# THE ROLE OF MONETARY POLICY IN MITIGATING FINANCIAL MARKET VOLATILITY IN NIGERIA

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## Abstract

*This study investigated the role of monetary policy in mitigating financial market volatility using monthly data from January 1990 to December 2022 and adopted the Exponential Generalized Autoregressive Conditional Heteroscedasticity (EGARCH) model. The study categorized the financial market into the capital market and the money market. Utilizing the Johansen cointegration method, the study found a long-run relationship between the variables. Based on the EGARCH results, it was determined that monetary policy, represented by money supply and the monetary policy rate, has a negative correlation with the capital market and a positive correlation with the money market. These findings indicate that monetary policy does not mitigate volatility in the capital market but rather affects the money market. Furthermore, the study revealed that monetary policy can either increase or decrease financial market volatility. Consequently, the study recommends that monetary authorities exercise caution in the indiscriminate application of policy instruments, as substantial evidence suggests that the use of monetary policy tools significantly impacts the performance of financial markets.*

**Keywords**: Financial markets, Capital market, Money market, Monetary policy, Volatility, EGARCH.

**Jel Classification:** E52, E58, G12, G14

## 1. Introduction

A financial market is a place where people buy and sell financial securities. These securities include various assets like stocks bonds, raw materials, & precious metals. We often call these in the financial market. The financial market plays a key role in capitalist economies. It helps with resource allocation and creates liquidity for businesses and entrepreneurs. This means that it makes it easier for buyers & sellers to trade their financial assets. Moreover, financial markets draw in investment funds, which then go to companies, allowing them to fund their activities & seek growth opportunities. Usually, we divide financial markets into capital markets and money markets. Capital markets deal with long-term financing, while money markets focus on short-term financing. Money markets allow firms to get short-term loans quickly. On the other hand, capital markets help corporations secure long-term funding needed for growth (Hayes, Smith and Schmitt, 2024). Volatility refers to the degree of variation in the price of an asset over a specified timeframe. It plays a vital role in financial markets, influencing both the risk and potential returns associated with investments. Volatility can be perceived as a double-edged sword; it offers traders opportunities for profit while simultaneously posing the risk of substantial losses. Various factors contribute to volatility, including shifts in economic conditions, political developments, and changes in investor sentiment. When volatility is high, prices tend to change rapidly, whereas low volatility indicates a more stable price environment.

Money markets are places where short-term funds are lent and borrowed, and where securities with maturities of one year or less are traded. These markets offer safe and liquid investment options for those with funds, like banks and investors, while providing low-cost funding for borrowers such as banks and corporations. They mainly serve the short-term needs of large fund users, including governments and businesses. Money markets help connects those who have capital with those who need it, and they also help spread risks across different debt products. In Nigeria, the money market includes the interbank funds market and short-term securities market, involving institutions like the Central Bank of Nigeria and Deposit Money Banks. In contrast, capital markets focus on long-term financing for investments in assets that last longer. They play a crucial role in strengthening corporate finances and enhancing the overall stability of the financial system. A strong capital market is essential for economic growth, as it facilitates the formation of long-term capital. Without a well-developed capital market, financial resources may not be fully utilized, while a robust capital market can attract foreign investment for local industries. Capital markets mainly consist of stock and debt markets.

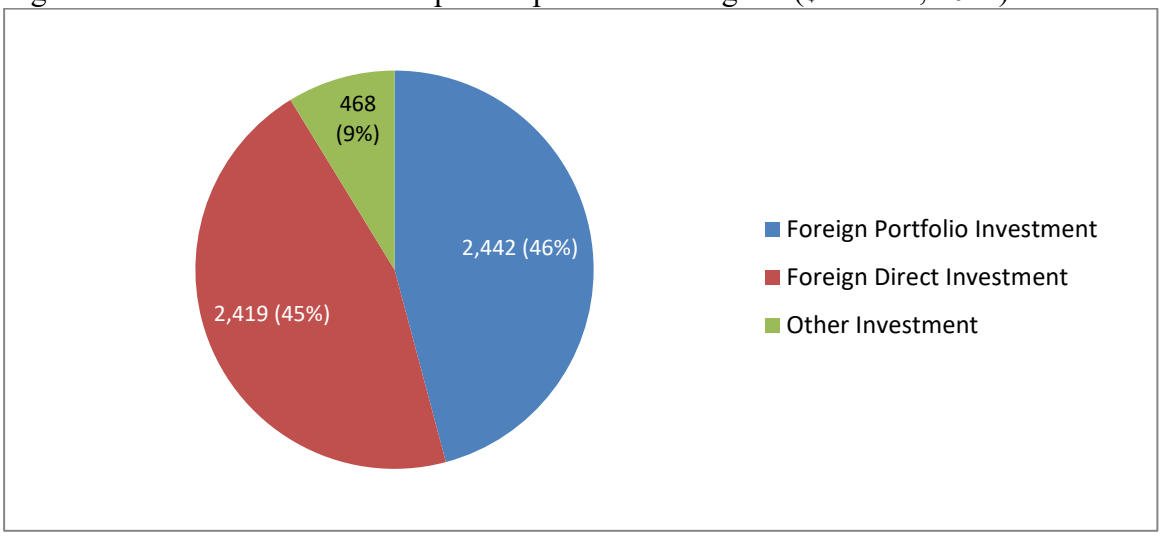
A well-functioning capitalist economy is significantly dependent on financial markets. These markets are crucial for the allocation of resources and the provision of liquidity to businesses. They facilitate the flow of investments and savings, thereby generating additional capital to enhance the production of goods and services. Furthermore, financial markets cater to the requirements of borrowers, investors, and the overall economy. They encompass various categories, including stock markets, over-the-counter markets, bond markets, money markets, derivatives markets, futures markets, and foreign exchange markets. In essence, financial markets act as specialized platforms that link those with surplus funds (savers) to those in need of funds (borrowers) for economic endeavors. All financial institutions that gather savings and extend loans to those requiring assistance are integral to this system (Jalloh, 2009).

In the second quarter of 2021, the Nigerian economy experienced year-on-year growth for three consecutive quarters, indicating a recovery from the difficulties faced in 2020.

The National Bureau of Statistics (NBS) reported a 5.0% increase in real gross domestic product (GDP) compared to the same quarter in the previous year. However, there was a contraction of 0.8% when compared to the first quarter of 2021. In the first half of 2021, the contributions to GDP were distributed as follows: 55% from the services sector, 22% from industry, and 23% from agriculture.

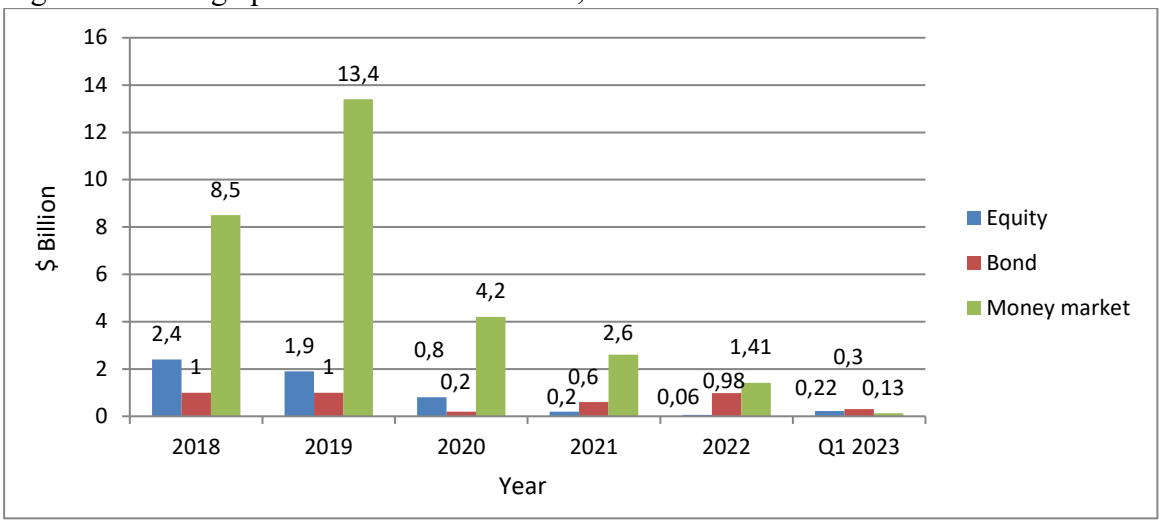
Capital inflows into Nigeria totaled $2.79 billion during the first half of 2021, reflecting a substantial decline of 61% from $7.15 billion in the corresponding period of 2020 (Figures 1 and 2). Of this total, foreign portfolio investment (FPI) constituted 54.8%, while other investments and foreign direct investments made up 36.8% and 8.4%, respectively. Regarding economic policy, the Central Bank of Nigeria (CBN) aimed to unify the exchange rate and introduced the Nigeria Autonomous Foreign Exchange Fixing (NAFEX) rate as the official rate in May 2021, which led to a 7.6% devaluation of the naira. Additionally, inflation rose to 17.4% in July 2021, an increase from 12.8% in July 2020 (PWC, 2021).

Figure 1 – Distribution of total capital importation in Nigeria ($'million, 2022)




Source: National Bureau of Statistics

Figure 2 – Foreign porfolio investment trend, 2018-march 2023




Source: National Bureau of Statistics

The stock market commenced positively, with the Nigeria Exchange rate All Shares Index (NGX ASI) reaching an annual peak of 42,412 points in January 2021, following a remarkable 50% return in 2020. Nevertheless, these advancements have been sluggish to evolve, influenced by increasing bond market yields, escalating inflation, unfavorable exchange rates, limited foreign investor engagement, and profit-taking by investors resulting in sell-offs. By June 2021, the stock market returns, as indicated by the NGX ASI, had experienced a year-to-date decline of -5.87%, while market capitalization decreased by N1.297 trillion, reflecting a 6.13% drop.

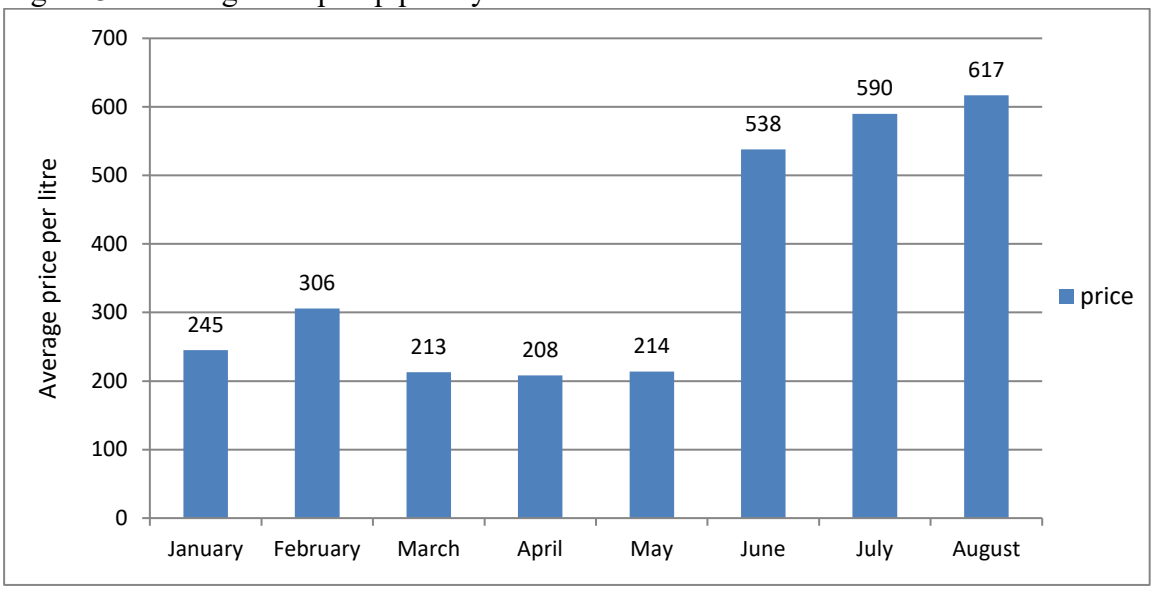
In the debt market, the benchmark 10-year FGN bond yield escalated from 7.3% at the close of 2020 to 12.7% by June 2021, subsequently stabilizing around 11.4% by the end of August 2021. This shift in stock market returns redirected investor focus towards fixed income assets and prompted companies to seek funding for growth and debt refinancing.

The commercial paper market has successfully raised over N2 trillion from 2017 to June 2021, as prominent corporations accessed this market for short-term financing and working capital from a diverse array of investors. In the first half of 2021, N237.7 billion was secured through 33 commercial paper issuances by 13 companies.

In the first quarter of 2023, the non-oil sector contributed 93.79% to GDP growth, a decrease from 95.66% recorded in the fourth quarter of 2022. The services sector accounted for 57.29% of real GDP, while agriculture and industry contributed 21.66% and 21.05%, respectively.

Inflation reached a historic high of 22.79%, marking an increase of 4.1% from 18.6% in June 2022, which may adversely affect real investment returns. In response, the Central Bank of Nigeria raised the Monetary Policy Rate (MPR) to 18.5% in May 2023 to foster price stability; however, this action may restrict the bank's ability to support the real economy. By the end of the first quarter of 2023, total capital imports had declined by 28%, falling to $1.1 million from $1.5 million in the same period of 2022. Additionally, in June 2023, the unification of exchange rates and the removal of the fuel subsidy resulted in a notable rise in both exchange rates and fuel prices (CBN, 2023) (Figure 3).

Figure 3 – Average fuel pump price year-to-date




Source: CBN, 2023

The Nigerian stock market exhibited a positive trend from June to October 2022, even after experiencing five months of consecutive declines. As a result, the All Share Index (ASI) and Market Capitalization (MC) concluded at 51,251.06 points and N27.91 trillion, respectively, compared to 42,716.44 points and N22.30 trillion in 2021. This remarkable performance during the specified period was largely attributed to the introduction of new companies and a rise in participation from domestic investors, including both individual and institutional investors (Central Bank of Nigeria, 2022).

Data from the Securities and Exchange Commission (SEC) indicate that the net asset value of the money market fund rose to N1.008 trillion in May 2024, up from N799 billion in 2023. Additionally, the fund experienced an increase of N50 billion from its previous value of N950 billion. Money market funds are a category of mutual funds that invest in highly liquid, short-term financial instruments, typically with maturities of one year or less. These instruments encompass treasury bills, commercial papers, time deposits, and various bank placements.

Historically, elevated interest rates have favored money market funds, as they attract savers seeking higher returns. Since the establishment of the money market in Nigeria in 1960, its operational performance has been commendable. In 2019, the total assets in the money market reached N13,043.59 billion, reflecting a 6.21% increase from N12,281.53 billion at the close of 2018 (Central Bank of Nigeria, 2019). This growth was attributed to heightened investments in certificates of deposit, FGN bonds, and commercial papers (George-Anokwuru, 2024).

Liquidity conditions within the money market were significantly affected by fiscal flows, the implications of cash reserve ratio (CRR) maintenance, the enforcement of the loan-to-deposit ratio (LDR) policy, the provision and settlement of foreign exchange interventions, and the issuance and maturity of government securities, among other factors. The implementation of the Naira redesign policy also played a role. Consequently, the reactions of market participants to these developments influenced interest rates across all segments of the market (CBN, 2022).

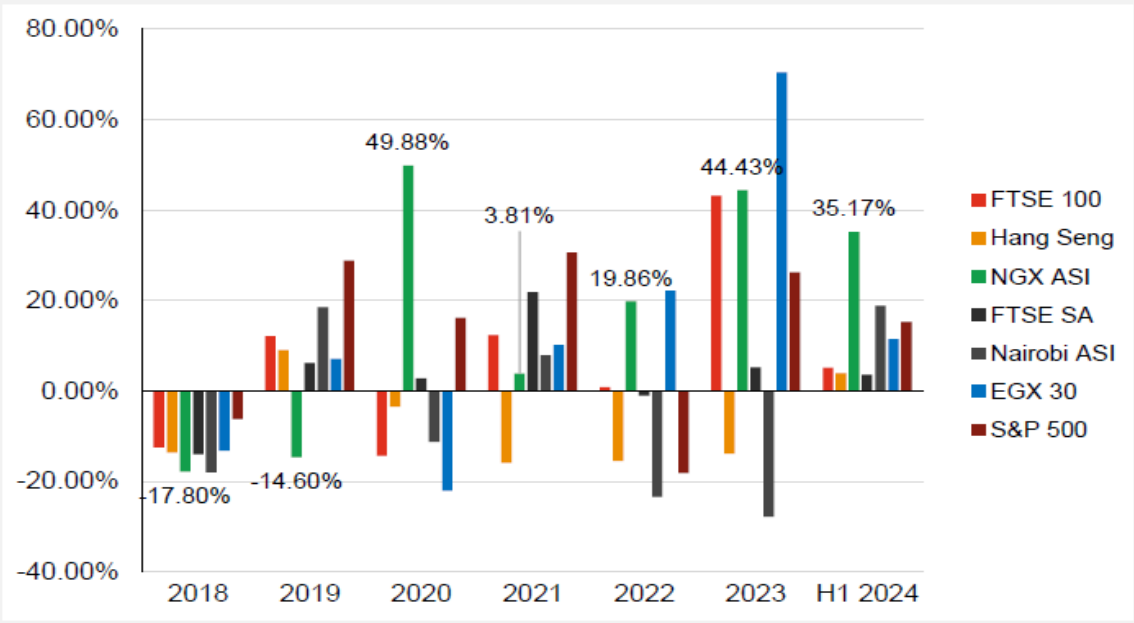
To maintain currency and price stability, the Central Bank of Nigeria upheld an accommodative monetary policy until May 2022, after which it shifted to a contractionary approach to address ongoing inflationary pressures. Consequently, the Monetary Policy Committee (MPC) raised the Monetary Policy Rate (MPR) for the first time in nearly two years, increasing it by 150 basis points to 13.00% in May 2022, up from 11.50% in September 2020. As inflation continued to rise, the MPC further adjusted the MPR to 14.00% in July, 15.50% in September, and 16.50% in November 2022. Additionally, the Cash Reserve Requirement (CRR) remained at 27.50% until July 2022, when it was raised by 500 basis points to 32.50% in September 2022.

The Liquidity Ratio (LR) was kept steady at 30.00%, while the asymmetric corridor for the Standing Loan Facility (SLF) and Standing Deposit Facility (SDF) was maintained at +100/-700 basis points (CBN, 2022).

The Monetary Policy Committee (MPC) as a team within the Central Bank of Nigeria (CBN) responsible for setting monetary policies has recently increased the Bank's Monetary Policy Rate (MPR) to 24.75% in March 2024 and further to 26.75% in June 2024, marking the highest level in two decades. This adjustment reflects a rise of 200 basis points (bps) from the previous rate of 22.75% in February 2024. Furthermore, the CBN has narrowed the asymmetric corridor to +100/300 bps around the MPR, having previously adjusted it to +100/-700 bps. The liquidity ratio and the cash reserve ratio (CRR) remain

stable at 30% and 45%, respectively. However, the CRR for commercial banks has been raised from 10% to 14% (CBN, 2024). In 2022, CBN bills amounting to 13,942.65 billion were sold in the Open Market Operation (OMO). The slight increase in OMO sales auctions was attributed to the tightening of monetary conditions aimed at controlling inflationary pressures. The All Share Index (ASI) and Market Capitalization (MC) of the Nigerian Exchange Limited (NGX) commenced 2022 at 43,026.23 points and N23.18 trillion, concluding the year at 51,251.06 points and N27.91 trillion, which surpasses the opening figures of 2021 at 41,147.39 points and N21.52 trillion, and a closing value of 42,716.44 points and N22.30 trillion (Figure 4). The performance in 2022 demonstrated a rise of 8,224.83 points, equivalent to 19.12%, and an increase of N4.73 trillion, representing 20.41% in the All-Share Index (ASI) and Market Capitalization (MC), respectively, when compared to the figures of 1,569.05 points or 3.81% and N0.78 trillion or 3.62% in 2021 (CBN, 2022). In the first half of 2024, the Nigerian Stock Exchange (NGX) achieved the top position among African stock markets, recording a growth of 35.17% relative to the fourth quarter of 2023. Additionally, the capitalization of the NGX rose by 38.33% in the first half of 2024, reaching N56.602 trillion, compared to N40.918 trillion in Q4 2023. This growth was fueled by new listings, substantial acquisitions, and increasing stock prices (PWC, 2024).

Figure 4 – NGX Vs Global Indices 2018 – June 2024




Source: Pwc (2024)

Financial market volatility may arise from shifts in risk perception over time or from price deviations from their intrinsic values. When the volatility of financial assets results in heightened capital costs, it can adversely affect economic growth. This situation has significant implications for portfolio management, asset valuation, and the assessment of market risk (Osazevbaru, 2014). Volatility in financial markets can be due to a variety of factors, including economic indicators, geopolitical events, investor sentiment and market speculation. Volatility can have a significant impact on financial markets, leading to sharp price fluctuations, increased trading volumes and increased uncertainty among market participants. For example, during periods of high volatility, stock prices can fluctuate

widely, making it difficult for investors to make informed decisions. To mitigate the impact, investors can use the diversification effect, i.e., spread investments across different asset classes and sectors to reduce the risk of individual market fluctuations, set clear investment objectives and maintain a long-term perspective.

The volatility present in the Nigerian Stock Exchange raises concerns among investors, analysts, brokers, traders, and regulators, and is a critical issue for economists who highlight the significance of market interconnections, returns, and the transmission of volatility to policymakers and market participants. Consequently, the stock market concluded 2016 with a negative turnover to sustain its unfavorable sales condition. The market's volume and value turnover experienced declines of 6.86% and 40.23%, respectively, finishing at 86.21 billion units and N566.24 billion in traded volume and value for that year. This lackluster performance was evident when compared to the declines of 10% and 28.9% in volume and value added, respectively, in 2015 (Fasanya and Akinde, 2019). In 2018, the stock data for the Nigerian Stock Exchange was reported at N11.271 trillion, while in April 2024, it reached N90.917 trillion, with volume data recorded at 8.580 billion units. In 2013, the data stood at 93,200 billion units, but by 2022, it had plummeted to a record low of 2,780 billion units ( Pwc, 2023; NGX, 2023) .

In Nigeria, the government and regulatory bodies have undertaken a range of initiatives aimed at stabilizing macroeconomic variables that are anticipated to influence the capital and money markets. The Central Bank of Nigeria (CBN) Act of 1958 mandates the promotion and maintenance of monetary stability alongside an effective financial policy framework within the nation. The CBN employs both rules-based and market-based approaches to execute its monetary policy programs (Chuku, 2009; Abdulkarim, Uwaleke, and Nwala, 2021). Under the rules-based approach, the CBN utilizes governance tools that may encompass direct regulation, selective credit control, moral suasion, and interest rate adjustments. Conversely, the market-based approach involves the use of indirect instruments such as the discount rate, open market operations, and reserve ratios. Additionally, the CBN has implemented various policies, including monetary control, exchange rate management, capital and money market regulation, inflation targeting, and nominal GDP targeting, to meet its established objectives (Abdulkarim, Uwaleke, and Nwala, 2021).

Many researchers have explored the relationship between monetary policy and capital or money markets, leading to varied conclusions. Sekandary and Bask (2023) found a negative link between unexpected monetary policy changes and stock market returns using a panel smooth transition regression model. Gürkaynak et al. (2022) noted that stock prices react to monetary policy announcements, influenced by corporate debt characteristics. Wen et al. (2022) reported that monetary policy uncertainty negatively affects stock returns in most countries, while Harjoto, Rossi, and Paglia (2021) found that monetary stimulus boosts abnormal stock returns. Schrank (2024) observed that rising interest rates and money supply correlate with higher stock and government bond returns. Zare, Azali, and Habibullah (2013) showed that contractionary monetary policy significantly impacts stock market volatility in ASEAN-5 nations over the long term. Adenji, Obansa, and Okoroafor (2018) established a strong positive correlation between monetary policy shocks and stock market volatility in Nigeria using ARDL and EGARCH models. However, the impact of monetary policy on financial market volatility remains underexplored. Most studies suggest a positive effect of monetary policy on stock returns, while others indicate a negative effect. This research aims to analyze how monetary policy can mitigate financial

market (capital and money market) volatility using the EGARCH model from 1990m1 to 2022m12. The rest of the paper is as follows. Section 2 reviews the literature, while Section 3 discusses the methodology. Section 4 discusses the data presentation and results, Section 5 discusses the results, and Section 6 discusses the conclusion and policy recommendations

## 2. Literature Review

### *2.1 Theoretical Literature*

#### 2.1.1 Efficiency Market Hypothesis

The concept was introduced in 1900 by French mathematician Louis Bachelier in his doctoral thesis, building on Benoit Mandelbrot's work (1963). Speculation theory explains commodity and stock price dynamics, while the efficient market hypothesis (EMH) asserts that asset prices reflect all available information, making it difficult to consistently outperform the market. The challenge of predicting financial returns is linked to Bachelier, Mandelbrot, and Samuelson, but is most associated with Eugene Fama, particularly due to his influential 1970 review categorizing market efficiency into "weak," "semi-strong," and "strong" forms.

- *Weak form efficiency:* In this form, market prices reflect all previous trading information, such as historical prices and trading volumes. According to weak form efficiency, technical analysis cannot consistently generate excess returns because this information is already reflected in stock prices.
- *Semi-strong form efficiency*: This idea states that all publicly available information, including recent and past trading data, is fully incorporated in stock prices. As a result, neither technical analysis nor fundamental analysis can consistently beat the market because all available information is already incorporated in prices.
- *Strong form efficiency:* The most robust version of the efficient markets hypothesis states that all information, public and private, is fully incorporated in stock prices. In other words, no individual or group of investors possesses information that can be used to consistently generate higher returns. This form of efficiency suggests that insider trading is pointless in the long run because insider information is also reflected in stock prices.

#### 2.1.2 Classical Capital Asset Price Theory

The Capital Asset Pricing Model (CAPM) outlines the relationship between an investment's systematic risk and its expected return, particularly for stocks. It establishes a linear correlation between required return and risk, based on three components: the asset's beta, the risk-free interest rate (like the Treasury Bill Rate), and the equity risk premium (expected market return minus the risk-free rate). CAPM suggests that higher betas lead to greater returns, while lower betas result in lower returns (Sharpe, 1964). However, Fama and French (1992) challenged this by finding no correlation between betas and returns. The model relies on two key assumptions: efficient, competitive markets and rational, risk-averse investors. CAPM provides a framework for analyzing financial securities' risks and returns, with investor returns calculated by summing cash dividends and capital gains and dividing by the stock's purchase price (Mullins, 1982).

2.1.3 Keynes's theory of Monetary Policy

This theory includes three main concepts: the investment multiplier, the marginal efficiency of capital, and the interest rate. Keynes advocated for low interest rates during high unemployment to influence price levels. The money supply's effect on price levels depends on its impact on aggregate demand and output supply elasticity (Nwoko, Ihemeje, and Anumadu, 2016). An increased money supply initially lowers interest rates, stimulating investment through the marginal efficiency of capital. This leads to a multiplier effect, boosting effective demand, income, production, and employment. In unemployment scenarios, both wage and non-wage production factors are readily available at a stable wage rate due to the elastic supply curve.

### *2.2 Empirical Literature*

Schrank (2024) analyzed 15 years of data from Thailand, including the Covid-19 pandemic period, to study the impact of monetary policy on the financial market. The findings show that higher interest rates and increased money supply lead to greater stock and government bond returns. Babangida and Khan (2021) used the Smooth Transition Autoregressive (STAR) model with monthly data from 2013 to 2019 to examine the non-linear effects of monetary policy on the Nigeria Stock Exchange. They found that interest rates, money supply, lagged interest rates, and lagged treasury exchange rates positively influence the stock market, while the current treasury exchange rate negatively impacts it at both low and high interest rate levels.

Additionally, money supply and lagged treasury exchange rates significantly harm the stock market. Sekandary and Bask (2023) analyzed the impact of unexpected monetary policy changes on stock returns during varying levels of monetary policy uncertainty, following the method of Babangida and Khan (2021). They found a negative relationship between monetary policy surprises and stock returns in both high and low uncertainty periods, with a weaker link during low uncertainty.

Wen et al. (2022) uses a quantile-by-quantile method to examine the effects of monetary policy uncertainty (MPU) on stock returns in G7 and BRICS nations. They found that higher MPU generally results in lower stock returns during market crashes, but in lower MPU quantiles, uncertainty can sometimes enhance stock performance. Suhaibu, Harvey, and Amidu (2017) studied the impact of monetary policy on stock market performance in 12 African nations from 1979 to 2013 using panel VAR methodology. They found that individual monetary policies positively affect stock markets in the short term through the interest rate channel, but no reverse effect was identified.

Osuagwu (2009) examined the impact of monetary policy on Nigeria's stock market from 1984Q1 to 2007Q4, using ordinary least squares, co-integration, and error correction models. His finding shows that money supply, exchange rates, and the consumer price index significantly influenced stock market performance, while the minimum discount rate and treasury bill interest rates had mixed results. Similarly, Abdulkarim et al. (2021) analyzed the effects of monetary policy on capital market growth in Nigeria from 1986 to 2018, employing the ARDL and ECM models. They found that exchange rates, inflation, and interest rates negatively affected capital market development, while money supply positively impacted it in the long term at a 5% significance level. Akanbi (2021) analyzed the impact of monetary policy on Nigeria's stock market performance from 2018 to 2022 using multiple OLS regression. The study found that the monetary policy interest rate had

a positive but insignificant effect, while the exchange rate negatively and significantly impacted stock market performance.

The key interest rate showed a negative but insignificant correlation, whereas the deposit rate had a positive and significant relationship with stock market performance during this period. Ojiako (2021) uses co-integration and the Error Correction Model (ECM) to examine the relationship between stock performance and monetary policy from 1981 to 2018, finding that stock performance is inversely related to private sector lending and loan interest rates, but positively correlated with the money supply. In a separate study, Shirya, Njoka, and Abdul (2023) analyzed the impact of monetary policy tools on the financial performance of Nigerian commercial banks, concluding that open market operations significantly enhance bank earnings, with monetary policy reforms further strengthening this relationship.

Zervou (2013) studied how monetary policy affects financial market segmentation and stock market volatility, suggesting that effective policy should be expansionary in adverse conditions and contractionary in favorable ones. The research found that dividend stocks respond differently to policy changes compared to optimal strategies and a 2% inflation target. Similarly, Gospodinov and Jamali (2014) used a vector autoregressive model to show that stock returns and volatility significantly react to monetary policy shocks. Aliyu (2012) analyzed the Nigerian stock market's response to monetary policy during the global financial crisis, using monthly data from January 2007 to August 2011 and employing GARCH and EGARCH models. The study found that unexpected monetary policy innovations regarding M2 and MPR destabilized Nigerian Stock Exchange (NSE) returns, while expected components did not, supporting the rational expectation hypothesis (REH). Similarly, Adeniji, Obansa, and Okoroafor (2018) used EGARCH and ARDL models to assess the impact of monetary policy on stock price volatility in Nigeria from June 1999 to December 2016. Their findings show a strong positive correlation between monetary policy shocks and stock market volatility, with interest rates significantly affecting volatility in both the short and long term, while MI1 was significant only in the short term.

## 3. Methodology

### *3.1 Theoretical Framework*

This research is grounded in the Efficient Market Hypothesis (EMH). According to this hypothesis, markets operate efficiently, meaning there are no chances to achieve above-average returns through investments since all available information is already incorporated into asset prices. This concept is linked to the Random Walk Theory and can be expressed through the Fundamental Theorem of Asset Pricing, which provides mathematical forecasts regarding stock prices in the following manner:

$$P_t = E_t\left[M_{t+1}(P_{t+1} + D_{t+1})\right] \tag{1}$$

Where:

$E_t$ = expected value given information at time $t$,

$M_{t+1}$ = stochastic discount factor

$D_{t+1}$ = dividend the stock pays next period.

The concept of an efficient market suggests that stock prices follow:

$$E\left[S_{t+1} / S_t\right] = S_t \tag{2}$$

The Exponential Generalized Autoregressive Conditional Heteroscedasticity (EGARCH) model, developed by Nelson in 1991, addresses asymmetric effects that traditional ARCH models cannot capture, particularly the leverage effect, where volatility increases after bad news (price declines) but reacts less to good news (price rises). This asymmetry is not adequately handled by ARCH and GARCH models. Nelson's EGARCH model highlights this phenomenon in the context of real growth. Consequently, the GARCH-M (GARCH-p,q) model has the following attributes:

$$h_t = \gamma 0 + \sum_{i=1}^{p} \delta j h_{t-1} + \sum_{j=1}^{q} \gamma j u^2{}_{t-1}. \tag{3}$$

EGARCH (p, q) model is given by.

$$Log(\delta_{t2}) = \alpha + \beta In(\delta_{t-1}) + \frac{\gamma \mu_{t-1}}{\sqrt{\delta 2_{t-1}}} + \alpha\left[\frac{\mu_{t-1}}{\sqrt{\delta 2_{t-1}}} - \sqrt{\frac{2}{\pi}}\right] \tag{4}$$

Where:
σt2 = Conditional variance
$\sigma_{t-1}$ = 1st lag of the coefficients
$\mu_{t-1}$ = 1st lag of the residual
β α γ and Π are the parameter of the model.

### *3.2 Model Specifications*

The role of monetary policy in reducing financial market volatility (Capital market and Money market volatility):

$$ASI_t = f(MS, MPR, INT, INF, EXCR, GDP, COP) \tag{5}$$

$$TB_t = f(MS, MPR, INT, INF, EXCR, GDP, COP) \tag{6}$$

Equation (5) and (6) are transformed into an autoregressive conditional heteroskedastic model with the conditional mean equations as:

$$ASI_t = \beta_1 + \beta_2 MS + \beta_3 MPR + \beta_4 INT + \beta_5 INF + \beta_6 EXCR + \beta_7 GDP + \beta_8 COP + \mu_t \ldots \mu_t \approx iiN(0, \sigma t2) \tag{7}$$

$$TB_t = \beta_1 + \beta_2 MS + \beta_3 MPR + \beta_4 INT + \beta_5 INF + \beta_6 EXCR + \beta_7 GDP + \beta_8 COP + \mu_t ... \mu_t \approx iiN(0, \sigma t2) \quad (8)$$

All Shares Index of Nigeria Stock Exchange (ASI) proxy for capital market, Treasure Bill (TB) proxy for money market, Money supply (MS) and Monetary policy rate (MPR) proxies for monetary policy, Interest rate (INT), Inflation rate (INF), Exchange rate (EXCR), Gross domestic product (GDP) and Crude oil price (COP), where $\beta_1$, $\beta_2$, $\beta_3$, $\beta_4$, $\beta_5$, $\beta_6$, $\beta_7$ and $\beta_8$ represents the intercept and slope parameters of the conditional variance under the ARCH(q) and the GARCH (1,1) is the simplest form of the GARCH (p q) model for which the variance equation has the form:

$$ht = \frac{\alpha_0}{1-\delta} + \gamma 1 \sum_{j=1}^{\infty} \delta^{j-1} \mu_{t-j}^2 \quad (9)$$

The GARCH(1,1) model is analogous to an infinite-order ARCH model with geometrically declining coefficients. When modeling volatility, challenges arise from the non-negativity constraint in equation (4) and the numerous lags. To address these issues, Nelson (1991) proposed the Exponential GARCH (EGARCH) model.

$$\log(ht) = \alpha + \sum_{j=1}^{m} \beta j \left| ut-j \Big/ \sqrt{ht-j} \right| + \sum_{j=1}^{n} \theta j \frac{ut-j}{\sqrt{ht-j}} + \sum_{i=1}^{n} \delta i \log(ht-i) \quad (10)$$

## 4. Data Presentation and Results

### *4.1 Unit Root Analysis*

Table 1 presents the results of the ADF test statistics for the levels and first differences of the stochastic time series data for the period from January 1990 to December 2022. The asterisk (*) denotes the rejection of the unit root hypothesis at the 5% significance level.

Table 1 − Unit Root of Variables

| Variables | ADF (Intercept and trend) | | | | | |
|---|---|---|---|---|---|---|
| | Test Critical value@5% | Level | I$^{st}$ Diff | 2$^{nd}$ Diff | Diff Prob | Order of Integration |
| ASI | -3. 421270 | -2.996950 | -19.83161* | | 0.0000 | I(1) |
| TB | -3.421600 | -2.037322 | -3.902245* | | 0.0128 | I(1) |
| MS2 | -3.421600 | 1.783339 | -3.067716 | -27.92193* | 0.0000 | I(2) |
| MPR | -3.421270 | -2.815351 | -19.86245* | | 0.0000 | I(1) |
| INF | -3.421270 | -2.457118 | -19.78187* | | 0.0000 | I(1) |
| INT | -3.421270 | -3.287021 | -19.78368* | | 0.0000 | I(1) |
| EXCR | -3.421600 | -0.995140 | -4.086452* | | 0.0071 | I(1) |
| GDP | -3.421600 | -2.807551 | -2.578869 | -35.83587* | 0.0000 | I(2) |
| COP | -3.421270 | -2.346384 | -19.81018* | | 0.0000 | I(1) |

Source: Authors' calculation using E-view 10

The results of the unit root tests conducted on the levels and first differences of the money supply (MS2) and gross domestic product (GDP) clearly indicate the presence of a unit root. However, after applying second differencing to the series, we observe a robust rejection of the null hypothesis of a unit root, suggesting that the series are integrated of order two, denoted as I(2). Additionally, the unit root tests performed on the levels of the all shares index of the stock exchange (ASI), treasury bills (TB), monetary policy rate (MPR), inflation (INF), interest rate (INT), exchange rate (EXCR), and crude oil price (COP) also indicate the presence of a unit root. Yet, after first differencing these series, there is a strong rejection of the null hypothesis of a unit root, indicating that these series are integrated of order one, denoted as I(1).

### *4.2 Johansen Co-integration Test*

In the trace test, seven (7) co-integration equations were found at a 5% significance level. Based on the results presented above, it appears that the trace statistic values are less than 5% of the critical value. The maximum eigenvalue statistic serves as further confirmation of this result.

Typically, this approach tests the null hypothesis of r versus r+1 co-integrating relationship. Max-eigenvalue test statistics that exceed the respective critical value are considered sufficient to reject the null hypothesis. The results of this test are presented in column 2 of Table 2.

Table 2 − Unrestricted Co-integration Rank Test (Trace)

| Hypothesized No. of CE(s) | Eigenvalue | Trace Statistic | 0.05 Critical Value | Prob.** |
|---|---|---|---|---|
| None * | 0.980100 | 358.7784 | 197.3709 | 0.0000 |
| At most 1 * | 0.842265 | 237.3509 | 159.5297 | 0.0000 |
| At most 2 * | 0.781252 | 180.0988 | 125.6154 | 0.0000 |
| At most 3 * | 0.690992 | 132.9839 | 95.75366 | 0.0000 |
| At most 4 * | 0.669998 | 96.57783 | 69.81889 | 0.0001 |
| At most 5 * | 0.581127 | 62.20947 | 47.85613 | 0.0013 |
| At most 6 * | 0.477254 | 35.23367 | 29.79707 | 0.0107 |
| At most 7 | 0.330408 | 15.12520 | 15.49471 | 0.0568 |
| At most 8 | 0.083161 | 2.691533 | 3.841466 | 0.1009 |

Source: Authors' calculation using E-view 10

At the 5% significance level, the Max-Eigenvalue test indicates the presence of four co-integrating equations (Table 3). Based on the normalized co-integrating coefficients, it was further determined that the four co-integrating variables are the all-shares index, treasury bill, money supply, and monetary policy rate. This suggests that these variables are likely to be related in the long run.

Table 3 − Unrestricted Co-integration Rank Test (Maximum Eigenvalue)

| Hypothesized No. of CE(s) | Eigenvalue | Max-Eigen Statistic | 0.05 Critical Value | Prob.** |
|---|---|---|---|---|
| None * | 0.980100 | 121.4274 | 58.43354 | 0.0000 |
| At most 1 * | 0.842265 | 57.25210 | 52.36261 | 0.0146 |
| At most 2 * | 0.781252 | 47.11494 | 46.23142 | 0.0401 |
| At most 3 | 0.690992 | 36.40607 | 40.07757 | 0.1224 |
| At most 4 * | 0.669998 | 34.36836 | 33.87687 | 0.0437 |
| At most 5 | 0.581127 | 26.97580 | 27.58434 | 0.0597 |
| At most 6 | 0.477254 | 20.10847 | 21.13162 | 0.0690 |
| At most 7 | 0.330408 | 12.43366 | 14.26460 | 0.0954 |
| At most 8 | 0.083161 | 2.691533 | 3.841466 | 0.1009 |

Source: Authors' calculation using E-view 10

### *4.3 EGARCH Model*

Table 4 consists of two distinct sections: the upper section illustrates the mean equation, while the lower section delineates the variance equation. The residuals obtained from the mean equation have been employed to estimate the variance equation. The LOG(GARCH) model reflects the conditional variance, which acts as the dependent variable indicative of return volatility.

Analysis of the mean equation reveals that money supply, inflation, and gross domestic product exhibit statistical significance and a negative correlation with the all shares index of the Nigeria stock exchange. Conversely, the monetary policy rate, interest rate, exchange rate, and crude oil price demonstrate statistical significance and a positive correlation with the all shares index of the Nigeria stock exchange.

The negative statistical significance of the coefficient C(11) or *RESID(-1)/@SQRT(GARCH(-1)) indicates a detrimental effect of monetary policy on capital market volatility. This suggests the presence of a volatility transmission, leverage effect, or mitigation effect between monetary policy and the capital market in Nigeria, characterized by a negative relationship.

Table 5 consists of two sections: the upper section is designated as the mean equation, while the lower section is referred to as the variance equation. The residuals obtained from the mean equation have been utilized to estimate the variance equation. The LOG(GARCH) represents the conditional variance and serves as the dependent variable, reflecting the volatility of returns. Analysis of the mean equation indicates that the interest rate is statistically significant and exhibits a negative correlation with Treasury bills. Additionally, the money supply, monetary policy rate, inflation rate, exchange rate, and crude oil price are all statistically significant and positively correlated with Treasury bills.

The positive statistical significance of the coefficient C(11) or *RESID(-1)/@SQRT(GARCH(-1)) suggests a positive relationship between monetary policy and money market volatility. This implies that there exists a volatility transmission, leverage effect, or mitigation effect between monetary policy and the money market in Nigeria, characterized by a positive influence.

Table 4: The role of monetary policy in reducing financial market volatility (Capital market volatility)

| LOG(GARCH) = C(9) + C(10)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(11) *RESID(-1)/@SQRT(GARCH(-1)) + C(12)*LOG(GARCH(-1)) | | | | |
|---|---|---|---|---|
| Variable | Coefficient | Std. Error | z-Statistic | Prob. |
| D(D(MS2)) | -0.000903 | 0.000367 | -2.457380 | 0.0140 |
| D(MPR) | 227.0682 | 38.20500 | 5.943416 | 0.0000 |
| D(INF) | -42.83371 | 12.70798 | -3.370616 | 0.0008 |
| D(INT) | 178.9774 | 13.32369 | 13.43303 | 0.0000 |
| D(EXCR) | 46.25830 | 3.543835 | 13.05317 | 0.0000 |
| D(D(GDP)) | -8.24E-05 | 3.40E-05 | -2.420567 | 0.0155 |
| D(COP) | 241.1571 | 4.588006 | 52.56251 | 0.0000 |
| C | -2.592932 | 1.067158 | -2.429755 | 0.0151 |
| Variance Equation | | | | |
| C(9) | 13.98313 | 0.648808 | 21.55202 | 0.0000 |
| C(10) | -2.580289 | 0.135494 | -19.04355 | 0.0000 |
| C(11) | -0.206972 | 0.034695 | -5.965415 | 0.0000 |
| C(12) | 0.086896 | 0.042390 | 2.049937 | 0.0404 |
| R-squared | 0.210937 | Mean dependent var | | 128.7748 |
| Adjusted R-squared | 0.196627 | S.D. dependent var | | 2480.912 |
| S.E. of regression | 2223.668 | Akaike info criterion | | 17.61740 |
| Sum squared resid | 1.91E+09 | Schwarz criterion | | 17.73850 |
| Log likelihood | -3458.627 | Hannan-Quinn criter. | | 17.66539 |
| Durbin-Watson stat | 1.999950 | | | |

Dependent Variable: D(ASI)
Source: Authors' calculation using E-view 10

Table 5: The role of monetary policy in reducing financial market volatility (Money market volatility)

| LOG(GARCH) = C(9) + C(10)*ABS(RESID(-1)/@SQRT(GARCH(-1))) + C(11) *RESID(-1)/@SQRT(GARCH(-1)) + C(12)*LOG(GARCH(-1)) | | | | |
|---|---|---|---|---|
| Variable | Coefficient | Std. Error | z-Statistic | Prob. |
| D(D(MS2)) | 0.000105 | 5.00E-05 | 2.105446 | 0.0353 |
| D(MPR) | 18.48692 | 1.740711 | 10.62033 | 0.0000 |
| D(INF) | 7.066329 | 0.518762 | 13.62152 | 0.0000 |
| D(INT) | -1.415194 | 0.592175 | -2.389824 | 0.0169 |
| D(EXCR) | 7.232364 | 0.155339 | 46.55859 | 0.0000 |
| D(D(GDP)) | -1.90E-05 | 1.75E-05 | -1.087987 | 0.2766 |
| D(COP) | 4.409680 | 0.248937 | 17.71403 | 0.0000 |
| C | 0.052702 | 0.050064 | 1.052687 | 0.2925 |

| Variance Equation | | | | |
|---|---|---|---|---|
| C(9) | 7.916737 | 0.510682 | 15.50229 | 0.0000 |
| C(10) | -2.004499 | 0.142611 | -14.05572 | 0.0000 |
| C(11) | 0.327856 | 0.071655 | 4.575462 | 0.0000 |
| C(12) | 0.100540 | 0.058036 | 1.732356 | 0.0832 |
| R-squared | 0.283059 | Mean dependent var | | 11.16051 |
| Adjusted R-squared | 0.270057 | S.D. dependent var | | 96.97361 |
| S.E. of regression | 82.85104 | Akaike info criterion | | 11.23060 |
| Sum squared resid | 2649618. | Schwarz criterion | | 11.35171 |
| Log likelihood | -2200.429 | Hannan-Quinn criter. | | 11.27859 |
| Durbin-Watson stat | 2.000021 | | | |

Dependent Variable: D(TB)
Source: Authors' calculation using E-view 10

## 5. Discussion of Results

Based on the results of the study, there is a significant negative statistical correlation between monetary policy and capital market volatility in Nigeria. In other words, monetary policy does not effectively reduce capital market volatility; rather, it exacerbates it. This finding aligns with the research conducted by Sekandary and Bask (2023) and Abdulkarim et al. (2021). Additionally, the results indicate a significant positive statistical correlation between monetary policy and money market volatility in Nigeria. This suggests that monetary policy positively mitigates money market volatility, meaning it effectively reduces volatility in this sector. This conclusion is supported by the findings of Schrank (2024), Babangida and Khan (2021), Osuagwu (2009), Akanbi (2021), and Shirya, Njoka, and Abdul (2023). In conclusion, the study's findings suggest that monetary policy, through mechanisms such as money supply or the monetary policy rate, can influence financial market volatility (both capital and money markets) in either a positive or negative manner, thereby increasing or decreasing volatility in Nigeria.

## 6. Conclusion and Policy Recommendation

This research examined the influence of monetary policy on the reduction of financial market volatility in Nigeria, utilizing monthly data spanning from January 1990 to December 2022, sourced from the statistical bulletins of the Central Bank of Nigeria (CBN, 2023). The analysis employed the Exponential Generalized Autoregressive Conditional Heteroscedasticity (EGARCH) model. Monetary policy was assessed through the lens of money supply and the monetary policy rate, while the financial market was divided into two segments: the capital market, represented by the All Share Price Index of the Nigerian Stock Exchange, and the money market, represented by Treasury bills. The results indicated a negative relationship between monetary policy, specifically money supply, and capital market volatility. Specifically, a 1% change in the money supply resulted in a 9% decrease in capital market volatility. Conversely, there was a positive correlation between the monetary policy rate and capital market volatility, where a 1% change in the monetary policy rate led to a 22.7% increase in capital market volatility. This suggests that monetary

policy, via money supply, does not reduce volatility in the capital market, whereas it does so through the monetary policy rate. Additionally, a positive association was found between monetary policy (both money supply and monetary policy rate) and money market volatility. A 1% change in the money supply and the monetary policy rate resulted in increases of 10.5% and 18.4% in money market volatility, respectively, indicating that monetary policy has a dampening effect on the money market. An increase in the money supply typically leads to a rise in bond prices and a decrease in nominal interest rates, while an increase in the monetary policy rate results in a decline in bond prices and a rise in interest rates. Consequently, the study concluded that monetary policy can have both positive and negative impacts, either increasing or decreasing financial market volatility in Nigeria. Based on these results, the study offers the following recommendations:

1. The monetary authorities should strengthen the money and capital markets through strategic policy modifications, financial reforms, and resolution initiatives.
2. The monetary authorities should undertake reforms in the financial market to function as a catalyst for economic development and to improve the welfare of the Nigerian populace.
3. The capital market should be rejuvenated through the collaboration of all stakeholders, transforming it into a premier capital market that attracts investments from both domestic and international investors.
4. Policymakers and monetary authorities must work diligently to eliminate any barriers to the advancement of financial markets and establish a conducive environment that allows these markets to flourish, thereby acting as a driver of growth and development.
5. The government must ensure that responsibilities related to monetary policy in financial markets are entrusted to individuals with the necessary expertise.
6. Monetary authorities are tasked with ensuring that relevant information regarding securities is easily accessible to participants in both the capital and money markets, with a particular focus on the capital market. Additionally, they must maintain transparency and accountability in audit reports.
7. Furthermore, monetary authorities should exercise caution in the indiscriminate use of policy instruments, as substantial evidence suggests that the application of monetary policy tools significantly influences the performance of financial markets.

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