

Full Length Research Paper

A dynamic analysis of economic interaction between price instability, unemployment and economic growth in Nigeria: A *Cointegration and Causality Analysis*

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ABSTRACT

This is a study on dynamic analysis of economic interaction between price instability, unemployment and economic growth in Nigeria between 1986 to 2015. Main variables used in this study are GDP (proxy for economic growth), unemployment rate, consumer price index (proxy for inflation rate), money supply, imports, exports and exchange rate respectively. Secondary data used were sourced from the statistical bulletins published by World Bank Development Indicators (WBDI) 2015. The study adopts diagnostic tests to ascertain the stationary properties and the longrun relationship of the series in the model. Also an error correction mechanism together with multivariate granger causality test (block exogeneity test) is conducted through the Vector Autoregressive (VAR) technique. Empirical evidence emanating from the co-integration analysis indicated the existence of a unique longrun equilibrium relationship among the series in the model. In addition to this, the ECM output revealed a time frame of three years and eight months as the period required to bring the economy back to a point of convergence again after deviating from its longrun path. Evidence from the granger causality testing revealed that a rise in the volume of money in circulation in an economy without the requisite production capability gives rise to increases in the prices of goods and services. This further proved that inflationary pressures in Nigeria are caused by the volume of money supply by the monetary authorities at any given time. In addition to this, it was revealed that a rise or decline in economic growth, unemployment rate and exports in Nigeria is a function of the exchange rate policy in place at any given time. In a nutshell, the economic interpretation of the Block Endogeneity test revealed that an appreciation in exchange rate has the potential of increasing exports in Nigeria thus leading to a rise in economic growth and a decline in the rate of unemployment. The study recommended amongst others that the monetary authority of the country should strive to maintain a manageable inflation rate in order to motivate foreign investors. Finally, government should revitalize the various ailing industries and establish new ones to encourage massive industrialization. With functional industries working to full capacity, our agricultural products often exported in their raw form would have value addition before they are eventually exported. This strategy will boost economic growth, bring in more forex and create massive jobs for our teeming graduates.

Keywords: Price instability, Unemployment, Economic Growth, Cointegration and Causality

INTRODUCTION

The Nigerian economy since her political independence in 1960 has undergone different fundamental and structural

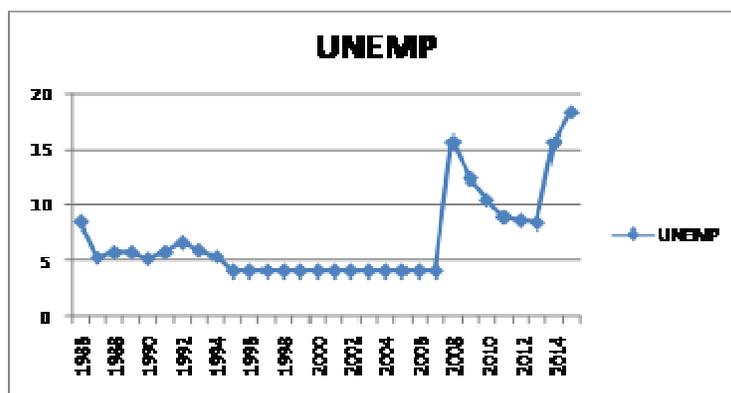


Figure 1. Trend of Unemployment rate 1986 - 2015
Source: World Bank Development Indicators (2015)

changes in various sectors of the economy. The subject of inflation, unemployment and economic growth are the three most significant variables in any macroeconomic decision making and they are subject of social and economic life of every country. In the case of Nigeria, unemployment was 8.5 percent in 1986 and it remained on a downward trend until 2008 when it skyrocketed to double-digit rate of 15.7 percent. Thereafter it started decreasing from 2009-2013 before rising to 16 per cent in 2015 (World Bank, 2015).

Figure 1. Besides unemployment, inflation which is measured by gross domestic product deflator (GDP deflator) is another macroeconomic problem that hurts both economic and social indicators in the country. To attain sustainable economic growth, price stability continues to be the central objective of macroeconomic policies for most countries in the world today. Among others, the emphasis given to price stability in the conduct of monetary policy is with a view to promoting sustainable economic growth as well as strengthening the purchasing power of the domestic currency (Umaru and Zubairu, 2012). The question on whether or not inflation is harmful to economic growth has recently been subject of intense debate to policy makers and macroeconomists. The Nigerian economy has also come across this macroeconomic problem and the inflation rate was 5.7 percent in 1986. Thereafter, it increased continuously and got to 50 percent in 1989. It stabilized at a single-digit rate of 7.3 percent in 1990 before continuing on a spiral from 1991 – 1996. These periods were moments of uncertainty in the economy of the nation owing to almost complete detachment of the Nigerian economy from other world economies due to the tyrannical, despotic and totalitarian rule of that era. That regime operated an autarchic kind of economy. The inflation rate was mild for about four years of 1997 to 2000 when it stabilized at a single digit for these periods. Generally, inflation rates had remained on a double digit rate except in 2006 and 2007 when it dropped

to 8 and 5 percent respectively. From 2008 to 2012 it moved back to double digits and remained so except for 2011-2013. The arbitrary rise in inflation figures is majorly due to wrong government fiscal policies and inconsistent shifts in monetary policy decisions by the Central Bank of Nigeria. The persistent upward trends in inflation have become a serious and contentious problem in Nigeria since independence. In reaction to this, several measures have been taken to tackle this contentious problem through fiscal and monetary policies. This includes cut back of public spending and the use of bank financing (World Bank, 2015).

Figure 2 show gross domestic product growth rate is used as proxy for economic growth in this study and it is generally perceived that when economic growth takes place in the country, it increases the pace of economic activity in the country hence jobs are created leading to decrease in unemployment figures. The increase in employment opportunities will enhance the purchasing power of the people in the country and as a result, consumption increases which leads to a rise in aggregate demand and hence inflation in the country. In case of Nigeria, gross domestic product growth rate recorded negative growth of -8.7 and -10.7, -0.67 and -0.30 percent between 1986, 1987, 1991 and 1995 respectively. This was the period the country was in dire strait occasioned by bad and unsustainable economic policies from the previous military government. Subsequent years recorded positive growth.

Figure 3 show the situation in Nigeria is disturbing. The various macroeconomic policies by government have been unable to achieve desired goals of price stability, reduction in unemployment and sustained economic growth. The fluctuations in the economy have confirmed the need to manage the economy effectively. The essence of macroeconomic management underlines the rationale of the government as a vital economic agent. However, it appears that government intervention has not been able to

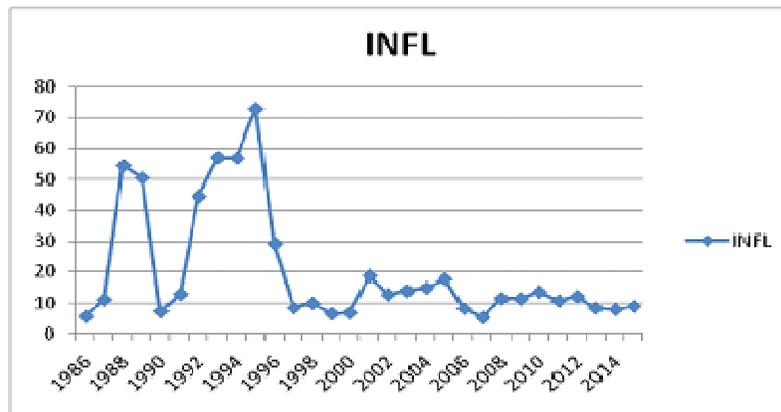


Figure 2. Trend of Inflation Rate 1986 - 2015
 Source: World Bank Development Indicators (2015)

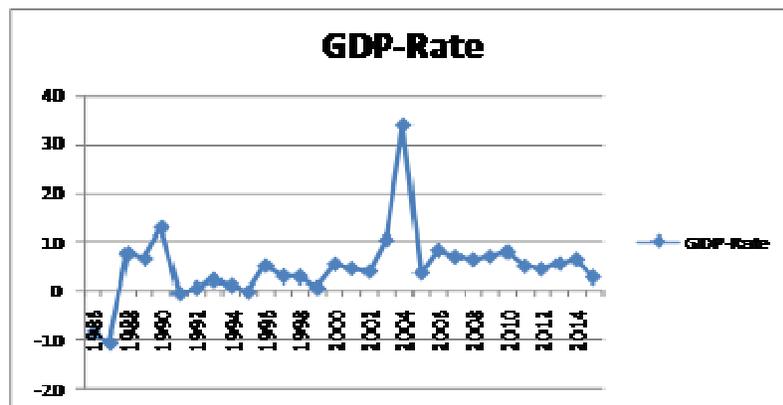


Figure 3. Trend of gross domestic product growth rate, 1986 - 2015
 Source: World Bank Development Indicators (2015)

cure the ills in the economy. For several decades, economic performance has not been impressive. The continued economic crisis, with the associated problems of high inflationary pressure, high exchange rate, debt overhang, adverse balance of payment and high inflation rates is difficult to explain. Against a high rate of unemployment and underemployment, a large public sector, low wages and poor working conditions, has been a persistent high inflation rate in Nigeria. Also, underemployment and unemployment are prominent features of the informal labour market in Nigeria as well. Consequently, the full potentials of labour-surplus economy have not been fully exploited (Aminu and Manu, 2014).

Problem statement

Unemployment and Inflation are issues that are central to the social and economic life of every country. The existing

literature refers to inflation and unemployment as constituting twin problems that explains the endemic nature of poverty in developing countries. It has been argued that continuous improvement in productivity is the surest way to reduce inflation. Growth in productivity provides a significant basis for adequate supply of goods and services thereby improving the welfare of the people and enhancing social progress.

In Nigeria overdependence of the economy on oil brought a boom in the 1970s while economic recession set in 1981. The recession had a very significant implication for the utilization of the country's human resources leading to very high level of unemployment. The problem aggravated to the extent that many university graduates could not secure jobs, let alone secondary and primary school leavers. Despite various government policies and programmes aimed at reducing unemployment among the youths and adults, the problem remained unabated. The phenomenon of stagflation in the 1970s and 1980s had

gone further to complicate the conduct of monetary and fiscal policies aimed at remedying unemployment. Stagflation was a situation of simultaneous occurrence of rising inflation and unemployment with stagnant growth. The Structural Adjustment Programme (SAP) adopted in 1986 had in no small measure ended up in aggravating the problems of unemployment due to retrenchment of workers in the private and public sectors of the economy. It is in line with the foregoing that this study restricts its scope from 1986, the year the Structural Adjustment Programme was launched to properly determine the effect of SAP on the twin economic problems of rising prices vis-a-vis unemployment in Nigeria.

Most of the works done in this subject area such as (Adeyeye and Fakiyesi (1980); Egwaikhide et al. (1994); Englama (2001); Umaru and Zubairu (2012); Hamilton (2001); Balami (2006) had been strictly on either inflation or unemployment alone. None had attempted in analyzing their relative impacts on the economy, either in the short run or in the long run, hence, this study intends to empirically examine the impact of price instability on unemployment and economic growth to determine what type of relationship exists between price instability, unemployment and economic growth in Nigeria. The specific objectives include (i) To analyze the relationship between price instability and economic growth in Nigeria (ii) To analyse the relationship between price instability and unemployment in Nigeria (iii) To analyze the impact of price instability on unemployment and economic growth in Nigeria. To achieve this task, the study was divided into four sections. The next section presents conceptual and empirical framework followed by methodology and data analysis. The last section concludes the study.

Literature review

The concept of inflation

Inflation is commonly seen to be a situation in the economy when the money supply is growing faster than the production of new goods and services in the same economy (Fatukasi, 2012). Inflation is further defined to be the general price increases in goods and services over a particular time period (Faria and Carneiro, 2001). However, the definition of inflation, the cause of inflation and its effects on the economy depends on the school of thought the economist belongs, hence the differences in definitions and approach. It is a generally held view that it is the persistent increase in the general price level within the economy which affects the value of the domestic currency. It is not a once and for all upward price movement but has to be sustained over time and affect all goods and services within the economy. There are several factors that are responsible for inflation in Nigeria. The inflation which results from excess aggregate demand is called the

demand pull inflation, the cost push inflation results from upward movement in the cost of production while structural inflation arises from some constraints such as inefficient production, marketing and distribution systems in the productive sectors of the economy (ILO, 2009). Other forms of inflation in developing country could be imported, open and seasonal inflation. The imported inflation comes as a result of transmission of inflation through internationally traded goods and services. This is when the economy imports goods from countries already experiencing inflation. The open inflation comes as a result of uninterrupted market mechanisms while seasonal inflation is associated with off season in production, when supply constraints permeates the economy as a result of a fall in production, especially farming produce. In Nigeria other factors can be attributed to inflation such as the nature of the economy, its history and fiscal and monetary policy direction (Jhingan, 2003).

The concept of unemployment

Unemployment is often defined by the classical economists as the excess supply of labour over the demand for labour which is caused by adjustment in real wage. The classical or real-wage unemployment occurs when real wages for job are set above the market-clearing level, causing number of job-seekers to exceed the number of vacancies. Unemployment as defined by Stock and Watson (1999) is a state of joblessness which occurs when people are without jobs and they have actively sought for work within the past four weeks. The unemployment rate is a measure of the prevalence of unemployment and it is calculated as a percentage by dividing the number of unemployed individuals by individuals currently in the labour force. In a 2011 news story, Business Week reported that, "more than two hundred million people globally are out of work"; a high record, as almost two-third of advanced economies and half of developing economies are experiencing a slowdown in employment growth.

Unemployment has been categorized as one of the serious impediments to social welfare. Apart from representing a colossal waste of a country's manpower resources, it generates welfare loss in terms of lower output, thereby leading to lower income and wellbeing. The need to avert the negative effects of unemployment has made the tackling of unemployment problem to feature very prominently in the development objectives of many developing countries. One of the steps taken by the Nigerian government to reduce the problem of youth unemployment in Nigeria was the establishment of agencies such as the National Directorate of Employment (NDE), YOU-Win programme etc. Even though these agencies have been performing below expectations, their modest contribution has not gone unnoticed.

The concept of economic growth

Economic growth according to Jhingan (2003), is the process whereby the real per capita income of a country increases over a long period of time, and is measured by the increase in the amount of goods and services produced in a country. A growing economy produces more goods and services in each successive time period. Thus in a wider perspective, it implies raising the standard of living of the people and reducing inequality of income distribution. In the words of Omoke (2010) economic growth is the basis of increase prosperity and it comes from accumulation of more capital and innovations which lead to technical progress, the idea similar to (Sweidan, 2004). Growth Model who sees economic growth in terms of growth in total GDP due to increase in population, technical progress and investment. Growth according to Classical Economists signifies increase in the rate of investment. In other words, growth is a function of share of profit in the national income. There exists a positive relationship between higher rate of profit and higher rate of growth in the long run.

Theoretical framework

Theoretical viewpoint supports the existence of positive relationship between real GDP growth and employment level. William Phillips proposed higher price level following increasing employment level. Increasing employment level tends to increase the GDP growth rate, thus, employment and GDP growth rates are positively related with each other and as such, unemployment and GDP growth rates will be negatively related to each other. Okun (1962) defined this negative relationship between GDP growth and unemployment rate and this is the only empirical hypothesis explaining the relationship between unemployment rate and GDP growth.

Empirical review from other countries

This section of the study presents the empirical literature on the impact of price instability on unemployment and economic growth. As mentioned above many scholars have researched on the relationship between unemployment and economic growth and between unemployment and inflation using Phillips Curve model. For example (Vaona, 2012), used the conventional Phillips curve (unemployment rate) to investigate forecasts of U.S. inflation at the 12-month horizon. These authors focused on three questions. First, has the U.S. Phillips curve been stable? If not, what are the implications of the instability for forecasting future inflation? Second, would an alternative Phillips curve provide better forecasts of inflation than unemployment rate of Phillips curve? Third, how does inflation forecasts different from Phillips curve stack up

against time series forecasts made using interest rate, money, and other series? They found that inflation forecasts produced by Phillips curve generally had been more accurate than forecasts based on other macroeconomic variables, including interest rates, money and commodity prices but relying on it to the exclusion of other forecasts was a mistake. Forecasting relations based on other measures of aggregate activity could perform as well or better than those based on unemployment, and combining these forecasts would produce optimal forecasts.

On the other hand, Ahmed and Mortaza (2005), investigated the relationship between inflation and economic growth of Brazil for the period between 1980 and 1995 with the result establishing a negative relationship in the short run but that inflation does not affect economic growth in the long run. This could be a situation where the scope of production can change to absorb the lag of excess demand. Saeed (2007) viewed the findings of Faira and Carneiro to support the neutrality concept of money and that inflation affects of economic growth in the long run as established by some other researchers. Erbaykal and Okuyan (2008) examined the possibility of the relationship between inflation and economic growth having a structural breakpoint effects for Jordanian economy covering the period of 1970 and 2003. He found out a positive and significant relation of economic growth with the inflation rate below 2 percent and he established structural breakpoint at 2 percent level of inflation and as such inflation which is higher than 2 percent affect economic growth negatively. This poses a serious policy question for Nigeria which has not recorded the rate of inflation less than 5 percent since 1986, the study scope for this research. The lowest in 2007 was 5.4 percent and the highest being 72.72 percent in 1995. Tan (2008), established the threshold of annual inflation increase to be around 1 percent for developed countries while that of developing country which Nigeria belongs was put at 11%.

Pallis (2006) empirically established a statistically significant negative relationship between inflation and economic growth using CPI and real GDP as proxy variables for Bangladesh for the period between 1980 and 2005. This reconciles with the work of Muhammad (2014) for Kuwait between 1985 and 2005 which indicates long run and strong inverse relationship between CPI and real GDP. Aminu and Manu (2014) established relationship between inflation and economic growth for Turkey within the period of 1987 to 2006 and found out that there exists a negative and significant relationship in the short run but no significant relationship was found between the two variables in the long run. They further carried out causal relationship between the two variables with the results establishing a causality relationship from economic growth to inflation.

Omoke (2010) integrated the Philips curve within the framework of Okuns law for some members of ASEAN,

specifically, Malaysia, Singapore, Thailand, the Philippines, Indonesia, Japan and South Korea, using quarterly data for the countries from 1991 to 2007. They empirically established a small trade-off between economic growth and inflation in Singapore, South Korea, and Thailand after 1997/98 ASEAN financial crises years while no trade-off relationship was established for Malaysia, Philippines, Indonesia and Japan. Omoke (2010) conducted a research on inflation and unemployment in the EU: comparative analysis of Phillips regularity through correlation analysis of unemployment and inflation in EU for the 1998-2007 period and found that the simple linear correlation coefficient between them is negative. They concluded that the relation between unemployment and inflation is moderate and inverse (negative). Engle and Granger (1987), studied the effect of inflation and unemployment on economic growth in Pakistan and found that there is an inverse relationship between economic growth and unemployment.

Empirical review from nigerian scholars

Oladipo and Akinbobola (2011) carried out research on analysis of unemployed resources and inflation in Nigeria from 1986 to 2010 using OLS technique and found that both unemployed human resources, rate of natural resource production (i.e rate of tapped resources), total inflation have positive impact on rate of economic growth in Nigeria.

Ogwu (2010) used the data covering the period of 1970 to 2005 to establish positive relationship between inflation and economic growth in Nigeria. He employed Johansen-Juselius Co-integration technique which is considered superior to Engle and Granger (1987) in assessing co-integration properties of variables in a multivariate context. The results showed a no co-integrating relationship between inflation and economic growth for Nigeria. They further employed VAR-Granger causality at two lag periods and established unidirectional causality running from inflation to economic growth and he therefore concluded that inflation indeed has an impact on growth. In Nigeria, the pursuits of higher economic growth in most cases have spiral effects on upward price movement.

According to Nembee and Madume (2011), Nigerian government has greater influence on the nation's economic activities through the use of fiscal instruments such as budget deficit operation. He added that this fiscal policy in most cases has some effect on macroeconomic variables such as interest rate, exchange rate, inflation, consumption, investment etc. which in turn affect economic development. He reasoned further that the major impact of the increase in budget deficit was felt in 1993 with high rate of inflation which shows an evidence of a positive relationship between budget deficit and inflation in Nigeria. He further gave a view that the source of financing the deficit has varying impact of a budget deficit on inflation.

This thinking makes Nigeria's fight against high inflationary level difficult in the sense that the economy being almost entirely monotype in nature finances its deficit from the petroleum sector. This hinders the country from generating more investment which could ordinarily bring about more employment and hence economic growth. This negates the postulation of the Philips curve that there is a stable and negative relationship between the level of unemployment and the rate of change of wage which indicate that unemployment being accompanied by falling wages, reduced levels of unemployment by rising wages. The relationship of Philips connotes that as the wage rates are increased, more demands will be stimulated giving rise to more investment to offset the gap in demand and supply and that the more demand persist, inflation will increase until equilibrium is further achieved.

In addition Fatukasi (2012), maintained that inflation hurt the poorest the most as they have least ability to protect themselves from the rising commodity prices. He added that the cost-push inflation comes as a result of depreciation of naira which raises the prices of essential commodity as well as other imported commodities. With the passage of time, more wage increases will be demanded to offset the price hike and the real wages will continue to depreciate as the price will keep on rising after wages might have been increased to meet workers demand. This phenomenon is seen to impact negatively on the non-working population as well as the low and medium income workers' who may have not benefited from the compensatory income increase or have little income increase that may not match up with the wage increase within the economy.

This is why Okun (1962) after empirically investigating the impact of monetary policy on Nigeria's macroeconomic stability between 1970 and 2009 concluded that Nigeria should adopt the macroeconomic policy mix of monetary, fiscal and exchange rate in managing inflation with the aim of achieving price stability required for achieving sustainable growth and development. The over-dependence on petroleum economy is a major factor responsible for the bottlenecks of the supply side in Nigeria. According to Philips (1958), factors such as agricultural bottlenecks, industrial production, imports and exports, militancy, wage bill, government deficit financing and money supply are responsible for inflation in Nigeria. In the views, inflation is a major macroeconomic problem which needs to be curbed in the sense that low level of inflation indicates a positive effect on the economy whereas high inflation gives negative signals to the economy. This explains why the pursuit of price stability invariably implies an indirect pursuance of other economic objectives such as economic growth. He added that economic growth can only be achieved under the condition of price stability and allocative efficiency of financial markets. From the reviewed literature above, the dynamic

analysis of economic interaction between price instability, unemployment and economic growth in Nigeria is still ambiguous which calls for further research, hence this study.

METHODOLOGY

This section focuses on methodology used to determine the dynamic analysis of economic interaction between price instability, unemployment and economic growth in Nigeria. Prices become unstable if they are increasing from a certain range which is around 3% to 5%. This section also discusses study design, procedure and choice of variables. The relationships among variables will be analyzed through co-integration and causality tests.

Choice of variables

Main variables, used in this study, are inflation rate (proxy for consumer price index (CPI), unemployment rate (UNMPR), Economic Growth (proxied by Gross Domestic Product (GDP), Money Supply (MS), Imports (IMPT), Exports (EXPT), Exchange Rate (EXCR). The source of data is essentially from the publication of World Bank Development Indicators (WBDI) 2015.

Method of data analysis

In any econometric research, pre-testing for stationarity among time series data is a necessity. To empirically determine the dynamic analysis of economic interaction between price instability, unemployment and economic growth in Nigeria the study adopts diagnostic tests to ascertain the stationary properties of the series in the model since most time series are prone to unit root problem(s). Therefore, before carrying out cointegration test and ECM analysis, the unit root test is conducted on the series using Augmented Dickey-Fuller (ADF) test. This enables us test for stationarity of the variables included in the model. Also, multivariate granger causality test (block exogeneity test) is conducted through the Vector Autoregressive (VAR) technique. The rationale for this test is to determine how the variables enter the model. It enables us to know how granger causality runs from one variable to the others. It is in fulfillment of the above techniques that the following models have been designed.

Model specification

VAR Equation

This study used time series technique of econometric

simulations for its analysis and employed the Johansen-Juselius Cointegration test together with multivariate granger causality test (block exogeneity test) VAR method of estimation. Vector Autoregressive Model was developed by Sims (1980) in response to the problem of simultaneity among variables in a system. Following Sims (1980) seminal paper, the vector autoregressive (VAR) model has become one of the leading approaches employed in the analysis of dynamic economic interaction (Adrangi and Allender, 1998; Palm, 1983). Though this study employs granger causality and cointegration approach in its analysis, it equally adopted the use of Vector Error Correction Model (VECM) to test for the convergence of variables in the model. The VAR model which is the platform upon which the ECM model is built is hereunder specified as follows:

$$\Delta Gdp_t = \alpha_0 + a_1 \Delta Cpi_{t-1} + a_2 \Delta Unmpr_{t-1} + a_3 \Delta Ms_{t-1} + a_4 \Delta Excr_{t-1} + a_5 \Delta Impt_{t-1} + a_5 \Delta Expt_{t-1} + \mu_{t1} \dots (1)$$

$$\Delta Cpi_t = \alpha_0 + a_1 \Delta Unmpr_{t-1} + a_2 \Delta Ms_{t-1} + a_3 \Delta Excr_{t-1} + a_4 \Delta Impt_{t-1} + a_5 \Delta Expt_{t-1} + a_5 \Delta Gdp_{t-1} + \mu_{t2} \dots (2)$$

$$\Delta Unmpr_t = \alpha_0 + a_1 \Delta Ms_{t-1} + a_2 \Delta Excr_{t-1} + a_3 \Delta Impt_{t-1} + a_4 \Delta Expt_{t-1} + a_5 \Delta Gdp_{t-1} + a_5 \Delta Cpi_{t-1} + \mu_{t3} \dots (3)$$

$$\Delta Ms_t = \alpha_0 + a_1 \Delta Excr_{t-1} + a_2 \Delta Impt_{t-1} + a_3 \Delta Expt_{t-1} + a_4 \Delta Gdp_{t-1} + a_5 \Delta Cpi_{t-1} + a_5 \Delta Unmpr_{t-1} + \mu_{t4} \dots (4)$$

$$\Delta Excr_t = \alpha_0 + a_1 \Delta Impt_{t-1} + a_2 \Delta Expt_{t-1} + a_3 \Delta Gdp_{t-1} + a_4 \Delta Cpi_{t-1} + a_5 \Delta Unmpr_{t-1} + a_5 \Delta Ms_{t-1} + \mu_{t5} \dots (5)$$

$$\Delta Impt_t = \alpha_0 + a_1 \Delta Expt_{t-1} + a_2 \Delta Gdp_{t-1} + a_3 \Delta Cpi_{t-1} + a_4 \Delta Unmpr_{t-1} + a_5 \Delta Ms_{t-1} + a_5 \Delta Excr_{t-1} + \mu_{t6} \dots (6)$$

$$\Delta Expt_t = \alpha_0 + a_1 \Delta Gdp_{t-1} + a_2 \Delta Cpi_{t-1} + a_3 \Delta Unmpr_{t-1} + a_4 \Delta Ms_{t-1} + a_5 \Delta Excr_{t-1} + a_5 \Delta Impt_{t-1} + \mu_{t7} \dots (7)$$

Where α_0 and α_1 , are coefficients and μ_t is the residual and Δ is the operator for change.

Vector error correction model

Since the evaluation considered both the short-run and long-run simultaneously, the econometric methodology of the Vector Error Correction Mechanism (VECM) was employed. In order to undertake the empirical analysis using the VECM technique, the variables involved in the model must be stationary, integrated of the same order and as well co-integrated. Thus, both the Augmented Dickey-Fuller (ADF) (Dickey and Fuller, 1979, 1981) and Phillips-Perron (PP) (1988) unit root tests were utilized to test for the order of integration of the variables. VECM is a dynamic system with the characteristics that the deviation of the current state from its longrun relationship will be fed into its shortun dynamics. Error Correction Models are a category of multiple time series models that directly estimate the speed at which a dependent variable 'Y' returns to equilibrium after a change in an independent variable 'X'. ECMs are a theoretically driven approach useful for estimating both short term and long term effects

of one time series on another. ECMs are useful model when dealing with co-integrated data but can also be used with stationary data.

It should be noted that we can determine the long run and short run causality from the VECM. If ϕ is statistically significant and different from zero, it implies the existence of long run causality. Therefore, we can estimate both unrestricted VAR and VECM to obtain long-run and short-run causal relationships respectively in addition to other useful diagnostics. From the discussion above, if cointegration is established then, GDP, CPI, UNMPR, MS, IMPT, EXPT and EXCR may be considered to be generated by error correction models of the form:

$$\Delta Gdp_t = a_i + \sum_{i=1}^{p=6} a_i \Delta Cpi_{t-1} + \sum_{j=1}^{p=6} \beta_j \Delta Unmpr_{t-1} + \sum_{k=1}^{p=6} \gamma_k \Delta Ms_{t-1} + \sum_{j=1}^{p=6} \beta_j \Delta Excr_{t-1} + \sum_{k=1}^{p=6} \gamma_k \Delta Impt_{t-1} + \sum_{j=1}^{p=6} a_i \Delta Expt_{t-1} + \phi_1 ECM_{1t-1} + e_{1t} \dots \quad (8)$$

$$\Delta Cpi_t = a_i + \sum_{i=1}^{p=6} a_i \Delta Unmpr_{t-1} + \sum_{j=1}^{p=6} \beta_j \Delta Ms_{t-1} + \sum_{k=1}^{p=6} \gamma_k \Delta Excr_{t-1} + \sum_{j=1}^{p=6} \beta_j \Delta Impt_{t-1} + \sum_{k=1}^{p=6} \gamma_k \Delta Expt_{t-1} + \sum_{i=1}^{p=6} a_i \Delta Gdp_{t-1} + \phi_1 ECM_{2t-1} + e_{2t} \dots \quad (9)$$

$$\Delta Unmpr_t = a_i + \sum_{i=1}^{p=6} a_i \Delta Ms_{t-1} + \sum_{j=1}^{p=6} \beta_j \Delta Excr_{t-1} + \sum_{k=1}^{p=6} \gamma_k \Delta Impt_{t-1} + \sum_{j=1}^{p=6} \beta_j \Delta Expt_{t-1} + \sum_{k=1}^{p=6} \gamma_k \Delta Gdp_{t-1} + \sum_{i=1}^{p=6} a_i \Delta Cpi_{t-1} + \phi_1 ECM_{3t-1} + e_{3t} \dots \quad (10)$$

$$\Delta Ms_t = a_i + \sum_{i=1}^{p=6} a_i \Delta Excr_{t-1} + \sum_{j=1}^{p=6} \beta_j \Delta Impt_{t-1} + \sum_{k=1}^{p=6} \gamma_k \Delta Expt_{t-1} + \sum_{j=1}^{p=6} \beta_j \Delta Gdp_{t-1} + \sum_{k=1}^{p=6} \gamma_k \Delta Cpi_{t-1} + \sum_{i=1}^{p=6} a_i \Delta Unmpr_{t-1} + \phi_1 ECM_{4t-1} + e_{4t} \dots \quad (11)$$

$$\Delta Excr_t = a_i + \sum_{i=1}^{p=6} a_i \Delta Impt_{t-1} + \sum_{j=1}^{p=6} \beta_j \Delta Expt_{t-1} + \sum_{k=1}^{p=6} \gamma_k \Delta Gdp_{t-1} + \sum_{j=1}^{p=6} \beta_j \Delta Cpi_{t-1} + \sum_{k=1}^{p=6} \gamma_k \Delta Unmpr_{t-1} + \sum_{i=1}^{p=6} a_i \Delta Ms_{t-1} + \phi_1 ECM_{5t-1} + e_{5t} \dots \quad (12)$$

$$\Delta Impt_t = a_i + \sum_{i=1}^{p=6} a_i \Delta Expt_{t-1} + \sum_{j=1}^{p=6} \beta_j \Delta Gdp_{t-1} + \sum_{k=1}^{p=6} \gamma_k \Delta Cpi_{t-1} + \sum_{j=1}^{p=6} \beta_j \Delta Unmpr_{t-1} + \sum_{k=1}^{p=6} \gamma_k \Delta Ms_{t-1} + \sum_{i=1}^{p=6} a_i \Delta Excr_{t-1} + \phi_1 ECM_{6t-1} + e_{6t} \dots \quad (13)$$

$$\Delta Expt_t = a_i + \sum_{i=1}^{p=6} a_i \Delta Gdp_{t-1} + \sum_{j=1}^{p=6} \beta_j \Delta Cpi_{t-1} + \sum_{k=1}^{p=6} \gamma_k \Delta Unmpr_{t-1} + \sum_{j=1}^{p=6} \beta_j \Delta Ms_{t-1} + \sum_{k=1}^{p=6} \gamma_k \Delta Excr_{t-1} + \sum_{i=1}^{p=6} a_i \Delta Impt_{t-1} + \phi_1 ECM_{7t-1} + e_{7t} \dots \quad (14)$$

Whereas:

Δ = Difference operator

α = Constant term

ϕ = Speed or rate of adjustment

p = optimal lag length

ECM_{1t-1} , ECM_{2t-1} , ECM_{3t-1} , ECM_{4t-1} , ECM_{5t-1} , ECM_{6t-1} and ECM_{7t-1} are the error correction terms respectively, while e_{1t} , e_{2t} , e_{3t} , e_{4t} , e_{5t} , e_{6t} , and e_{7t} are error terms which are identically and independently normally distributed with mean zero and constant variance,

α , β and γ are the error correction coefficients and are expected to capture the adjustment of ΔGdp , ΔCpi , $\Delta Unmpr$, ΔMs , $\Delta Excr$, $\Delta Impt$, $\Delta Expt$ towards long run equilibrium, while

ΔGdp_{t-1} , ΔCpi_{t-1} , $\Delta Unmpr_{t-1}$, ΔMs_{t-1} , $\Delta Excr_{t-1}$, $\Delta Impt_{t-1}$, $\Delta Expt_{t-1}$ are expected to capture the short run dynamics of the model.

Empirical Results

Data presentation

Data and variables for this study gross domestic product (GDP- the proxy for economic growth), a measure of the productivity and economic performance of the Nigerian economy, consumer price index (CPI - proxied for inflation rate – a measure of price instability), unemployment rate (UNMPR), money supply (MS - quantity of money in circulation in the country), import (IMPT), export (EXPT) and exchange rate (EXCR - the value of a foreign nation's currency in terms of the home nation's currency. Data for the study is essentially sourced from World Bank Development Indicators (2015). It is presented in table 1.

Augmented Dickey Fuller (ADF) Unit Root Tests

The Augmented Dickey Fuller (ADF) test of stationarity will be employed to determine the underlying properties of the time series data, that is, whether the variables of interest have unit root or not. The unit root test below reveals the result of stationarity for the variables used in the model. Below are the tabulated results.

Table 2 above shows the results of unit root test using Augmented Dickey-Fuller (ADF). The unit root test indicated that all the variables are integrated of order one I(1) i.e. first difference stationary. A variable is assumed to be stationary (has no unit root problem), if the critical value in absolute term is less than test statistic. In the same vein,

Table 1. Data and Variables used for the Study

YEAR	GDP	CPI	UNMPR	IMPT	EXPT	MS	EXCR
1986	7.49E+10	0.876848	8.5	7.79E+09	9.97E+09	2.36E+10	1.754523
1987	1.12E+11	0.975847	5.3	1.65E+10	3.02E+10	2.89E+10	4.016037
1988	1.48E+11	1.507793	5.8	1.84E+10	3.38E+10	3.84E+10	4.536967
1989	2.28E+11	2.268726	5.8	3.75E+10	1E+11	4.34E+10	7.364735
1990	2.82E+11	2.435804	5.2	4.98E+10	9.95E+10	5.76E+10	8.038285
1991	3.29E+11	2.752629	5.944	7.63E+10	1.37E+11	7.91E+10	9.909492
1992	5.55E+11	3.979994	6.186	1.31E+11	2.08E+11	1.29E+11	17.29843
1993	7.15E+11	6.255168	6.2	1.74E+11	2.42E+11	1.98E+11	22.0654
1994	9.46E+11	9.822597	6.207	1.7E+11	2.3E+11	2.67E+11	21.996
1995	2.01E+12	16.97694	6.251	4.82E+11	7.18E+11	3.19E+11	21.89526
1996	2.8E+12	21.94579	6.874	7.12E+11	9.02E+11	3.7E+11	21.88443
1997	2.91E+12	23.81774	4.629	1.02E+12	1.21E+12	4.3E+11	21.88605
1998	2.82E+12	26.19865	5.239	1.03E+12	8.36E+11	5.26E+11	21.886
1999	3.31E+12	27.93258	5.927	7.28E+11	1.12E+12	7E+11	92.3381
2000	4.72E+12	29.86923	6.702	9.27E+11	2.44E+12	1.04E+12	101.6973
2001	4.91E+12	35.50664	6.777	1.79E+12	2.23E+12	1.31E+12	111.2313
2002	7.13E+12	40.07868	6.853	1.95E+12	2.56E+12	1.56E+12	120.5782
2003	8.74E+12	45.70243	6.931	3.1E+12	3.48E+12	1.77E+12	129.2224
2004	1.17E+13	52.5569	7.011	2.13E+12	3.52E+12	2.13E+12	132.888
2005	1.47E+13	61.9454	7.057	2.81E+12	4.66E+12	2.61E+12	131.2743
2006	1.87E+13	67.04941	7.102	4.02E+12	8.07E+12	3.56E+12	128.6517
2007	2.09E+13	70.65815	7.147	6.44E+12	7.06E+12	5.88E+12	125.8081
2008	2.47E+13	78.83894	7.192	6.19E+12	9.84E+12	9.32E+12	118.546
2009	2.52E+13	87.93512	7.238	7.83E+12	7.76E+12	1.09E+13	148.9017
2010	5.55E+13	100	7.286	9.64E+12	1.4E+13	1.17E+13	150.298
2011	6.37E+13	110.8408	7.334	1.37E+13	2E+13	1.32E+13	153.8616
2012	7.26E+13	124.3822	7.6	9.4E+12	2.28E+13	1.54E+13	157.4994
2013	8.1E+13	134.9246	7.1	1.05E+13	1.46E+13	1.73E+13	157.3112
2014	9.01E+13	145.796	4.8	1.12E+13	1.66E+13	1.82E+13	158.5526
2015	9.52E+13	158.9435	4.275	9.99E+12	1.01E+13	1.86E+13	192.4405

Source: World Bank Development Indicators (WBDI) 2015

Table 2. Result Augmented Dickey Fuller Unit Root Test with Intercept

Variable	1 st Difference t-statistic value	5% Critical value	P-value (%)	Order of Integration
Log(Gdp)	-5.216251	-2.971853	0.0002	I(1)
Log(Cpi)	-3.266748	-3.004861	0.0294	I(1)
Log(Unmpr)	-6.602714	-2.971853	0.0000	i(1)
Log(Ms)	-3.088981	-2.976263	0.0394	i(1)
Log(Impt)	-5.547094	-2.971853	0.0001	I(1)
Log(Expt)	-6.554015	-2.971853	0.0000	I(1)
Log(Excr)	-5.568183	-2.971853	0.0001	I(1)

Source: Author's computation from Eviews 8.0

stationarity is attained if the probability value is less than or equal to five percent significant level. Deriving from these rules of thumb, it is hereby concluded that series in the model are all first difference stationarity. Having ascertained the stationarity properties of the variables in the model, their long run relationship will be determined through Johansen Cointegration test after a lag length is chosen.

Table 3 show the result of the VAR lag order selection indicates that the maximum lag length is 2 using both AIC, SIC, FPE and HQ information criteria. Based on this result, the optimum lag length is 2 ($k=2$) and it is hereby selected for this study. Having determined the VAR lag length selection criteria, the longrun relationship can now be determined.

Table 3. VAR Lag Length Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-43.38810	NA	8.63e-08	3.599150	3.932201	3.700967
1	127.1667	243.6497	1.64e-11	-5.083333	-2.418924	-4.268797
2	233.0396	98.31057*	6.03e-13*	-9.145685*	-4.149918*	-7.618429*

Source: Author's computation using Eviews 8.0

Table 4. Trace and Maximum Eigenvalue Cointegration Table
Series tested: GDP, CPI, UNMPR, MS, IMPT, EXPT and EXCR

Trace Statistic	5% critical value	Prob. Value	Max- Eigen statistic	5% critical value	Prob. Value
422.9934	125.6154	0.0000	191.0026	46.23142	0.0000
231.9908	95.75366	0.0000	91.01976	40.07757	0.0000
140.9711	69.81889	0.0000	54.59790	33.87687	0.0001
86.37317	47.85613	0.0000	33.92118	27.58434	0.0067
52.45199	29.79707	0.0000	24.00181	21.13162	0.0192
28.45018	15.49471	0.0003	18.83792	14.26460	0.0088
9.612263	3.841466	0.0019	9.612263	3.841466	0.0019

Source: Author's computation using E-views 8.0

$\text{GDP} = 1.0000 + 1.44\text{E}+11(\text{Cpi}) + 1.21\text{E}+12(\text{Unmpr}) + 5.059101(\text{Ms}) + 0.991066(\text{Expt}) - 2.02\text{E}+10(\text{Excr}) - 1.555550(\text{Imp})$
$(6.4\text{E}+09) \quad (1.1\text{E}+11) \quad (0.03705) \quad (0.03702) \quad (2.2\text{E}+09)$

Figure 4. Normalizing the Estimates of the Unconstrained Co-integrating Vector.

Note: Standard errors are in parenthesis

Source: Author's computation using Eviews 8.0

Co-integration test

A co-integration test is one sure way of establishing the presence or absence of a long-run relationship among series in a model. Economically speaking, two or more variables will be co-integrated if they have a long-run or an equilibrium relationship between or among them (Gujarati, 2004). That is, if they can walk together for a long time without deviating from an established path. (Table 4).

Table 3 above indicates seven (7) cointegration equations at those ranks where the values of the trace statistic exceed the 5% critical values. This occurred in seven places in the table. In addition, this was confirmed by the results of the maximum eigenvalues where cointegration exists at ranks where the value of eigenvalues is at least 0.5. The discovery here is that both the trace and max-eigenvalue statistic yielded seven cointegrating equations. However, theory agrees that cointegration exists where there is at least one cointegrating equation, hence we conclude that the series – gross domestic product, consumer price index, unemployment rate, money supply, imports, exports and exchange rate respectively have longrun relationship, i.e. they can both walk together for a long time without

deviating from such established path.

Since there is at least one co-integrating vector, an economic interpretation of the relationship between gross domestic product and the independent variables can be obtained by normalizing the estimates of the unconstrained co-integrating vector.

An economic interpretation of the long-run function of the model is obtained by normalizing the estimates of the unconstrained cointegrating vector on GDP. The parameters (i.e., long-run estimates) of the cointegrating vector for the long-run equation are presented in Figure 4. The results in Figure 4 above show a positive relationship between gross domestic product, consumer price index, unemployment rate, money supply and exports while an inverse relationship existed between economic, exchange rate and imports respectively. The outcome from all the series with the exception of CPI, UNMPR, EXCR and IMPT are consistent with economic theory. All things being equal, a percentage change in consumer price index, unemployment rate, money supply and exports collectively resulted to a unit change in economic growth. On the other hand, a unit change in exchange rate and imports resulted to a decrease or decline in economic growth. Exchange rate is a better indicator of any country's international

Table 5. ECM Output

Variable	Coefficient	Std. Error	t-Statistic
ECM(-1)	-0.261814	0.43310	-0.60451

Source: Author's computation using E-views 8.0

Table 6. Block Exogeneity Test

Description	Decision	Prob. Value
CPI does not Granger cause GDP	Reject	0.0825
MS does not Granger cause CPI	Reject	0.0001
CPI does not Granger cause MS	Reject	0.0705
GDP does not Granger cause EXCR	Reject	0.0328
UNMPR does not Granger cause EXCR	Reject	0.0255
EXPT does not Granger cause EXCR	Reject	0.0736
UNMPR does not Granger cause EXPT	Reject	0.0111

Source: Author's computation using E-views 8.0

purchasing power and relative economic growth. Exchange rate determines the GDP growth rate and the position of currency in the international market. An economic interpretation of the core variables (GDP, CPI, UNMPR, MS and EXCR) clearly reveals that as prices of goods and services move on an upward trend and with a spiraling unemployment rate and unstable exchange rate regime, the prospect of growth in the economy remains dicey as a decline or negative growth is the probable outcome. Furthermore, an increase in money supply has the tendency to lead to the parlance of 'more money chasing few goods' thus leading to inflation.

Error correction mechanism

In the short-run, deviations from the long-run relationship established in Table 2 could occur due to shocks to any of the variables. In addition, the dynamics governing the short-run behavior of the model are different from those in the long-run. Due to this difference, the short-run interactions and the adjustments to long-run equilibrium are important because of the policy implications. The error-correction model arises from the long-run co-integration relationship. To check for the speed of adjustment of the model from the short run to the long run equilibrium state, we consider the error correcting term (ECM). The greater the coefficient of the error correction term, the faster the speed of adjustment of the model from the short run to the long run and vice-versa. Below is the extract of ECM output. Table 5.

The estimated coefficient of the ECM term which is also the speed of adjustment to equilibrium is negative as required by economic theory. Judging from the result above, the ECM coefficient -0.261814 is rightly signed in line with economic a priori expectation. The coefficient of -0.261814 indicates that about 26% of the disequilibrium or

distortion in the Nigerian economy is yearly being corrected for. This means that for long run equilibrium to be restored in the system, it would take the Nigerian government about three years and eight months to bring the economy back to an equilibrium level again. This suggests that there will be a convergence within this period to equilibrium path regarding economic growth and series in the model.

Granger causality / block exogeneity test

The existence of cointegration relationships indicates that there are long-run relationships among the variables, and therefore Granger causality among them in at least one direction.

The result in the first section of the table shows unidirectional causality running from inflation (proxied by consumer price index) to Gross Domestic Product (economic growth) at the 10% significant level. This reveals the truism that during the years under reference, price instability contributed in retarding economic growth in Nigeria. The second section indicates a one-way causation running from money supply (MS) to inflation also at the 10% significance level. This also is a further proof that a rise in the volume of money in circulation in an economy without the requisite production capability gives rise to increases in the prices of goods and services. This further proved that inflationary pressures in Nigeria are caused by the volume of money supply by the monetary authorities at any given time. Similarly, empirical evidence revealed that a rise or decline in economic growth, unemployment rate and exports in Nigeria is a function of the exchange rate policy in place at any given time. It should be noted that exchange rate measures the purchasing power of a country. It has positive effect on unemployment. When the exchange rate changes it affect goods market in the

Table 7. Residual Diagnostic Tests

Type of Tests	P-Value
VAR Residual Normality Tests	>0.05
Inverse Roots of AR Characteristic Polynomial	Within acceptable region
VEC Residual Portmanteau Tests for Autocorrelations	>0.05

country and the value of money depreciates which causes a reduction in consumption and industrial production and ultimately decrease employment opportunities for the citizens. In a nutshell, the economic interpretation of these results revealed that an appreciation in exchange rate has the potential of increasing exports of available exportable goods to other destinations thus leading to a rise in economic growth and a decline in the rate of unemployment.

Diagnostic test

Having presented the results from the empirical analysis, it is also necessary to examine the statistical properties of the estimated model. Diagnostic checks are crucial in this analysis, because if there is a problem in the residuals from the estimation of a model, it is an indication that the model is not efficient, such that parameter estimates from such model may be biased. The model was tested for normality, serial correlation and inverse roots of AR characteristic polynomial.

The results as presented in Table 7 suggest that the model is well specified. The diagnostics indicates that the residuals are normally distributed, serially uncorrelated. This is attested to by the insignificant probability values. More so, the parameters appear to be stable as all points remained within the acceptable region of the Inverse Roots of AR Characteristic Polynomial. This indicates that the model is stable and valid for policy making.

CONCLUSION

The Nigerian economy is in a crucial phase of its turmoil. A lot of social and economic problems, like low literacy rate occasioned by falling standard in education at all levels, poor health facilities, hyper inflation, high unemployment, rising trade deficit and continuous low economic growth have been faced by successive administrations in the country. The government has been indulging in unnecessary political bickering and debates which have no direct link with the revival of the economy and welfare of the general public. In this study, the dynamic analysis of economic interaction between price instability, unemployment and Economic Growth in Nigeria is discussed. The variables which were selected for analysis are Gross Domestic Product (GDP – proxy for economic

growth), consumer price index (CPI – proxy for inflation rate), money supply (MS), volume of imports (IMPT), exchange rate (EXCR) and exports (EXPT) respectively. Annual time series data from 1986 to 2015 were sourced from World Bank Development 2015 and subjected to unit root, Johansen cointegration test and granger causality analysis. There was evidence of longrun equilibrium relationship among variables in the models. Empirical evidence revealed unidirectional causality running from inflation (proxied by consumer price index) to Gross Domestic Product (economic growth) at the 10% significant level. This showed that during the years under reference, price instability contributed in retarding economic growth in Nigeria. There was a proof of causation from money supply to inflation; that a rise in the volume of money in circulation in an economy without the requisite production capability will lead to increases in the prices of goods and services. This also is evidence that inflationary pressures in Nigeria are caused by the volume of money supply by the monetary authorities at any given time. Another major finding from this study is the fact that a rise or decline in economic growth, unemployment rate and exports in Nigeria is a function of the exchange rate policy in place at any given time. When the exchange rate changes it affect goods market in the country and the value of money depreciates which causes a reduction in consumption and industrial production and ultimately decrease employment opportunities for the citizens. In a nutshell, an appreciation in exchange rate has the potential of increasing exports of available exportable goods to other destinations thus leading to a rise in economic growth and a decline in the rate of unemployment.

Deriving from the findings above, some major policy recommendations of this study are as follows:

- The monetary authority of the country should strive to maintain a manageable inflation rate in order to motivate foreign investors.
- Government should revitalize the various ailing industries and establish new ones to encourage massive industrialization. With functional industries working to full capacity, agricultural products often exported in their raw form would have value addition before they are eventually exported. This strategy will boost economic growth, bring in more forex and create massive jobs for the teeming graduates.
- Government should use the level of inflation as an operational guide in measuring the effectiveness of its

monetary policy. If these policy measures for the control of money supply in the economy are applied, they may be helpful in the control of monetary expansion.

- (d) Government should embark on policies that will reduce the number of imported goods drastically and encourage local production and consumption to encourage domestic industries; these will reduce unemployment and inflation in Nigeria and increase output.
- (e) The Central Bank of Nigeria should intensify the deregulation policy of the exchange rate sector of the economy to make available foreign currency to exporters and investors. Promotion of exports within the context of sub-regional and regional economic integration should be vigorously pursued to expand Nigerian international market and the importation policy of the government should be adhered to in order to control dumping and to encourage local investors.

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