LANGUAGE; ENGLISH

THE ECONOMIC EFFECTS OF THE RISE AND FALL OF RICE PRODUCTION IN NIGERIA

Grace Sopuru Ekoh
Nassarawa State University
gracesopuruekoh@gmail.com

Christelle Mbuyu Ilunga
Girne American University
ilungachristelle7@gmail.com

A R T I C L E   I N F O

ABSTRACT

The world experienced a dramatic increase in food prices during the first half of 2008. According to FAO (2008), international nominal prices of all major food commodities reached their highest levels in nearly 50 years while prices in real terms were highest in nearly 30 years. The FAO food price index increased by 53.0 percent for the first three months of 2008 compared to the same three months in the previous year. The rising prices of food is led by vegetable oils which increased by more than 97.0 percent followed by grains which increased by about 87.0 percent (Ehui, 2013) The current agricultural market is characterized by the increase in international prices of not just a few but of nearly all major food and feed commodities. The increase in prices is expected to have adverse effects on poverty and is worrisome precisely because it is expected to hurt the poor the most.

1.1   Introduction

Rice is one of the leading and main food crop that most Nigerians depend on, and it constitutes a key part of their diet. Within the last three decades' rice grain has seen steady rise in demand and its growing significance has become obvious in the food security planning strategies of Nigeria. Though a small number of countries have achieved self-sufficiency in rice production, the demand for the crop exceeds production with large quantities of rice imported to meet the demand at a huge cost in Nigeria.

Subsistence rice farming is the leading agricultural activity that is practiced by nearly 85% of the farming families. Though farmers do cultivate other crops such as yams, sweet potatoes, cassava, and vegetables, rice is evidently the foremost crop cultivated by most farmers.

Nigeria requires about 530,000 metric tonnes of milled rice yearly to meet the consumption requirements of the population (Adams, 2014). The National paddy rice production was estimated at 525,000mt in 2006 and 639,000mt in 2007 (FOA, 2012). The level of rice independence rose from 57.48 percent in 2002, to 69.50 percent in 2005 and followed by 72 percent in 2015 (Ukeje, 2016). This implies the rest must be imported at an increasingly expensive price in the existing situation of high prices for foodstuffs including rice. The International nominal prices of most food commodities reached, in the first four months of 2012, their highest peak in almost 45 years, while prices in actual terms in nearly 35 years. The price of rice, the leading staple food in Nigeria has seen a steady increase by more than 55% generally in the whole country (Intal & Godwin, 2015).

The rising of food prices including rice in Nigeria since January 2016 is a very serious risk to the livelihoods of most Nigerians. Mostly affected by this latest food price inflation, are those with low-income in the urban areas and peri-urban families, who are mostly reliant on the market to access their daily food needs. Smallholder food deficit cultivators are also among the mostly affected by the persistent increase in prices of the leading food, causing among them, and extreme levels of food uncertainty. The development of local rice production is thus a key factor in the strategies for developing food security, motivate economic growth and hence increase rural income. Attempt to support rice production schemes is the only solution to drag the country beyond the worsening rice circumstances and reverse the present declining trend in food independence. Although rice is the staple food of most Nigerians, so far, the annual per capita consumption of rice is regarded the highest amongst the sub Saharan Africa.

A rice production survey was recently implemented in Nigeria and the results indicates that the final consumers of rice grain in the country could not

notice the impact of domestic rice production due to their preference for imported rice varieties from abroad. Better accuracy at the country level will offer the necessary foundations for enhancing rice production, inflation rates effects on its cost of local production and thus, overcoming food uncertainty in the country.

The upsurge in the inflationary rates has had major economic distortions on production levels in the economy. Given the relevance of rice as a staple food in most families in Nigeria, and its raising cost and demand by the people especially as it affects the peasant rice producer, it becomes imperative to uncover the factors that are germane to this rise in the cost of its production and consumption. It is against this background that this study is out to uncover the place of inflation in the production of rice output in Nigeria.

1.2 Statement of the Problem

Since mid-1960s, inflation has become so serious and contentions problem in Nigeria. Though inflation rate is not new in the Nigerian economic history, the recent rates of inflation have been a cause of great concern to many. During the period under review (1999–2016), there has been an upsurge in the inflationary rates leading to major economic distortions. The continued over valuation of the naira in 1980, even after the collapse of the oil boom engendered significant economic distortions in production and consumption as there was a high rate of dependence on import which led to balance of payment deficits. This resulted to taking loans to finance such deficits. An example was the Paris Club loan, which was a mere Five Billion, thirty-nine million dollars ($5.39billion) in 1983 rose to twenty-one billion, six million dollars ($21.6billion) in 1999 (CBN, 2012) The oil glut from 1981, that resulted into balance of payment deficits also led to foreign exchange crises that necessitated various measures of import restrictions. These restrictions reduced raw materials for domestic production and spare parts for machinery operation. The resultant shortage of goods and services for local consumption spurred the inflation rate to rise from 20% in 1981 to 39.1% in 1984 (Itua, 2010). With the adoption of the Structural Adjustment Programme (SAP) in 1986, there was a temporal reduction in fiscal deficits as government removed subsidies and reduced her involvement in the economy. But as the effects of the Structural Adjustment Programme (SAP) policies gathered momentum, there was a fall in the growth rate of rice production in 2010 from 28.3% to 21.2% in 2014, with inflation rising from 7.96% in 2013 to 9.55% 2015 (CBN, 2015).

More so, various agricultural programmes like the "Operation Feed the Nation" of 1979 and the "Green Revolution" of 1980 where implemented to boost output to reduce prices of food items especially rice production, but yielded minimal results.

Notwithstanding the various efforts of the Nigerian government to curb the inflationary trend, inflation continued to cause setback in the growth rate of the living standard of most Nigerians who are all fixed income earners or unemployed (Agba, 2014). Inflation has had adverse effects on savings, investment, productivity and balance of payment in the Nigerian economy, hence the fall in the growth rate of the Gross Domestic Product (GDP) from 26.8% in 1981 to 9.54% in 2010 and 2.79% in 2015 (CBN, 2015).

With these efforts, Nigeria overall rice output or sector performance outcomes have not been so encouraging because lack of access to credit by rice farmers, access to rice input, access to farm input and access to farm land. Since rice outputs are limited, they are not likely to be efficiently accessible and affordable by the poor. This heralds the need to investigate the effect of inflation on rice output in Nigeria.

1.3 Research Questions

The following research questions are posed to guide direction of data analysis for the findings of the study.

  i. To what extent has access to credit by farmers affected rice output in Nigeria?

  ii. What is the causal link between inflation rate and rice output in Nigeria?

1.4 Objectives of the study

The main objective of the study is to assess the impact of inflation rate on rice output. This research study has the following objectives which include:

  i. Determine the extent to which access to credit by farmers have affected rice output in Nigeria

  ii. Examine the causal link between inflation rates and rice output in Nigeria.

1.5 Statement of Hypotheses

In order to find solutions to the research questions, hypothesis are posed to validate data for findings of this study. Specifically, the research would test the two hypotheses stated below:

  i. H_{01}: Access to credit has no impact on rice output in Nigeria.

  ii. H_{02}: There is no causal link between inflation rate and rice output in Nigeria.

Bounds test approach developed by Pearsan, Shin and Smith (2001) would be used to attend to the first research hypothesis; while the multivariate causality (often referred to as VAR-Granger causality) test would be used to test the second hypothesis. The test would help to circumvent probable biased and inconsistent inferences arising from restricting endogenous variables in the pairwise causality test.

1.6 Significance of the Study

The study will contribute to existing literature on the subject Impact of Inflation on Rice Output in Nigeria and also, contribute to the awareness and scope of the impact of inflation on rice and output among the citizens of Nigeria.

The findings of this research would enhance the forecasting abilities of policy makers, and all who are involved in charting the future of economic development for Nigeria.

Other developing countries would find this study useful to make necessary and more accurate adjustment towards managing inflation rates in their country. This would specifically enable them to enhance agricultural sector performance in Nigeria as the engine of economic growth and development. The research work is therefore not just relevant to the policy makers alone, but also to other researchers or stake holders that may want to understudy researches in this field.

The study will serve as a challenge to the academic pursuit of other researchers; and enable them apply the various economic and analytical tools acquired in reaching conclusion that may serve as a synthesis. The study will lay a good foundation for future research, and would equally serve as a reference to future prospective researchers. It will assist professional bodies by contributing to knowledge for future aid on research.

More so, the Nigerian society as a whole would benefit because of the prominent role agricultural sector (especially rice productions) plays in creating employment opportunities, expanding export base, manpower development and aiding research and development in Nigerian society.

1.7 Scope of the Study

The scope of this study centered on the impact of inflation rates on rice outputs in Nigeria from 1986 to 2016. It reflects the period when different policies were introduced by democratic regimes to improve agricultural output including rice production.

This research covers the total rice output produced in Nigeria. The choice for this is predicated on the fact that they seem to cover larger population unlike many that have been hijacked by the privileged class. It is thus necessary to embark on the impact of inflation on rice output in Nigeria.

2. Theoretical Framework

Various theories were reviewed during this study and they are discussed under the subsections below:

Demand-Pull Inflation Theory

Demand-pull inflation is the traditional and most common type of inflation. This theory was propounded by Irving Fisher in 1911. It takes place when aggregate demand is rising while the available supply of goods is becoming less. There are two principal theories about the demand-pull, that of the monetarists and the Keynesians. The monetarists stress the role of money in the demand-pull inflation. They state that when the money supply is in-

creased in order to increase production and employment, it creates an inflationary situation within an economy.

Friedman (1961) (a monetarists), held that "inflation is always and everywhere a monetary phenomenon that arises from a more rapid expansion in the quantity of money than in total output."

John Maynard Keynes (1936) and his followers were of the view that increase in the aggregate demand is the source of demand-pull inflation. Demand pull inflation is where the total demand for goods and services is more than the aggregate supply and provisions of goods and services in the economy. The aggregate demand in this sense comprises of consumption, investment and government expenditure. According to Totonchi (2011), policy that causes the decrease in each component of total demand is effective in reduction of pressure on demand and invariably inflation. This is basically involving reduction in government expenditures, increase in tax as well as controlling the volume of money.

The Keynesian school of thought suggests that money is exogenously determined by the central authority. This school assumes an economy under less than full employment equilibrium since according to it; the economy can never operate at full employment equilibrium. Therefore, we can only talk about the short –run period since in the long-run, we all must have been dead. The opportunity

cost of holding money is bonds; hence, an increase in money supply creates excess supply of money which in turn leads to excess demand for bonds. Consequently, the price of bonds rises. A rise in the rate of interest has three effects; the wealth, the cost-of-capital and the credit rationing effects. One remarkable issue in this school of thought is that the weak cost of capital gives rise to the concept the 'liquidity Trap' where money ceases to matter in the economy. Here, the additional money supply would be trapped by the system and used as speculative balances. At this point, monetary policy ceases to be effective in controlling the level of inflation rather fiscal policy becomes the alternative measure that could be used to fine-tune the economy (Simeon, 2002).

In Nigeria, where the economy can hardly produce output to meet up with economy's demand and which is highly foreign dependent, may be faced with more inflationary pressures due to excess demand and when taxes are increased as the producers may get involved more in rent seeking economic activities rather getting involved in the real sectors of the economy which can tackle the problem of low productivity and unemployment.

According to Keynes (1936), an increase in general price levels or inflation is created by an increase in the aggregate demand which is over and above the increase in aggregate supply. If a given economy is at its full employment output level, an increase in

government expenditure (G), private consumption (C) and private investment (I) will create an increase in aggregate demand; leading towards an increase in general price.

2.2 Cost Push Theory

This type of inflation became more prominent in the 50's and 70's when it became known as "New inflation". The theory was propounded by Milton Friedman. This is taken to be associated with increase in the cost of production which results from wage increases or increases in the input prices. According to Totonchi (2011), when the labour unions demand for more wages from the employers and if granted, the employers in turn will increase the cost of their products which will ultimately result in cost push inflation. He added that the resultant price increase may affect some other companies that use the products whose prices have risen and thereby pushing up their prices. This spiral may be on the national scale and may be sustained over time Totonchi (2011).

The developing countries especially Nigeria is confronted with deficient input resources especially capital goods and has to resort to importation of such goods from developed countries. This has the tendencies of extra cost of importation which in the long run often make the domestically produced goods to be costly compared to similar finished goods imported to the country and hence has the negative impact of undermining the domestic pro-

duction and lead ultimately sustained higher prices (Totonchi 2011).

2.3 Cobweb Theory

The cobweb theory is an economic model that explains why prices might be subject to periodic fluctuations in certain types of market. It describes cyclical supply and demand in a market where the amount produced must be chosen before prices are observed; it is based on the time lag between supply and demand decisions. The cobweb theory suggests that prices can become stuck in a cycle of ever-increasing volatility. E.g. if prices fall, many farmers will go out of business, the next year supply will fall. This causes price to increase. However, this higher price acts as incentive for greater supply. Therefore, next year supply increases and prices plummet again. (Pashigin 2008).

The fluctuation in prices of commodities affects the fortunes of individuals in the economy. Prices give signal to the producers regarding the commodities to be produced in the economy and how to earn money and sustain the process of production. Subba et al. (2008) observed that, most agricultural commodities are affected by price variation arising from seasonal fluctuations in demand, supply and marketing, agricultural prices are volatile in the sense that they are subject to changes over time and space. Prices in agricultural markets are often much more volatile than other industries. This is because:

Supply is price inelastic in short term (it takes a year to grow most crops), demand is price inelastic. (Food is essential and people are not usually put off by higher prices) and supply can be due to climatic conditions (Mutt 1961).

Owing to the complexity of pricing, and hence revenue generated form sales, the Federal Ministry of Agriculture (FMA) (2008) asserts that one of the cardinal objectives of agricultural pricing policy of Nigeria is the stabilisation of prices and revenues to farmers. This may not be unconnected with the profound effect price and revenue fluctuations may have on the growth, equity and stability of the economy. For instance, incomes and living standards of the farmers, labourers and consumers are very affected by price and revenue fluctuations. According to Shively (1996), increased price variability can have detrimental impacts on both consumers and producers of agricultural commodities. He continued that since stocks are a large proportion of a farm household's portfolio in developing countries, and since the level of market risks and ability to bear risks may be correlated with income, low-income farmers are likely to be sensitive to price risks. Juselius (2006) observed that, higher food prices have affected price increases in downstream and upstream products and services. Consequently, these result in people eating less frequently and in lesser quantities, as well as cheaper and less nutritious food.

According to Awoyemi (2010), stabilization of prices of essential agricultural commodities continues to be an area of major concern for policy makers. This is important because high growth in the prices of rice may spill over to other sectors of the economy leading to an increase in the overall rate of inflation. These concerns about commodity price fluctuations have led to pervasive commodity policy interventions by national governments. There is thus a need to study the price behavior of essential agricultural commodities and the reasons that underlie the large variations in their prices in order to devise improvements in the system. His study analyses the behaviour of the rice prices over some years. Results indicate that there is fairly stability in the price of rice but instability in domestic rice prices can occur due to fluctuations in local rice markets and a large shortfall in domestic production. In their journal report on rice production in Nigeria, Eco-systems development organization (EDO, 2003), said that "Although rice is a traditional crop in Nigeria, local production was limited until recently. Internal demand is growing and, at the same time, rice is a major commodity of world trade. Nigeria is therefore under pressure from international bodies not to restrict imports; production under local conditions to match prices of rice produced on large mechanised farms therefore represents a considerable challenge."

2.4 Nexus between Inflation Rates and Output Growth

Economics have long been interested in the effect inflation on real economic variable; it has expanded greatly, spurred on by the relatively high inflation rates in the development economics beginning in the 1970s and the coincident slowing in the rate of output growth. On traditional and widely accepted notion is that anticipated inflation has little or no effects arising from institutional features such as incompletely indexed tax zero and zero interest payments on currency and reserves. It is also widely accepted that unanticipated inflation affects real variable, at least in the short run. Many analyses also hold that uncertainty about future inflation rates affects real variables. Indeed, Marshall (1886) expressed concern about the negative effects of an uncertain future value of the English pound on output over 100 years ago. More recent arguments in this spirit are continued in Okun (1971) and Friedman (1977), who argue that uncertainty about future inflations is detrimental to real economic activity. Furthermore, they suggest that uncertainty about future inflation in linked to the mean rate of inflation by the policy environment. Friedman, in particular, argues that nations might temporality purse a set of goals, for real variable (for example, output and underpayment) threat leads to a high inflation rate. The high inflation rate induces strong political pressure to reduce it, leading to stop-go policies and attendant uncertainty about future inflation. Thus, high inflation coexists with increased inflation uncertainty, as individuals become less certain about the political choice over future inflation paths. Friedman postulates a negative effect of a highly volatile inflation rate on economic efficiently for two reasons. First, increased volatility in inflation makes long term contracts costlier because the future long term contracts more costly because the future value of dollar payment is more uncertain. Second, increased volatility inflation reduces the ability of markets of convert information to market participants about relative price movement. By reducing economic efficacy, greater inflation uncertainty should at least temporarily increase the rate of unemployment and reduce economic growth. Through these theoretical concerns about the effect of inflation, uncertainty seem reasonable and persist in economic discussions and existing studies provide only mixed support for them.

Economic theories reach a variety of conclusions about the responsiveness of output growth to inflation. Theories are useful, as they account for some observed phenomenon. Historically, in the absence of what is termed 'persistent inflation', the early inflation-growth theories were built on cyclical observations. Persistent inflation is regarded as a post-World War II phenomenon. Before then, bouts of inflation were followed by bouts of deflation. Having showed no upward or downward trend, infla-

tion was said to behave like a 'lazy dog'. It stays at a particular level unless and until there is a disturbance. Thereafter, it moves to another level, at which it settles. Theory, therefore sought to account for a positive correlation between inflation and growth. The aggregate supply-aggregate demand (AS-AD) framework also postulated a positive relationship between inflation and growth where, as growth increased, so did inflation. In the 1970s, however, the concept of stagflation gained prominence, and the validity of the positive relationship was questioned.

2.5 Inflation Profile in Nigeria

In Nigeria, inflation was curtailed effectively in the late 1990s when the country recorded single digit of 8.5% and 6.6% in 1997 and 1999 respectively. Inflation entered the two-digit range between 2001 and 2004 when 18.9%, 13.2%, 14% and 15% were recorded in 2001, 2002, 2003 and 2004 respectively. It is in the light of bringing inflation back to single digit level that the present study becomes highly relevant

Achieving price stability in Nigeria has remained one of the key objectives of monetary policy since the 1970s. In spite of this target by monetary authorities, a persistent increase in prices has constituted a major macroeconomic challenge. From a single digit level in 1960s the inflation rate increased to 16% in 1971 only to jump to an all-high level of 33.9% in 1975. The 1975 high level of in-

flation has been attributed to the oil boom of the early 1970s and the increases in salaries and wages of both government and private workers. Even though several control measures put in place to control inflation in the late 1970s yielded good results with lower inflation recorded during the period, high inflation levels were nevertheless recorded in 1984, 1988 and 1989 when inflation stood at 39.6%, 38.3% and 40.9% respectively.

Inflation became more worrisome to both monetary regulating authorities and other policy makers in the early 1990s when it increased from 13% in 1991 to 44.5% in 1992 and to an unprecedented level to 72.8% in 1995. It suffices to also note that from 1992 to 1999, Nigeria's real gross domestic product (real GDP) grew at an average of about 2.6%, which is far short of propelling the economy into sustainable growth and development. However, during the democratic era (1999-2007), inflation rate increased from 6.6% in 1999 to a peak of 17.9% in 2005, and later declined by 53.1% to 8.4% in 2006 and further eased to its historical low (since 1986 SAP era) of 5.4% in 2007 (see Figure 1). The emergence of global financial crisis (2008-2011) further increased inflation rate by over 100% and it averaged 11.8% during the crisis era.

2.6 Gaps in Literature

While the volumes of previous studies are attempting to reach a theoretical consensus on inflation rates and economic growth, it will be of interest to

examine in the same vein the pathway of rice outputs in the wake of inflation rates. Most empirical studies on inflation rates such as Datta (2011), Gokal and Hanif (2004), Chuan (2009), Chimobi (2010) and Umaru and Zubairu, (2012) concentrated on the effects of inflation rates on economic growth, with little attention on the rice outputs growth.

Furthermore, the long run examination methods used in literatures are mostly Johansen (1991) and Engle and Granger (1987) cointegration methods, whereas the unrestricted ARDL bound testing approach to cointegration developed by Pesaran, Shin and Smith (2001) is particularly applicable in the presence of the disequilibrium nature of the time series data stemming from the presence of possible structural breaks as happens with most economic variables. With the unrestricted ARDL-ECM approach, it can be conveniently tested whether the underlying structural breaks have affected the long-run stability of the estimated coefficients.

In summary, the gap the study intends to fill would be to empirically examine the effects of inflation on the output growth of rice production in Nigeria rather than concentrating on economic growth that has been mostly studied in the past.

3.1   Research Design

Ex-post facto research design was adopted for the study facilitates the tests of hypotheses concerning cause-and-effect relationships; as well as combining theoretical consideration with empirical observation. The use of this design in this study allowed for the testing of expected relationships between and among variables and the making of predictions regarding the relationships between rice output and inflation rates.

3.2   The Model

The theory adopted and utilized in this study is the Keynesian theory of inflation. John Maynard Keynes (1936) and his followers were of the view that increase in the aggregate demand is the source of demand-pull inflation. Demand pull inflation is where the total demand for goods and services is in excess of the aggregate supply and provisions of goods and services in the economy. The aggregate demand in this sense comprises of consumption, investment, and government expenditure.

The Keynesian school of thought suggests that money is exogenously determined by the central authority. This school assumes an economy under less than full employment equilibrium since according to it; the economy can never operate at full employment equilibrium.

In Nigeria, where the economy can hardly produce output to meet up with economy's demand and which is highly foreign dependent, may be faced with more inflationary pressures due to excess demand and when taxes are increased as the producers may get involved more in rent seeking economic activities rather getting involved in the real sec-

3.3 Model Specification

This research work adopted the econometric model previously used by Osuala & Onyeike (2013). Following the position of Osuala & Onyeike (2013), the relationship between the dependent variable and explanatory variable can be specified as:

$$Y = f(X) \qquad (1)$$

Where Y = dependent variable and X is the explanatory variable.

Integrating the variables used in this research work equation 1 above is rewritten as

$$RO = f(IFR) \qquad (2)$$

Where;

RO = Rice Output

IFR = Inflation rates

Specifying equation (2) in a stochastic (linear regression) form we have:

$$RO = \alpha_0 + \alpha_1 IFR + \alpha_2 CPI + \alpha_3 GMS + \mu_t \qquad (3)$$

Where;

μ_t = denotes the white noise error term

α_0 = is a constant parameter, while

$\alpha_1, \alpha_2, \alpha_3$ = is the parameter of coefficients. It is the slope of the graph that measures the change in the rice output as a result of a unit change in inflation rate

Parameters for Estimation/A Priori Expectation

The *a priori* expectations of the explanatory variables are as expressed as:

$\alpha_1, \alpha_2, \alpha_3 < 0$; that is, inflation rate is expected to have a negative effect on rice output.

Unit Root Test for Stationarity of Data

Econometric studies have shown that most financial and macro-economic time series variables are non-stationary and using non-stationary variables lead to spurious regression (Engel & Granger, 1987). The first step involves testing the stationarity of the variables, and then the order of integration of the individual series under consideration. Researchers have developed several procedures for the test of order of integration. The most popular ones are Augmented Dickey-Fuller (ADF) test due to Dickey and Fuller (1979). Augmented Dickey-Fuller test relies on rejecting a null hypothesis of unit root (the series are non-stationary) in favour of the alternative hypotheses of stationarity. The tests are conducted with and without a deterministic trend (t) for each of the series. The general form of ADF test is estimated by the following regression:

$$\Delta Z_t = \beta_1 + \beta_2 t + \delta Z_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta Z_{t-i} + \varepsilon_t \qquad (4)$$

Where Z_t is the time series under consideration, ε_t is pure white noise error, t is trend, β_1 is drift and $\delta = \rho - 1$. The number of lagged difference terms to include is often determined empirically, the idea being to include enough terms so that the error term is serially uncorrelated. If the null hypothesis that $\delta = 0$ is rejected, it means the series is

is stationary. Unfortunately, under the null hypothesis that $\delta = 0$ (i.e., $\rho = 1$), the t value of the estimated coefficient of does not follow the t distribution even in large samples; that is, it does not have an asymptotic normal distribution. Dickey and Fuller have shown that under the null hypothesis that $\delta = 0$, the estimated t value of the coefficient of Z_{t-1} follows the τ (tau) statistic. These authors have computed the critical values of the *tau statistic* on the basis of Monte Carlo simulations.

Co-integration Test for Stationarity of Data

The second step is the testing of the presence or otherwise of co-integration between the series of the same or different order of integration through forming a co-integration equation. The basic idea behind co-integration is that if, in the long-run, two or more series move closely together, even though the series themselves are trended, the difference between them is constant. It is possible to regard these series as defining a long-run equilibrium relationship, as the between them is stationary. A lack of co-integration suggests that such variables have no long-run relationship: they can wander arbitrarily far away from each other (Dickey, 1979).

Pesaran and Shin (1999) showed that cointegrating systems can be estimated using bound test, with the advantage that the variables in the specified model can either be I(0) or I(1) or a combination of both; and without needing to pre-specify which are I(0)

or I(1).

The bounds test procedure is captured with the following representation:

$$\Delta RO_t = -\sum_{i-1}^{p-1} \gamma i^* \Delta RO_{t-1} + \sum_{i=1}^{k} \sum_{i=0}^{q_j-1} \Delta IFR_j + \Delta CPI_j + \Delta GMS_j, t-$$

The bound test for the existence of long-run relationships is then simply a test of:

$$\rho = 0$$
$$\delta_1 = \delta_2 = ... = \delta_k = 0 \qquad (6)$$

Where;

RO_t = Rice outputs at time t

IFR_j = Inflation rates

IFR_j = Inflation rates

CPI_t = Consumer price index

GMS_j = growth in Money supply

γ = coefficient of parameter estimate of lagged rice outputs

As a tradition, the test for null hypothesis of no Co-integration against alternative of the existence of a long run relationship is tested by using F-test such as;

$$H_0 = \alpha_1 = \alpha_2 = ... = \alpha_n = 0$$
$$H_1 = \alpha_1 = \alpha_2 = ... = \alpha_n \neq 0$$

If the computed F-statistic falls above the upper bound critical value of F-tabulated developed by Pesaran and Shin (1999), the null of no Co-integration is rejected which implies that long run relationship exists among the variables of interest.

On contrary, if it falls below the lower bound, then the null of no Co-integration cannot be rejected. Finally, if it lies between these two bounds, the result seems inconclusive.

Finally, after establishing the existence of long-run cointegration relationship between rice output and inflation rates, the study shall investigate both the long-run effects and the short-run dynamics using the (unrestricted) Error Correction Model (ECM) approach. ECM will be applied to find out the speed of adjustment the variables follow towards the long-run equilibrium path in response to any divergence that occurred in the short-run.

3.4   Sources and Nature of Data

The data used for this research work consist mainly of secondary data which are relevant to the study and were obtained from published sources. The published sources include data from Central Bank of Nigeria (CBN) publications, CBN statistical bulletin, journals, magazines, newspapers, National Bureau of Statistics (NBS), internet and other relevant publications.

3.5   Method of Data Analysis

The study shall employ two econometric models to achieve the empirical results. The first econometric model examines the short-run and long-run relationship between rice outputs and Inflation rate by applying the Autoregressive Distributed Lag (ARDL) approach test and the associated Error Correction Model (ECM) and the second is the ap-

plication of the Granger causality test to determine the direction of causality between the two variables.

3.5.1 Autoregressive Distributed Lag (ARDL) Approach

We incorporate our inflation rates and rice output relationship into the unrestricted ARDL model framework of equation (5) so as to obtain the conditional (restricted) ARDL steady-state model of the form:

$$\Delta RO_t = \alpha_0 + \sum_{i=1}^{m} \alpha_1^i \Delta RO_{t-i} + \sum_{j=0}^{n} \alpha_2^i \Delta IFR_{t-j} + \sum_{j=0}^{0} \alpha_3^i \Delta CPI_{t-j} + \sum_{j=0}^{n} \alpha_4^i \Delta GM$$
$$\alpha_8 GMS_{t-1} + \varepsilon_t \qquad (7)$$

Once a long-run association is established between the variables, the study would proceed to examine the long-run effect and the short-run dynamics using unrestricted Error Correction Model (ECM) approach. A dynamic ECM can be derived from cointegrating ARDL through a simple linear transformation. The ECM gives the short run coefficient without losing the long run information. It helps to reconcile the short-run error and establish a long-run equilibrium relationship between the variables which are more suitable for this study. Using the ECM proposed by Inder (1993) which is in-line with our study, we specify our model as follows:

$$\Delta RO_t = \alpha_0 + \sum_{i=1}^{m} \alpha_1^i \Delta RO_{t-i} + \sum_{j=0}^{n} \alpha_2^i \Delta IFR_{t-j} + \sum_{j=0}^{n} \alpha_3^i \Delta CPI_{t-j} + \sum_{j=0}^{n} \alpha_4^i \Delta GMS_{t-j} + \delta ECT_{t-1} + \varepsilon_t \qquad (8)$$

Where; δ is the speed of adjustment parameter; ECT_{t-1} (which is the lagged Error Correction Term) is the residual obtained from the long run estima-

estimation. The coefficient (δ) is expected to be less than one, negative and statistically significant. The negative sign of the ECT_{t-1} term indicates long-run convergence of the model to equilibrium; as well as explaining the proportion and the time it takes for the disequilibrium to be corrected in order to return the disturbed system to equilibrium. The magnitude of the coefficient measures the speed of adjustment.

3.5.2 Granger-Causality Test

After the testing of the co-integration relationship, we test for causality between rice output and inflation rates in Nigeria. If the two variables are co-integrated, an error correction term (ECT) is required to be included (Granger, 1969) in the following bi-variate auto-regression:

$$RO_t = \beta_0 + \sum_{t=1}^{n} \beta_{1t} RO_{t-1} + \sum_{t-1}^{m} \beta_{2t} IFR_{t-1} + \varepsilon_t \quad (9)$$

$$IFR_t = \varphi_0 + \sum_{t=1}^{0} \varphi_{1t} IFR_{t-1} + \sum_{t-1}^{p} \varphi_{2t} RO_{t-1} + \varepsilon_t \quad (10)$$

Where:

RO   =   Rice outputs at time, t.

IFR_t =   is the inflation rate at time, t.

Thus, the following hypotheses are testable for equations (9) and (10):

The null hypothesis is given as:
$$H_0 : \sum_{j=1}^{p} A_{ni}^{j} = 0$$

This implies that inflation rates do not granger cause rice output;

While the alternative hypothesis is:

$$H_1 : \sum_{j=1}^{p} A_{ni}^{j} \neq 0$$; which implies that inflation rates granger cause rice output. Thus, the rejection of the null hypothesis in each case implies causality, and to determine the direction of causality, the F-test statistics would be used.

3.6   Justification of the Model

The justification for the use of ARDL and Granger causality approaches are:

The endogeneity problems and inability to test hypotheses on the limited coefficients in the long run are avoided. That is it has superior statistical properties in small samples as it is relatively more efficient in small sample data sizes found mostly in studies on developing countries.

The long run and short run parameters of the model are estimated simultaneously.

It can be applied irrespective of whether the variables in the model are endogenous.

The econometric methodology is relieved of the burden of establishing the order of integration among the variables and of pre-testing of unit roots.

Applying ARDL is helpful in data generating process through taking enough lags general-to-specific modelling framework.

4.1 Data Presentation

This section shows the data used for the empirical analysis. These data were adequately sourced from CBN statistical bulletin. The data used are data on Inflation Rates, Growth in Money Supply, Consumer Price Index and Rice Outputs at Current Basic Prices (N' Million); for the periods 1986 to 2016.

4.2 Data Analysis and Results

For examining of estimation technique among the study variables, pre-estimation test was conducted.

4.2.1 Unit Root Test Result

Augmented Dickey-Fuller (ADF) test was used to ascertain whether the four variables of the study exhibit unit root property. This is to find out if the relationship between economic variables is spurious. Thus, in this section, the analyses continue with a test of unit root to avoid "spurious" or "nonsense" regression results. The result of unit root test is presented in Table 1 below.

Table 1: Summary of ADF Unit Root Test Results

Variables	ADF-statistics	Critical Values	Order of integration
RO	-7.790918	-4.356068*	I(0)
IFR	-5.819927	-4.374307*	I(0)
CPI	-3.645969	-3.574244**	I(1)
GMS	-4.29157	-3.595026**	I(0)

Note: * and **indicate significant at 1% and 5% levels respectively
Source: Authors computations (2018), using Eviews-9

From Table 4.2, the traditional test of the ADF in-dicates that three of the variables tend to be stationary at levels and they are RO, IFR and GMS. Their ADF test statistics values of -7.790918, -5.819927 and -4.29157are greater than their critical values of -4.356068, -4.374307 and -3.595026 in absolute term at 1%, 1% and 5% levels respectively. However, CPI was found stationary at first difference (that is at order I(1)) and 5 percent. Therefore, all the variables were found to be stationary at different orders (a mixture of I(1) and I(0) and thus that the bounds testing co-integration approach.

4.2.2 Co-integration Test Result

Having established the order of integration, the next task of the study is to establish long run relationship among the variables. Economically, variables are co-integrated if they have a long term, or equilibrium relationship between them. Thereafter, the bounds testing approach is used to determine whether a long-run co-integration relationship exists between inflation rate variables and rice output. The result of the co-integration test is presented in Table 2.

Table 2: Bounds Test Co-integration Result

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	15.28175	10%	2.2	3.09
K	3	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

computations (2018), using Eviews-9

The co-integration test result shows that the F-statistic value of 15.28 is greater than the lower (I(0)) and upper bound (I(1)) critical value at the 5% significance level. Thus, the null hypothesis of no long-run relationship is rejected at the 5% significance level. It can therefore be inferred that the variables are co-integrated. Thus, there is a long-run co-integrating relationship between inflation rates and rice output.

4.2.3 Estimation of Results and Test of Hypothesis

This section deals with model estimation and interpretation. The ECM results are presented in table 3 as follows:

Table 3: Error Correction Regression

Dependent Variable: RO
Method: ARDL

Variable	Coefficient	Std. Error	t-value	Prob.*
RO(-1)	0.938141	0.064826	14.47167	0.0000
INF	-0.743616	0.151493	-4.908579	0.0008
CPI	48.93881	21.29281	2.298373	0.0302
GMS	3.726180	5.882614	0.633422	0.5322
C	-82.94511	36.85304	-2.250699	0.0334
ECT(-1)*	-0.061859	0.005660	-10.92933	0.0000

R-squared	0.695716	Mean dependent var	5523.550
Adjusted R-squared	0.595030	S.D. dependent var	6110.215
S.E. of regression	430.7593	Akaike info criterion	15.11999
Sum squared resid	4638839.	Schwarz criterion	15.35352
Log likelihood	-221.7998	Hannan-Quinn criter.	15.19470
F-statistic	14.52503	Durbin-Watson stat	1.981684
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection

Source: Authors Computation, 2018 (Eviews-9)

As expected, the lagged error correction term is negative, less than unity and statistically significant at 5 percent. The coefficient of (-0.061) revealed that once there is disequilibrium in the system, it takes an average (high) speed of 6.1% to adjust itself back towards long-run equilibrium level.

The R^2 (R-square) value of 0.6957 shows that inflation rate- rice output model have a good fit. It indicates

that about 69.57 per cent of the variation in rice output is explained by inflation rate variables, while the remaining unaccounted variation of 30.43 percent is captured by the error term.

Durbin Watson (DW) statistic was used to test for the presence of serial correlation or autocorrelation among the error terms. The acceptable Durbin – Watson range is between 1.5 and 2.5. The model also indicates that there is no autocorrelation among the variables as indicated by Durbin Watson (DW) statistic of 1.98. This shows that the estimates are unbiased and can be relied upon for managerial decisions.

Test of Hypotheses One:

H_{01}: Inflation rate has no significant impact on access to rice farmers output in Nigeria.

From regression result in Table 6, the calculated t-value for the relationship between inflation rates and rice outputs in Nigeria is -4.90 and the p-value computed is 0.0008 at 95% confidence levels. Since the p-value is less than 0.05 used as the level of significance, we reject the null hypothesis (**H_{01}**) and conclude that inflation rate has a significant impact on rice farmers output in Nigeria

Granger Causality Test Results

Test of Hypotheses Two:

H_{02}: There is no causal link between inflation rate and rice output in Nigeria.

The criteria for granger causality between variables are determined by the probability value. If the P-value of the variables is less than 5% level of significance, then there is granger causality or bi-directional relationship between the variables and vice-versa. The Granger Causality/Block Exogeneity Wald Tests results are presented below in table 4 to 5 for the variables

Table 4 Granger Causality on RO and the other Variables

Dependent variable: RO			
Excluded	Chi-sq	Df	Prob.Value
INF	0.67367	2	0.0041
CPI	1.56348	2	0.0076
GMS	2.61788	2	0.0001
All	7.84421	6	0.0097

Source: Authors Computation, 2018 (Eviews-10)

At a 5% level of significance, the augmented Granger causality test result (in Table 4.5.1) reveals that all the inflation rate variables in the model does jointly have a causal impact on rice output. The results showed that INF, CPI and GMS Granger-cause rice output. This was captured by the RO equation which has a chi square (χ^2) value of 7.844 with a probability value of 0.0097 (P.V V 0.05), which suggest acceptance of the null hypothesis (**H_0**) that there is a causal link between inflation rate and rice output in Nigeria. Thus, the causality results showed that there is a causal relationship between inflation rates and rice output.

Next is to determine the causality between INF and the other variables. the result is presented in table 5 below.

Table 5 Granger Causality on INF and the other Variables

Dependent variable: INF			
Excluded	Chi-sq	Df	Prob.
RO	6.28314	2	0.0432
CPI	7.76453	2	0.0206
GMS	3.71535	2	0.156
All	14.9716	6	0.0205

Source: Authors Computation, 2018 (Eviews-10)

However, there is no evidence of feedback, which means that RO does not Granger-cause inflation rates as RO was not significant at the 5% level. Considering the other variables of inflation the causality results are presented below.

Table 6 Granger Causality on CPI and the other Variables

Dependent variable: CPI			
Excluded	Chi-sq	Df	Prob.
RO	2.63106	2	0.2683
INF	0.13178	2	0.9362
GMS	4.95942	2	0.0838
All	8.74236	6	0.1886

Source: Authors Computation, 2018 (Eviews-10)

Similarly the causality result of CPI and the other variables indicate that no feedback between inflation and rice output. Thus, rice output does not Granger cause inflation rates as RO was not significant at the 5% level. The last variable of inflation is GMS. The causality result between GMI and the other variables is also presented in table 7 below

Table 7 Granger Causality on GMS and the other Variables

Dependent variable: GMS			
Excluded	Chi-sq	Df	Prob.
RO	0.15322	2	0.9263
INF	2.40143	2	0.3011
CPI	1.17408	2	0.556
All	6.72094	6	0.3474

It is clearly shows that in any of the models with inflation rates variables as the dependent variable there is no evidence of feedback, which means that RO does not Granger-cause inflation rates as RO was not significant at the 5% level.

4.2.4 Post- Estimation Diagnostics Tests

Serial correlation

Serial LM test: More so, the estimated ECM regression model is free of serial correlation going by the result of the serial LM test.

Table 8: Breusch-Godfrey Serial Correlation LM Test

F-statistic	2.102918	Prob. F(2,3)	0.2686
Obs*R-squared	15.75911	Prob. Chi-Square(2)	0.0004

Source: Authors Computation, 2018 (Eviews-9)

From Table 4.5, the Prob. Chi-square gave 0.2686, and it's greater than 0.05; thus we accept the null hypothesis that there is no serial correlation among the variables used in the model.

Heteroscedasticity Test

The regression model is homoscedastic (that is constant variance) as shown in Table 4.6 below:

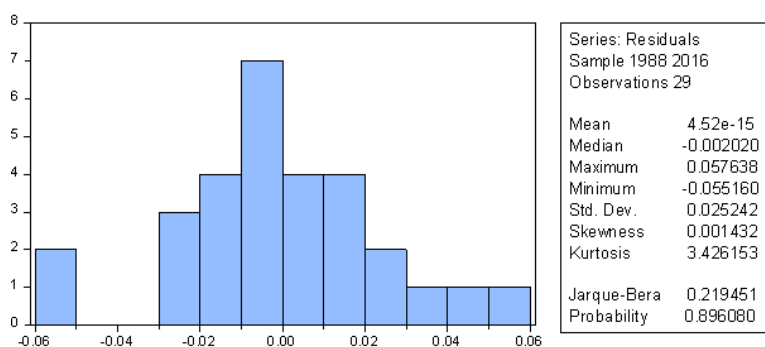### Table 9: Heteroscedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.491901	Prob. F(21,5)	0.8847
Obs*R-squared	18.19369	Prob. Chi-Square(21)	0.6367
Scaled explained SS	0.828208	Prob. Chi-Square(21)	0.2222

Source: Authors Computation, 2018 (Eviews-9)

From Table 9, the Prob. F-value gave 0.8847 and it's greater than 0.05; thus, we accept the null hypothesis that there is no heteroscedsticity among the variables used in the model

Normal Distribution Test

The normal distribution result shows the properties of the residuals. It is a test for normality distribution assumption of the error term. Notably, the Jarque-Bera statistics is a test which shows whether the residual from our equation violates the normality assumption of the OLS technique.

Series: Residuals	
Sample 1988 2016	
Observations	29
Mean	4.52e-15
Median	-0.002020
Maximum	0.057638
Minimum	-0.055160
Std. Dev.	0.025242
Skewness	0.001432
Kurtosis	3.426153
Jarque-Bera	0.219451
Probability	0.896080

4.3 Discussion of Findings

Findings from the study revealed that inflation rates have a negative and significant impact on access to rice farmer's outputs in Nigeria. Hence, we accept the alternate hypothesis which states that inflation rate has significant impact on rice output in Nigeria. The constant rise in the

cost of production, coupled with imported inflation has had a detrimental effect of rice production level in Nigeria as a whole. This is in-line with Quartey, (2010) which found that there is a negative impact of inflation on growth. He further established that the rate of inflation that is growth maximizing is not a single digit one.

In addition, consumer price index was found to have a negative but significant impact on rice output in Nigeria. The negative implication stems from consistent increase in domestic price level due to huge fiscal deficits activities of the government.

More so, the findings from the study revealed that money supply has a positive and significant effect on rice output in Nigeria. The result suggests that variation in output levels is mainly caused by money supply and with which by implication inflation in Nigeria is to a great extent a monetary phenomenon. This is in agreement with Omoke (2010) findings support the context of the money-price-output hypothesis for Nigerian economy.

The result revealed that inflation has a strong causal effect on the real output as well as prices. Therefore, based on empirical result the alternate hypothesis was accepted. Money supply also was seen to Granger-cause output.

Lastly, findings from the study showed that there is a causal relationship between inflation rates and rice output in Nigeria.

However, there is no evidence of feedback, which means that RO does not Granger-cause inflation rate in Nigeria. The implication of the result is that inflationary trend in the country has an influence on rice output productions. It thus implies that higher inflation rates, directly affects the outcome of rice output in Nigeria negatively.

Summary of Major Findings

Inflation is one of the major macroeconomic problems that confront the rice output in Nigerian economy today and inspite of attempts by the government to control this menace using the traditional monetary and fiscal policies; it has not provided a long-lasting solution. The study hence examined impact of inflation rates on rice outputs in Nigeria between 1986 and 2016. Below is the summary of findings from the study:

The bound test (co-integration) result showed long-run equilibrium relationship exists between inflation rates and rice output in Nigeria during the scope of the study.

In addition, Inflation rate was found to have a negative and significant impact on the access to farmer's rice outputs in Nigeria.

Moreover, consumer price index was found to have a positive and significant impact on farmer's rice output in Nigeria.

The findings from the study also revealed that money supply has a positive and significant effect on rice output in Nigeria.

Lastly, all the Granger causality findings from the study revealed that there is a causal relationship between inflation rates and rice output. Even though there is no evidence of feedback, which means that rice output (RO) does not Granger-cause inflation rate in Nigeria.

5.2   Conclusion

This study found out that an increase in the general price level (inflation) has been detrimental to sustainable growth in rice output productions in Nigeria. These results have important policy implications for both domestic policy makers and development partners, implying that controlling inflation is a necessary condition for promoting output growth in general. Thus, policy makers should focus on maintaining inflation at a low rate (single digit). Stability in inflation rate is an important factor as the results from the findings indicated that about 59.50 percent of the variations in rice output have been explained by inflation. This could imply any fluctuation in country's general price level has a significant impact on rice output. In this regard the study concluded that all factors which cause an increase in the general price levels such as energy crisis, price index fluctuations, exchange rates volatility, increase in money supply, poor agricultural production and so forth should be addressed with the appropriate policies so as to foster rice output growth in Nigeria.

5.3   Recommendations

Based on the findings, the following recommendations are suggested:

i.   The Central Bank of Nigeria should improve on its monetary policy by ensuring that there is a reduction in money supply. Also, the government should reduce its expenditure especially on current expenditure so as to control the inflation rate. Both the government and the Central Bank of Nigeria should ensure that the inflation rate is maintained at a single digit level.

ii. Government should place a high premium of control on money supply since it has a significant link with inflation in the economy-such as Nigeria. In this regard, the monetary authority can think of an alternative way by working on the expectations channel to reduce inflation. This requires credibility of the monetary authority in following through its monetary program as communicated in advance to the stakeholders.

iii. The government should stabilize the quantity of rice produced in the country, at a point in which the price of rice will favour both the consumers and producers.

iv. More effort should be given to production of rice considering its relevance to food security and the rising population of the country and efforts should be placed to counter the excessive rise in price.

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