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Relationship between Inflation and Stock Market Returns: Evidence from Nigeria

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The linkage between stock prices and inflation has been subjected to extensive research in the past decades and has arouse the interests of academics, researchers, practitioners and policy makers globally, particularly since the 1990s. The issue has been the apparent anomaly of the negative relationship between inflation and stock market returns as most studies in the industrialized economies have shown. This paper investigates this relationship using monthly and quarterly data of Nigeria for the period 1985 to 2008. The findings of this paper seem to suggest that stock market returns may provide an effective hedge against inflation in Nigeria.

Keywords: Inflation, stock market, Fisher effect, Fama's proxy hypothesis, Nigeria.

JEL Classification: E31, G11

1. Introduction

The last two decades have been a tranquil for the Nigerian economy. Inflation rate for example, rose markedly in the fourth quarter of 2008 reaching a 3-year high of 15.1 per cent in December from its single digit level of 7.8 per cent at end of March, 2008. Precisely, the inflation rate was 6.5 per cent in December 2007. The inflationary pressure which continued into 2009 as some sources have it (notably the Central Bank of Nigeria, 2009), may have been attributed to rising food prices, inefficient and poor transport services, port congestion, depreciation of the naira and the rush to spend budgetary allocations by government agencies before fiscal year end (Sampson, 2009). During the same periods, the Nigerian capital market experienced a bullish trend when it started the year 2008 at 58,580 (with a market capitalization of N10.284 trillion), and went on to achieve its highest value ever of 66,371 on March 5, 2008,with a market capitalization of about N12.640 trillion (Aluko, 2008). The capital market has since the March 5 to October, 2008 lost about N3.38 trillion, over 26.7 percent; as market capitalization stood at N9.11 trillion. Nigeria equally faced a major decline in portfolio equity flows perceived to be correlated with the sharp fall in stock market. For instance, foreign portfolio investors withdrew $15 billion from the Nigerian capital market in January 2009 (Ajakaiye and Fakiyesi, 2009). The All Share Index (ASI) consequently shred a total share of 67 per cent from March 2008 to March 2009.

In attempt to find some reprieves for the continuous bearish trend in the market, the Central Bank of Nigeria took over the management team of 8 commercial banks effective from August 14, 2009 as the illiquidity in the capital market dove-tailed into the money market. The action described as a hybrid attempt to restructure these banks as a result of their debt exposure to the capital market is beginning to have its toll on the average general price level as analysts speculate precautionary cash balances. One puzzle left to be answered is if the sharp movements in general prices (inflationary) during these years have any linkage with the bullish/bearish capital market dominated activities before and after the 2008 crash.

This paper investigates the relationship between inflation and stock market returns using Nigerian data. Specifically, we effect the analysis by exploring the distinct impacts of inflation on the stock market returns at different time horizons, and also test the Fisher hypothesis by examining the relationship between, (b) contemporaneous inflation and stock market returns, and (c) between inflation and money on the one hand, and between inflation and real activity on the other. The outcomes of the analyses are expected to be of immense importance to investors particularly, in reaching rational decisions on asset allocation and advancement of the literature on financial economies.

The rest of the paper is organized as follows: the next sections briefly review some related literature and presents the historical perspective and performance of Nigerian capital market. Section 4 presents the model, data sources and measurements. Section 5 discusses the results. Section 6 explains the role money and economic activity played in the inflationary process, while the last section concludes the paper.

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2. Review of Some Related Literature

The linkage between stock market returns and inflation if any has drawn the attention of researchers and practitioners alike particularly since the twentieth century. The foundation of the discourse is the Fisher (1930) equity stocks proclamation. According to the generalized Fisher (1930) hypothesis, equity stocks represent claims against real assets of a business; and as such, may serve as a hedge against inflation. If this holds, then investors could sell their financial assets in exchange for real assets when expected inflation is pronounced. In such a situation, stock prices in nominal terms should fully reflect expected inflation and the relationship between these two variables should be positively correlated *ex ante* (Ioannides, et.al., 2005:910). This argument of stock market serving as a hedge against inflation may also imply that investors are fully compensated for the rise in the general price level through corresponding increases in nominal stock market returns and thus, the real returns remain unaltered.

Further extension of the hedge hypothesis posits that since equities are claims as current and future earnings, then it is expected that in the long run as well, the stock market should equally serves as a hedge against inflation. Fama (1981) however, put up a proxy hypothesis when he argued the relationship between high rates of inflation and future real economic growth rates as negative. Views that rationalize the negative co-movements between inflation rates and real stocks returns however differ.

The inflation illusion hypothesis of Modigliani and Cohn (1970) point's out, that the real effect of inflation is caused by money illusion. According to Bekaert and Engstrom (2007:1), inflation illusion suggest that when expected inflation rises, bond yields duly increase, but because equity investors incorrectly discount real cash flows using nominal rates, the increase in nominal yields leads to equity under-pricing and vice versa.

Feldstein's (1980) variant of the inflation and stock market returns theoretical nexus, suggests that inflation erodes real stock returns due to imbalance tax treatment of inventory and depreciation resulting to a fall in real after-tax profit. Feldstein further observed that the failure of share prices to rise during substantial inflation was because of the nominal capital gains from tax laws particularly, historic depreciation cost (Friend and Hasbrouck, 1981). In Fama's (1981) hypothesis, which is based on money demand theory; correlation between inflation and stock market returns is not a causal one; rather, it is a spurious relationship of dual effect. Yeh and Chi (2009:168) in explaining the Fama's hypothesis observed that the reason for the revised correlation is because when inflation is negatively related to real economic activity, and there is a positive association between real activity and stock returns, the negative relationship and stock returns holds. This flow of relationship according to them is not direct.

Hoguet (2008), explanation of stock-inflation neutrality is anchored on two stances as outlined from Giammarino (1999); 1) 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.

The appropriate direction of the relationship or the neutrality between inflation and stock market returns relationship have equally generated a large body of evidence in the empirical literature. Earlier studies by Bodie (1976), Nelson (1976), and Fama and Schwert (1977) were aroused by the rising inflation of the 1970s in the US. According to Alagidede and Panagiotidis (2006), these studies compared the inflation hedge properties of common stocks with those of other financial and real variables for the US. They found that common stock acted as poor hedge against unexpected and expected inflation. In another development, Firth (1979) and Gultekin (1983) found reverse evidence using UK data. Jaffe and Mandelker (1976) also report a negative relation between annual stock returns and concurrent rates of inflation over short sample periods but a positive relation over the much longer period 1875-1970. In another vein, Marshall (1992) argued that the negative relationship between stock returns and inflation will be less pronounced during periods when inflation is generated primarily by monetary fluctuations. Studies that have agreed with this proposition are Graham (1996), who found a positive relationship between common stocks and inflation in the USA (1976-1982) during the period money rather than real activity was the cause of the inflation. Spyrou (2004) study of ten emerging economies further provide evidences that may suggest

equity providing an effective hedge against inflation and that the inflation could be explained by a significant relationship between money and consumer prices in the emerging markets.

Rapach (2002) employed data of 16 OECD countries to determine the direction of the correlates. He observed that long-run inflation neutrality exists in the stock markets of the countries. Following the methodology of King and Watson (1997) in the establishment of time series properties, Rapach explained that the long-run Fisher effects exists if the long-run real stock returns do not respond to a permanent inflation shock (Yeh and Chi, 2009: 169).
Studies on the inflation-stock return maxim for the Nigerian economy as the scan on the literature revealed are however relatively sparse. The available few from our search equally have their limitations. Subair and Salihu (n.d.)using an error correction model to investigate the effects of exchange rate volatility on the Nigerian stock market though found exchange rate volatility to exert strong negative impact on the Nigerian stock market, the rate of inflation did not have any long run relationship with stock market capitalization. The reason for no long run relationship as adduced by the authors is the overbearing participation of the government in the market. First, the cointegration result which authors claimed to underscore this reason was not reported. Second, which market (stock exchange or foreign exchange) government participation is overbearing is not explicitly defined. However, in either of the two markets, government participation over the years has been eroded. Consequently, Subair and Salihu findings may be misleading.

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 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.

Table 1. Summary of Some Previous Studies

Author(s)	Sign
Kessel (1956)	Positive
Nelson (1976)	Negative
Jaffe and Mandelker (1977)	Negative
Fama and Schwert	Negative
Firth (1979)	Positive
Fama	Negative
Gultekin (1983)	Negative
Pearce and Ripley (1988)	Neutral
Lee (1992)	Neutral
Amidhud (1996)	Neutral
Samarakoon (1996)	Positive
Anari and Kolari (2001)	Neutral
Crosby (2002)	Neutral
Spyrou (2001)	Negative
Mark	Neutral
Ioannides et.al. (2004)	Positive
Akmal (2007)	Positive
Yeh and Chi (2009)	Negative
Baekaert and Engstrom (2009)	Positive

Source: Author's compilation

Yaya and Shittu (2010) examined the predictive power of inflation and exchange rate on Nigeria's stock volatility. The QGARCH model shows a significant relationship of inflation and exchange rate to conditional stock market volatility. This study however did not test whether equities are a good hedge against inflation. This further creates the impetus for our study which sets out to determine direction of relationship between equities and inflation on the

one hand; and if stock market returns provided an effective hedge against inflation in Nigeria on the second hand. However, some other previous studies (not on Nigeria) which attempt to empirically establish the direction of relationships between inflation and stock returns are summarized in Table 1. The progeny is however still inconclusive as the puzzle rears.

3. The Historical Perspective and Performance of Common Stocks

The historical monthly behavior of the nominal (and real) stock prices along with the general price index for the periods of 1985(1)-2008(12) are presented in Figures 1 to 4. The two series as shown in Figure 3 look related to each other. In real terms, economic units experienced the highest spike in 2005. This may not be unconnected with the new political order of return to democratic governance in the country in late 2003. The stock index which stood at a value of 58,579.77 on 2nd January 2008 with market capitalization of N10.284 trillion), attained its peak value of 66,371.2 on 5th March 2008 (market capitalization, N12.640 trillion). Since this unprecedented height, the stock index has been exhibiting secular bearish gyration. The index declined to 50,393.88 on 23rd July, 2008 along a capitalization of N10.091 trillion with a continued decline to 33,754.11 and a market capitalization of N7.405 trillion. A noticeable rise to 38,018.44 (market capitalization of N8.390 trillion) was experienced on 17th November, 2008. The rise was short-lived as the market weaned to 28,028.01 with capitalization record of N6.213 trillion and further decline to 20, 827.17 on 31 December, 2009 (market capitalization was N4.989 trillion). Since the start of the bearish market, the lowest threshold of 20,618.71 and a market value of N4.904 were recorded on 14 December 2009. Also from March 5, 2008 to 14 December 2009, the capital market lost well over N7.736 trillion, or about 61.2 per cent.

4. Model Specification, Data Sources and Measurements

4.1. Model specification

In this study, we apply a simple model in the estimation of the relationship between stock returns and inflation, following the lead by Spyrou (2001) as:

$$STK_t = \lambda_1 + \lambda_2 CPI_t + \varepsilon_t \quad (1)$$

where, STK_t is return on the stock portfolio for Nigeria and CPI_t is the rate of inflation. λ_1 is a constant, and λ_2 is the slope coefficient that captures the sensitivity of the stock returns to inflation level. ε_t is the stochastic term which assumes the properties $\sim N(0, \delta^2)$. Economic theory as implied in the Fisher effect supports the existence of a linear relationship of the above system. Other studies that have previously estimated this form of linear relation include Jaffe and Mandelker (1976), Choudhry (2001), and Alagidede and Panagiotidis (2006) among others. Graham (1996) has argued elsewhere that although this simple model of analysis does not distinguish between expected and unexpected components of inflation, the resulting quantitative evidence are not different. λ_2 is *a priori* expected to be positive. The reason is because for emerging economies unlike industrialized economies as previous empirical studies have shown, inflation are primarily caused by money rather than real activity and the effect may appear less pronounced (Marshall, 1992). Should the estimated results of Equation (1)[1] follow this pattern, we shall then investigate whether indeed this proposition holds for Nigeria. Such a relation following Spyrou (2004) is functionally stated as:

$$LCPI = f(LM2, LRGDP) \quad (2)$$

The objective here is to examine whether consumer prices (LCPI) are related more to money supply (LM2) and /or economic activity (LRGDP).

Figure 1. Stock Price Index

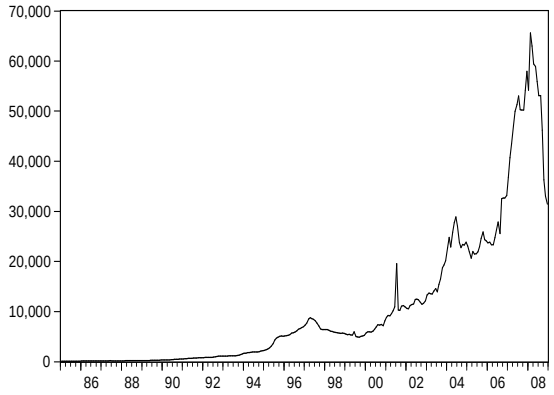


Figure2. Consumer Price Index

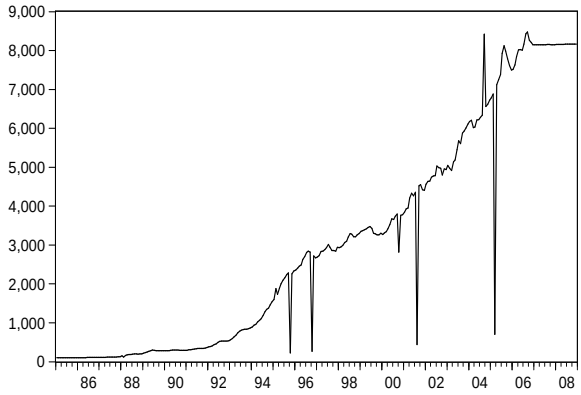


Figure3. Stock Price Index and the Consumer Price Index

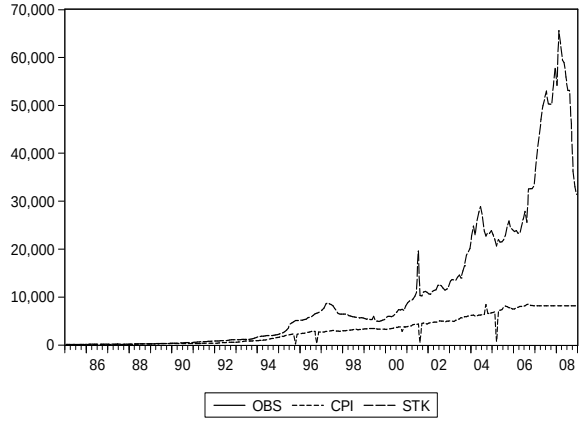
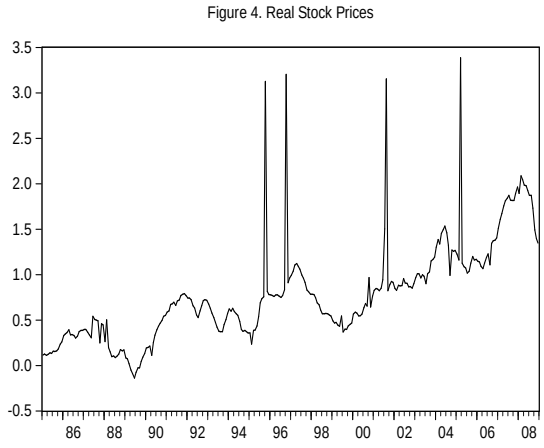


Figure 4. Real Stock Prices



The time series characteristics of the variables in Equations (1 and 2) will be investigated to determine their levels of integration or presence of unit root (stationarity). The level of integration of the variables or the order of autoregressive process (AR1) of the variables is considered by applying the augmented Dickey-Fuller (ADF) tests. The objective is to determine whether the underlying stochastic process that generated the series can be assumed to be invariant with respect to time (Pyndyck and Rubinfied, 1998:493). The ADF is specified when Σ_t is autoregressive to eliminate serial correlation of errors and it takes the form:

$$\Delta Y_t = \alpha + \beta_t + \delta Y_{t-1} + \sum_{j=1}^{p} \lambda_t \Delta Y_{t-1} + \varsigma_t \qquad (3)$$

If all the variables are found to be I(1), that is should the ADF unit-root tests show that the variables reject the null for their first differences, then we shall test for the cointegration of the variables. According to Granger representation theories (Granger, 1987), if two variables are non-stationary that is I(1), and the series have cointegrating relationship among them, then the dynamic function can be represented as an error correction mechanism (Engle and Granger, 1987). The error correction mechanism (ECM) according to Qayyum (2005) is popularized by David Handry through a number of studies (Hendry, Pagan and Sargan, 1984; Hendry and Ericsson, 1991; Hendry and Mizon, 1993).

In order to impose the cointegrating vectors on the error correction model, should the variables have cointegration relationships, Equation (1) will be transformed by linearilization and incorporation of a differenced operator (Δ) and lagged error term as in Equation (4):

$$\Delta STK_t = \lambda_o + \lambda_1 \Delta CPI_t + \mathrm{ECM}_{t-1} + \nu_1 \qquad (4)$$

4.2 Data sources and measurements

The data set consists of monthly stock from January 1985 to December 2008. The data were obtained from the Central Bank of Nigeria (CBN) *Statistical Bulletin, 50 Years Special Anniversary Edition* (2009). Data include monthly observations on Stock Price Index (STK) measured as the Nigerian Exchange's All Share Index simply ASI and consumer price index (CPI). The monthly STK is used as a proxy for stock returns (also known as equity returns). The growth rates of the series are defined as the first difference of the logarithmic price levels. For purpose of examining the stability of the estimate, the sample size of the data is split into two equal sub-periods: February 1985-January 1997, and January 1997-December, 2008. Further justification for this choice of exogenous break date is the fact that the Nigerian capital market experienced its first fundamental and unprecedented growth at end of 1996. For instance, turnover value of the exchange changed by 284 per cent to N7.063billion at end of 1996 from N1.83billion at end of 1995; while Foreign Investment Portfolio Transactions ($US million) increased from $1.137million to $32.99million during these respective periods thus setting a new platform of structural shifts of dealings on the market from January 1997 (See Table in Appendix for more information).

We use the log of broad money supply (LM2) measurement to represent money in the analysis. The use of M2 also finds favour in the argument of Hafer and Jansen (1991) and Laidler (1993) that the boundaries of narrow money shift over time to accommodate new financial instruments, thus making it plausible to apply M2 in money supply related analyses. Real activity (LRA) is proxied with the change in log of real gross domestic product Δlog (LRGDP). We use LRGDP as proxy because of unavailability in obtaining quarterly series for industrial production. The data covered the period 1985(1) to 2008(4).

5. Empirical Results

The descriptive statistics on the rates of the stock indices and the correlations with the rates of inflation (rates of change in consumer prices) are presented in Table 2. It can be observed that the sub-period mean values for both stock market returns and inflation were highest during the period 1985(2) -1997(1). This sub-period however recorded the lowest total risk (standard deviation), while the period 1997(1)-2008(12) returned the highest total risk. This is not however surprising as the worst market crash in the history of the Nigerian Capital Market occurred during this period.

Table 2. Descriptive statistics

Panel A. Monthly stock market returns

Sample period	Mean	Standard deviation	Skewness	Kurtosis	Sample size
1997(1)-2008(12)	0.010	0.096	-0.728	24.644	144
1985(1)-2008(12)	0.020	0.076	-0.910	36.872	287
1985(2)-1997(1)	0.029	0.046	0.427	14.420	144

Panel B. Monthly inflation rates

Sample period	Mean	Standard deviation	Skewness	Kurtosis	Sample size
1997(1)-2008(12)	0.008	0.389	0.076	34.817	144
1985(1)-2008(12)	0.015	0.390	-0.093	34760	287
1985(2)-1997(1)	0.023	0.392	-0.259	35.014	144

As regards the correlation coefficients, the results are mixed. The sub-period 1985(2)-1997(1) indicate a negative relationship between the stock market returns and inflation. This sub-period experienced the highest rate of inflation. The correlation coefficients of the full period of analysis [1985(1) 2008(12)] and the sub-period 1997(1) 2008(12) are positive. Activities in the market during the later sub-period may have influenced the behavior of the entire period, given that the growth during this sub-period account for over 93 per cent of the total period growth. Thus, the relatively higher risk during this period may not be amazing. Should we be guided preliminary by the

signs and significance of the correlation coefficients, we may well conclude that the relationship between stock returns and inflation is positive. However, this should not be extended to imply causality.

Table 3. Correlation between changes in stock indices (ΔSTK) and inflation (ΔCPI)

Statistic	1997(1)-2008(12)	1985(1)-2008(12)	1985(2)-1997(1)
Correlation coefficient	0.323 (4.065)*, *ρ=0.000*	0.196 (3.365)*, *ρ=0.000*	-0.033 (0.404), *ρ=0.697*
observations	144	287	144

Note: *Denotes significance at 1%. *t*-statistics reported in parentheses. *ρ =probability*

The results from estimation of Equation (1) as presented in Table 4 suggest that for the empirical relationship between stock returns and inflation (for the whole period) is positive and statistically significant. However, the relationship is negative for the first sub-period and statistically not significant except the constant term, which may imply better role for other factors (e.g. Treasury bill rate as hedge) than inflation. Interestingly, the relationship is positive in the second sub-period (1997 1 2008 12) and statistically significant. These results in their various forms are not different from previous ones for emerging economies, but differ substantially from the documented negative relationship in more advanced North American economies (Spyrou, 2004). A possible explanation for the difference in behavior of the Nigerian Stock Market as an emerging one (like other emerging economies, in the 1990s) as it relates to the stock return-inflation nexus from those of the typical industrialized economies, particularly in the late 1990s and early 2000s, as earlier noted could be as a result money rather than real economic activity being the more significant determinant of inflation in Nigeria. The less pronounced effect may have accounted for the low levels of the coefficients of determination. The empirical verification of the money, economic activity and the stock returns-inflation nexus is addressed in section 5.

Table 4. Relationship between stock returns and inflation ($STK_t = \delta_1 + \delta_2 CPI_t$)

Period	δ_1	δ_2	R^2	Durbin-Watson Stat.
1985(2)-1997(1)	0.029 (7.521)*	-0.004 (0.404)	0.005	2.001
1997(1)-2008(12)	0.010 (1.292)	0.080 (4.065)*	0.098	2.060
1985(2)-2008(12)	0.019 (4.330)*	0.038 (3.365)*	0.035	2.010

Notes *Denotes significance at 1%. *t*- statistics reported in parentheses

Table 5. Augmented Dickey-Fuller (ADF) Unit Root Tests.

Variables	Intercept	Intercept and Trend	Variables	Intercept	Intercept and Trend
CPI	-2.09	-2.08	ΔCPI	-14.02	-9.89
STK	-1.42	-0.97	ΔSTK	-18.68	-18.72

Critical Values: 1% = -3.99; 5% = -3.43 and 10% = -3.14.

Next, we address the concern of one of the anonymous referees on the need to establish the integration order of each variable in Equation (1) even though they may be stationary given that they are rates of change. This query is underscored by the fact that well into the 1980s; empirical researches in macroeconomics were based on the assumption that the variables in such models are stationary. Problem of validity arises if statistical inferences associated with presumably stationary processes are indeed nonstationary. Clive Granger (1981) is credited with this change of realization and equally contributed enormously to the testing hypotheses of stationarity and other time series properties. In this regard, we conduct the tests for stationarity and detection of cointegration of the series in Equation (1).

5.1. Long-run relationship between inflation and stock market returns.

Stationarity test and cointegration

To test whether the two time series are nonstationary, the ADF unit root test is employed. Table 5 presents the results of these tests for levels as well as first differences of the variables. The null hypothesis is that the series are non-stationary (that is, presence of a unit root), and the alternative hypothesis is that they are stationary (that is, absence of a unit root). The test statistics suggest the levels of the series are not stationary but the first differences

of the series are stationary; thus accepting the null hypothesis of an I(1) process. This implies that the series are integrated of order one and can be tested for cointegration in the Johansen sense.

The results of the Johansen (1991, 1995) system of maximum likelihood approach to cointegration analysis are presented in Table 6. The Johansen's trace test aimed at determining whether a long-term relation exists between the two series starts with the null hypothesis that there is no cointegrating relation, and if this hypothesis cannot be accepted, we test the hypothesis that there is at most one cointegrating equation. Since there are only two variables in the model, we test whether the number of cointegrating equations is zero, one, or two (Anari and Kolari, 2001). The results of the trace test suggest the existence of one cointegrating equation (or long-run relation). The maximum eigenvalue test equally report the existence of one cointegrating equation between stock returns and inflation. Cointegration also implies that causality exists between the variables in at least one direction but does not indicate the direction of causal relationship (Erdal, et.al. 2008).

Table 6. Trace and ʎ –max Test Statistics

Null, Ho	Alternative	Trace	5% Cri. Val.	Null, Ho	Alternative	ʎ –max	5% Cri. Val.
r = 0	r ≥ 1	21.24	15.49	r = 0	r = 1	18.52	14.26
r ≤ 1	r ≥ 2	2.72	3.84	r ≤ 1	r = 2	2.72	3.84

Trace test and Max-eigenvalue test all indicate 1 cointegrating equation at the 0.05 level.

Test of causality in the spirit of Granger when series co integrates, tantamount to estimating an error correction model (ECM) of Equation (1) using first differences of the variables. The results of the long-run relations based on the Least Squares technique are reported in Table 7 while the Granger causality results are presented thereafter In Table 8 respectively.

As shown in Table 7, the estimated Fisher coefficient (δ_2) is positive, very low (less than 1) but statistically significant at 1 percent and not serially correlated. The low level of the Fisher coefficient provides a conservative estimate of how inflation in the long-run affects stock market returns in a typically emerging market. Low levels of Fisher coefficient have also been reported by other researchers for emerging markets (some include Nigeria) using different periods, empirical methods and data series (see Alagidede and Panagiotidis, 2006; Spyrou, 2010 etc.). It may be argued as well that the low Fisher coefficient may result from failure of the market to include information contained in inflation and thus likely to offer only a partial hedge to investors against rising inflation.

We also report the estimate of the speed-of-adjustment coefficient (ϑ_3) in Table 7. The value of -0.005 means that stock market returns takes a longer time to return to their long-run equilibrium following movements in the Nigerian goods market. This finding of long time for inflation to be fully reflected in stock market returns is consistent with Fisher. As noted by Anari and Kolari (2001:598), the long time effect influenced Fisher (1930) invents of distributed lag models and consequent analysis of interest and inflation rate series for the United Kingdom and United States. The outcome is that interest rates follow price changes with long distributed lags of about fifteen to thirty years.

Table7. Long-Run Relation between Inflation and Stock Market Returns

$$\left(\Delta \mathrm{STK}_t = \vartheta_1 + \vartheta_2 \Delta \mathrm{CPI}_t + \vartheta_3 \mathrm{ECM}_{t-1}\right)$$

Period	ϑ_1	ϑ_2	ϑ_3	Prob.	R^2	Durbin-Watson Stat.
1985(1)-2008(12)	0.019 (4.372)	0.067 (5.341)	-0.005 (-4.672)	0.000	0.107	2.074

5.2. Granger causality

As earlier noted, cointegration imply that causality exists between the variables in at least one direction but does not indicate the direction of causal relationship. To avoid miss-specifying the model, we include the one period

lagged error correction term following Chontanawat *et. al*. (2006) in the estimating the Granger causality test. The empirical result as presented in Table 8 suggests long-run uni-directional causal relationship from inflation to stock market returns and not the other way round.

Table 8. Pairwise Granger causality tests

Null Hypothesis	Obs.	F-Statistic	Probability
ΔSTK does not Granger cause ΔCPI	286	29.765	2.E-12
ΔCPI does not Granger cause ΔSTK		2.862	0.053

5.3. Stability analyses

Stability tests were conducted over the sample period by applying both the Chow breakpoint and Quandt-Andrews tests. The results could not reject the null hypothesis of no breaks at specified breakpoints. Thus, there were periods at which significant drift in the relationship between inflation and stock market returns blipped. This is more noticeable in 1995 and after 2006. The results of the Chow breakpoint are contained in Table 9.

Table 9. Chow breakpoint Tests

F-Statistic	6.367	Prob. F(3,281)	0.0003
Log likelihood ratio	18.875	Prob. Chi-square	0.0003
Wald statistic	19.102	Prob. Chi-square	0.0003

6. Money, Economic Activity and the Stock Returns-Inflation Nexus

This section explains the role money and economic activity could have played in inducing the positive relation between stock returns and inflation nexus of Nigeria particularly in the late 1990s up till 2008; as eulogized by Marshall (1992) among others. To achieve this, the validity of the long term equilibrium among the variables (consumer prices, money and real activity) is examined using the variant of the Johansen technique detailed in Johansen and Juselius (1990).

We begin by first considering whether each series is integrated (the order of difference before stationarity is achieved) of the same order. To do this, the standard Augmented Dickey-Fuller (ADF) test and Schwarz Information Criterion (SIC) as indicator for lag selection were first determined. The ADF results are presented in Table 10 and in no case can the hypothesis that the series contain a unit be rejected. The first differences are, however, stationary and thus the series are I(1) and candidates for cointegration. All the ADF regressions include an intercept and trend, while the asymptotic critical values are from MacKinnon (1999) provided by the econometric software (EViews version 7).

The cointegration rank is then conducted with the maximum eigenvalue and trace test. The model lag selection is based on the lowest SIC. We however discussed only the results of the cointegration tests for the sample periods 1997(1)-2008(4) in Table 11 for two reasons; first, for purpose of space and second but most important, the robustness of its results when we analyzed the long-run relationships of the three sample periods. Consequent upon this, further analyses and discussions shall be restricted to this sub-period.

Table 10. ADF Unit Root Test on Variables

Series	Levels	First Difference	Order of Integration
LCPI	-2.051	-12.542*	I(1)
LM2	0.943	-10.689*	I(1)
LRGDP	1.725	-9.306*	I(1)

Note: * denotes significance at 1% critical values from MacKinnon (1999)

The trace statistic and the maximum eigenvalue statistic suggest one cointegration vector at 5 percent significance level for the three sample periods. Given the evidence of one cointegrating vector among the three variables (r = 1), we normalize the cointegrating vector on the natural log of consumer prices (LCPI) of Table 11. This also means that the hypothesis that r = 0 is rejected against the rule r = 1, but the hypothesis that r = 1 cannot be rejected

against r = 2, and so on. The implication is that there is a long-run relationship between consumer prices (inflation index), money and real activity in the Nigerian capital market.

Table 11. Cointegration Results

Panel A: Trace Statistic

Period	Null	Alternative	Statistic	0.05 Critical Values	Prob. *
1997 1 2008 4	r = 0	r ≥ 1	80.16687	29.79707	0.0000
	r ≤ 1	r ≥ 2	6.427749	15.49471	0.6450
	r ≤ 2	r = 3	0.845752	3.841466	0.3578

Note: Trace test indicates 1 cointegrating equation at the 0.05 level.
*MacKinnon-Haug-Michelis (1999) p-values

Panel B. Max-Eigen Statistic

Period	Null	Alternative	Statistic	0.05 Critical Values	Prob. *
1997 1 2008 4	r = 0	r ≥ 1	73.73912	29.79707	0.0000
	r ≤ 1	r ≥ 2	5.581997	15.49471	0.6450
	r ≤ 2	r = 3	0.845752	3.841466	0.3578

Note: Max-eigenvalue test indicates 1 cointegrating equation at the 0.05 level.
*MacKinnon-Haug-Michelis (1999) p-values

We extracted the estimates of the normalized cointegrating coefficients below the cointegration vector with their standard errors reported in parentheses. The normalized cointegrating results reported on Table 12 connote that money supply is positively related to consumer price index, while the sign of the economic activity indicates a negative relationship with the consumer price index. The coefficients are equally statistically significant at 5 percent level. The implication of this shall be discussed alongside the tests of restrictions.

The sequential tests of restrictions were carried out by imposing over-identifying restriction on a re-estimated cointegrating relation; first, that money supply equals zero [LM2 = 0], and then the measure of economic activity [LRGDP = 0]. The results reported in Table 12 show that the restrictions are rejected, that is, the log-likelihood ratio statistic for testing the restriction based on the probability values for both restrictions are statistically significant. Thus the restrictions are rejected at the 5 percent level of significance. This further confirms the normalized cointegrating results that consumer prices are related to both money and real activity and that the money also matters in the determination of inflation in Nigeria. The implication of the results is that though money matter in the relation, equities are a good hedge against inflation in Nigeria (during the period of review) as economic theory suggest. This may not be unconnected to the bullish market trend during a significant part of the period of analysis before the great global financial crash in the later part of the period under review which eventually had a backlash effect.

Table 12. Normalized Cointegrating Vector and LR Test of Restrictions (1997 1 2008 4)

Normalized cointegrating vector (standard error in parentheses)
LCPI = 0.551 LM2 (0.058) -22.827 LRGDP (1.911)

LR test of restrictions [probability]
LM2 = 0 $\chi^2(1) = 5.288$ [0.021]
LRGDP = 0 $\chi^2(1) = 67.455$ [0.000]

7. Conclusions.

Fama's 'proxy hypothesis' explains the apparent anomaly of the negative relationship between inflation and stock market returns as against economic theory suggestion that equities are a good hedge against inflation. The focal objective of the paper is to investigate this relationship using monthly and quarterly data of Nigeria for the period 1985 to 2008. The findings of this paper seem to suggest that stock market returns may provide an effective hedge against inflation in Nigeria. This is explained by the significant and positive relationship between inflation and stock prices as the Fisher (1930) hypothesis postulates. This also implies that investors in making good portfolio decisions should perhaps view equities as long-term holdings against inflation's erosion of purchasing power. This is with caution as recent developments in the Nigerian capital market may have suggested that equities may not necessarily be the best performing asset class over the short term.

Another implied finding of the paper interesting to be mentioned is that the monetary and real sectors of the economy may not be independent of each other, as money may also matter in explaining the behaviour of inflationary process in Nigeria. Thus policies geared at controlling inflation should take into cognizance the role of monetary and real variables especially as these will go a long way in further deepening of the stock market.

Endnote

1. The results of Equation (1) from a simple Ordinary Least Squares (OLS) technique are presented in Table 4.

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Appendix

Nigerian Stock Exchange Performance

Indicator	(End) 1995	(End) 1996	% Change
All-share index	5092.15	6992.10	37.3
Market Capitalisation (N billion)	171.1	285.6	66.9
Turnover Volume (N million)	397	882	122.2
Turnover Value (N billion)	1.83	7.063	284.0
Number	31	36	16.1
Value (N billion)	7.063	21.500	202.800
Foreign Investment Portfolio Transactions ($US million)	1.137	32.99	
Average P/E Ratio	9.2	12.2	

Source: http://www.mbendi.com/exch/16/p0005.htm [Downlaod 25-02-2011].