0.496123 \end{bmatrix}$$

Hence $P_{11} = 0.966042, and\ P_{22} = 0.496123. Where;\ P_{11} + P_{12} = 1, P_{21} + P_{22} = 1$

Constant expected durations:

	1	2
	29.44848	1.984610

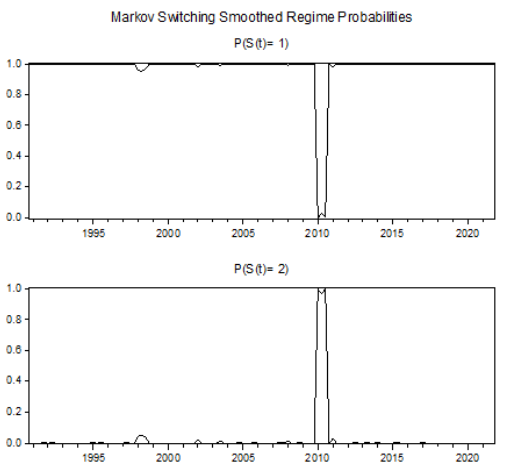
Source: Author's computation

In the above transition matrix, under the current state of 1, there also exists a 96.6 percent chance of being in state 1 or remaining in state 1 (i.e. no transition) and 3.4 percent chance of transitioning to state 2. Alternatively, given the fact that the current state is 2, there is a 50.4 percent chance of moving to state 1 and 49.6 percent chance that the state will remain 2. Constant expected durations means the anticipated time in each of the states before the state is converted to the other state. If the current state is 1, the expected duration is 29.45 units of time, while if the current state is 2, the expected duration is 1.98 units of time. Overall, the summary suggests that the Markov process tends to remain in state 1 for longer periods of time and that changes from one state to another are relatively infrequent compared to switches between states two and one.

Regime Smoothed Probabilities

The regime smoothed probabilities represent the probability of being in a specific state (State 1 or State 2) at a given time point, based on data and the estimated variables of the regime-switching model. The probability of being in State 1 is almost close to 1 for all the years except for 2010 when it drops to 0. The probability of being in State 2 is very low, close to 0, for most of the time period, except for a notable increase around 2010. In general, the probability of being in State 1 is always much higher than the probability of being in State 2. This indicates that the data is well explained by a regime-switching model with two states, where State 1 is the dominant state and State 2 represents a rare occurrence.

Figure 1

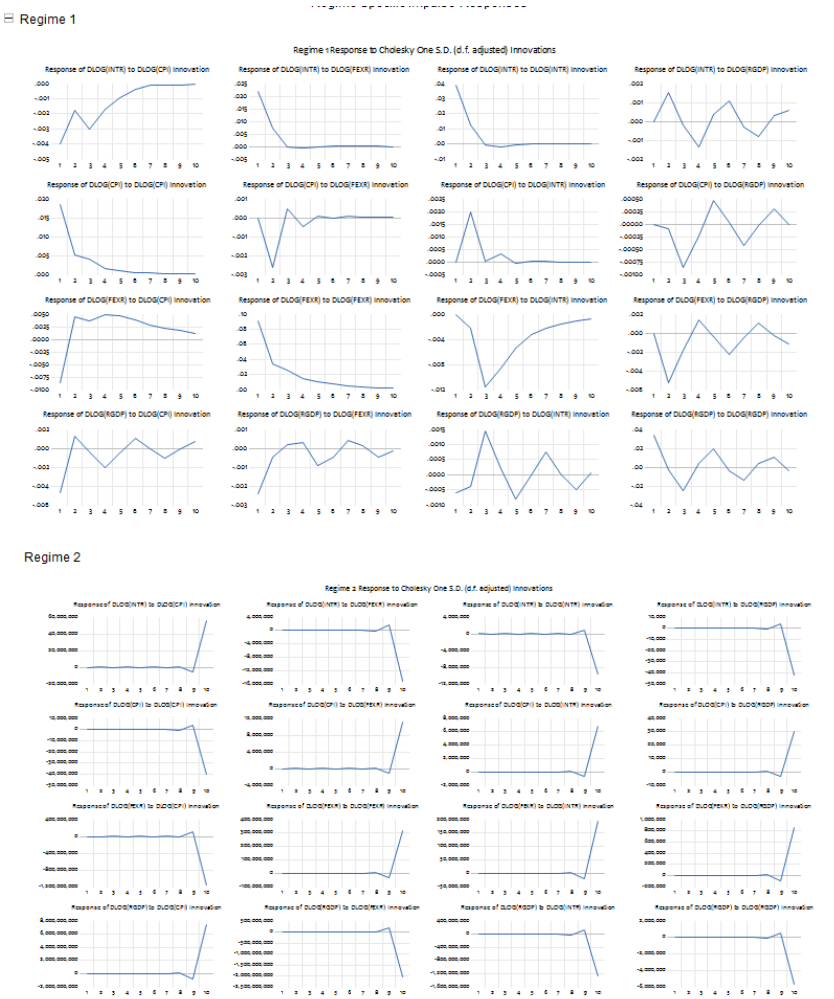


Variance Decomposition

An endogenous variable's fluctuation is broken down into its constituent shocks to the VAR via variance decomposition. The proportionate impact of every arbitrary invention on the variables in the VAR is thus shown by the variance decomposition. Based on the ordering with other variables, the variance of INTR is broken down into several components using the Cholesky decomposition method. For Regime 1, as evidence in figure 2, INTR explains the majority of its own variance, with percentages ranging from 74.80% to 74.09%. This means that most of the variation in interest rates is due to internal factors within the financial system. The other variables, such as CPI, FEXR, and RGDP, explain a much smaller proportion of INTR's variance. For example, in period 1, CPI explains only 0.80% of the variance in INTR, while FEXR explains 24.39% of the variance. However, over time, the contribution of these external factors to INTR's variance decreases, while INTR's own contribution remains relatively constant. Overall, the results suggest that the internal factors within the financial system have a much greater impact on interest rates than external factors such as inflation, exchange rates, or economic growth.

For Regime 2, as evidence in figure 2, the shock in INTR explains 74.8% of the variance in the variable INTR itself. It also explains 0.807364% of the variance in CPI, 24.4% of the variance in FEXR, and 0% of the variance in RGDP. In period 2, the shock in INTR explains only 0.38% of the variance in INTR itself, while explaining 95.1% of the variance in CPI, 4.5% of the variance in FEXR, and a negligible % of the variance in RGDP. As we move further in time, the percentage of variance explained by the shock in INTR for each variable tends to decrease. This suggests that the shock's effects wear off over time. Overall, the output suggests that a shock in INTR has a substantial impact on the variable's CPI and FEXR in the short term, but its effect on RGDP is negligible. Investors and policymakers may find this information helpful in understanding the possible effects of interest rate changes on the financial markets and the economy.

Figure 2



Diagnostic Checks

Stability Test

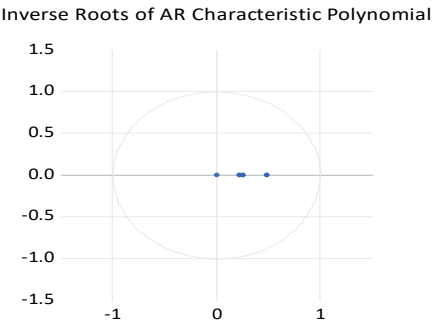
Root	Modulus
0.489592	0.489592
0.261365	0.261365

0.227821	0.227821
0.000210	0.000210

Source: Author's computation

The unit circle contains all of the roots. The stability criteria are met by VAR.

Figure 3



From the graph as shown in figure 3, all units lie within the circle as such stability condition is satisfied. Therefore, the VAR model is stable.

Table 3: SERIAL CORRELATION

Lags	Q-Stat	Prob.*	Adj Q-Stat	Prob.*	Df
1	2.284671	----	2.302948	----	----
2	12.85905	0.6830	13.04788	0.6693	16

Source: Author's computation

** Only lags greater than the VAR lag order are suitable for the test. For the (approximate) chi-square distribution, df stands for degrees of freedom.*

From the table 3 above, probability is greater than 0.5 and the rule states that if probability is less than 0.5 there is serial correlation and if probability is greater than 0.5 there is no serial correlation. Therefore, in this case since probability is greater than 0.5 there is no case of serial correlation.

Discussion of Findings

In keeping with this paper's goal of analyzing how the derivative market, a segment of the financial market, reacts to Changes in Monetary Policy regimes, the study examined how the derivative market responded to changes in monetary policy regimes using the Markov Switching Vector Autoregressive framework. The findings demonstrated that while INTR has a little impact on RGDP, it has a considerable short-term impact on the variable's CPI and FEXR. This study covered this facet of the financial sector, which is uncommon.

Its outcomes indicate that, interest rate shocks have a significant influence on Consumer Price Index (CPI, or inflation) and Forward Exchange Rate (FEXR, a proxy of the derivatives market). This suggests that inflation and forward exchange rates are primarily influenced by changes in monetary policy, with this relationship further reinforced through various monetary policy transmission channels. Historically, the Central Bank of Nigeria (CBN) has focused on the interest rate channel to implement its monetary policy. However, to enhance the overall effectiveness of monetary policy on the financial market's well-being, other transmission channels must also be leveraged. Given the transmission mechanism results, there is a clear need for financial innovation to strengthen the financial market, a crucial sector for driving economic growth. Previous studies on this note include Atis & Deniz (2018). However, it goes against the results of the study that showed that interest rates had a poor response to inflation and the production gap by Yoshino et al. (2014).

Conclusion and Recommendations

This paper evaluated the reaction of the derivative market as one of the wider financial market with respect to the alteration in the stance of monetary policy applying the Markov Switching Vector Autoregressive during the period 1990Q1 to 2023Q4. The financial market information is crucial to the participant in the financial market as well as to the central bank. While market players use the information to determine stock prices and manage their portfolios, the apex bank is curious as to whether monetary policy decisions are disseminated throughout the financial system. The idea that Stock values are the same.to the anticipated present value of future net cash flow serves as the foundation for the evidence. Because of this, monetary policy that is expansionary either boosts future cash flows or lowers

the discount factors used to capitalize those cash flows which results in a positive connection between stock values and the policy. Therefore, the results of this analysis indicate that INTR has a small impact on RGDP but a large short-term impact on the variables CPI and FEXR (a proxy for the derivatives market). Again, the findings showed that all two regimes of the MS GARCH of the Nigeria's stock market have strong volatility reaction to past negative return slow unconditional volatility and low volatility process persistence are characteristics of the first regime. On the other hand, high unconditional volatility and high volatility process persistence are characteristics of the second regime. Based on these findings, it is recommended that regulatory agencies minimize their interventions in the market during crises and allow market forces to stabilize fluctuations. This is because such interventions tend to reduce volatility in the short term, without producing lasting effects.

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