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Empirical Analysis of the Relationship between Stock Market Returns and Macroeconomic Indicators in Nigeria

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Abstract
The objective of this paper is to investigate the relationship between stock market returns and macroeconomic indicators (exchange rates, money supply and M2, credit to the private sectors, and net foreign assets) in Nigeria. Monthly data ranging from January 2000 to March 2013 were analysed for evidence of long-run and short-run relationship. Results of Augmented Dickey Fuller Unit root test show that all the variables are integrated of order one ($I(1)$). Results of the Engle and Granger Cointegration test evidence of long-run relationship between stock market returns and all the macroeconomic variables examined. Results of the Error correction model indicate evidence of negative relation between exchange rate and stock market returns as well as a positive relation between credit to private sector and stock market returns in the short-run. The implication is for investors and regulators in the stock market to monitor changes in the macroeconomic indicator and adjust their portfolios accordingly.
Keywords: Stock Market Returns, Macroeconomic Indicators, Nigeria.
JEL Classification Code: G14, E44.

1. Introduction

A correct assessment of the relationship between stock market returns and macroeconomic indicators is crucial for portfolio management. The strong link between the macro economy and the stock market makes any shock in macroeconomic variables to present a source of systematic risk which will affect the market portfolio, irrespective of how well diversified the portfolio is (Emenike and Okwuchukwu, 2014). Finance theory, based on rational expectations, assumes that stock prices are determined in a forward-looking manner such that they are determined by expected future earnings. Macroeconomic policy shocks influence stock prices directly through the discount rate and indirectly through its influence on the degree of uncertainty or risks that an agent may face in the market (Bjornland, Hilde, and Leitemo, 2009). For example, increase in money supply leads to increase in liquidity which ultimately results in upward movement of nominal equity prices. Tightening the money supply, on the other hand, would raise the real interest rate. An increase in the real interest rate will lead to an increase in the discount rate, which decreases the value of the stock. Again, changes in the stock price may signal changes in future economic activity, and hence affect the level of loan demand.

The knowledge of the relationship between stock market returns and macroeconomic indicators is crucial to the investors in the equity market as well as to the policy makers. For investors, discovering the nature of this relationship could help them to appropriately adjust their portfolios in response of the changes in macroeconomic indicators as well as forecast stock return changes. Changes in macroeconomic indicators can thus be used as reliable direction of the stock market return changes thereby help investors in managing their investment portfolios. Similarly, from the macroeconomic point of view, it is important for policy makers to be able to identify relationships between stock market returns and macroeconomic indicators. If stock market returns lead macroeconomic indicators, policymakers could use stock market return as a leading indicator to predict future changes in macroeconomic indicators. On the other hand, if stock market returns do not lead macroeconomic indicators, it is not wise for policy makers to focus on stock market returns in order to determine changes in macroeconomic indicators. Therefore, it is worthwhile to examine empirically whether macroeconomic indicators can explain stock market returns volatility, or vice versa.

The key purpose of this study, therefore, is to empirically examine the relationship between stock market returns and macroeconomic indicators which includes, Naira/US$ exchange rates, money supply, credit to the private sectors, and net foreign assets, both in the long-run and short-run, in Nigeria. The remainder of the paper proceeds as follows. Section 2 presents the review of related literature. Section 3 provides the data and methodology. Section 4 presents the empirical results, and section 5 provides the conclusions.

2. Literature Review

There are many previous studies examining the empirical relationship between the stock market returns and macroeconomic indicators. Maku and Atanda (2010) critically examine the long-run macroeconomic determinants of stock market performance in Nigeria between 1984 and 2007. The properties of the time series variables are examined using the Augmented Dickey-Fuller (ADF) unit root test and most of the incorporated

variables in the study were found to have a unit root at level. The Augmented Engle-Granger Cointegration test result revealed that the stock market performance in Nigeria is mainly determined by macroeconomic forces in the long-run. However, the empirical analysis showed that the NSE all share index is more responsive to changes in exchange rate, inflation rate, money supply, and real output. The study recommended that investors should pay close attention to exchange rate, inflation, money supply, and economic growth rather than treasury bill rate in the long-run in their investment decision.

Emenike and Nwankwegu (2013) investigate whether stock market returns protect investors against inflation. Monthly All-share Index and monthly consumer price index from January 1985 to March 2011 were analysed for evidence of cointegration using the Engle and Granger two steps cointegration model. Results of the cointegration analyses indicate that the stock returns and inflation are cointegrated. Similarly, results of the error correction model suggest that stock returns and inflation converge to long-run equilibrium but the speed of adjustment to equilibrium is slow. The results also suggest that inflation does not have significant short-term effects on stock returns.

Akingunola, Adekunle and Ojodu (2012) studied the impact of interest rate on capital markets growth and to shed some light on how other macroeconomic variables such as inflation rate, exchange rate also influence capital markets growth, they employed multiple regression analysis of the ordinary least square to determine the impact of interest rate as well as other macroeconomic variables such as inflation rate, exchange rate on capital market growth. Pooled data regression method was also employed to estimate the specified model equations. Augmented Dickey –Fuller (ADF) Test was used to determine the order of integration that is the number of times a variable has to be differenced before it becomes stationary. Findings of the study revealed that interest rates have an adverse effect on capital market growth. The study concludes by saying that in order to enable the capital market to take full advantage of the various opportunities and cope with challenges, interest rates must be properly put at check.

Khan et al. (2012) explore the impact of interest rate, exchange rate and inflation on stock returns of KSE 100 index. Ten years monthly data from July, 2001 to June 2010 was used in the consideration. Multiple regression model is applied on the data and the result shows that there is a weak relationship between the dependent variable and independent variables. The impact of interest rate and inflation is insignificant on stock returns of KSE 100 index while the exchange rate has significant impact on stock returns of KSE 100 index.

Babalola and Adegbite, examined the Performance of the Nigerian Capital Market since Deregulation in 1986, with focus on their evolution, performance and prospects. The market in Nigeria was compared with other emerging markets with the conclusion that the market remains shallow and without the expected variety that characterized markets in countries at similar level of development.

Hsing (2013) finds that the Japanese stock market index is positively affected by industrial production, is negatively associated with the ratio of the government deficit to GDP, the domestic real interest rate and the expected inflation rate, and exhibits a nonlinear relationship with the ratio of M2 to GDP or the nominal effective exchange rate. The study suggests that to promote a robust stock market, the authorities are expected to pursue economic growth, fiscal discipline, and a relatively low interest rate and expected inflation rate. Too much money supply relative to GDP or continual appreciation of the yen would impair the Japanese stock market index.

In the same vein, Okodua and Olabanji. (2013), examined the relationship Stock Market Performance and Sustainable Economic Growth in Nigeria. Though stock market provides equity and a direct form of finance to potential investors for economic purposes, the study found out that in the long-run, overall output in the Nigerian economy is less sensitive to changes in stock market capitalization as well as the average dividend yield. The study concludes that with marginal variations in the interest rate which is suggestive that macroeconomic variables in the country are at present more useful in shaping the long-run direction of the Nigerian economy.

Accordingly Izedonmi and Abdullahi, (2011) empirically test the performance of the Arbitrage Pricing Theory (APT) in the Nigerian Stock Exchange (NSE) for the period of 2000 up to 2004 on monthly base and three macroeconomic variables (inflation, exchange rate and market capitalization variables) against 20 sectors of the Nigerian Stock Exchange to observe the effects of inflation exchange rate. Using Ordinary Least Square (OLS) it is observed that there are no significant effects of those variables on the stocks' return in Nigeria. The results are broadly consistent with similar studies carried for most developed and emerging economies.

Addo and Sunzuoye (2013) examine the joint impact of interest rates and Treasury bill rate on stock market returns on Ghana Stock Exchange over the period between January 1995 and December 2011. Using Johansen's Multivariate Cointegration Model and Vector Error Correction Model the study establish that there is cointegration between Interest rate, Treasury bill rate and stock market returns indicating long run relationship. Their results also show that Treasury bill rate and interest rate both have a negative relationship with stock market returns but are not significant. These results lend support to the idea that interest rate and Treasury bill rate both have negative relationship but weak predictive power on stock market returns independently. The study conclude that interest rate and Treasury bill rate jointly impact on stock market returns in the long run.

Also, Abraham (2012) examined the relationship between the stock market and selected macroeconomic variables in Nigeria. The all share index was used as a proxy for the stock market while inflation, interest and exchange rates were the macroeconomic variables selected. Employing error correction model, it was found that a significant negative short run relationship exists between the stock market and the minimum rediscounting rate (MRR) implying that, a decrease in the MRR, would improve the performance of the Nigerian stock market. It was also found that exchange rate stability in the long run, improves the performance of the stock market. Specifically, the study concludes that, by achieving stable exchange rates and altering the MRR, monetary policy would be effective in improving the performance of the Nigerian stock market.

3. Research Methodology

3.1 Model Specification

To investigate relationship between macroeconomic indicators and stock market returns, we adopt the following structural model:

$$SMR = \alpha_0 + \alpha_1 MS + \mu_t \quad (1)$$

$$SMR = \beta_0 + \beta_1 EXR + \mu_t \quad (2)$$

$$SMR = C_0 + C_1 NFA + \mu_t \quad (3)$$

$$SMR = D_0 + D_1 CPS + \mu_t \quad (4)$$

Where *SMR* is the dependent variable and is an estimate of the stock market return, *MS* denotes broad money supply that determines the level of liquidity in the economy, *EXR* is the exchange rate variable, *NPA* is the net foreign investment as a proxy for investors' confidence, *CPS* is the credit to the private sector, α_1, β_1, C_1 and D_1 are coefficients and their effects on stock market returns, and μ_t is the stochastic error term at time *t*. The *a priori* expectations of the explanatory variables are: $MS > 0, EXR > 0, CPI < 0, NPA > 0, CPS > 0$

3.2 Description of Data

To estimate the relationship stock market returns and macroeconomic indicators, we identified several macroeconomic indicators that could impact stock market returns and obtained monthly their data series from the Central Bank of Nigeria (CBN) statistics databank. For monetary aggregates we have employed broad money (M2) as a proxy for money supply. To capture the exchange rate relationship with stock market returns, we have included the data of official exchange rate of the Nigeria Naira vis-à-vis the United States dollar (EXR). To capture the relationship between foreign investors' confidence and stock market returns, we included the net foreign assets (NFA), and domestic investment is captured by the credit to the private sectors (CPS).

The monthly data cover the period from January 2000 to March 2013.

3.3 Techniques of Analysis

The technique of analysis of the relationship between stock market returns and macroeconomic indicators are the Engel-Granger cointegration model. Basically, the idea of cointegration is predicated on the thesis that even though two time series may not themselves be stationary, a linear combination of the two non-stationary time series may be stationary. If this is the case, the two original non-stationary time series are said to be 'cointegrated'. Usually, for co-integration, the two time series have to be stationary after the same number of differencing. If a given time series becomes stationary after first differencing, it is said to be integrated of order one *I*(1). If the time series becomes stationary after second differencing, it is integrated of order two *I*(2). If the original time series is stationary, it is integrated of order zero *I*(0). When a linear combination of two *I*(1) series is stationary, then the two time series are cointegrated. Cointegration implies a long–run relationship between them. Once cointegration is established, the short run adjustment dynamics can be usefully described by the error correction model (ECM). The ECM involves using the lagged residual to correct for deviations of actual values from the long-run equilibrium values.

To check for the order of integration we follow the Augmented Dickey-Fuller (ADF) (1981) test for unit roots. The ADF is generally regarded as the most efficient test from among the simple tests for integration and is at present the most widely used in practice. The ADF can be stated thus:

$$\Delta Y_t = \alpha_o + \alpha_1 Y_{t-1} + \sum_{i=2}^{k} b_1 \Delta Y_{t-1} + \varepsilon_t \quad (5)$$

The testing procedure follows an examination of the student-t ratio for α_1. The ADF test is conducted to determine whether the estimate of α_1 is equal to zero (i.e., $\alpha_1 = 0$) – the time series is non-stationary. The alternative hypothesis is that $\alpha_1 < 0$; that is, the time series is stationary. Fuller (1976) provides cumulative distribution function of the ADF statistic. If the computed absolute value of the coefficient of α_1 exceeds the ADF critical tau values, reject the null hypothesis that $\alpha_1 = 0$, in which case Y is stationary. Otherwise do not reject the null hypothesis, in which case Y is not stationary.

After determining the order of integration, the next step is to obtain the co-integrating vector in the regression equation as stated in Equation (1), and then test if the residuals μ_t are stationary. We can test whether stock market returns and macroeconomic indicator are cointegrated by testing whether the residuals μ_t are stationary.

Since we cannot observe μ_t, we instead test the Stationarity of the least squares residuals using a Dickey-Fuller test. We estimate the residual-based unit root test thus:

$\Delta\mu_t = \alpha_1\mu_{t-1} + \varepsilon_t$ (6)

Where $\Delta\mu_t$ is the first difference of μ_t, and examine the *t* (*tau*) statistic for the estimated slope (α). Because we are basing this test upon estimated values, to test the hypothesis of a unit root, we estimate by least squares and examine the *t-statistic* for the hypothesis that $\alpha = 0$. The t-statistic must be compared to special critical values taken from Davidson and Mackinnon (1993). If the *tau* statistic is less than the critical value at either 1% or 5% level of significance, we reject the null hypothesis that the least squares residuals are non-stationary, and conclude that they are stationary. Thus we conclude that the variables are cointegrated, indicating that there is a long-run, equilibrium relationship between the variables.

Given stationary residuals, and hence cointegration among variables, the next step is to estimate the error correction model (ECM). The ECM captures the extent of disequilibrium between the dependent and explanatory variables. For *I*(1) variables, the error-correction model relates changes in a variable, say ΔY_t, to departures from the long-run equilibrium in the previous period ($y_{t-1} - \beta_1 - \beta_2 x_{t-1}$). The ECM can be stated thus:

$\Delta SMR = \alpha_0 + \alpha_1\Delta MS + \mu_{t-1} + \varepsilon_t$ (7)

$\Delta SMR = \beta_0 + \beta_1\Delta EXR + \mu_{t-1} + \varepsilon_t$ (8)

$\Delta SMR = C_0 + C_1\Delta NPA + \mu_{t-1} + \varepsilon_t$ (9)

$\Delta SMR = D_0 + \beta_1\Delta CPS + \mu_{t-1} + \varepsilon_t$ (10)

Where, Δ denotes the first difference operator, β_{1-5} is the coefficient of the macroeconomic indicators, α_2 is coefficient of the one period lagged value of the error term from the cointegrating regression in equation (1), and ε_t is a random error term. The β_{1-5} measures the short-term effect of macroeconomic indicators on stock market returns. The α_2, which is the error correction term, captures the rate at which stock return adjusts to the equilibrium state after a shock (Emenike and Nwankwegu, 2013). The coefficient of α_2 should be negative in sign for the series to converge to long-run equilibrium. Negative and statistically significant α_2 coefficient is regarded as a convincing evidence and confirmation for the existence of cointegration found in the cointegrating regression (Engle and Granger, 1987). More so, the size of α_2 is an indication of the speed of adjustment towards equilibrium. Small coefficient of α_2, tending to -1, indicate that the speed of adjustment is fast; larger values, tending to 0, indicate that adjustment is slow; and positive values would imply that the series diverge from the long-run equilibrium path.

4. Empirical Results

4.1. Graphic Presentation of Variables and Descriptive Statistics

Figure 1 presents line graph of stock market returns and changes in selected macroeconomic indicators which includes money supply, Naira/US$ exchange rates, net foreign assets and credit to the private sectors in Nigeria. The major feature of Figure 1 is the upward and downward movements in the series. Worthy of note is downward movement of the NFA in the first quarter of 2002 and 2005. Also noticeable is movements of the SMR and EXR during the period of the global financial crisis. Finally, the series appear to have short memory, in which they are briefly interrupted and quickly return to pre-shock levels, suggesting that they may be stationary at first difference.

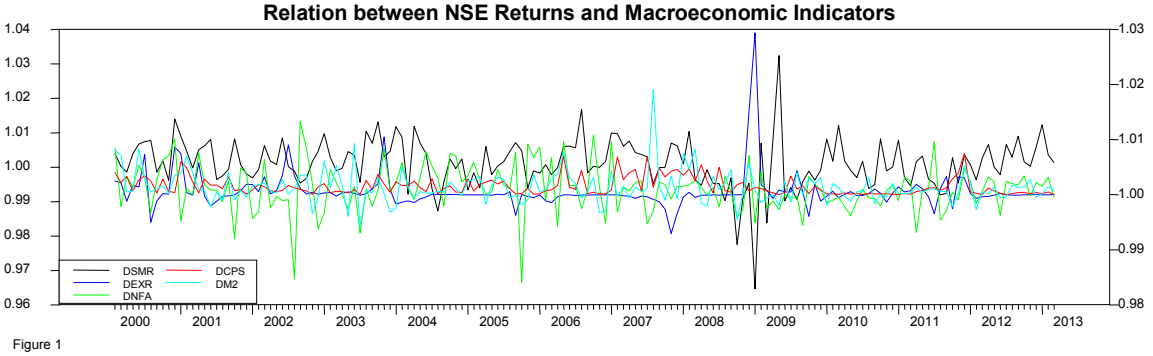

Figure 1

Table 1 shows descriptive statistics of the stock market returns and changes in macroeconomic indicators. We observe, from this table, that CPS has the highest mean log-return whereas SMR has the highest standard deviation. The distributional characteristics of all the variables appear to be inconsistent with the normality assumption. In a normally distributed series, the skewness is zero (0), Kurtosis is three (3), and Jarque-Bera is equal to zero (0). Positive or negative skewness and J-B indicate evidence against the normality assumption. Also, Kurtosis greater than or less than 3, suggest deviation from normality. From Table 1, SMR and NFA are negatively skewed, whereas EXr, M2 and CPS are positively skewed. All the variables also show excess Kurtosis, indicating evidence of leptokurtic distribution. Jarque-Bera coefficients for all variables are not zero.

The overall results from Table 1 indicate evidence against normal distribution in the series at conventional significance levels.

Table 1: Descriptive Statistics of NSE Returns Macroeconomic Variables

	Mean	**Std. Dev.**	**Kurtosis**	**Skewness**	**Jarque-Bera**
SMR	1.115	7.186	6.536 {0.000}	-0.657 {0.000}	292.6 {0.000}
Exr	0.294	1.603	38.184 {0.000}	5.023 {0.000}	10263.6 {0.000}
M2	2.012	4.362	8.951 {0.000}	1.791 {0.000}	612.03 {0.000}
CPS	2.243	2.419	2.903 {0.000}	1.700 {0.000}	131.62 {0.000}
NFA	1.653	6.472	1.927 {0.000}	-0.361 {0.066}	27.912 {0.000}

4.2 Unit Root Test

Table 2 presents the results of unit root tests performed on log-level and first difference of stock market returns, Naira/$ exchange rate, net foreign assets money supply and credit to the private sector series. All the variables are not stationary at levels but are stationary at first difference. These results indicate that the series require first differencing to achieve stationarity, that is they are *I*(1) variables. Hence, we can conduct cointegration tests.

Table 2: Unit Root Test Results

	SMr	Exr	M2	CPS	NFA	CritVal5%	Test
Level	-2.136	-2.473	-2.165	-1.553	-1.016	-3.43	**ADF**
Diff.	-5.739**	-8.033**	-12.94**	-4.236**	-6.010**	-3.43	**ADF**

4.3 Testing the Long-run Relationship

In this section, the results of the relationship expressed in equation (1-4) are presented. Table 3 shows the estimated results of the Engle-Granger cointegration test and Table 4 shows the results of the residual-based ADF cointegration test. Notice from Table 3 that macroeconomic indicators have a positive and significant relationship with stock market returns. This evidenced in the lesser value of the marginal significance level (0.00) to the significance level (0.05).

It is clear from the evidence that we cannot reject cointegration (i.e. long-run relation) between stock market returns and macroeconomic indicators (i.e., money supply, Naira/US$ exchange rates, net foreign assets and credit to the private sectors). From the residual-based unit root result presented in *Table 4*, it can be seen that the test statistics (-5.844), (-10.749), (-5.539), (-5.809) are less than the 5% critical tau (*τ*) value (-2.88) for exchange rate, net foreign assets, credit to the private sector, and money supply respectively. Since the computed *τ* value is less than the conventional critical tau values, we reject the null hypothesis of no cointegration in favour of the alternative. These results, therefore, indicate evidence of long-run relationship between stock market returns and macroeconomic indicators in Nigeria.

Table 3: Estimation Results of Long-run Relationships

Variable	Coefficient	Std Error	T-Stat	Significance
Stock Market Returns and Exchange Rate				
A	0.328	1.527	0.214	0.830
B	1.973	0.313	6.302	0.000
Stock Market Returns and Net Foreign Assets				
A	1.449	0.474	3.055	0.002
B	0.563	0.031	17.952	0.000
Stock Market Returns and Credit to the Private Sector				
A	5.028	0.448	11.218	0.000
B	0.330	0.030	11.015	0.000
Stock Market Returns and M2				
A	3.758	0.542	6.932	0.000
B	0.407	0.035	11.446	0.000

Table 4: Engle-Granger Cointegration Test

Variables	Critical Value 5%	Test Statistic
Stock Market Returns and Exchange Rate		
μ_t	-2.88	-5.844**
Stock Market Returns and Net Foreign Assets		
μ_t	-2.879	-10.749**
Stock Market Returns and Credit to the Private Sector		
μ_t	-2.880	-5.539**
Stock Market Returns and M2		
μ_t	-2.880	-5.809**

4.4 Testing the Short-run Relationship

This section presents the results of the ECM. The model of the ECM is of the form specified in Equation (7-10) and the estimates of the short-run and long-run movements, as well as the error correction term, which proxies speed of adjustment, are provided in Table 5. It can be observed that short-run changes in exchange rates have a negative and statistically significant impact on short-run changes on stock market returns. This suggests that stock market returns are inversely related to exchange rate in the short-run. Similarly, changes in credit to the private sector, in the short-run, positively impact stock market returns. On the other hand, changes in net foreign assets and money supply have positive but statistically insignificant effects on stock market returns.

Table 5 also shows useful long-run information. The equilibrium adjustment coefficient, (α_2), enters with a correct sign (negative) in all the estimates but are only significant in exchange rates and credit to the private sector. These suggest that stock market returns and exchange rate series converge to long-run cointegrating equilibrium at 5% significance level; Stock market returns and credit to the private sector are cointegrated in the long-run at 10% level. Deviations from this equilibrium relationship as a result of shocks will be corrected over time.

Notice also that α_2 tends to zero in both cases, indicating that the speed of adjustment to equilibrium is slow. It follows that about 0.39% of the deviation from equilibrium path is corrected per month in the case exchange rate and 0.2% for credit to private sector. The ECM results therefore confirm the long-run relationship between stock market returns with exchange rate and stock market returns with credit to the private sector observed from the residuals of equations 2 and 4, but do not appear to show such relationship for money supply and net foreign assets.

Table 5: Error Correction Model

Variable	Coefficient	Std Error	T-Stat	Significance
Stock Market Returns and Exchange Rate				
α_o	1.653	0.160	10.310	0.000
α_1	-0.651	0.160	-4.067	0.000
α_2	-0.003	0.001	-3.077	0.002
Stock Market Returns and Net Foreign Assets				
α_o	0.890	0.130	6.809	0.000
α_1	0.110	0.130	0.844	0.399
α_2	-0.002	0.001	-1.340	0.182
Stock Market Returns and Credit to the Private Sector				
α_o	0.231	0.360	0.641	0.522
α_1	0.768	0.360	2.134	0.034
α_2	-0.002	0.001	-1.910	0.057
Stock Market Returns and M2				
α_o	0.992	0.195	5.076	0.000
α_1	0.008	0.195	0.045	0.964
α_2	-0.001	0.001	-1.363	0.174

5. Conclusions

This paper empirically examined the relationship between stock market returns and macroeconomic indicators in Nigeria using the Engle-Granger two steps cointegration method. The economic motivation is to assess whether stock market returns have short-run and long-run relationship with macroeconomic indicator in Nigeria. The descriptive statistics show credit to the private sector has the highest mean log-return whereas stock market returns has the highest standard deviation, and that the series are not normally distributed. The ADF unit root tests indicate that the variables require first differencing to achieve stationarity, that is they are *I*(1) variables. The analyses of residuals from our cointegrating regression indicate evidence of cointegration between stock market returns and macroeconomic indicators (exchange rates, money supply and M2, credit to the private

sectors, and net foreign assets). Similarly, estimates from the error correction model (ECM) show stock market returns and exchange rate as well as credit to private sector and stock market returns series converge to a long run cointegrating equilibrium but at a very slow rate. The ECM results also show that short-run changes in exchange rate have a negative and statistically significant impact on short-run changes in stock market returns; short-run changes in credit to private sectors have a positive and statistically significant impact on short-run changes in stock market returns. The implication is for investors and regulator in the stock market to monitor changes in the macroeconomic indicator and adjust their portfolios accordingly.

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