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Asymmetric effect of monetary policy on stock market performance in the ECOWAS zone: empirical evidence from the NARDL approach

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Abstract. *The aim of this study is to analyze the effect of monetary policy on stock market performance in the ECOWAS zone, from 2000 to 2021, using data from three stock exchanges (BRVM, Ghana Stock Exchange and Nigerian Stock Exchange). Applying the NARDL (Nonlinear Autoregressive Distributed Lag) model, the results indicate that monetary policy has an asymmetric effect in the short and long term on stock market performance in the ECOWAS zone. The study revealed that the Nigerian stock market is more reactive to changes in monetary policy than the Ghanaian stock market and the BRVM.*

Keywords: Monetary policy, stock market performance, asymmetric effect, NARDL, ECOWAS.

JEL Classification: E32, E44, E52, G10.

1. Introduction

Stock markets today occupy a central place in the global financial system. They promote the growth of different economic sectors by directing savings from agents in need of financing to those with financing deficits, thus ensuring an optimal allocation of resources (Tripathi and Kumar, 2014). They also act as catalysts for the economic development of countries, which explains the growing interest of researchers in the factors influencing their performance. While financial theory emphasizes firm- and sector-specific factors, a growing body of research highlights the importance of macroeconomic variables, such as monetary policy, inflation, exchange rate, interest rates, and industrial production, in stock market performance (Fama, 1981; Tripathi and Kumar, 2014; Barakat et al., 2016; Omodero and Mlanga, 2019). Among these factors, monetary policy is often considered one of the main variables influencing overall market returns.

It is widely accepted that expansionary monetary policy can improve stock market performance. Indeed, it generally leads to lower interest rates. Given the inverse relationship between lending rates and stock prices, lower interest rates increase stock values, thereby encouraging business investment and enhancing stock market performance (Modigliani, 1971). Conversely, contractionary monetary policy, which increases interest rates, tends to lower stock prices, encouraging investors to raise funds in the stock market, leading to lower demand and stock market value (Waud, 1970). These conflicting predictions about the link between monetary policy and stock market performance have prompted numerous empirical studies using various econometric approaches, leading to mixed results. Some studies have found a positive relationship between these two variables (Jonathan and Oghenebrume, 2017; Marozca, 2020), while others, such as Neri (2002), have found a negative relationship. These divergences highlight the persistent interest of researchers and policy makers in this issue.

Within the Economic Community of West African States (ECOWAS), initiatives have been taken to develop financial markets. For example, in August 2012, a regional meeting in Lagos, bringing together central banks, the West African Bankers Association (WABA) and the private sector, validated the creation of a regional credit risk database and an information sharing system. Furthermore, in 2012 in Accra, it was decided to create a Capital Markets Integration Council composed of leaders of the region's stock exchanges and stock exchange commissions. Regarding monetary policy, the main objective of the region's central banks remains price stability. In the West African Economic and Monetary Union (WAEMU), in accordance with Article 8 of the statutes of the Central Bank of West African States (BCEAO), this objective is a priority, with an inflation target of 2%. In contrast, in Ghana, the Bank of Ghana pursues a policy aimed at maintaining inflation between 6.5% and 10.5%, while maintaining a flexible exchange rate (African Economic Outlook, 2012). The Central Bank of Nigeria, for its part, has maintained price and exchange rate stability since 2001. These initiatives aim to strengthen the performance of

the stock markets in the ECOWAS zone. However, the evolution of the relationship between monetary policy and stock market performance in this area remains ambiguous. From 2000 to 2002, despite an expansionary monetary policy, with an increase in the money supply from 20.3% to 21.5% of GDP, stock market performance declined, as evidenced by the decline in stock market returns from -0.03% to -0.19% and the stock turnover rate from 6.5% to 4.9% (World Bank, 2022). On the other hand, between 2005 and 2008, although monetary policy remained expansionary, stock market performance improved. This period saw the stock market return increase from -0.15% to 0.16%, and the stock turnover rate increase from 6.2% to 16.3% (World Bank, 2022). Between 2008 and 2020, despite a still expansionary monetary policy, with an increase in the money supply to 31.6% of GDP, stock market performance declined again, with a return of -0.11% and a stock turnover rate of 3.4% in 2020 (World Bank, 2022). These data show a contrasting relationship between monetary policy and stock market performance in the ECOWAS zone. Based on this observation, this work questions the effect of monetary policy on the performance of stock markets in the region. The central question of this study is: What is the effect of monetary policy on the performance of stock markets in the ECOWAS zone?

This study therefore analyzes the effect of monetary policy on the performance of stock markets in the ECOWAS zone, focusing on the three main stock exchanges: the Regional Stock Exchange (BRVM), the Ghana Stock Exchange and the Nigerian Stock Exchange. To our knowledge, no previous research has studied this effect asymmetrically in this region while simultaneously focusing on these three stock markets. Previous work (Jonathan and Oghenebrume, 2017; Aladejare et al., 2018; Alugbuo and Chika, 2020) has been limited to analyzing the symmetric effect of monetary policy on stock market performance. Our study attempts to fill this gap by highlighting the asymmetric effect of monetary policy on the performance of these three major stock markets in the region.

The article is structured in six sections. The second presents the literature review, the third details the methodology and variables used, the fourth addresses the data sources and descriptive analysis, the fifth presents the estimation results, and the sixth concludes the study.

2. Literature Review

This section reviews theoretical and empirical contributions on the relationship between monetary policy and stock market performance.

2.1. Theoretical Contributions

There are differing opinions on the effect of monetary policy on stock market performance. Some argue that monetary policy promotes stock market performance, while others argue

that it tends to diminish it. According to the former's arguments, an expansionary monetary policy leads to a reduction in interest rates. This decrease in rates makes stocks more attractive, which stimulates business investment and, consequently, improves the performance of the stock market (Modigliani, 1971 and Miskin, 1977). In addition, lower interest rates attract greater capital flows to the stock market, in the hope of higher returns, which also contributes to improving market performance. This view is supported by Fisher's (1930) theory and Fama's (1970) theory of efficient markets.

According to Fisher's theory (1930), stocks, as claims on a firm's real assets, can serve as a hedge against inflation. Therefore, in times of expected inflation, investors could exchange their financial assets for real assets, leading to higher stock returns. Thus, in such a context, stock prices, in nominal terms, should fully reflect expected inflation, and the relationship between these two variables should be positively correlated (Ioannides et al., 2005). From another perspective, Fama's (1970) theory of efficient markets also suggests a positive relationship between monetary policy and stock market performance through the inflation channel. This theory states that information is rapidly incorporated into stock prices. Thus, stock prices should fully reflect all new and available information in a fair manner for all market participants. This allows markets to provide accurate signals for resource allocation, as prices represent the fundamental value of each security, although deviations may occur. Therefore, an increase in the inflation rate should have a positive effect on stock prices, as investors adjust these prices according to inflation (Schöler et al., 2014). As for the latter, they argue that monetary policy has an adverse effect on the performance of stock markets. Unlike the former, they believe that expansionary monetary policy decreases the performance of stock markets due to its inflationary impact. According to Fama and Schwert (1977), there is a negative relationship between inflation and stock prices. Fama (1981) indicates that inflation represents a significant threat to long-term investors because it reduces the returns on financial assets, including stock returns, by disrupting real economic activity. He points out that this negative relationship between inflation and stock returns stems from the positive correlation between stock returns and real activity, as well as the negative correlation between inflation and real activity. They also argue that even tight monetary policies have an adverse effect on stock market performance. According to this perspective, tight monetary policy lowers stock returns. Indeed, the increase in interest rates associated with such a policy leads to a decline in stock prices. This decline encourages investors to sell stocks to raise funds, which further reduces demand and causes prices to fall to a level that could deter new investors (Waud, 1970). As a result, the value of the stock market is reduced. In addition, the increase in interest rates makes bonds more attractive relative to stocks, which also contributes to the decline in stock prices and, consequently, stock returns (Mishkin, 1995). Having presented the theoretical body, we will now discuss the synthesis of empirical research on the effect of monetary policy on stock market performance.

2.2. Empirical Contributions

Several empirical studies have been conducted to assess the effect of monetary policy on stock market performance. Positive or negative results have been observed using econometric methods. For example, Nwakoby and Alajekwu (2016) studied the effect of monetary policies on stock market performance in Nigeria between 1986 and 2013. The ordinary least squares (OLS) regression results indicate that monetary policy significantly explains 53% of the variations in the performance of the Nigerian stock market. However, while the monetary policy rate has a non-significant positive effect on the overall stock market index, the lending rate has a positive and significant effect on this index. Alugbuo and Chika (2020) studied the effect of monetary policy on stock market performance in Nigeria from 1981 to 2018 using the ARDL model. The results show that lending interest rate has a positive relationship with all stock indices in the current year. On the other hand, money supply has a negative relationship with stock indices in the current year as well as in the lag periods of the first, second and third year in the short run, but it has a positive relationship with all stock indices in the long run.

Marozca (2020) studied the case of South Africa by analyzing the relationships between stock returns, interest rates, and exchange rates from 1995 to 2019. His results, obtained by the OLS and GARCH (1,1) methods, show a positive and significant relationship between stock returns and interest rates. In Ghana, Adabor and Buabeng (2020) examined the effect of monetary policy on the stock market for the period 1990-2019. Using the Autoregressive Distributed Lag (ARDL) model, they found that the monetary policy rate and the money supply have a negative and statistically significant effect on stock market performance in the long run, while they exert a positive and statistically significant effect in the short run. In contrast to the aforementioned work, other research has focused on larger samples. Lütkepohl and Netšunajev (2018) studied the relationship between monetary policy in the euro area and the stock market using a structural vector autoregressive (SVAR) model. The results indicate that contractionary monetary policy shocks lead to a sustained decline in real stock prices. For their part, Suhaibu et al. (2017) analyzed the relationship between monetary policy and stock market dynamics in 12 African countries for the period 1979–2013, using a panel VAR model.

Their results show that stock markets are positively influenced by respective monetary policies through the interest rate channel. Similarly, Asiedu et al. (2020) examined the dynamics of stock market performance in response to changes in monetary aggregates in 10 African countries from 1993 to 2019, using a vector error correction model (VECM). They found that increases in broad money supply positively improve stock market performance through the interest rate channel.

3. Methodology

In this section, we present the empirical model used to assess the effect of monetary policy on the performance of financial markets in the ECOWAS zone. This involves, on the one hand, specifying the model of the study and, on the other hand, defining the variables used.

3.1. Specification of the empirical model and description of variables

The objective of this work is to analyze the effect of monetary policy on the performance of stock markets in the ECOWAS zone. More precisely, this study examines the nature of this effect by focusing on the three main stock exchanges: the Regional Stock Exchange (BRVM), the Ghana Stock Exchange and the Nigerian Stock Exchange. We seek to demonstrate that monetary policy has an asymmetric effect on the performance of stock markets in this region. To our knowledge, this aspect has not yet been explored for stock markets in the ECOWAS zone.

In this study, we use two indicators to assess the stock market performance: stock market return and stock turnover rate, which provide a better understanding of market performance. For the explanatory variables, based on the literature, we include, in addition to monetary policy which is the variable of interest, the inflation rate, economic growth and the exchange rate. Thus, the equations to be estimated can be written as follows:

$$R_{it} = \beta_0 + \beta_1 MP_{it} + \beta_2 INF_{it} + \beta_3 GDP_{it} + \beta_4 ER_{it} + \varepsilon_{it} \quad (1)$$

$$Turnover_{it} = \alpha_0 + \alpha_1 MP_{it} + \alpha_2 INF_{it} + \alpha_3 GDP_{it} + \alpha_4 ER_{it} + \varepsilon_{it} \quad (2)$$

Where, β_0 ,β_1, β_2, β_3, β_4, α_0, α_1, α_2, α_3 et α_4 are the parameters to be estimated. ε_{it} is the error term.

The dependent variable R_{it} represents the stock return and $Turnover$ e is the stock turnover rate. The stock return is the rate of change of the stock index. It is obtained from the following formula:

$$R = \frac{I_t - I_{t-1}}{I_{t-1}} \quad (3)$$

With I_t the stock index of period t and I_{t-1} the stock index of period t-1.

The stock turnover rate (Turnover) is the total value of shares traded during the period, divided by the average market capitalization of the period.

The variable MP_{it} denotes monetary policy, which can be either expansionary or contractionary depending on its variations. Expansionary monetary policy aims to increase the quantity of money in circulation, while contractionary monetary policy seeks to reduce it. Various indicators can be used to measure monetary policy, such as the central bank policy rate, the money market rate, or the money supply as a percentage of GDP. However, in our study, and due to the unavailability of data, we use the money supply as a percentage of GDP to assess monetary policy. An increase in the money supply indicates an

expansionary policy, while a decrease reflects a contractionary policy. Economists generally agree that a contractionary monetary policy leads to a decrease in stock prices, while an expansionary monetary policy leads to an increase in these prices (Modigliani, 1971). We will test this theoretical hypothesis by postulating a positive effect of expansionary monetary policy and a negative effect of contractionary monetary policy on stock market performance.

The variable INF_{it} denotes inflation, which is defined as the increase in the general price level. It is measured by the GDP deflator, which is the ratio of nominal GDP to real GDP multiplied by 100. The tax effects hypothesis predicts that inflation has a negative impact on stock market returns. During periods of inflation, firms face increased tax liabilities, which reduce their real profits (Feldstein, 1980). Therefore, rational investors tend to decrease the value of common stocks during these periods to account for the effect of inflation. This decrease in valuation leads to lower stock market returns. Based on this theoretical prediction, we expect a negative effect of inflation on stock market performance.

The variable GDP_{it} is the GDP growth rate. It is an indicator that measures the economic performance of a country. It is generally accepted that economic growth is favorable to stock market performance. Recessions are bad for stock market profitability, and recoveries are good (Ritter, 2005). We expect a positive effect of economic growth on stock market performance.

The variable ER_{it} represents the exchange rate, defined as the value of a domestic currency relative to that of another country. It indicates the amount of a foreign currency that can be obtained with one unit of another currency. In general, the exchange rate is the relative price of one currency to another. In this study, we use the real exchange rate to capture this variable. Stock prices decrease when the exchange rate increases, while a decrease in the exchange rate has a positive impact on the stock market (Pilinkus and Boguslauskas, 2009). For this purpose, we expect a negative sign.

3.2. Estimation Method

To highlight the asymmetric effects of monetary policy on the performance of stock markets in the ECOWAS region, the study adopts the NARDL model developed by Shin et al. (2014). According to them, the Panel NARDL approach reveals the differences in responses to positive and negative variations. The main advantages of the Panel NARDL model lie in the possibility of examining the non-linear integration relationship between the variables of the model, while estimating the short and long-term effects. It is therefore superior to the Panel ARDL in that it highlights the asymmetric effects of the explanatory variables on the explained variable in the short and long term. Indeed, this approach uses partial sum decompositions to implement non-linearity by examining the possible asymmetric effects in the short and long term. This approach will shed light on the effect of expansionary and restrictive monetary policies on the performance of stock markets in

the ECOWAS zone. It will thus make it possible to simultaneously analyze the effects of the two types of monetary policy on the three main stock markets in the region, in order to determine which contributes the most to improving their performance. This analysis, which previous studies have not highlighted and which the symmetrical relationship does not allow to observe, may be made possible by the NARDL model. Following Shin et al. (2014), the NARDL model is as follows:

$$\Delta y_{it} = \beta_{0i} + \beta_{1i} y_{i,t-1} + \beta_{2i}^{+} x_{t-1}^{+} + \beta_{2i}^{-} x_{t-1}^{-} + \sum_{j=0}^{N1} \varphi_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{N2} (\gamma_{ij}^{+} \Delta x_{t-j}^{+} + \gamma_{ij}^{-} \Delta x_{t-j}^{-}) + \varepsilon_{it} \quad (4)$$

Equation (4) can be written in the form of an error correction model as follows:

$$\Delta y_{it} = \tau_i \omega_{i,t-1} + \sum_{j=1}^{N1} \varphi_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{N2} (\gamma_{ij}^{+} \Delta x_{t-j}^{+} + \gamma_{ij}^{-} \Delta x_{t-j}^{-}) + + \varepsilon_{it} \quad (5)$$

Where ρ is the long-term autoregressive coefficient, $\emptyset_j$ is the short-term autoregressive coefficient, γ_j^{+} and γ_j^{-} are the short-term asymmetric effects of positive and negative variations of x on y.

According to equation (5), the models to be estimated are as follows:

$$\begin{aligned} \Delta R_{it} = {} & \beta_{oi} + \sum_{i=1}^{p-1} \emptyset_{ij} \Delta R_{i,t-i} + \sum_{t=0}^{q-1} \varphi_{ij}^{+} \Delta MP_{i,t-i}^{+} + \sum_{t=0}^{q-1} \varphi_{ij}^{-} \Delta MP_{i,t-i}^{-} + \\ & \sum_{t=0}^{q-1} \varphi_{ij}^{+} \Delta INF_{i,t-i}^{+} + \sum_{t=0}^{q-1} \varphi_{ij}^{-} \Delta INF_{i,t-i}^{-} + \sum_{t=0}^{q-1} \varphi_{ij}^{+} \Delta GDP_{i,t-i}^{+} + \\ & \sum_{t=0}^{q-1} \varphi_{ij}^{-} \Delta GDP_{i,t-i}^{-} + \sum_{t=0}^{q-1} \varphi_{ij}^{+} \Delta ER_{i,t-i}^{+} + \sum_{t=0}^{q-1} \varphi_{ij}^{-} \Delta ER_{i,t-i}^{-} + \rho R_{i,t-1} + \\ & \theta_{1i}^{+} MP_{i,t-1}^{+} + \theta_{2i}^{-} MP_{i,t-1}^{-} + \theta_{3i}^{+} INF_{i,t-1}^{+} + \theta_{4i}^{-} INF_{i,t-1}^{-} + \theta_{5i}^{+} GDP_{i,t-1}^{+} + \\ & \theta_{6i}^{-} GDP_{i,t-1}^{-} + \theta_{1i}^{+} ER_{i,t-1}^{+} + \theta_{2i}^{-} ER_{i,t-1}^{-} + \varepsilon_{it} \end{aligned} \quad (6)$$

$$\begin{aligned} \Delta Turnover_{it} = {} & \alpha_{oi} + \sum_{i=1}^{p-1} \omega_{ij} \Delta Turnover_{i,t-i} + \sum_{t=0}^{q-1} \gamma_{ij}^{+} \Delta MP_{i,t-i}^{+} + \\ & \sum_{t=0}^{q-1} \gamma_{ij}^{-} \Delta MP_{i,t-i}^{-} + \sum_{t=0}^{q-1} \gamma_{ij}^{+} \Delta INF_{i,t-i}^{+} + \sum_{t=0}^{q-1} \gamma_{ij}^{-} \Delta INF_{i,t-i}^{-} + \\ & \sum_{t=0}^{q-1} \gamma_{ij}^{+} \Delta GDP_{i,t-i}^{+} + \sum_{t=0}^{q-1} \gamma_{ij}^{-} \Delta GDP_{i,t-i}^{-} + \sum_{t=0}^{q-1} \gamma_{ij}^{+} \Delta ER_{i,t-i}^{+} + \\ & \sum_{t=0}^{q-1} \gamma_{ij}^{-} \Delta ER_{i,t-i}^{-} + \sigma Turnover_{i,t-1} + \delta_{1i}^{+} MP_{i,t-1}^{+} + \delta_{2i}^{-} MP_{i,t-1}^{-} + \\ & \delta_{3i}^{+} INF_{i,t-1}^{+} + \delta_{4i}^{-} INF_{i,t-1}^{-} + \delta_{5i}^{+} GDP_{i,t-1}^{+} + \delta_{6i}^{-} GDP_{i,t-1}^{-} + \delta_{7i}^{+} ER_{i,t-1}^{+} + \\ & \delta_{8i}^{-} ER_{i,t-1}^{-} + \varepsilon_{it} \end{aligned} \quad (7)$$

where:

$$MP_t^{+} = \sum_{j=1}^{t} \Delta MP_{ij}^{+} = \sum_{j=1}^{t} max\,(\Delta MP_{ij}, 0) \quad (8)$$

$$MP_t^{-} = \sum_{j=1}^{t} \Delta MP_{ij}^{-} = \sum_{j=1}^{t} min\,(\Delta MP_{ij}, 0) \quad (9)$$

$$INF_t^{+} = \sum_{j=1}^{t} \Delta INF_{ij}^{+} = \sum_{j=1}^{t} max\,(\Delta INF_{ij}, 0) \quad (10)$$

$$INF_t^{-} = \sum_{j=1}^{t} \Delta PINF_{ij}^{-} = \sum_{j=1}^{t} min\,(\Delta INF_{ij}, 0) \quad (11)$$

$$GDP_t^{+} = \sum_{j=1}^{t} \Delta GDP_{ij}^{+} = \sum_{j=1}^{t} max\,(\Delta GDP_{ij}, 0) \quad (12)$$

$$GDP_t^{-} = \sum_{j=1}^{t} \Delta GDP_{ij}^{-} = \sum_{j=1}^{t} min\,(\Delta GDP_{ij}, 0) \quad (13)$$

$$ER_t^+ = \sum_{j=1}^{t} \Delta\, ER_{ij}^+ = \sum_{j=1}^{t} max\,(\Delta ER_{ij}, 0) \quad (14)$$

$$ER_t^- = \sum_{j=1}^{t} \Delta\, ER_{ij}^- = \sum_{j=1}^{t} min\,(\Delta ER_{ij}, 0) \quad (15)$$

where, PM_t^+, MP_t^-, INF_t^+, INF_t^-, GDP_t^+, GDP_t^-, ER_t^+ and ER_t^- represent the positive and negative partial sums of MP_t, INF_t, GDP_tet ER_t, respectively.

φ_{ij}^+,φ_{ij}^-, γ_{ij}^-, γ_{ij}^+, θ_{1i}^+, θ_{2i}^-, θ_{3i}^+,θ_{4i}^-, θ_{5i}^+,θ_{6i}^-,θ_{7i}^+, θ_{8i}^-, δ_{1i}^+, δ_{2i}^-, δ_{3i}^+,δ_{4i}^-, δ_{5i}^+,δ_{6i}^-,δ_{7i}^+ et δ_{8i}^- are the short-term and long-term asymmetric parameters to be estimated. $\emptyset_{ij}$ and ω_{ij} are the autoregressive parameters. β_{oi} et α_{oi} are constants. ε_{it} is the error term. p and q are optimal lags.

The use of the NARDL model first requires the performance of certain econometric tests. First, it is essential to check the stationarity of the series. If the variables are integrated of order 2, this model is not applicable. Then, it is appropriate to test the cointegration between the variables, if the unit root tests indicate a possible long-term relationship. Indeed, a long-term relationship is envisaged when certain variables are integrated of order 1. Thus, if the cointegration tests confirm that the variables are cointegrated, that is, that they maintain a long-term relationship, the NARDL model can be used.

4. Data sources and Descriptive Analysis

This section presents firstly the data sources and secondly the descriptive statistics.

4.1. Data sources and descriptive analysis

The data used in this study are annual and come mainly from the World Bank (WDI, 2023). Due to the unavailability of data, the analysis focuses on 3 stock markets in the ECOWAS zone (the BRVM, the Ghana Stock Exchange and the Nigerian Stock Exchange) and covers the period 2000-2021. Table 1 presents a summary of the variables, their sources and the expected effects.

Table 1. *Variables, data source and expected variable signs*

Variables	Definition of variables	Data sources	Expected signs
R	Stock market performance	WDI (2023)	
Turnover	Stock turnover rate	WDI (2023)	
MP	Monetary policy	WDI (2023)	+/-
INF	Inflation rate	WDI (2023)	-
GDP	GDP growth rate	WDI (2023)	+
ER	Exchange rate	WDI (2023)	-

Source: Authors, from literature.

4.2. Descriptive Analysis

Table 2 presents the descriptive statistics of the data. It presents the mean values and the respective standard deviations as well as the minimum and maximum values of the variables used. The mean value essentially indicates the average value of the variable and the standard deviation shows the magnitude of the deviation from the mean value.

Table 2. *Descriptive statistics of the variables*

Variable	Mean	Standard deviation	Min	Max	Observations
R	0.027	0.253	-0.459	1.346	N = 63
Turnover	6.411	5.245	0.873	34.785	N = 63
MP	24.748	6.431	11.300	38.663	N = 63
INF	13.342	12.662	0.686	80.754	N = 63
GDP	4.802	3.211	-4.825	15.329	N = 63
ER	244.896	240.394	0.544	732.397	N = 63

Source: Authors, based on World Bank data (2022).

Table 2 shows that the average stock return is 0.027, with a minimum value of -0.459 and a maximum of 1.346. The standard deviation, of 0.253, higher than the average, reflects a high dispersion. Turnover, on the other hand, has an average of 6.411 with a dispersion of 5.245, its minimum value being 0.873 and the maximum of 34.785. Regarding monetary policy, the average is 24.748 with a low dispersion of 6.431, a minimum of 11.300 and a maximum of 38.663. Inflation has an average of 13.342, a dispersion of 12.662, and varies between a minimum of 0.686 and a maximum of 80.754. GDP has an average of 4.802 with a standard deviation of 3.211, a minimum of -4.825 and a maximum of 15.329. Finally, the exchange rate has an average of 244.896, with a significant dispersion of 240.394, a minimum value of 0.544 and a maximum of 732.397. Table 3 also shows the results of the correlation matrix of the different variables.

Table 3. *Correlation matrix*

Variables	(1)	(2)	(3)	(4)	(5)
(1)R	1				
(2)MP	-0.003	1			
(3)INF	0.129	-0.140	1		
(4)GDP	0.207	-0.335*	0.263*	1	
(5)ER	-0.231	-0.008	-0.483*	-0.426*	1
Variables	(1)	(2)	(3)	(4)	(5)
(1)Turnover	1				
(2)MP	-0.225	1			
(3)INF	0.046	-0.140	1		
(4)GDP	0.355*	-0.335*	0.263*	1	
(5)ER	-0.345*	-0.008	-0.483*	-0.426*	1

Note: * represents the correlation between variables at the 10% threshold.
Source: Authors, based on World Bank data (2022).

Table 3 reveals that inflation and economic growth are positively correlated with stock market returns and turnover, while monetary policy and exchange rate are negatively correlated with these two indicators. In addition, a low correlation between the explanatory variables is observed, suggesting the absence of multicollinearity problem in the models of the study. Thus, all the selected variables will be integrated into the regression.

Following the analysis of descriptive statistics and correlation, in the next section, we will present the results.

5. Estimation Results

This section first presents the results of the econometric tests before moving on to those of the estimations.

5.1. Econometric tests

The results of the econometric tests in this study mainly include the homogeneity test, the Hausman test, the cross-sectional dependence test, the unit root tests and the cointegration tests. The results of these different tests are shown in Tables 4, 5, 6, 7 and 8, respectively.

Table 4. *Results of Pesaran and Yamagata (2008) homogeneity test*

	Yield	Turnover
Delta	1.662**	2.001**
	(0.007)	(0.045)
adj.	-2.091**	-2.518**
	(0.037)	(0.012)

Note: (**) represent the significance level at the 5% threshold.
Source: Authors, based on World Bank data (2023).

The results of the homogeneity test indicate that the null hypothesis of panel homogeneity is rejected at the 5% level, as both the delta and adjusted delta statistics are significant at this level. This shows that the panel is heterogeneous, suggesting the presence of specific effects. To test whether these specific effects are fixed or random, we performed the Hausman test, the results of which are presented in Table 5.

Table 5. *Hausman Test*

	Stock market performance	Turnover
Chi2(4)	60.67***	17.63***
(Prob>chi2)	(0.000)	(0.0001)

Note: (**) represent the significance level at the 5% threshold.
Source: Authors, based on World Bank data (2023).

The results of the Hausman test indicate the presence of fixed effects, with a probability of less than 1%. This leads us to perform the Breusch-Pagan (1980) dependence test. The results of this test are presented in Table 6.

Table 6. *Results of the interindividual dependency test*

	Stock market performance	Turnover
Chi2(3)	3.448	4.636
Prob > chic2	0.327	0.200

Source: Authors, based on World Bank data (2023).

The results of the cross-sectional dependence test confirm the inter-individual independence, since the probability exceeds 10%. Consequently, the first-generation unit root tests will be applied to check for the presence of a unit root and determine the order of integration of our series. We performed the unit root test of Choi (2001), the results of which are presented in Table 7.

Table 7. *Choi (2001) unit root test*

Variables	Dickey-Fuller		Phillips-Perron		Decision
	Level (0)	Differance (1)	Level	Differance (1)	
R	8.690***		8.690***		I(0)
	(0.000)	-	(0.000)	-	
Turnover	6.650***		6.650***		I(0)
	(0.000)	-	(0.000)	-	
MP	-0.460	9.077***	-0.460	9.077***	I(1)
	(0.677)	(0.000)	(0.677)	(0.000)	
INF	21.397***		21.397***		I(0)
	(0.000)	-	(0.000)	-	
GDP	0.417	15.346***	0.417	15.346***	I(1)
	(0.338)	(0.000)	(0.338)	(0.000)	
ER	-0.876	3.294***	-0.876	3.294***	I(1)
	(0.809)	(0.000)	(0.809)	(0.000)	

Note: (***) represent the significance level at the 1% level.
Source: Authors, based on World Bank data (2023).

The results of the unit root tests indicate that the variables stock return, turnover and inflation are stationary in level, or integrated of order 0. On the other hand, the variables monetary policy, GDP and exchange rate are stationary in first difference, therefore integrated of order 1. This suggests a possible long-run relationship between these variables. We therefore carry out tests to verify the existence of such a relationship. The results of the cointegration tests of Pedroni (1999) and Kao (1999) are reported in Table 8.

Table 8. *Cointegration test of Pedron (1999) and Kao (1999)*

	Stock market performance		Turnover	
Pedroni (1999)	Statistic	p-value	Statistic	p-value
Modified Phillips-Perron t	-0.525***	0.009	0.363***	0.008
Phillips-Perron t	-9.541***	0.000	5.356***	0.000
Augmented Dickey-Fuller t	-9.196***	0.000	-3.772***	0.0001
Kao (1999)				
Modified Dickey-Fuller t	-0.261***	0.006	-2.910***	0.001
Dickey-Fuller t	-2.066**	0.019	-2.728***	0.003
Augmented Dickey-Fuller t	-1.923**	0.027	-3.025***	0.001
Unadjusted modified Dickey- Fuller	-9.181***	0.000	-4.445***	0.000

Note: (***) and (**) represent significance levels at the 1% and 5% level, respectively.
Source: Authors, based on World Bank data (2023).

The results of the cointegration test show that the probabilities are less than 5%, which leads to the rejection of the null hypothesis of no cointegration relationship. Therefore, a long-run relationship exists between the variables. With the results of the econometric tests being presented, in the following, we will present the estimation results as well as the discussion of these results.

5.2. Estimation Results and Discussion

The estimation of the NAR DL model requires the prior verification of asymmetry. Table 9 provides the results of the asymmetry test.

Table 9. *Asymmetry Test*

	Long term		Short term		
Variables	Chi2	P-value	Chi2	P-value	Decision
MP	19.51***	0.000	53.08***	0.000	Asymmetry
INF	10.86***	0.001	5.25**	0.021	Asymmetry
GDP	21.46***	0.000	14.33***	0.000	Asymmetry
ER	3.34**	0.007	10.03**	0.004	Asymmetry

Note: (***) and (**) represent significance levels at the 1% and 5% level, respectively.
Source: Authors, based on World Bank data (2023).

As shown in Table 9, the symmetry hypothesis is rejected for both short-run and long-run relationships at the 5% level. Therefore, monetary policy, inflation, economic growth, and the exchange rate have an asymmetric effect on stock market performance. This confirms the choice of the NARDL model. The estimates of the long-run parameters are reported in Table 10 and those of the short-run parameters are presented in Table 11.

Table 10. *Estimation results of the NARDL model (Long-term dynamics)*

Variables	Yield	Turnover
MP^+	0.051 ***	3.278***
	(0.000)	(0.000)
MP^-	-0.107***	-0.941***
	(0.000)	(0.000)
INF^+	-0.011**	-1.054***
	(0.027)	(0.000)
INF^-	0.009*	0.884***
	(0.053)	(0.000)
GDP^+	0.033***	2.445***
	(0.004)	(0.000)
GDP^-	-0.033	0.826***
	(0.100)	(0.000)
ER^+	-0.003***	-0.082***
	(0.000)	(0.000)
ER^-	-0.001	-3.284***
	(0.398)	(0.001)

Note: (***), (**), (*) represent the significance level at the 1%, 5% and 10% level, respectively. Probabilities are in parentheses. [+] and [-] are positive and negative changes in the variables, respectively.
Source: Authors, based on data from the World Bank (2021).

Table 11. *Estimation results of the NARDL (Short-term dynamics) model*

	CEDEAO		BRVM		Ghana Stock Exchange		Nigeria Stock Exchange	
	Rendement	Turnover	Rendement	Turnover	Rendement	Turnover	Rendement	Turnover
Ec	-0.957***	-0.188*	-0.844***	-0.003**	-1.078	-0.169**	-0.950***	-0.39***
	(0.000)	(0.095)	(0.000)	(0.045)	(0.000)	(0.021)	(0.000)	(0.000)
ΔMP^+	-0.037***	-0.117*	-0.054*	-0.155	-0.039	0.246	-0.019***	-0.44***
	(0.000)	(0.054)	(0.058)	(0.715)	(0.585)	(0.624)	(0.001)	(0.000)
ΔMP^-	0.068***	1.539***	0.054	0.870	0.090	1.369**	0.060***	2.378***
	(0.000)	(0.001)	(0.440)	(0.431)	(0.306)	(0.043)	(0.000)	(0.000)
ΔINF^+	0.004	0.125	-0.002	-0.123	0.004	0.207*	0.012***	0.292***
	(0.259)	(0.323)	(0.925)	(0.759)	(0.741)	(0.053)	(0.000)	(0.000)
ΔINF^-	-0.010**	-0.073**	-0.014*	0.135	-0.001	0.078*	-0.016***	0.007
	(0.020)	(0.045)	(0.071)	(0.262)	(767)	(0.084)	(0.000)	(0.762)
ΔGDP^+	-0.002	-0.092	-0.011	0.221	0.015	0.134	-0.012	-0.63***
	(0.745)	(0.733)	(0.646)	(0.584)	(0.734)	(0.695)	(0.325)	(0.000)

	CEDEAO		BRVM		Ghana Stock Exchange		Nigeria Stock Exchange	
ΔGDP^{-}	0.042***	0.112	0.047*	-0.231	0.036	0.045	0.041***	0.524***
	(0.000)	(0.609)	(0.061)	(0.407)	(0.410)	(0.884)	(0.000)	(0.000)
ΔER^{+}	-0.011	-0.741	0.001**	-0.005	-0.038	-2.258	0.002**	0.040***
	(0.394)	(0.329)	(0.039)	(0.624)	(0.907)	(0.327)	(0.027)	(0.000)
ΔER^{-}	-0.016	-0.529	-0.001	0.011	-0.047	-2.357	-0.046***	-1.60***
	(0.298)	(0.323)	(0.145)	(0.380)	(0.706)	(0.465)	(0.000)	(0.000)
Cons	-0.049	-1.285***	-0.064**	-0.533	0.012	-1.670*	-0.097***	-1.65***
	(0.129)	(0.001)	(0.036)	(0.216)	(0.888)	(0.082)	(0.000)	(0.000)

Note: (***), (**), (*) represent the significance level at the 1%, 5% and 10% level, respectively. Probabilities are in parentheses. [+] and [-] are positive and negative changes in the variables, respectively.
Source: Authors, based on data from the World Bank (2023).

The result shows that the coefficients of the adjustment term are statistically significant at the 1%, 5% and 10% levels in the regressions. This result indicates that the system returns to equilibrium in the event of a shock causing an imbalance. In addition, it reveals a stable long-term cointegration between the variables. The estimates reveal that monetary policy has an asymmetric effect on the long-term performance of stock markets in the ECOWAS region. Indeed, an increase in the money supply has a positive and statistically significant impact at 1% on stock market returns and turnover, which means that an expansionary monetary policy improves the performance of stock markets in this region. Conversely, a decrease in the money supply has a negative effect, also significant at 1%, on these same indicators, suggesting that a restrictive monetary policy harms long-term stock market performance in the ECOWAS region. This asymmetric effect can be explained by the stock price channel in the transmission of monetary policy. According to this mechanism, a restrictive monetary policy causes stock prices to fall, while an expansionary policy causes them to rise (Tobin, 1969). Monetarist theory maintains that when the money supply increases, agents, believing that they have excess liquidity, seek to spend it, particularly on the stock market, thereby increasing the demand for stocks and pushing up prices, which strengthens stock market performance. In addition, an expansionary monetary policy reduces interest rates, making bonds less attractive relative to stocks, which contributes to rising stock prices and improving market performance (Modigliani, 1971). In contrast, a restrictive policy raises interest rates, making bonds more attractive than stocks, which leads to falling stock prices and, consequently, to a deterioration in stock market performance.

The short-run results, as shown in Table 11, show a different asymmetry compared to the long-run results. In the short run, an expansionary monetary policy, characterized by an increase in the money supply, has a negative and statistically significant effect on stock market returns and turnover at the 1% and 10% thresholds, respectively. In contrast, a contractionary monetary policy, leading to a decrease in the money supply, improves stock market performance positively and significantly at the 1% threshold in the ECOWAS region. This seemingly counterintuitive result could be explained by the fact that in the short run, an expansionary monetary policy can be interpreted by investors as a reaction to

difficult economic conditions. To this end, if they consider this policy as an indicator of economic weakness or financial distress, they could respond by selling stocks, which could cause stock prices to decline. Our results contrast with those of Marozca (2020), who showed that money supply has a negative effect on long-term stock market performance in South Africa, while exerting a positive effect in the short term.

The stock market-specific results show that monetary policy has an asymmetric effect on the Nigerian Stock Exchange. Indeed, an increase in the money supply linked to an expansionary monetary policy leads to a decrease in stock returns and turnover, while a decrease in the money supply causes an increase in these indicators. On the other hand, expansionary monetary policy has a positive but insignificant effect on the performance of the Ghana Stock Exchange, while restrictive monetary policy has a positive and significant effect on turnover, but not significant on stock returns. For the BRVM, the results show that the increase in the money supply resulting from an expansionary monetary policy has a negative and significant effect on stock returns, but does not significantly affect turnover. On the other hand, the decrease in the money supply linked to a restrictive monetary policy has a positive, although insignificant, effect on stock returns and turnover. Monetary policy seems to have little influence on the performance of the Ghana Stock Exchange and the BRVM. These results suggest that the Nigerian Stock Exchange is more sensitive to monetary policy changes than the Ghana Stock Exchange and the BRVM. This difference could be attributed to the dynamics of the Nigerian Stock Exchange relative to the other two stock markets.

Regarding the control variables, a decrease in inflation has a negative effect on stock market performance in the short term in the ECOWAS region. However, in the long term, an increase in inflation negatively and significantly affects stock market performance, while a decrease in inflation has a positive effect, which confirms Fisher's (1930) theory that inflation has a positive effect on stock market returns when companies use stocks as a hedge against inflation. Regarding economic growth, in the short term, a decrease has a positive and significant effect on stock market returns, but not a significant effect on turnover. In the long term, an increase in the GDP growth rate improves stock market returns and turnover, while a decrease has a positive and significant effect on turnover. This result corroborates those of Şentürk et al. (2014) highlighted in Turkey. As for the exchange rate, in the long term, an increase has a negative and significant effect on the performance of stock markets in the ECOWAS zone, just like a decrease, which also negatively affects stock markets.

6. Conclusion and Policy Implications

This study aimed to analyze the asymmetric effect of monetary policy on stock market performance in the ECOWAS zone, focusing on three stock exchanges in the region. Methodologically, the nonlinear ARDL (NARDL) model was used. The results from the

zone showed that monetary policy has an asymmetric effect in the short and long term on stock market performance in the ECOWAS zone. In the short term, an expansionary monetary policy has a negative and significant effect on stock market performance, while a restrictive monetary policy has a positive and significant effect. However, in the long run, an expansionary monetary policy significantly improves the performance of stock markets, while a restrictive monetary policy influences it negatively. The analysis by stock market revealed that the Nigerian Stock Exchange is more responsive to variations in monetary policy than the Ghana Stock Exchange and the BRVM. In light of these results, the main lessons of this study are as follows. First, the effect of monetary policy on the performance of stock markets in the ECOWAS zone is asymmetric, rather than symmetric. Second, it appears that expansionary monetary policy improves the performance of stock markets only in the long run, while in the short run, it has a negative effect. On the other hand, restrictive monetary policy improves stock market performance in the short term, but becomes detrimental in the long term. Third, the BRVM and the Nigerian Stock Exchange are more responsive to changes in monetary policy than the Ghana Stock Exchange. Thus, as economic policy implications, an expansionary monetary policy could be considered to boost stock market performance in the long term in the ECOWAS region, while in the short term, a restrictive monetary policy could be more effective in improving stock market performance in the region. However, monetary authorities should exercise caution, as excessive expansion of the money supply could have negative consequences for both the economy and stock markets in the region.

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