Relative Price Variability and Inflation: Evidence from the Agricultural Sector in Nigeria

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Abstract

The main objective of this study is to establish quantitative relationships among the relative price volatility of agricultural commodities, inflation and agricultural polices in Nigeria. The data for the study, covering the period 1970–2003, were obtained from publications of the Central Bank of Nigeria, Federal Office of Statistics, and Federal Ministry of Agriculture and Rural Development. Our results show that the effect of inflation on relative price variability among agricultural commodities in Nigeria is non-neutral. Inflation has a significant positive impact on relative price variability in both the long run and the short run. The findings suggest the need for policies that will buffer the agricultural sector from the effects of inflation in the short run, and in addition the crops subsector from the long-run effect of inflation. Similarly, policies that reduce the rate of inflation will minimize relative price variability among agricultural commodities and consequently reduce inefficiency, distortions and misallocation of resources in agriculture that might be caused by inflation. No data points in the study period showed negative inflation. As a result of this, the data could not provide evidence for the effect of deflation on relative price variability. Policies like the Green Revolution and structural adjustment programmes and post-SAP policies increased relative price variability among cash crops in the long run, but influenced food crop prices only in the short run. In addition to this, the Operation Feed the Nation project (OFN) had a significant positive short-run effect on food prices. Thus the agricultural policies under SAP, post-SAP and Green Revolution caused price changes that led to efficient reallocation of resources among cash crops in the long run and food crops in the short run. The policies should be considered in planning for the agricultural sector. On the other hand, the price control policy brought about a reduction in relative price variability among cash crops and consequently led to a misallocation of resources in the sector. Cash crop prices should be allowed to be determined by market forces of demand and supply, and no attempts should be made to fix prices administratively.

Keywords: price variability, inflation, agricultural sector, Nigeria

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1. Introduction

General inflation affects the farm economy most directly through the cost of inputs. Compared with any other major sector in the economy, because it is highly competitive and most of the output is perishable, agriculture is the least able to pass input cost increases through into higher output prices. Consequently, farmers suffer loss of income/profits during inflation. Thus, in Nigeria, the government's agricultural pricing policy objective is to ensure attractive producer prices for agricultural commodities in order to encourage farmers to produce more. To attain this objective, the Federal Government has always left the domestic food prices to be determined by free market forces with little or no intervention.

On the other hand, the cash crop subsector was the major area of government price intervention in the pre structural adjustment period (i.e., the period before 1986). The government replaced the Regional Marketing Boards, which controlled export cash crops prices from 1949 to 1976, with the National Commodity Board in 1977. A central machinery was evolved for the determination of producer prices of the crops. This measure was adopted in the belief that by improving commodity prices periodically, farmers' incomes, as well as agricultural productivity, would be enhanced. This policy stance was specifically articulated in the Third National Development Plan and later enacted into law by Decree 29 of 1977 (Akanji and Ukeje, 1995).

By the end of 1985, however, it was obvious that the commodity boards could not achieve most of their functions as evidenced by their pricing, which resulted in implicit taxation of farmers. On the average, the farmers suffered an implicit tax of 35.74% for cocoa and 35.53% for rubber during the period 1970–1985 (Akanji and Ukeje, 1995).

The introduction of the structural adjustment programme (SAP) and the dissolution of the commodity boards in 1986 ushered in an era of trade liberalization of agricultural commodities. Under this system, individual farmers are free to purchase and sell/export their commodities at market determined prices.

The agricultural commodity prices assumed a rising trend during the study period in parallel with increases in the rate of inflation (see Table 1). It is therefore pertinent to determine the effect of inflation on the relative prices of agricultural commodities. The study is necessary because agriculture plays an important role in rapid growth and development of Nigeria. It provides food for the growing population, employment for over 65% of the population, and raw materials and foreign exchange earnings for the development of the industrial sector (Ajibefun, 2004).

Table 1: Inflation and changes in agricultural commodity prices in Nigeria, 1970–2003 (%)

Item	1970-1974	1975-1979	1980-1984	1985-1989	1990-1994	1995-1999	2000-2003
Inflation rate	10.28	19.74	20.26	20.06	23.84	25.44	13.18
Crops							
(a) Sorghum	12.48	9.41	28.23	26.31	34.09	39.52	37.09
(b) Maize	18.37	11.63	17.2	29.14	24.64	51.42	21.18
(c) Rice (Milled)	13.15	15.39	40.52	21.86	30.04	34.45	9.8
(d) Cassava	14.66	43.84	30.35	29.07	41.64	42.98	46.8
(e) Millet	29.12	15.63	18.73	40.48	40.63	42.7	21.18
(f)) Beans	19.72	19.39	35.41	20.55	34.96	47.16	13.13
(g) Yam	25.35	22.25	21.51	24.11	37.27	38.63	15.01
(h) Soyabeans	11.78	20.03	17.93	80.11	31.19	28.08	7.5
(i) Palm oil	29.42	18.12	6.24	19.8	193.76	-10.50	18.14
(j) Groundnut	26.33	20.69	14.32	70.9	135.0	26.26	6.88
Price deflator for livestock	32.66	16.13	22.19	29.92	36.19	23.98	7.13
Price deflator for fish	26.43	19.11	6.29	15.43	36.58	24.24	7.21
Price deflator for agriculture	16.18	19.01	18.57	17.49	35.66	24.69	8.84

Sources: CBN (2003); CBN, *Annual Report* and *Statement of Accounts*, various issues; FMANR (1997).

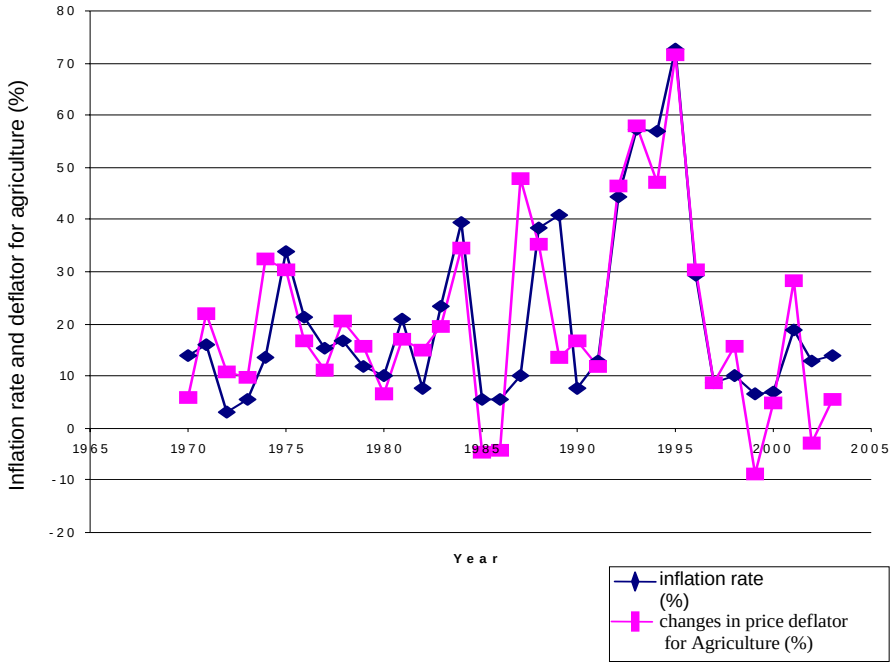
The research problem

In Nigeria, an observed variability in agricultural commodity prices accompanies inflation. For example, the rate of inflation increased from 10.28% in the period 1970–1974, fluctuating over the years to 25.44% in 1995–1999, then declined to 13.18% in 2000–2003 (see Table 1). The price deflator for agriculture and the prices of most food crops seem to exhibit a similar trend behaviour with inflation. Figure 1 illustrates the variability of inflation and the agricultural price deflator. The movements of the agricultural price deflator have a similar trend with the rate of inflation.

The removal of all relative price variability is not an objective of any rational policy. Relative price adjustments associated with changes in demand shift variables, resources, weather and technology are essential for the efficient allocation of resources.

But when relative prices within agriculture vary because of inflation, such movements may decrease economic welfare for society as a whole and the agricultural sector in particular. Efficiency of resource allocation decreases because decision makers have less useful information on prices to guide their decisions. The risk associated with choosing which commodities to produce increases with inflation. Producers (farmers) may suffer loss of real income due to inflation. For example, Tweeten (1983) found that inflation brings cycles to farm prices, expenses, receipts and balance sheets. A major social cost is incurred for adjustments and for risk management strategies that would be unnecessary in a more stable economy.

Figure 1: Variability of inflation rates and price deflator for agriculture, 1970–2003 (%)



Justification for the study

This study was motivated by two main factors. First, although an extensive empirical literature exists on the relationship between inflation and relative price variability, there is still substantial controversy about the nature of the relationship (Gardner, 1981; Grennes and Lapp, 1986; Smith and Lapp, 1993; Loy and Weaver, 1998; Jaramillo, 1999; Caglayan and Filiztekin, 2003).

Moreover, in spite of the observed variability in the rates of inflation in Nigeria in the study period, there is an absence of adequate studies on the links between inflation and relative price variability and the impact of government policies on relative agricultural prices in Nigeria.

Objectives

Broadly, the objective of this study is to establish quantitative relationships among relative price variability of agricultural commodities, inflation and agricultural policies in Nigeria. The specific objectives are to:

1) Derive the link between inflation and agricultural price variability and determine the impact of inflation on relative agricultural prices; and
2) Show the impact of agricultural policies on relative agricultural prices.

2. The link between inflation and relative price variability

In order to investigate the effect of inflation on relative price variability, we need to discuss briefly the menu cost, signal extraction and search models. Menu cost models predict that because of costs associated with changing the price of a product, monopolistically competitive firms will set prices as close as possible to a chosen target level while making infrequent adjustments (Caglayan and Filiztekin, 2003). Sheshinski and Weiss (1977, 1983), and more recently Ball and Romer (1993), proposed that firms follow one-sided *(S,s)* pricing rules when faced with inflation. According to this approach, firms keep the nominal price of their product unchanged until the real price hits the lower bounds. Thereafter, firms increase the real price of the product to the upper bound *S*. The model predicts that the optimal *(S,s)* band widens with the expected inflation leading to a greater dispersion of prices simultaneously. The menu-cost models emphasize the positive effect of expected inflation, and therefore address the price setting behaviour of different sellers of the same good, and their predictions are more about intra-market variability.

The signal extraction model says that relative price variability should rise in an inflationary environment as unexpected inflation causes misperceptions about absolute and real price changes (Lucas, 1973; Barro, 1976). Since firms cannot differentiate between real and nominal shocks in these models, individual firms adjust prices more often than output levels in response to all shocks, including real demand shocks. Thus, as inflation uncertainty increases, the signal extraction models predict a positive effect of unexpected inflation on relative price variability. Therefore, the signal extraction models are more relevant for the variability of prices of different goods around an aggregate price level or inter-market variability.

The search models state that consumers accumulate information only on a subset of all existing prices, but because of the deterioration in consumers' price information during inflationary periods, the stock of information a person holds declines and consequently the dispersion of prices widens (Caglayan and Filiztekin, 2003). Benabou and Gertner (1993), however, have shown that in a search model with learning, inflationary noise induces search, and consequently a reduction in price dispersion depending on the size of information costs.

In the case of agricultural prices, their short-run overshooting can be explained by the relatively greater flexibility of agricultural markets, compared with non-agricultural markets. Among the reasons frequently offered for this relative flexibility are the relatively long production and gestation periods of agricultural production. Thus, changes in economic environment may result in significant price swings in the short run (Gardner, 1981). This

explanation also presupposes that trade flows cannot be altered sufficiently in the short run in response to price changes and/or sufficient stocks are not being held. The role of stocks is important, even in a (supposed) absence of biological delays in production, because agricultural commodities are usually less storable than non-agricultural commodities, thereby justifying greater price variability (Chambers, 1985). Furthermore, Bordo (1980) proposed the existence of long-term contracts as a source of relative price variability, with long-term contracting in agricultural product markets being unimportant compared to the non-agricultural sector.

From the preceding discussion, it may be understood that the link between inflation and volatility of agricultural prices is found in the framework of demand and supply of agricultural products.

3. Agricultural policies

Owing to the important role of agriculture in the Nigerian economy, the government over the years has pursued policies to boost the agricultural sector. These include fiscal (e.g., investment, rural infrastructure, institution creation, etc.), monetary, pricing and exchange rate policies, among others. The government went into direct agricultural production through such parastatals as the River Basin Development Authorities (RBDA), the Directorate of Food, Roads and Rural Infrastructure (DFRRI), and a number of food producing companies. A host of agricultural production programmes was also established at different times. These programmes included Operation Feed the Nation (OFN), the Green Revolution (GR) and the National Accelerated Food Production Project (NAFPP). This study, among other things, appraised the government agricultural policies. A review of some specific policies follows.

Agricultural price control policy (1949–1985)

Agricultural price control policy was carried out under the framework of marketing boards. According to Ojo et al. (1995), the marketing boards were for cocoa, groundnut, cotton, palm produce, rubber and grains. The functions of the boards were basically to purchase and export scheduled agricultural commodities, stabilize producer prices, promote expansion in the production of the crops and ensure stability of farm incomes.

Operation Feed the Nation (OFN)

OFN was launched in 1976 and it lasted till 1979. The OFN was aimed at mobilizing the entire nation to fight the increasing food problems by massive participation in a food production programme embracing full-time farmers, armed forces, schools and universities, and other individuals. The essence of the campaign was to increase food production through application of key inputs and to improve the image of farming as a way of life. The Federal Government provided substantial amounts of money to finance the programme and to procure inputs for delivery to many parts of the country (Ogbuagu, 1995).

To achieve the objectives of OFN, the Federal Government offered the following incentives:

- A five-year tax holiday for agricultural production and processing that use a substantial portion of local plantation.
- A limitless tax-holiday until all cumulative losses incurred in agricultural production are offset against future profits.
- Establishment of an agricultural credit guarantee scheme to provide guarantee for agricultural loans granted by commercial and merchant banks.
- Preferential treatment for agriculture in the credit guidelines given to financial institutions.
- Special tax exemptions on interest on loans granted to aid investment in agriculture.
- Capital allowance for equipment leasing to agriculture.
- Duty-free importation of tractors, machinery and equipment used solely for agriculture.
- Duty-free importation of raw materials for manufacture of livestock feeds.
- Subsidized fertilizer scheme.
- Subsidized tractor-hire services.
- Additional investment allowance of 10% on capital expenditure incurred in agricultural production.

The OFN was a "crash" modernization food production programme, rather than a systematically planned scheme in support of a set of unique policies (Ojo, 1991). The programme operated without much practical effort to involve the peasant farmers on whom the nation has long depended for its primary agricultural products. Consequently, the OFN never succeeded in meeting its objectives and was replaced by "Green Revolution"

The Green Revolution (1980–1985)

Aimed at achieving food self-sufficiency in Nigeria within the shortest time possible, the Green Revolution (GR) was a comprehensive review of the agricultural sector and proposals for removing the constraints on rapid growth and modernization. The proposed implementation involved all levels of government, as well as public and private sector institutions with some role to play in the implementation of the plan (Ojo, 1991).

Under this programme, liberal resource allocations were made by the government particularly for infusion into the agricultural sector of imported inputs such as farm tractors, irrigation pumps and facilities, agro-chemicals and equipment, improved seeds, animal feeds, and fishing inputs such as outboard engines, fishing nets, etc. In addition, the programme sought to enhance the construction, maintenance and rehabilitation of infrastructural facilities such as bridges and culverts, roads, housing, and power and water supply (Tijani and Williams, 1981).

Like OFN, the rural and farming population were not adequately mobilized into the GR programme. There was the problem of over-reliance on the government and government agencies to actualize programme objectives, and the problem of corruption. The implementation of the programme did not progress much, partly because of financial problems and the change of government in late 1983.

Agricultural policy for Nigeria (1988)

Launched in 1988, the agricultural policy document contained the SAP package as it related to the agricultural sector. The overall policy objective of the new document was to achieve self-sustaining growth in all the agricultural subsectors and the realization of structural transformation for socioeconomic development of the rural areas. Specifically, policy aimed to attain self-sufficiency in basic food commodities, increase production of agricultural raw materials, increase production and processing of export crops, and diversify the country's export base. Other objectives were to modernize agricultural production, processing, storage and distribution through the infusion of improved technology and management; and enhance rural employment opportunities through improvement of infrastructural facilities. The policy also aimed at improving the quality of life of rural dwellers through the provision of social amenities and protection of agricultural land resources from drought, desert encroachment, soil erosion and flood (Evbuomwan, 1988).

New Agricultural Policy (2001)

Nigeria's New Agricultural Policy has the overall goal of attaining self-sustaining growth in all subsectors of agriculture, the structural transformation necessary for the overall socioeconomic development of the country, and the improvement of the quality of life of Nigerians. The agricultural policies are being pursued within the framework of NEEDS (National Economic Empowerment and Development Strategy). NEEDS was formulated with the objective of reducing poverty, generating employment and creating wealth. It is a reform that aspires to achieve a long-term goal of social and economic transformation of Nigeria into a sustainable modern, competitive and prosperous economy. The New Agricultural Policy (2001) is an attempt to overcome the pitfalls of the past policies.

A common feature of all the government agricultural policies from 1970–2003 is that they all involved enormous Federal Government expenditure. For example, Table 2 shows that between 1970 and 2003, Federal Government's annual expenditures on agriculture have been reasonably high. In the years of OFN (1976–1979), the Federal Government capital expenditure on agriculture was as high as ₦129.2 million in 1976 or 3.2% of total federal capital expenditure, and the least annual expenditure of ₦98 million (or 2.32% of total federal capital expenditure) was made in 1979. In the period of the Green Revolution, (1980–1985), the annual federal capital expenditure on agriculture ranged from ₦285 million (or 6.95% of total federal capital expenditure) in 1984 to ₦662 million (or 13.55% of total federal capital expenditure) in 1983. In the SAP period (1986–1993), the agricultural sector gulped as much as 11.53% of total capital expenditure in 1989. Again in the post-SAP era (1994 to date), capital investment in agriculture consumed 13.19% and 10.07% of total capital expenditure in 2001 and 2002, respectively.

Table 2: Federal government capital expenditure on agriculture as a percentage of total federal budget (1970–2003)

Year	(1) Agricultural capital expenditure (₦ million)	(2) Total federal capital expenditure (₦ million)	(3) (1) as percentage of (2)
1970	5.6	187.8	2.98
1971	8.4	173.6	4.86
1972	20.7	451.3	4.59
1973	35.4	565.7	6.26
1974	87.4	1,223.5	7.14
1975	211.2	3,207.7	6.58
1976	129.2	4,041.3	3.2
1977	113.7	5,004.6	2.27
1978	125.0	5,200.0	2.4
1979	98.0	4,219.5	2.32
1980	413.0	10,163.4	4.06
1981	400.4	6,567.0	6.1
1982	616.0	6,417.2	9.6
1983	662.0	4,885.7	13.55
1984	285.0	4,100.1	6.95
1985	306.0	5,464.7	5.6
1986	374.0	8,526.8	4.39
1987	443.0	6,372.5	6.95
1988	659.0	8,340.1	7.9
1989	1,733.0	15,034.1	1.53
1990	1,598.0	24,048.6	6.64
1991	1,219.0	28,340.9	0.77
1992	941.3	39,763.3	2.37
1993	1,824.0	97,079.4	1.88
1994	2,179.0	70,918.3	3.07
1995	2,414.0	121,138.3	1.99
1996	3,898.8	212,926.3	1.83
1997	6,247.4	269,651.7	2.32
1998	6,064.6	309,015.6	1.96
1999	6,912.6	498,027.6	1.39
2000	8,803.2	239,450.9	3.68
2001	57,879	438,696.5	13.19
2002	32,364.4	321,378.1	10.07
2003	8,510.9	241,688.3	3.52

Source: CBN (1987, 1999, 2002, 2003, 2004) and various past issues of the *Annual Report and Statement of Accounts*.

4. Literature review

Controversy over whether inflation affects relative agricultural prices has generated a vast empirical literature. A number of such studies have found a relationship between the level of anticipated future inflation rates and changes in relative prices of particular products (Parks, 1978; Cukierman, 1979; Fischer, 1981; Stockton, 1988; Ball and Mankiw, 1992). Within this literature, change in relative prices has been labelled relative price volatility and has been identified as an indicator of the real costs of inflation. Real costs of inflation are due to changes in relative prices that result from a differential transmission of inflation across particular products or markets. The resulting price structure is distorted from initial cost and preference fundamentals and may induce resource misallocation and welfare loss (Fisher, 1981). However, relative price adjustments associated with changes in demand shift variables, resources, weather and technology are essential for the efficient allocation of resources.

Lapp and Smith (1992) tested this for the United States and extended the study to the United Kingdom (Smith and Lapp, 1993). The results obtained for US data were tentative; for example, no evidence was found to support or reject the hypothesis that variations in inflation affect relative price variability among agricultural commodities. However, the results support the hypothesis that the variability of relative prices in agriculture is related to the average rate of nominal price change among agricultural commodities and actual and unexpected aggregate inflation. Nevertheless, the effect of aggregate inflation appears random across individual commodities. Different results were obtained for the United Kingdom; these support the hypothesis that relative price variability is positively related to actual inflation. Unexpected inflation does not affect relative price variability in agriculture.

The whole analytical structure of the studies reviewed above is to test for causal structure, which shows only the direction of causality. An attempt to fill this gap was made by Zanias (1997), when he studied the relationship between agricultural prices and the general price level in Greece. He used econometric methods for non-stationary variables, preceded by cointegration and unit root tests. Agricultural price deflator was regressed on GDP deflator and the per capita volume of agricultural production. The results show that agricultural prices overshoot in the short run, while the adjustment speed to the long-run inflation neutrality is slow.

Gregorio et al. (1994) analysed sectoral inflation in 14 OECD countries, classifying the commodities into tradeables and non-tradeables. They regressed the relative price of non-tradeables to tradeables on the difference of total factor productivity across sectors, the ratio of government expenditure to GDP, per capita income and expected inflation.

The results show that inflation in non-tradeable goods exceeds inflation in tradeables. Demand shift toward non-tradeables and faster growth of total factor productivity in the tradeable goods sector were identified as the prime cause of the differential inflation.

Furthermore, Loy and Weaver (1998) carried out a time series analysis of retail food prices in Russian markets to determine the effects of anticipated and unanticipated inflation, as well as inflation uncertainty on relative agricultural price volatility. The results indicate that distortions in relative prices were induced by the anticipated inflation rate, rather than by unanticipated inflation or a measure of inflation uncertainty. Contrary to Lucas's hypothesis, there was no positive relationship between the relative price structure and the unanticipated rate of inflation.

Turkey was the venue for Caglayan and Filiztekin (2003), who investigated the link between inflation and relative price variability in that country, along with the impact of structural changes in the behaviour of inflation, using panel data techniques to control for aggregate shocks. The results show that the effect of inflation is non-neutral and lower in magnitude during the high inflationary period. Relative price variability increased in inflationary as well as deflationary periods.

Jaramillo (1999) analysed time series relationship between inflation and relative price variability using US data. A significant positive association was obtained between inflation and relative price variability, allowing for an asymmetrical response of relative prices to episodes of positive and negative inflation.

In spite of the extensive studies done elsewhere on the relationship between inflation and relative price variability within the agricultural sector, adequate studies have not been done for Nigeria. Rather, most studies on inflation have focused on explaining Nigeria's inflationary process (see Nwade and Oke, 1977; Asogu, 1991; Egwaikhide et al., 1994; Ojo, 1982; and Afolabi and Efunwoye, 1995). Only a few studies analysed the effects of inflation on the economy. Examples of such studies include CBN (1974) and Osakwe (1982). Both of these studies focused on the impact of inflation on output growth and several other macroeconomic variables: gross fixed investment, savings, imports, inventories, residential investment, exports and foreign capital inflow. Inconclusive results were obtained because the coefficients were not statistically significant. Again, the studies did not analyse the effect of inflation on agricultural prices. Thus, there is a research need to investigate the effects of inflation on the relative prices of agricultural commodities as this will fill the existing information gap.

Theoretical framework

The link between inflation and relative price variability is found in the framework of supply and demand (Jaramillo, 1999). A Lucas (1973) type of model assumes that quantity supplied, q_{it} in an industry, of commodity i in period t consists of trend output q^n_{it} and cyclical output q^c_{it}. That is:

$$q_{it} = q^n_{it} + q^c_{it} \quad (1)$$

All variables are expressed in logs. From Lucas (1972), the cyclical component of output is further decomposed into the lagged value of the cyclical component of output

q^c_{it-1} (persistence effects), plus a relative price effect, which is proportional to the deviation from the mean price level P_t of the relative price P_{it}, which firms in the industry receive.

The supply equation becomes:

$$q_{it} = q^n_{it} + rq^c_{it-1} + b(P_{it} - P_t) \quad (2)$$

where /r/ <1 and b are constant parameters (b is price elasticity of supply), P_t is the mean price level and represents the anticipated price level in period t from the perspective of period t-I, and P_{it} is the price of output i.

Demand is a function of relative prices and income (Jaramillo, 1999):

$$q_{it} = a(P_{it} - P_t) + dm_{it} \quad (3)$$

where m_t is income, d is the income elasticity of demand for good i, and a is the price elasticity of demand for the same good. Equating demand to supply and rearranging terms, an expression for the commodity-specific rate of price change is given by:

$$P_{it} - P_{it-1} = \frac{1}{(b-a)} [d(m_t - m_{t-1}) - (q^n_{it} - q^n_{it-1}) - r(q^c_{it-1} - q^c_{it-2}) + r(P_t - P_{t-1})] \quad (4)$$

In this framework, commodity inflation rates are a result of demand shocks and the anticipated aggregate inflation rate transmitted through sector-specific elasticities. Aggregate demand shocks have an effect in each market that is identical for positive or negative changes in income. Consequently, an increase in demand has the same aggregate effect on inflation and relative price variability as an equivalent variation of opposite sign. While the symmetric price response to shocks is a feature of most simple linear models of supply and demand interaction, its real world relevance has often been questioned within the tradition of downward price rigidity (Fischer, 1981; Cagan, 1979; Akerloff et al., 1996). The downward price rigidity in some markets will produce an asymmetrical response in the rigid sector, which makes the new aggregate level of relative price variability higher than that obtained under the positive shock (Jaramillo, 1999). In addition, the absolute value of inflation will be lower than for a positive shock, reinforcing the fact that negative inflation rates will be associated with higher variations by working through the asymmetric price responses to shocks in some markets arising from downward price rigidity in those markets. In this study, we analysed the change in relative agricultural prices from inflation due to rigidities and government policies that affect prices.

Measuring relative price variability

Change in relative prices is called relative price variability or volatility and is used as an indicator of the real costs of inflation in relation to its effect on commodity price changes (Loy and Weaver, 1998). Real costs of inflation occur as a result of changes in relative prices caused by a differential transmission of inflation across particular products or markets. The resulting price structure is distorted from initial cost and preference fundamentals and may induce resource misallocation and welfare loss (Fisher, 1981).

Domberger (1987) extended the consideration of the real costs of inflation by noting that by disrupting the relative price structure between products within a particular market, inflation could also produce real costs by affecting changes in intra-market relative price volatility.

Relative price variability is measured by constructing an index to show changes over time in relative prices among a commodity group. A commodity's relative price is defined as its nominal price divided by the average price of all commodities in the group. Relative price variability is defined as the variance across a set of commodities of the rates of change of individual nominal prices (Lapp and Smith, 1992).

The nominal rate of price change of each commodity can be decomposed into an aggregate component, interpreted as the inflation rate, and a relative price component. That is,

$$P_{i,t} = P^*_t + Z_{i,t} \tag{5}$$

where $P_{i,t}$ is defined as the natural logarithm of the nominal price of the ith commodity in period t, P^*_t is the natural logarithm of a price index for the N commodities in period t, and $Z_{i,t}$ is the natural logarithm of the relative price of commodity i in period t,

$$P_t = \sum_{i=I}^{N} W_{i,t} P_{i,t} \tag{6}$$

where the $W_{i,t}$'s are price index weights that sum to one. Taking first differences of (6) and rearranging terms, the rate of commodity i's relative price,

$$Z_{i,t} - Z_{i,t-1} = \left(P_{i,t} - P_{i,t-1}\right) - \left(P^*_t - P^*_{t-1}\right) \tag{7}$$

The weighted sum of each commodity's relative price, using $W_{i,t}$ as weight,

$$\sum_{i=I}^{n} W_{i,t}\left(Z_{i,t} - Z_{i,t-1}\right) = \sum_{i=I}^{n} w_{i,t}\left\{\left(P_{i,t} - P_{i,t-1}\right) - \left(P^*_t - P^*_{t-1}\right)\right\} \tag{8}$$

is always zero. The weighted sum of squares of each commodity's relative price change,

$$V_t = \sum_{i-1}^{n} W_{i,t}\left[\left(P_{i,t} - P_{i,t-1}\right) - \left(P^*_t - P^*_{t-1}\right)\right]^2 \tag{9}$$

is always positive when nominal rates of change differ among individual commodities. As the differences increase, V_t also increases. Therefore, V_t, which is an approximation of the variance of relative price changes from period *t-1* to *t* for the N commodities, is used as the measure of relative price variability.

5. Research methodology

Measuring V_t requires data on actual commodity prices and the weights attached to each commodity. Parks (1978) and Lapp and Smith (1992) used income shares as the weight attached to each commodity. Domberger (1987) used both income shares and *1/N* as weight and reported that his results were unaffected by choice. Smith and Lapp (1993) used output as weight. In this study we used income shares as the weight attached to each commodity. Lasperes price index was used in computing price indexes (Gupta, 1981).

The empirical models were specified as shown below according to the objectives of the study. Data were obtained from the publications of Central Bank of Nigeria, Federal Office of Statistics, and Federal Ministry of Agriculture and Natural resources. The data covered the period 1970–2003. All the equations were estimated by ordinary least squares method. The augmented Dickey–Fuller (ADF) test was carried out to determine the time series properties of the variables. The variables (relative price variability and inflation) were integrated and therefore error correction models and long-run static models were specified and estimated.

Objective 1: Relative price variability

For the analysis related to our first objective – to derive the link between inflation and agricultural price variability and determine the impact of inflation on relative agricultural prices – we specified a relative price variability equation for food crops (Equation 10) and another price equation for cash crops (Equation 11). (See Jaramillo, 1999; Caglayan and Filiztekin, 2003, and Equation 4 in this paper.)

$$VF_t = \lambda_0 + \lambda_1 \pi_t + \lambda_2 \left(D_* \pi\right)_t + U_t \tag{10}$$

$$VC_t = \theta_0 + \theta_1 \pi_t + \theta_2 \left(D_* \pi\right)_t + \sum_t \tag{11}$$

where: $VF_{t,}$ and VC_t are relative prices of food and cash crops, respectively; and

λ_1's and θ_1's = constants
π = absolute value of inflation
D = a dummy variable (= 1 when inflation is negative and 0 otherwise)

$D*\pi$ = product of D_1 and π that allows for a different slope of the relationship during deflationary periods

U_t and $\Re_t$ = error terms

The term $D_1*\pi$ helps to test the hypothesis that the relationship between inflation and relative price variability exhibits an asymmetry stemming from downward price rigidity in some markets. If the coefficient (λ_2) or θ_2 on this term is significantly different from zero, then the hypothesis of an asymmetrical relationship is accepted; otherwise it is rejected.

Objective 2: Effect of government policies

We analysed our second objective here – show the impact of agricultural policies on relative agricultural prices. Government policies on agriculture examined were Operation Feed the Nation (1976–1979), Green Revolution (1980–1985), agricultural policies under the structural adjustment programme (1986–1993) and the post-SAP policies (1994 to date).

To control for the effects of different government policies, we introduced dummy variables $(D_i s)$ into our basic models (equations 10 and 11) that took the value 1 (one) in the policy period and 0 (zero) otherwise and interacted it with the slope coefficient. The required equations are:

$$VF_t = \alpha_0 + \alpha_1\pi_t + \alpha_2\left(D_*\pi\right)_t + \alpha_3\left(OFN\right)_t + \alpha_4\left(GR\right)_t + \alpha_5\left(SAP\right) + \alpha_6\left(PSAP\right)_t + e_t \quad (12)$$

$$VC_t = \beta_0 + \beta_1\pi_1 + \beta_2\left(D_*\pi\right)_t + \beta_3\left(OFN\right)_t + \beta_4\left(GR\right)_t + \beta_5\left(SAP\right) + \beta_6\left(PSAP\right)_t + \beta_7\left(PC\right)_t + \delta_t \quad (13)$$

where *OFN*, *GR*, *SAP*, *PSAP* and *PC* are dummy variables for, respectively, Operation Feed the Nation, Green Revolution, structural adjustment programme, post-structural adjustment programme policies and commodity price control. The α_i's and β_i's are coefficients, whereas e_t and δ_t are stochastic error terms. Other variables are as previously defined (see equations 10 and 11). Our expectation is that *SAP*, *PSAP*, *OFN* and *GR* will positively affect price variability, whereas *PC* will have a negative impact. We also expect that inflation will have a positive effect on price variability.

6. Model results and discussion

In this section we present and discuss the results obtained from data analysis. The analyses in this study are based on 14 agricultural commodities, as presented in Table 3. These commodities are the major food crops and cash crops in Nigeria.

Table 3: Commodities in sample

Food crops	Cash crops
Cassava	Groundnut
Yam	Palm oil
Rice	Cotton
Beans	Palm kernel
Maize	Cocoa
Millet	Benniseed
Sorghum	
Soyabeans	

Unit root test results

Table 4 reports the ADF tests for the order of integration of our variables provided by *PC Give 10* Econometric software. The data used for the test and subsequent analysis are presented in Appendix Table A1. Inflation (*p*) is not stationary at the level, but is stationary in the first difference. Food price variability (*VF*) is stationary at the level for the first and zero lags. Cash crops price variability (*VC*) is stationary at zero lag. We cannot therefore specify equations 10–13 in the levels of the variables without the risk of obtaining spurious regressions.

Table 4: Unit root test results – ADF statistics

Variable	lag	Level	1st difference	Order of integration
π	2	-2.459	-3.923***	1(1)
	1	-3.298	-5.238***	1(1)
	0	-2.866	-5.27***	1(1)
VF	2	-2.956	-4.924***	1(1)
	1	-3.811***	-6.841***	1(0)
	0	-4.35***	-7.675***	1(1)
VC	2	-2.434	-3.58**	1(1)
	1	-2.174	-4.578***	1(1)
	0	-4.474***	-11.13***	1(0)

Note: The variables are as defined in equations 10–13. *** and ** indicate significant at 1% and 5% probability levels, respectively.

Empirical issues and estimation results

The existence of cointegration between the regressands *VC* (relative price variability of cash crops) and *VF* (relative price variability of food crops) and the regressor *p* (inflation) was determined. The Engle–Granger two-step procedure was adopted to test for cointegration (Gujarati, 2004). The unit root tests on the individual variables have already been conducted in the preceding section. The next stage is that the order of integration of the residuals generated from static models (equations 10 and 11) were evaluated for their order of integration and were found significant. Consequently, the existence of cointegration with respect to the regressands and regressors in each of equations 10 and 11 could not be rejected. Table 5 presents the results of the long-run (static) regression, while Table 6 shows the order of integration of the residuals generated from static models.

Table 5: OLS estimation results of the long-run cointegrated equilibrium models

Equation 11 (Dependent variable = VC)			Equation 10 (Dependent variable = VF)	
Regressor	**Coefficient**	**t-value**	**Coefficient**	**t-value**
Constant	-0.1235	-1.53	1.4263***	15.5
π	0.0124***	4.19	0.0037***	3.52
Adj R^2	0.34		0.27	
F-Statistic	17.6***		12.4***	
DW	2.51		1.92	
Normality test	68.24 (0.0000)***		45.91 (0.0000)***	
Hetero test	2.87 (0.0736)		6.91 (0.0036)***	
Hetero –X test	2.87 (0.0736		6.91 (0.0036)***	
RESET test	3.94 (0.0564)		3.87 (0.0585)	

Note: *** indicates significant at the 1% probability level.

The results in Table 6 suggest that the variables in the equations are cointegrated. A confirmation test was performed using the Johansen multivariate cointegration technique. Test results confirm that the variables in each of equations 10 and 11 are indeed cointegrated. What this suggests is that an error correction specification would provide a better fit than would be the case without it. Table 7 presents the result of estimation of error correction models for equations 10 and 11.

Table 6: Test for order of integration of residuals from static regressions of equations 10 and 11 (Table 5)

Equation	Lag	ADF statistics	Order of integration
e_{10}	2	-3.124***	1(0)
	1	-3.868***	1(0)
	0	-5.101***	1(0)
e_{11}	2	-3.365**	1(0)
	1	-3.882***	1(0)
	0	-6.892***	1(0)

Note: *** and ** mean significant at the 1% and 5% probability levels, respectively. e_{10} and e_{11} are error terms from equations 10 and 11, respectively.

Table 7: Parsimonious error correction model estimates for equations 10 and 11

Equation 10 (Dependent variable = DVC)			Equation 10 (Dependent variable = DVE)		
Regressor	**Coefficient**	**t-value**	**Regressor**	**Coefficient**	**t-value**
Constant	-0.0349	-0.415	Constant	0.0024	0.046
$\Delta\pi_t$	-0.0043***	5.81	$\Delta\pi_t$	0.0127***	3.891
$\Delta\pi_{t-3}$	-0.0012*	-1.77	ECM_{t-1}	-1.2597***	-6.78
ECM_{t-1}	-1.0281***	-5.82			
$AdjR^2$	0.64		0.60		
F-statistic	17.31***		25.38***		
Hetero test	0.58 (0.75)		1.89 (0.15)		
Normality test	20.52 (0.00)***		48.54 (0.00)***		
RESET test	0.67 (0.42)		1.13 (0.30)		
ARCH I-1 test	0.09 (0.77)		0.17 (0.84)		
AR1-2 test	2.1 (0.15)		0.03 (0.86)		
DW	1.52		1.97		
Hetero-X test	6.75 (0.0007)***		1.89 (0.14)		

Note: ***, ** and * represent significance at 1%, 5% and 10% probability levels, respectively.

Table 7 shows that the model has good explanatory powers as shown by the values of the adjusted r-squared. Furthermore, the RESET test results indicate that the equations are not mis-specified and that the assumption of linearity is correct. Besides, the ARCH test suggests absence of autocorrelation in the residuals.

In order to examine the effect of government polices on relative price variability, we re-estimated the models, incorporating dummy variables that capture the effects of government policies. Equation 12 has been estimated in both the static (long-run) and the short-run (parsimonious error correction) forms, and presented in Table 8.

Table 8: The short-run effect of government policies on relative price variability

Error correction model for Equation 12: Food price equation (Dependent variable =DVF)			Error correction model for Equation 13: Cash crops price equation (Dependent variable = DVC)		
Regressor	**Coefficient**	**t-value**	**Regressor**	**Coefficient**	**t-value**
Constant	-1.80**	-2.43	Constant	-0.02	-0.18
$\Delta\pi_t$	0.065***	5.96	$\Delta\pi_t$	0.01***	3.23
OFN	2.201**	2.46	OFN	-0.03	-0.17
GR	1.78**	2.33	GR	-0.05	-0.28
SAP	1.87**	2.54	SAP	0.17	1.11
PSAP	1.67*	2.17	PSAP	0.00	-
$\Delta\pi_{t-3}$	-0.012*	1.96	PC	-0.02	-0.13
ECM_{t-1}	-0.89***	-4.58	ECM_{t-1}	-1.25***	-6.19
$AdjR^2$	0.73		0.63		
F-statistic	9.7***		7.09***		
Hetero test	0.67(0.73)		2.96(0.08)		
Normality test	14.35(0.001)***		1.06(0.44)		
RESET test	0.54(0.47)		1.87(0.19)		
ARCH I-1 test	0.14(0.71)		0.005(0.95)		
AR1-2 test	0.16(0.86)		0.04(0.96)		
DW	2.04		1.97		

Note: ***, ** and * indicate significance at 1%, 5% and 10% probability levels, respectively.

Table 8 shows that both the food price and cash crop price variability equations are significant at the 1% level. That is, the equations have goodness of fit. The Durbin–Watson statistic shows that autocorrelation is not a serious problem in the equations. The strong significance of the error correction terms in the two equations confirms that the residuals of the static models are level stationary and that the series are cointegrated.

Next, we re-estimated the food price and cash crop price variability equations in the static (long-run) form to determine the long-run effects of government policies on relative price variability. The results obtained for food crops price variability are presented in Table 9, while the results for cash crops price variability are in Table 10. For the relative food price variability equation (Equation 12), the linear model gave the best fit and the results are presented. To reduce the incidence of multicollinearity, Equation 13 was estimated in different forms, using the variables that are highly correlated in separate equations (see variants 1 to 4 of Equation 13, in Table 10). The linear model gave the best result for variant 1 of Equation 13, whereas the double-log performed best for variants 2 to 4.

Table 9: Long-run food price variability equation with agricultural policy dummies (Estimated Equation 12) Dependent variable = VF

Regressor	Coefficient	T-value
Constant	1.61***	6.12
π	0.02***	2.78
OFN	-0.16	-0.44
GR	-0.19	-0.56
SAP	-0.07	-0.23
PSAP	-0.33	-1.07
Adj R2	0.31	
F-statistic	2.61**	
Hetero test	2.71(0.04)**	
Normality	28.12(0.00)**	
RESET test	3.27(0.08)	
DW	2.04	

Note: ***, ** and * indicate significance at 1%, 5% and 10% probability levels, respectively. *OFN* means Operation Feed the Nation, *GR* stands for Green Revolution, *SAP* represents structural adjustment programme, *PSAP* stands for post-SAP dummy and *p* stands for inflation.

Table 10: Long-run cash crops price variability functions with agricultural policy dummies (Estimated Equation 13)
Dependent variable: relative cash crops price variability (VC)

Variables	Variant 1 of Equation 13 (Linear)	Variant 2 of Equation 13 (Double-log)	Variant 3 of Equation 13 (Double-log)	Variant 4 of Equation 13 (Double-log)
Constant	0.023	-7.13***	-6.62***	-5.72***
	(1.64)	(-7.73)	(-7.18)	(-5.73)
π	0.0001	1.03***	1.26***	1.05***
	(0.14)	(3.13)	(3.93)	(3.22)
OFN	0.045	-	-	-
	(0.69)			

Continued

Table 10, continued

Variables	Variant 1 of Equation 13 (Linear)	Variant 2 of Equation 13 (Double-log)	Variant 3 of Equation 13 (Double-log)	Variant 4 of Equation 13 (Double-log)
GR	-0.00	-	1.75**	-
	4-0.17		(2.67)	
SAP	-0.22	1.74**	-	-
	(-0.99)	(2.66)		
PSAP	0.111***	1.25**	-	-
	(2.85)	(2.06)		
PC	-	-	-	-1.46***
				(-2.8)
R-square	0.66	0.45	0.43	0.44
Adjusted R-square	0.53	0.40	0.39	0.40
F-statistic	2.93***	7.72***	11.02***	11.51***
Durbin Watson	2.06	2.03	2.14	2.08
Lag-likelihood	-0.20	-55.02	-55.63	-55.31
Normality test	32.37(0.00)***	0.73(0.69)	2.91(0.23)	0.5(0.78)
Hetero test	18.27(0.00)**	1.34(0.29)	1.06(0.38)	1.59(0.22)
Hetero –X test	-	0.86(0.54)	0.99(0.43)	1.17(0.35)
RESET test	55.01(0.00)***	2.9(0.10)	4.06(0.05)	2.72(0.11)

Note: The footnote is the same as that of Table 9. *PC* is a dummy for Marketing Board Price Control.

The link between inflation and relative price variability

The results of all the estimated equations show that inflation has a positive impact on relative price variability across agricultural commodities (see tables 5, 7, 8, 9 and 10). The coefficients of inflation in all the equations (except variant 1 of Equation 13 in Table 10, where there is a problem of multicollinearity) are all significant at the 1% level, and are positive in sign. This result is similar to those obtained by Caglayan and Filiztekin (2003), Smith and Lapp (1993), and Jaramillo (1999).

Table 5 shows that inflation explains 27% and 34% of adjusted total variations in food crops and cash crops prices, respectively, in the long run. On the other hand, inflation accounts for 64% and 60% of the short-run volatility of the prices of food and cash crops, respectively (see Table 7).

The error correction term *(ECMt-1)* is negative in sign and statistically significant at 1% probability level in all the estimated short-run relative price variability equations (see tables 7 and 8). The error correction estimate indicates quick convergence to equilibrium in each period, with intermediate adjustments captured by the differenced terms.

On the impact of inflation in the long run, Table 11 shows that a 10% increase in the rate of inflation causes a 6.8% and 22.8% increase in price variability among food crops and cash crops, respectively. Thus, the impact of inflation is higher among cash crops than among food crops, in the long run. This is probably because food is a necessity and most food producers in the country are small-scale farmers who produce mainly for subsistence and may not readily alter their enterprises in response to changes in inflation.

The ECM model shows the short-run effects of changes in inflation rate on relative price variability among agricultural commodities. The short-run elasticities shown in Table 11 reveal that a 10% increase in the rate of inflation increases food price and cash crops

price variability by 1.4% and 0.45%, respectively. Thus food prices respond more to inflation in the short run than do cash crop prices. The reason is probably because most cash crops are less perishable and their buffer stock helps to stabilize prices in the short run.

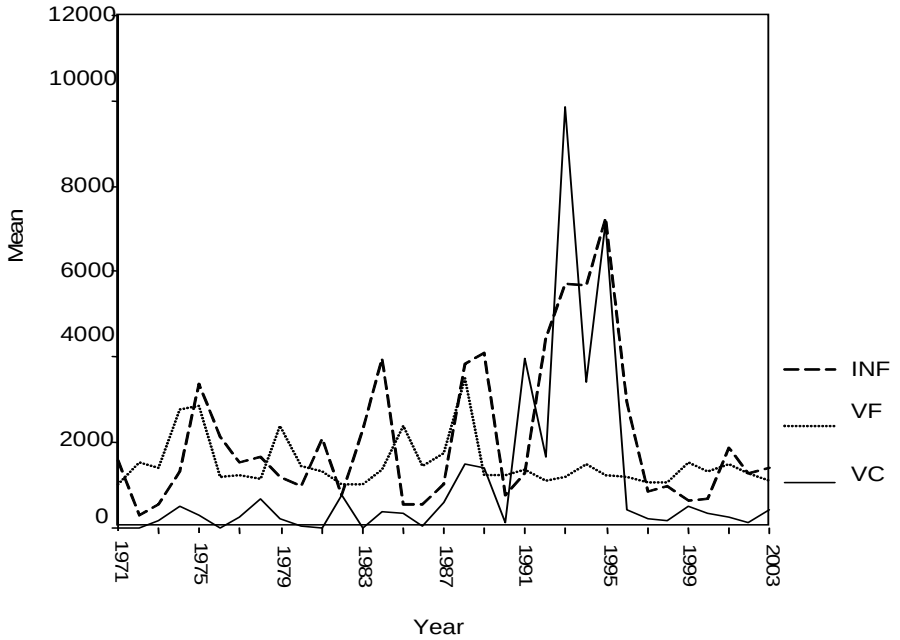
Table 11: Impact of inflation on relative price variability

Price variability	Elasticity with respect to inflation	
	Long-run elasticity	Short-run elasticity
1. Food price variability (VF)	0.68	0.14
2. Cash crops price variability (VC)	2.28	0.045

Notes: The long-run elasticities were computed from the coefficients of *p* (inflation) in Table 5, and the mean values of *p*, *VF* and *VC*. Similarly, the short-run elasticities were computed form the coefficients of *pD* (first difference of inflation) from Table 7 and the mean values of *pD, DVF* and *DVC*.

A visual picture of the relationship between inflation and relative price variability is shown in Figure 2. The rate of inflation had a rising trend from 1971 to 1996, fluctuating greatly with peak values in 1975, 1981, 1984, 1989 and 1995, and slowed down from 1996 to 2003. Similarly, food prices fluctuated and moved in the same direction with inflation.

Figure 2: Relationship between inflation, food price variability and cash crops price variability



Note: INF = Inflation, VF = Food price variability and VC = Cash crops price variability.

On the other hand, cash crop prices fluctuated tremendously from 1971 and 1996 and slowed down thereafter following the same trend with inflation. High peak values of cash crop price variations were recorded in the SAP and post-SAP periods, specifically in 1991, 1993 and 1995. These results indicate that Nigerian agricultural commodity prices become more volatile relative to one another when the economy-wide inflation rate increases. This finding suggests that Nigerian farmers experience increased risk and uncertainty in their production during periods of inflation. In other words, the effect of inflation is non-neutral and there is a considerable impact of inflation on price variability.

Furthermore, no data points in the study period showed negative inflation. As a result of this, the data could not provide evidence for the effect of deflation on relative price variability. That is the reason why the variable that captures the effect of deflation, denoted by $D_*\pi$ in equations 10–13, does not have any entry in tables 5, 7, 8, 9 and 10 where the results of estimation of these equations are presented.

Impact of agricultural policies on relative agricultural prices

In this study, we included dummy variables that controlled for the effects of agricultural policies on relative agricultural prices for the period 1970 to 2003. As noted earlier, the policies studied are price control (PC;1970–1985), Operation Feed the Nation (OFN;1976–1979), Green Revolution (GR;1980–1985), agricultural policies under the structural adjustment programme (SAP;1986–1993), and the post-SAP policies (PSAP;1994–2003).

Impact of agricultural polices on relative food prices

The regression result of Equation 12 (Table 8) shows that OFN, GR, SAP and PSAP polices have significant positive short-run effect on the variability of relative prices among food crops. In other words, the policies caused significant short-run reallocation of resources among the food crops.

In the long-run, however, these policies had no significant effects on the variability of relative prices among food crops (see Table 9). This might be because the policies were short-lived and suffered discontinuity from one political regime to another.

Impact of agricultural policies on relative prices of cash crops

Table 10 (Equation 13) presents the regression results of the long-run effect of agricultural policies on relative prices of cash crops. To reduce the incidence of multicollinearity, Equation 13 was estimated in different forms using the variables that are highly correlated in separate equations and the best results were reported on Table 10 (see variants 1 to 4 of Equation 13, Table 10).

The coefficient of *OFN* was not statistically significant in all the equations tried out, implying that the policy did not have a significant effect on relative prices of cash crops. A possible reason for the insignificance of *OFN* might be because this was a food production programme and therefore its implementation was directed mainly to food production rather than cash crop production.

On the other hand, *SAP*, *PSAP* and *GR* had a significant positive impact on relative prices. Thus, the policies were effective in the cash crops subsector and the result was an increase in relative price variations, and consequently, a more efficient reallocation of resources. The export promotion incentives provided in the SAP and PSAP periods probably encouraged the production of cash crops. Among others, the incentives included the liberalization of agricultural exports, the retention of 100% of export proceeds in domiciliary accounts instead of the 25% allowed previously, the liberalization/devaluation of the naira exchange rate, etc. Similarly, the Green Revolution (GR) provided incentives in the form of liberal resource allocation to agriculture, particularly irrigation facilities, agro-chemicals, equipment, improved seeds, infrastructural facilities, etc., which probably encouraged the production of cash crops.

In contrast, price control *(PC)* had a significant negative impact on cash crop price variability. That is, the policy caused distortions in prices by reducing resource reallocating price variations among cash crops. Consequently, the policy caused a misallocation of resources among cash crops. A possible reason may be that the administrative fixing of commodity prices by the marketing boards created unrealistic prices that were at variance with the market-determined prices.

Furthermore, agricultural policies had no short-run effects on the variability of relative prices among cash crops. (see Table 8). A possible reason might be that most cash crops are less perishable than food crops and their buffer stocks stabilize prices. Also, the long maturation period of most cash crops probably results in delayed response to price incentives.

7. Conclusion and recommendations

Our results show that the effect of inflation on relative price variability is non-neutral for both food crops and cash crops, and that there is a significant positive impact of inflation on price variability in both the short run and the long run. Similarly, the Green Revolution, SAP and post-SAP policies positively affected the relative prices of cash crops in the long run. Furthermore, the price control policy (*PC*) had a significant negative impact on price variations among cash crops. On the other hand, *OFN*, *GR*, *SAP* and *PSAP* polices have no short-run effect on cash crops, but have significant positive short-run effect on food crop price variability. Recommendations include the following:

- SAP, GR and the post-SAP policy measures had significant positive long-run impact on relative prices of cash crops and significant positive short-run effect on relative prices of food crops, and should therefore be continued. These policy measures would ensure an efficient allocation of resources in agriculture.

- The OFN policy measures favoured food crops and therefore a selective application of the policy for food crops would ensure efficiency. The policy included liberal resource allocation to agriculture and the provision of infrastructural facilities.

- The price control policy had a long-run significant negative impact on cash crops price variability, which distorted resource allocation and caused inefficiency. Therefore, the sale of agricultural commodities should continue to be liberalized and no attempts should be made to fix prices administratively.

- Inflation positively affects price variations among agricultural commodities. Thus, the policies that reduce the rate of inflation will minimize relative price variability among agricultural commodities and consequently reduce the inefficiency and misallocation of resources in agriculture that might arise from the effect of inflation.

- The impact of inflation on relative price variability is higher for cash crops in the long run than for food crops. The reverse is the case in the short run. The effect of inflation on relative price variability is higher for food crops than cash crops in the short run and the short-run elasticities are much lower than the long-run elasticities. These findings suggest the importance of policies intended to buffer the agricultural sector from the effects of inflation in the short run, and in addition food crops subsector from the long-run effect of inflation.

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Appendix

Table A1: Computed data on food price variability, cash crops price variability and inflation

Year	Food producer price variability (VF)	Cash crops producer price variability (VC)	Inflation rate (%)
1971	0.0171	0.0015	16
1972	0.4249	0.0008	3.2
1973	0.3513	0.0162	5.4
1974	1.0273	0.0512	13.4
1975	1.0585	0.0318	33.9
1976	0.194	0.0268	21.2
1977	0.2281	0.025	15.4
1978	0.146	0.0676	16.6
1979	0.8632	0.0204	11.8
1980	0.3871	0.0028	9.9
1981	0.2703	0.002	20.9
1982	0.034	0.0769	7.7
1983	0.0396	0.0001	23.2
1984	0.3187	0.0363	39.6
1985	0.8647	0.0323	5.5
1986	0.3868	0.0044	5.4
1987	0.5603	0.0588	10.2
1988	1.2476	0.1504	38.3
1989	0.2144	0.1414	40.9
1990	0.2048	0.0113	7.5
1991	0.3227	0.3977	13
1992	0.1191	0.1673	44.5
1993	0.1713	1.1875	57.2
1994	0.3853	0.3427	57
1995	0.224	0.7143	72.8
1996	0.1926	0.0407	29.3
1997	0.0824	0.0229	8.5
1998	0.084	0.0189	10
1999	0.4285	0.0528	6.6
2000	0.2716	0.0329	6.9
2001	0.4082	0.0277	18.93
2002	0.2606	0.0119	12.88
2003	0.0978	0.0424	13.99
Mean	0.3602	0.1149	21.14
Standard deviation	0.3083	0.2375	17.28
Coefficient of variation (%)	86	207	82

Source: Computed by the researcher from data in CBN, *Statistical Bulletin* (2002, 2003), and various issues of *Annual Report and Statement of Accounts* from 1970 to 2004. *VF* and *VC* were computed using equation 9. (Figures are in excel).

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