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An Econometric Analysis of the Impact of Macroecomomic Variables on Stock Market Movement in Nigeria

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Abstract: This study investigates the impact of macroeconomic variables on Average Share Price (ASP) and goes further to determine whether changes in macroeconomic variables explain movements in stock prices in Nigeria. Various econometric analysis such as Augmented Dickey Fuller (ADF) test, Granger Causality test, Co-integration and Error Correction Method (ECM) were employed on time series data from 1986-2007 and the results revealed that a weak relationship exists between ASP and macroeconomic variables in Nigeria. The findings further point that ASP is not a leading indicator of macroeconomic performance in Nigeria, albeit, a long run relationship was found between ASP and macroeconomic variables for the period under review.

Key words: Granger causality, macroeconomic variables, stock market

INTRODUCTION

The stock market plays a major role in financial intermediation in both developed and developing countries by channeling idle funds from surplus to deficit units in the economy. As the economy develops, more resources are needed to meet the rapid expansion. The stock market serves as a veritable tool in the mobilization and allocation of savings among competing uses which are critical to the growth and efficiency of the economy (Alile, 1984). Through mobilization of resources the stock market promotes economic growth by providing avenue to pool large and long term capital through issuing of shares and stocks and other equities for industries in dire need of finance to expand their business. Thus, the overall development of the economy is a function of how well the stock market performs and empirical evidences have proved that development of the capital market is sine qua non for economic growth. While developed economies have fully explored the mobilization of resources through the capital market, the developing countries are yet to fully usurp the benefits of raising capital via the capital market.

Before the introduction of the Structural Adjustment Programme (SAP) in Nigeria, the capital market was grossly underutilized and only very few Nigerians invested in the capital market as a result of inadequate awareness and apathy by Nigerians. But since the deregulation of the economy in 1986, the stock market has grown very significantly. For example, with a market capitalization of less than five (5) trillion in the 1990s the stock market in Nigeria attained over thirteen (13) trillion market capitalization in 2007 before the global economic meltdown.

No doubt, a relationship exist between stock market development and growth of the economy and stock prices are generally believed to be determined by some fundamental macroeconomic variables such as interest rate, inflation, money supply and exchange rate. Empirical evidences have shown that changes in stock prices are linked with macroeconomic behaviour in advanced countries (Muradoglu *et al*., 2000; Diacogiannis *et al*., 2001; Wongbampo and Sharma, 2002; Mukhopadhyay and Sarkar, 2003; Gan *et al*., 2006; Robert, 2008) inter alia. The question is to what extent and in what ways can movement in stock prices be determined by changes in macroeconomic variables in a developing country like Nigeria? This study attempts to answer this question by examining the relationship between stock prices and a range of macroeconomic variables using time series data from 1986 to 2007 which captures the structural adjustment and post adjustment and reform periods in Nigeria.

REVIEW OF THEORETICAL AND EMPIRICAL LITERATURE

Several literatures now exists which investigates the relationship between stock market returns and a range of macroeconomic factors. One way of linking

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macroeconomic variables and stock market returns is through Arbitrage Pricing Theory (APT) where multiple risk factors can explain asset returns (Ross, 1976). Empirical works based on the APT theory are characterized by modeling a short run relationship between macroeconomic variables and the stock price in terms of first differences assuming trend stationarity (Fama, 1981, 1990; Fama and French, 1989; Ferson and Harvey 1991; Black *et al*., 1997). Another approach is the discounted cash flow or Present Value Model (PVM). This approach relates the stock price to future expected cash flows and the future discount rate of the cash flows. Thus, the PVM can be used to focus on the long run relationship between the stock market and macroeconomic variables.

Fama and Gibbon (1982) examine the relationship between inflation, real returns and capital investment. Their finding is in confinement with Mundell (1963) and Tobin (1965) findings that expected real returns on bills and expected inflation are negatively correlated. Fama (1991) study also shows that expected inflation is negatively related to share price. Geske and Roll (1983) in their study of the United States confirm that stock price is negatively related to inflation rate and positively related to real economic activity.

Darrat (1990) examines the effect of monetary and fiscal policy on share returns in Canada and concludes that budget deficits, long term bond rates, interest rate volatility and industrial production determine share returns. Chen *et al*. (1986) while testing the validity of Arbitrage Pricing Theory affirm that macroeconomic variables are causally related to share returns. Najand and Rahman (1991) also applied the Schwetz (1989) volatility measure and found evidence of the existence of a causal relationship between share returns and inflation. Ajayi and Mougoue (1996) showed that an increase in stock prices has a negative short term effect on domestic currency but in the long term this effect is positive, while currency depreciation has short and long term effect on the stock market. Mukherjee and Naka (1995), Maysami and Koh (2000) and Kwon and Shin (1999) found that there is a positive relationship between money supply and stock returns. Also, Kwon and Shin (1999) examined the Korean market and found that the Korean stock markets are co integrated with the production index, exchange rate, trade balance and money supply. The authors did not find stock price as a leading indicator for macroeconomic variables. Leigh (1997) while studying the Singapore stock market found that the stock index is related to money demand but it has no relationship with macroeconomic fundamentals. Similar result was obtained for Taiwan stock market by Fung and Lie (1990). A study conducted by Kwon *et al*. (1997) for the South Korean market revealed that Korean stock market was more sensitive to real economic and international trading activities, trade balance and production index than that of the U.S. and Japanese stock indexes. Gjerde and Saettem (1999) and Achsani and Strohe (2002) examined small regional markets like Norway and Indonesia and conclude that stock returns react negatively to changes in interest rates, but positively to oil prices and real economic activity. However, Achsani and Strohe (2002) study revealed that stock price has a negative relationship with inflation and money call rates.

Another comprehensive study on the relationship between stock price and macroeconomic variables was conducted by Muradoglu *et al*. (2000), Diacogiannis *et al*. (2001), Wongbampo and Sharma (2002) and Mukhopadhyay and Sarkar (2003). Diacogiannis *et al*. (2001) in their study of the Greek stock market found significant loadings between stock returns and 13 of the 19 macroeconomic variables. Muradoglu *et al*. (2000) also found that the relationship between stock returns and macroeconomic variables were mainly due to the relative size of the respective stock market and their integration with world markets. Wongbampo and Sharma (2002) while exploring the relationship between stock returns in 5-Asean countries of Malaysia, Indonesia, Philippines, Singapore and Thailand and five macroeconomic variables found that in the long run all the five stock price indexes were positively related to growth in output and negatively related to the aggregate price level. However, a negative relationship was found between stock prices and interest rate for the Philippines, Singapore and Thailand, but positive for Indonesia and Malaysia.

Gan *et al*. (2006) while investigating the relationships between New Zealand stock market index and a set of seven macroeconomic variables from January 1990 to January 2003 using co-integration and Granger causality test found out that there exists a long run relationship between New Zealand's stock market index (NZSE40) and the macroeconomic variables tested. The Granger causality test result shows that NZSE40 is not a leading indicator for changes in macroeconomic variables. Kyereboah-Coleman and Agyire-Tettey (2008) concluded in their study of the impact of macroeconomic indicators on Ghana stock market that lending rates from deposit money banks have adverse effect on stock market performance. The study also found inflation to be negatively related to stock market performance and this effect takes time because of the presence of a lag period. Also, Robert (2008) while conducting a study on the effect of macroeconomic variables on stock market returns for four emerging economies of Brazil, Russia, India and China affirmed that there was no significant relationship between present and past market returns with macroeconomic variables, suggesting that the markets of Brazil, Russia, India and China exhibit weak form of market efficiency. Also, no significant relationship was

Table 1: Unit root test (1986-2007)

VAR	ADF	1%	5%	Level
FCI	- 4.26630* **	-3.7856	-3.0114	at level
INF	- 3.875227* **	-3.8067	-3.0199	1st difference
ASP	- 4.370292* **	-3.8067	-3.0199	1st difference
INDO	- 4.800517* **	-3.7856	-3.0114	at level
IR	- 4.919878* **	-3.7856	-3.0114	at level
EX	- 4.104030* **	-3.8067	-3.0199	1st difference
FD	- 5.169646* **	-3.8067	-3.0199	1st difference
ED	- 3.654309**	-3.8067	-3.0199	1st difference
INV	- 4.523023* **	-3.7856	-3.0114	at level
GR	- 4.160225* **	-3.8067	-3.0199	1st difference

*: Significance @ 1%; **: Significance @ 5%

found between respective exchange rate and oil price on the stock market index prices of the four countries studied.

MATERIALS AND METHODS

In carrying out this study, time series data sourced from Statistical Bulletin, Economic and Financial Review and Annual Reports and Statement of Accounts of the Central Bank of Nigeria (CBN), the Federal Office of Statistics (FOS) Statistics and Nigeria Stock Exchange Reports and Statistics of various issues were made use of. The macroeconomic data cover External Debt (ED), Inflation Rate (IR), Fiscal Deficit (FD), Exchange Rate (EX), Foreign Capital Inflow (FCI), Investment (INV), Industrial Output (INDO) and Inflation Rate (INF) between 1986 and 2007. The Average Share Price (ASP) of twenty five (25) quoted companies in Nigeria spanning through insurance, manufacturing, banking, service companies and real estate were averaged between 1986 and 2007 to represent the dependent variable while the other variables are the exogenous variables.

The model: The basic empirical question here is whether macroeconomic variables significantly affect stock market prices in Nigeria. Thus, the model for this study uses Granger causality test to ascertain the direction of causality between Average Share Price (ASP) and the Macroeconomic Variables (MEV) in Nigeria between 1986 and 2007 which covers the structural adjustment and post adjustment periods in Nigeria (Table 2). other econometric tests such as unit root test (Table 1), co-integration test (Table 3) and error correction mechanism (Table 4) were also performed to determine the stationarily of the data and the long run relationship between the variables.

Table 3: Johansen co-integration test results

Eigen value	Likelihood ratio	5%	1%	No. of CE	Lag length
0.241634	5.531772	3.76	6.65	none	1

L.R. indicates 1 Co-integrating equation at 5% level

The test procedure as described by (Granger, 1969) is illustrated below:

$$ASP_t = \sum_{j=1}^{K} A_j \; MEV_{t-1} + \sum_{j=1}^{K} B_j \; ASP_{t-j} + U_{it} \qquad (1)$$

$$MEV_t = \sum_{j=1}^{K} C_i \; MEV_{t-i} + \sum_{j=1}^{K} D_j \; ASP_{t-j} + U_{2t} \qquad (2)$$

Equation (1) postulates that current ASP is related to past values of itself as well as that of MEV and vice- versa for Eq. (2). Unidirectional causality from MEV to ASP is indicated if the estimated coefficient on the lagged MEV in Eq. (1) are statistically different from zero as a group (i.e., $\sum Ai \neq 0$) and the set of estimated coefficients on the lagged ASP in Eq. (2) is not statistically different from 0 (i.e., $\sum D_j = 0$). The converse is the case for unidirectional causality from ASP to MEV.

Feedback or bilateral causality exists when the sets of MEV and ASP coefficient are statistically different from 0 in both regressions (Gujarati, 2004).

The more general model with instantaneous causality is expressed as:

$$ASP_t + bo\ MEVt = \sum_{j=1}^{K} A_j \; MEV_{t-i} + \sum_{j=1}^{K} B_j \; ASP_{t-i} + U_{it} \qquad (3)$$

Table 2: Granger causality test result between variables (1986-2007)

VARS	ASP	ED	EX	FCI	FD	GR	INDO	INF	INV	IR
ASP	,,	,,	,,	,,	,,	,,	,,	,,	,,	,,
ED	,,	,,	,,	,,	,,	,,	10%	,,	,,	
EX	1 & 5%	5 & 10%		,,	,,	,,	,,	,,	,,	,,
FCI	,,	,,	,,		,,	1 & 5 %	,,	1 & 5%	10%	,,
FD	,,	,,	,,	,,		1 & 5%	,,	1 & 5%	10%	,,
GR	,,	,,	5 & 10%	,,	,,		,,	,,	,,	,,
INDO	,,	,,	,,	1 & 5%	5%	,,		,,	10%	,,
INF	,,	,,	,,	,,	,,	1 & 5%	,,		,,	,,
INV	,,	,,	,,	10 %	,,	,,	10%	,,		,,
IR	,,	,,	,,	,,	,,	,,	,,	,,	,,	

(,,): means variable in row does not Granger cause variable in column. The percentage indicates how large the variables in row Granger cause the variables in column

Table 4: Vector error correction mechanism (1986-2007)

Var	C	D(ASP-1)	D(ASP-2)	ED	EX	FCI
	15.83174	-0.672259	-0.370575	0.584463	0.039894	5.274086
	(33.1452)	(0.37578)	(0.26287)	(0.24166)	(0.04738)	(5.73224)
	(0.47765)	(-1.78597)	(-1.40950)	(2.41850)	(0.84195)	(0.92007)
Var	FD	GR	INDO	INF	INV	IR
	6.436975	-0.307142	-0.047916	0.129172	0.103985	-0.646240
	(2.87065)	(0.22877)	(0.20317)	(0.21723)	(0.16151)	(0.72934)
	(2.24234)	(-1.34260)	(-0.23585)	(0.59464)	(0.64383)	(-0.88606)

Dependent variable = D (SAP); $R^2 = 0.602840$; Adjusted $R^2 = -0.021270$; F-Statistics = 0.965920; Akaike AIC = 7.291581; Schwarz S/C = 7.888069; Standard error and t- statistics are in parenthesis

$$MEV_t + Co\ ASPt = \sum_{j=1}^{K} C_i\ MEV_{t-i} + \sum_{j=1}^{K} D_i\ ASP_{t-j} + U_{2t} \quad (4)$$

Instantaneous causality occurs and knowledge of ASP will improve prediction or goodness of fit of the Eq. (1) for MEV.

In this study, a bi-variate regression of the form presented below is estimated:

$$MEVt = \alpha_o + \alpha_1 MEV_{t-1} + \ldots\ldots + \alpha_1 MEV_{t-1} + \beta_1 ASP_{t-1} + \ldots + \beta_1 ASP_{t-1} \quad (5)$$

$$ASPt = \alpha_o + \alpha_1 ASP_{t-1} + \ldots\ldots + \alpha_1 ASP_{t-1} + \beta_1 MEV_{t-1} + \ldots\ldots + \beta_1 ASP_{t-1} \quad (6)$$

The equation for the second model is stated thus:

$$ASPt = f\ (Grt + Fdt + Edt + Irt + Ext + FCIt + INVt + INDOt + INFt) \quad (7)$$

$$GDPt = \alpha + GRt + \beta FDt + \kappa EDt + \lambda IRt + \mu EXt + \gamma FCIt + \epsilon INVt + éINDOt + INFt + \mu t \quad (8)$$

To avoid spurious regression outcomes on time series data, unit root test that affirms the stationarity of the series and co integration test that confirms at least one co integrating equation were conducted. Sequel to the above, the O.L.S in Eq. (8) is re-specified to take care of possible short term disequilibrium as follows:

$$\Delta\ ASPt = \alpha + \Delta GRt + \beta\ \Delta\ FDt + \kappa\ \Delta\ EDt + \lambda\ \Delta\ IRt + \mu\ \Delta\ EXt + \gamma\ \Delta\ FCIt + \epsilon\ \Delta\ INVt + \Delta INDOt + \Delta INFt + \beta_2 \mu t\text{-}_{1+\sum t} \quad (9)$$

β, κ, λ, μ are expected to be < 0 and γ, ϵ, , are expected to be > 0.

where, ASR = Average share price of quoted stocks, GR = GDP growth rate, ED = External Debt measured by external debt/GDP percent, FD = Fiscal Deficit measured by fiscal deficit/GDP percent, IR = Interest rate, EX = Exchange rate, FCI = Foreign capital inflow/GDP percent, INV = Growth rate of Investment, INDO = Industrial output and INF = Inflation rate.

Test for stationarity: To avoid spurious regressions which may arise as a result of carrying out regressions on time series data without subjecting them for test whether they contain unit root, we first subject the data to stationarity test by using the widely acclaimed Augmented Dickey Fuller (ADF) test by Dickey and Fuller (1979) to confirm stationarity of the series. The tests and regressions were carried out using the econometric package E-views.

DISCUSSION

To confirm the stationarity of the variables, Augmented Dickey Fuller (ADF) test as defined by Dickey and Fuller (1979) was performed on the series and the results show that of all the variables only Foreign Capital Inflow (FCI), Industrial Output (INDO), Interest Rate (IR) and Investment (INV) were found stationary at levels are confirmed as I(0) series. All other variables were found to contain unit root. These results are consistent with similar results in the literature that most macroeconomic variables and stock indexes are non stationary.

Applying 1st difference to the remaining series, they were found to be I(1) series at -3.877527, -4.370292, -4.104030, -5.169646, -3.654309 and -4.160225 for inflation, average share price, exchange rate, fiscal deficit, external and GDP growth rate, respectively. All the series were significant at both 1 and 5% except External Debt (ED) that was significant only at 5%. In determining the causality between stock market index and macroeconomic performance in Nigeria, we perform Granger Causality test on average share price (ASP) with nine other macroeconomic variables (ED, EX, FCI, FD, GR, INDO, INF, INV and IR). This is done to study the lead lag relationship between macroeconomic variables and average share price. The findings in Table 2 indicate that Average Share Price (ASP) does not Granger cause any of the nine (9) macroeconomic variables in Nigeria in the sample period. Only exchange rate (EX) Granger causes Average Share Price (ASP) when considered in pairs.

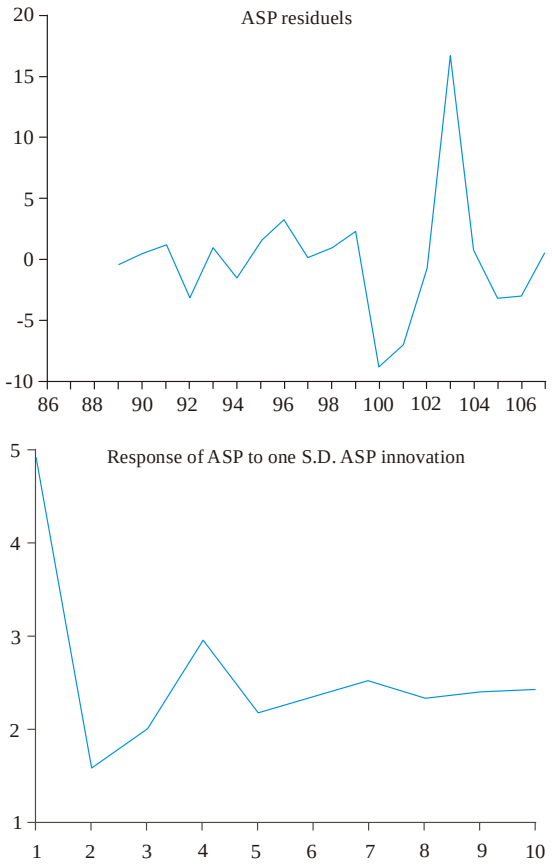

Fig. 1: ASP residuals

However, as shown in Fig. 1, the response of ASP to one ASP innovation portends that average share price can be a good measure of predicting changes in the share price in the Nigerian stock exchange market. That is, past and current prices can be used a good predictive indicator of future prices.

These results suggest that ASP is not a leading indicator for any macroeconomic variable in Nigeria and macroeconomic variables also do not explain movements in stock prices. In comparison with other advanced world economies like U.S. and Japan, the results obtained for Nigeria is not in confinement with results obtained for these advanced economies. However, similar findings were obtained for such other countries like Korea and New Zealand. Kwon and Shin (1999) did not find the Korean stock index as a leading indicator for macroeconomic variables. Also, Gan *et al*. (2006) study submitted that New Zealand stock index (NZSE40) does not Granger cause any macroeconomic variable in New Zealand.

Similar studies that obtained similar findings include Fung and Lie (1990) for Taiwan and Robert (2008) for Brazil, Russia, India and China.

The Johansen Co-integration test when performed on the Error Correction Method confirmed at least 1 co-integrating equation at 5% level (Table 3). This shows that a long run relationship exists between Average Share Price (ASP) and the macroeconomic variables studied. This finding is in confinement with similar studies in both developed and under developed countries which have found long run relationship between share price and macroeconomic variables. For example, Gan *et al*. (2006) and Kyereboah-Coleman and Agyire-Tettey (2008).

The results in Table 4 shows the ECM based on the error correction specification in Eq. (9). Only investment (INV) and Foreign Capital Inflow (FCI) are correctly signed of all the macroeconomic variables. The absolute value of the ECM is less than one, and this indicates a stable error which eventually converges to the long run equilibrium when there is a departure from short run equilibrium level. The negative coefficient of the ECM confirms the existence of long run equilibrium relationship of the model.

The t-statistics were found to be significant only in the case of external debt (ED) and fiscal deficit (FD). Though, the F-statistics could not confirm the significance of the overall equation at 0.965920, the R^2 of 0.602840 seems reasonable. Comparing values of the AIC and SIC for lags 2, 3 and 4, lag 2 is preferred because it gave us the lowest value of AIC and SIC and a reasonable value of the R^2.

CONCLUSION AND POLICY IMPLICATION

The purpose of this study is to investigate the relationship between stock market and a range of macroeconomic variables in Nigeria. It goes further to examine whether movement in stock prices is determined by macroeconomic variables in Nigeria. To capture this, time series macroeconomic data were culled from 1986-2007, a period considered as the boom period in Stock market activities in Nigeria. The period covered the post deregulation and Structural Adjustment Period (SAP) when capital market activities actually gained dominance and wider patronage and the pre collapse period when serious downturn was recorded in capital market business partially as a result of the global economic meltdown.

Although, the Johansen Co- integration test affirmed that a long run relationship exists between Average Share Price (ASP) and the macroeconomic variables, the Granger causality results failed to confirm any relationship between ASP and macroeconomic variables in Nigeria. Only exchange rate (EX) was found to Granger cause ASP in the sample period. This portends that ASP is not a leading indicator of macroeconomic variables in Nigeria and that movements in stock prices can not actually be explained by macroeconomic factors. The ECM also revealed a weak relationship between ASP

and macroeconomic variables in Nigeria, albeit the R^2 showed that about 60% of the variation in stock prices is accounted for by macroeconomic variables in Nigeria.

The policy implication of the above is that the Nigerian stock market is not responsive to changes in macroeconomic factors in spite of the sizable proportion of stock market capitalization as a share of the country's GDP. Hence, predicting stock prices and returns via changes in macroeconomic performance becomes precarious and this affects economic forecast, planning and growth. It thus becomes obvious that Nigerian Stock market might be very sensitive to global macroeconomic factors or other salient issues in the Nigerian environment which of course warrants further investigation.

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