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EMPIRICAL ANALYSIS OF EFFECTS OF INFLATION ON AGGREGATE STOCK PRICES IN NIGERIA: 1980-2012

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ABSTRACT: *This paper investigates empirically the effects of inflation on aggregate stock prices in Nigeria during the period of 1980-2012. Annual time series data on Stock Prices (ASP) and inflationary pressure measure were sourced from the Central Bank of Nigeria Statistical bulletin and Nigeria Stock Exchange Fact book. Employing the Engle-Granger and Johansen-Joselius method of co-integration in a Vector Error Correction Model (VECM) setting, in addition to Granger causality Test, Argumented Dickey Fuller Test (ADF) was employed. The empirical results shows that there exist a long run equilibrium negative and significantly relationship between inflation rate and aggregate stock prices, Broad money supply (M2) has a negative and significantly effects on aggregates stock prices, Narrow Money Supply (M1) shows a positive and significantly effects on aggregates stock prices while Average inflation rate show a positive and significantly relationship between aggregate stock prices. The results also show a strong relationship with an R^2 of 0.886 representing 89.6% variations in the explanatory variables. However, the direction of causality between the money supply measures and aggregate stock prices is mixed. We recommend for the strengthening of monetary policy objective of price stability for the purpose of achieving efficiency in performance of the stock prices quoted in the Nigerian Stock Exchange (NSE).*

KEYWORDS*:* Inflation Rate, Aggregate Stock Prices, Co-Integration, Unit Root Causality Tests

INTRODUCTION

Prior to the deregulation of securities price in 1993, prices of newly issued and existing stocks in Nigerian Stock Exchange were directly influenced by Securities and Exchange Commission (SEC) without considering the market forces of demand and supply and other macroeconomic variables such as inflation. The deregulation of stock price following the internationalization of Nigerian capital market reflects the function of macroeconomic variables in determining the prices of stocks Onoh (2002). Stock price is the market value of equities listed in the stock exchange.

Economic theories and empirical studies consider stocks prices as the function of macroeconomic variable such as inflation rather than the relevant and the irrelevant dividend theories of Gordon (1960) and Miller and Magdoric (1961) and market index to be one best indicators of changing in economic activities. This intellectual curiosity gained ascendancy in the last two decades due to increases belief that real economic activities impact on stock price

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Osanwonyi and Osagie (2012). For instance inflation rate from 2008-2012 was 15.06%, 13.93%, 11.80%, 10.30% and 12.00% according CBN 2012 report respectively (CBN, 2012), compared to with aggregate stock price of ₦3,187.8, ₦2,179.7, ₦3,517.0 and ₦3,643.4 within the same period.

Finance scholars have attempt to explained factors that influenced stock price at different times. For instances Efficiency Market Hypotheses (EMH) asserts that in an efficient market, prices of stocks at all time fully reflect all available information that is relevant to their valuation Kalu (2008). This means that dividend policy of the firm matters in determining the price of the stocks as noted by Gordons (1960) while the Random Work model states that the current market prices of any security fully reflect the information content of its historical sequences of price which determine aggregate stock price Chuks (2009). This reflects the Miller and Modigliani (1961) irrelevant theory of dividend policy on stock price in 1961.

Inflation discouraged saving and crowd out investment Onoh (2007). This can have a negative effect on the prices of stocks. Apart from inflation, other macroeconomic variables such as exchange rate, money supply, interest rate, economic growth have direct effect on the prices of stocks. It is theoretically that stocks should be a good hedge against inflation since stock is claims on real asset. The real return on equity should be affected by inflation contrary to what theory suggest, mast empirical evidence suggests that there is significant negative relationship inflations and stock price. This can be explained by monetary authorities' responses to inflation and its damaging effects on the real economy, tendency of increasing the risk conversion of the agents, altering the behaviour of agents suffering from money illusions without considering its effect on the nominal dividend growth rate Garmendia (2008).

Over the years, the relationship between inflation and stock price has been a topic of great interest in both the developed and the developing or emerging capital market like Nigeria. Despite the existence research on the exact relationship between the variables, the issue still remains vexing, inclusive and ambiguous Shanmugan and Misra (2008). The origin of the debate goes back to fisher (1930) that inflation should not affect stock price and return, a notion known as fisherian hypothesis.

However, in Nigeria, this argument can not be determine or hold valid due to the nature of the capital market and the investment climate. The assumption of these theories such as efficient market hypothesis, fisher hypothesis and the Random work model is based on capital market of the developed financial market compared with the emerging Nigerian capital market, the theory assumed a perfect capital market with perfect information compared with the Nigeria capital market that is characterized with insider dealings by the stock brokers and the market operators. For instance the crash in the capital market was traced to the margin loans by the banking sector in 2008. The capital market is not fully deregulated and not fully regulated to determine the effect of macroeconomic variables such as inflation on stock price. Stock price is intentionally lowered by stock borkers for selfish interest. Some of them are stock brokers and still dealing members Onoh (2002).

Furthermore, the effect of inflation on stock price is still controversial due the problem of the international financial market. Significant proportion of investment in the capital market is foreign portfolio investment, exposing stock price into international monetary shock. The capital market crash in 2007/2008 was blamed on the global financial crisis in the period. From the above, this study wants to examine the effect of inflation on stock price in Nigeria.

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In the light of the above, viewpoints and controversy, this study seeks to contribute to the on-going debate by examining empirically whether there is any functional long-run relationship between inflationary pressures and aggregates stock prices in the Nigerian context and Secondly to determine the direction of causality between inflationary pressures and aggregates stock prices within the Nigerian government. To achieve the objective of this study, the following hypotheses have been formulated to aid the analysis.

1. There is no positive long run relationship between inflationary pressures and the aggregate stock prices.

2. Inflationary pressures do not Granger cause aggregate stock prices in Nigeria

LITERATURE REVIEW

Broadly speaking, there are two main views relating to stock market prices: the efficient market hypothesis and the Random Walk theory.

The efficient market hypothesis

The efficiency of stock markets has been a major area of research in financial econometrics, and reflects the importance of price related information in the market for stocks. Thus, it argues that competition between investors seeking abnormal profit drives prices to their 'fair' value. This implies that prices should incorporate information in the market. The ability of a stock market to incorporate information into prices determines its level of efficiency.

In an efficient market, prices at all times fully reflect all available information that is relevant to their valuation (Fama, 1970). Inegbedion (2009) believes that the behaviour of stock prices is explained by the behaviour of investors, reflecting the implication of market efficiency to the functionary of the capital market, especially as it concerns investors' returns and thus stimulation of investor's interest in market activities.

EMH argues that competition between investors seeking abnormal profits drives prices to their 'fair' value. This implies that prices should incorporate information in the market. The ability of a stock market to incorporate information into prices determines its level of efficiency.

Stock market forecasting is marked more by its failure than by its successes since stock prices reflect the judgments and expectations of investors based on information available (Aguebor, Adewole and Maduegbuna, 2010). However, stock prices following a random walk imply that the price changes are as independent of one another as the gains and losses. The independence assumption of the random walk hypothesis is valid as long as knowledge of the past behaviour of the series of price changes cannot be used to increase expected gains (Aguebor, *etal* 2010). A simple policy of buying and holding the security will be as good as any more complicated mechanical procedure for timing purchase and sales (Fama, 1965; 1995).

Fama (1970) stated that the sufficient but not necessary conditions for efficiency are:

(i) There are no transaction costs in trading securities;

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(ii) All information is costlessly available to all market participants, and

(iii) All agree on the implication of current information for the current price and distribution of future prices of each security. The EMH can be more specifically defined with respect to the information item available to market participants. Fama (1970) classified the information items into three levels depending on how quickly the information is impounded into prices:

(1) Weak- Form EMH, (2) Semi-Strong Form EMH, and (3) Strong-Form EMH

Weak-form efficiency

In weak-form efficiency, future prices cannot be predicted by analyzing prices from the past. Excess returns cannot be earned *in the long run* by using investment strategies based on historical share prices or other historical data Lulia (2009). Technical analysis techniques will not be able to consistently produce excess returns, though some forms of fundamental analysis may still provide excess returns. Share prices exhibit no serial dependencies, meaning that there are no "patterns" to asset prices. This implies that future price movements are determined entirely by information not contained in the price series. Hence, prices must follow a random walk. This 'soft' EMH does not require that prices remain at or near equilibrium, but only that market participants not be able to *systematically* profit from market 'inefficiencies'. However, while EMH predicts that all price movement is random, many studies have shown a marked tendency for the stock markets to trend over time periods of weeks or longer and that, moreover, there is a positive correlation between degree of trending and length of time period studied. Various explanations for such large and apparently non-random price movements have been promulgated.

The problem of algorithmically constructing prices which reflect all available information has been studied extensively in the field of computer science. For example, the complexity of finding the arbitrage opportunities in pair betting markets has been shown to be NP-hard.

Semi-strong-form efficiency

In semi-strong-form efficiency, it is implied that share prices adjust to publicly available new information very rapidly and in an unbiased fashion, such that no excess returns can be earned by trading on that information. Semi-strong-form efficiency implies that neither fundamental analysis nor technical analysis techniques will be able to reliably produce excess returns. To test for semi-strong-form efficiency, the adjustments to previously unknown news must be of a reasonable size and must be instantaneous. To test for this, consistent upward or downward adjustments after the initial change must be looked for. If there are any such adjustments it would suggest that investors had interpreted the information in a biased fashion and hence in an inefficient manner Olowe (2009).

Strong-form efficiency

In strong-form efficiency, share prices reflect all information, public and private, and no one can earn excess returns. If there are legal barriers to private information becoming public, as with insider trading laws, strong-form efficiency is impossible, except in the case where the laws are universally ignored. To test for strong-form efficiency, a market needs to exist where investors cannot consistently earn excess returns over a long period of time. Even if some money managers are consistently observed to beat the market, no refutation even of strong-

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form efficiency follows: with hundreds of thousands of fund managers worldwide, even a normal distribution of returns should be expected to produce a few dozen "star" performers Mishra (2009).

Random Walk Theory

The Random walk model states that the current market price of any security fully reflects the information content of its historical sequence of prices Okafor (2002). The financial asset's price series is said to follow a random walk if the successive price changes is independent and identically distributed Fama, (1970). Consequently, knowledge of the historical prices and volume traded of a security and/or detailed analysis based on this knowledge would not enhance abnormal returns from such security.

Campbell, Lo and Mackinlay (1997) summarize various versions of Random walk model as the following three models based on the distributional characteristics of increments. Random walk 1 implies that price increments are independent and identically distributed (IID), in which case the process *Pt* is given by:

$$P_t = \mu + P_{t-1} + \varepsilon_t, \qquad \varepsilon_t \sim IID(0, \sigma^2) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where, μ is the drift parameter or the expected price change and IID (0,σ2) denotes that et is independent and identically distributed with Zero (0) mean and constant variance. The independence of increments (e*t*.) implies not only that e*t* is uncorrelated but any nonlinear functions of the increments are also uncorrelated. Fama (1970) stated that the statement that security prices fully reflect all available information was assumed to imply that successive price changes are independent. It was also assumed that successive returns are identically distributed Kalu (2008).

However, the assumption of identically distributed increments has been questioned for financial assets prices over long periods of time because of changes in probability distributions of stock returns resulting from changes in economic, technological, institutional and regulatory environment surrounding the asset prices.

Random walk 2 assumes independent but not identically distributed increments and thus allows for heteroscedasticity in e*t*. Random walk 2 is estimated as:

$$P_t = \mu + P_{t-1} + \varepsilon_t, \qquad \varepsilon_t \sim INID(0, \sigma^2) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where, NID denotes that the error term is Not Identically Distributed. Relaxing of the identical distribution assumption in Random walk 2 does not change the main economic property of e*t*s, that is, prediction of future price increments cannot be estimated using past price increments.

Random walk 3 is obtained by relaxing the independence assumption of Random walk 2 to include processes with dependent but uncorrelated increments. It only imposes lack of correlation between subsequent ε_{tS}. A case in which Random walk 3 will hold but not RW1 and RW2 is any process where $Cov(\varepsilon_t, \varepsilon_t, +_k) = 0$ for all *K*, but where $Cov(\varepsilon_t, \varepsilon_t, +_k) = 0$ for some *K*, in both cases $K \neq 0$. This process has uncorrelated increments but is evidently not independent because its squared increments are correlated.

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The import of the Random walk model is that price changes during period *t* are independent of the sequence of price changes during previous time periods Kalu (2008).

Inflation and Stock Price : Empirical Studies

The previous empirical works on the link between inflation and stock price is broadly acknowledged in literature.

Chen et al. (2006) explored a set of macroeconomic variables as systematic influence on stock market returns by modeling equity return as a function of macro variables and non-equity assets returns for US. They empirically found that the macroeconomic variables such as industrial production anticipated and unanticipated inflation, yield spread between the long and short term government bond were significantly explained the stock returns. The authors showed that the economic state variables systematically affect the stock return via their effect on future dividends and discount rates.

Ratanapakorn and Sharma (2007) examined the short-run and long run relationship between the US stock price index and macroeconomic variables using quarterly data for the period of 1975 to 1999. Employing Johansen's co-integration technique and vector error correction model (VECM) they found that the stock prices positively relates to industrial production, inflation, money supply, short term interest rate and also with the exchange rate, but, negatively related to long term interest rate. Their causality analysis revealed that every macroeconomic variable considered caused the stock price in the longrun but not in the short-run. Mukherjee and Naka (2005) employed a vector error correction model (VECM) to examine the relationship between stock market returns in Japan and a set of six macroeconomic variables such as exchange rate, inflation, money supply, industrial production index, the long-term government bond rate and call money rate. They found that the Japanese stock market was cointegrated with these set of variables indicating a long-run equilibrium relationship between the stock market return and the selected macroeconomic variables. ookerjee and Yu (2007) examined the nexus between Singapore stock returns and four macroeconomic variables such as narrow money supply, broad money supply, exchange rates and foreign exchange reserves using monthly data from October 1984 to April 1993. Their analysis revealed that both narrow and broad money supply and foreign exchange reserves exhibited a long run relationship with stock prices whereas exchange rates did not.

Wongbampo and Sharma (2002) explored the relationship between stock returns in 5-Asian countries viz. Malaysia, Indonesia, Philippines, Singapore and Thailand with the help of five macroeconomic variables such as GNP, inflation, money supply, interest rate, and exchange rate. Using monthly data for the period of 1985 to 1996, they 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, they found a negative relationship between stock prices and interest rate for Philippines, Singapore and Thailand, but positive relationship for Indonesia and Malaysia. Maysami et al. (2004) examined the relationship among the macroeconomic variables and sector wise stock indices in Singapore using monthly data from January 1989 to December The Impact of Macroeconomic Fundamentals on Stock Prices Revisited 2001. They employed the Johansen co-integration and VECM approaches and found a significant long-run equilibrium relationship between the Singapore stock market and the macroeconomic variable tested. Gan et al. (2006) investigated 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. The analysis revealed a

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long run relationship between New Zealand's stock market index and the macroeconomic variables tested. The Granger causality test results showed that the New Zealand's stock index was not a leading indicator for changes in macroeconomic variables. However, in general, their results indicated that New Zealand stock market was consistently determined by the interest rate, money supply and real GDP. Robert (2008) examined the effect of two macroeconomic variables (exchange rate and oil price) on stock market returns for four emerging economies, namely, Brazil, Russia, India and China using monthly data from March 1999 to June 2006. He 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. Furthermore, no significant relationship was found between respective exchange rate and oil price on the stock market index of the four countries studied.

Abugri (2008) investigated the link between macroeconomic variables and the stock return for Argentina, Brazil, Chile, and Maxico using monthly dataset from January 1986 to August 2001. His estimated results showed that the MSCI world index and the U.S. T-bills were consistently significant for all the four markets he examined. Interest rates and exchange rates were significant three out of the four markets in explaining stock returns. However, it can be observed from his analysis that, the relationship between the macroeconomic variables and the stock return varied from country to country. For example from his analysis it is evident that, for Brazil, exchange rate and interest rate were found to be negative and significant while the IIP was positive and significantly influenced the stock return. For Maxico, the exchange rate was negative and significantly related to stock return but interest rates, money supply, IIP were insignificant. For Argentina, interest rate and money supply were negatively and significantly influenced on stock return but exchange rate and IIP were insignificant. But for Chile, IIP was positively and significantly influence stock return but exchange rate and money supply were insignificant. These results implies that the response of market return to shock in macroeconomic variables cannot be determine a priori, since it tends to vary from country to country. Rahman et al. (2009) examined the macroeconomic determinants of stock market returns for the Malaysian stock market by employing co-integration technique and vector error correction mechanism (VECM). Using the monthly data ranged from January 1986 to March 2008, they found that interest rates, reserves and industrial production index were positively related while money supply and exchange rate were inversely related to Malaysian stock market return in the long run. Their causality test indicates a bi-directional relationship between stock market return and interest rates.

Asaolu and Ognumuyiwa (2011) investigated the impact of macroeconomic variables on Average Share Price for Nigeria for the period of 1986 to 2007. The results from their causality test indicated that average share price does not Granger cause any of the nine macroeconomic variables in Nigeria in the sample period. Only exchange rate Granger causes average share price. However, the Johansen Co- integration test affirmed that a long run relationship exists between average share price and the macroeconomic variables. Akbar et al. (2012) examined the relationship between the Karachi stock exchange index and macroeconomic variables for the period of January 1999 to June 2008. Employing a co-integration and VECM, they found that there is a long-run equilibrium relationship exists between the stock market index and the set of macroeconomic variables. Their results indicated that stock prices were positively related with money supply and short-term interest rates and negatively related with inflation and foreign exchange reserve. Pethe and Karnik (2000) employed co-integration and error correction model to examine the inter-relationship

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between stock price and macroeconomic variables using monthly data from April 1992 to December 1997. Their analysis revealed that the state of economy and the prices on the stock market do not exhibit a long run relationship.

Bhattacharya and Mukherjee (2006) examined the relationship between the Indian stock market and seven macroeconomic variables by employing the VAR framework and Toda and Yamamoto non-Granger causality technique for the sample period of April 1992 to March 2001. Their findings also indicated that there was no causal linkage between stock returns and money supply, index of industrial production, GNP, real effective exchange rate, foreign exchange reserve and trade balance. However, they found a bi-directional causality between stock return and rate of inflation. Ray and Vani (2003) employed a VAR model and an artificial neural network (ANN) to examine the linkage between the stock market movements and real economic factors in the Indian stock market using the monthly data ranging from April 1994 to March 2003. The results revealed that, interest rate, industrial production, money supply, inflation rate and exchange rate have a significant influence on equity prices, while no significant results were discovered for fiscal deficit and foreign investment in explaining stock market movement. Ahmed (2008) employed the Johansen's approach of co-integration and Toda – Yamamoto Granger causality test to investigate the relationship between stock prices and the macroeconomic variables using quarterly data for the period of March, 1995 to March 2007. The results indicated that there was an existence of a long-run relationship between stock price and FDI, money supply, index of industrial production. His study also revealed that movement in stock price caused movement in industrial production.

Pal and Mittal (2011) investigated the relationship between the Indian stock markets and macroeconomic variables using The Impact of Macroeconomic Fundamentals on Stock Prices quarterly data for the period January 1995 to December 2008 with the Johansen's co-integration framework. Their analysis revealed that there was a long-run relationship exists between the stock market index and set of macroeconomic variables. The results also showed that inflation and exchange rate have a significant impact on BSE Sensex but interest rate and gross domestic saving (GDS) were insignificant. Hoguet (2008), explanation of stock-inflation neutrality is anchored on two stances as outlined from Giammarino (2009) that companies can pass on one-for-one costs; and 2) that the real interest rate which investors use to discount real cash flows does not rise when inflation rises and in addition, inflation has no long-term negative impact on growth. Daferighe and Aje (2009) using annual data analyzed the impact of real gross domestic product, inflation and interest rates on stock prices of quoted companies in Nigeria from 1997-2006. The results among others showed that low inflation rate resulted in increased stock prices of quoted firms in Nigeria. Daferighe and Aje (2012) study suffers from misspecification drawbacks and spurious relationship. A high R-2 with suspected highly autocorrelated residuals signify that the conventional significant tests are biased. The integrated process of the variables was not analyzed, neither are the individual test of the series for random walks checked. The short data span of only ten points using a multiple regression technique is inappropriate.

RESEARCH METHODOLOGY

This research employed co-integration and Error Correction Model (ECM) techniques. It has been observed recently that virtually, the body of statistical estimation theory is based on asymptotic convergence theorems which assume that data series are stationary. However,

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econometric tools are increasingly being brought to bear on non-stationary data which are not even asymptotically consistent with the nations of convergence.

The contrast between stationary and non-stationary series can be illustrated by the following model:

$h^t = \phi^{ht} - t^+et$; $h_o =$ - - - - - - (3)

A stationary series is one where the absolute value of ϕ is less than 1. Stationary series have a finite variance, transitory innovations from mean, and a tendency for the series to return to its mean value. In contrast, the non-stationary series is one where the absolute value of ϕ is greater or equal to 1. Non-stationary series have a variance which 1 asymptotic infinite, the series rarely cross the mean (in finite samples), and innovations to the series are permanent.

The essence of the problem lies with the presence of spurious regression which arises where the regression of non-stationary series, which are known to be unrelated, indicates that the series are correlated. This has led to the introduction of a more comprehensive treatment of the time-series characteristics into economics modeling and the development of the notion of co-integration. The aim of the co-integration method analysis is to establish long-run equilibrium relationship between variables. In the Engle Granger Co-integration analysis, variables of consideration are said to be co-integrated or have long-run equilibrium relationship if the OLS regression of one variable on the others, their residuals as the proxy for their combination are integrated less than original variable. For instance, if the variables are integrated of order one, 1(1), then the residuals of the variables are less integrated than the original variables and should be integrated of order zero, 1(0) such as the residuals are stationary; 1(0). Alternatively, co integration exists among the variable if they are integrated of the same level. The implication of this analysis is that the deviation or drift may occur between the variables, but this is temporary as equilibrium holds in the long-run for them.

The vector error correction model technique represents an alternative of presenting long-run equilibrium relationship between variables. It shows the dynamic error analysis of the co-integration variables.

Sources of Data

For the purpose of arriving at a dependable and unbiased analysis, we employed a secondary data obtained from Central Bank of Nigeria Statistical Bulletin and Annual Reports various issues. Information was gathered on such variables as inflation rate, narrow money supply (M_1) broad money supply (M_2), Average Inflation Rate (AIFR) and aggregate stock prices covering the period of 1980 – 2012. The functional relationship between dependent and the independent variables in our study were established as follows:

The model

ASP = f(INFR, M_1, M_2 + AIFR)

Thus, transforming the functional relationship into a testable form, we have;

$ASP = a_0 + a_1INFR + a_2m_1 + a_3m_2 + a_4AINFR + ut$……. (4)

Where;

ASP = Aggregate stock prices
INFR = Inflation Rate

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M_1 = Narrow Money supply
M_2 = Bread money supply
A1NFR = Average inflation measured y consumer price index of non food items
ao = Intercept
ut = Error term

a-prior expectation = $a_1, a_2, a_3, a_4 > 0$

Table 1: Inflationary Pressure and Aggregates Stocks Prices Data For Nigeria (1980-2012)

Year	ASP	INFR	M1	M2	AIFR
1980	377.30	9.900	6,053.4	16,161.7	20.6
1981	393.00	20.900	9,915.3	14,471.17	21.2
1982	406.10	7.7000	10,291.8	15,786.74	21.9
1983	417.80	23.200	11,517.8	17,687.93	23.3
1984	429.70	30.800	12,497.1	20,105.94	23.8
1985	412.9	3.2300	13,878.0	22,299.24	24.4
1986	481.2	6.2500	13,560.4	23,806.40	25.2
1987	498.3	11.7600	15,195.7	27,573.58	25.8
1988	521.8	34.2100	22,232.1	38,356.80	26.4
1989	550.3	49.0200	26,268.8	45,902.88	27.0
1990	601.9	7.8900	39,156.2	52,857.03	27.5
1991	655.5	12.1900	50,071.7	75,401.18	28.2
1992	766.2	4.5600	75,970.3	111,112.31	28.4
1993	919.4	57.1400	118,753.4	165,338.75	29.0
1994	994.8	57.4100	169,391.5	230,292.60	29.6
1995	1,113.3	72.7200	201,414.5	289,091.07	29.9
1996	1,652.2	29.2900	227,464.4	345,853.96	30.4
1997	1,938.0	10.6700	268,622.9	413,280.13	30.3
1998	2,081.3	7.86000	318,576.0	488,145.79	31.0
1999	2,140.2	6.61000	393,078.8	628,952.16	31.2
2000	2,206.3	6.69000	637,731.1	878,457.27	31.5
2001	2,349.0	18.8600	816,707.6	1,269,321.61	31.4
2002	2,453.7	12.8800	946,253.4	1,505,963.50	31.5
2003	2,595.0	14.0300	1,225,559.3	1,952,921.19	31.8
2004	2,705.0	15.0100	1,330,657.8	2,131,818.98	31.7
2005	2,894.9	17.8500	1,725,395.8	2,637,912.73	31.6
2006	3,075.6	8.21000	2,280,648.9	3,797,908.98	32.6
2007	3,202.3	5.41000	3,116,272.1	5,127,400.70	32.4
2008	3,137.8	11.5000	4,857,312.2	8,008,203.95	32.6
2009	2,179.7	12.5400	5,017,115.9	9,411,112.25	32.8
2010	3,417.0	13.7200	5,571,269.89	11,034,940.93	32.9
2011	3,643.4	10.7200	5,424,517.2	12,172,490.28	32.9
2012	3,715.90	12.00	6,522,940.4	13,895,389.13	33.2

SOURCE: Central Bank of Nigeria Bulletin, Vol. 19 December 2012. CBN Annual Report and Nigeria Stock Exchange fact book various issues

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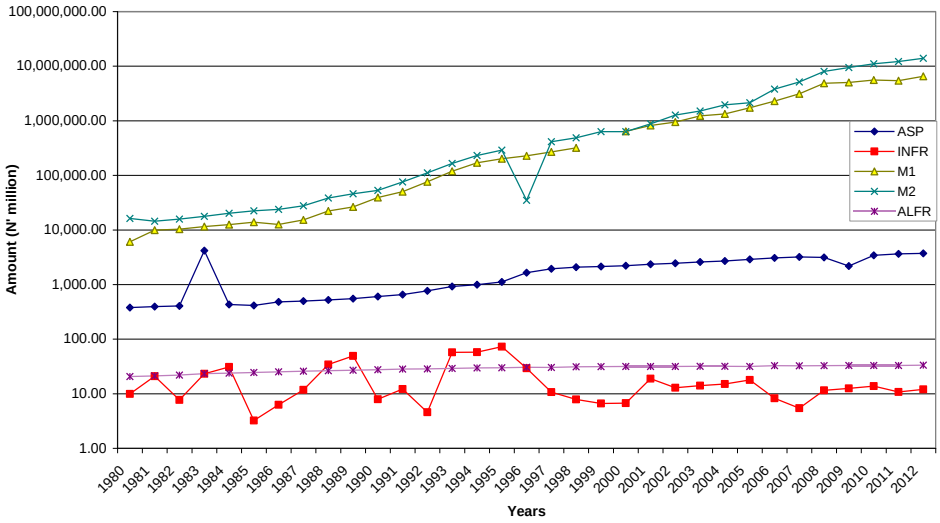
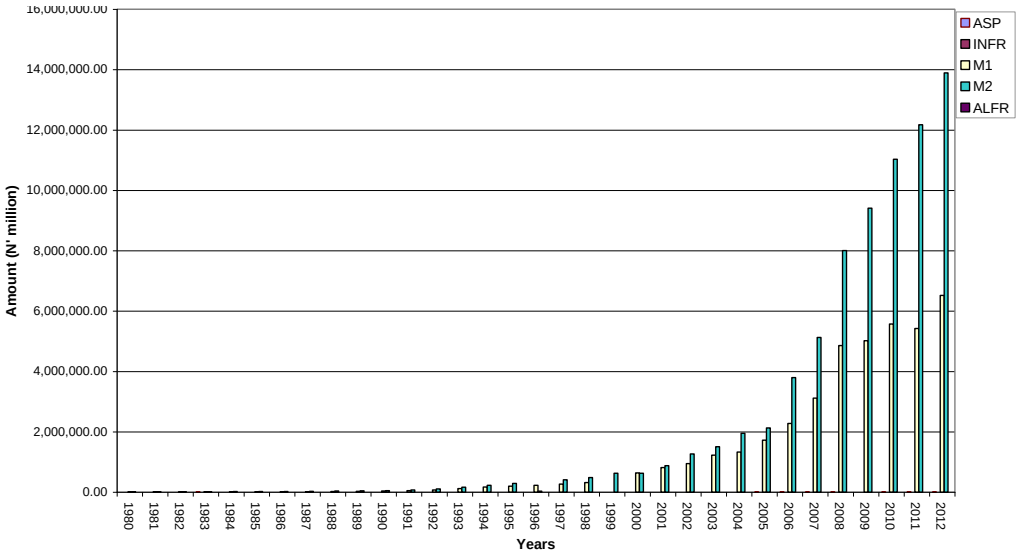
Descriptive Analysis of the Variables

Fig 1: Line Graph showing the relationship between INFR, M1, M2, ALFR and ASP of Annual Time Series data for the period (1980-2012)



The line graph above shows fluctuations of the variables under study, the broad money supply (M2) and the narrow money supply (M1) shows a steady increase within the time period and lies above other variables. Average inflation rate shows a steady increase but intercept inflation rate in 1981, 1989, 1995 to 1999 but fluctuates below 10% from 1990 to 2012.

Fig 2: Bar chart showing the Relationship between INFR, M1, M2, ALFR and ASP of Annual Time Series for the period (1980-2012)



The figure above shows fluctuations of the variables under study, the narrow money supply and the broad money supply (M_2) shows a steady increase within the period and lies above other variables. Average inflation rate shows a steady increase but intercept inflation rate in 1981, 1989, 1995 to 1999 but fluctuates below 10% from 1990 to 2012.

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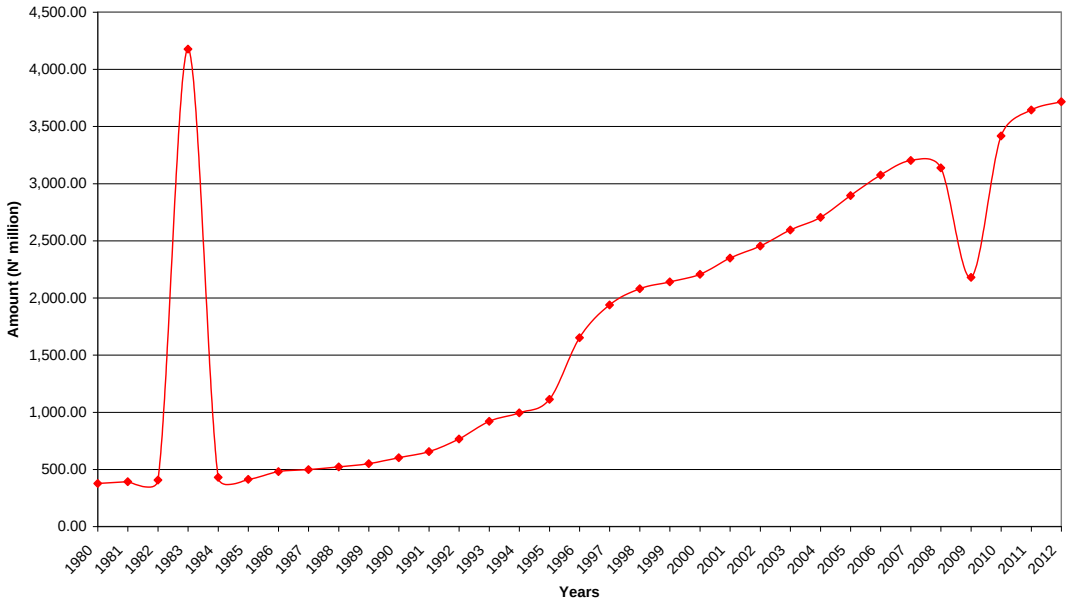
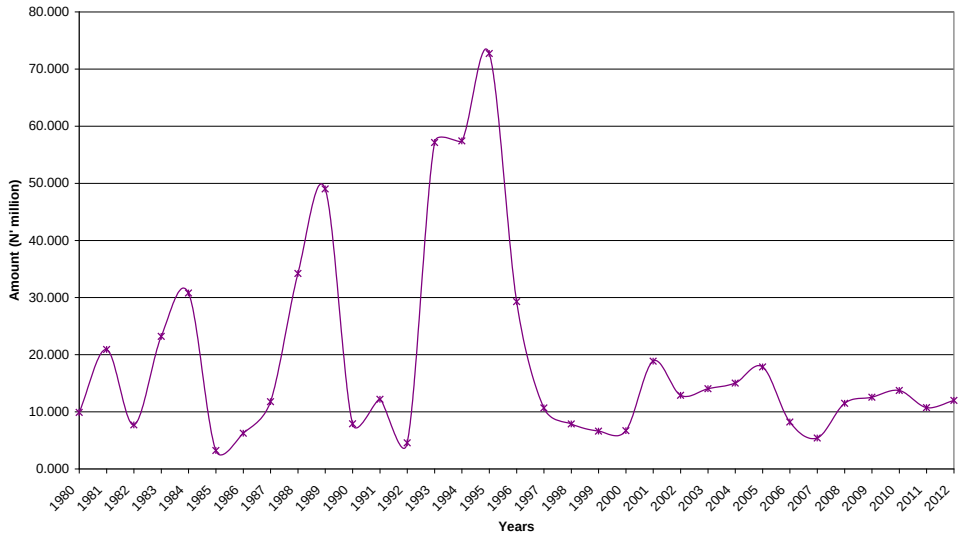
Fig 3: Line Graph showing the trend of aggregate stock price (ASP) for the period (1980 – 2012)



The line graph above shows a sharp rise in 1982 a sharp fall in 1984 in the value of aggregate stock prices within the period understudy. It shows a steady increase from 1980 to 2009 with fall in 2010. The fall can be traced to macroeconomic and monetary policy effects. The trend corresponds with shocks in Nigerian macroeconomic policies within the period. However, the sharp fall in the variable in 1984 can be traced to monetary policy shocks in Nigeria and the macroeconomic crisis in the 1980s.

Fig. 4: Line graph showing the trend of inflation rate (INFR) for the period (1980 – 2012)



The line graph above shows the steady fluctuation in Nigerian inflation rate. It shows that Nigerian inflation rate fluctuates at a very high degree in the year 1996 with 72.06% and low in the year 2007 with 7.8%. The fluctuation does not correspond with the increase in return

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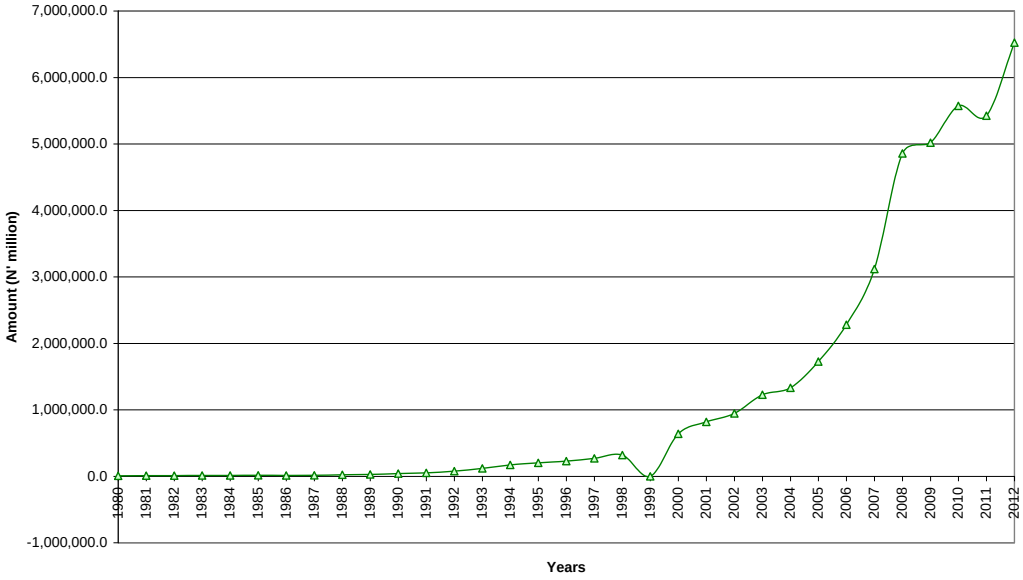
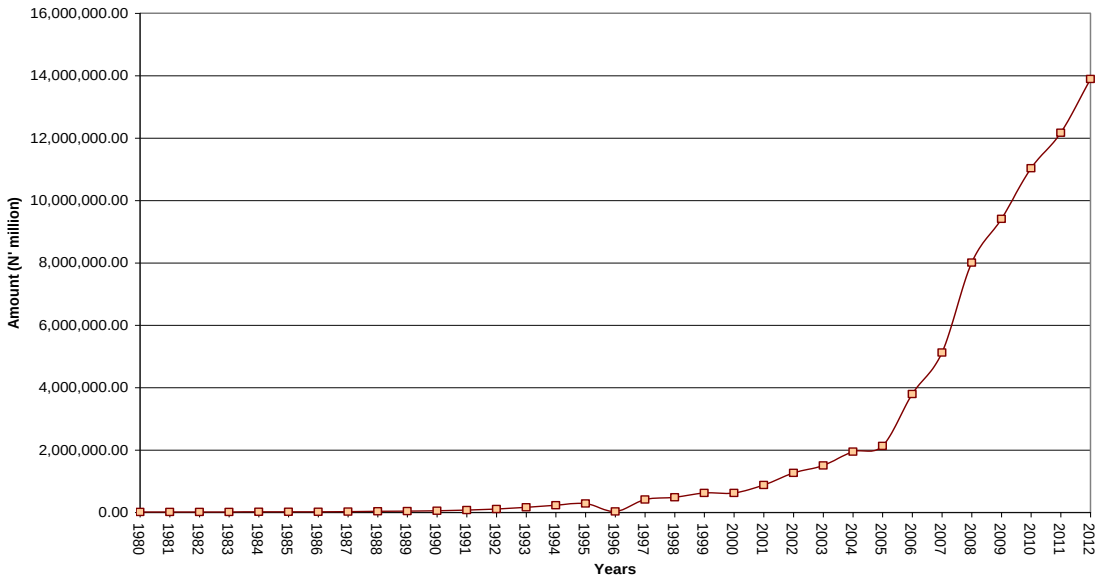
on investment. The high fluctuation in inflation rate can be traced to ineffective and unstable monetary policy variables used to combat inflation in Nigeria. Again the increase in 1996 can be attributed to excess money supply.

Fig. 5: Line graph show the trend of narrow money supply (M_1) for the period (1980 – 2012)



The line graph above shows the steady increase in Nigerian narrow money supply (M_1) and a fall in 1999 flaring the introduction civil rule in the country. The trend shows steady increase below ₦1 million from 1980 to 2003, but fluctuates to above ₦6 million from 2004 to 2012. The increase from 2004 can be traced to macroeconomic policies of expansionary monetary policy.

Fig. 6: Line graph showing the trend of broad money supply (M_2) for the period (1980 – 2012)



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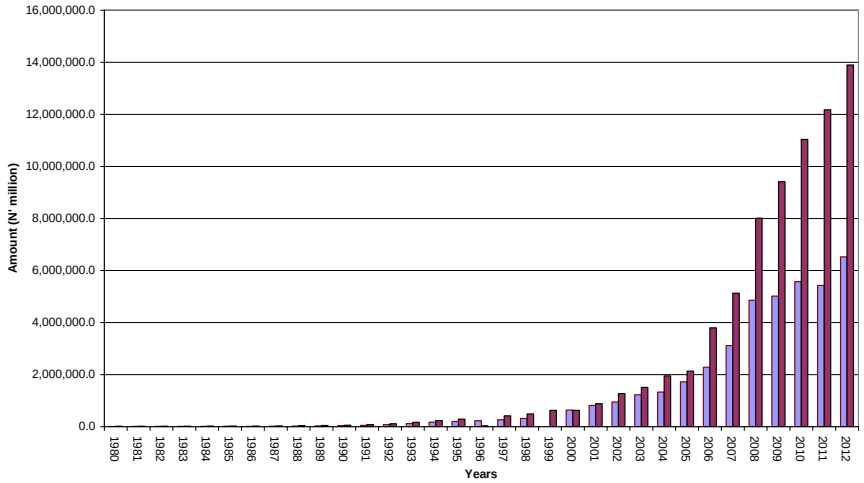
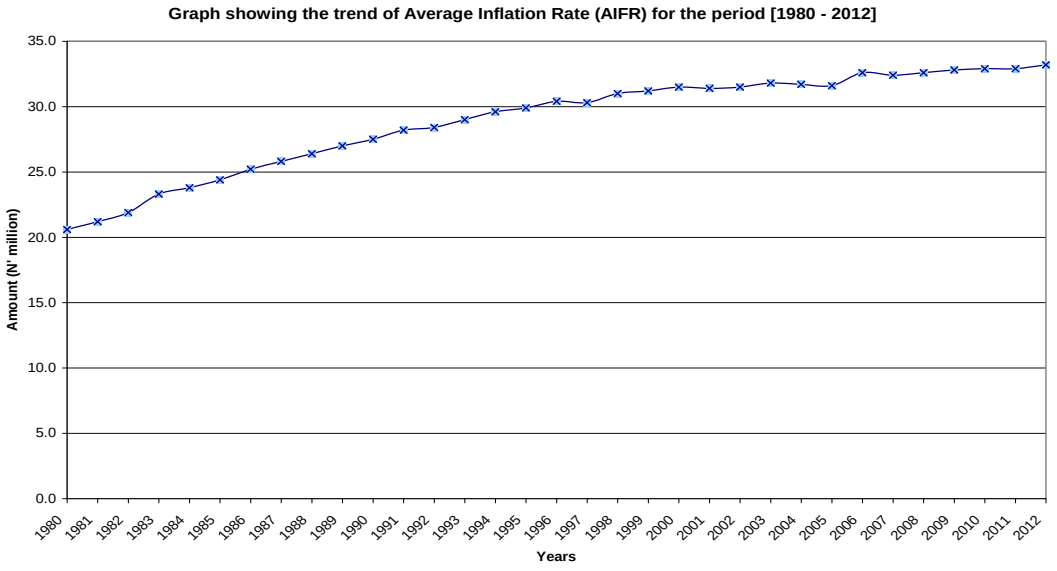
The line graph above shows the steady increase in Nigerian Broad money supply (M_2). The trend also shows steady increase below ₦1 million from 1980 to 2005, but fluctuates to all year high above ₦6 million from 2005 to 2012. The increase from 2004 can be traced to macroeconomic policies of expansionary monetary policy.

Fig 7: Bar Chart showing relationship between M1, M2 of Annual Time Series for the Period (1980 – 2012)



The bar chart above shows the steady increase in Nigerian narrow money and Broad money supply. The trend shows steady increase below ₦1 million from 1980 to 2005, but fluctuates to high above ₦6 million from 2005 to 2012. The increase from 2004 can be traced to macroeconomic policies of expansionary monetary policy.

Fig. 8: Line graph show the trend of average inflation rate (ALFR) for the period (1980 – 2012)



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The above average inflation rate shows a steady increase in Nigerian Average inflation rate. The trend also shows steady increase above 20% and 30% within the time covered in this study.

Empirical Results and Findings

Table 2: level series OLS multiple regression results

Dependent Variable: ASP, Method: Least Squares, Sample: 1980 2012

Included observations: 33

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INFR	-10.18555	4.478080	-2.274536	0.0308
M1	0.000372	0.000323	1.153128	0.2586
M2	-7.71E-05	0.000154	-0.501579	0.6199
AIFR	189.1750	26.58236	7.116560	0.0000
C	-3899.996	716.4010	-5.443873	0.0000
R-squared	0.887074	Mean dependent var		1664.448
Adjusted R-squared	0.870941	S.D. dependent var		1150.836
S.E. of regression	413.4349	Akaike info criterion		15.02560
Sum squared resid	4785996.	Schwarz criterion		15.25235
Log likelihood	-242.9225	F-statistic		54.98733
Durbin-Watson stat	0.753831	Prob(F-statistic)		0.000000

Source: Author's computation

From table (2), R^2 is 88.7% and the adjusted R^2 is 87.1% showing that 88.7% of the variation in aggregate stock prices (ASP) can be explained by changes in the explanatory variables. The explanatory variable inflation rate (INFR) and average inflation rate are significant at 5% level of significance while narrow money supply (M_1) and broad money supply (M_2) are significant at 10% - with respect to the signs and sizes of the parameter estimates, narrow money supply (M_1) and Average inflation rate (AINFR) are positively signed and inflation rate (INTR) and broad money supply (M_2) are negatively signed. Furthermore, the overall fit of the regression model is good given an F-statistic of 54.98733 and P.value of 0.0000.

However, the Durbin – Watson Statistic is found to be 0.75383, which is lower than adjusted R^2 of 0.8770941 and lies below the Durbin – Watson critical values of 1 and 2, suggesting the presence of some degree of positive autocorrelation in the level series. This indicates that there may be some degree of time dependence in the level series which could head to spurious regression results, suggesting the need for more rigorous analysis of the properties of the level series data.

Table 3: ADF Unit Root test summary results

Variables	ADF Statistics At Level	Critical Value at 5%	Order of Integration
ASP	*-0.310*	*-2.959*	*1(0)*
INFR	*-3.151*	*-2.959*	*1(1)*
M1	*-2.631*	*-2.959*	*1(1)*
M2	*-2.150*	*-2.959*	*1(1)*
AIFR	*-6.126*	*-2.959*	*1(1)*

Critical value: (ADF): 1% = -3.6576; 5% = -2.9591; 10% = -2.6181
Source: Author's computation

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Table 3: above presents the summary results of the ADF unit root test. The result of the unit root test shows that the null hypothesis of a unit root pest for level and 1st differencing series for all the variables can be rejected at the critical values indicating that the level series which is largely time – dependent and non-stationary can be made stationary at the maximum lag. Thus, the reduced form model follows an integrating order of 1(0) and 1(1) process and is therefore a stationary process.

Table 4: Johansen Cointegration test

Applying the Johansen co-integration test, we find that the null hypothesis of no co-integration is rejected and we conduct that the variable are co-integrated in the long run. To determine the number of co-integrating equations, we employ the Johansen (1991) test for co-integrating vectors in a VAR system. The test assumption as show in table 4 below is linear deterministic trend in the data and lag interval of 1 to 1.

Sample: 1980 2012, Included observations: 31, Lags interval: 1 to 1

Eigenvalue	Likelihood Ratio	5 Percent Critical Value	1 Percent Critical Value	Hypothesized No. of CE(s)
0.861321	141.1480	68.52	76.07	None **
0.768020	79.90458	47.21	54.46	At most 1 **
0.486888	34.61031	29.68	35.65	At most 2 *
0.338788	13.92523	15.41	20.04	At most 3
0.034896	1.101100	3.76	6.65	At most 4

*(**) denotes rejection of the hypothesis at 5%(1%) significance level
L.R. test indicates 3 cointegrating equation(s) at 5% significance level

Source: Author's computation

Table 4 above shows the results of Johansen co-integration test. The null hypothesis of at most 5 co-integrating equations is rejected at 5% level of significance and hence the alternative hypothesis of at most 3.

Co-integrating equation(s) at the 5% level of significance is accepted. This implies that there are 3 linear combinations of the variable that are stationary in the long run.

Table 5: Vector Error Correction model (VECM)

Sample (adjusted): 1983 2012, included observations: 30 after adjusting endpoints,

Standard errors & t-statistics in parentheses

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Cointegrating Eq:	CointEq1			
C	5396.522			
Error Correction:	D(ASP)	D(INFR)	D(M1)	D(M2)
CointEq1	0.081525	-0.019931	-112.3742	-112.9891
	(0.03982)	(0.00447)	(85.8866)	(109.226)
	(2.04744)	(-4.45440)	(-1.30840)	(-1.03445)
C	183.4484	-0.479988	-363318.6	-396311.1
	(94.2057)	(10.5861)	(203200.)	(258419.)
	(1.94732)	(-0.04534)	(-1.78798)	(-1.53360)
R-squared	0.886404	0.568375	0.679662	0.839052
Adj. R-squared	0.816984	0.304605	0.483899	0.740694
Sum sq. resids	313624.9	3960.308	1.46E+12	2.36E+12
S.E. equation	131.9985	14.83297	284718.8	362090.1
F-statistic	12.76874	2.154808	3.471873	8.530643
Log likelihood	-181.3895	-115.8113	-411.6835	-418.8952
Akaike AIC	12.89263	8.520757	28.24557	28.72635
Schwarz SC	13.45311	9.081236	28.80604	29.28683
Mean dependent	110.3267	0.143333	217088.3	462653.4
S.D. dependent	308.5493	17.78739	396322.7	711067.1
Determinant Residual Covariance		2.26E+24		
Log Likelihood		-1054.008		
Akaike Information Criteria		74.60051		
Schwarz Criteria		77.63644		

Source: Author's computation

To further the analysis of the long run relationship, the inflation – aggregates stock prices model under investigation is then specified in the VECM is employed to capture the short-run deviations of the parameters from the long-run equilibrium and the vector error correction results is presented in table 5. The Akaike information criteria with a value of 74.60 and Schwarz criteria with a value of 77.63 are properly signed. The independent variables of the vector error correction model appears to be negatively signed and dependent variable is also positively signed which indicate that the error is now corrected.

The vector error correction results indicates a good fit with an F-ratio of 12.768, R^2 of 88.64% and an adjusted R^2 of 81.7% meaning that the model explains approximately 88.64% of the variation in Aggregate Stock Prices (ASP)

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Table 6: Granger Causality Test Result

Pairwise Granger Causality Tests, Sample: 1980 2012, Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
INFR does not Granger Cause ASP	31	1.40290	0.26388
ASP does not Granger Cause INFR		0.79544	0.46206
M1 does not Granger Cause ASP	31	12.8456	0.00013*
ASP does not Granger Cause M1		5.41150	0.01084*
M2 does not Granger Cause ASP	31	10.6786	0.00041*
ASP does not Granger Cause M2		3.81483	0.03526*
AIFR does not Granger Cause ASP	31	1.86506	0.17502
ASP does not Granger Cause AIFR		0.11499	0.89182
M1 does not Granger Cause INFR	31	0.42479	0.65836
INFR does not Granger Cause M1		0.33337	0.71952
M2 does not Granger Cause INFR	31	0.39146	0.67998
INFR does not Granger Cause M2		0.32998	0.72191
AIFR does not Granger Cause INFR	31	0.16026	0.85276
INFR does not Granger Cause AIFR		0.08137	0.92209
M2 does not Granger Cause M1	31	0.90541	0.41675
M1 does not Granger Cause M2		3.76088	0.03676
AIFR does not Granger Cause M1	31	0.99807	0.38228
M1 does not Granger Cause AIFR		0.00508	0.99493
AIFR does not Granger Cause M2	31	1.28740	0.29300
M2 does not Granger Cause AIFR		0.00620	0.99382

* sig. at 5%

Source: Author's computation

The table above the granger causality test shows a relationship between the variables. From the table, the probability value of 0.26 and 0.46 is greater than 0.05, therefore inflation rate does not Granger cause ASP and ASP does not Granger cause inflation rate.

The probability value of 0.00013 and 0.01084 is less than 0.05, therefore M1 does cause Granger ASP and ASP does cause Granger M1. The probability of 0.00041 and 0.03526 is less than 0.05, therefore M2 does cause Granger ASP and ASP does cause Granger M2. The probability of 0.17502 and 0.89182 is greater than 0.05 therefore AIFR does not cause Granger ASP and ASP does not cause Granger AIFR.

CONCLUDING REMARKS

This study set to investigate the effects of inflation on aggregate stock prices in Nigeria from 1980 – 2012. The study used the econometric method of co-integration and vector error correction model method (VECM) the study also examines stochastic characteristics of each time series by testing their stationarity using Augumented Dickey Filler (ADF) test. Then, the

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causal linkage from short run adjustment of individual variables is explored using the vector error correction model (VECM). With respect to the level series regression, the result shows the value of narrow money supply (M_1) and average inflation rate (AINFR) are positively and significantly related to aggregate stock price (ASP) while inflation rate (INFR) is negatively and significantly related to ASP and broad money supply (M_2) is also negatively but not significantly related to aggregate stock price.

Overall the level series multiple regressions show a high R^2 of 88.7%, an adjusted R^2 of 87.1% and a Durbin – Watson of 0.75831. However, given the non stationary features of the level series data, it was found in the results that all the variables in the model were integrated of order zero (0) and one (1). That is, all the variables under consideration were stationary at level and first differencing 1(0) and 1(1). The Johansen co-integration test conducted indicates the existence of 3 co-integrating equations in the model meaning that there exists a long run relationship among the variables.

The result of the vector error correction model shows the short-run dynamic adjustment of the variables in the level and first differencing. The vector error correction model variable is appropriately signed, significant and demonstrates that errors in the disequilibrium in the model is corrected by changes in the explanatory variables it also revealed that the Akaike information criteria and Schwarz criteria appears to be appropriately signed indicating the existence of long-run relationship between them. However, with the respect to the direction of causality between inflationary pressure measures and aggregate stock prices, the granger causality test provide mixed results as shown in table 6 using an independent variables, narrow money supply (M_1) and broad money supply (M_2). This means that increase in inflation measures such as M_1 and M_2 will granger cause increase in aggregate stock prices within the period understudy. The policy implications of the above findings are that the government can comfortably regulate the level of inflation in the economy by controlling the level of its aggregate stock prices. It also appears that the above result would verify our a - prior expectation and the efficacy of Keynesian fiscal policy model as a veritable tool of combating inflation in developing countries like Nigeria and there should be policies to compel all firms to be listed in the Nigerian stock exchange to increase market value of their stocks.

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