Does International Oil Price Volatility Complement Domestic Food Price Instability in Nigeria? An Empirical Enquiry

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Abstract

Of recent, there has been growing global concern over oil price fluctuation and soaring food prices. In this disquisition, we re-examine the co-movement and the causality relationship between international oil price fluctuations and domestic food price inflation in Nigeria, using data for the period 1970 to 2008. The empirical results provide clear evidence in support of a causal relationship between oil price distortions and food price instability in Nigeria. The Granger causality test show that causality runs from international oil price to domestic food price, and not vice versa. In this wise, the paper recommends that food price instability in Nigeria may be addressed by eliminating domestic and external bottlenecks which tend to undermine food supply in the country despite the abundant fertile land and conducive climatic conditions. These could be achieved through the judicious utilization of oil windfall revenue.

1. Introduction

Recently, there has been growing global concern over energy and food prices. A combination of record high oil and food prices has been a destabilizing element for the global economy because of their potential growth, inflation and distributional effects. In terms of their impact on income distribution, inflation and poverty, high food prices are of greater and more immediate concern than high energy prices. The accompanying uncertainty, distortions and erosion of purchasing power in many countries call for concerted effort both at global and national levels to relieve people from the predicament (Braun, 2007).

However, the task of crafting appropriate policy responses to the food crisis is made harder by rising oil prices and ensuing fiscal and balance of payments problems. As understood by the G8 finance ministers, the high food and energy prices pose a serious challenge to global economic stability and growth, and risk reversing years of progress in many poor countries. Developing countries are facing the surge in food and energy prices in an increasingly fragile macroeconomic environment, especially in the poorest countries.

The World Bank President, Robert Zoellick, has estimated that 33 countries could face social unrest because of higher food and energy prices. In 2008, several United Nation (UN) agencies issued warnings against impending food riots because of rapid hikes in prices of some staple food stuff such as rice, corn and wheat (Wroughton, 2008). The case of Yemen clearly demonstrates how soaring food prices can increase poverty. It is estimated that record inflation in Yemen and doubling of staple foodstuff prices increased national poverty by 6 percentage points (The World Bank, 2007).

Globally, food prices have risen due to a number of individual factors, whose combined effect has led to an upward price spiral (IMF, 2010). First, the fall in world cereal production by 3.6 percent in 2005 and 6.9 percent in 2006 due to bad weather in major producing countries. Second, low stock levels to smooth out food consumption. For instance, the ratio of world cereal ending stock in 2007/2008 to the trend world cereal utilization is estimated at 18.7 percent lowest in three decades. Many of the economic buffers that allowed countries to weather the 2003 and 2005 oil price shocks and the initial increase in food prices of 2007 have been depleted.

Third, petroleum prices and food prices are highly correlated (estimated correlation of 0.65 for Nigeria). Rapid rise in petroleum prices exerted an upwards pressure on food prices; as fertilizer prices nearly tripled and transport costs doubled over a two year period. Fourth, increased demand from bio-fuel sector. Fifth, economic growth in some large developing countries is leading to changes in diet and increased demand for food stuff. Over the last 15 years, meat consumption more than doubled in China and grew by 70 percent in Brazil and 20 percent in India. Sixth, trade policies put in place by some countries, such as export bans, have contributed to higher prices in certain cases.

The run up in oil prices was motivated initially by demand driven tightening of market balances; but later has been further fuelled by a combination of supply concerns and financial factors. Market tightening is expected to persist because of a sluggish supply response. Beginning from the last quarter of 2008 demand pressures have eased as global output growth slowed, owing largely to the global economic and financial crisis. Oil prices are likely to remain volatile, arising from low stocks, limited spare capacity, supply disruptions, and uncertainty over exploiting new reserves and the development of non-oil sources.

As a net seller of crude oil, many Nigerians today strongly believe that the nation should be free from any negative oil price shocks. However, the reality is a far cry from this expectation. Only few households seem to benefit from the oil windfall while others are subjected to further deprivation, higher food prices, higher transport costs and higher energy costs. On the other hand, there are groups of analysts who believe that the massive infrastructural development of the mid'1970s would not have been possible if not for the oil money. So much so that the debate about the economic impact of the oil windfall has now become the concern of all and no more the exclusive preserve of economists.

While the debate rages on, the present enquiry focuses on the relevance of international oil price distortions in explaining food price instability in Nigeria. The pertinent question now is; does fluctuations in oil price cause food price distortions? If it does, then food price inflation should fall with a decrease in oil price, and vice-versa. Many economists have observed an asymmetric relationship between food prices and the oil prices – that is, retail prices of food stuff tends to respond more quickly to oil price increases than when they decrease. This is described by Bacon (1991) as the "rockets and feathers" hypothesis. The question, therefore arises to whether this form of asymmetric relationship is observable in Nigeria?

The objective of this paper is to provide answers to the above questions and then investigate econometrically the nature of food price distortions in Nigeria, especially in the context of oil price volatility. In Section 2, the paper provides a review of the recent trends in food prices and agricultural policy, and also their relationship. This is followed by Section 3 in which the discussion of the theories and empirical literature provides the analytical framework for the study. Section 4 discusses the empirical methodology as well as analysis of the estimated results. The policy implications and conclusions are provided in section 5.

2. Trends in Food Production and Food Policy in Nigeria

2.1 Food Production and Price Trends

Food was relatively plenty and cheap in Nigeria immediately after political independence in 1960. But, the advent of the civil war in 1967 and its attendant consequences, coupled with increasing fortunes in oil wealth, which engendered the upsurge in rural-urban migration, robbed the subsistence agriculture of able hands, thus resulting to a decline in farming activities. Consequently, the hitherto self-sufficient nation lost her food security and resorted to food importation to complement local production. The percentage of food import in total import rose from 15.8 percent in 1980 to 19.8 percent in 1983 before falling to 17.0 percent in 1985 (Okuneye, 2002).

Output of food crops in Nigeria has been quite erratic over the past four decades. Figure 1 shows that growth rate of staple food production was negative in the 1970s, with an average annual growth of -5.51 percent per annum. A moderate recovery was recorded in the 1980s; until a peak in growth rate was achieved in 1989. Thereafter, the growth rate of staple food production fell to 6.37 percent per annum in the 1990s and up to 6.76 percent per annum between 2000 and 2006. Reported in Table 1 is the per capita output of some basic food crops in Nigeria in the period 1970-2005.

Although all the crops recorded increases in per capita output between 1970 and 2005, except for millet, the increases were dotted with seasons of decreases. For instance, per capita output of maize declined between 1975 and 1984 and during 1995-1999 period. During the early 1980s, all the food crops experienced mild decline in per capita output. The increase in the latter part of the 1980s is usually attributed to the positive impact of the Structural Adjustment Programme (SAP).

Despite the increased output recorded in some years, prices of staple food stuff remained on a steady increase over the years. One major reason for this has been the increasing speculative business of hoarding and large scale smuggling of food stuff at the period of abundance, such as harvest season, with the intention to hike prices of food at subsequent

times. The policy of creating the so-called Commodity Market and Traders' Associations to improve the market price of farm commodities is another way of cunningly hoarding of food items.

The rise in food prices in the late 1990s and 2000s seemed to coincide with the steady volatility of oil prices in the international market. As Figure 2 shows, the index of food price rose gradually between the 1970s and 1990s and accelerated subsequently. Probably, the rise in food prices must have been fuelled by increases in petroleum products which entered into production cost of food producers.

2.2 A Brief Review of Government Food and Agricultural Policies

Historically, successive administrations at the Federal level had initiated programmes to boost food production. Some of these programmes are the Farm Settlement Scheme, National Accelerated Food Production Programme (NAFFP), launched in 1972 by General Yakubu Gowon; Operation Feed the Nation introduced by the Murtala/Obasanjo administration; River Basin and Rural Development established in 1976; Green Revolution and the World Bank founded Agricultural Development Programme (ADP) launched by the administration of Shehu Shagari in 1980; and Babangida's Directorate for Food, Road and Rural Infrastructure (DFRRI). Table 2 presents a summary of the various agricultural and food production policies of the government.

Though the programmes and schemes were established to address the immediate and future food needs of the country, they recorded little success. The top-down approach adopted by the various administrations failed to impact on the peasant farmers that formed the bulk of the farming population. Consequently, agriculture has been constrained by numerous challenges like rural-urban migration, wavering policies formulation and implementation. Other challenges include insufficient infrastructure support, poor input distribution system; emphasis on oil economy; pricing system; over dependence on rain-fed farming; poor capacity utilization, low investor's confidence; environmental degradation; poor access to funds; poor socio-economic status of farmers and insufficient technological transfer system, corruption and poor commitment to implementation of agricultural policies (Ikeokwu, 2008).

3. Theoretical Survey and Empirical Literature

The relationship between the oil sector and food production in Nigeria can be viewed as a typical example of the popular 'Dutch Disease Syndrome'. The term "Dutch Disease" originated in the Netherlands during the 1960s, when the high revenue generated by its natural gas discovery led to a sharp decline in the competitiveness of its other, non-booming tradable sector. Despite the revenue windfall the new discovery brought, the Netherlands experienced a drastic decline in economic growth. The huge foreign exchange from the export of the gas led to a shift in prices and appreciation of the exchange rate, so that previously competitive exporters lost market share and production of those exports fell.

In general, Dutch Disease describes a reduction in a country's export performance as a result of an appreciation of the exchange rate after a natural resource has been discovered. The increase in revenue from the natural resources hurts traditional exports or tradable sectors (such as local manufacturing and agricultural exports) through an increase in the exchange rate. The additional government revenue also implies greater government spending and movement of resources, such as labour and capital away from the non-booming tradable sectors to the booming sector and government sector. If there is limited supply of these resources (as usually the case) then the prices of goods and services produced through the employment of these resources will rise in response to the higher demand.

The core model of Dutch Disease Syndrome presented in Corden and Neary (1982) and Corden (1981) assumes three sectors; the booming sector (B), the lagging sector (L) and the non-tradeable sector (N). The first two sectors produce goods which are traded in the international market at given world prices. Output in each sector is produced using a sector-specific factor and labour, which is mobile between all three sectors. All factor prices are flexible and all factors are internationally immobile.

An exogenous rise in the price of one of the tradable sectors' output or a windfall discovery of new resources, bring about a boom in that sector. As a result of the boom, the aggregate income of the factor initially employed in that sector rises. A central feature of the analysis is a distinction between two effects of the boom, namely the resource movement effect and the spending effect. As the marginal product of labour rises in booming sector (B), the demand for labour in B rises, and induces a movement of labour out of the lagging tradable sector and out of the non-tradable sector. This is the resource movement effect. In event of a country like Nigeria, where the booming sector is unable to fully absorb the labour from the lagging and non-tradable sectors, it results in severe structural dislocation and underemployment.

If some part of the extra income in the booming sector is spent, whether directly by factor owners or indirectly by the government through collection of taxes and public expenditure, and provided the income elasticity of demand for the non-tradable is positive, the price of non-tradable relative to the prices of tradables must rise.

This framework can be used for the analysis of the relationship between the oil and food prices in Nigeria. Let the lagging sector represents the agricultural exports sector (that is, cash crops) and the booming sector be the oil sector, while the non-tradable sector is the staple food crops sector. In Figure 3, the vertical axis shows price of the food crops while the quantity is on the horizontal axis. The demand curve shows the demand for food at various prices of food. The spending effect has shifted the demand curve from D_0 to D_1 due to the boom in the oil sector, thus has raised price of foodstuff and drawing resources from agricultural exports production into food production. However, the level of resources drawn from the food production sector as a result of the boom in the oil sector is assumed larger than the resources attracted into it. Hence, the supply curve shifted from S_0 to S_1. The final equilibrium is at point E with higher food price.

A sizable literature on the Dutch Disease has examined the commodity booms experienced by some countries over the years. Early papers are Hirschman (1958), Baldwin (1966), Mckinnon (1976) on Kuwait, Gregory (1976) and Snape (1977) on Australia, Eide (1973) and Enders and Herberg (1983) on Norway, among others. Studies by Hirschman (1958) and Baldwin (1966) revealed that the relatively small "backward and forward linkages" from natural resource to other sectors limit the growth potential of natural resource rich countries. Other economists, example Gelb (1988), Lane and Tornell (1995), Auty (1990) and Rosser (2006) argue that the explanation to Dutch Disease lies in the area of political economy. They postulate that abundance of the natural resources leads to poorer governance and conflicts. Higher corruption, lack of incentive to build necessary institutions and erosion of social infrastructure are characteristics of these economies. These negative factors impose additional constraints on domestic production of non-tradable (including food production) and prices escalate due to the general poor macroeconomic performance (Alichi and Arezki, 2009).

The petroleum boom in Nigeria, from 1973 to 1979, produced the most generally significant consequences. Adedipe (2004) provides a comprehensive assessment of the impact of oil windfall on the macroeconomic management of the country noting the ill effect of weak governance and political conflicts. Udoh et al (2008) study of the impact of the oil windfall on the social infrastructure lends support to the political economy explanation of resource curse. Despite years of oil windfall gains the social infrastructure, in particular education and health sectors, tend to be experiencing decay with tremendous implications for productivity and development of the country.

A pocket of studies has also focused specifically on the impact of oil price shocks on selected macroeconomic variables in Nigeria, these include Aliyu (2009a, 2009b), Akpan (2009), and Olomola (2006) amongst others. Extending the frontiers of empirical research on the macroeconomic effects of oil price shocks, Aliyu (2009a) employed both linear and non-linear approaches, similar to those adopted by other studies such as Gounder and Bartlett (2007), Mork, Olsen and Mysen (1994), Mork (1989), Lee, Ni and Ratti (1995) elsewhere, to examine the effect of oil price shocks on real gross domestic product using vector error correction technique. This study finds evidence of both linear and non-linear impact of oil price shocks on real economic activities represented by gross domestic product (GDP). Specifically, the paper finds that asymmetric oil price increases in the non-linear models have positive impact on real GDP growth of a larger magnitude than adverse effects of asymmetric oil price decreases. These findings are supported by earlier studies such as Aliyu (2009b) which show that oil price shock and appreciation in the level of exchange rate exert positive impact on real economic growth in Nigeria. In a similar study, Akpan (2009) finds that positive oil price shocks directly increases real national income and government expenditure though with a significant increase in inflation and decline in exports demand by Nigeria's trading partners. In addition, Akpan (2009) observes that the significant real effective exchange rate appreciation was suggestive of the existence of 'Dutch Disease' in the Nigerian economy.

To the best our knowledge, there is yet no study on the effects of oil price shocks on food prices. This study attempts to contribute to the literature on the impact of oil price shocks, with special reference to its effects on domestic food price.

4. Methodology and Empirical Results

This paper seeks to establish the relationship between international oil price and domestic food prices. The methodology adopted in this study is time series technique. This involves the test for stationarity of the variables, cointegration test and conventional Granger Causality test based on Vector Autoregression (VAR). The Granger Causality test is used in the study to determine the direction of causality of price instability. Finally, a multivariate model is estimated to explicitly show the impact of the oil price volatility on domestic food price inflation.

4.1 Data and Stationarity Test

Data for this study were obtained from the world commodity prices and the Central Bank of Nigeria Statistical Bulletin. Food price inflation (FINF) was calculated as percentage variation of food price. The scattergram for the

food price inflation series is presented in figure 4. To obtain the oil price volatility, we adopted an ARCH-type approach and constructed the following GARCH(1,1) model:

$$x_t = \Phi_0 + \Phi_1 x_{t-1} + \ldots + \Phi_K x_{t-K} + \varepsilon_t \tag{1}$$

$$h_t = \alpha_0 + \alpha_1 \varepsilon_t^2 + \alpha_2 h_{t-1} \tag{2}$$

Where x is the oil price, ε is the residual and h is the conditional variance of the error. The estimates of the residuals (ε) and conditional variance (h) are plotted in figures 5 and 6, respectively. Oil price volatility is estimated as the conditional standard deviation ($h^{0.5}$).

With the estimated volatility, the next step is to test for stationarity of the relevant variables. In this paper, the augmented Dickey- Fuller (ADF) test was used to test the stationarity of the series. The ADF tests were performed on level and first differenced by estimating the following three models:

No Constant and No Trend model:

$$\Delta y_t = \gamma y_{t-1} + \sum_{i=1}^{k} \beta_i \Delta y_{t-i} + \varepsilon_t \tag{3}$$

Constant and No trend:

$$\Delta y_t = \alpha_0 + \gamma y_{t-1} + \sum_{i=1}^{k} \beta_i \Delta y_{t-i} + \varepsilon_t \tag{4}$$

Constant and trend:

$$\Delta y_t = \alpha_0 + \alpha_1 t + \gamma y_{t-1} + \sum_{i=1}^{k} \beta_i \Delta y_{t-i} + \varepsilon_t \tag{5}$$

Where $\Delta y_t = y_t - y_{t-1}$ is the difference of series y_t; $\Delta y_{t-1} = y_{t-1} - y_{t-2}$ is the first difference of y_{t-1}, etc; α, γ and β are parameters to be estimated, and ε_t is a stochastic disturbance term. The number of lagged terms was chosen based on the Akaike and Schwarz information criterion. The difference among the three regressions (3)-(5) lies in the inclusion or exclusion of the deterministic elements α_0 and $\alpha_1 t$. Equation (3) does not include the drift α_0 and time trend $\alpha_1 t$, equation (4) includes α_0 but no time trend and equation (5) includes both α_0 and $\alpha_1 t$.

The results of the ADF test are presented in table 3. They reveal that the null hypothesis of a unit root is accepted for the level series of FINF in all three models. Therefore, it can be concluded that the series is integrated of order zero, I(0) or stationary series. However, oil price volatility (OILVOL) was integrated of order two, I(2). Because of weakness observed in the use of bivariate causality model by other studies, such as Odhiambo (2009) and Caporale and Pittis (1997), two other variables, nominal exchange rate (NER) and money supply (MS), were included in the model. The justification for inclusion of the nominal exchange rate is not farfetched. The Dutch Disease model upon which the study is anchored posits that the oil boom would result in exchange rate appreciation which would lead to domestic inflation. Money supply is included to control for the effect of monetary expansion on the domestic prices. These two variables are integrated of order one, I(1).

4.2 Testing for Cointegration of Variables

The cointegration test was performed to investigate any long-run equilibrium relationships between OILVOL, NER and FINF. After a careful search and trial, a model with two lags, constant and trend was chosen. The result of the Johansen Cointegration rank test is summarized in Table 4, which indicates the presence of three cointegrating vectors at 5 percent level of significance. This implies that there exists a long run relationship between the variables.

4.3 VAR Granger Causality Test

To analyze the causal relationship between the variables, the following VAR system was employed.

$$FINF_t = \alpha_1 + \sum_{i=1}^{k} \alpha_{11I} FINF_{t-i} + \sum_{i=1}^{k} \alpha_{12i} OILVOL_{t-I} + \sum_{i=1}^{k} \alpha_{13i} NER_{t-i} + \varepsilon_{FINFt} \tag{6}$$

$$OILVOL_t = \alpha_2 + \sum_{i=1}^{k} \alpha_{211} FINF_{t-i} + \sum_{i=1}^{k} \alpha_{22i} OILVOL_{t-I} + \sum_{i=1}^{k} \alpha_{23i} NER_{t-i} + \varepsilon_{OILVOLt} \tag{7}$$

$$NER_t = \alpha_3 + \sum_{i=1}^{k} \alpha_{31i} FINF_{t-i} + \sum_{i=1}^{k} \alpha_{32i} OILVOL_{t-1} + \sum_{i=1}^{k} \alpha_{33i} NER_{t-1} + \varepsilon_{NERt}$$

(8)

Where:

$FINF_t$ = Food price inflation in Nigeria in year t

$OILVOL_t$ = Oil price volatility in year t

NER_t = nominal exchange rate in year t

α_i and $\alpha_{ij(i)}$ = the parameters

ε_{finft}, ε_{nert} and $\varepsilon_{oilvolt}$ = white-noise disturbance terms that may be correlated with each other.

Table 5 presents the Granger causality test results for the three variables. The estimation results reveal that OILVOL does Granger cause FINF and NER. However, there is no reverse causality running from food price to either nominal exchange rate or the volatility in oil price. Thus, it is obvious that there is a unidirectional causal relationship between domestic food price and international oil price volatility.

In order to confirm the true impact of international oil price volatility on domestic food price, a multiple regression was estimated for food price inflation. The estimated model expresses domestic food price inflation as a function of international oil price volatility, nominal exchange rate, and money supply. Since the dependent variable was found to be integrated of order zero, a log differenced transformation was performed on the explanatory variables to enable the application of ordinary least square technique in estimating the parameters. The estimation results are presented as follows (with the absolute value of t-statistics reported in parenthesis):

$$FINF = 0.1611 + 0.1321\Delta\log(OILVOL) - 0.0001\,\Delta\log(NER) + 0.2807\,\Delta\log(MS)$$

(9)

$$(2.09) \qquad (2.08) \qquad\qquad (0.01) \qquad\qquad (0.98)$$

R-square = 0.18 F-statistics = 2.16   DW Statistics = 1.31

The coefficient of oil price volatility was positive and strongly significant statistically. This conforms to the basic proposition of the Dutch Disease thesis. The booming tradable sector leads to higher domestic price in the non-tradable. The results show that a percentage increase in oil price volatility leads to 0.13 percent increase in the rate of growth of domestic food price inflation. Hence, oil price volatility complements domestic food price instability. However, the other variable, nominal exchange rate and money supply were not significant. Despite the low value of the R-square, the F-statistics indicates that the model is statistically significant at 10 percent level of significance. The Durbin Watson statistics indicates the presence of serial correction in the error terms, hence the model cannot be relied upon for forecasting. Nonetheless, it would be an invaluable tool for theoretical analysis.

5. Conclusions

The aim of this paper was to provide evidence on impact of oil price volatility on domestic food price in Nigeria. Most developing countries suffer from varying degrees of domestic inflation in food prices transmitted via importation of petroleum products; but this may not apply to the oil exporting countries. However, among the oil exporting developing countries, rising oil prices create windfalls which lead to increase in government revenues and income. Mismanagement of such windfalls and the ensuing corruption in the polity heat up the economy and probably lead to worst economic outcomes including inflation.

Based on the empirical analysis and findings in this paper, it is obvious that oil price volatility does have a complementary relationship with food price inflation in Nigeria. Rather than invest the windfalls in breaking domestic supply bottle-necks in agriculture and other sectors, the unexpected wealth is often embezzled and misappropriated by corrupt leaders. To meet with the domestic demand the government resort to importation of some staple foodstuff, like rice; thus importing global inflation, as a result of the rising oil price, back into the domestic economy.

Future research should incorporate the income effect channel to the resource curse literature. A probable area of research should be on the relationship between oil gross domestic product (GDP), oil price and food price inflation.

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Table 1. Per Capita Output of some staple Food Crops in Nigeria, selected years (tones per capita)

Year	maize	Millet	sorghum	Rice	cassava	yams
1970-1974	0.017	0.062	0.064	0.007	0.067	0.154
1975-1979	0.015	0.051	0.054	0.006	0.047	0.127
1980-1984	0.012	0.036	0.048	0.002	0.036	0.065
1985-1989	0.026	0.043	0.056	0.008	0.100	0.070
1990-1994	0.060	0.045	0.054	0.028	0.264	0.186
1995-1999	0.058	0.048	0.061	0.028	0.275	0.197
2000-2005	0.063	0.052	0.068	0.027	0.258	0.196

Source: Authors' computation using data from ADP.

Table 2. Major Food and Agricultural Programmes of Nigerian Government, 1970-2008

Peiord	Major Policies/Programmes	Objectives
Pre-Colonial (before 1960)	Ten Year Plan for Development and Welfare in Nigeria	Provision of research and extension infrastructure needed to accelerate production for export. No policy for food crops production
1962-1968	First National Development Plan	Expansion of export crop production through extension services programmes
1970-1974	Second National Development Plan (NAFPP) Tree Crops Planting and Replanting Programme	❖ NAFPP was designed to enhance food crop production through the use of high yielding seeds and application of fertilizers, pesticides and herbicites ❖ Development of efficient marketing, storage and processing facilities ❖ Supply of cheap farm credits ❖ Increased production of tree crops
1975-1980	NAFPP, Operation Feed the Nation (OFN) Guaranteed Minimum Price Scheme(1976) Land Use Act (1978) Agriculture Credit Guarantee Scheme (1977) Commodity Board (1977) Green Revolution (1980) Agricultural Development Project (ADP)	❖ Accelerate food production via liberal distribution of seeds and fertilizers ❖ Price stabilization and bringing food crops under institutional marketing system ❖ Provision of funds through commercial banks for agricultural purposes at cheap rates
1981-1985	River Basin Authorities (RBAs) World Bank Assisted Tree Crops Project ADP	❖ To have one RBA in each state ❖ RBAs were meant to facilitate large-scale, all year-round irrigated production of food crops
1986-1993	exchange rate policy, Directorate for food, Road and Rural Infrastructure (DFRRI)	❖ Promotion of agricultural and rural development ❖ Stimulation of food production via the use of generous subsidies
1994-1998	3-year Rolling plans; and Annual Budgetary provisions	❖ Increase fiscal allocation to agriculture ❖ Enunciation of commercial policies with positive effect on agriculture
2001-2006	New Agricultural and Food policy	❖ Ensure self-sufficiency ❖ Improvement in technical and economic efficiency in food production ❖ Reduction of risks and uncertainties in agriculture
2007	7-point Agenda	❖ Revolutionalization of agriculture via development of modern technology, research and production ❖ Massive domestic and commercial outputs and technological knowledge transfer to farmers

Source: Compiled from various policy documents of the Federal Government of Nigeria.

Table 3. ADF Test for a Unit root

Variables	No Constant & No Trend	Constant & No Trend	Constant & Trend
ADF test at level:			
FINF	-2.2750	-4.3916**	-4.2954**
OILVOL	-0.5767	-2.1145	-2.0842
MS	-0.2738	0.1143	1.1967
NER	-2.5164*	-2.6748	-2.6268
ADF test at first differenced:			
FINF	-6.7409**	-6.6312**	-6.5653**
OILVOL	-3.1233**	-3.0335*	-2.9745
MS	6.0703**	6.2400**	6.5398**
NER	-4.1053**	-4.0445**	-3.9933*
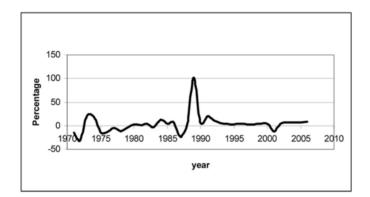
Note: **(*) denotes significance at the 1 (5) percent levels.

Table 4. Results of the Johansen Cointegration Rank Test

Johansen Cointegration Tests				
Null Hypothesis (H$_0$)	Alternative (H$_1$)	Likelihood Ratio	5 percent Critical value	1 percent Critical value
Rank = 0	r≥1	60.25**	29.68	35.65
Rank ≤ 1	r≥2	27.02**	15.41	20.04
Rank ≤ 2	r≥3	7.17**	3.76	6.65
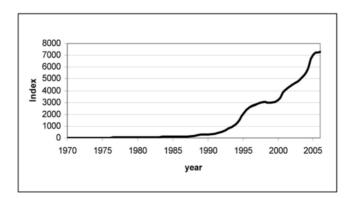
Note: * and ** denote rejection of the null hypothesis at the 5 percent and 1 percent significance levels respectively.

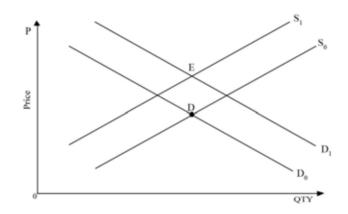Table 5. Results of Granger Causality test

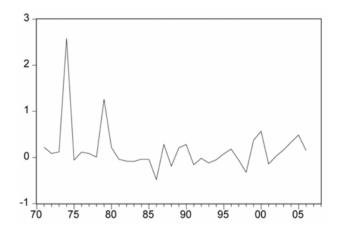| Null Hypothesis:	Obs	F-Statistic	Probability
GARCH01 does not Granger Cause FINF	34	8.65148	0.00113
FINF does not Granger Cause GARCH01		0.48315	0.62171
NER does not Granger Cause FINF	34	1.08518	0.35117
FINF does not Granger Cause NER		1.00776	0.37746
NER does not Granger Cause GARCH01	34	1.29558	0.28912
GARCH01 does not Granger Cause NER		3.77078	0.03502

Source: Authors' computation using data from ADP.

Figure 1. Growth rate of Production of staple food Crops
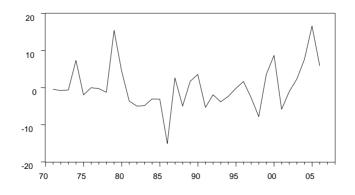

Source: National Bureau of Statistics (2006) *Statistical Abstract*.

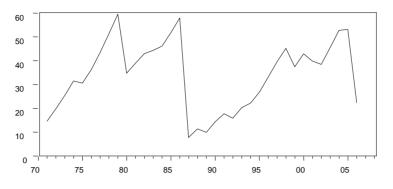Figure 2. Index of Food Price in Nigeria, 1970-2006

Quantity of Food

Figure 3. Effect of Oil Boom on Food price

Source: Authors' Computation

Figure 4. Graph of Domestic Food Price Inflation, 1970 -2008

Source: Authors' Computation

Figure 5. Residuals from the GARCH(1,1) model.

Source: Authors' Computation

Figure 6. Conditional Variance