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Assessment of the Effect of Inflation on Nigeria's Economic Growth: Vector Error Correction Model Approach

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Abstract
The study examined the effect of inflation on Nigeria's economic growth for the period ranging from 1980 to 2015. Cointegration approach, vector error correction model (VECM) and Granger causality test were employed in the analysis. Variables engaged in the study involve real gross domestic product (RGDP), inflation rate (INFR), government investment expenditure (GINVXP), private investment expenditure (PINVXP) and total export (TEXP). The results of cointegration test showed evidence of long-run relationship among the selected variables. The VECM results demonstrated that inflation affect Nigeria's economic growth negatively and insignificantly. More so, it was shown in the results that GINVXP and TEXP have significant and negative effect on RGDP. The results also indicate that PINVXP has significant and positive influence on RGDP. Similarly, the results of the Granger causality test revealed no causation between inflation rate and real GDP. The implication of these results is that while government economic measures aimed at improving public spending on both private and public investments leads to increase real GDP, such measure does not lead to solving Nigeria's inflation problems. In view of the above, the study therefore recommends as follows: that government may reconsider the over reliance in its spending on public and private investments in solving inflation problems in Nigeria, as there are other factors responsible for high inflation in the economy. Similarly, government is advised to pursue vigorously the economic policies targeted at improving economic growth because that will help to reduce high inflation in the economy. Furthermore, government is by this study advised to increase its capital budget spending on public investment projects, and as well create business friendly environment for private investment in Nigeria. In so doing, significant economic growth will be achieved and sustained in the Nigerian economy.
Keywords: Inflation, Economic growth, Cointegration, Vector error correction model, Granger causality

1.   Introduction

To achieve rapid economic growth, as well as low inflation rate are the main goals of macroeconomic policies in any economy. According to Bill & Khan (2008), most researchers, policymakers and economists have agreed that zero inflation is not healthy for an economy and as a result should be discouraged. This is because; deflation has serious effects on economic growth and development of a country. Thus, moderate inflation enhances nation's domestic economy, while high inflation is inimical to the growth and development of the domestic economy (Mubarik, 2005). In view of the above, the policymakers, as well as the monetary authorities are advised to work toward achieving low rate of inflation in an economy, as that would help to maximize the overall economic well-being of citizens in their countries.

Generally, high inflation imposes welfare costs on a nation, hinders efficient allocation of resources by affecting the role of changes in the relative price level, and as well discourages investments and savings in an economy as it creates unpredictable future prices. The situation also affects financial development because it makes financial intermediation more costly, and the poor are mostly affected because they rescind in holding financial assets that provides a hedge against high inflation and decreases a country's international competitiveness by making exports more expensive. It also has negative effect on payments balance, and reduces long-term growth of a country. Business and households perform poorly during the period of high inflation (Frimpong & Oteng-Abayie, 2010).

In Nigeria, high inflation has been one of the major challenges facing the nation's economy. The inability of the government to proffer a lasting solution to this problem indicates the inevitability of inflation in the economy; hence, it shows that government lacks the power to eliminate the persistent rising prices of goods and services in the domestic economy (Taiwo, 2011). Inflation in Nigeria can be traced to 1950s, though not prevalent then. Scholars have argued that during an inflationary period, domestic currency finds it difficult to act as medium of exchange and a store of value without adversely affecting output level, income distribution and employment level of the country (CBN, 1984). Inflation leads to currency depreciation and a rise in foreign exchange rate. This is obviously the case of the Naira as it has depreciated overtime against US dollar and other major foreign currencies. For example, naira exchange rate was ₦0.61 per US dollar in 1981, and depreciated to ₦2.0206 to a dollar in 1986. In 1991, the exchange rate depreciated to ₦9.9095 per dollar, and further depreciated to ₦21.886, ₦111.9433, ₦128.6516, ₦153.8616 and ₦199.268 in 1996, 2001, 2006, 2011 and 2015 respectively. However, the corresponding rate of inflation in 1981 stood at 20.8% in Nigeria; and in 1986, the inflation rate declined to 5.7%, and increased to 13.0% in 1990. By 1996, the rate of inflation again rose to 29.3%; in 2001 and 2006, the rates of inflation were 18.9% and 8.2% respectively; and it was 10.8% and 9.0% in

2011 and 2015 respectively (CBN, 2015). More so, the growth rate of real gross domestic product (RGDP) in 1981 was -20.4%; in 1986, the growth rate of RGDP rose to 1.9%, and declined to 0.01% in 1991. By 1996, 2001, 2006, 2011 and 2015, the growth rates of the RGDP were 4.1%, 9.8%, 6.0%, 7.4% and 3.9% respectively (CBN, 2015).

According to Taiwo (2011), inflation in Nigeria has become a major threat to economic activities, especially on workers whose standard of living declines continuously. The inflationary factors traced to Nigeria's high inflation include continuous hike in petroleum price and exchange rate depreciation/devaluation. These increases in the two variables (price of petroleum and exchange rate depreciation) have been blamed for the increases in the transportation costs, input materials, foodstuffs, rents, and goods and services coupled with the exchange rate depreciation in Nigeria. Inflation in an economy can be measured using consumer price index approach and wholesale or producer price index approach. The period to period changes in wholesale or producer price index are used as direct measures of inflation, though not the best measure of inflation in Nigeria. The consumer price index (CPI) approach on the other hand, is the least efficient of the approaches used in measuring inflation rates in Nigeria, yet it is the most used measure of inflation, because it is easily and currently available on monthly, quarterly and annual basis (CBN, 1991).

To control inflation in the country, the Central Bank of Nigeria (CBN) often adopts monetary policies with the aim of achieving price stability, as well as sustainable economic growth. The monetary authorities in an attempt to achieve the overall inflation objective of the government via effective monetary management, sets intermediate and operating targets that is in line with the targets for GDP growth, inflation rate and balance of payments (Sani & Abdullahi, 2011). Despite all the monetary policies adopted by the monetary authorities to reduce high inflation in Nigeria, the rate of inflation in the country is still high with the standard of living of the citizens decreasing continuously. It is against this background that the study investigates the effect of inflation on economic growth of Nigeria for the period of 1980-2015.

2.   Review of Related Literature

There exist several related and relevant literatures that explain the relationship between inflation and growth of the domestic economy in the economic development literature. The main objective of this approach is to theoretically explain the effect of inflation on economic growth and development in any economy. In view of the above, the review of the related literature is decomposed into theoretical review and empirical review.

2.1   Theoretical Review

The issue of inflation in an economy is one of the determinants debates across the world, both in the developed and the developing countries. It is the major concept that usually cut the attention of the economists, policymakers, monetary authorities and researchers in any economy. In order to attain price stabilization, and encourage private savings that promotes investments and improves output level of a country, the regulatory authorities often adopt inflation targeting policies.

2.1.1 Money Supply, Inflation, Exchange Rate and Gross Domestic Product

Overtime, scholars have lacked consensus on the nexus between inflation and some macroeconomic variables including gross domestic product (GDP), money supply and exchange rate. Based on the relationship between inflation and money supply, the monetarist postulated that increase in the volume of money in circulation leads to a proportionate increase in general price level (Friedman, 1956). In this sense, the monetarists believed that there exists direct relationship between inflation and money supply in an economy. It was also argued that increase in the volume of money in circulation that results from government budget deficit or expansionary fiscal policy of government leads to a rise in the general price level.

On the other hand, the monetarists looked into exchange rates, gross domestic product and balance of payments deficit, and argued that balance of payments deficit causes disequilibrium in the domestic money market, as well as excess money supply, which is as a result of government expansionary policy on foreign goods and assets through depreciation of exchange rate. During a fixed exchange rate regime, expansionary policy involves budget deficit financed by drawing on external reserves of the country mainly to close up the gap created by deficit in the budget. However, some investigations violated this theoretical postulation that exchange rate has influence on domestic price level. For example, Chibber & Safik (1991) argued that exchange rate does not have relationship with inflation. The basis for the argument was anchored on empirical studies of selected African countries, which found that devaluation led to increase in the general price level in the short run. They argued further that, the degree at which currency devaluation affects inflation in an economy largely depends on the policy effect on the government expenditure, revenues and monetary policy pursued simultaneously in the economy. Similarly, Sowa & kwakye (1991) explained that exchange rate depreciation does not have significant relationship with the movement of price. In contrast, monetary expansion and exchange rate depreciation results to high inflation in an economy (Elbadawi, 1990).

2.1.2 Inflation and Economic Growth

Phillips (1958) developed hypothesizes, which revealed that high inflation in an economy affect growth of the domestic economy positively by decreasing the rate of unemployment. Similarly, Prasanna & Gopakumar (2010) argued that nations with high inflation experience a decrease in the rate of economic growth; hence, inflation affects economic growth negatively. Kilindo (1997) stated that high inflation, low domestic savings, balance of payments deficits, low agricultural produce, increase in public spending and fall in industrial capacity utilization hinders economic growth of a nation. Fischer (1993) was of the opinion that uncertainty in inflation is the major economic instability indicator, which affects economic growth of a country negatively. However, Dotsey & Sarte (2000) postulated that fluctuations results to economic growth via a precautionary savings motive.

According to Awogbemi & Taiwo (2012), persistent rise in the price level of goods and services are the most serious challenges facing every economic unit. In view of this, every nation strives to achieve price stability as the main factor that is required to promote economic growth and development of a nation. They identified some variable determinants of inflation to include monetary policy, fiscal policy and balance of payments position of a country. In their explanation of the monetary policy as one of the determinants of inflation, they argued that inflation results due to increase in money supply. The fiscal policy according to the authors related to fundamental factors that causes inflation in an economy. They argued that fiscal policy involves government budget deficit, which are often financed through money creation in the less developed countries, and hence, fuels inflation. On the other hand, balance of payment position was based on the rate of exchange. If exchange rate collapses, it will bring about inflation that may either be inform of higher import prices or in the form of accelerated wage bill (Akinbobola, 2012).

Awogbemi & Ajao (2011) also argued that increase in the cost of goods and services are often considered to be counterproductive, and it has negative effect on an economy of a nation. The most significant influence of inflation is its effect on the public revenue. If the inflation is higher than the past planned, the revenue of the government decreases. Kevin & Liu (2004) stated that inflation stability and output gap have been the major objectives for many central banks all over the world. The main objective of any central bank is to achieve optimal monetary policy rules. In both policy practice and academic research, inflation target being explicit or implicit is almost measured through the standard of living index, the consumer price index, the cost of production index and the producer price index. It was argued that most countries that have adopted an explicit inflation targeting policy targets inflation or its variants than those that are not.

2.1.5 Theories of Inflation

Quantity Theory of Money

Quantity theory of money belief that the quantity of money in circulation is the main factor that determines prices level in any economy. If the quantity of money in circulation changes, it will lead to change in the price level of goods and services. The theory was propounded by Irving Fisher in his famous equation of exchange: MV=PQ, where M is stock of money, V is the velocity of circulation of money, Q is the volume of transactions generated internally, while P is the general price level. Transforming the equation by substituting Y, which is the total amount of goods and services exchanged for money for Q, the equation of exchange becomes MV=PY. The introduction of Y provides the relationship between the monetary and the real side of the economy.

However, P, V and Y are endogenously determined internally. The variable M is the policy variable, which is exogenously determined by the monetary authorities. The monetarists argued that change in quantity of money affects price level only or the monetary side of the economy with the real sector totally excluded. This implies that variations in the supply of money do not affect the real output of goods and services, rather, their values or the prices at which they are exchanged. The main trust of the monetarists' model is its focus on long run supply side properties of the economy as against the short run dynamics (Dornbusch, Fischer & Kearney, 1996).

The Keynesian Theory of Money

The Keynesian theory countered the postulation of the monetarists of direct and proportional links between the quantity of money and price level. The school of thought argued that the nexus between changes in the quantity of money and price level is never proportionate and indirect via interest rate. The Keynesian theory is famous due to its integration of monetary theory; and the theory of output and employment through the interest rate. Keynesian theory argued that when the quantity of money rises, interest rate will fall resulting to increase in the volume of investment and aggregate demand; which in turn, raise output and employment in an economy. In contrast, the theory saw a relationship between the real sector and the monetary sector of the economy as an economic phenomenon that explains equilibrium relationship between the commodity and the money markets.

Other important aspect of the Keynesian theory is that they looked into the relationship between the quantity of money and price level in both the unemployment and the full employment situations. Accordingly, as long as unemployment, employment and output exists, it will always change in the same proportion as the quantity of money changes, while there will be no change in prices. At full employment, however, change in the quantity of money induces a proportionate change in price level. Olafin (2001) argued that, the approach

emphasizes that the objectives of full employment and price stability may be unachievable.

The Neo-Keynesian Theory of Money

This theory combines both aggregate demand and aggregate supply. The theory assumes a Keynesian view in the short run and a classical view in the long run. Therefore, the approach adopted in the theory explained that a change in public expenditure or nominal money supply, which is expected to produce inflation, is zero. As a result, aggregate demand increases with real money balances and therefore, decreases with the price level. The Neo-Keynesian theory focuses on productivity; this is because, a decline in productivity leads to diminishing returns to scale and consequently, results to inflationary pressures which widened output gap.

2.2 Empirical Review

Erbaykal & Okuyan (2008) investigated the nexus between inflation and economic growth in Turkey from 1987 to 2006 through the applications of cointegration test and Toda-Yamamoto approach to causality test. The result showed that inflation does not have significant long run relationship with economic growth in Turkey. The results of the Toda-Yamamoto approach to causality test indicate unidirectional relationship between inflation and economic growth, with causality running inflation to economic growth. Saaed (2007) studied the relationship between inflation and economic growth in Kuwait from 1985 to 2005 using cointegration approach. The results of the study indicate long run relationship between real gross domestic product (GDP) and consumer price index (CPI) in Kuwait.

Ahmed & Mortaza (2005) examined the nexus between inflation and economic growth in Bangladesh for the period 1980-2005 by employing cointegration test and error correction model. The study employed consumer price index (CPI) and gross domestic product (GDP) in the investigation. The results revealed that long run relationship exists between inflation and economic growth. Similarly, the results showed that inflation has negative relationship with economic growth in Bangladesh for the period studied. Sweidan (2004) investigated the relationship between inflation and economic growth in Jordan from 1970 to 2003 using chow breakpoint test. The results indicate that inflation has positive and significant influence on economic growth of Jordan, and that structural breakpoint effect occurs at an inflation rate of 2%. Above the threshold level of 2%, inflation affects economic growth negatively.

Mohanty, Chakraborty, Das & John (2011) studied the nexus between inflation and growth in India using quarterly data series and found that the inflation rate of 4% to 5.5% can be considered as an inflation threshold in the economy. Hence, the study concluded that inflation rate less than 5.5% would have positive impact on Indian economic growth, while inflation rate above 5.5% threshold level will have negative impact on the economy. Fakhri (2011) investigated the possibility of threshold effect of inflation on economic growth in Azerbaijani economy from 2000 to 2009. The estimated threshold model indicates that threshold level of inflation for GDP growth in Azerbaijan is 13%. Thus, below this threshold level, inflation will have significant and positive effect on GDP growth, while a threshold level above 13% will have negative effect on the growth of Azerbaijan. Frimpong & Oteng-Abayie (2010) examined the threshold effect of inflation on economic growth in Ghana for the period 1960-2008 by using threshold regression models. The result shows an inflation threshold level of 11% at which inflation begins to have adverse effect on economic growth in Ghana. Below the threshold level of 11%, inflation will affect economic growth positively, while above the threshold level of 11%, inflation will have adverse effect economic growth in Ghana.

More so, Faraji & Kenani (2013) investigated the impact of inflation on economic growth in Tanzania from 1990 to 2011 through the applications of cointegration approach, ordinary least square (OLS) technique and correlation coefficient analysis. The results of the cointegration test indicate no cointegration between inflation and economic growth. Similarly, the results of the correlation coefficient indicate that strong relationship exist between inflation and gross domestic product (GDP) in Tanzania. The results also showed that inflation has a negative impact on economic growth in Tanzania. Quartey (2010) investigated the impact of inflation in Ghanaian economy from 1970 to 2006 by using the Johansen cointegration method. The study found negative impact of inflation on the growth of Ghana. Marbuah (2010) investigated the nexus between inflation and economic growth in the Ghana's economy for the period 1955-2009. The study found evidence of significant threshold effect of inflation on economic growth with and without structural break. The evidence indicated both a minimum and maximum inflation threshold levels of 6% and 10%. Moreover, the study found that adjusting for structural break in the model increases the effect of inflation on growth at a robust threshold level of 10% by a factor of approximately 81%.

Omoke (2010) investigated the impact of inflation on economic growth in Nigeria for the period 1970-2005, using co-integration and Granger causality tests. 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. A stationarity test was carried out using the Augmented Dickey-Fuller test (ADF) and Phillip-Perron test (PP), and stationarity was found at first difference. More so, Johansen-Juselius cointegration technique employed in the study showed no evidence of cointegration between inflation and economic growth in Nigeria. The VAR-Granger causality

employed in the investigation indicated unidirectional relationship between inflation and economic growth, with causality running from inflation to economic growth in the economy. Sani & Abdullahi (2011) utilized a quarterly time series data for the period 1981-2009 to estimate a threshold level of inflation for Nigeria. The study used a threshold regression model developed by Khan and Senhadji (2001), and found a threshold inflation level of 13% for Nigeria. Below the threshold level, inflation will have positive effect on economic growth, and therefore, has negative effect on the growth when the threshold level exceeds 13%. The negative and significant relationship between inflation and economic growth for inflation rates both below and above the threshold levels is robust with respect to changes in econometric methodology.

Osuala, Osuala & Onyeike (2013) investigated the impact of inflation on economic growth in Nigeria from 1970 to 2011 using Augmented Dickey-Fuller (ADF) and Philip-Perron (PP) tests, Granger causality test in the analysis. The variables used in the study include real gross domestic product (GDP) and inflation rate. The results showed that bi-directional relationship exists between inflation and economic growth in Nigeria. More so, Umaru & Zubairu (2012) studied the impact of inflation on economic growth and development in Nigeria between 1970 and 2010 through the applications of Augmented Dickey-Fuller (ADF) technique and Granger causality test. The empirical results indicated that all the variables were stationary at first difference; and the results of causality showed that GDP granger causes inflation. Inyiama (2013) examined the nexus between inflation rate and economic growth in Nigeria for the period 1979-2010 by using Johansen-Juselius co-integration technique, ordinary least squares (OLS) approach, Granger causality technique. The empirical results indicated that inflation rate has negative relationship with real gross domestic product, while exchange rates and interest rates have positive and insignificant relationship with inflation rate in the economy. The results of the Granger causality revealed that causality does not run between inflation rate and real gross domestic product in the economy. However, unidirectional causality runs from exchange rate to real gross domestic product.

Aminu, Manu & Salihu (2013) investigated the impact of unemployment and inflation on economic growth in Nigeria from 1986 to 2010 by employing Augmented Dickey-Fuller (ADF) approach, Johansen cointegration test and Granger causality test. The results of the stationarity test showed that all the variables were stationary at first difference. The results of the Johansen cointegration test indicate long run relationship among economic growth, unemployment and inflation. The results of the Granger causality showed that unemployment and inflation granger cause RGDP in the economy. Aminu & Anono (2012) investigated the effect of inflation on economic growth and development in Nigeria using Augmented Dickey Fuller (ADF) test, Ordinary Least Square (OLS) technique and Granger causality test from 1986 to 2011. The empirical result showed positive correlation between inflation and economic growth in Nigeria. The results also revealed that the coefficient of inflation is not statistically significant, but it is consistent with the theoretical expectation. The result of the granger causality test indicates that causality runs from GDP to inflation, which implies that inflation does not Granger causes GDP, but GDP granger causes inflation in the economy.

Ozurumba (2012) examined the causal relationship existing between inflation and fiscal deficits in Nigeria from 1970 to 2009 by employing autoregressive distributed lag (ARDL) model and the Granger causality test. The result of the Granger causality test indicates that fiscal deficit/GDP granger causes inflation. The results of the ARDL test showed that fiscal deficit/GDP has significant and negative relationship with inflation in the economy. Muhammad, Hazoor, Anam & Naeem (2014) investigated the relationship among economic growth, savings and inflation; and as well estimated the threshold level of inflation for Pakistani economy. Simultaneous equation model was utilized in the study. The variables used in the study include GDP growth rate, inflation rate, savings rate, depreciation of exchange rate, total debt servicing, interest rate, unemployment rate and indirect taxes. Three equations were employed including 2SLS technique; OLS model was used for investigating the suitable rate of inflation for the economic growth. Inflation, savings and economic growth were endogenous variables while unemployment, depreciation rate, foreign direct investment, total debt servicing, real interest rate, indirect taxes, total investment, dependency ratio were exogenous variables. The results of 2SLS showed that inflation and real interest rate negatively and significantly affect economic growth, whereas economic growth, unemployment and real interest rate negatively affect inflation rate. More so, indirect taxes had positive impact on inflation. The results also showed that economic growth, dependency ratio and foreign direct investment were beneficial for enhancing the savings of a country, while depreciation rate is harmful for savings.

Najid & Uma-Tul (2012) examined the relationship between inflation and gross domestic product in Pakistan for the period 1971-2011. Granger Causality test and Ordinary Least Square (OLS) method were employed in the analysis. The variables used in the investigation include gross domestic product (GDP) as the dependent variable, whereas the independent variable was inflation rate (INFR). The empirical results of the Granger causality test showed that GDP causes inflation. The results of OLS revealed that positive relationship exist between inflation and economic growth in Pakistan. Muhammad, Imran & Fatima (2011) studied the impact of inflation on GDP in the economy of Pakistan from 1972 to 2010, using ordinary least square (OLS) technique. The variables used in the investigation include gross domestic product (GDP) growth rate used as

dependent variable; whereas consumer price index (CPI) proxied for inflation, trade openness (OPNS) and investment growth rate (INVG) were used as the independent variables. The results showed that inflation has negative and significant impact on the growth of Pakistani economy. Ezeanyeji & Ugochukwu (2015) investigated the effect of inflation on economic growth in Nigeria from 1991 to 2013 using Ordinary Least Square (OLS) method of simple regression model. The variables used in the investigation include gross domestic product (GDP) as the dependent variable, whereas inflation rate (INF) is the independent variable. The results showed that inflation has negative impact on economic growth in Nigeria.

The study reviewed wide range of empirical studies on the impact of inflation on economic growth across the countries of the world. In spite of the several empirical studies conducted on the subject matter, the studies on the subject matter in Nigeria are scanty, and showed existence of contradictory findings in the economy, which motivated the research study on the subject.

3.   Methodology

In order to investigate the effect of inflation on economic growth of Nigeria, the study utilized unit root test through the application of Augmented Dickey-Fuller (ADF) stationarity, Johansen cointegration test, vector error correction model (VECM) and Granger causality test in the analysis. The unit root test is applied to examine the order of integration of the time series employed in the study. The Johansen cointegration test on the other hand, is used to investigate the long run equilibrium relationship among the variables under study. The vector error correction model (VECM) is employed to estimate the short run dynamics and long run relationship among the variables of the study, while the Granger causality test is applied to examine the causality between inflation and economic growth in Nigeria. The variables used in the study include real gross domestic product (RGDP) proxied as a common measure for economic growth, inflation rate (INFR), government investment expenditure (GINVXP), private investment expenditure (PINVXP) and total export (TEXP). Data for the study are obtained from the CBN statistical bulletin, volumes, 20, 24, 25 of 2010, 2014 and 2015 respectively.

3.1   Model Specification

This study follows Aigbokhan (1991) modeling. The model indicates that real gross domestic product (RGDP) growth rate is a function of macroeconomic variables including inflation rate, government expenditure, money supply, private consumption expenditure and capital formation. This is also in accordance with the Keynesian theory of quantity of money and price level, which is adopted as the theoretical framework of this study. Keynesian theory argued that when the quantity of money rises, interest rate falls leading to increase in the volume of investment and aggregate demand, which in turn, raise output and employment level in an economy. In contrast, the theory saw a relationship between the real sector and the monetary sector of the economy as an economic phenomenon that explains equilibrium relationship between the commodity and money markets. In this study, the model illustrating the relationship among the variables employed in the study in a functional form is specified thus:

$$RGDP = f(INFR, GINVXP, PINVXP, TEXP) \qquad\qquad 1$$

Where; RGDP is the real gross domestic product; INFR is the inflation rate; GINVXP is the government investment expenditure; PINVXP is the private investment expenditure; and TEXP is the total export.

In linear function, it is represented as:

$$RGDP_t = \beta_0 + \beta_1 INFR_t + \beta_2 GINVXP_t + \beta_3 PINVXP_t + \beta_4 TEXP_t + U_t \qquad\qquad 2$$

Where; RGDP is the dependent variable, while INFR, GINVXP, PINVXP and TEXP are the independent variables; β_0 is the constant term, U_t is the error term and t is the current time period.

4.   Results and discussion

This section of the study deals with the presentation of the estimation results and consequently, discusses the results as estimated on the subject matter, ''Assessment of the effect of inflation on Nigeria's economic growth''.

4.1   Unit Root Test

This test is carried out by applying the Augmented Dickey-Fuller (ADF) stationarity test to investigate the order of integration of the time series. It is used to find the long term properties of the variables employed in the study. If the series are found to be stationary in any level, it therefore, means that their mean, variance and covariance are constant overtime and it implies that the results obtained from the analysis are reliable and can be useful in predicting future economic activities in the economy (Eze, Atuma & Egbeoma, 2016). Thus, the estimation results of the unit root test are revealed below.

Table 1: Augmented Dickey-Fuller (ADF) Unit Root Test

| Variables | At Level | | | At First Difference | | | |
	ADF Statistic	5% Critical Value	Prob.	ADF Statistic	5% Critical Value	Prob.	Remarks
RGDP	-0.510541	-2.948404	0.8773	-6.073270	-2.951125	0.0000	Stationary
INFR	-2.917564	-2.948404	0.0534	-5.701912	-2.951125	0.0000	Stationary
GINVXP	-0.813964	-2.948404	0.8027	-7.744809	-2.951125	0.0000	Stationary
PINVXP	4.593137	-2.948404	1.0000	-3.011659	-2.951125	0.0438	Stationary
TEXP	-1.263934	-2.948404	0.6347	-3.196170	-2.951125	0.0290	Stationary

Source: Researcher's compilation from E-view 8

The table 1 above depicts the estimation results of the unit root test through the application of the Augmented Dickey-Fuller (ADF) stationarity test at 5% critical value. The estimation results revealed that all the variables such as RGDP, INFR, GINVXP, PINVXP and TEXP were not stationary at level; and however, became stationary after first differencing at 5% critical value. This claim is evidence by the ADF statistic values, critical values and p-values of the respective variables estimated in the test, respectively (see table 1 above). Having established evidence of integration of the same order among the variables after first differencing, it means that the variables possessed long run properties, and that its mean, variance and covariance are constant overtime at that level. Hence, the series are reliable to be applied for further estimation of the behaviours of the variables employed in the study.

4.2   Johansen Cointegration Test

Since the study has established evidence of integration of the series at the same order one, Johansen cointegration test is used to estimate the long run relationship among the variables of the study. The estimation results via the application of the Johansen cointegration test are shown in tables 2 and 3 below.

Table 2: Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.822395	123.2566	69.81889	0.0000
At most 1 *	0.633428	66.22620	47.85613	0.0004
At most 2 *	0.450890	33.10871	29.79707	0.0200
At most 3	0.264886	13.32666	15.49471	0.1034
At most 4	0.091635	3.171582	3.841466	0.0749

Trace test indicates 3 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
Source: Researcher's compilation from E-view 8

Table 3: Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.822395	57.03039	33.87687	0.0000
At most 1 *	0.633428	33.11749	27.58434	0.0088
At most 2	0.450890	19.78205	21.13162	0.0763
At most 3	0.264886	10.15508	14.26460	0.2019
At most 4	0.091635	3.171582	3.841466	0.0749

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
Source: Researcher's compilation from E-view 8

Tables 2 and 3 above illustrate the results of the Johansen cointegration test. The results indicate evidence of long run relationship among the variables of the study. The evidence of this claim is shown by both the trace statistic and the maximum eigenvalue statistic including their respective p-values as estimated in the test. Both the trace statistic and the maximum eigenvalue statistic in the estimation results indicate that long run relationship exist among the variables such as RGDP, INFR, GINVXP, PINVXP and TEXP by indicating 3 cointegrating equations at 5% critical value in case of the unrestricted cointegration rank test (trace) and 2 cointegrating equations at the same 5% critical value in case of the unrestricted cointegration rank test (maximum eigenvalue). This means that all the variables as employed in study have long run equilibrium relationship. This result is line with the discovery of Saaed (2007), Ahmed & Mortaza (2005), Aminu, Manu & Salihu (2013) who investigated the effect of inflation on economic growth in various countries including Turkey,

Kuwait, Bangladesh, Jordan, India, Azerbaijan, Ghana, Tanzania, Nigeria and Pakistan; and found long run equilibrium relationship among the variables employed their various studies; however, the study negate the findings of Faraji & Kenani (2013), Quartey (2010), Omoke (2010) and Inyiama (2013) who also carried out research on the similar subject, and found no cointegration among the variables used in their studies.

4.3 Vector Error Correction Model (VECM)

Having found the evidence of long run relationship among the variables, the study proceeded on to estimate the vector error correction model (VECM) in order to investigate the short run dynamics and the long run relationship among the variables of the study. The estimation results of the VECM are revealed in table 4 below.

Table 4: Vector Error Correction Model (VECM)

	Coefficient	Std. Error	t-Statistic	Prob.
CointEq1	-0.719153	0.145471	-4.943619	0.0001
C(RGDP(-1))	0.259250	0.146521	1.769378	0.0914
C(RGDP(-2))	0.610590	0.332630	1.835644	0.0806
C(INFR(-1))	-0.583563	0.376584	-1.549625	0.1362
C(INFR(-2))	-0.236407	0.347178	-0.680939	0.5033
C(GINVXP(-1))	-0.412281	0.082132	-5.019719	0.0001
C(GINVXP(-2))	-0.136195	0.081679	-1.667441	0.1103
C(PINVXP(-1))	0.027914	0.008969	3.112377	0.0053
C(PINVXP(-2))	-0.027385	0.008261	-3.314986	0.0033
C(TEXP(-1))	-0.017940	0.008257	-2.172780	0.0414
C(TEXP(-2))	0.002709	0.007272	0.372468	0.7133
C	16.99441	7.291545	2.330701	0.0298
R-squared	0.803720	Mean dependent var		13.66909
Adjusted R-squared	0.700906	S.D. dependent var		56.24839
F-statistic	7.817268	Durbin-Watson stat		1.747838
Prob(F-statistic)	0.000033			

Source: Researcher's Compilation from E-view 8

The table 4 above illustrates the estimation results of the vector error correction model (VECM). The results indicated that the a priori expectation is satisfied; hence, the stability condition is met in the study. The error correction term (ECT) value is -0.719153, which possessed its desired signs. The ECT value is negative, fractional and statistically significant, which implies that the condition is satisfied. The value of the ECT is -0.719153, which is less than unity, with its p-value being 0.0001; this means that the a priori expectation is satisfied in the study. The result of the ECT also shows that the speed of adjustment from short run disequilibrium towards long run equilibrium relationship corrected annually is 71.9%. The estimation results also indicated that the coefficient value of inflation rate (INFR) is -0.583563 with its associated p-value being 0.1362, which implies that the inflation rate has negative and insignificant effect on real gross domestic product (RGDP) in Nigeria. More so, the coefficient values of government investment expenditure (GINVXP) and total export (TEXP) are -0.412281 and -0.017940, while their respective p-values are 0.0001 (GINVXP) and 0.0414 (TEXP). These results indicate that government investment expenditure (GINVXP) and total export (TEXP) have negative and significant impact on real gross domestic product (RGDP) in the economy. Furthermore, the coefficient value of private investment expenditure (PINVXP) is 0.027914 with its p-value being 0.0053, which implies that the private investment expenditure (PINVXP) has positive and significant influence on real GDP in Nigeria.

Similarly, the result showed F-statistics value of 7.817268, with its associated Prob(F-statistic) value of 0.000033. This result indicates that the joint influence of the explanatory variables on the explained variable is statistically significant. Furthermore, the computed value of the coefficient of multiple determination (R^2) is 0.803720, which indicates that 80.4% of the changes in real gross domestic product (RGDP) is accounted for by the independent variables including INFR, GINVXP, PINVXP and TEXP while the remaining 19.6% of the changes in the independent variables is attributed to other factors excluded in the model. The result also revealed that the Durbin Watson (DW) statistic value is 1.7478. In this investigation, the tabulated value of the lower limit (dL) of the Durbin Watson is 1.271, while the upper limit is 1.651. Since the computed value of Durbin Watson statistic of 1.7478 exceeds the upper limit value of 1.651, the study concludes that serial correlation does not exist in the model. In confirming this claim, the result of Breusch-Godfrey Serial Correlation LM Test showed that Obs*R-squared value of LM test is 4.773235, while the p-value is 0.0919, which further supported the earlier assertion that evidence of serial correlation is found in the model. The finding of this study is in accordance with the findings of Ahmed & Mortaza (2005), Faraji & Kenani (2013), Quartey (2010) and Inyiama (2013) who investigated the effect of inflation on economic growth in various countries, and found that inflation

has negative impact on gross domestic product (GDP) of the countries studied; however, the finding of the study negate the finding of Sweidan (2004) who also carried out research on the similar study on the subject matter, and found that inflation has positive impact on the gross domestic product (GDP) in the country.

4.4   Granger Causality Test

Granger causality test is employed to examine the causality between inflation and economic growth in Nigeria. The results of the Granger causality test is revealed in table 5 below.

Table 5: Granger Causality test

Null Hypothesis:	Obs	F-Statistic	Prob.
INFR does not Granger Cause RGDP	34	0.03471	0.9659
RGDP does not Granger Cause INFR		0.94150	0.4016
GINVXP does not Granger Cause RGDP	34	3.99148	0.0294
RGDP does not Granger Cause GINVXP		0.94529	0.4002
PINVXP does not Granger Cause RGDP	34	6.56691	0.0044
RGDP does not Granger Cause PINVXP		4.76010	0.0163
TEXP does not Granger Cause RGDP	34	1.09000	0.3496
RGDP does not Granger Cause TEXP		7.20898	0.0029
GINVXP does not Granger Cause INFR	34	1.55755	0.2278
INFR does not Granger Cause GINVXP		0.00656	0.9935
PINVXP does not Granger Cause INFR	34	0.75520	0.4789
INFR does not Granger Cause PINVXP		0.42468	0.6580
TEXP does not Granger Cause INFR	34	1.19640	0.3168
INFR does not Granger Cause TEXP		0.07320	0.9296
PINVXP does not Granger Cause GINVXP	34	7.78029	0.0020
GINVXP does not Granger Cause PINVXP		4.30936	0.0230
TEXP does not Granger Cause GINVXP	34	1.94480	0.1612
GINVXP does not Granger Cause TEXP		3.99619	0.0293
TEXP does not Granger Cause PINVXP	34	14.9896	3.E-05
PINVXP does not Granger Cause TEXP		1.92303	0.1643

Source: Researcher's compilation from E-View 8

The above table 5 is the estimation results of the Granger causality test. The results revealed that causality does not run between inflation and real gross domestic product (RGDP). The evidence of this claim is shown by the p-values of the causalities that run from INFR to RGDP (0.9659) and RGDP to INFR (0.4016) in the estimation results. However, the results showed that unidirectional relationship exists between RGDP and GINVXP, PINVXP with causality running from GINVXP and PINVXP to RGDP. This claim is also evidenced by the p-values of the causalities that run from GINVXP to RGDP (0.0294) and PINVXP to RGDP (0.0044) respectively. This finding negate the findings of Omoke (2010), Osuala, Osuala & Onyeike (2013), Umaru & Zubairu (2012), Aminu & Anono (2012) and Najid & Uma-Tul (2012) who investigated the effect of inflation on economic growth across countries and found unidirectional relationship between inflation and economic growth.

4.5   Policy Implications of the Results

The study examined the effect of inflation on economic growth in Nigeria for the period 1980-2015. The Johansen cointegration test indicated that long run relationship exist between inflation and economic growth in Nigeria. Furthermore, the vector error correction model (VECM) estimation results showed that inflation has negative and insignificant effect on economic growth in Nigeria. Thus, it is estimated on average that any economic policy, which raises inflation by 1%, will lead to 0.58% decrease in real gross domestic product (RGDP), though statistically insignificant in the Nigerian economy.

Furthermore, the results indicated that government investment expenditure and total export have negative and significant impact on real gross domestic product (RGDP) in the economy. Hence, it is estimated on the average that 1% increase in government investment expenditure, as well as total export will lead to 0.41% and 0.02% decrease in real GDP of Nigeria. More so, the result revealed that private investment expenditure has positive and significant effect on real GDP in Nigeria. This result implies that any government economic policy that is able to increase private investment expenditure by 1% will increase real GDP by 0.03%. Finally, the result of the Granger causality test indicated no causality between inflation and economic growth in Nigeria. This implies that any economic policy targeted towards increasing inflation by 1% will not have significant effect on the economic growth of Nigeria.

5.   Conclusion and Recommendations

The main objective of the study is to empirically examine the effect of inflation on economic growth of Nigeria for the period of 1980-2015. Cointegration approach, vector error correction model (VECM) and Granger causality technique were employed in the analysis. The variables used in the study involves real gross domestic product (RGDP) as the explained variable, while inflation rate (INFR), government investment expenditure (GINVXP), private investment expenditure (PINVXP) and total export (TEXP) were employed as the explanatory variables in the investigation. Stationarity test was conducted through the application of the Augmented Dickey-Fuller (ADF) unit root test; and the results indicated that all the variables were non-stationary at level; however, all the variables became stationary after first differencing. The results of the cointegration approach showed evidence of long run relationship among the variables of the study. Similarly, the results of the VECM revealed that inflation rate has negative and insignificant effect on real gross domestic product (RGDP) in Nigeria. Furthermore, the results indicated that government investment expenditure (GINVXP) and total export (TEXP) have negative and significant effect on real gross domestic product (RGDP) in the economy. The result also demonstrated that private investment expenditure (PINVXP) has positive and significant influence on real gross domestic product (RGDP) in Nigeria.

The results of the Granger causality test indicate no causation between inflation rate and real gross domestic product (RGDP). The results however, showed that unidirectional relationship exists between RGDP and GINVXP, PINVXP with causality running from GINVXP to RGDP and PINVXP to RGDP. The results further indicated that causality does not run between inflation rate (INFR) and government investment expenditure (GINVXP), as well as private investment expenditure (PINVXP) in the economy. Based on these findings, the study therefore recommends as follows: Government is advised to pursue vigorously those economic policies that are capable of promoting economic growth, as it will help to reduce inflation rate in the country. Similarly, government is also advised to expand its capital budget expenditures on public investment projects, and as well create a favourable business environment for private investment in Nigeria. It is only in this way that significant economic growth will be achieved and sustained in the economy. More so, government may reconsider its over reliance on its expenditures on government investment and private investment in solving inflation problems, as there are other variables responsible for high inflation in the economy.

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