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The long-run and short-run effects of price fluctuation on production of selected food grains in Nigeria (1981 – 2020)

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ABSTRACT

The study examined the long-run and short-run effects of price fluctuation on production of selected food grains in Nigeria (1981 – 2020). The data for this study were collected from secondary sources. The data was obtained from records of the National Bureau of Statistics (NBS), Food and Agriculture Organization Statistical Database (FAOSTAT) and annual reports. Data for this study were analyzed using Vector Error Correction Model (VECM) after testing for unit roots and cointegration among the variables using Augmented Dickey Fuller (ADF) and Johansen Co-integration Test, respectively. The result of the Augmented Dickey Fuller (ADF) test indicated that all the variables were found to be stationary on first differencing and Johansen co-integration mechanism indicated that there was co-integration among the variables. The result of VECM revealed that in the long run, the coefficient of rice price (0.000533) was statistically significant at 1% probability level; the coefficient of maize price (1115.509) was positive and statistically significant at 1% probability level while the coefficient of wheat price (4.728131) was positive and statistically significant at 1% probability level. The study concluded that prices of rice, maize and wheat have a positive and significant influence on the production or output of rice, maize and wheat in Nigeria in the long run. Therefore, an increase in prices of rice, maize and wheat increases the quantities that are being produced by the farmers in Nigeria. The study therefore recommended that efficient marketing systems should be put in place so that rice, maize and wheat farmers benefit directly from high prices of crops thereby serving as an incentive to engage in production in order to boost national output levels.

Keywords: Prices, Fluctuation, Food grains, Nigeria, Co-integration.

1. INTRODUCTION

Nigerian domestic economy is dominated by agriculture, which accounts for about 40% of the Gross Domestic Product (GDP) and two-thirds of the labour force (Awotide, 2012). Agriculture supplies raw materials, generates household income and food grains for the majority of the people. The food sub-sector of Nigerian agriculture displays a large grouping of staple crops, made possible by

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the diversity of agro-ecological production systems. The major food crops are: cereals (sorghum, maize, millet, rice, wheat, fonio); tubers (yam, cassava); legumes (groundnut, cowpeas) and vegetables (spinach, cabbage, tomato, onion, garlic, okro, lettuce, cucumber). These are the major commodities which are of considerable importance for food security, expenditures and incomes of households. Of all the major food crops, cereals have risen to a position of dominance. The significance of cereal grains as sources of food for man cannot be over emphasized, particularly in the developing nations. Grains, depending on the processing technique and the types of cereal engaged, have offered a wide range of food products to man, particularly in the developing countries, but also to the animals in the developed countries. Millet, maize, rice, sorghum and wheat have formed the major food-based grains, particularly in Nigeria.

Price serves an important role in the selection of crops and generation of marketable surplus. Usually higher prices are expected to result in a larger output. Prices are then, among the most significant determinants of the country under different crops. In economic analysis of the farm supply response, price is considered to be critical economic factor that determines farmers' production decisions (Barnabe and Semedo, 2020). In addition, agricultural pricing policy plays a key role in increasing farm production and fundamental to an understanding of this price mechanism is supply response (Aina *et al.,* 2015).

The fluctuation in the price of agricultural commodities in Nigeria has been attributed to various factors including variances in bargaining power among consumers, cyclical income fluctuations among sellers and consumers; natural shocks such as flood, pests, and diseases; as well as diseases, and inappropriate response by farmers to price signals. Long term productivity increases could undoubtedly result from the use of superior inputs (fertilizers, improved high yielding seeds and planting materials), adoption of better farming practices including those related to water management and resource conservation (for which a strong extension system may be a necessary precondition) and participation in agricultural credit, insurance, input as well as product markets. The last, in particular, takes time to develop, but is often a necessary precursor to private investment in better technology.

Short-run fluctuations in prices food grains also occur between production seasons (Akanni, 2013). During the harvesting period, farmers offer the market the minimum price for their products. In the off-season, prices become high due to reduced production and seasonal changes (Taru, 2014). Product price instability among agricultural commodities is a regular phenomenon in markets across Nigeria (Ama *et al.,* 2013). Price fluctuation in food grains among markets could be detrimental to the marketing system and the economy as a whole. It could cause inefficiency in resource allocation among sellers and consumers depending on the source of fluctuation (that is, whether it is induced by the supply or demand side or both). It could also increase the poverty level among wage earners in society. This study consequently estimated the long-run and short-run effects of price fluctuation on outputs of rice, maize and wheat in Nigeria (1981-2020). The hypothesis tested in the study was that, positive effect exists between yields of rice, maize and wheat as well as their prices. This implies that increase in relative price of the crops in t-1 year leads to an increase in the yields of the crops in 't' years. In this study, Johansen's co-integration test was used to overcome the trouble of spurious regression.

Statement of the Problem

Awotide (2012) reported that, the sharp increase in food commodity prices from 2006 until mid-2008 raised serious concerns in a number of significant areas; food and nutrition deficiencies among poor people in developing countries, inflation, long or short terms capacity of the country to feed itself, and in some countries civil unrest. Although real prices are still below their mid-1970s peak, they have reached their highest point since that time. In consequence all governments, both of developing and developed countries, have roles to play in learning from the recent production shortfalls and consequent price fluctuation (Baba, 2018).

Research works on effect of price fluctuation on rice production and price fluctuation of selected cereal in Nigeria have been conducted and a lot of recommendations made. Taru (2014) worked on price fluctuation and market integration of selected cereal in North-Eastern Nigeria. He established the major source of variability in the price series from 2001-2010. Aina *et al.* (2015) researched on the effect of price variation on rice production as it is the most widely consumed staple food for a large part of the world's human population. Their study established that, price of rice and quantity of production has a positive effect on each other, which corresponds with the theory of supply. Consequently, a decrease in price of rice reduces the quantity that is being produced by the farmers so as not to run into a loss in production. Despite the contextual scope covered by these researchers, their studies still left out the aspect of long-run and short-run effects of price fluctuation and did not make any particular position in relation to outputs of rice, maize and wheat in Nigeria from 1981 to 2020.

In spite of the intensity of research work done on price fluctuation, the conversation about understanding the long-run and short-run effects of food price fluctuation is to first, separate the various factors which create variances in bargaining power among consumers, cyclical income fluctuations among sellers and consumers; natural shocks such as flood, pests, and diseases; as well as diseases, and inappropriate response by farmers to price signals. On that account, therefore, natural hazards always results to long

and short run high effects of food price fluctuations. To have the above dichotomy for studies is good but to think of how a society will exist without such is unimaginable. The dual can be found across rural and urban sectors. In developing countries such as Nigeria where the higher proportion of the population who engaged in agriculture are considered poor. Not only are they characterized with low income, most of these developing countries are still net food importers as government often spend huge on food importation.

Specific Objectives of the Study
1. To ascertain whether there is existence of a long run relationship between prices and outputs of rice, maize as well as wheat in Nigeria (1981-2020);
2. To determine the long run and short run effects of price fluctuation on outputs of rice, maize and wheat in Nigeria (1981-2020).

2. METHODOLOGY

The data for this study were collected from secondary sources. The data was obtained from records of the National Bureau of Statistics (NBS), Food and Agriculture Organization Statistical Database (FAOSTAT) and annual reports. Data for this study were analyzed using Vector Error Correction Model (VECM) after testing for unit roots and cointegration among the variables using Augmented Dickey Fuller (ADF) and Johansen Co-integration Test respectively.

Model Specification

Vector Error Correction Model: The Vector Error Correction Model (VECM) was used to model causal influence between non stationary I (1) variables with evidence of long run relationship. Thus, the Vector Error Correction Model (VECM) is specified as follows:

$$\ln Ry_{t-1} = \alpha_0 + \alpha_1 \ln Ry_{t-1} + \alpha_2 \ln Rprfl_{t-1} + \alpha_3 \ln Inf_{t-1} + \alpha_4 Exr_{t-1} + \partial ECM_t + \mu_{1t} - - - - - - - - - - - - - - - -(1)$$

$$\ln My_{t-1} = \alpha_0 + \alpha_1 \ln My_{t-1} + \alpha_2 \ln Mprfl_{t-1} + \alpha_3 \ln Inf_{t-1} + \alpha_4 FExr_{t-1} + \partial ECM_t + \mu_{1t} - - - - - - - - - - - - - - (2)$$

$$\ln Wy_{t-1} = \alpha_0 + \alpha_1 \ln Wy_{t-1} + \alpha_2 \ln Wprfl_{t-1} + \alpha_3 n Inf_{t-1} + \alpha_4 FExr_{t-1} + \partial ECM_t + \mu_{1t} - - - - - - - - - - - - - - (3)$$

Where:

Ry_{t-1} = Rice production,

My_{t-1} = Maize production,

Wy_{t-1} = Wheat production,

Inf_{t-1} = Inflation rate

$Rprfl_{t-1}$ = Rice price fluctuation,

$Mprfl_{t-1}$ = Maize price fluctuation,

$Wprfl_{t-1}$ = Wheat price fluctuation,

$FExr_{t-1}$ = foreign exchange rate,

$PrFl_{t-1}$ = price fluctuation,

α_0 = the constant,

∂ECM_t = error correction term,

μ_t = error term.

3. RESULTS

Test for Stationarity

Unit root test: The ADF test for unit root was employed to test whether or not a variable is stationary and also determine the order of integration of the variable. The null hypothesis of the ADF is that the series of interest is stationary, hence the rejection of the null hypothesis implies the variables are not stationary. The result presented in Table 1 indicated all the variables were integrated at order one and stationary at first difference. This implies that all the variables exhibit random walk (unit root). The result of unit root implies that, outputs and prices of rice, maize and wheat cannot be specified at their levels without the risk of obtaining spurious regression.

Table 1: Result of the Augmented Dicker-Fuller test for unit root test for prices and outputs of rice, maize and wheat in Nigeria

Variables	Crops	Level		First difference		Inference
		t-statistic	Prob.	t-statistic	Prob.	
Outputs	Rice	1.371769	0.9985	-3.650968***	0.0053	1(1)
	Maize	-1.177782	0.6743	-6.077182***	0.0000	1(1)
	Wheat	-3.175582	0.0292	-5.833755***	0.0000	1(1)
Prices	Rice	-0.051862	0.9473	-7.075982***	0.0000	1(1)
	Maize	-0.816441	0.8026	-10.40867***	0.0000	1(1)
	Wheat	-1.125538	0.6960	-5.809512***	0.0000	1(1)

Note: asterisks *** indicate stationarity at 1% level of significance.
Source: Data analysis (2021).

Johansen Co-integration Test

Further investigations were carried out to determine the series properties of the variables. Johansen co-integration mechanism test was carried out to determine whether there is existence of a long-run relationship between prices and outputs of rice, maize as well as wheat grains in Nigeria. This is based on the assumption that linear combinations of non-stationary variables can be stationary (Enger and Granger, 1987). Thus, based on the trace statistics value (252.7036) which is greater than the critical value (159.5297), and maximum Eigen value (84.07272) which is also greater than the critical value (52.36261) a long-run relationship exists among outputs of rice, maize and wheat grains in Nigeria within the period of study at 5% level (Table 2). Using trace = statistics, the result revealed that combination of these variables has four co-integrating equations and this means that linear combination of these variables has four long run linear combinations of relationship or four co-integrating equations.

Table 2: Results of Johansen's Co-integration Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistics	Critical Value at 5% (Prob.**)	Maximum Eigen statistics	Critical Value at 5% (Prob.**)
None *	0.890567	252.7036	159.5297 (0.0000)	84.07272	52.36261 (0.0000)
At most 1 *	0.791057	168.6309	125.6154 (0.0000)	59.49643	46.23142 (0.0012)
At most 2 *	0.593783	109.1344	95.75366 (0.0044)	34.23297	40.07757 (0.1965)
At most 3 *	0.531934	74.90148	69.81889 (0.0185)	28.84752	33.87687 (0.1771)
At most 4	0.453105	46.05396	47.85613 (0.0731)	22.93291	27.58434 (0.1764)
At most 5	0.382780	23.12105	29.79707 (0.2402)	18.33613	21.13162 (0.1771)
At most 6	0.088549	4.784919	15.49471	3.523268	14.26460

			(0.8312)		(0.1178)
At most 7	0.032656	1.261651	3.841466 (0.2613)	1.261651	3.841466 (0.2613)

Trace and Max-eigenvalue tests indicate 1 cointegrating eqn(s) at the 0.05 level

 * denotes rejection of the hypothesis at the 0.05 level

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

Source: Data analysis (2021).

Long-Run and Short-Run Effects of Price Fluctuation on Production of Selected Food Grains in Nigeria

As a result of the existence of co-integrating equations among the variables, implying long run relationship exist among the variables, the Vector Error Correction Model (VECM) was estimated. The Vector Error Correction model shows the short run and long run effects of price fluctuation on production of selected food grains in Nigeria.

Long-run and short-run effects of price fluctuation on output of rice in Nigeria:

The result of VECM as shown in Table 3 indicated that in a long run, the estimated parameter (rice price) is positive and significant at 1%. This implies that a unit increase in the price of rice will increase output of rice by 0.000533%. However, inflation is not significant and has no effect on output of rice in the long-run (Table 3).

The Vector Error Correction Term [VECT (-1)] is statistically significant and negative revealing a slow speed of adjustment (that is, the speed at which the deviation from long run equilibrium is adjusted quickly where -2885.217 of the disequilibrium is removed immediately in each period). This also reveals that, there is a general concern that rice price spikes take a long period of time to return back to the true market equilibrium in Nigeria. This is in line with the findings of Aina *et al.* (2015) that, price stability of rice is a frequent forerunner of macro-economic shocks and political turmoil that may discourage long-run investment and curtail growth. However, in the short run, the result shows that price and inflation were not significant hence has no significant effect on output of rice in the short run (Table 4).

Table 3: Vector Error Correction Model (VECM) Estimates of Long-Run Effect of Price Fluctuation on Output of Rice in Nigeria

Cointegrating Eq: Variables	CointEq1: Coefficients	Standard error	t-statistic
LNRICE_OUT(-1)	1.000000	-	-
LNRICE_PF(-1)	0.000533	0.00011	4.75335
LNINFLATION(-1)	-0.037545	0.02332	-1.61020
LNEXCHANGE_RATE(-1)	0.000495	0.00371	0.13346
Constant	-15.33105	-	-

Note: *significant at 10%, ** significant at 5%, *** significant at 1%.

Source: Data analysis (2021).

Table 4: Vector Error Correction Model (VECM) Estimates of Short-Run Effect of Price Fluctuation on Output of Rice in Nigeria

Error Correction:	D(LNRICE_OUT)	D(LNRICE_PF)	D(LNINFLATION)	D(LNEXCHANGE_RATE)
CointEq1	-0.016228 (0.01666) [-0.19408]	-2885.217 (613.778) [-4.70075]	0.138299 (1.52861) [0.09047]	4.434445 (2.18013) [2.03403]
D(LNRICE_OUT(-1))	-0.350951 (0.18580) [-1.88891]	-286.2357 (6845.07) [-0.04182]	-18.86979 (17.0476) [-1.10689]	20.68669 (24.3136) [0.85083]
D(LNRICE_OUT(-2))	0.115859 (0.18075) [0.64098]	-184.2400 (6659.29) [-0.02767]	3.204052 (16.5849) [0.19319]	-13.80297 (23.6537) [-0.58354]

D(LNRICE_PF(-1))	6.29E-06	0.508325	-0.000229	-0.001092
	(5.7E-06)	(0.20887)	(0.00052)	(0.00074)
	[1.10903]	[2.43371]	[-0.43942]	[-1.47135]
D(LNRICE_PF(-2))	1.24E-06	-0.114392	-5.54E-05	-0.001131
	(4.4E-06)	(0.16308)	(0.00041)	(0.00058)
	[0.27996]	[-0.70146]	[-0.13632]	[-1.95285]
D(LNINFLATION(-1))	-0.003331	-66.08037	0.054096	0.025726
	(0.00209)	(76.9207)	(0.19157)	(0.27322)
	[-1.59522]	[-0.85907]	[0.28238]	[0.09416]
D(LNINFLATION(-2))	0.000564	-198.6747	-0.125517	-0.152935
	(0.00212)	(78.2540)	(0.19489)	(0.27796)
	[0.26554]	[-2.53884]	[-0.64404]	[-0.55021]
D(LNEXCHANGE_RATE(-1))	0.001017	2.319039	-0.010524	0.456656
	(0.00150)	(55.1930)	(0.13746)	(0.19604)
	[0.67860]	[0.04202]	[-0.07656]	[2.32935]
D(LNEXCHANGE_RATE(-2))	-0.001743	189.1878	0.072930	-0.240799
	(0.00149)	(54.9206)	(0.13678)	(0.19508)
	[-1.16893]	[3.44475]	[0.53320]	[-1.23438]
C	0.068266	-1595.688	0.014255	7.659897
	(0.03061)	(1127.68)	(2.80847)	(4.00549)
	[2.23028]	[-1.41502]	[0.00508]	[1.91235]
R-squared	0.662525	0.857197	0.108095	0.294328
Adj. R-squared	0.150033	0.809596	-0.189206	0.059104
Sum sq. Resids	0.546822	7.42E+08	4603.619	9364.216
S.E. equation	0.142312	5243.042	13.05773	18.62318
F-statistic	1.706063	18.00793	0.363588	1.251266
Log likelihood	25.46843	-363.5640	-141.7388	-154.8748
Akaike AIC	-0.836132	20.19265	8.202098	8.912151
Schwarz SC	-0.400748	20.62803	8.637481	9.347534
Mean dependent	0.050390	45.40541	-0.269189	9.678022
S.D. dependent	0.154362	12015.59	11.97400	19.19919
Determinant resid covariance (dof adj.)	2.72E+10			
Determinant resid covariance	7.71E+09			
Log likelihood	-631.1643			
Akaike information criterion	36.49537			
Schwarz criterion	38.41106			

Log-likelihood -528.7541 Akaike information criterion 30.04076   Schwarz criterion 31.21630

Note: Figures in parentheses are standard errors in ( ) & t-statistics in [ ]; *significant at 10%, ** significant at 5%, *** significant at 1%.

Source: Data analysis (2021).

Effects of price fluctuation on output of maize in Nigeria:

The result of VECM as shown in Table 5 revealed that in the long run, the coefficient of maize price (1115.509) was positive and statistically significant at 1% probability level. This implies that, an increase in price of maize will increase output of maize by 1115.509%. However, in the short run, the result shows that price and inflation were not significant hence has no significant effect on maize output in the short run (Table 6).

The Vector Error Correction Term [VECT (-1)] is statistically significant and negative (-0.039940) revealing a slow speed of adjustment (that is, the speed at which the deviation from long run equilibrium is adjusted quickly where 0.039940 of the disequilibrium is removed immediately in each period). This also reveals that, there is a general concern that price of maize spikes take a long period of time to return back to the true market equilibrium in Nigeria.

Table 5: Vector Error Correction Model (VECM) Estimates of Long-Run Effect of Price Fluctuation on Maize output in Nigeria

Cointegrating Eq: Variables	CointEq1: Coefficients	Standard error	t-statistic	Decision
LNMAIZE_OUT(-1)	1.000000	-	-	
LNMAIZE_PF(-1)	1115.509	270.153	4.12917	
LNINFLATION(-1)	-174930.0	51260.2	-3.41259	
LNEXCHANGE_RATE(-1)	-26815.67	8094.18	-3.31296	
C	-2710418.	-	-	

Note: *significant at 10%, ** significant at 5%, *** significant at 1%.

Source: Data analysis (2021).

Table 6: Vector Error Correction Model (VECM) Estimates of Short-Run Effect of Price Fluctuation on Maize output in Nigeria

Error Correction:	D(LNMAIZE_OUT)	D(LNMAIZE_PF)	D(LNINFLATION)	D(LNEXCHANGE_RATE)
CointEq1	-0.039940	-0.001080	7.00E-07	1.53E-06
	(0.04786)	(0.00030)	(8.7E-07)	(1.3E-06)
	[-2.83455]	[-3.56503]	[0.80720]	[1.17624]
D(LNMAIZE_OUT(-1))	-0.055311	0.000221	2.86E-06	3.90E-06
	(0.19970)	(0.00126)	(3.6E-06)	(5.4E-06)
	[-0.27697]	[0.17524]	[0.78947]	[0.71783]
D(LNMAIZE_OUT(-2))	0.167601	0.001104	6.56E-07	1.43E-06
	(0.19265)	(0.00122)	(3.5E-06)	(5.2E-06)
	[0.86998]	[0.90512]	[0.18810]	[0.27232]
D(LNMAIZE_PF(-1))	-31.42683	0.215382	-0.000698	-0.000873
	(36.7350)	(0.23250)	(0.00067)	(0.00100)
	[-0.85550]	[0.92639]	[-1.04850]	[-0.87274]
D(LNMAIZE_PF(-2))	-19.34422	-0.189687	-0.000573	-0.000260
	(26.4398)	(0.16734)	(0.00048)	(0.00072)
	[-0.73163]	[-1.13356]	[-1.19624]	[-0.36130]
D(LNINFLATION(-1))	12278.59	-172.2634	0.056739	0.207216
	(12417.7)	(78.5916)	(0.22491)	(0.33804)
	[0.98880]	[-2.19188]	[0.25228]	[0.61299]
D(LNINFLATION(-2))	2872.076	-68.68201	0.000265	-0.270259
	(12086.0)	(76.4921)	(0.21890)	(0.32901)
	[0.23764]	[-0.89790]	[0.00121]	[-0.82143]

D(LNEXCHANGE_RATE(-1))	-17395.70	-29.21017	-0.005711	0.317032
	(7414.79)	(46.9282)	(0.13430)	(0.20185)
	[-2.34608]	[-0.62244]	[-0.04253]	[1.57063]
D(LNEXCHANGE_RATE(-2))	7209.773	126.8109	0.107264	0.017242
	(7917.25)	(50.1083)	(0.14340)	(0.21553)
	[0.91064]	[2.53073]	[0.74802]	[0.08000]
C	322233.6	-1113.996	-1.971114	5.452451
	(172467.)	(1091.54)	(3.12373)	(4.69501)
	[1.86838]	[-1.02057]	[-0.63101]	[1.16133]
R-squared	0.795189	0.750430	0.110981	0.218826
Adj. R-squared	0.773082	0.667240	-0.185359	-0.041565
Sum sq. Resids	1.40E+13	5.60E+08	4588.725	10366.12
S.E. equation	719773.8	4555.451	13.03659	19.59414
F-statistic	0.727582	9.020677	0.374506	0.840373
Log likelihood	-545.6793	-358.3627	-141.6789	-156.7553
Akaike AIC	30.03672	19.91150	8.198857	9.013798
Schwarz SC	30.47210	20.34688	8.634240	9.449181
Mean dependent	265037.8	60.00000	-0.269189	9.678022
S.D. dependent	694831.7	7897.067	11.97400	19.19919

Determinant resid covariance (dof adj.)	5.41E+23
Determinant resid covariance	1.53E+23
Log likelihood	-1197.681
Akaike information criterion	67.11787
Schwarz criterion	69.03355

Log-likelihood   -528.7541 Akaike information criterion 30.04076   Schwarz criterion 31.21630

Note: Figures in parentheses are standard errors in ( ) & t-statistics in [ ]; *significant at 10%, ** significant at 5%, *** significant at 1%.

Source: Data analysis (2021).

Effects of price fluctuation on output of wheat in Nigeria:

The result of VECM as shown in Table 7 revealed that in the long run, the coefficient of wheat price (4.728131) was positive and statistically significant at 1% probability level. This implies that, an increase in the price of wheat will increase output of wheat by 4.728131%. Inflation is significant and has a positive effect on output of wheat in the long run. While in the short run, the result shows that price and inflation were significant hence has significant effect on output of wheat in the short run.

The result of the short run indicated that Vector Error Correction Term [VECT (-1)] is statistically significant and negative (-0.546521) indicating a slow speed of adjustment (that is, the speed at which the deviation from long run equilibrium is adjusted quickly where -0.546521 of the disequilibrium is removed immediately in each period). This indicates that the tendency for the price of wheat to fluctuate may consequently reduce the level of domestic production and thus discourage commercial production (Ayinde *et al.*, 2014).

4. CONCLUSION

The study revealed that prices of rice, maize and wheat have a positive and significant influence on the production or output of rice, maize and wheat in Nigeria in the long run. This implies that price is an incentive to farmers and engenders increased production which corresponds with the theory of supply. Therefore, an increase in prices of rice, maize and wheat increases the quantities that

are being produced by the farmers in Nigeria. Therefore, the study concluded that rice, maize and wheat supply was influenced by market signals (prices) and hence small incremental changes in prices have significant impact on national output level.

Recommendation

It is recommended that efficient marketing systems should be put in place so that rice, maize and wheat farmers benefit directly from high prices of crops thereby serving as an incentive to engage in production in order to boost national output levels.

Conflicts of interests

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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