ANALYSIS OF SPATIAL PRICE TRANSMISSION OF CASSAVA PRODUCTS BETWEEN RURAL AND URBAN MARKETS IN EKITI STATE, NIGERIA

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Abstract

This study investigated spatial price transmission of cassava products in urban and rural markets in Ekiti State, Nigeria. The study made use of secondary data where average monthly prices of cassava products spanning between March, 2014 and February, 2019 were sourced from NBS, Ekiti State Ministry of Commerce and Industry. Descriptive statistics, profitability analysis, vector error correlation model and impulse responses factors were used in analyzing the data. The results of spatial price transmission level between urban and rural markets of cassava products showed that there was presence of long run equilibrium in all the product price pairs between urban and rural markets. The implication of the E.C.M result is that the whole system is returning back to equilibrium at a speed of 1.5%, 13.2%, 19%, 13.8%, and 1.4% for yellow gaari, white gaari, cassava flour, tuber and fufu respectively. Again, the results of Granger causality tests revealed that yellow gaari and cassava flour took the leading positions in the cassava products price formation and transmission between urban and rural markets.

Keywords: Cassava products, spatial co-integration, price, rural, urban, market

1.0 Introduction

Cassava is a key agricultural commodity in Nigeria because of the importance of cassava and cassava products in the agricultural sector, as well as the links to manufacturers. It is mainly produced in Nigeria with about 20% world shared, followed by Indonesia, Thailand, Brazil, and Congo (Food and Agriculture Organization [FAO], 2017). The efficient marketing system of cassava products and its role in food security in Nigeria is pivotal to a reduction in post-harvest losses; ensuring adequate returns to farmer's investment and stimulating an expansion in food production thereby enhancing the level of food security in Nigeria through adequate information about prices of cassava products (Obayelu and Alimi, 2013).

In empirical trade models that attempt to assess the effect of trade policy reform on prices, production, consumption, and welfare in a country, the degree of market transmission from global to domestic prices is a critical parameter (Fredy, 2006).Therefore, prices are a measure of availability because they tend to rise as the supply of food falls in relation to demand (e.g. poor production, constrained imports of food), and they tend to fall when supply expands in relation to demand (e.g. a bumper harvest). Agricultural prices contribute significantly to the pace and direction of agricultural development. Prices form the main determinant of how market works. They act as market indicators of a product's relative scarcity or abundance (Akintunde, 2012). Prices often function as a stimulant to guide the allocation of economic capital, and they

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determine the structure and pace of economic growth to a large extent. According to FAO (2011), the knowledge of the relationship between prices received by producers and paid by consumers gathers some information about market efficiency and welfare; while the price levels of vertically bound market also have effect on trade policy. Again, in the food system, prices are signals sent between or among the market participants (Ojiako, 2014; Adeniyi, 2019). Included among the operators of the food system are input producers and suppliers, farmers, marketing agents, like rural assemblers, transporters, millers, packagers, wholesalers, retailers, and consumers. Prices also play vital roles in agricultural value chain discuss in both wholesale and retail trades especially for highly perishable commodity like cassava fresh roots. The effect of price shock is usually high because of its vulnerable nature, and the farmer will be compelled to choose between giving out the commodity at a very low price or in an effort to reduce the risk of incurring additional losses (Ojiako, 2014).

The intrinsic components of the commodity (e.g., storability, perishable existence, seasonality), the market structure (e.g., strength of competition at each phase of the chain and number of intermediaries in the chain), as well as current public policies, all influence price formation in the food supply chain (Giulia and Esposti, 2012). Also, price transmission through the food supply chain, or how often and how quickly price changes are transmitted through the various stages of the chain, is often used as a measure of the chain's effectiveness and productivity, as well as the degree of competition in food processing and distribution (Ojiako, 2014).

The presence of large intermediaries in the cassava value chain has led to a stronger price transmission where prices decline than when they rise. Empirical evidence reveals that asymmetric price transmission is consistent with the presence of large intermediaries with monopoly power in the chain. Many developing countries, like Nigeria, have a large proportion of their active population working in agriculture and particularly cultivating cassava (Ehinmowo, 2015). Thus, the amount of revenue they receive will be crucial to their survival.

2.0 Materials and methods

2.1. Study Area

The research was carried out in Ekiti State. The State was carved out from old Ondo State on October 1, 1996. It lies between 7^0 15^1 and 8^0 7^1 North of the equator and longitude 4^0 47^1 and 5^0 45^1 East of the Greenwich Meridian. Ekiti State is made up of sixteen (16) Local Government Areas and Ado-Ekiti is the state capital as well as the headquarters of Ado-Ekiti Local Government Area. The State is bounded to the North by Kwara and Kogi States, to the South and East by Ondo State and to the West by Osun State (Encarta, 2009). Ekiti State has a mean annual rainfall of about 1400mm and a mean annual temperature of 27^0C. The population of Ekiti State from 2006 census was 2,384,212 people and is made up predominantly of the Yoruba ethnic groups that have settled in the State. They are closely related traditionally as well as culturally, and speak the same dialect with minor dialect differences. Its vegetation ranges from Rain forest in the South to Guinea savannah in the North with soil largely rich in organic minerals thereby making the State a major producer of both tree and food crops. The occupation of the people is farming with food crops like yam, maize, cassava and cash crops such as cocoa, kola nut, cashew and oil palm with reasonable percentage of the people engaging in other forms of occupation such as trading, weaving and handcraft. Hence, Ekiti State is predominantly agrarian in nature.

2.2 Sampling Procedure and Sample Size

The respondents for this study were all actors (input providers, farmers, processors, marketers and consumers) in the cassava value chain in the study area. The respondents were chosen using a multi-stage sampling technique. In the first stage, six communities were purposively selected due to the prevalence of cassava cultivation and processing. Snowball sampling technique was used to select twelve (12) farmers, twelve (12) processors while random sampling was used to select twelve (12) consumers for each of these communities. Again, purposive sampling technique was used to select three (3) major markets known for the sales of cassava and cassava products in the study area. Using simple random sampling procedure, twenty-five (25) marketers and five (5) input suppliers were selected from each of these markets. Total numbers of actors in the cassava value chain were three hundred and six (306).

2.3 Data and Sources of Data

For this analysis, both primary and secondary data were used. A well-structured questionnaire, Focus Group Discussions (FGDs), and observations were used to collect primary data. Secondary data were collected from the Nigerian Bureau of Statistics, Ekiti State Ministry of Agriculture, Ekiti State Agricultural Development Programme (EKSADEP), Ministry of Commerce and Industry, Agricultural Input Supply Agency (AISC), journals and publications.

2.4 Analytical techniques

2.4.1 Johansen Approach to Co-integration Test

The fundamental fact about co-integration is to establish and demonstrate the long run equilibrium relationship among the variables (price series). If two or more variables are independently non-stationary (i.e., have one or more unit roots), but there exists a linear combination of the variables that is stationary, they are said to be co-integrated (Mafimisebi, 2008). The number of co-integration vectors in the model was determined using the Johansen method. The Johansen technique was used because it is based on vector auto-regression (VAR) and performs better in multivariate models (Maddala, 2001 and Ayinde et al., 2011). As shown below, the two variable systems were modeled as a vector auto-regression (VAR) (Mafimisebi, 2008):

$$\Delta X_t = \mu_t + \sum_{i=1}^{k-1} \tau_i \Delta X_{t-i} + \pi X_{t-k} + \varepsilon_t \qquad (1)$$

Where:

X_t is a (nx1) vector containing the price series of interest (cassava product prices), Γ and π are parameters' matrices, K = number of lags, and should be large enough to capture the short run dynamics of the underlying Vector Auto-Regressive (VAR) and generate normally distributed white noise residuals, ε_t = vectors of errors considered to be white noise.

The Johansen test gave an insight into the number of estimation necessary for the analysis of long run relationship of the prices to be plausible. The general form of the Johansen's model to be estimated for the rural and urban markets' prices of cassava products is presented as follows:

$$X_t = \mu + a_1 X_{t-1} + a_2 X_{t-2} + a_p X_{t-p} + E_t \ldots\ldots (2)$$

$$X_t = \mu + \sum_{t=1}^{p} a_1 X_{t-1} + E_t \dots \dots (3)$$

Where

$X_t - px_1$ = vector of price series

$X_{t-1} - px_1$ = Vector of the ith lagged values of xi

$\mu - px_1$ = Vector of constants;

$\alpha - px_1$ = Matrix of unknown coefficients to be estimated;

P = Lag length; and

$E_t - px_1$ = Vector of error terms with contemporaneous covariance matrix and zero mean.

2.4.2 Vector Error Correction Model (VECM)

Once co-integration is established, how fast a shock is absorbed using vector error correction model (VECM) was as well determined. The theory states that if two variables let say Y_t and X_t are co-integrated, the relationship between them can be expressed as ECM. VECM was used to check for price transmission across levels in the cassava value chain.

There are two possible specifications for error correction:

(a). Long-run VECM:

$$\Delta X_t = \mu + \phi D_t + \Pi_i X_{t-p} + \Gamma_{p-1}\Delta X_{t-p+1} \dots + \Gamma_1 \Delta X_{t-1} + e_t, t = 1, \dots, T \dots \dots (4)$$

Where

$$\Gamma_1 = \Pi_1 + \dots + \Pi_i - I, i = 1, \dots, p-1 \dots \dots (16)$$

(b). The transitory VECM:

$$\Delta X_t = \mu + \phi D_t - \Gamma_{p-1}\Delta X_{t-p+1} \dots - \Gamma_1 \Delta X_{t-1} + \Pi \quad X_{t-1} e_t, t = 1, \dots, T \dots \dots (5)$$

Where

$$\Gamma_1 = (\Pi_{i+1} + \dots + \Pi_p), i = 1, \dots, p-1 \dots \dots (6)$$

In both VECM

$$\Pi = \Pi_1 + \dots + \Pi_p - I \dots \dots (7)$$

Where;

Π = matrix of co − integration

X = Vector of price series

E_t= Vector of identically and independently distributed error terms

μ = Constant

2.4.3 Impulse Response Functions (IRFs): Shock Transmission among the Variables

The IRFs are the dynamic response of each endogenous variable to a one-period standard deviation shock to the system. Impulse responses trace out the responsiveness of the dependent variables in the VAR to shocks to each of the variable. So, for each variable from each equation separately, a unit shock is applied to the error, and the effects upon the VAR system over time are noted (Brooks, 2008). The Vector Auto Regression (VAR) was introduced by Sims (1980) as a technique that could be used by macroeconomists to characterize the joint dynamic behaviour of a collection of variables without requiring strong restrictions of the kind needed to identify underlying structural parameters. It has become a prevalent method of time-series modeling.

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2.4.4 Granger Causality Test

When two series are stationary, of the same order, and co-integated, Gujarati and Porter (2009) claim that causality can be investigated. This is because in a group of co-integated series, at least one granger-causal relationship exists (Nielson, 2006).

The causality test is stated as:

$$\Delta X_{it} = \beta_0 + \beta_1 X_{i(t-1)} + \beta_{2j(t-1)} + \sum_{k=1}^{m} \delta_k \Delta X_{j(t-k)} + \sum_{h=1}^{m} \alpha_h \Delta X_{j(t-h)} + \epsilon_t \ldots\ldots\ldots(8)$$

Where

m and n are number of lags determined by Schwarz Information Criterion (SIC), X is the price series of cassava products, β is coefficient to be estimated, and ε_t is the error term.

According to Mafimisebi (2014), rejection of the null hypothesis that $\alpha_h = 0$ for h = 1, 2, …n and β = 0 indicates that prices of product jin the market granger-cause prices of product i. Again, if the prices of i and j are granger-caused, the prices are calculated by a simultaneous field-back process. This is what bi-directional causality is all about. If the granger-causality moves in one way, it is referred to as uni-directional granger-causality, and the consumer product that granger-causes the other is referred to as the exogenous product in the market. Therefore, the study compares cassava product prices in urban and rural markets, as well as between urban and rural markets.

3.0 Results and discussion

3.1 Trend Analysis of Urban and Rural Prices of Cassava Product

The trend and graphical relationship between urban and rural price series were examined in the Figures. The figure 1a depicts that relationship between urban yellow *garri* (UYG) and rural yellow *garri* (RYG) for the periods of 2014 to 2019 using monthly prices of the product. UYG showed a positive spike in price in between second and third quarters of 2014, while RYG experienced a high volatility between first and third quarters of the same year. Both prices were relatively stable between last quarter of 2014 to third quarter of 2016. There was small upward growth in the prices till 2019 with wavy growth in the periods.

Figure 1b presented the relationship between the prices of urban white *garri* (UWG) and rural white *garri* (RWG) for the periods. UWG was relatively constant between 2014 and first quarter of 2017, while a sharp drop in the price was observed in second quarter of 2014 and returned back to the level of UWG price which continued till first quarter of 2017. Both prices jump up at second quarter of 2017 with price of RWG higher than that of UWG. It follows the same trend with a little spike till 2019.

Figure 1c presented the relationship between the prices of urban cassava flour (UCF) and rural cassava flour (RCF) for the periods. It was observed that both prices experienced a little spike with the price of UCF higher than RCF in 2014. The prices showed a great disparity with UCF higher than the RCF from last quarter of 2014 to first quarter of 2017. With the price of UCF higher than RCF, both prices showed an upward growth with an undulating movement till 2019.

Figure 1d showed the relationship between the prices of urban cassava tuber (UCT) and rural cassava tuber (RCT) for the periods. RCT experienced high volatility in 2014 before it was experiencing a wavy growth from second quarter of 2017 to 2019. UCT experienced a downward spike in second and third periods of 2014, and then gradually moving upward until it becomes stable from second quarter of 2017 to 2019.

Figure 1e showed the relationship between the prices of urban *fufu* (UF) and rural *fufu* (RF) for the periods. UF showed a spike in the second and third quarters of 2014, while RF experienced a high volatility in the same period. UF grew with a long stable with a little spike till second quarter of 2018. Similar growth was observed in RF with a downward movement but stable between fourth quarter of 2014 and third quarter of 2015, and then jump up with long and stable prices till second quarter of 2018. UF dropped sharply and relatively low till 2019, while volatility was experienced in RF till 2019.

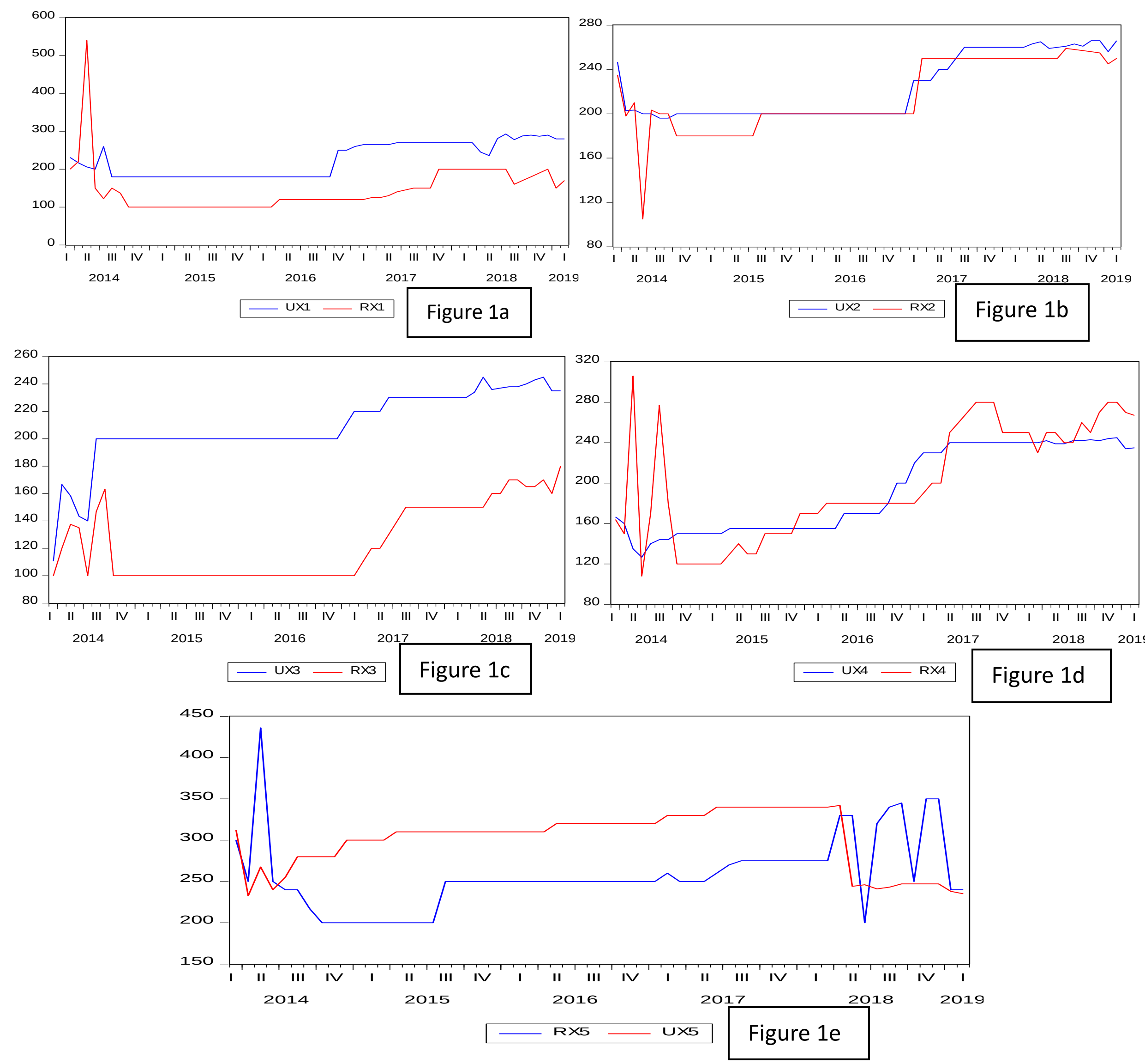

Figure 1a-1e: Graphical presentation of urban and rural prices of cassava product
Source: computed from field survey, 2019

3.2 Co-integrations between the Price Pairs of Urban and Rural Markets of Cassava Products

Table 1 shows the results of co-integration tests between urban and rural price pairs of cassava goods. The findings revealed price co-integration between urban and rural markets in all product price pairs. The null hypothesis of no co-integration was rejected in all price pairs between urban and rural markets because test statistics (both Trace and Eigen value) were greater than the critical value for all market price pairs. Thus, alternative hypothesis of the presence of co-integration is favoured for both maximal Eigenvalue and trace tests. This confirmed that cassava products were strongly linked together in the long run, as well as demonstrating that cassava product marketing in Ekiti State, Nigeria, has a high degree of marketing efficiency. The results of this study corroborate with the findings of Okon and Egbon (2003) and Mafimisebi et al. (2014) in their studies carried out on rural and urban foodstuff markets in Nigeria, and locally produced rice in Ekiti State, Nigeria, respectively. It also in agreement with the findings of Chirwa (2001) who conducted a study on food marketing in Malawi and discovered that there is market convergence between rural and urban prices, but not in all cases as stated in this study. Again, the long run assertion of equilibrium of market price series has recently been an issue of discuss in terms of development economists' analysis of market performance. According to Chirwa (2001) and Nielsen (2006), this is owing to the fact that markets with price series stationary at same order and co-integrated as also observed in this study, are spatially economically integrated. Oladapo (2004) and Mafimisebi *et al.* (2014) stated that such price series cannot drift far apart without bounds and hence, the existence of long-run equilibrium between them.

Table 1: Johansen Maximum Likelihood Tests and Parameter Estimates between Urban and Rural Cassava Product Market Price Pairs

Market Pairs	Trace Test		Test statistics	Maximal Eigenvalue Test		Test statistics
	Null	Alternative		Null	Alternative	
UYG – RYG	$r \leq 0$	$r = 1$	85.60961*	$r \leq 0$	$r = 1$	84.57526*
UWG – RWG	$r \leq 0$	$r = 1$	21.26919*	$r \leq 0$	$r = 1$	21.26533*
UCF – RCF	$r \leq 0$	$r = 1$	58.38464*	$r \leq 0$	$r = 1$	58.14656*
UCT – RCT	$r \leq 0$	$r = 1$	18.07458*	$r \leq 0$	$r = 1$	16.70438*
UF – RF	$r \leq 0$	$r = 1$	18.99947*	$r \leq 0$	$r = 1$	15.90997*

Note: r = number of co-integrating vectors; * means significant at least 5% level; Co-integration likelihood ratio tests are based on trace and maximal eigenvalue of the stochastic matrix.
Source: Extracted from Results of Co-integration test

3.3: VECM for Price Series Pairs of Cassava Products between Urban and Rural Markets

The results of vector error correction model were presented in Tables 2, 3, and 4. The price series were paired between urban and rural markets for each cassava product. The VECM results in the figures truly demonstrated the existence of long-run equilibrium relationships between urban and rural market price series. According to table 2, the price pairs between urban yellow garri (UYG) and rural yellow garri (RYG) showed that 1% change in the price of RYG will result in 135% decrease in the price of UYG. The evidence of correctly signed and significant coefficient of

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CointEq1 reiterated the long-run property in the short-run dynamics. The implication of the ECM result is that the whole system is returning back to equilibrium at a speed of about 1.5% in each period. This shows a slow rate of adjustment to the previous month's deviation from long-run equilibrium. The short-run result revealed that there is a significant causal relationship between RYG and first lagged of UYG in the market, ceteris paribus. The Table also revealed the VECM for price pairs of urban white garri (UWG) and rural white garri (RWG). The estimate implies that 1% change in the price of RWG will result 109% decrease in the price of UWG. The error correction term (ECM) t statistics for D(UWG) is negative and significant (-0.1315), suggesting that the price series has a long-run causal relationship. The implication of the result was that the whole system is returning back to equilibrium at a speed of 13% in each period. Despite low speed of adjustment, there is significant causal association between one lagged of RWG and UWG, all things being equal.

In Table 3, the price pairs between urban cassava flour (UCF) and rural cassava flour (RCF) confirmed the existence of long-run equilibrium using ECM. It was shown that 1% change in the price of RCF will result to 51% decrease in the price of UCF in the market. The negative and significant of the ECM coefficient (-0.1893) depicted that an approximately 19% of disequilibria from the previous period's shock converge to the long-run equilibrium in the current period. Ceteris paribus, UCF has a causal relationship with UCF(-2), and RCF(-1), while RCF has a causal relationship with UCF(-2) in the short-run. In the case of urban cassava tuber (UCT) and rural cassava tuber (RCT), the result in the Table showed that 1% change in the price of RCT will cause a negative change in the price of UCT by 71%. There is presence of long-run equilibrium relationship in the price pairs as revealed by the coefficient of ECM (-0.0138). The implication of the result was that an approximately 14% of disequilibria from the previous period's shock converge to the long-run equilibrium in the current period. It can be also stated that previous price changes in the UCT are transmitted to RCT at adjustment rate of 14%. In the short-run, ceteris paribus, there is a causal relationship between RCT and UCT(-2), RCT(-1), and RCT(-2) in the periods.

From Table 4, the price pairs between urban fufu (UF) and rural fufu (RF) showed that 1% change in the price of RF will result in 147% decrease in the price of UF. The statistically significant negative coefficient of ECM (-1) verified the long run relationship among the price series. As a result, ECM in the Table had a value of -0.013575, which was statistically significant at the 1% level. This meant that in the current period, approximately 1.4 percent of disequilibria from the previous period's shock converge to the long-run equilibrium. This suggests a slow rate of adjustment to the previous month's deviation from long-run equilibrium, as well as a lack of price transmission between the two markets. The short-run result revealed that there is a significant causal relationship between RF and first and second lagged of UF in the market, ceteris paribus.

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Table 2: VECM for Price Pairs: UYG and RYG; UWG and RWG

CointegratingEq:	CointEq1		CointegratingEq:	CointEq1	
UYG(-1)	1.000000		UWG(-1)	1.000000	
RYG(-1)	-1.354842 (0.08650) [-15.6632]		RWG(-1)	-1.091736 (0.05954) [-18.3354]	
C	-30.28812		C	12.47779	
Error Correction:	D(UYG)	D(RYG)	Error Correction:	D(UWG)	D(RWG)
CointEq1	-0.014508 (0.00585) [-2.48172]	0.575496 (0.04422) [13.0155]	CointEq1	-0.131533 (0.06218) [-2.11538]	0.681572 (0.13319) [5.11738]
D(UYG(-1))	-0.071743 (0.11151) [-0.64340]	-0.462816 (0.16371) [-2.82706]	D(UWG(-1))	-0.023724 (0.13702) [-0.17314]	0.676880 (0.29349) [2.30628]
D(UYG(-2))	-0.053404 (0.10451) [-0.51097]	-0.219528 (0.15344) [-1.43068]	D(UWG(-2))	0.065207 (0.09402) [0.69358]	1.486868 (0.20138) [7.38344]
D(RYG(-1))	-0.004272 (0.03805) [-0.11227]	-0.110209 (0.05586) [-1.97303]	D(RWG(-1))	-0.106803 (0.06067) [-1.76037]	-0.135204 (0.12996) [-1.04039]
D(RYG(-2))	0.183932 (0.03387) [5.43128]	-0.094802 (0.04972) [-1.90673]	D(RWG(-2))	-0.019839 (0.04511) [-0.43981]	0.056797 (0.09662) [0.58784]
C	1.427987 (1.73444) [0.82331]	-5.885129 (2.54643) [-2.31113]	C	1.194951 (0.68261) [1.75057]	-0.343789 (1.46214) [-0.23513]
R-squared	0.528588	0.884276	R-squared	0.108633	0.753484
Adj. R-squared	0.482371	0.872931	Adj. R-squared	0.021244	0.729316
Sum sq. resids	8632.467	18607.10	Sum sq. resids	1299.542	5962.428
S.E. equation	13.01015	19.10092	S.E. equation	5.047893	10.81251
F-statistic	11.43712	77.94075	F-statistic	1.243093	31.17667
Log likelihood	-223.9562	-245.8445	Log likelihood	-169.9909	-213.4097
Akaike AIC	8.068638	8.836651	Akaike AIC	6.175120	7.698585
Schwarz SC	8.283696	9.051709	Schwarz SC	6.390178	7.913643
Mean dependent	1.298246	-6.491228	Mean dependent	1.100000	0.701754
S.D. dependent	18.08311	53.58382	S.D. dependent	5.102380	20.78238

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Table 3: VECM for Price Pairs: UCF and RCF; UCT and RCT

CointegratingEq:	CointEq1		CointegratingEq:	CointEq1	
UCF(-1)	1.000000		UCT(-1)	1.000000	
RCF(-1)	-0.511626 (0.17390) [-2.94199]		RCT(-1)	-0.712561 (0.09770) [-7.29356]	
C	-147.8904		C	-50.27432	
Error Correction:	D(UCF)	D(RCF)	Error Correction:	D(UCT)	D(RCT)
CointEq1	-0.189264 (0.06096) [-3.10479]	0.044789 (0.08512) [0.52617]	CointEq1	-0.013821 (0.00574) [-2.40732]	0.578122 (0.14488) [3.99024]
D(UCF(-1))	0.162809 (0.13843) [1.17609]	0.274594 (0.19331) [1.42051]	D(UCT(-1))	0.179732 (0.12627) [1.42338]	1.315703 (0.53915) [2.44031]
D(UCF(-2))	-0.246245 (0.11446) [-2.15135]	-0.321958 (0.15983) [-2.01433]	D(UCT(-2))	0.045314 (0.13097) [0.34598]	-1.344274 (0.55922) [-2.40382]
D(RCF(-1))	-0.255092 (0.10065) [-2.53443]	-0.243266 (0.14055) [-1.73083]	D(RCT(-1))	-0.048488 (0.02552) [-1.89977]	-0.265593 (0.10898) [-2.43710]
D(RCF(-2))	0.007196 (0.09932) [0.07246]	-0.253832 (0.13869) [-1.83019]	D(RCT(-2))	0.006387 (0.02078) [0.30739]	-0.252011 (0.08871) [-2.84072]
C	1.900806 (1.03245) [1.84107]	1.657452 (1.44172) [1.14964]	C	1.547805 (0.71232) [2.17290]	0.528659 (3.04148) [0.17382]
R-squared	0.347810	0.376486	R-squared	0.170675	0.671000
Adj. R-squared	0.283870	0.315357	Adj. R-squared	0.089369	0.638746
Sum sq. resids	2849.405	5556.196	Sum sq. resids	1347.353	24563.96
S.E. equation	7.474669	10.43767	S.E. equation	5.139912	21.94644
F-statistic	5.439621	6.158888	F-statistic	2.099163	20.80308
Log likelihood	-192.3662	-211.3986	Log likelihood	-171.0206	-253.7600
Akaike AIC	6.960217	7.628021	Akaike AIC	6.211250	9.114388
Schwarz SC	7.175275	7.843079	Schwarz SC	6.426308	9.329446
Mean dependent	1.345614	0.745614	Mean dependent	1.754386	-0.684211
S.D. dependent	8.832753	12.61454	S.D. dependent	5.386224	36.51384

Table 4: VECM for Price Pairs: UF and RF

CointegratingEq:	CointEq1	
UF(-1)	1.000000	
RF(-1)	-1.466954 (0.62000) [-2.36606]	
C	75.03453	
Error Correction:	D(UF)	D(RF)
CointEq1	- 0.013575 (0.00548) [-2.47610]	0.197198 (0.06408) [3.07742]
D(UF(-1))	-0.074283 (0.13974) [-0.53159]	0.359076 (0.31405) [1.14337]
D(UF(-2))	0.108377 (0.11557) [0.93773]	-0.074619 (0.25974) [-0.28728]
D(RF(-1))	-0.104749 (0.05050) [-2.07424]	-0.433798 (0.11350) [-3.82216]
D(RF(-2))	-0.082968 (0.04948) [-1.67666]	-0.262589 (0.11121) [-2.36116]
C	-0.384068 (1.87357) [-0.20499]	-3.404754 (4.21071) [-0.80859]
R-squared	0.164248	0.505765
Adj. R-squared	0.082312	0.457311
Sum sq. resids	10141.61	51224.56
S.E. equation	14.10160	31.69232
F-statistic	2.004580	10.43797
Log likelihood	-228.5480	-274.7058
Akaike AIC	8.229755	9.849327
Schwarz SC	8.444813	10.06438
Mean dependent	-0.570175	-3.438596
S.D. dependent	14.72044	43.02080

3.4: Analysis of Impulse Response Factor (IRF) in the Price Pairs of Cassava Products between Urban and Rural Markets

Table 5, 6 and 7 depict the response of urban and rural prices of cassava product market to one standard deviation shock in the 10 periods. According to Table 5, UYG had positive shock to itself, while negative shock to RYG except in period 3. The implication is that UYG accounts for about 13.0%, 12.7% and 13.5% of the variations in itself in the short run, medium term and long run respectively. The positive shock explained by RYG on UYG was 3%. Again, the one standard deviation shock in RYG resulted to 3.8%, 8.2%, and 9.7% in the short run, medium term and long run respectively. However, within these periods, one standard deviation shock in RYG caused 18.7%, and 1.1% in short run and medium term respectively, while it was negatively shocked in the long run. In response to one standard deviation shock to UWG, RWG becomes positive with 0.0%, 1.7% and 2.24% variations that occur in the short run, medium term and long run respectively over the periods. It accounts for about 5.0%, 5.7% and 6.3% of variations in itself for short run, medium and long run respectively. Again, in response of RWG to one standard deviation shock, UWG becomes positive and accounts for 2.44%, 6.03% and 6.03% for the short run, medium term and long run respectively. It was also observed that one standard deviation shock to RWG will cause itself variations of about 10.53%, 3.26% and 2.26% for short run, medium term and long run respectively. In Table 6, in response to one standard deviation shock to UCF causes a decrease effect on itself by 7.47% at period one, 4.02% at mid-period and 2.42% at period 10. In response to one standard deviation shock to UCF, RCF becomes negative in periods 2 and 3, and start increasing with positive effect with 1.28% and 2.23% at medium term and long run respectively. In the case of one response to one standard shock to RCF, UCF becomes positive at short run, medium term and long run by 4.71%, 4.24% and 3.55% respectively, while RCF becomes positive but decrease to itself from 9.32% at period one to 5.45% at period 10. Again, the Table also indicated that in response to one standard deviation shock to UCT, UCT becomes positive to itself with unstable effect over the periods, while RCT becomes negative in periods 2 and 3 with positive and gradual increase effect to period 10 by 0.53%. Again, in response to one standard deviation shock to RCT, UCT becomes varied and spiked over the periods with positive effects, while RCT drastically decrease to itself from 21.53% at period one to 3.83% at period 5, and 1.56% at period 10.

Table 7 revealed that the response of UF to one standard deviation shock makes UF becomes relatively stable to itself over the 10 periods with 14.10%, 14.57% and 14.10% for short run, medium term, and long run respectively. In response to one standard deviation shock to UF, RF becomes negative throughout the periods with 0.00% at period one, -3.12% at medium term, and -2.45% at long run. Again, in response to one standard deviation shock to RF makes UF negative at period one, positively increased at medium term and long run with 5.91% and 7.76% respectively. In response to one standard deviation shock to RF, there was sharp decrease to itself from period one to period 5 and further decrease to 1.85% by period 10.

Table 5: Results of IRF for the Price Pairs for UYG and UWG, RYG and RWG

Response of UYG:			Response of UWG:		
Period	UYG	RYG	Period	UWG	RWG
1	13.01015	0.000000	1	5.047893	0.000000
2	12.17568	-0.448125	2	4.353878	0.387621
3	12.37903	3.052928	3	4.601987	1.290315
4	12.13684	-0.197867	4	5.032903	1.543454
5	12.68305	-0.496270	5	5.683838	1.728569
6	13.29087	-0.025250	6	5.835036	1.864132
7	13.25387	-0.248090	7	5.985715	2.036632
8	13.30608	-0.315291	8	6.104532	2.128392
9	13.40395	-0.417583	9	6.235076	2.197442
10	13.45946	-0.439323	10	6.301903	2.244688
Response of RYG:			Response of RWG:		
Period	UYG	RYG	Period	UWG	RWG
1	3.754418	18.72831	1	2.437914	10.53408
2	1.879292	2.061708	2	7.151574	1.271450
3	4.801895	0.465027	3	11.33454	2.702584
4	8.126655	2.093413	4	4.875326	2.038812
5	8.198919	1.055139	5	6.449372	3.258274
6	8.582434	0.758640	6	6.025996	2.311054
7	9.089167	0.131212	7	6.735909	2.426278
8	9.421326	-0.016881	8	6.010210	2.257951
9	9.632372	-0.029344	9	6.141611	2.376366
10	9.724368	-0.169274	10	6.027354	2.263438
Cholesky Ordering: UYG RYG			Cholesky Ordering: UWG RWG		

Table 6: Results of IRF for the Price Pairs for X3 and X4

Response of UCF:			Response of UCT:		
Period	UCF	RCF	Period	UCT	RCT
1	7.474669	0.000000	1	5.139912	0.000000
2	6.531907	-1.474313	2	5.828637	-0.831981
3	3.611784	-0.073766	3	5.908725	-0.056742
4	3.888255	1.553441	4	6.416019	0.252237
5	4.020773	1.281995	5	6.246378	0.040935
6	3.096320	1.222037	6	6.048132	0.297637
7	2.840100	1.863362	7	6.135222	0.454330
8	2.942473	2.085458	8	6.067778	0.392214
9	2.664940	2.046707	9	5.976791	0.467514
10	2.417804	2.231574	10	5.995024	0.533379
Response of RCF:			Response of RCT:		
Period	UCF	RCF	Period	UCT	RCT
1	4.707562	9.315787	1	4.245469	21.53189
2	5.841782	6.836102	2	11.10309	6.943170
3	1.864221	4.447161	3	1.004330	0.955705
4	2.164654	6.411769	4	4.140061	7.934344

5	4.241822	6.458791	5	8.415776	3.831459
6	3.690519	5.259658	6	5.729112	0.914403
7	3.054979	5.544568	7	6.468819	3.140302
8	3.634000	5.931449	8	8.212605	2.114353
9	3.813584	5.577006	9	7.482000	0.889266
10	3.545725	5.446753	10	7.580668	1.559716
Cholesky Ordering: UCF RCF			Cholesky Ordering: UCT RCT		

Table 7: Results of IRF for the Price Pairs for UF and RF

Response of UF:		
Period	UF	RF
1	14.10160	0.000000
2	13.75318	-3.918107
3	14.56803	-4.080671
4	14.13964	-2.450963
5	14.56672	-3.115763
6	14.26062	-3.022018
7	14.22607	-2.623878
8	14.21085	-2.628101
9	14.15011	-2.585636
10	14.10098	-2.452322
Response of RF:		
Period	UF	RF
1	-4.072326	31.42959
2	6.716638	8.703528
3	2.697504	5.611679
4	4.018970	10.72648
5	5.912175	6.330611
6	6.091474	4.088375
7	6.424801	4.520009
8	7.190339	3.232548
9	7.490160	2.193110
10	7.762020	1.853347
Cholesky Ordering: UF RF		

3.5: Pairwise Granger Causality Test

According to the Table 8, exogeneity in cassava products market price series was depicted using pairwise granger causality test. In this study, five cassava products price pairs between urban and rural markets were investigated for the evidence of price causation and exogeneity. Out of ten (10) price pairs tested for Granger-causality, only three (3) pairs failed to reject the null hypothesis of no causality. Again, three (3) market price links displayed uni-directional granger causality. The price market links are: UWG – RWG, UCT – RCT, and UF – RF. Furthermore, four (4) market price links displayed bi-directional granger causality and they are: RYG ↔ UYG, and RCF ↔ UCF.UYG was statistically stronger in the first link, granger-causing RYG at a 1% significant level (4.E-09), whereas RYG granger-caused UYG at a 1% significant level (4.E-09) (3.E-07).UCF was also stronger in the third connection, granger-causing RCF at a 1% significant level (4.E-08), whereas RCF granger-caused UCF at a 1% significant level (4.E-08) (3.E-07). Therefore, UYG, RYG, UCF, and RCF are the prices occupying leadership positions in the cassava products price formation and transmission. It can be deduced from the results that exogeneity occurs in the prices of cassava products in Ekiti State, Nigeria in favour of these four price series in the urban and rural markets. Again, the results showed that UYG, RYG, UCF, and RCF formed the origin of stochastic trends driving the prices of cassava products in the market. The implication is that these product prices play dominant roles in cassava products market in Ekiti State, and this might be consistent with the importance of cassava production in the area. More so, prices formed in them are efficiently transmitted to the other cassava products in the market with very minor distortions during the transmission process. The findings were in agreement with Mafimisebi (2008), who discovered in his analysis of price integration in the Nigerian fresh fish market that the market that dominates often forms efficient price transmission. The result agrees with the findings of Okoh and Egbon (2003), Mafimisebi et al. (2014), and Adeniyi (2019) who reported the presence of both uni-directional and di-directional granger causality in the prices of Nigerian's rural and urban foodstuff markets including cassava products.

Table 8: Results of Pairwise Granger Causality Test for Price Pairs of Urban and Rural Markets

Null Hypothesis:	Obs	F-Statistic	Prob.
RYG does not Granger Cause UYG	57	15.5236	3.E-07
UYG does not Granger Cause RYG		21.7917	4.E-09
RWG does not Granger Cause UWG	58	2.83991	0.0674
UWG does not Granger Cause RWG		7.35204	0.0015
RCF does not Granger Cause UCF	56	13.2912	3.E-07
UCF does not Granger Cause RCF		15.4488	4.E-08
RCT does not Granger Cause UCT	58	2.14701	0.1269
UCT does not Granger Cause RCT		8.46360	0.0006
UF does not Granger Cause RF	58	0.71083	0.4959
RF does not Granger Cause UF		6.22189	0.0037

Source: Computed from Field Survey, 2019

4.1 Conclusion

The study concluded that there is a long run relationship between cassava products in the urban and rural markets of Ekiti State, Nigeria at the spatial price transmission level. Despite potential short-term divergence among products, the markets are strongly linked in the long run. In the case of spatial price transmission, the prices of yellow garri and cassava flour are the prices occupying leadership positions in the cassava products price formation and transmission between urban and rural markets. Therefore, it is established that cassava products were strongly linked together in the long run, and that any disequilibrium or price shocks in the previous period could be quickly converged in the current period but at a low speed of transmission.

4.2 Recommendation

Arising from this, it is suggested that; price stabilization should be initialized to control the magnitude of price transmission within the value chain by the government, since price transmission has significant positive relationship with profitability, efforts should be geared to increase the speed of price transmission within the value chain by the government. Also, it is recommended that products such as garri yellow, garri white, flour and tuber which have been shown in this study to be the market leaders should be the target of government developmental reforms. Incomes can be greatly enhanced through the lead market products with incentives by government to intensify their production and marketing in the area. Thus, create greater opportunities for economic growth and development, and eventually leads to market efficiency and increased technical and allocative efficiency of cassava producers.

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