Inflation and Economic Growth in Nigeria

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Abstract

The main purpose of this study is to ascertain the existence (or not) of a relationship between Inflation and economic growth in Nigeria. The methodology employed in this study is the cointegration and Granger causality test. Consumer price index (CPI) was used as a proxy for Inflation and the GDP as a perfect proxy for economic growth to examine the relationship. The scope of the study spanned from 1970 to 2005. A stationarity test was carried out using the Augmented Dickey-Fuller test (ADF) and Phillip-Perron test (PP). and stationarity found at first difference at 1% and 5% level of significance. The Johansen-Juselius co-integration technique employed in this study proved to be superior to the Engle and Granger (1987) approach in assessing the co-integrating properties of variables, especially in a multivariate context. The result of the test showed that for the periods, 1970-2005, there was no co-integrating relationship between Inflation and economic growth for Nigeria data. Further effort was made to check the causality relationship that exists between the two variables by employing the VAR-Granger causality at two different lag periods. The results showed the same at different lags. The first test was conducted using lag two (2) and in the result unidirectional causality was seen running from Inflation to economic growth. Further test at lag four (4) was carried out and it only supported the first by also indicating a unidirectional causality running from Inflation to economic growth. Various studies as reviewed in the literature came out with the result that high inflation is and has never been favourable to economic growth. Hence, the study through the empirical findings maintain the fact that the causality that run from inflation to economic growth is an indication of relationship showing that Inflation indeed has an impact on growth.

Keywords: Inflation, Economic growth, Nigeria, Cointegration, Granger causality

1. Introduction

There is a high level consensus among many economists, Central bankers, policy makers and practitioners that one of the fundamental objective of macroeconomic policies in both the developed and developing economies is to sustain high economic growth together with low, one-digit inflation. This is because a high level of inflation disrupts the smooth functioning of a market economy (Krugman, 1995). At the individual level, inflation exerts a heavy toll on those with fixed income; inflation relatively favours debtors at the expense of creditors, at the firm level; the effect of inflation is called the 'menu cost' Rotemberg (1982, 1983), Naish (1986), Dmaziger (1988), Benabou and Konieezny (1994), Yap (1996), Valdovinoz (2003), and Guerrero (2004) because it affects output when firms have to incur costs as they adjust to the new price level (e.g. changing their price lists for customer) .

However, much less agreement exists about the precise relationship between inflation and economic performance, and the mechanism by which inflation affects economic activity at the macroeconomic level. This has generated a significant debate both theoretically and empirically. A series of studies found no conclusive empirical evidence for either a positive or a negative association between inflation and economic growth, notable among these studies are Wai, 1959; Bhatia, 1960; Dorrance, 1963, 1966) Johansen (1967).

The second strand of the literature found a negative correlation between inflation and economic growth. Among these studies are Fisher (1993) De Gregorio (1993) Barro (1995,1996); Brunno and Easterly (1995); Malla (1997); Faria and Carneiro (2001) Dewan & Hussein (2001). While the third strand of the literature found a positive relationship between inflation and economic growth.

Despite these plethora of studies both for developing and developed countries, the literature on inflation and economic growth in Nigeria is scanty. The purpose of this paper is therefore to empirically examine the relationship between inflation and economic growth in Nigeria. This paper is organized as follows; section one is the introduction while section two reviews the empirical literature on inflation and economic growth; section three discusses the model and methodology while section four provides data and empirical evidence and the final section which is section five provides the summary and conclusion of the study.

2. Review of Related Literature

There have been extensive theoretical and empirical research examine the relationship between inflation and economic growth both in the context of developed and developing countries. This section presents a brief review.

Tan (2008) ascertained whether there is any trade-off between inflation and economic growth in the founding members of ASEAN namely Malaysia, Singapore, Thailand, the Philippines and Indonesia and Japan and South Korea. The purpose of the paper was met by integrating the Phillips curve framework with Okun's theory. Quarterly data of these countries spanning generally from 1991 through 2006/7 were mobilized for the purpose. The empirical results suggest that a trade-off albeit small exists between economic growth and inflation in

Singapore, South Korea and Thailand after the 1997/98 Asian financial crisis years while none in the other countries. In the wake of these findings, one might somehow infer that monetary cooperation is sustainable amongst these sample countries.

Erbaykal and Okuyan (2008) examined the relationship between the inflation and the economic growth in Turkey has been in the framework of data covering 1987:1-2006:2 periods. The existence of the long term relationship between these two variables was examined using Bound Test developed by Pesaran et al. (2001), and the existence of a cointegration relationship between the two series was detected following the test result. Whereas no statistically significant long term relationship was found with the formed ARDL models, a negative and statistically significant short term relationship has been found. The causality relationship between the two series was examined in the framework of the causality test developed by Toda Yamamoto (1995). Whereas no causality relationship was found from economic growth to inflation, a causality relationship was found from inflation to economic growth.

Saaed (2007) explored the relationship between inflation and economic growth in the context of Kuwait, using annual data set on real GDP and CPI for the period of 1985 to 2005. The estimated result of the relationship shows a long-run and strong inverse relationship between CPI and real GDP in Kuwait.

Mubarik (2005) estimated the threshold level of inflation for Pakistan using an annual data set from the period between 1973 and 2000. He employed the *Granger Causality* test as an application of the threshold model and finally, the relevant sensitivity analysis of the model. His estimation of the threshold model suggests that an inflation rate beyond 9-percent is detrimental for the economic growth of Pakistan. This in turn, suggests that inflation rate below the estimated level of 9-percent is favorable for the economic growth. Moreover, the sensitivity analysis performed for the robustness of the threshold model also confirms the same level of threshold inflation rate.

Ahmed and Mortaza (2005) empirically explored the relationship between inflation and economic growth in Bangladesh, using annual data set on real GDP and CPI for the period of 1980 to 2005, and the co-integration and error correction models. The empirical evidence demonstrates that there exists a statistically significant long-run *negative* relationship between inflation and economic growth for the country as indicated by a statistically significant long-run *negative* relationship between CPI and real GDP.

Sweidan (2004) examined whether the relationship between inflation and economic growth has a structural breakpoint effect or not for the Jordanian economy from the period between 1970 and 2003. He finds that this relation tends to be positive and significant below an inflation rate of 2-percent and the structural breakpoint effect occurs at an inflation rate equal to 2-percent. Beyond this threshold level inflation affects economic growth negatively.5

Mallik and Chowdhury (2001) examined the short-run and long-run dynamics of the relationship between inflation and economic growth for four South Asian economies: Bangladesh, India, Pakistan, and Sri Lanka. Applying co-integration and error correction models to the annual data retrieved from the International Monetary Fund (IMF) *International Financial Statistics* (IFS), they found two motivating results. First, the relationship between inflation and economic growth is positive and statistically significant for all four countries. Second, the sensitivity of growth to changes in inflation rates is smaller than that of inflation to changes in growth rates. These results have important policy implications, that is, although moderate inflation promotes economic growth, faster economic growth absorbs into inflation by overheating the economy. Therefore, these four countries are on the turning point of inflation-economic growth relationship.

Faria and Carneiro (2001) investigated the relationship between inflation and economic growth in the context of Brazil which has been experiencing persistent high inflation until recently. Analyzing a bivariate time series model (i.e., vector autoregression) with annual data for the period between 1980 and 1995, they found that although there exist a negative relationship between inflation and economic growth in the short-run, inflation does not affect economic growth in the long-run. Their empirical results also support the *superneutrality* concept of money in the long run. This in turn provides empirical evidence against the view that inflation affects economic growth in the long run.

Shitundu and Luvanda (2000) used the Least Trimmed Squares (LTS) method, as introduced by Rousseeuw and Leroy (1987), which detects regression outliers and produces robust regression, to examine the impact of inflation on economic growth in Tanzania. The empirical results obtained suggest that inflation has been harmful to economic growth in Tanzania.

Malla (1997) conducted an empirical analysis using a small sample of Asian countries and countries belonging to the Organization for Economic Cooperation and Development (OECD) separately. After controlling for labor and capital inputs, the estimated results suggest that for the OECD countries there exists a statistically significant negative relationship between economic growth and inflation including its first difference. However, the relationship is not statistically significant for the developing countries of Asia. The crucial finding of this empirical analysis suggests that the cross-country relationship between inflation and long-term economic growth experiences some fundamental problems like adjustment in country sample and the time period. Therefore,

inconclusive relationship between inflation and economic growth can be drawn from comparing cross country time-series regressions with different regions and time periods.

Barro (1995) explored the inflation–economic growth relationship using a large sample covering more than 100 countries from 1960 to 1990. His empirical findings indicate that there exists a statistically significant negative relationship between inflation and economic growth if a certain number of the country characteristics (e.g., fertility rate, education, etc.) are held constant. More specifically, an increase the average inflation by 10 percentage points per year reduces the growth rate of real per capita GDP by 0.2 to 0.3 percentage points per year. In other words, his empirical analysis suggests that the estimated relationship between inflation and economic growth is negative when some reasonable instruments are considered in the statistical process. Finally, he added that there is at least some reason to consider that higher long-term inflation reduces economic growth.

Bruno and Easterly (1995) examined the determinants of economic growth using annual CPI inflation of 26 countries which experienced inflation crises during the period between 1961 and 1992. In their empirical analysis, inflation rate of 40 percent and over is considered as the threshold level for an inflation crisis. They find inconsistent or somewhat inconclusive relationship between inflation and economic growth below this threshold level when countries with high inflation crises are excluded from the sample. In addition, the empirical analysis suggests that there exists a temporal negative relationship between inflation and economic growth beyond this threshold level. The robustness of the empirical results is examined by controlling for other factors such as shocks (e.g., terms of trade shocks, political crises, and wars). Finally, they found that countries recover their pre-crisis economic growth rates following successful reduction of high inflation and there is no permanent damage to economic growth due to discrete high inflation crises.

Sarel (1995) mentioned that inflation rates were somewhat modest in most countries before the 1970s and after then rates started to be high. Therefore, most empirical studies conducted before the 1970s show the evidence of a positive relationship between inflation and economic growth and a negative relationship between the two beyond that time period due to the severe inflation hike.

3. Econometric Methodology

Following the lead of Ahmed and Mortaza (2005) and Alfred (2007), the study employs two econometric models to achieve the empirical results. The first econometric model examines the short-run and long-run relationship between real GDP and CPI by applying the Johansen (1988) co-integration test and the associated Error Correction Model (ECM) and the second is the application of the Granger causality test to determine the direction of causality between the two variables.

3.1 Model Specification

The primary model showing the relationship between Money and Inflation is specified thus:

GDP = f (CPI) ---------- (1)

$$GDP_t = \alpha_0 + \alpha_1 CPI_t + \varepsilon_t \quad \text{----------(2)}$$

Where

GDP is Gross Domestic product as a proxy for growth

CPi is the Consumer Price Index used as a proxy for inflation

α_0 is the constant term, 't' is the time trend, and 'ε' is the random error term-

3.2 Data Description and Sources

To capture the relationship between growth and Inflation, Economic growth was proxied by the GDP and the Consumer Price Index (CPI) is used as a proxy for Inflation. The data covers the period from 1970 to 2005. All the variables are taken on annual basis from various issues of the Central Bank of Nigeria (CBN) Statistical Bulletin.

3.3 Estimation Technique

3.3.1 Unit Root Test

The first step involves testing the order of integration of the individual series under consideration. Researchers have developed several procedures for the test of order of integration. The most popular ones are Augmented Dickey-Fuller (ADF) test due to Dickey and Fuller (1979, 1981), and the Phillip-Perron (PP) due to Phillips (1987) and Phillips and Perron (1988). Augmented Dickey-Fuller test relies on rejecting a null hypothesis of unit root (the series are non-stationary) in favor of the alternative hypotheses of stationarity. The tests are conducted with and without a deterministic trend (t) for each of the series. The general form of ADF test is estimated by the following regression

$$\Delta y_t = \alpha^0 + \alpha^1 y^{t-1} + \sum_{i=1}^{n} \alpha \Delta y_i + e^t \quad \text{---------- (3)}$$

$$\Delta y_t = \alpha_0 + \alpha_1 y_{t-1} + \sum_{n=1}^{n} \alpha_1 \Delta y_i + \delta_t + e_t \quad \text{---------- (4)}$$

Where:

Y is a time series, t is a linear time trend, Δ is the first difference operator, α_0 is a constant, n is the optimum number of lags in the dependent variable and e is the random error term; the difference between equation (1) and (2) is that the first equation includes just drift. However, the second equation includes both drift and linear time trend pp.

$$\Delta y_t = \alpha_0 + \alpha y_{t-1} + e_t \quad \text{---------- (5)}$$

3.3.*2.* The Cointegration Test

The second step is the testing of the presence or otherwise of cointegration between the series of the same order of integration through forming a cointegration equation. The basic idea behind cointegration is that if, in the long-run, two or more series move closely together, even though the series themselves are trended, the difference between them is constant. It is possible to regard these series as defining a long-run equilibrium relationship, as the difference between them is stationary (Hall and Henry, 1989). A lack of cointegration suggests that such variables have no long-run relationship: in principal they can wander arbitrarily far away from each other (Dickey et. al., 1991). We employ the maximum-likelihood test procedure established by Johansen and Juselius (1990) and Johansen (1991). Specifically, if Y_t is a vector of n stochastic variables, then there exists a p-lag vector auto regression with Gaussian errors of the following form:

Johansen's methodology takes its starting point in the Vector Autoregression (VAR) of order P given by

$$y_t = \mu + \Delta_1 y_{t-1} + - - - + \Delta p \quad y_{t-p} + \varepsilon_t \quad \text{---------- (6)}$$

Where

Y_t is an nx1 vector of variables that are integrated of order commonly denoted (1) and ε_t is an nx1 vector of innovations.

This VAR can be rewritten as

$$\Delta y_t = \mu + \eta_{yt-1} + \sum_{i-1}^{p-1} \tau_i \Delta y_{t-1} + \varepsilon_t \quad \text{---------- (7)}$$

Where

$$\prod = \sum_{i-1}^{p} A_{i-1} \quad \text{and} \quad \tau_i = -\sum_{j=i+1}^{p} Aj$$

To determine the number of co-integration vectors, Johansen (1988, 1989) and Johansen and Juselius (1990) suggested two statistic test, the first one is the trace test (λ trace). It tests the null hypothesis that the number of distinct cointegrating vector is less than or equal to q against a general unrestricted alternatives q = r. the test calculated as follows:

$$\lambda \text{ trace } (r) = -T \sum_{i=r+1} \text{In} \left(1 - \hat{\lambda}_t\right) \quad \text{---------- (8)}$$

Where

T is the number of usable observations, and the $\lambda_{1,s}$ are the estimated eigenvalue from the matrix.

3.3.3 Granger-causality test

After the testing of the Cointegration relationship, we test for causality between Growth and Inflation in Nigeria. If the two variables are co-integrated, an Error Correction term (ECT) is required to be included (Granger, 1988) in the following bivariate autoregression:

$$GDP_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1t} GDP_{t-1} + \sum_{i=1}^{m} \alpha_{2t} CPI_{t-1} + \delta_1 ECT_{t-1} + \varepsilon_{1t} \quad \text{---------- (9)}$$

$$CPI_t = \beta_0 + \sum_{i=1}^{m} \beta_{1t} GDP_{t-1} + \sum_{i=1}^{n} \beta_{2t} CPI_{t-1} + \delta_1 ECT_{t-1} + \varepsilon_{1t} \quad \text{---------- (10)}$$

Where:

GDP_t is Gross Domestic product

CPI is the Consumer Price Index used as proxy for inflation;

The term ECT_{t-1} is the error correction term derived from the long-run cointegrating relationship in equation 3. We note that the estimate δ_1 and δ_2 can be interpreted as the speed of adjustment. According to Johansen and Juselius (1987), the existence of cointegration implies the existence of the causality relation between the

variables (Growth and Inflation) under the constraint $/\delta_1/ + /\delta_2/ > 0$. If cointegration relationship between the variables GDP_t and CPI_t does not exist, the term ECT will be removed and the bivariate autoregression equation 9 and 10 becomes:

$$GDP_t = \alpha_0 + \sum_{i=1}^{n} \alpha_{1t} GDP_{t-1} + \sum_{i=1}^{m} \alpha_{2t} CPI_{t-1} + \varepsilon_{1t} \quad \text{---------- (11)}$$

$$CPI_t = \beta_0 + \sum_{i=1}^{m} \beta_{1t} GDP_{t-1} + \sum_{i=1}^{n} \beta_{2t} CPI_{t-1} + \varepsilon_{1t} \quad \text{---------- (12)}$$

Rejecting (accepting) H_0; $\alpha_{21} = \alpha_{22} =$ ---------- $= \alpha_{2m}$ in equation (9 and 10) or equation (11 and 12) suggests that Growth do (do not) Granger cause Inflation. On the other hand, rejecting (accepting) H_0; $\alpha_{11} = \alpha_{12} =$ ---------- $= \beta_{1m}$ suggest that Inflation do (do not) Granger Cause (have an effect) on Growth. These tests enable us to reveal the relationship of no causality, unidirectional causality of feedback causality between Money Supply and Inflation.

4. Data and Empirical Results.

4.1 Unit Root Test

This involves testing for the stationarity of the individual variables using both the Augmented Dickey Fuller (ADF) and Phillips – Perron (PP) tests to find the existence of unit root in each of the time series. The results of both the ADF and PP tests are reported in Tables 4.1(Levels) and 4.2 (First Difference).

All the variables were not found stationary in levels. This can be seen by comparing the observed values (in absolute terms) of both the ADF and PP test statistics with the critical values (also in absolute terms) of the test statistics at the 1%, 5% and 10% level of significance. Result from table 4.1 provides strong evidence of non stationarity. Therefore, the null hypothesis is accepted and it is sufficient to conclude that there is a presence of unit root in the variables at levels.

As a result of the above result, all the variables were differenced once and both the ADF and PP test were conducted on them a shown in table 4.2. The coefficients compared with the critical values (1%, 5% and 10%) reveals that all the variables were stationary at first difference and on the basis of this, the null hypothesis of non-stationary is rejected and it is safe to conclude that the variables are stationary. This implies that the variables are integrated of order one, i.e. 1(1).

4.2 Cointegration test result and Analysis

The result of the cointegration condition (that is the existence of a long term linear relation) is presented in Table 4.3 (Trace Statistics) and 4.4 (Maximum Eigenvalue) using methodology proposed by Johansen and Juselius (1990):

In the Cointegration tables, both trace statistic and maximum Eigenvalue statistic indicated no cointegration at the 5 percent level of significance, suggesting that there is no cointegrating (or long run) relationship between Growth and Inflation. Since the null hypothesis was accepted, there is no need to further subject the variables to error correction test which has lead us to examine the causality between growth and inflation.

4.3 Granger Causality Test Analysis

Causality does not necessarily suggest exogeneity in the sense that the result gotten may not explain whether the relationship is positive or negative. However, growth and inflation, as widely suggested by many economist scholars in the literature reviewed are known to relate inversely, in other words, the economy does not grow well in the midst of high inflation. In any case the following result shown in the tables below reveals the direction of causality between growth and inflation at lag two (2) and lag four (4).

Following the result in table 4.5, the null hypothesis that LCPI does not Granger Cause LGDP is rejected and it is safe to conclude that Uni-directional causality run from Inflation to GDP at lag two (2).

In the result shown in table 4.6, the null hypothesis that LCPI does not Granger cause GDP is also rejected, further confirming a unidirectional causality from Inflation to GDP at lag 4.

5. Conclusion

The objective of this study is to find out the existence of (if there is) a relationship between Inflation and economic growth in Nigeria.

The methodology employed in this study is the cointegration and Granger causality test. We used the Consumer price index (CPI) as a proxy for Inflation and the GDP as a perfect proxy for economic growth to examine the relationship. The scope of the study spanned from 1970 to 2005. A stationarity test was carried out using the Augmented Dickey-Fuller test (ADF) and Phillip-Perron test (PP). The null hypothesis being that there is presence of a unit root was accepted at levels but rejected at first difference implying that the variables were found stationary at 1% and 5% level of significance.

We used the Johansen-Juselius co-integration technique proven to be superior to the Engle and Granger (1987) approach in assessing the co-integrating properties of variables, especially in a multivariate context. The result of

the test showed that for the periods, 1970-2005, there was no co-integrating relationship between Inflation and economic growth for Nigeria data. Thus, we could not find any long-run relationship between Inflation and economic growth for Nigeria.

Besides the non-existence of cointegration existing between economic growth and openness, further effort was made to check the causality relationship that exist between the two variables by employing the VAR-Granger causality at two lag periods as could be seen in table 4.1 to 4.2. The results showed the same at different lags. The first test was conducted using lag two (2) and in the result unidirectional causality was seen running from Inflation to economic growth. Further test at lag four (4) was carried out and it only supported the first by also indicating a unidirectional causality running from Inflation to economic growth.

It should be borne in mind that the study did not consider if the relationship between inflation and growth was negative or positive; however, various studies as reviewed in the literature has come out with the result that high inflation is and has never been favourable to economic growth. Hence it will be good to maintain the fact that the causality that run from inflation to economic growth is an indication of relationship showing that Inflation indeed has an impact on growth.

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Appendix

Table 4.1 ADF and PP Stationarity test at Levels

Variables	ADF (Intercept)	ADF (Intercept & Trend)	PP (Intercept)	PP (Intercept & Trend)
LGDP	0.401(-3.632)*	-1.383(-4.243)*	0.353(-3.632)*	-1.531(-4.243)*
LCPI	-0.072(-3.639)*	-2.593(-4.252)*	2.292(-3.632)*	-1.920(-4.243)*

Note: Significance at 1% level. Figures within parenthesis indicate critical values. Mackinnon (1991) critical value for rejection of hypothesis of unit root applied.
Source: Author's Estimation using Eviews 6.0.

4.2 ADF and PP Stationarity test at First Difference

Variables	ADF (Intercept)	ADF (Intercept & Trend)	PP (Intercept)	PP (Intercept & Trend)
LGDP	-4.984(-3.639)*	-4.965(-4.252)*	-4.984(-3.639)*	-4.971(-4.252)*
LCPI	-3.229(-2.951)**	-3.192(-3.548)**	-3.018(-2.951)**	-2.994(-4.252)*

Note: * and ** denotes Significance at 1% & 5% level, respectively. Figures within parenthesis indicate critical values. Mackinnon (1991) critical value for rejection of hypothesis of unit root applied.
Source: Author's Estimation using Eviews 6.0.

Table 4.3 Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None	0.190841	7.203769	15.49471	0.5541
At most 1	0.000116	0.003935	3.841466	0.9487

Trace test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 4.4 Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None	0.190841	7.199833	14.26460	0.4658
At most 1	0.000116	0.003935	3.841466	0.9487

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 4.5 Pairwise Granger Causality Tests (lag 2)

Null Hypothesis:	Obs	F-Statistic	Probability
LCPI does not Granger Cause LGDP	34	2.08237	0.14288
LGDP does not Granger Cause LCPI		0.86471	0.43175

Table 4.6 Pairwise Granger Causality Tests (lag 4)

Null Hypothesis:	Obs	F-Statistic	Probability
LCPI does not Granger Cause LGDP	32	2.30776	0.08862
LGDP does not Granger Cause LCPI		0.30337	0.87269