

# The Dynamics of Inflation and its Impact on the Nigerian Economy: 1960 – 2012: An Empirical Analysis

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## Abstract

This study is conducted with the main objective of investigating the dynamics of inflation and its impact on the Nigerian economy between 1960 – 2012. It employed an Augmented Dickey – Fuller technique to testing for stationarity of the time series data and the Granger – Causality model to detecting the direction of long – run relationship between the consumer price index (CPI) as proxy for inflation and real gross domestic product (RGDP) as proxy for economic growth. The preliminary regressions results shows a statistically significant positive relationship between consumer price index (CPI) and real gross domestic product (RGDP) for the period under investigation. The results of the unit root test shows that all the variables were stationary at second differencing while the cointegration results reveals that causality runs from inflation to economic growth and not the other way round. The policy implication of this finding is that economy can only grow when individuals consumes those commodities that were produced within the economy. It concludes that the level of output has to be increased continuously to guarantee high mass consumption which will in-turn result in low and stable prices to ensure sustainable development.

**Keywords:** Inflation, Economic Growth, Stationarity, Causality

## 1. Introduction

Inflation, which today confronts policy makers throughout the world in the form of a dominant economic problem has its origin in the earliest days of recorded history. As a matter of fact, inflation remains a pervasive and persistent world problem because no economy in the world has been spared by its phenomenon while no full proof solution to the problem has yet been found. All countries of the world, irrespective of their social, political and economic system have experienced one form of inflation or the other at different stages of development, making the maintenance of price stability a fundamental objective of macroeconomic policy. The emphasis here is that achieving the goal of price stability helps in the promotion of sustainable growth and development as well as strengthening the purchasing power of the domestic currency.

Historically, the upsurge of inflation can be traced to the ancient Mediterranean civilization, where existed, frequent increases in the prices of metallic currency due to the discoveries of new mines and improved methods of mining gold. The early Mediterranean war caused inflation as a result of the release of hoards of metallic money that were accumulated through pillage. However, the largest single inflationary act is traceable to the capture of the Persian gold hoards by Alexander the Great. This was followed by the acquisition of substantial gold and silver hoards by the conquering of the Roman Emperors which also had an inflationary impact in the Kingdom. Again, the frequent debasement of coins in Ancient China, Greece and Rome resulted in inflation coupled with the metallic inflation occasioned by the discovery of America which constituted one of the most important instances of inflations in history.

With the adoption of paper money towards the end of the 17<sup>th</sup> century in the USA and France, inflation began to occur at regular intervals. For instance, in 1775, USA experienced substantial inflation as a result of the issue of continental Dollars by the government to finance the war of independence. The discovery of gold mines in California in 1848 and the gold rushes in Australia, Alaska, South Africa and the Yuan Dynasty caused inflation. In the present century, instances of substantial inflations are the war and post war inflations that occurred during and immediately after the first and second world wars. The German hyper inflation in the early twenties was the worst in the living memory as prices increased One Trillion times of the pre – war level. In Canada, there was rapid inflation during the 1914 – 1920 and 1947 – 1948 periods. In 1951, there came a return to double – digit inflation as the North American economy became over stimulated by the demands of the Korean war. Related to this was the “price revolution” in Western Europe between the second half of the 15<sup>th</sup> century to the first half of the 17<sup>th</sup> century through which Western Europe experienced a major inflationary cycle with prices on average, rising six folds over 150 years. This was caused by the sudden influx of gold and silver from the new world into Hasburg, Spain. The silver spread throughout a previously cash – starved Europe and caused widespread inflation.

The rest of the paper is divided as follows: Section 2 gives the literature review and theoretical framework, Section 3 presents the methodology, Section 4 presents the results of the findings and its policy implication while Section 5 gives the concluding remark.

## 2. Literature Review and Theoretical Framework

### 2.1 Theoretical Review

Conceptually, inflation can be defined as a sustained rise in the general level of prices, brought by high rates of expansion in the aggregate money supply for a long period of time. Intrinsically, inflation has been linked to money as often captured by a popular maxim “inflation is too much money chasing too few goods”. As Hamilton (2001) put it, inflation is an economic situation when the increase in money supply is “faster” than the new production of goods and services in the same economy. More generally, Barro and Grilli (1994) opined that economists believe that high rates of inflation are caused by an excessive growth in the money supply. This view was reinforced by Makin (2010) who argued that the growth in money supply does not necessarily lead to inflation because under conditions of liquidity trap, large monetary injections are synonymous to “pushing on a string” since factors that determines how to moderate the rates of inflation are more varied and are attributed to fluctuations in real demand for goods and services or changes in the available supplies such as during scarcities. However, the consensus of opinion according to Mankiw (2002) and Abel and Bernanke (2005) is that a long and sustained period of inflation is caused by money supply growing faster than the rate of economic growth.

By the 19<sup>th</sup> century, economists categorized three separate factors that cause a rise or fall in the price of goods and services. These are: a change in the value of goods or the production costs; a change in the price of money which used to be a fluctuation in the commodity price of the metallic content in the currency; and, depreciation in the value of a currency that results from an increased supply of currency relative to the quantity of redeemable metal backing the currency.

Theoretically, there have been three dominant schools of thought that attempt to explain the causes of inflation in recent times. These are the neoclassical/monetarists; the Keynesian /neokeynesians and the structuralists. The neoclassical / monetarist economists were offshoots of the classical economists who believe that inflation is caused by the growth in money supply. Their argument is premised on the Quantity Theory of Money (QTM) as the main determinant of changes in the price level. Based on the early work of Fisher (1911) in an equation of exchange  $MV = PY$ . Any change in the quantity of money affects only the price level of the economy, with the real sector being totally insulated. Leading advocates of this school were Friedman (1975) who opined that inflation is every where and always a monetary phenomenon. Accordingly, the monetarists believed that changes in the supply of money do not affect the real output of goods and services, but their values or prices which they are exchanged are so determined. In the words of Dornbush et al (1996), an essential feature of the monetarists model is its focus on the long – run supply – side properties of the economy as opposed to the short – run dynamics of the model. This monetarist stand was criticized by Hamilton (2001) and Colander (1995), taking practical experience of the US Federal Reserve System and maintained that this may not be entirely correct because the US money supply growth rate increases faster than the price itself – a phenomenon that has been traced to the increase demand for the US dollar as a global trade currency (dollarization).

In the Keynesian / neo-keynesian orthodoxy, inflation is attributed to diminishing returns to production which occurs when there is an increase in the velocity of money and excess of current consumption over investment. The Keynesians opposed the monetarists view of a direct relationship between the quantity of money and the price level, believing that such relationship is indirect through the rate of interest. One basic advantage of the Keynesian proposition over the monetarists is that, it integrates both monetary theory on the one hand and the theory of output and employment through the rate of interest on the other hand. As the quantity of money increased, the rate of interest falls, leading to an increase in the volume of investment and aggregate demand; thereby raising output and employment. Secondly, the Keynesian examines the relationship between the quantity of money and prices under both unemployment and full employment situations such that, so long as unemployment exists in an economy, output and employment will change in the same proportion as the quantity of money but there will be no change in prices. This means that at full employment, changes in the quantity of money will induce a proportionate change in price. As Olofin (2001) put it, this approach has the virtue of emphasizing that the objective of full employment and price stability may be inherently irreconcilable.

In the neokeyesian exposition, both aggregate demand and aggregate supply are combined with the assumption that expected inflation is zero because aggregate demand increases with the real money balances and, therefore, decrease with the price level due to changes in public expenditure or nominal money supply. This approach focuses on productivity because declining productivity implies diminishing return to scale and, consequently indirect inflation pressures which results from over-heating of the economic system and widening output gap occasioned in an increase in government expenditures, increase in foreign price level, or increase in money supply.

In the structuralists reformulation of the model, inflation is caused by structural factors that underly the characteristics of the economy. As Adamson (2000) remarked, in all developing countries that are characterized by underground economies and prevalent hoarding or hedging, individuals expect future prices to increase above current prices and, hence demand for goods and services are not only transactionary, but precautionary. This tends to create artificial shortages of goods and reinforce inflationary pressures.

## 2.2 Empirical Literature

The precise direction of the relationship between inflation and economic growth has been a major focus of most researchers across the world. In most of such studies, less agreement exists about the level of relationship and the mechanism by which inflation affects economic activities at the macro level. Beginning from the early 1960s up until present moment, no conclusive empirical evidence exist for either positive or negative association between inflation and economic growth as well as which one causes the other. A review of some of these studies becomes imperative since the dynamics of inflation is a key factor to the success or otherwise of the monetary policy to ensure the attainment of price stability in any given economy. For instance, in most countries of the world, Savel (1995) observed that inflation figures were some what modest before the 1970s and higher afterwards. This means that prior to 1970s, most empirical studies showed evidence of positive relationship between inflation and economic growth and negative relationship between the two variable afterward.

In Bruno and Easterly (1995), the determinants of economic growth using CPI was examined for 26 countries that experienced inflation crises between 1961 and 1992. Their studies found inconclusive relationship between inflation and economic growth below the inflation rate of 40 percent threshold and over, even though their study suggest the existence of temporal negative relationship between inflation and economic growth beyond the threshold level.

In a large sample of more than 100 countries, Barro (1995) examined the relationship between inflation and economic growth between 1960 and 1990. This study revealed the existence of a statistically significant negative relationship between the two variables particularly when certain characteristics of the country (such as fertility rates and education) are held constant. Specifically, the study observed that an increase in the average inflation by 10 percent points per year could reduce the growth rate of real per capita GDP by 0.2 to 0.3 percent points per year.

On the other hand, Malla (1997) conducted an empirical study for a small sample of Asian countries and those belonging to OECD separately and found that, while there exists a statistically significant negative relationship between inflation and economic growth for the OECD countries, that of the Asian countries were not statistically significant.

For Tanzania, Shittundu and Luvanda (2000), applying the Least Trimmed Square (LTS) technique of Rousseeur and Leroy (1987) to study the impact of inflation on economic growth. They found that inflation has a harmful effect on economic growth.

In Brazil, Faria and Carneiro (2001) investigated the relationship between inflation and economic growth for the 1980 and 1995 periods and found that, although there exist a negative relationship between the two variables in the short – run, inflation does not affect economic growth in the long – run.

In the case of some South Asian countries of Bangladesh, India, Pakistan and Sri Lanka, Mallik and Chowdhury (2001) applied a cointegration and error correction models (ECMs) and found two important results. Firstly, the relationship between the two variables are positive and statistically significant for the four countries and secondly, the sensitivity of growth to changes in inflation is some what smaller than that of inflation to changes in economic growth rates. This implies that as moderate inflation tends to promote economic growth, faster rate of economic growth absorbs into inflation by overheating the economy.

For the Dominican Republic, Williams and Adedeji (2004) examined the role of price dynamics by exploring the joint effects of distortions in the money and traded goods markets on inflation, holding other potential influences constant, they found that the major determinants of inflation were changes in monetary aggregates, real output, foreign inflation and exchange rate.

For the Jordanian economy, Sweidan (2004) examined whether (or not) the relationship between inflation and economic growth has any structural breakpoint effect for the period 1970 and 2003. The study showed that below an inflation rate of 2 percent, the relation tends to be positive and significant and at that point, structural breakpoint effect occurs and beyond this threshold level, inflation affects economic growth negatively.

Using annual data on real GDP and CPI for the periods 1980 – 2005, Ahmed and Mortaza (2005) examined the relationship between inflation and economic growth for Bangladesh and found that there exists, a statistically significant long – run negative relationship between inflation and economic growth for the country. Also, Mubarik (2005) estimated the threshold level of inflation for Pakistan for the period 1973 and 2000. He found that an inflation rate beyond 9 percent is detrimental to economic growth while the rate below 9 percent is favorable to economic growth.

In Turkey, Erbaykal and Okuyan (2008) investigated the relationship between inflation and economic growth for the period 1987:1 and 2006:2. Their study did not reveal any statistically significant long – term relationship but only found a short – run negative and statistically significant relationship between the two variables while causality relationship was not found from economic growth to inflation but inflation to economic growth.

For the founding members of ASEAN – Malaysia, Singapore, Thailand, the Philippines, Indonesia, Japan and South Korea, Tan (2008) examined whether there is a trade – off between inflation and economic

growth for the period 1991 and 2006/7. Integrating the Philips curve framework with Okun's theory, they found that trade – off do exist between growth and inflation in countries like Singapore, South Korea and Thailand for period after the 1997/98 Asian Financial Crisis while none in other countries of the study.

In Nigeria, a number of literature exist regarding the relationship between inflation and economic growth. Of particular interest were those of Omoke (2010) who employed cointegration and Granger causality test on annual data for the period 1970 to 2005. The study showed no cointegrating relationship between inflation and economic growth for Nigeria.

In a related study, Umaru and Zubairu (2012) investigated the impact of inflation on economic growth and development in Nigeria for period 1970 – 2010 through the application of the ADF test and Granger – Causality test between GDP and inflation. The result showed that GDP Granger – cause inflation and not the other way round. The result further showed that inflation exerts a positive impact on economic growth through encouraging productivity and output level and on evolution of total factor productivity.

### 3. Methodology and data

#### 3.1 Data

The data used for this paper are basically time series data covering the period 1960 – 2014. They were sourced from the Statistical Bulletin of the Central Bank of Nigeria and the Annual Abstract of Statistics of the National Bureau of Statistics.

#### 3.2 Model Specification, Stationary And Cointegration

##### 3.2.1 Model Specification:

Following Romer (1990), inflation is considered as an independent factor of production. The primary model that shows the relationship between inflation and economic growth could be specified as follows:-

$$GDP = f(CPI) \dots\dots\dots 1$$

Where: GDP is the gross domestic product which is used as a proxy to economic growth; CPI is the consumer price index which proxies the rate of change in the price level and reflects on the actual budget of consumers. Since equation (1) above is only a drift factor, it is re-specified in a Cobb-Douglas production function of the form:

$$GDP = \beta_0 CPI^{\beta_1} \mu \dots\dots\dots 2$$

The logarithmic conversion of equation (2) yields a structural form of the production function as follows:-

$$\text{Log GDP} = \text{Log } \beta_0 + \beta_1 \text{Log CPI} + \text{log } \mu \dots\dots\dots 3$$

Equation (3) shows the variables in logarithmic form.  $B_0$  is the intercept (equivalently the total factor productivity in the production function),  $\beta_1$  is the slope coefficient while  $\text{log } \mu$  is the log of white noise error term which assumes the value of 1. On apriori, both  $\beta_0$  and  $\beta_1$  are positive ( $\beta_0, \beta_1, >0$ ).

##### 3.2.2 Stationarity

For a guide to an appropriate specification of equations (1) and (2), the characteristics of the time series data used for estimating the relationship between inflation and economic growth are examined so as to avoid spurious regression that may result from the regression of two or more non-stationary series. Usually, stationarity tests are performed on the levels of the variables. In this study, the Augmented Dickey – Fuller (ADF) test is carried out as follows:

$$ADF: \delta RGDP_t = Q_0 + Q_1 RGDP_{t-1} + \sum r \delta GDP + \sum_{1 \dots} (4)$$

Where:  $\delta RGDP_t = RGDP_t - RGDP_{t-1}$ ; k is the length of lag on the dependent variable necessary to make  $\Sigma_i$  white – noise;

$$\Sigma_i = \text{white – noise process} \quad \triangle \quad K = 1 \quad t-k$$

### 3.3 Causality Test:

In order to determine the direction of a long-run relationship between inflation and economic growth, a Granger test is performed on the level of the error term. The causality model is specified as follows:

$$\text{Log GDP} = \alpha_1 \text{Log CPI}_{t-1} + \alpha_2 \text{Log GDP}_{t-1} + \Sigma_1 \dots\dots\dots 5$$

$$\text{Log CPI} = \lambda_1 \text{Log CPI}_{t-1} + \lambda_2 \text{Log GDP}_{t-1} + \Sigma_2 \dots\dots\dots 6$$

The F – Statistic is used to reject (or other wise) the null hypothesis of no (or other wise) causality between the two variables when the F – test ( $F \geq 2$ ) is greater than or less than 2 respectively.

## 4. Results and Discussion

Table 2 in the appendix contains a simple log linear regression of the relationship between real gross domestic product (RGDP) and the consumer price index (CPI). The result are plausible in that the estimated t – statistics which measures the strength of the parameter estimates corresponding to the coefficients are statistically high while the  $R^2$  which measures the goodness of fit of the regressions are high at 0.831. This means that about 83.12 per cent of the total variations in the regression are accounted for by the explanatory variable making the



explanatory powers to be statistically significantly high. Equivalently, the F – Statistic which measures the overall significance of the model is found to be statistically high and significant.

This model provides an overwhelming evidence of a positive relationship between inflation and economic growth. The results show that real gross domestic product (RGDP) will rise by about 19.62 per cent (0.196178) for every one unit change in the consumer price index (CPI). As a matter of fact, the results show that 19.62 per cent of the variations in real gross domestic product were found to be caused by variations in the level of inflation. This phenomenon clearly shows that, there exist, a statistically significant positive relationship between economic performance (in real terms) and the level of inflation and that the growth of the economy can be attained by adjusting the purchasing power of individuals by encouraging more consumption of goods and services produced within the economy which in turn, helps to reduce the average price of commodities within the economy.

In table 3, the result of unit root tests are presented. The Augmented Dickey – Fuller (ADF) test is used to check for stationarity. The results revealed that all the variables of the model are found to be stationary at both 1 per cent, 5 per cent and 10 per cent levels at second differencing,  $d(2)$ .

In table 4, the results of causality test are presented. The results revealed that Granger – Causality is found running from consumer price index (CPI) to economic growth and not the other way round. The implication here is that economy grows only when citizens patronize the commodities that are produced within the economy through their buying power as indicated by F – Statistic of 5.85. The implication of this in policy term is that the level of output need to be constantly increased to enhance the supply of commodities, which in turn could help to keep prices low and stable.

## 5. Conclusion:

This study is conducted with the main objective of investigating the dynamics of inflation and its impact on the Nigerian economy between 1960 and 2012. The methodology used in this study is the Augmented Dickey – Fuller (ADF) test and the Granger – Causality test. The preliminary regressions results show a statistically significant positive relationship between inflation and economic growth (in real terms) while the unit root test results suggest that all the variables in the model are stationary after second differencing. The results further revealed that causality is found, running from consumer price index to real gross domestic product – implying that economy can only grow when individuals buy up goods and services that have been produced in the economy. In turn, high mass consumption helps to keep the commodity prices low and stable for sustainable development.

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**Table 1: Regression data**

Year	Real GDP at 1990 Basic Price (=N= Million)	CPI (%)
1960	2,489.0	0.14
1961	2,501.2	0.15
1962	2,597.6	0.15
1963	2,825.8	0.20
1964	2,947.6	0.20
1965	3,146.8	0.20
1966	3,044.8	0.21
1967	2,527.3	0.21
1968	2,543.8	0.22
1969	3,225.5	0.22
1970	4,219.0	0.23
1971	4,715.5	0.23
1972	4,892.8	0.24
1973	5,310.0	0.28
1974	15,919.7	0.31
1975	27,172.8	0.45
1976	29,145.5	0.50
1977	31,520.3	0.68
1978	29,212.4	0.70
1979	29,948.0	0.75
1980	31,520.3	0.88
1981	251,052.3	1.03
1982	246,726.6	1.10
1983	230,380.8	1.53
1984	227,254.7	1.87
1985	253,013.3	1.89
1986	257,784.5	2.15
1987	255,997.0	2.36
1988	275,409.6	3.80
1989	295,090.8	5.50
1990	328,606.1	5.70
1991	328,644.5	7.00
1992	337,288.6	10.42
1993	342,540.5	16.80
1994	345,228.5	29.70
1995	352,646.2	45.03
1996	367,218.1	51.47
1997	377,830.8	56.73
1998	388,468.1	63.49
1999	393,107.2	68.63
2000	412,332.0	72.87
2001	431,783.2	84.90
2002	451,785.7	95.20
2003	495,007.2	117.90
2004	527,576.0	129.70
2005	561,931.4	144.70
2006	595,821.6	157.10
2007	634,251.1	167.40
2008	672,202.6	192.60
2009	718,977.3	192.71
2010	776,332.2	189.68
2011	834,000.8	191.77
2012	888,893.0	199.20

Source: National Bureau of Statistics

**Table 2: Regression Result**

Dependent Variable	:	Log of Real GDP
Method	:	Least Squares
Date	:	12/30/2014, Time: 12:03
Sample (adjusted)	:	1960 – 2012
Included observations	:	52 (32) after adjusting end points

Variable	Coefficient	std. Error	t-statistic	Probability
C	5.326729	0.026000	204.8718	0.0000
CPI	0.196178	0.016142	12.15340	0.0000
R-Square	0.831181	mean dependent	Var.	5.601562
Adj. R-Square	0.825554	S.D dependent	Var.	0.173784
S.E of Regression	0.072584	Akaike info	criterion	-2.347689
Sum Square resid.	0.158052	Schwartz	criterion	-2.256081
Log Likelihood	39.56303	F-statistic		147.7050
Durbin – Watson Stat	1.520126	Pro (F – Statistic)		0.0000

Source: Own Computation using E – views 7.0

**Table 3: Result of Unit Root Test**

Null Hypothesis	:	D (Log Real GDP) has a unit root
Exogenous	:	Constant
Log Length	:	0 (Automatic, based on SIC, MAX LAG= 2)

Variable	ADF test statistic with constant but not linear trend	Critical value for AP at 95%	Order of Cointegration
D (RGDP)	- 5.211802	- 2.9202	1(1)
D (CPI)	- 5.166209	- 2.9705	2(1)

Source: Own Computation using E-views 7.0

\*, \*\*, \*\*\* are levels of significance at 1%, 5% and 10% respectively.

**Table 4: Causality Test Result**

Pair wise Granger Causality Tests

Date	:	12/30/2014, Time: 12:13 & 12:16
Sample (adjusted)	:	1981 – 2012
Included observations	:	32 (Excluded observation 20) after adjusting end points

**Log: 1**

Null Hypothesis	F – Statistic	Probability
Log CPI cause LogRGDP	5.85 E + 29	0.000000
Log RGDP cause Log CPI	2.22 E + 31	0.000000

Source: Own Computation using E-views 7.0



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