

Inflation and Capital Market Performance in Nigeria: Canonical Cointegrating Regression Analysis

Gbenga Festus Babarinde¹ and Tajudeen Idera Abdulmajeed²

¹Department of Banking and Finance, Modibbo Adama University of Technology Yola, Nigeria

²Department of Banking and Finance, Nasarawa State University Keffi, Nigeria

¹liftdfgb@gmail.com and ²idera4ever@yahoo.com

Abstract— The macroeconomic view of the capital market postulates that the market is affected by several macro-economic variables among which is inflation. Though, theoretically, capital market reacts to changes in inflation rate but the degree and direction have been a subject of debate of interest to academics, researchers, and policy makers. Therefore, this paper investigates the effect of inflation on capital market in Nigeria, using annual time series data obtained from the Central Bank of Nigeria and World Development Indicators for the years 1981-2018. The Canonical Cointegrating Regression (CCR) technique was applied to the data after descriptive analysis, augmented Dickey-Fuller (ADF) unit root and Johansen cointegration tests were conducted. Cointegration analysis indicates that a long run equilibrium relationship exists between inflation and capital market in Nigeria. The CCR estimates show evidence of a negative significant effect of inflation on capital market in Nigeria. Hence, Nigerian government should consciously embrace inflation-targeting monetary policy regime to stem the tide of rising inflation in Nigeria in order to reduce its negative effect on the Nigerian capital market.

Keywords— Canonical cointegrating regression, Capital market, Cointegration analysis, Inflation, Macroeconomic view.

I. INTRODUCTION

Capital market as the market where medium and long terms funds are traded, is perceived (Maku & Atanda, 2010) as the heartbeat of the economy given its ability to react to changes in economic fundamentals. The authors argue further that the market facilitates savings and real investments in any healthy economy thereby increasing the capital stock and economic growth of the country. The market as a reflection of public confidence in the economy in general and the financial system in particular, can only function well in a stable macroeconomic environment (Babarinde, 2019). This implies capital market tends to reflect movement in macroeconomic factors such as inflation rate, exchange rate, interest rate, and others.

Inflation, as a key macroeconomic factor in an economy, could be described as a sustained, persistent and general

increase in the level of prices of goods and services in the economy. It is a situation where “much money is chasing few goods” because the purchasing power of money has been reduced due to reduction of value of money in transaction. Gidigbi et al. (2018) simply refers to inflation as the erosion of the purchasing power or real value of money in an economy. Developing countries such as Nigeria have been embattled by high inflation rates which tells on the purchasing power of the economy. Thus, price stability forms a cardinal aim of most macroeconomic policies. This is unconnected, partly, with its effect on the economy at large, and the financial sector of the economy in particular. Available evidence from the Central Bank of Nigeria [CBN], (2018) shows that inflation rate in Nigeria has been on the upward swing. Aliyu (2019) argues that inflation-the persistent increase in price levels tend to reduce the value of income, thereby making room for extreme poverty in the country. What will be level of capital market performance in a country whose currency’s value is eroded by inflation? Theoretically, there is a consensus that inflation affects capital market returns, though what remains unresolved is the direction of the existing relationship. Although, empirical studies have attempted resolving the puzzle, yet no consensus is reached up till date. While inflation has negative influence on the value of money; inflation’s influence on the performance of the capital market has been a subject of debate over a long period of time starting with Fisher (1980). It is seen that most studies report evidence of negative relationship between inflation and capital market (Al-Abbadi and Abdul-Khaliq (2017), Jepkemei (2017), Akani and Uzobor (2015), Khumalo (2013)). However, evidence of positive connection between the two variables are reported by other scholars (like Ibrahim and Agbaje (2013), Kaur (2017), Lawal (2016), Mbulawa (2015), Omotor (2010)). The third category of empirical evidence shows inflation to be of no significance in predicting the movement in capital market performance. Authors such as Ahmadi (2016), Floros (2004), Qamri et al (2015), Sokpo et al (2017), belong to this category of neutrality school of thought on inflation-capital market performance nexus. This suggest that the age-long debate over the effect of inflation rate on performance of capital market seems to

persist despite a large body of empirical studies on the subject in both developed and developing countries of the world.

The lacuna in literature in the form of lack of consensus on inflation- capital market response in both theoretical literature (Fisher (1930), Fama (1981)) and empirical studies, spurred the need for this current study. Thus, this study attempts to fill the existing gap in empirical literature by empirically investigating the effect of inflation on market capitalisation in the Nigerian Stock Exchange over the period of 38 years (1981-2018) by applying the Park (1992)’s Canonical Cointegration Regression (CCR) technique, which is to best knowledge of the researchers, appears to be scarce or rare estimation method applied by previous scholars on the subject of inflation-capital market nexus studies.

In this paper, in addition to this introduction, theoretical and empirical literature review on inflation-capital market performance is the subject of section two. In section three, the methodology of the study is explained while section four is on empirical analyses, results and discussion of findings. Finally, the conclusion of the study as well as policy recommendations are presented in section five.

II. LITERATURE REVIEW

According to the macro-economic factor model of the capital market, macroeconomic variables influence the behaviour and performance of capital market. Inflation, exchange rates, money supply, government expenditure, interest rate, unemployment rate, industrial production, gross domestic product, human capital development, etc are some of these potential factors. Thus, capital market capitalisation, stock prices, capital market liquidity, and other market indicators are reflectors of various macroeconomic variables.

As one of the macroeconomic factors, inflation refers to persistent increase in the general price level in an economy over a period of time. Two notable pioneering theories on the relationship between inflation and capital market are the Fisher (1930)’s hypothesis and Fama (1981)’s proxy hypothesis. Fisher Effect Theory or Fisher Hypothesis, postulates a positive relationship between stock returns and inflation based on the understanding that assets ought to maintain their values against inflation (Fisher, 1930). According to the scholar, expected rate of return is an embodiment of both real return and expected rate of inflation. He assumes no relationship exists between real rate and monetary sector. Thus, based on this theory, investment in stock can serve as hedge against the risk of inflation. This is because financial assets like stocks, which represent claims to real assets, should be positively related with expected inflation.

On the other hands, Fama (1981) in his Proxy Hypothesis found that stock returns are negatively related to inflation because stock returns are positively related to real activity and real activity is negatively related to changes in the level of prices. Thus, equity investment in the capital market cannot be used as a hedge against inflation. The reason adduced for the negative relation is indirect relationship between both variables and economic activity. Thus, equities are not a good hedge against inflation.

Empirically, there are many studies on inflation-capital market nexus but they report divergent findings, ranging from positive, negative, mixed, and neutral nexus. A summary of related empirical findings from international studies as reported in Table 1 shows that the divergent results range from negative, positive, mixed and neutral results on the relationship between capital market performance and inflation. The yet unsettled divergent empirical findings are both intra-country and across different countries. For instance, in the same South Africa, Khumalo (2013) reports negativity between capital market and inflation while Moores-Pitt et al. (2017) found a positive nexus. Another case in point is Al-Abbadi et al (2017)’s negative results and Asab et al. (2020)’s positive nexus found in the same Jordan. Conversely, some findings are similar in the same county such as Aliyu (2011) and Kwofie et al (2018) in Ghana reporting evidence of positive inflation-capital market performance nexus.

Table 1. Inflation-capital market nexus: Empirical evidence from international studies

Author(s)	Country	Period	Methods	Results
Mbulawa (2015)	Zimbabwe	1890-2008	VECM	Positive
Aliyu (2011)	Ghana	1999-2010	GARCH,	Positive
Floros (2004)	Greece	1988-2002	OLS	Neutral
Khumalo(2013)	South Africa	1980-2010	ARDL, VAR	Negative
Al-Abbadi et al (2017)	Jordan	1978-2015	VECM	Negative
Jepkemei (2017)	Kenya	2002-2011	OLS	Negative
Cohn et al(1980)	U.K., USA, et al	1969-1979	OLS	Negative
Qamri et al (2015)	Pakistan	1999-2011	OLS	Neutral
Ahmadi (2016)	Iran	2005-2015	EGARCH	Neutral
Kwofie et al (2018)	Ghana	2000-2013	ARDL	Positive
Kaur (2017)	India	2011-2017	OLS	Positive
Dengke(2015)	China	1997-2015	VECM	Positive
Moores-Pitt et al. (2017)	South Africa	1982-2013	VECM	Positive

Asab et al. (2020)	Jordan	1980-2018	Conditional LS, 2SLS	Positive
Antonakakis et al (2016)	USA	1791-2015	GARCH & Correlation	Mixed
Geetha et al (2011)	Malaysia, USA & China	2000-2009	VECM	Positive: China; Negative: USA & Malaysia

Source: Authors' compilation from literature review.

Furthermore, Table 1 shows that popular among the methods employed in past international studies (reviewed) are VECM, OLS and GARCH.

In the same vein, some Nigerian studies were reviewed and summarised in Table 2. Findings are skewed towards a positive association between the two variables, but there are still some Nigerian empirics reporting mixed, negative and neutral influence of inflation on the Nigerian capital market. Just like in international literature, divergent findings on inflation-capital market nexus are reported in Nigeria. Some crops of scholars support the view of capital market investment as possessing hedging property against inflation risk, thus reporting a positive relationship between capital market performance and inflation in Nigeria (Aliyu (2011); Ibrahim et al. (2013); Omotor (2010); Lawal (2016)). Others (such as Akani et al. (2015); Iwegbu and Adeoye (2020); Jelilov et al. (2020); Orajaka et al (2017); Njogo et al (2018); Usman et al (2013)) are of the view that capital market investment does not constitute a hedging facility against the risk of inflation Nigeria.

Table 2. Inflation-capital market nexus: Empirical evidence from Nigeria

Author(s)	Period	Methods	Results
Aliyu (2011)	1998-2010	GARCH & Q-GARCH	Positive
Omotor (2010)	1985-2008	OLS & Granger Causality	Positive
Uwubanmwene et al (2015)	1995-2010	ARDL	Neutral
Orajaka et al (2017)	1980-2014	OLS	Negative
Nwude(2013)	2000-2011	OLS	Negative
Njogo et al (2018)	1995-2014	VECM & Granger Causality	Negative
Sokpo et al (2017)	1995-2016	GARCH & E-GARCH	Neutral
Lawal(2016)	1995-2014	VECM & Granger Causality	Positive
Daferighe et al (2012)	1991-2010	OLS	Negative
Usman et al (2013)	1970-2010	OLS	Negative

Ibrahim et al (2013)	1997-2010	ARDL	Positive
Akani et al. (2015)	1980-2012	VECM, OLS, & Causality	Negative
Jelilov et al. (2020)	02.-04, 2020	GARCH	Negative
Iwegbu et al. (2020)	2007-2018	ARDL	Negative

Source: Authors' compilation from literature review

It is clear from the above empirical review that the debate on capital market-inflation nexus in both Nigeria and other countries is still ongoing, despite the avalanche of studies on the subject matter. Generally, based on the review, methodologically, the authors are not aware of any past study that have applied CCR to the study of nexus between capital market and inflation. The findings of past studies still appear mixed, ranging from positive, negative and mixed/neutral. Thus, this study in handy in its attempt at contributing to empirical literature on the effect of inflation on capital market with focus on Nigeria. On this premises, the study hypothesizes as follows:

HO: Inflation does not have significant effect on the performance of the Nigerian capital market

III. METHODOLOGY

A. Data

This study is a causal study and time series in nature employing secondary data sourced from Central Bank of Nigeria (CBN) statistical bulletin and World Bank World Development Indicators(WDI). Specifically, except for inflation rate (the dependent variable) obtained from WDI, all other variables (explanatory variables) were from CBN statistical bulletin.

Table 3. Variables definition

Variables	Definition
LMCAP: Capital Market	Log. of Nigerian capital market capitalisation in Nigeria
INFR: Inflation	Inflation rate in Nigeria
EXR: Exchange Rate	Average official foreign exchange rate of 1USDollar/Naira
LRGDP: Economic Growth	Log. of real gross domestic growth in Nigeria
LM2: Money Supply	Log. of broad money supply in Nigeria

Source: Authors' extraction from literature review, 2020.

B. Estimation Procedure

This study adopts a four-step estimation procedure. Firstly, the variables are examined in terms of their stationarity. Tests of stationary is necessary so as to avoid spurious regression occasioned by regression one non-stationary variable on another non-stationary variable. This is because time series regression assumes

that time series data are stationary but in reality it is not always so. Test of stationarity was carried using augmented Dickey-Fuller (ADF) unit root test. It is based on the hypothesis of a unit root, which is rejected when the probability value is less than the chosen significance level (1%, 5% or 10%). Secondly, since the variables are not stationary in level but have induced variable of the first difference, hence the need for cointegration test. This is because, individually non-stationary variables, when linearly combined, via cointegration, the variables become stationary. Hence the Johansen cointegration test, based on Unrestricted Cointegration Rank trace test and Maximum Eigen value test were applied to the variables since they are integrated of the same order one I(1). The decision rule of the two tests are to reject the null hypothesis of no cointegration relationship when the t-statistic exceeds the critical value of each test. Thirdly, having established long run co-movement among the variables of study, the regression model was specified and estimated using the Canonical Cointegration Regression (CCR) technique. The coefficient of each variable in the regression output denotes the size and sign while its probability value signifies the significance or otherwise, of the particular variable to the explained variable, in this case, market capitalisation. Conventionally, when the probability value of the test statistic is less than a given level of significance, (say 1%, 5% or 10%), the said variable in the regression output is said to have significant effect/relationship with the explained variable. Fourthly and finally, the model's diagnostic tests were carried to determine the degree of reliance that may be placed on the regression outputs. In this case, the CCR model was diagnosed for any problem of non-normality, autocorrelation, and parameter instability, among others.

C. Model Specification

Park (1992)'s Canonical Cointegration Regression (CCR) is used for testing cointegrating vectors in a model with an integrated process of I(1). It is an estimator that corrects for any element of serial correlation in the errors with regressors and the problem of endogeneity in the variables.

In the model, capital market performance is expressed as a function of inflation.

$$MCAP = f(INFR) \tag{1}$$

Other macroeconomic variables included in the model as control variables are exchange rate, real GDP and broad money supply. This represented in equation (2) thus.

$$MCAP = f(INFR, EXR, RGDP, M2) \tag{2}$$

Thus, the general equation of the cointegration regression model for this study is specified thus:

$$MCAP = INFR + EXCR + RGDP + M2 \tag{3}$$

The econometric version of the equation is specified in equation 4:

$$LMCAP_t = \beta_0 + \beta_1 INFR_t + \beta_2 EXR_t + \beta_3 LRGDP_t + \beta_4 LM2_t + U_t \tag{4}$$

a-prior expectation: $\beta_1 < 0$, $\beta_2 < 0$, $\beta_3 > 0$, $\beta_4 > 0$. It is expected that inflation through erosion of the purchasing power of money, will tend to reduce investible capital available for capital market investment, by extension the reduce capital market performance. Higher exchange rate which indicates depreciation of local currency vis-à-vis foreign currency.

This tends to impact negatively on domestic investors and by extension reduce capital market performance. Unlike both inflation and exchange rate which are expected to be negatively signed; both economic growth and money supply are expected to lead to promote capital market performance, and therefore to be positively signed in the regression output.

IV. RESULTS AND DISCUSSIONS

A. Unit Root Test

The augmented Dickey-Fuller (ADF) unit root test was applied to each variable to avoid spurious regression of non-stationary time series on another non-stationary time series. Table 4 reports the results of the ADF test and reveal that all the variables were not stationary in levels but until after first differencing.

Table 4. Augmented Dickey-Fuller unit root test result

Variables	ADF Test-Statistics	p-value	Order of Integration I(d)
LMCAP	-4.606412	0.0007***	I(1)
INFR	-6.327588	0.0000***	I(1)
EXR	-4.216837	0.0021***	I(1)
LRGDP	-3.395053	0.0177**	I(1)
LM2	-3.707386	0.0088***	I(1)

Note: ***, and ** denote rejection of the null hypothesis of presence of unit root at 1%, and 5%, respectively.

Source: Authors' computation.

B. Cointegration Tests

Since the series are I (1) series, there is the need to test for its long run co-movement via cointegration test. Johansen Cointegration tests whose results are reported in table 5 was used to achieve this objective. The Trace test indicates 2 cointegrating equations at the 0.05 level while the Max-eigenvalue test indicates 1 cointegrating equation at the 0.05 level.

This implies that there is long run relationship amongst these variables. It is safe to model the long run relationship between inflation and capital market performance using the Canonical Cointegrating Regression (CCR) model.

Table 5. Johansen cointegration tests

Unrestricted Cointegration Rank: Trace Test		
Hypothesized	t-Statistic	0.05 Critical values
No. of CE (s)		
None	89.43854	89.43854*
At most 1	55.03993	55.03993*
At most 2	29.24425	29.24425
At most 3	15.06652	15.06652
At most 4	4.452561	4.452561*
Maximum Eigenvalue Test		
Hypothesized	t-Statistic	0.05 Critical values
No. of CE (s)		
None	34.39861*	33.87687
At most 1	25.79568	27.58434
At most 2	14.17772	21.13162
At most 3	10.61396	14.26460
At most 4	4.452561*	3.841466

Note: * denotes rejection of the hypothesis at the 0.05 level

Source: Authors' computation.

C. Model Estimation

The results of the Canonical Cointegrating Regression (CCR) reported in table 6 show that inflation is negatively signed and also significant at 5 percent. This suggests among others, that the Nigerian capital market responds negatively to inflation rate. However, both money supply and economic growth have positive significant effect on the capital market. Exchange rate, though positively signed but its influence on the market is not significant in Nigeria.

Table 6. Long-run estimates of canonical cointegrating regression (CCR)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INFR	-0.011724	0.005546	-2.113928	0.0436**
EXR	0.001788	0.004394	0.406885	0.6872
LRGDP	1.578326	0.626499	2.519280	0.0177**
LM2	0.850644	0.123316	6.898074	0.0000***
C	-16.28980	5.737374	-2.839243	0.0083***
Note: ***, and ** denote significance at 1% and 5% respectively.				
Model Diagnostics:				
R- Squared (R2)			0.982775	
Adjusted R- Squared			0.980314	
Normality (Jargue-Berra)			0.663997	0.717488#
Autocorrelation(Correlogram squared Residual Q-Stat at 2)			4.5375	0.103▪
Stability(Hansen Parameter Instability(Lc statistic))			0.393171	> 0.2

Note: # and ▪ denotes the acceptance of hypotheses of normality and no-serial correlation respectively.

Source: Authors' computation.

Furthermore, findings from the CCR model (in table 6) are considered reliable considering its coefficient of determination (R2) measure of its fitness. This implies that 98 per cent of variation in capital market

performance is attributed to changes in inflation and other regressors in the model. The model is also normally distributed and does not suffer from higher-order serial correlation. Based on Hansen Parameter Instability test, since under the alternative hypothesis of no cointegration, there is likely to be evidence of parameter instability. Thus, the CCR model parameter can be considered stable since the acceptance of the null hypothesis of cointegration because the p-value of Langrage coefficient (Lc) exceeds 5% (>0.2).

D. Discussion of Results

Although macro-economic model of capital market behavior asserts that macroeconomic variables such as inflation rate affect capital market, it however fails to provide guidance on the direction and strength of the influence. Unlike Fisher Hypothesis of a positive inflation-capital market nexus, Fama (1981) opine that capital market reacts negatively in the face of rising inflation. This paper investigates the empirical relation between capital market capitalisation and inflation rate in Nigeria. Thus, capital market capitalisation was regressed against inflation rate, exchange rate, real GDP and money supply within the Canonical Cointegrating Regression (CCR) model, after preliminary testing for unit root (stationarity) and cointegration among variables of study. The ADF unit root results reveal that the variables are non-stationary in level but after first difference, they all attain stationarity. Furthermore, Johansen cointegration tests' results show evidence of a long run relationship between the inflation and capital market. This implies that inflation as a macro-economic variable has long term implications and association with the movement in capital market performance in Nigeria. This is the similar evidence found by Al-Abbadi and Abdul-Khaliq (2017), Akani and Uzobor (2015), Mbulawa (2015), Dengke (2014), Geetha et al (2011) but Khumalo (2013) found no long run equilibrium relationship between inflation and capital market.

Moreover, the results from CCR model show evidence of a negative significant relationship between inflation rate and the market performance in Nigeria, such that a 1% increase inflation rate will suppress capital market capitalisation by about 0.117%. This finding is in line with a priori expectation. This result appears to be consistent with Fama (1981)'s proxy hypothesis of a negative relationship between stock prices and inflation. This finding is in agreement with evidence found by past studies (such as Al-Abbadi and Abdul-Khaliq (2017), Jepkemei (2017), Akani and Uzobor (2015), Khumalo (2013), Cohn and Lessard (1980)). Contrarily, evidence of a positive inflation-capital market nexus was found by others studies (such as Kaur (2017), Mbulawa (2015), Ibrahim and Agbaje (2013), Omotor (2010)).

The negative relation between inflation and capital market established in this study is based on the fact that higher inflation rate leads to greater erosion of purchasing power of investors which tends to reflect negatively on the amount of capital available for investment in the capital market for instance. This implies that capital investment does not constitute a good hedge against inflation risk, this because any returns generated by the investment will be eroded by inflation, which weakens the purchasing power of money in which the investment returns are expressed. Furthermore, by showing that inflation is one of the macroeconomic determinants of capital market in Nigeria over the study period (1981-2018); this study therefore, aligns with the macroeconomic school of thought on capital market behavior.

In the same vein, economic growth, another macroeconomic variable in the model which is positively signed with market capitalisation with a coefficient of 1.5783 and also significant at 5% (p -value=0.0177). This implies that a 1% increase in economic growth causes a rise in stock market performance at a rate of about 1.58%. Similarly, money supply which is positively signed (0.8506) with market capitalisation and significant at 1%, suggests that a 1% increase in money supply in the economy of Nigeria, will lead to 0.86% increase in capital performance over the study period in Nigeria. The results of money supply and economic growth are in line with *a priori* expectation. However, exchange rate result does not uphold theoretical expectation. This is because it is positively signed (with a coefficient of 0.0017 but is not significant given its very high probability value (0.6872).

Given a flexible exchange, the higher the amount of domestic currency (Naira) needed to exchange for a unit of a foreign currency, in this case Dollar, the lower its value in international transactions and thus the higher the currency depreciation rate in the foreign exchange market. Currency depreciation erodes the purchasing power in economy which also tends to reduce demand for capital market investment by the local investors. By market forces of demand and supply, when the demand falls, holding supply constant, the price in the market tends to fall, a case of excess supply. This will eventually transmit to lower returns because of lower level of demand-oriented activities in the capital market. Therefore, it is theoretically expected that exchange rate should exhibit a negative correlation with market capitalisation, but the contrary is discovered in this study. This constitutes a potential matter of empirical significance, for future study.

V. CONCLUSION

The kernel of this paper is to determine the effect of inflation on the Nigeria capital market based on secondary annual time series sourced from the CBN and WDI for the years 1981-2018. Thus, Canonical Cointegrating Regression (CCR) was employed in data analysis, after descriptive analysis, ADF unit root and Johansen cointegration tests were conducted. The cointegration test results report an evidence of a long run equilibrium relationship between inflation and capital market in Nigeria. The regression (CCR) results reveal a negative relationship between inflation and capital market in Nigeria, thus upholding the Fama (1981)'s proxy hypothesis of a negative inflation-capital market nexus. Furthermore, the CCR model also reports that money supply and economic growth have positive significant effect on the capital market in Nigeria. Exchange rate has positive but insignificant effect on the capital market in Nigeria

The evidence of a negative inflation-capital market nexus established in this study reveals the fact that the Nigerian capital market is a reflector of inflation rate. Thus, the higher the inflation rate, the lower the market capitalisation. This implies that capital market cannot be used as a hedge against inflation in Nigeria. In the same vein, the finding in this study further buttresses the need for a macroeconomic stability management in Nigeria where capital market can thrive. Inflation and other macroeconomic variables have implications on the depth and breadth of the capital market.

Other macroeconomic variables (money supply and real GDP) shown, in this study, to have significant (positive) influence on the performance of Nigerian capital market points to the reality of macroeconomic view of capital market. Lack of control by individuals, groups and the market at large, further buttresses the need for policy framework aim at proactively limiting the risk

Since capital market investment is not a good hedge against inflation in Nigeria as found in this study, it is recommended that investors should acquire stocks on a short term basis in the face of high rising inflation. In other words, capital market should not be used as an inflation risk management technique. Government of Nigeria should aggressively focus on conscious and proactive management of inflation in Nigeria through her inflation-targeting monetary policy model/approach. Government should also design measures to stem inflation due to its adverse effect on capital market in the country. The macroeconomic factors such as gross domestic product, money supply should also be attended to pro-actively in the management of the economy by government of Nigeria, so as to further encourage their positive contributions to capital market in Nigeria.

If the above recommendations are embraced and implemented, it can be concluded that inflation has negative significant effect on capital market in Nigeria and therefore capital market investment is not a hedge against inflation risk in Nigeria.

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