



MACROECONOMIC POLICY MANAGEMENT FOR SUSTAINABLE FOOD SECURITY OUTCOME IN NIGERIA

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ABSTRACT: *The study analyzed the effect of monetary and fiscal policies on food production index an indicator of food security from 1985 to 2016. The results of the study showed that government expenditure on agriculture and exchange rate were stationary at level while food production index, inflation rate and interest rate were stationary at first difference; there was a single cointegrating equation showing that there was a long run relationship among variables. The result of the vector error correction model (VECM) revealed that in the short run, only government expenditure positively affected food production index significantly. In the long run government expenditure on agriculture, inflation rate and interest rate at negatively affected food production index and exchange rate positively affected food production index. It was therefore recommended that government budget allocation to agriculture should meet up with the Maputo agreement to ensure the necessary increase of food production.*

KEYWORDS: Food Security, Policy, Inflation Rate, Interest Rate, Exchange Rate, Nigeria

INTRODUCTION

There are different definitions of food security developed by different sources. The World Bank report on poverty and hunger defines food security as access by all people at all times to enough food for an active and healthy life (World Bank, 1996). According to the definition of the Food and Agriculture Organization (FAO), food security is a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. This involves four dimensions: adequacy of food supply or availability; stability of supply, without seasonal fluctuations or shortages; accessibility to food or affordability; and utilization, quality and safety of food (Applanaidu, Bakar & Baharudin, 2014). There are four types of food security indicators, namely: average dietary energy supply adequacy; average value of food production; average protein supply; and share of dietary energy supply derived from cereals, roots and tubers. For the purpose of this study, average value of food production was used and was proxied as food production index.

Asides the country's rapid annual population growth rate, other issues are equally accountable for Nigeria's emergent food insecurity amongst which is decades of bad policies in the agricultural sector, prominent among which are lack of infrastructural development,



lack of incentives such as loan for farmers and undercapitalization of the sector which has accounted for poor performance of the sector thus fueling food insecurity in Nigeria. Attainment of food security is imperative in any country. This is why all developed and developing countries make considerable efforts to increase their food production capacity. It should be noted that availability of food alone does not seem sufficient to explain the attainment of food security in a country. Food can be available in a country because of effective agricultural policy; good harvest in a particular year or massive importation of food; or food handout (aid) (Ojo & Adebayo, 2012).

Monetary and fiscal policies play a key role in the promotion of the main government objective of promoting the welfare of citizens. Monetary policy constitutes the major policy thrust of the government in the realization of various macroeconomic objectives (Ogar *et al.*, 2014)). Fiscal policy is considered an important variable which may determine changes in national income in developing countries like Nigeria (Abdurrauf, 2015). According to Abata *et al.* (2012), the objectives of fiscal and monetary policies in Nigeria are wide ranging. These include increase in gross domestic product growth rate, reduction in the rates of inflation and unemployment, improvement in the balance of payments, accumulation of financial savings and external reserves as well as stability in naira exchange rate. The policy as well as instruments applied to attain these objectives however have been until recently been far from adequate as undue reliance has been placed on fiscal policy rather than monetary policy in Nigeria. Public expenditure policy is one of the most important instruments of public sector policy. Public expenditure is the government spending from revenue derived from tax and other revenue. The agricultural sector is due to its relevance in the provision of raw materials for industries and most importantly the provision of food for the teeming Nigerian population and also serving as a source of foreign exchange for the economy (Adofu, Abula & Audu, 2010). Food and Agricultural organization (FAO) recommended that 25 percent of government capital budget allocation be assigned to the agricultural development capital budget. In Nigeria, this has not been achieved by the government, thereby affecting government programmes and policies for the sector (Iganiga & Unemhilin, 2011).

Interest rate constitutes a very important factor affecting the productivity of agriculture. A real interest rate is an interest rate that has been adjusted to remove the effects of inflation to reflect the real cost of funds to the borrower and the real yield to the lender or to an investor. Anyawu *et al.* (2010) observed that one of the purposes of the policies of agricultural credit over the years was the provision adequate credit to the agricultural players at an affordable cost and at the right time. Inflation is undeniably one of the most leading and dynamic macroeconomic issues confronting most economies of the world as its effects penetrate more deeply into nation's life due to prevailing increase in prices (Olatunji *et al.*, 2010). The rate-of-exchange policy influences prices paid domestically to producers of export goods. For the rest of the world what counts are prices expressed in foreign currency.

The development of agricultural policy in Nigeria for some years back has been based on the understanding that agriculture is the only panacea to the achievement of an inclusive growth due to its inward linkages. Hence, the focus of the agricultural development efforts has been to improve and sustain the sector to play this assigned role with special emphasis on the attainment of a sustainable level in the production of basic food (Fan *et al.*, 2008). Though some policies adopted by government showed positive impact on food production, the positive effects later turned out to be insignificant. Many investigations have found that



persistent rise in prices discourages investment in crops production, reduce agricultural output and consequently the objective of food security becomes threatened. In view of the above, the study aims at to analyze the effect of fiscal and monetary policies on food security outcome in Nigeria

LITERATURE REVIEW

In Ilaboya *et al.*, (2012) view, the panacea for food security lies in improving agricultural productivity; enhancing science and technology; building farmers capacity; facilitating access to the market; and good governance amongst others. Climatic changes have varying effects on agriculture and, therefore, food security. Higher temperatures result in decreased agricultural productivity and production, high evaporation rates, reduced soil moisture and lowering of the groundwater table and shrinking of surface water. Heat stress reduces leads to rapid deterioration and wastage of farm produce. Applanaidu, Bakar & Baharudin in their attempt to analyse the dynamic relationship between selected macroeconomic variables and food security in Malaysia using VAR approach found that biodiesel production, exchange rate, food price index, GDP, government development expenditure on rural development and population accounted for variation in food security. Biodiesel production, exchange rate and government expenditure on rural development will give the highest shock to food security in year the long run whereas; exchange rate and population in will give the highest shock in the short run. Oke (2015) examining the determinants of national food security in Nigeria concluded that the determinants of food security actually captured using the agriculture gross domestic product, per capita income, food import, food export and population all proved to be determinants because they all had effects on food prices relative to food security.

Empirically investigating the impact of macroeconomic policies on agricultural output by Muftaudeen & Hussainatu, (2014), the study found a significant variation in Nigeria's agricultural food output to be due to changes in exchange rate and government expenditure movements. The result also indicated that price instability as a result of inflation rate had a negative impact on agricultural output implying that increase in inflation raised the nominal price of agricultural inputs through its multiplier effects thereby discouraging agricultural investment for increased food production (Muftaudeen & Hussainatu, 2014). In the study by Oyinbo & Rekwot (2014) to investigate the links existing between inflationary trend, agricultural productivity and economic growth in Nigeria, their results indicated a unidirectional causality from inflationary trend to agricultural productivity. Ali *et al.*, (2017) examined the effect of interest rates on access to agro-credit by farmers in Kaduna State, Nigeria. Interest rate, credit awareness and farm income were determinants of credit sourced by the farmers in the study area. the lower the interest rate charged by financial institutions, the higher the volume of credit sourced by farmers and vice versa. Ukpe (2016) evaluated the effects of access to microcredit on the food security status of crop farm households in the Niger Delta. Interest rate had a negative and significant influence on access to microcredit. Ezeanyejji (2014) result for assessing the impacts of interest rate deregulation in enhancing agricultural productivity in Nigeria showed that interest rate deregulation had significant and positive impact on agricultural productivity in Nigeria within the period under review.



METHODOLOGY

Study Area

The study was carried out in Nigeria located in the western part of Africa in the Gulf of Guinea which lies between longitudes 3° and 14° East and latitudes 4° and 14° North, has a land mass of 923,768 sq.km and known for her agro-ecological resources and diversity, capable of producing different types of nutritious and sustainable food throughout the year.

Method of Data Collection

Secondary data consisting of annual time series covering a period of 32 years (195-2016) was used for the study. Particularly, data on the values of food production index, inflation rate, interest rate, government expenditure on agriculture and exchange rate were obtained from World Bank development indicator data base, Central Bank of Nigeria statistical Bulletin, World Factfish and National Bureau of Statistics.

Data Analysis Techniques

Augmented Dickey Fuller test (ADF) was used for stationary test of variables. Johansen cointegration test was used to test the existence of the long run relationship, vector error correction model (VECM) model was used to analyze long and short run effects of determinants of food importation, variance decomposition was used to examine contribution of variables affecting food importation and impulse response was used to examine the response of food importation to unit shock of each variables affecting food importation.

Models Specification:

Augmented Dickey-Fuller test (ADF)

Following Oyinbo & Rekwot (2014) the Augmented Dickey Fuller (ADF) model with the constant term and trend was specified as

$$\Delta Y_t = \alpha_0 + \alpha_1 t + \beta Y_{t-1} + \sum_{i=1}^p \delta_i \Delta Y_{t-i} + \varepsilon_t \quad \text{---- (1)}$$

Where:

Y is the value of the variable of interest (food production index, exchange rate, inflation rate government expenditure on agriculture and interest rate), α_0 is the constant, α_1 is the coefficient of the trend series, p is the lag order of the autoregressive process, Y_{t-1} is lagged value of order one of Y_{t-1} and ε_t is the error term.

Johansen Cointegration Test

A linear combination of two or more $I(1)$ series may be stationary or $I(0)$, in which case the series are co-integrated. The null hypothesis for the Johansen Co-integration test ($H_0: r = 0$) implies that co-integration does not exist, while the alternative hypothesis ($H_1: r > 0$) implies that it does. If the null for non-co-integration is rejected, the lagged residual from the co-



integrating regression is imposed as the error correction term in a Vector Error Correction Model (VECM) given below as:

$$\nabla Y_t = \Pi Y_{t-1} + \sum_{i=1}^{k-1} \tau_i \nabla Y_{t-1} + u + \varepsilon_t \text{ ----- (2)}$$

Where:

∇Y_t = First difference of a $(n \times i)$ vector of the n variables of interest,

Π = $(n \times n)$ Coefficient matrix associated with lagged values of the endogenous dependent variables, Y_{t-1} = Lagged values of Y_t , $\tau = (n \times (k - 1))$ Matrix of short-term coefficients,

$u = (n \times 1)$ Vector of constant and $\varepsilon_t = (n \times 1)$ Vector of White Noise Residuals

Vector Error Correction Model (VECM)

$$\nabla \ln FPI_{t-i} = a_0 + \sum_{i=1}^p a_1 \nabla \ln GEXPA_{t-i} + \sum_{i=1}^p a_2 \nabla \ln EXCH_{t-i} + \sum_{i=1}^p a_3 \nabla \ln INF_{t-i} + \sum_{i=1}^p a_4 \nabla \ln INT_{t-i} + ECM_{t-i} + \varepsilon_t \text{ ----- (3)}$$

Where:

FPI_{t-i} = Food production index, $GEXPA_{t-i}$ = Government expenditure on Agriculture (₦), $EXCH_{t-i}$ = (Parity between ₦ to US Dollar), INF_{t-i} = Inflation rate, INT_{t-i} = Interest rate, Ln = Natural Logarithm, ECM_{t-i} = error correction model, ε_t = error term and

∇ = difference operator

RESULTS

Table 1: Unit Root Test (ADF TEST)

Variables	ADF Results				Decision
	At level		At First difference		
	t-statistic	probability	t-statistic	probability	I(1)
FPI_{t-1}	-0.842340	0.3426	-9.212891	0.0000***	I(1)
$GEXPA_{t-1}$	-2.436748	0.0167**	-5.941655	0.0000***	I(1)
$EXCH_{t-1}$	-2.215823	0.0279**	-3.593848	0.0008***	I(1)
INF_{t-1}	-0.447471	0.5121	-6.055269	0.0000***	I(1)
INT_{t-1}	-0.384675	0.5356	-4.357985	0.0001***	I(1)

*** and ** indicate stationary at 1% and 5% levels of significance respectively

Source: Data analysis, 2018

**Table 2: Cointegration Rank Test Based on Trace Statistics**

Hypothesised No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob**
None *	0.841989	102.8216	69.81889	0.0000
At most 1	0.561271	47.46886	47.85613	0.0543
At most 2	0.348668	22.75269	29.79707	0.2584
At most 3	0.221606	9.890600	15.49471	0.2892
At most 4	0.076112	2.374935	3.841466	0.1233

Max-eigen value test indicates 1 cointegrating eqn(s) at the 0.05 level

** denotes rejection of the hypothesis at the 0.05 level*

***MacKinnon-Haug-Michelis (1999) p-values*

Source: Data analysis, 2018

Table 3: Estimated Long Run Coefficients

Variables	Coefficient	t-statistics
LNGEXPA(-1)	-5.774478***	-7.98590
LNINF(-1)	-5.640669***	-8.12229
LNINT(-1)	-1.254262**	-2.15669
LNEXCH(-1)	3.902457***	4.51988
C	132.0213	

****, ** are significant at 1% and 5% respectively*

Source: Data analysis, 2018

Table 4: Estimated Short Run Coefficients

Error Correction:	D(LNFPI)	D(LNGEXPA)	D(LNINF)	D(LNINT)	D(LNEXCH)
D(LNFPI(-1))	-0.549571*** [-2.68856]	-0.055734 [-0.21777]	-0.066989 [-0.31118]	0.124260 [0.26107]	0.074799 [0.73964]
D(LNGEXPA(-1))	0.136632 [0.69516]	-0.040747 [-0.16558]	0.466211 [2.25227]	0.343176 [0.74986]	-0.211030** [-2.17020]
D(LNINF(-1))	0.071079 [0.38185]	0.049667 [0.21311]	0.379230 [1.93446]	0.879393 [2.02891]	-0.077510 [-0.84166]
D(LNINT(-1))	-0.059095 [-0.80735]	0.023468 [0.25608]	0.056789 [0.73670]	-0.487840*** [-2.86236]	-0.022382 [-0.61808]
D(LNEXCH(-1))	0.075737 [0.21043]	0.299978 [0.66567]	0.883324 [2.33033]	-0.440055 [-0.52508]	-0.102509 [-0.57567]
C	-0.029848 [-0.23523]	-0.124994 [-0.78677]	0.230246 [1.72296]	-0.048005 [-0.16248]	-0.231817 [-3.69272]
R-squared	0.679947	0.580596	0.580575	0.597842	0.574266
Adj. R-squared	0.472854	0.309217	0.309182	0.337623	0.298792
F-statistic	3.283296	2.139427	2.139240	2.297453	2.084643

**** is significant at 1%. Values on brackets are t-values*

Source: Data analysis, 2018

**Table 5: Variance decomposition Analysis**

Period	LNFPFI	LNGEPA	LNINF	LNINT	LNEXCH
5	68.87718	7.942851	6.190508	11.46085	5.528609
15	43.21802	38.02767	5.580111	7.375654	5.798546

Source: Data analysis, 2018

DISCUSSION

Stationarity Test

The result in Table 1 presents the summary of unit root tests conducted under the Augmented Dickey-Fuller (ADF) at level and first difference. The result indicates that government expenditure on agriculture (GEXPA) and exchange rate (EXCH) were stationary at level while food production index (FPI), inflation rate (INF) and interest rate (INT) were not stationary at level but were stationary at first difference at 1% level of significance respectively.

Johansen Cointegration Test

The unrestricted cointegration test is based on the Max-Eigen Statistic at 5% level of significance. Table 2 shows that Max-Eigen Statistic value (102.82) is greater than the critical value (69.82) implying the presence of cointegration which indicates the long run relationship among variables. But in the subsequent cointegration equation, critical values are greater than the Max-Eigen Statistic implying the rejection of the null hypothesis that there is cointegration. Max-Eigen value test indicates one (1) cointegrating equations at 5% level of significance

Determinants of Food Production Index in the Long Run

The result of the determinants of food production index in the long run is presented in Table 3. The result shows that government expenditure on agriculture in the previous year, inflation rate in the previous year, interest rate in the previous year and exchange rate in the previous year significantly affected food production index. Specifically, the coefficients of government expenditure on agriculture (-5.77), inflation rate (-5.64) and interest rate (-1.25) were negative and significant at 1 percent and 5 percent respectively indicating that a unit increase in government expenditure on agriculture, inflation rate and interest rate decreased food production index by 5.77, 5.64 and 1.25 respectively in the long run. This could be due to the fact that increase in government expenditure on agriculture fall short of the Maputo resolution that government of member states of African Union (AU) allocate at least 10 percent of national budgeting resources to agriculture for the implementation of the comprehensive Africa Agricultural Development programme (CAADP) which Nigeria is a signatory. This result disagrees with that of Iganiga & Unemhilin (2011) who found that the variable of one-year period lag of federal capital agricultural expenditure on agricultural output found to be significant at 5 percent significance level is positively related to agricultural output.

Similarly, increase in inflation rate affected the prices of both consumable and non-consumable farm inputs by increasing the prices of these inputs above the purchasing power



of farmers. This suggests that the control measures for inflation control are not sustainable. This result agrees with that of Oyinbo & Rekwot (2014) who implied that that inflation rate proxied by the trend of inflation was significant in influencing agricultural productivity over the study period. The observed influence of inflationary trend on agricultural production was attributed to the persistent rise in the cost of farm inputs over the years leading to an increase in the cost of agricultural production activities. High interest rate reduced food production index as a result of farmers not being able to access agro-credits and other loans from banks and other lending agencies because the higher the interest rate, the lower the probability of farmers accessing credit, this will therefore reduce the financial capital necessary and required by farmers to increase and improve agricultural production. This result is in line with theoretical expectation meaning that, as interest rate increases, agricultural output will decrease, *ceteris paribus*, it is also in concordance with Udoka, Mbat & Duke (2016) who found that the relationship between interest rate and the Nigerian agricultural output was negative by the negative sign of its coefficient. It disagrees with Adofu, Abula & Audu (2010) who found that there is a positive relationship between interest rate deregulation and agricultural production. The result further disagrees with the result of Ezeanyej (2014) who found that there is insignificant contribution of exchange rate system to agricultural productivity.

In contrast, the coefficients of exchange rate in the previous year (3.9) is positive and significant at 1 percent indicating that a unit increase of exchange rate in the previous year increased food production index by 3.9 in the long run. This could be due to the high cost associated with importation which discouraged food importation and farmers thereby seizing the opportunity and the advantage to cultivate more land area which will further increase agricultural production and in essence food production index. This result agrees with the findings of Adofu, Abula & Audu (2010) who found that there is a positive relationship between exchange rate deregulation and agricultural production in Nigeria between the period under review

Determinants of Food Production Index in the Short Run

The result of the short run estimates of determinants of food production index is presented in Table 4. The result shows that the coefficient of determination (R^2) is 0.679 indicating that 68% of the variation of food production index in the short run is explained by food production index in the previous year, government expenditure on agriculture in the previous year, exchange rate in the previous year, interest rate in the previous year and inflation in the previous year. The result further showed that food production index in the previous year is the variable that significantly affected food production index in the short run. Specifically, the coefficients of food production index (-0.55) in the previous year was negative and significant at 1 percent indicating that a unit increase of food production index in the previous year decreased food production index by 0.55 in the short run. This could be due to the fact that farmers reduced farming activities that results into increased food production because of the bountiful harvest recorded in the previous year. This result disagrees with the findings of Okpara (2017) and Idoko & jatto (2018) who found that increase in government expenditure on agriculture increased economic growth in Nigeria. However, the coefficients of inflation rate, interest rate and exchange rate were not significant. Therefore, they have no significant effect on food production index in the short run.



Variance decomposition Analysis

The variance decomposition of food production index (FPI) showed that, in Nigeria, food production index (FPI) contributed to itself about 68.88% in the short run and about 43.22% in the long run period. government expenditure on agriculture (GEXPA), inflation rate (INF), interest rate (INT) and exchange rate (EXCH) accounted for 7.94%; 6.19%; 11.46% and 5.53% respectively in the short run to food production index. In the long run government expenditure on agriculture (GEXPA), inflation rate (INF), interest rate (INT) and exchange rate (EXCH) accounted for 38.03%; 5.58%; 7.38% and 5.80% respectively to food production index. This implies that among the variables used government expenditure on agriculture is the most contributing factor to food production index in both long and short run.

Implication to Research and Practice

Among the variables used government expenditure on agriculture is the most contributing factor to food production index in both long and short run. This implies that government allocation to agriculture has to be increased and ensured to be channeled appropriately to optimize food production index hence food security.

CONCLUSION

Food production index and by implication food security is a major concern of the government. Government expenditure on agriculture and exchange rate were stationary at level while food production index, inflation rate and interest rate were stationary at first difference. There was a single cointegrating equation showing that there was a long run relationship among variables. The result of the vector error correction model (VECM) revealed that in the short run, only government expenditure positively affected food production index significantly. In the long run government expenditure on agriculture, inflation rate and interest rate negatively affected food production index and exchange rate positively affected food production index.

The following were recommended based on the findings of the study:

- Government budget allocation to agriculture should meet up with the Maputo agreement, to ensure the necessary increase of food production;
- Interest rate should be regulated by the apex bank.

Future Research

Microeconomic policy management for sustainable food security outcome in Nigeria is hereby suggested for further research.



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