IMPACT OF AGRICULTURAL POLICY ON RELATIVE PRICE VARIABILITY OF FOOD CROPS AND INFLATION IN NIGERIA

[IMPACTO DE POLÍTICAS AGRÍCOLAS EN LA VARIACIÓN DEL PRECIO RELATIVO DE CULTIVOS DE ALIMENTOS E INFLACIÓN EN NIGERIA]

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SUMMARY

Prices of food crops in Nigeria tend to exhibit similar trend with inflation. The study therefore established quantitatively relationships among agricultural policy, relative price variability (RPV) of food crops and inflation in Nigeria. Data for the study includes annual producer prices (nominal) and output of food crops and annual inflation rate obtained from the publications of the Central Bank of Nigeria, Nigerian Bureau of Statistics, Food and Agricultural Organisation and Nigerian Institute of Social and Economic Research covering the period of 1970-2009. Analytical tools used were RPV index and Error Correction Method (ECM). The results showed that the variables are stationary at their levels. As inflation increases, RPV of food crops also increases both in short run (0.0002) and the long run (0.0310). Civilian Post-Structural Adjustment Period Policies (CPSAP) caused a significant reduction in inflation and consequently reduced the RPV of food crops in the long run. There is a need for policies that will buffer the food crop sub-sector from the effects of inflation. Policies that reduce the rate of inflation and minimise RPV among food crops are needed. Effective management of inefficiencies and misallocation of resources in the sub-sector should be explored.

Key words: Relative Price Variability; Food Crops; Inflation; Agricultural Policy.

RESUMEN

Los precios de los cultivos de alimentos en Nigeria tienden a mostrar una tendencia similar a la inflación. Por tanto, el estudio estableció cuantitativamente las relaciones entre la política agrícola, la variabilidad de los precios relativos (RPV) de los cultivos alimentarios y la inflación en Nigeria. Los datos para el estudio incluyen los precios anuales a los productores (nominales), la producción de los cultivos alimentarios y la tasa de inflación anual obtenida a partir de las publicaciones del Banco Central de Nigeria, Oficina Nigeriana de Estadísticas, Organización para la Alimentación y la Agricultura y el Instituto Nigeriano de Investigación Social y Económica que cubre el período de 1970-2009. Las herramientas analíticas utilizadas fueron el índice RPV, método de corrección de error (ECM). Los resultados mostraron que las variables son estacionarias en sus niveles. A medida que aumenta la inflación, RPV de los cultivos alimentarios también aumenta tanto en corto plazo (0.0002) y largo plazo (0.0310). Políticas civiles Post-SAP (CPSAP) causaron una reducción significativa de la inflación y por lo tanto reducen la RPV de los cultivos alimentarios en el largo plazo. Hay una necesidad de políticas que amortigüen el sub-sector de los cultivos de alimentos de los efectos de la inflación. Se necesitan políticas que reduzcan la tasa de inflación y minimicen RPV entre los cultivos alimentarios. La gestión eficaz de las ineficiencias y mala asignación de recursos en el subsector debe ser explorado.

Palabras clave: variabilidad precio relativo; cultivo de alimentos; inflación; política agrícola.

INTRODUCTION

Agriculture plays an important role in the rapid growth and development of Nigeria. Agriculture in the context of the economy is tied with the various sectors and is essential for generating broad based growth necessary for development. Agriculture is fundamental to the sustenance of life. It is the bedrock of economic development, especially in the provision of adequate and nutritious food vital for human development, and raw materials for Industries. 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).CBN (2010), reports that the agricultural sector accounts for an average of 33.5% of the Gross Domestic Product (GDP) between 2005-2009. Hence, a rapid development in agriculture would serve as a catalyst for the improvement of the standard of living of the majority of the population.

Agricultural price is a key variable that affects demand and supply of agricultural products and motivation of producers. Agricultural prices are structurally prone to fluctuations because of the short-run inelasticity of supply and demand for agricultural products (Cohen, 1999). These price changes create price risk against which those engaged in agriculture seek protection. A commodity's relative price is defined as its nominal price divided by the average price of all commodities in the group. Changes 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). Relative price variability (RPV) is therefore defined as the variance across a set of commodities of the rates of change of individual nominal prices (Lapp and Smith, 1992). It is measured as the standard deviation of the individual price changes around the average inflation rate.

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 (Ukoha, 2007). Variation in producer price of food crops is more reflected in the relative price of food crops, therefore if inflation should relate to relative prices of food crops in any policy period, the extent and direction of this relationship may reduce the economic welfare of both producers and consumers of food crops during the policy regimes. Many Nigerians depends on food crops for their daily dietary need but it is observed that inflation affects the prices of food crops.

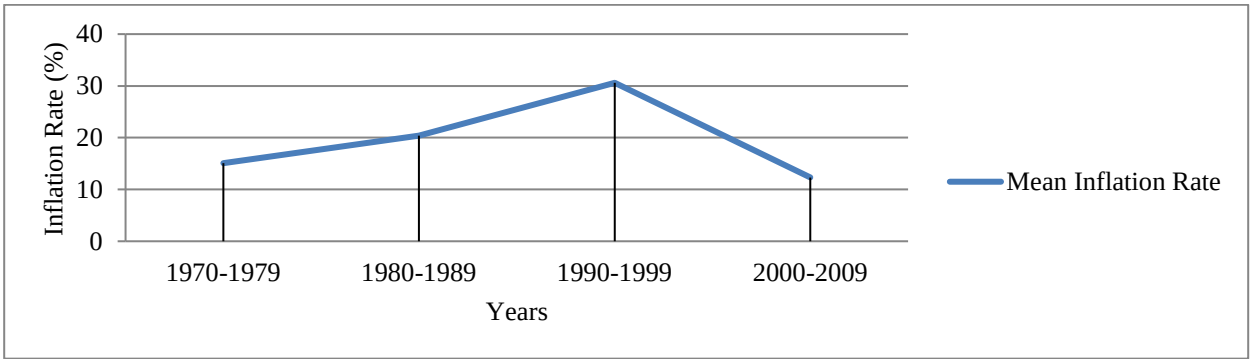

Figure 1: Inflation Rate (1970-2009)

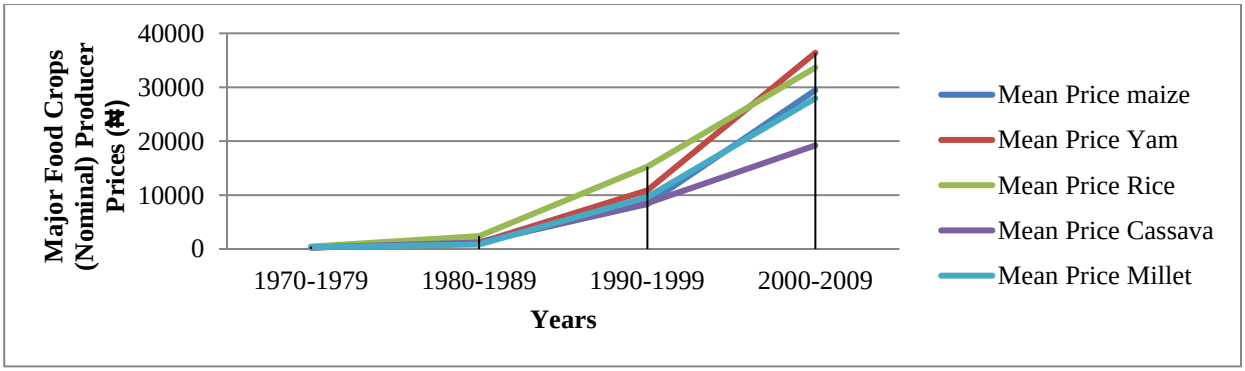

Figure 2: Major Food Crop (Nominal) Producer Prices (1970-2009)

Owing to the important role of agriculture in the Nigerian economy, government, over the years has pursued various policies to boost the agricultural sector. The policies include fiscal, monetary, pricing and exchange rate policies among others. The government went into direct agricultural production through associations such 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 were also established at different times. These programmes included Operation Feed the Nation (OFN), Green Revolution (GR), National Accelerated Food Production Project (NAFPP) among others (Ukoha, 2007).

The controversy whether inflation affects RPV has generated vast empirical literature. Parks (1978) analysed the determinants of the variability in inflation across different components of the US consumer price index. Parks found a significant positive correlation with the aggregate inflation rate. Papers, like Parsley (1996), and Debelle and Lamont (1997) analysed the determinants of the variability of inflation across different US cities. Again they found a significant positive correlation with aggregate inflation. Furthermore, some empirical studies such as Domberger (1987) and Hercowitz (1982) found a positive correlation between the RPV and inflation rate consistent with the Menu cost models however, Silver and Ioannidis (2001) documented a negative one consistent with imperfect information model.

Empirical works such as Reinsdorf (1994) founds that RPV in the United States during the 1980s recession was monotonically decreasing in unanticipated inflation and that positive inflation shocks reduce RPV (that is, they found a negative relationship between inflation and measures of the dispersion of relative price change). Tosupport Reinsdorf (1994), Fielding et al., (2011) used data from inter-war Japan, their results indicated that in recessionary conditions a positive inflation shock does reduce RPV. However, this reduction is unlikely to correspond to higher consumer utility; this has implications for the conduct of monetary policy during a recession.

Garba (2000) analysed the impact and stability of Nigerian agricultural policies from 1970 to1993, the results show that volatility was most intense for most policy variables in the structural adjustment period, implying that agricultural policies were relatively more stable before than after adjustment. Ukoha, (2007) examined the relationships among the RPV of agricultural commodities, inflation and agricultural policy in Nigeria. The study showed that the effect of inflation on RPV among agricultural commodities is non-neutral, inflation had a significant positive impact on RPV in both long-run and the short-run, OFN, GR, Structural Adjustment Programme (SAP) and post-SAP policies had significant positive impact on RPV of food crops in the short run, but in the long run, none of these policies has significant impact on RPV of food crops. The study recommended that 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. Furthermore, Akpan and Udoh (2009) estimated a functional relationship between RPV of grains and inflation rate in various agricultural policy periods in Nigeria. Empirical results revealed that inflation had a positive significant effect on RPV of grains. The result further showed that the SAP and civilian post SAP agricultural policy regimes brought about a positive significant shift in the coefficient of inflation which implies a increase in RPV of grains. Hence, the objective of this study is to establish quantitatively the relationships among agricultural policy, RPV of food crops and inflation in Nigeria.

MATERIAL AND METHODS

Scope of the study. The subject of RPV in Nigeria is wide and complex. However, this study focused on the role of inflation and agricultural policies on RPV of food crops from 1971 to 2009. The study covered the whole Nigeria.

Source of data. The data used for the study were secondary and obtained from publications of the Central Bank of Nigeria (CBN), Nigerian Bureau of Statistics (NBS), Food and Agricultural Organisation (FAO) and Nigerian Institute of Social and Economic Research (NISER). The following major food crops were considered for the analysis: Yam, Maize, Rice, Millet and Cassava (Ukoha, 2007). The data included annual producer prices (nominal), output of food crops and annual inflation rate, the data covered the period of 1970-2009.

Analytical technique

Measuring RPV. The nominal rate of price change consists of two aggregate components, the inflation and relative price component.

$$P_{i,t} = P_t + Z_{i,t} \quad (1)$$

Where, $P_{i,t}$ = Nominal price of ith commodity in period t, P_t = the producer price index (PPI) in period t and $Z_{i,t}$ is the relative price of commodity i in time t. All variables are expressed in natural log.

The PPI was calculated using the Laspeyres price index as shown below:

$$P_t = \left[\frac{\sum P_n Q_o}{\sum P_o Q_o}\right] \times 100 \quad (2)$$

Where, P_t = PPI of 'i' commodity in period t, P_n = Price in the current year
P_o = Price in the base year, Q_o= Quantity in the base year

Inflation rate in period t can be defined as:

$$\Omega_t = LnP_t - LnP_{t-1} \quad (3)$$

RPV as defined by Parks (Parks, 1978) is:

$$V_t = \sqrt{\sum_{i=1}^{\mu} W_i(\Omega_{it} - \Omega_t)^2} \quad (4)$$

Where, V_t= Relative price variability, W_i= Weight of price 'i' in the price index (it reflects the relative importance of each commodity), Ω_{it}= nominal rate of price change in period t (inflation rate of price 'i') which equals:

$$LnP_{i,t} - LnP_{i,t-1} \quad (5)$$

The annual measure of RPV (RPV index) of food crops was computed from the Producer Price Index (PPI) computed from the data named above. Laspeyres price index was used to compute the PPI (Gupta, 1981). This study used 1/N as weight attached to each food crop (Akpan and Udoh, 2009), where N is the total number of observations in t_k (N=5, 't_k' represents 'each year'). The augmented dickey-fuller (ADF) test was carried out to determine the time series properties of the data. The variables RPV of food crop and inflation were integrated and therefore error correction models (ECM) and long-run static models were specified and estimated. The empirical models for the study were specified as shown below according to the objectives. All the equations were estimated by OLS method (See equations 6 and7).

OLS Estimation of objective 1: To derive the relationship between inflation and food crop RPV and determine the impact of inflation on food crop RPV.

$$V_{ft} = \alpha_0 + \alpha_1\lambda_t + U_t \quad (6)$$

Where, V_{ft}= RPV of food crops, α_0= constant, α_1= coefficient, λ_t= absolute value of inflation in period t (Annual inflation rate), U_t = error term

OLS Estimation of objective 2: To show the impact of different agricultural policies on inflation and RPV of food crops. The agricultural policies examined includes: the Price Control (PC)1971-1975, Operation Feed the Nation (OFN) 1976–1979, Green Revolution (GR) 1980–1985, Structural Adjustment Programme (SAP) 1986–1993, Military Post-SAP (MPSAP)1994 - 1999 and Civilian Post-SAP (CPSAP) 2000 to date (Akpan and Udoh, 2009).
The required equation is:

$$V_{ft} = \alpha_0 + \alpha_1\lambda_t + \alpha_2(PC * \lambda)_t + \alpha_3(OFN * \lambda)_t + \alpha_4(GR * \lambda)_t + \alpha_5(SAP * \lambda)_t + \alpha_6(MPSAP * \lambda)_t + \alpha_7(CPSAP * \lambda)_t + U_t \quad (7)$$

PC, OFN, GR, SAP, MPSAP and CPSAP are dummy variables for each agricultural policies respectively (1= policy period and zero otherwise). The product between each dummy variable and absolute inflation were found (for example PC*λ, OFN*λ, GR*λ etc.) to show the impact of inflation in different agricultural policy regimes on RPV of food crop. α_0 is the constant term, α's are coefficients, U_t is stochastic error term other variables are earlier defined (see equation 6).

RESULTS AND DISCUSSION

Table 1 reports the ADF test for RPV of food crop and absolute value of inflation. Comparing the ADF test statistic with the MacKinnon critical values, the ADF Statistic values are lesser than the MacKinnon critical values therefore that there is no unit root problem in the variables used. All the variables are stationary in their levels. This validates the use of OLS in estimating equations 6 and 7 without the risk of obtaining a spurious regression.

Table 2 reports Error Correction Model (Parsimonious / short run) estimate for equation 6. It revealed that equation 6 is significant at 1%; the model has a good explanatory power as shown by the value of the R-Square, The strong significance of the error correction term in the equation confirms that the residual of the static model is level stationary and that the series are co-integrated. The error correction term is negative and statistically significant at 1% probability level, therefore a quick convergence to equilibrium in each period, with intermediate adjustment captured by the differenced term. The Durbin–Watson statistics shows that autocorrelation is not a serious problem in the equation. The coefficient of inflation is positive at lag one.

Table 1: The Unit root test result (ADF- Statistic) for RPV of food crops and absolute value of inflation.

Variables	ADF Statistic	Critical Value of ADF 1%	5%	10%
V	-4.4320	-3.6171	-2.9422	-2.6092
λ	-4.3477	-3.6171	-2.9422	-2.6092

Table 2: Error Correction Model (Parsimonious / short run)†

Regressor	Coefficient	t-statistic
Constant	0.0551	0.4654
λ	-0.0290	-0.6835
D(λ(-1))	0.0310	0.8622
ECM(-1)	-0.5150***	-3.9930
R-squared	0.3729	
Adjusted R-squared	0.3159	
S.E. of regression	0.1706	
Sum squared residual	0.9605	
Log likelihood	15.0475	
Durbin-watson statistic	2.1569	
Mean dependent variable	-0.0284	
S.D. dependent variable	0.2063	
Akaike information criterion	-0.5972	
Schwarz criterion	-0.4230	
F-statistic	6.5410***	
Prob (F-statistic)	0.0014	

† estimated for equation 6
*** represent significance at 1% probability level.

Relationship between RPV of food crops and Inflation

The result on table 2 above shows that there is a positive relationship between RPV of food crops and inflation in Nigeria. This result is similar to those obtained by Caglayan and Filiztekin (2003), Smith and Lapp (1993), Jaramillo (1999) and Ukoha, (2007). Table 2 also shows that inflation explains 37% of the total variation in food crop prices. The result suggests that food crop producers in Nigeria are exposed to increased risks and uncertainties in their production activities during the period of high inflation. Also, there is high tendency of reallocation of resources from food crop sub-sector to other agricultural sub-sectors during the period of increasing rate of inflation. During the period of high inflation, due to high-anticipated probability of production risks, there will be reduced welfare for both producers and consumers of food crops in Nigeria.

Impact of different agricultural policies on inflation and RPV of food crops

In order to examine the impact of different agricultural policies on inflation and RPV of food crops, equation 6 was re-estimated by incorporating dummy variables that capture the government policies. The product of these dummy variables and inflation rates in different agricultural policy regimes were further found [that is, Agricultural policy (Dummy variable) * Annual inflation rate]. Table 3 reports the long run (static) impact of different agricultural policies on inflation and RPV of food crops. The table showed that inflation has a positive impact on RPV of food crops. PC Policy did not give any result; this may be because PC policy was more focused on cash crops than on food crops. OFN, GR, SAP and MPSAP, did not have any significant impact on inflation, this may be because many of the Nigeria policies were short-lived and suffered discontinuity from one political regime to another, and consequently, these policies did not have any significant impact on the RPV of food crops in Nigeria. This result is in line with Ukoha, 2007, who found that OFN, GR and SAP Policies did not have any significant impact on RPV of food crops in Nigeria in the long run. CPSAP caused a significant shift in the co-efficient of inflation causing a reduction in the co-efficient of inflation and consequently caused an decrease in RPV of food crops in Nigeria.

Table 3: Long run (Static) impact of different agricultural policies on inflation and RPV of food crops†

Regressor	Coefficient	T-value
λ	0.00020	0.03000
OFN*λ	-0.00367	-0.42000
GR*λ	-0.00603	-0.86000
SAP*λ	-0.00232	-0.38000
MPSAP*λ	-0.00264	-0.42000
CPSAP*λ	-0.02123***	-2.68000
Constant	0.35060	4.95000
R-square	0.23240	
F- statictic	1.62000	

† OLS estimation of equation 7.
Note: *** represent significance at 1% probability level.

CONCLUSION

The study shows that inflation has a positive impact on RPV of food crops in both the short run and the long run. The OFN, GR, SAP, MPSAP policies did not shift the coefficient of inflation and as a consequence did not have any significant impact on RPV of food crops. The CPSAP had a significant impact on inflation (at 1% level) thereby reducing the co-efficient of inflation and at the same time reducing RPV of food crops in Nigeria in the long run which further has implication for increased welfare. Inflation positively affects price variations among food crops. Thus, the need for policies that will buffer the food crop sub-sector from the effects of inflation. Policies that reduce the rate of inflation and minimise RPV among food crops are needed. Effective management of inefficiencies and misallocation of resources in the sub-sector should be explored.

REFERENCES

Ajibefun, I.A. 2004. Determinants of technical efficiency and policy implications in traditional agricultural production: Empirical study of Nigerian food crops farmers. A final research report, submitted to African Economic Research Consortium, Nairobi, Kenya.

Akpan, S.B. and Udoh, E.J. 2009. Estimating Grain Relative Price variability and Inflation Rate Movement in Different Agricultural Policy regimes in Nigeria. Humanity and Social Sciences Journal. 4(2): 107-113

Caglayan, M. and Filiztekin, A. 2003. Nonlinear impact of inflation on relative price variability. Economic Letters. 79(2): 213–18.

CBN 2010. Central Bank of Nigeria: Statistical Bulletin, 2010 Edition.

CBN/NISER 1992. The Impact of SAP on Nigerian Agricultural and Rural Life. Vol 1. The National report. A CBN/NISER National Study.

Cohen, B.H. 1999. Derivatives, volatility and price discovery. International Finance, 2: 167-202.

Debelle, G. and Lamont, O. 1997. Relative price variability and inflation: evidence from U.S. cities. Journal of Political Economy.105: 132-52.

Domberger, S. 1987. Relative price variability and inflation: A disaggregated analysis. Journal of Political Economy. 94: 547–67.

Fielding, D., Hajzler, C. and MacGee, J. 2011. Determinants of Relative Price Variability during a Recession: Evidence from Canada at the Time of the Great Depression. Economics Discussion Papers Series. No. 1107. University of Otago. Retrieved from http://hdl.handle.net/10523/1878

Garba, K.P. 2000. Analysis of the implementation and stability of Nigerian agricultural policies, 1970-1993. African Economic Research Consurtium. Nairobi paper, 101.

Gupta, C. B. 1981. An Introduction to Statistical Methods. New Delhi: Vikas Publishing House PVT Ltd.

Hercowitz, Z. 1982. Money and price dispersion in the United States. Journal of Monetary Economics. 9: 25-38.

Jaramillo, C.F. 1999. Inflation and relative price variability: Reinstating Parks results. Journal of Money, Credit and Banking. 31(3): 375–85.

Lapp, J.S. and Smith, V.H. 1992. Aggregate sources of relative price variability among

agricultural commodities. American Journal of Agricultural Economics. 74: 1–9.

Loy, J.P. and Weaver, R.D. 1998. Inflation and relative price volatility in Russian food markets. European Review of Agricultural Economics. 25: 373–94.

Parks, R.W. 1978. Inflation and relative price variability. Journal of Political Economy.86: 79– 95.

Parsley, D. 1996. Inflation and relative price variability in the short and long run: New Evidence from the United States. Journal of Money, Credit and Banking.28: 323-41.

Reinsdorf, M. 1994. New Evidence on the Relation between Inflation and Price Dispersion. American Economic Review. 84(3): 720-731.

Silver, M. and Ioannidis, C. 2001. Intercountry differences in the relationship between relative price variability and average prices. Journal of Political Economy. 109(2):355-374.

Smith, V.H. and Lapp, J.S. 1993. Relative price variability among agricultural commodities and macroeconomic instability in the United Kingdom. Journal of Agricultural Economics. 44(2): 272–283.

Ukoha, O.O. 2007. Relative Price Variability and Inflation: Evidence from the Agricultural Sector in Nigeria. AERC Research Paper 171. African Economic Research Consortium, Nairobi.

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