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Assessing Price Dynamics in Urban and Rural Cassava Markets: Evidence from Ekiti State, Nigeria

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Abstract

This study investigates the price dynamics and market integration of cassava products in Ekiti State, Nigeria, using co-integration and vector error correction modeling (VECM). Monthly price data for five cassava products (Gaari Yellow, Gaari White, Flour, Tuber, and Fufu) were analyzed across rural and urban markets over a five-year period (March, 2014 to February, 2019). The Johansen co-integration test confirmed long-run equilibrium relationships among the price series, with urban markets exhibiting two co-integrating equations and rural markets showing three. VECM results revealed significant short- and long-term adjustments in response to price shocks, with urban prices demonstrating higher rates of adjustment for Gaari Yellow and Gaari White, while rural prices highlighted the leading role of Gaari Yellow and Gaari White in driving market integration. Pairwise Granger causality tests further established key causal links, identifying urban Tuber (UX4) and rural Gaari Yellow (RX1) and Gaari White (RX2) as the primary drivers of price transmission in their respective networks. These findings indicate a well-integrated market structure, underscoring the efficiency of cassava product marketing in the area. However, the asymmetric price relationships and variability between urban and rural markets suggest opportunities for policy interventions to enhance price stability and equitable value distribution. This study contributes to the understanding of cassava market dynamics in developing economies and provides valuable insights for stakeholders and policymakers seeking to improve market efficiency and farmer welfare in Nigeria.

Keywords: Cassava value chain, cointegration analysis, granger causality, market efficiency, market integration, Nigeria.

Introduction

Cassava, a perennial vegetatively propagated shrub, is one of the most important crops cultivated in the lowland tropics, with Nigeria accounting for approximately 20% of global production and contributing significantly to Africa's 61% share (FAOSTAT, 2020). Its versatility as a staple food and industrial crop underscores its critical role in food security, rural development, and poverty alleviation. Cassava is not only consumed as fresh roots or processed products but also serves as a vital raw material for industries producing starch, bioethanol, and animal feed. Consequently, the commodity's price dynamics carry profound implications for stakeholders across the value chain, including smallholder farmers, traders, and end-users.

Agricultural markets in developing economies are characterized by price volatility, weak infrastructure, and inefficient market systems (Aturamu et al., 2021and Omosehin et al., 2021). Cassava markets are no exception. Price plays a pivotal role in determining farmers' earnings, trade incentives, and food affordability for consumers. Moreover, efficient price transmission and market integration serve as proxies for market performance, indicating the

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extent to which spatially separated markets are interconnected. In integrated markets, price changes in one region prompt commensurate adjustments in other regions, fostering economic equilibrium and reducing arbitrage opportunities (Aturamu et al., 2021; Omosehin et al., 2021 and Barrett et al., 2024).

In Nigeria, the cassava value chain has witnessed significant transformations driven by government interventions, increased processing capacities, and growing demand from industrial sectors (Ikuemonisan et al., 2020 and Ekundayo et al., 2021). However, despite these advancements, market inefficiencies persist due to price distortions, supply chain bottlenecks, and inadequate dissemination of price information. Understanding how price dynamics operate within and between rural and urban markets is essential for formulating effective policies that enhance market efficiency, reduce transaction costs, and improve farmers' income stability.

Despite cassava's prominence, the Nigerian cassava market faces persistent challenges of price volatility, asymmetric price transmission, and low market integration (Ibrahim et al., 2021). These issues disproportionately affect smallholder farmers, who often lack the market power to negotiate fair prices, particularly during periods of glut or post-harvest losses. Price shocks in rural markets are often inadequately transmitted to urban markets, resulting in reduced profitability for rural producers and increased consumer prices in urban areas. Similarly, limited vertical price transmission between producers, processors, and retailers impedes the fair distribution of value along the supply chain (Liu et al., 2022).

The extent of market integration and price transmission is further constrained by inadequate infrastructure, fragmented value chains, and the perishable nature of cassava roots. Studies have shown that such constraints lead to inefficiencies, such as delayed price adjustments, market segmentation, and producer exploitation (Ozturk, 2020). Despite its significance, there remains limited empirical evidence examining the dynamics of cassava price series using advanced econometric techniques, particularly in the Nigerian context.

While numerous studies have explored agricultural market integration and price transmission globally, research focused on cassava in developing economies like Nigeria remains sparse. Existing studies often rely on descriptive analyses, ignoring the deeper econometric underpinnings that can unravel the long-term relationships and causality patterns within price series. For instance, studies by Jena et al. (2023) and Xu et al. (2021) provided insights into price dynamics but did not account for potential cointegration between rural and urban markets or vertical integration across value chain levels. Another key limitation in the literature is the lack of attention to asymmetric price transmission (APT). APT, which describes situations where price increases are transmitted more rapidly than price decreases (or vice versa), has significant implications for market efficiency and equity (Peltzman, 2022). While asymmetric price transmission has been extensively studied in developed markets such as Europe and North America, its application to African agricultural markets, particularly cassava, is underexplored. Furthermore, while studies have employed cointegration techniques to analyze agricultural price series, few have combined these with Vector Error Correction Models (VECM) and Granger causality tests to uncover both long-run and short-run dynamics. Such advanced approaches can provide nuanced insights into how cassava prices in rural and urban markets respond to shocks, offering valuable evidence for policymakers and market participants.

Therefore, addressing these gaps is critical for advancing the understanding of cassava market dynamics in Nigeria. This study employs Johansen's cointegration test and VECM to explore the long-term equilibrium relationships between cassava product prices in rural and

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urban markets. It further investigates price causality to identify lead markets and assess the efficiency of price transmission mechanisms. By filling these empirical gaps, the study aims to provide actionable insights into improving market efficiency, reducing price volatility, and enhancing value distribution across the cassava value chain.

Literature Review

Price transmission, a critical aspect of market efficiency, describes the extent to which a price change in one market leads to adjustments in another. This concept is commonly measured using transmission elasticity, which quantifies the percentage change in one market's price in response to a 1% change in another (Alam et al., 2022 and Barboza Martignone et al., 2022). Vertical price transmission, which focuses on price adjustments across different levels of the supply chain (e.g., from farm to retail), is often a key determinant of how value is distributed along agricultural supply chains (McCorriston et al., 2013). For example, farm-gate price changes are frequently driven by exogenous factors, such as supply shocks, that ripple through the value chain (Abbott, 2021).Recent studies have highlighted the complexities of asymmetric price transmission (APT), where price increases are transmitted more quickly or fully than price decreases—or vice versa (Peltzman, 2022; Aturamu et al., 2021 and Omosehin et al., 2021). APT often arises due to adjustment costs associated with changing input quantities or prices (Bailey & Brorsen, 2009 and Ibrahim et al., 2021). For instance, firms may find it easier to cut input costs during production reductions than to hire additional resources during expansions, creating an uneven adjustment process.

APT is particularly pronounced in markets for perishable commodities. Retailers of perishable goods, such as fresh produce, may be reluctant to raise prices for fear of reduced sales, yet may readily lower prices to prevent spoilage (Ward, 1982). This phenomenon is supported by Munyeka (2014), who observed faster responses to price decreases than increases in fresh tomato markets. Similarly, Heien (1980) found that perishable goods experience dynamic pricing due to their time-sensitive nature, which contrasts with durable goods that exhibit more stable pricing behaviours. Inventory management further contributes to APT. According to Blinder (2012), firms facing low demand are more likely to accumulate inventory and raise prices during periods of high demand rather than reduce prices. Such strategies amplify asymmetries, particularly in agricultural markets where production cycles are inflexible (Reagan & Weitzman, 1982).

Asymmetries in price transmission also highlight the need for effective government interventions to support producers and stabilize markets. Gardner (1975) emphasized the importance of policies that buffer price shocks at the producer level, a recommendation echoed in subsequent studies on agricultural value chains (Kinnucan & Forker, 1987 and Serra et al., 2016). These policies are crucial in markets where farm-level supply shocks disproportionately affect retail prices, widening the farm-to-retail price spread. Ibrahim et al. (2021) posited that APT is particularly likely when information asymmetries exist within the market, such as when wholesalers delay passing cost savings to consumers. Bailey and Brorsen (2009) further argued that biased price reporting methods can exacerbate APT, underscoring the need for transparent and equitable pricing mechanisms.

In Nigeria, studies have revealed significant asymmetries in the cassava value chain, a sector characterized by high price volatility and inefficient market linkages (Omosehin et al., 2021 and Ibrahim et al., 2021). Price transmission between rural producers and urban consumers is often incomplete, leading to inequitable value distribution. Moreover, the

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dominance of intermediaries in the cassava value chain exacerbates inefficiencies, as these actors can manipulate price signals to their advantage (Xu et al., 2022). Despite extensive research on APT in developed economies, there is a lack of comprehensive studies applying advanced econometric methods, such as cointegration analysis and Vector Error Correction Models (VECM), to cassava markets in Nigeria. This gap underscores the need for further empirical studies to explore how price shocks propagate across spatial and vertical market dimensions. Therefore, understanding price transmission and its asymmetries is pivotal for enhancing market efficiency and equity in agricultural markets. By focusing on cassava markets in Nigeria, this study aims to contribute to the growing body of literature on price dynamics in developing economies, providing actionable insights for policymakers and stakeholders.

Materials and Methods

Study Area

The study was conducted in Ekiti State, Nigeria. The state was established on October 1, 1996, following its separation from the former Ondo State. Geographically, Ekiti State is situated between latitudes 7°15' and 8°7' North and longitudes 4°47' and 5°45' East of the Greenwich Meridian. It shares boundaries with Kwara and Kogi States to the north, Ondo State to the south and east, and Osun State to the west. The area experiences a tropical climate with an average annual rainfall of approximately 1,400 mm and a mean annual temperature of about 27°C. The state’s vegetation transitions from rainforest in the southern regions to Guinea savannah in the northern parts, supported by soils rich in organic matter. These conditions make Ekiti State a major producer of both food and cash crops.

Administratively, Ekiti State comprises 16 Local Government Areas and has a population of approximately 2,384,212 people, according to recent demographic statistics (National Population Commission, 2020). Its economy is predominantly agrarian, with cassava being one of the key crops cultivated for both subsistence and commercial purposes.

Data Collection

This study utilized secondary data on the monthly prices of cassava and its derivatives (e.g., gari, fufu, cassava flour) collected over a period of five years (March, 2014 to February, 2019), totaling 60 observations. The data sources included records from the Nigerian Bureau of Statistics, Ekiti State Ministry of Agriculture, the Ekiti State Agricultural Development Programme (EKSADEP), and the Ministry of Commerce and Industry. Additional information was obtained from the Agricultural Input Supply Agency (AISC), published journals, and relevant official reports.

Data Description

The price data were collected for both rural and urban markets across Ekiti State to capture variations in cassava product prices along the value chain. These data were crucial for assessing price transmission and market integration, providing a robust foundation for the study's econometric analysis.

Analytical Tools and Model Specification

Unit root test

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The unit root test was conducted to assess the stationarity of the price series data for cassava and its products. This step is essential to determine the order of integration and to avoid spurious regression results. The Augmented Dickey-Fuller (ADF) test was employed for this purpose. Stationarity is a condition where the mean and variance of a time series remain constant over time, whereas non-stationary series exhibit time-dependent mean and variance, as highlighted by Juselius (2006). The ADF test was applied to evaluate whether the series were integrated at a level I(0) or at the first difference I(1), following the methodology outlined by Ibrahim et al. (2021) and Omosehin et al. (2021).

ADF Test was specified as:

$$\Delta Y_t = \beta_1 + \beta_{2t} + \delta Y_{t-1}\alpha\sum_{t=1}^{n}\Delta Y_t + \varepsilon_t \quad \text{.................................. ………………………..}(1)$$

$$\varepsilon_t = \Delta Y_{t-1} = (Y_{t-1} - Y_{t-2}), \Delta Y_{t-2} = (Y_{t-2} - Y_{t-3}) \text{...} (2)$$

Where:

Δ = first difference operator

Y_t = price series

t = time or trend variable

Johansen Approach to Co-integration Test

The Johansen co-integration test was utilized to evaluate the long-term relationships between the price series of cassava and its derived products. This method, developed by Johansen & Juselius (1990), is particularly effective in examining multiple time series to identify whether a stationary linear combination exists among non-stationary variables. When two or more variables are non-stationary but their linear combination exhibits stationarity, they are considered cointegrated, indicating a stable long-run equilibrium relationship (Mafimisebi, 2008).The general specification of Johansen's co-integration model for analyzing rural and urban cassava product prices is formulated as follows:

$$X_t = \mu + a_1 X_{t-1} + a_2 X_{t-2} + a_p X_{t-p} + E_t \ldots\ldots(3)$$

$$X_t = \mu + \sum_{t=1}^{P} a_1 X_{t-1} + E_t \ldots\ldots(4)$$

Where

$X_t = p \times {}_1$ = vector of price series

$X_{t-1} = p \times {}_1$ = Vector of the ith lagged values of xi

$\mu = p \times_1$ = Vector of constants;

$\alpha = p \times {}_1$ = Matrix of unknown coefficients to be estimated;

P = Lag length; and

$E_t = p \times {}_1$ = Vector of error terms with contemporaneous covariance matrix and zero mean.

Vector Error Correction Model (VECM)

Following the confirmation of co-integration, the Vector Error Correction Model (VECM) was applied to analyze price transmission across various levels and markets within the cassava value chain. This model is particularly suited for assessing the short- and long-term dynamics between co-integrated variables. When two variables, denoted here as Y_t and X_t, are co-integrated, their relationship can be effectively modeled using an Error Correction Mechanism (ECM). The VECM framework was employed to capture the adjustment processes that restore equilibrium after short-term deviations, thus allowing an evaluation of

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price transmission across levels in the cassava value chain.The model offers two distinct error correction specifications to account for these dynamics:

(a). Long-run VECM:

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

$Where$

$$\Gamma_1 = \Pi_1 + \cdots + \Pi_i - I, i = 1, \dots, p-1 \dots \dots (6)$$

(b). The transitory VECM:

$$\Delta X_t = \mu + \phi D_t - \Gamma_{p-1}\Delta X_{t-p+1} \dots - \Gamma_1 \Delta X_{t-1} + \Pi \quad X_{t-1} e_t, t = 1, \dots, T \dots \dots (7)$$

$Where$

$$\Gamma_1 = (\Pi_{i+1} + \cdots + \Pi_p), i = 1, \dots, p-1 \dots \dots (8)$$

In both VECM

$$\Pi = \Pi_1 + \cdots + \Pi_p - I \dots \dots (9)$$

Where;

Π = matrix of cointegration

X = Vector of price series

E_t= Vector of identically and independently distributed error terms

μ = Constant

Granger Causality Analysis

According to Gujarati and Porter (2009), when two-time series are stationary, share the same order of integration, and exhibit co-integration, it becomes feasible to investigate causal relationships. This is because, in a co-integrated system, at least one variable must Granger-cause another within the group (Nielson, 2006).The Granger causality test is expressed as follows:

$$\Delta X_{it} = \beta_0 + \beta_1 X_{i(t-1)} + \beta_{2j(t-1)} + \sum_{k=1}^{m} \delta_k \Delta X_{j(t-k)} + \sum_{h=1}^{m} \alpha_h \Delta X_{j(t-h)} + \epsilon_t \dots \dots \dots (10)$$

Where:

m and *n* are a number of lags determined by the Schwarz Information Criterion (SIC), *X* is the price series of cassava products, β is the coefficient to be estimated, and ε_t is the error term. According toSadiq et al. (2016), rejection of the null hypothesis that $\alpha_h = 0$ for h = 1, 2 …n and $\beta = 0$ indicates that prices of product *j*in 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.

Results and Discussion

Summary Statistics of Cassava Product Prices in Urban and Rural Markets

The study analyzed monthly price data for five cassava products (Gaari Yellow (UX1), Gaari White (UX2), Flour (UX3), Tuber (UX4), and Fufu (UX5)) over a five-year period (March 2014 to February 2019) using EViews 10. Descriptive statistics revealed variations in the mean, standard deviation, and range for both urban and rural price series

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(Table 1).For urban markets, UX1 had a mean price of 225.69 units with a standard deviation of 45.00, ranging from 180.00 to 293.00. Similarly, UX2 recorded a mean of 223.85 and a standard deviation of 28.58, with prices ranging between 196.00 and 266.00. UX3, UX4, and UX5 exhibited mean values of 208.92, 192.64, and 300.58, respectively, with varying degrees of volatility. The Jarque-Bera test indicated that none of these urban variables were normally distributed over the study period. Skewness and kurtosis analyses further showed that UX3 and UX5 were negatively skewed, while the rest were positively skewed. All variables exhibited platykurtic distributions, indicating flatter curves relative to a normal distribution.

In rural markets, RX1 had a mean of 146.23 units and a standard deviation of 64.40, with prices ranging from 100.00 to 540.00. RX2 showed a mean price of 216.36 and a standard deviation of 32.31, ranging from 105.00 to 259.00. RX3, RX4, and RX5 recorded mean values of 123.71, 199.87, and 257.79, respectively, with standard deviations indicating moderate to high variability. The Jarque-Bera test found that RX2 and RX4 followed a normal distribution, while RX1, RX3, and RX5 did not. Additionally, all rural variables, except RX2, were positively skewed and demonstrated platykurtic distributions.

Table 1: Descriptive Statistics of Urban and Rural Cassava Product Prices

Urban Price Results					
Statistics	UX1	UX2	UX3	UX4	UX5
Mean	225.6945	223.8460	208.9167	192.6378	300.5750
Median	223.8350	200.0000	200.0000	170.0000	310.0000
Maximum	293.0000	266.0000	245.0000	245.0000	342.0000
Minimum	180.0000	196.0000	110.7000	126.6700	232.5000
Std. Dev.	45.00291	28.58076	26.11037	42.01528	34.76919
Skewness	0.107021	0.431916	-1.322475	0.104905	-0.702321
Kurtosis	1.210905	1.316822	5.773048	1.214116	2.148344
Probability	0.017278	0.011400	0.000000	0.017567	0.034289
Sum	13541.67	13430.76	12535.00	11558.27	18034.50
Sum Sq. Dev.	119490.4	48194.73	40223.34	104151.8	71324.91
Observations	60	60	60	60	60
Rural Price Results					
Statistics	RX1	RX2	RX3	RX4	RX5
Mean	146.2278	216.3555	123.7078	199.8667	257.7945
Median	123.5000	200.0000	100.0000	180.0000	250.0000
Maximum	540.0000	259.0000	180.0000	306.0000	436.0000
Minimum	100.0000	105.0000	100.0000	107.9200	200.0000
Std. Dev.	64.39851	32.31071	27.38382	56.31931	45.63797
Skewness	3.923462	-0.460815	0.506868	0.117326	1.318071
Kurtosis	24.31077	3.328669	1.603282	1.681974	5.784574
Jarque-Bera	1289.308	2.393558	7.446201	4.480635	36.75774
Probability	0.000000	0.302166	0.024159	0.106425	0.000000
Sum	8773.670	12981.33	7422.470	11992.00	15467.67
Sum Sq. Dev.	244682.9	61594.95	44242.55	187140.0	122886.6
Observations	60	60	60	60	60

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Unit Root Test of Price Series in Urban and Rural Markets Using ADF Test Statistics

The stationarity of the price series for cassava products in urban and rural markets was evaluated using the Augmented Dickey-Fuller (ADF) test (Table 2). This method helps determine the order of integration for the variables, addressing the potential non-stationarity common in macroeconomic time series (Yilmaz, 2014; Olutumise et al., 2017 and Ekundayo et al 2022-). The results, presented in Table 2, provide a basis for understanding the time-series properties of the data and ensuring the validity of further econometric analysis.

Table 2: Unit Root Test of Price Series in Urban and Rural Markets Using ADF Test Statistics

Variable	ADF test statistics			
	Urban Price Results at Level I[0]			
	t-statistic	Critical values	t-statistic	Critical values
UX1	-1.2900^{NS}	-2.9117	-1.0872^{NS}	-2.9117
UX2	-0.6464^{NS}	-2.9117	-0.7457^{NS}	-2.9117
UX3	-2.1628^{NS}	-2.9117	-3.9986^{S}	-2.9117
UX4	-0.3029^{NS}	-2.9117	-0.4619^{NS}	-2.9117
UX5	-1.6443^{NS}	-2.9117	-1.6491^{NS}	-2.9117
Urban Price Results at First Difference I[1]				
Variable	t-statistic	Critical values	t-statistic	Critical values
UX1	-9.8781^{S}	-2.9126	-9.9534^{S}	-2.9126
UX2	-11.5092^{S}	-2.9126	-11.2177^{S}	-2.9126
UX3	-10.4969^{S}	-2.9126	-13.6667^{S}	-2.9126
UX4	-5.8721^{S}	-2.9126	-5.7634^{S}	-2.9126
UX5	-11.3832^{S}	-2.9126	-10.9581^{S}	-2.9126
Rural Price Results at Level I[0]				
Variable	Price at Level I[0]		Price at first difference I[1]	
	t-statistic	Critical values	t-statistic	Critical values
RX1	-2.5676^{NS}	-2.9117	-4.6034^{S}	-2.9117
RX2	-2.5152^{NS}	-2.9117	-2.5152^{NS}	-2.9117
RX3	-1.3351^{NS}	-2.9117	-1.2085^{NS}	-2.9117
RX4	-2.4771^{NS}	-2.9117	-2.8098^{NS}	-2.9117
RX5	-1.6748^{NS}	-2.9117	-5.0715^{S}	-2.9117
Rural Price Results at First Difference I[1]				
Variable	t-statistic	Critical values	t-statistic	Critical values
RX1	-11.6101^{S}	-2.9126	-17.9113^{S}	-2.9126
RX2	-13.1441^{S}	-2.9126	-18.7876^{S}	-2.9126
RX3	-8.8516^{S}	-2.9126	-8.9567^{S}	-2.9126
RX4	-11.9752^{S}	-2.9126	-12.5710^{S}	-2.9126
RX5	-7.0827^{S}	-2.9126	-18.3203^{S}	-2.9126

Test Critical Value for both ADF and PP tests is at 5% level of Significance
Note: NS = Non-Stationary; S = Stationary

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Johansen Co-integration Analysis for Urban and Rural Markets

The Johansen co-integration test was applied to determine the long-term relationships between price series in urban and rural cassava markets (Table 3). As all series were integrated at order one, I(1), the test was appropriate and provided robust results. The null hypothesis of no co-integration was rejected when the test statistics (trace and max-eigen values) exceeded their critical values at the 5% significance level.

The urban market analysis identified at least two co-integrating equations, while the rural market showed three. These results suggest a strong long-run connection among cassava product prices in both market types, despite potential short-run fluctuations. This high degree of integration indicates efficient cassava product marketing in Ekiti State, as market integration serves as a proxy for marketing efficiency (Mafimisebi et al., 2014; Adeniyi, 2019; Omosehin et al., 2021; Ibrahim et al., 2021; Aturamu et al., 2021).

Table 3: The Summary of the Co-integration Test for Trace and Max-Eigen Statistics for Urban and Rural Markets' Price Series

Urban Results					Rural Results				
Unrestricted Cointegration Rank Test (Trace)					Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**	Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.533806	102.1217	69.81889	0.0000	None *	0.484822	109.9720	69.81889	0.0000
At most 1 *	0.405786	57.85880	47.85613	0.0044	At most 1 *	0.427321	71.50394	47.85613	0.0001
At most 2	0.267887	27.66885	29.79707	0.0863	At most 2 *	0.393258	39.17305	29.79707	0.0031
At most 3	0.144557	9.583262	15.49471	0.3142	At most 3	0.105611	10.19324	15.49471	0.2662
At most 4	0.009052	0.527392	3.841466	0.4677	At most 4	0.062118	3.719586	3.841466	0.0538
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)					Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**	Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.533806	44.26289	33.87687	0.0021	None *	0.484822	38.46811	33.87687	0.0132
At most 1 *	0.405786	30.18995	27.58434	0.0226	At most 1 *	0.427321	32.33090	27.58434	0.0113
At most 2	0.267887	18.08559	21.13162	0.1267	At most 2 *	0.393258	28.97981	21.13162	0.0032
At most 3	0.144557	9.055870	14.26460	0.2815	At most 3	0.105611	6.473654	14.26460	0.5532
At most 4	0.009052	0.527392	3.841466	0.4677	At most 4	0.062118	3.719586	3.841466	0.0538

Urban
Trace test indicates 2 co-integratingeqn(s) at the 0.05 level
Max-eigenvalue test indicates 2 co-integratingeqn(s) at the 0.05 level
Rural
Trace test indicates 3 co-integratingeqn(s) at the 0.05 level
Max-eigenvalue test indicates 3 co-integratingeqn(s) at the 0.05 level

Analysis of Vector Error Correction Model (VECM)

VECM Analysis of Urban Cassava Price Series

The Vector Error Correction Model (VECM) was employed to analyze the transmission of price shocks within the urban cassava product markets after confirming the presence of long-run relationships (Table 4). The analysis identified two co-integrating equations with UX1 (Gaari Yellow) and UX2 (Gaari White) as the dependent variables.

In the long-run dynamics, the results indicated that a unit increase in the prices of UX3 (Flour), UX4 (Tuber), or UX5 (Fufu) leads to a 40% decrease, 92% decrease, and 8.8%

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increase, respectively, in UX1. Similarly, for UX2, a 1% increase in UX3, UX4, or UX5 results in an 84%, 37%, and 5.2% decrease, respectively. The error correction terms (ECM) demonstrated significant and negative coefficients for UX1 and UX3, implying a speed of adjustment to equilibrium of 26% and 29% for these variables following a shock. This suggests that price shocks in UX1 and UX3 are transmitted to other cassava products over time. Additionally, UX2 showed a rapid adjustment rate of 62%, highlighting its strong influence in stabilizing deviations from long-term price equilibrium.

In the short run, the analysis revealed causal relationships between several variables. UX1 exhibited a significant causal relationship with UX5 at the first lag, while UX2 influenced UX1, UX3, and UX4 at various lags. UX3 showed bidirectional interactions with UX1 and UX5. For instance, a 1% change in UX1 is associated with a 54% reduction in UX5 in the short run. Similarly, a 1% change in UX2 impacts UX1, UX3, and UX4 at rates of 25%, 16%, and 33%, respectively. A 1% change in UX3 is linked to reductions of 23%, 22%, and 45% in UX1 and other series, reflecting strong interconnectedness among price variables.

Table 4: Results of VECM for Urban Market Price Series for Cassava Products

CointegratingEq:	CointEq1	CointEq2			
UX1(-1)	1.000000	0.000000			
UX2(-1)	0.000000	1.000000			
UX3(-1)	-0.401565 (0.21582) [-1.86061]	-0.839991 (0.11697) [-7.18100]			
UX4(-1)	-0.916665 (0.10908) [-8.40380]	-0.368355 (0.05912) [-6.23076]			
UX5(-1)	0.087817 (0.06697) [1.31120]	-0.051507 (0.03630) [-1.41895]			
C	10.15584	40.75460			
Error Correction:	D(UX1)	D(UX2)	D(UX3)	D(UX4)	D(UX5)
CointEq1	-0.259374 (0.12173) [-1.13074]	0.328339 (0.04938) [6.64907]	- 0.293703 (0.08746) [-3.35813]	0.141588 (0.07698) [1.83917]	0.360792 (0.21762) [1.65787]
CointEq2	-0.023693 (0.33287) [-2.07118]	-0.617247 (0.07166) [-8.61370]	0.117839 (0.12692) [0.92848]	-0.127789 (0.11172) [-1.14388]	-0.281113 (0.31580) [-0.89016]
D(UX1(-1))	-0.291021 (0.31753) [-0.91652]	-0.246364 (0.06836) [-3.60410]	-0.229308 (0.12107) [-1.89405]	-0.177204 (0.10657) [-1.66284]	0.199230 (0.30125) [0.66134]
D(UX1(-2))	0.451330 (0.25490) [1.77061]	-0.162667 (0.05487) [-2.96436]	-0.220693 (0.09719) [-2.27076]	0.075751 (0.08555) [0.88548]	-0.120400 (0.24183) [-0.49787]
D(UX2(-1))	-0.112845 (0.46247) [-0.24401]	-0.090677 (0.09956) [-0.91079]	-0.118183 (0.17633) [-0.67023]	-0.247855 (0.15521) [-1.59690]	-0.078137 (0.43876) [-0.17809]

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D(UX2(-2))	0.215550 (0.39623) [0.54400]	-0.170558 (0.08530) [-1.99953]	0.033041 (0.15108) [0.21871]	-0.015875 (0.13298) [-0.11938]	0.072124 (0.37592) [0.19186]
D(UX3(-1))	-0.562088 (0.46598) [-1.20625]	-0.108488 (0.10031) [-1.08148]	-0.252844 (0.17767) [-1.42311]	-0.351033 (0.15639) [-2.24461]	0.322759 (0.44209) [0.73007]
D(UX3(-2))	0.848475 (0.41377) [2.05060]	-0.175420 (0.08907) [-1.96936]	-0.448087 (0.15776) [-2.84026]	0.089765 (0.13887) [0.64641]	-0.283736 (0.39256) [-0.72279]
D(UX4(-1))	0.795286 (0.63538) [1.25166]	0.032534 (0.13678) [0.23785]	0.790036 (0.24226) [3.26111]	0.479207 (0.21324) [2.24724]	-0.367065 (0.60281) [-0.60893]
D(UX4(-2))	-0.988435 (0.64303) [-1.53714]	-0.334457 (0.13843) [-2.41607]	0.616787 (0.24518) [2.51568]	-0.025546 (0.21581) [-0.11837]	-0.089220 (0.61007) [-0.14625]
D(UX5(-1))	-0.536781 (0.16923) [-3.17181]	-0.057100 (0.03643) [-1.56730]	-0.016944 (0.06453) [-0.26260]	-0.130378 (0.05680) [-2.29549]	-0.144019 (0.16056) [-0.89699]
D(UX5(-2))	0.049494 (0.17082) [0.28975]	-0.057940 (0.03677) [-1.57561]	-0.144895 (0.06513) [-2.22470]	0.004808 (0.05733) [0.08387]	0.143487 (0.16206) [0.88539]
C	0.296675 (2.49161) [0.11907]	2.584767 (0.53638) [4.81887]	1.247736 (0.95000) [1.31340]	1.749755 (0.83622) [2.09246]	0.441039 (2.36387) [0.18658]
R-squared	0.454645	0.682551	0.667704	0.307634	0.259254
Adj. R-squared	0.305912	0.595975	0.577078	0.118807	0.057232
Sum sq. resids	9986.496	462.8146	1451.795	1124.845	8988.750
S.E. equation	15.06538	3.243226	5.744157	5.056150	14.29300
F-statistic	3.056787	7.883761	7.367674	1.629184	1.283295
Log likelihood	-228.1087	-140.5663	-173.1484	-165.8764	-225.1088
Akaike AIC	8.459955	5.388293	6.531522	6.276367	8.354695
Schwarz SC	8.925914	5.854252	6.997481	6.742326	8.820654
Mean dependent	1.298246	1.100000	1.345614	1.754386	-0.570175
S.D. dependent	18.08311	5.102380	8.832753	5.386224	14.72044

VECM Analysis of Rural Cassava Price Series

The Vector Error Correction Model (VECM) was employed to evaluate the long-run and short-run dynamics in the rural cassava price series after establishing co-integration (Table 5). The analysis identified three co-integrating equations, each with RX1 (Gaari Yellow), RX2 (Gaari White), and RX3 (Flour) as dependent variables, confirming the existence of long-run relationships.

In the long-run dynamics, Equation 1 indicated that a unit increase in RX4 (Tuber) or RX5 (Fufu) led to a 2.25-unit decrease or a 1.6-unit increase in RX1, respectively. For Equation 2, a 1% rise in RX4 or RX5 caused decreases of 1.46 units or 0.94 units in RX2, respectively. Similarly, Equation 3 showed that a 1% increase in RX4 or RX5 resulted in a 2.01-unit decrease or 1.46-unit increase in RX3, respectively. These findings highlight the interconnectedness of cassava product prices within rural markets.The error correction terms

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(ECM) revealed significant adjustment rates. In CointEq1, RX1 and RX5 had significant negative coefficients, indicating adjustment rates of 60% and 48%, respectively, as shocks in Gaari Yellow and Fufu prices were transmitted to other products. In CointEq3, RX3 (Flour) and RX4 (Tuber) exhibited adjustment rates of 27% and 61%, respectively, reflecting their influence on other cassava products. However, CointEq2 showed no negative coefficients, suggesting a lack of long-run equilibrium properties, which diverged from theoretical expectations and was disregarded.

In the short-run, the results indicated several causal relationships among price series. A 1% increase in RX1 was associated with a 23% reduction in RX1(-1) and a 60% reduction in RX3(-2). Similarly, a 1% increase in RX2 led to a 29% decrease in RX1(-1). For RX3, a 1% change resulted in decreases of 16%, 41%, and 23% in RX1(-1), RX3(-1), and RX3(-2), respectively. RX4 exhibited significant short-run effects, where a 1% increase led to decreases of 46%, 23%, 4%, 14%, and 19% in RX1(-1), RX1(-2), RX2(-1), RX2(-2), and RX5(-1 and -2), respectively. Lastly, RX5 had substantial impacts, with a 1% increase causing reductions of 86%, 51%, and 62% in RX4(-2), RX5(-1), and RX5(-2), respectively.

Table 5: Results of VECM for Rural Market Price Series for Cassava Products

Cointegrating Eq:	CointEq1	CointEq2	CointEq3		
RX1(-1)	1.000000	0.000000	0.000000		
RX2(-1)	0.000000	1.000000	0.000000		
RX3(-1)	0.000000	0.000000	1.000000		
RX4(-1)	-2.253701 (0.34410) [-6.54964]	-1.463841 (0.18853) [-7.76452]	-2.011817 (0.32860) [-6.12243]		
RX5(-1)	1.656965 (0.50161) [3.30327]	0.942386 (0.27483) [3.42893]	1.460916 (0.47902) [3.04979]		
C	-119.0715	-165.3765	-96.63980		
Error Correction:	D(RX1)	D(RX2)	D(RX3)	D(RX4)	D(RX5)
CointEq1	-0.597024 (0.07611) [-7.84460]	-0.021449 (0.04835) [-0.44360]	0.075485 (0.02886) [2.61594]	-0.065729 (0.06445) [-1.01976]	-0.479140 (0.15099) [-3.17342]
CointEq2	0.853493 (0.17647) [4.83654]	0.171169 (0.11211) [1.52678]	0.248363 (0.06691) [3.71203]	1.308226 (0.14945) [8.75351]	0.376073 (0.35009) [1.07422]
CointEq3	0.022733 (0.16112) [0.14109]	-0.080834 (0.10236) [-0.78970]	-0.270209 (0.06109) [-4.42327]	-0.608544 (0.13645) [-4.45975]	0.289818 (0.31964) [0.90670]
D(RX1(-1))	-0.227689 (0.06642) [-3.42784]	-0.287421 (0.04220) [-6.81106]	-0.159363 (0.02518) [-6.32786]	-0.458642 (0.05625) [-8.15299]	0.025120 (0.13178) [0.19062]
D(RX1(-2))	-0.153399 (0.09997) [-1.53450]	0.014331 (0.06351) [0.22565]	-0.053819 (0.03790) [-1.41993]	-0.229913 (0.08466) [-2.71564]	0.636403 (0.19832) [3.20893]
D(RX2(-1))	-0.298287 (0.32339) [-0.92238]	-0.155142 (0.20545) [-0.75513]	-0.046279 (0.12261) [-0.37745]	-1.042224 (0.27388) [-3.80541]	0.001241 (0.64156) [0.00193]

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D(RX2(-2))	0.015889 (0.16703) [0.09512]	0.023745 (0.10612) [0.22376]	0.034548 (0.06333) [0.54552]	-0.349192 (0.14146) [-2.46844]	-0.227669 (0.33138) [-0.68704]
D(RX3(-1))	-0.292471 (0.42705) [-0.68486]	0.067800 (0.27131) [0.24990]	-0.405735 (0.16192) [-2.50584]	1.009920 (0.36167) [2.79237]	1.749595 (0.84722) [2.06511]
D(RX3(-2))	-0.602722 (0.22762) [-2.64789]	-0.164909 (0.14461) [-1.14037]	-0.231816 (0.08630) [-2.68607]	0.313311 (0.19278) [1.62526]	0.316996 (0.45158) [0.70197]
D(RX4(-1))	-0.095660 (0.12814) [-0.74653]	0.034088 (0.08141) [0.41873]	0.282023 (0.04858) [5.80484]	0.029252 (0.10852) [0.26955]	0.033859 (0.25421) [0.13319]
D(RX4(-2))	0.073045 (0.17108) [0.42695]	0.001289 (0.10869) [0.01186]	0.067542 (0.06487) [1.04125]	-0.249634 (0.14489) [-1.72291]	-0.858106 (0.33941) [-2.52824]
D(RX5(-1))	0.015701 (0.07868) [0.19957]	0.003112 (0.04998) [0.06227]	-0.007894 (0.02983) [-0.26463]	-0.146739 (0.06663) [-2.20225]	-0.514098 (0.15608) [-3.29372]
D(RX5(-2))	-0.027041 (0.07138) [-0.37885]	-0.054174 (0.04535) [-1.19467]	-0.043151 (0.02706) [-1.59450]	-0.193417 (0.06045) [-3.19962]	-0.620790 (0.14160) [-4.38399]
C	-5.505826 (1.96152) [-2.80692]	0.596996 (1.24616) [0.47907]	0.450636 (0.74371) [0.60593]	-0.768673 (1.66122) [-0.46272]	-2.816568 (3.89141) [-0.72379]
R-squared	0.944364	0.850722	0.855689	0.914063	0.660299
Adj. R-squared	0.927544	0.805591	0.812060	0.888083	0.557599
Sum sq. resids	8945.643	3610.570	1285.969	6416.246	35208.00
S.E. equation	14.42353	9.163337	5.468662	12.21536	28.61452
F-statistic	56.14463	18.85017	19.61289	35.18224	6.429390
Log likelihood	-224.9718	-199.1137	-169.6917	-215.5003	-264.0198
Akaike AIC	8.384976	7.477675	6.445322	8.052642	9.755082
Schwarz SC	8.886778	7.979477	6.947124	8.554444	10.25688
Mean dependent	-6.491228	0.701754	0.745614	-0.684211	-3.438596
S.D. dependent	53.58382	20.78238	12.61454	36.51384	43.02080

Pairwise Granger Causality Tests

Identifying the leading markets within a network is essential for understanding price formation and transmission dynamics, as noted by Mafimisebi (2012), Ibrahim et al. (2021), Omosehin et al. (2021), and Aturamu et al. (2021). Literature suggested that such leading markets exist in integrated networks of homogeneous commodities with long-run equilibrium.

The pairwise Granger causality test results for the urban cassava product markets, presented in Table 6, highlight the direction and strength of causal relationships among price series. The analysis revealed six uni-directional (one-way) causal links: UX1 → UX2, UX1 → UX3, UX4 → UX1, UX5 → UX1, UX2 → UX3, and UX4 → UX5. These findings suggest that price changes in certain markets influence others without reciprocal causality.

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Additionally, two bi-directional (two-way) causal relationships were identified: UX4 ↔ UX2 and UX4 ↔ UX3. In both cases, UX4 (Tuber) demonstrated a stronger influence, Granger-causing UX2 (Gaari White) and UX3 (Flour) at the 1% significance level, and vice versa. This establishes UX4 as the dominant market, playing a leadership role in price transmission within the urban cassava product network. UX2 and UX3 also exhibited exogeneity but to a lesser extent compared to UX4. These findings align with the results of Okoh and Egbon (2003), Ibrahim et al. (2021), Omosehin et al. (2021), and Aturamu et al. (2021) who similarly observed strong market integration among cassava products in Nigeria. The results suggest that UX4 is the key driver of price movements for other cassava products in urban markets, emphasizing its role in shaping market dynamics.

Table 6: Results of Pairwise Granger Causality Tests for Urban Market

Null Hypothesis:	Obs	F-Statistic	Prob.
UX2 does not Granger Cause UX1	58	1.02666	0.3652
UX1 does not Granger Cause UX2		7.05129	0.0019
UX3 does not Granger Cause UX1	58	2.69516	0.0768
UX1 does not Granger Cause UX3		8.95240	0.0004
UX4 does not Granger Cause UX1	58	4.98741	0.0104
UX1 does not Granger Cause UX4		0.20310	0.8168
UX5 does not Granger Cause UX1	58	3.76359	0.0296
UX1 does not Granger Cause UX5		2.44008	0.0969
UX3 does not Granger Cause UX2	58	1.87127	0.1640
UX2 does not Granger Cause UX3		3.36597	0.0421
UX4 does not Granger Cause UX2	58	12.4424	4.E-05
UX2 does not Granger Cause UX4		5.76859	0.0054
UX5 does not Granger Cause UX2	58	1.47486	0.2380
UX2 does not Granger Cause UX5		2.89518	0.0641
UX4 does not Granger Cause UX3	58	15.8378	4.E-06
UX3 does not Granger Cause UX4		6.81495	0.0023
UX5 does not Granger Cause UX3	58	1.05618	0.3550
UX3 does not Granger Cause UX5		2.76313	0.0722
UX5 does not Granger Cause UX4	58	1.21740	0.3041
UX4 does not Granger Cause UX5		3.62193	0.0335

The pairwise Granger causality test results for rural cassava product markets, as presented in Table 7, reveal significant causation and exogeneity among price series. The analysis identified five uni-directional (one-way) causal links: RX5 → RX1, RX2 → RX3, RX4 → RX3, RX5 → RX3, and RX4 → RX5. These links indicate that price changes in

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specific markets influence others without reciprocal causality. In addition, five bi-directional (two-way) causal relationships were observed: RX2 ↔ RX1, RX1 ↔ RX3, RX1 ↔ RX4, RX2 ↔ RX4, and RX2 ↔ RX5. For instance, RX2 Granger-caused RX1 at the 1% significance level and vice versa, while RX3 Granger-caused RX1 and RX1 Granger-caused RX4, both also at 1% significance levels. These findings establish RX1 (Gaari Yellow) and RX2 (Gaari White) as the primary drivers in rural price formation and transmission, exhibiting the strongest exogeneity in the market network.

Other price series, such as RX4 (Tuber), RX3 (Flour), and RX5 (Fufu), also demonstrated exogeneity but to a lesser extent. RX1 and RX2's leadership in the rural cassava markets reflects their substantial influence on other price series, making them critical for price stabilization and policy planning. These results align with the findings of Okoh & Egbon (2003) on market integration of cassava products in Nigeria. The analysis underscores that RX1 and RX2 are key drivers of rural cassava product prices, with RX4, RX3, and RX5 also playing significant but secondary roles in price formation and transmission.

Table 7: Results of Pairwise Granger Causality Tests for Rural Market

Null Hypothesis:	Obs	F-Statistic	Prob.
RX2 does not Granger Cause RX1	57	45.8990	2.E-14
RX1 does not Granger Cause RX2		55.5141	6.E-16
RX3 does not Granger Cause RX1	57	22.5543	2.E-09
RX1 does not Granger Cause RX3		9.56272	4.E-05
RX4 does not Granger Cause RX1	57	29.9466	3.E-11
RX1 does not Granger Cause RX4		18.5755	3.E-08
RX5 does not Granger Cause RX1	57	5.80315	0.0017
RX1 does not Granger Cause RX5		1.70088	0.1788
RX3 does not Granger Cause RX2	57	1.82420	0.1548
RX2 does not Granger Cause RX3		11.8366	6.E-06
RX4 does not Granger Cause RX2	57	9.90287	3.E-05
RX2 does not Granger Cause RX4		3.34120	0.0264
RX5 does not Granger Cause RX2	57	6.83998	0.0006
RX2 does not Granger Cause RX5		5.95319	0.0015
RX4 does not Granger Cause RX3	57	20.7501	7.E-09
RX3 does not Granger Cause RX4		1.80976	0.1574
RX5 does not Granger Cause RX3	57	8.81428	9.E-05
RX3 does not Granger Cause RX5		1.56485	0.2095
RX5 does not Granger Cause RX4	57	1.60258	0.2005
RX4 does not Granger Cause RX5		2.77566	0.0508

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Conclusion and Recommendations

This study examined the price dynamics and market integration of cassava products in Ekiti State, Nigeria, using co-integration and vector error correction modeling (VECM) alongside Granger causality tests. The findings revealed significant long-run relationships among the price series in both urban and rural markets, indicating strong market integration.

Urban markets exhibited two co-integrating equations, while rural markets showed three, underscoring the interconnectedness of cassava product prices. VECM results demonstrated effective adjustment mechanisms to restore equilibrium after short-term deviations. In urban markets, Gaari Yellow (UX1) and Gaari White (UX2) emerged as key influencers, with rapid adjustments of 26% and 62%, respectively. In rural markets, Gaari Yellow (RX1) and Gaari White (RX2) showed strong exogeneity, confirming their leading roles in price transmission. Granger causality tests identified Tuber (UX4) as the primary price driver in urban markets, while Gaari Yellow (RX1) and Gaari White (RX2) dominated rural markets. These results reflect a well-integrated market structure, contributing to marketing efficiency for cassava products. However, the presence of asymmetric price relationships between rural and urban markets suggests the need for targeted policy interventions to address price disparities and ensure equitable value distribution.

Based on these findings, the following policy recommendations were made as follows:

i. The government should introduce policies to stabilize prices, particularly for key products like Gaari and Tuber, to reduce market inefficiencies and protect smallholder farmers.

ii. The government should also invest in transportation and storage infrastructure to minimize price disparities between rural and urban markets.

iii. Establishment of robust systems for real-time price dissemination to enhance transparency and reduce information asymmetry among stakeholders.

iv. The government through the extension agents should train farmers and market participants on value chain dynamics to improve market participation and income stability.

Further Research

Conduct longitudinal studies to explore the impact of external shocks and policy reforms on cassava market integration.

References

Adeniyi, S. (2019). Analysis of price transmission in cassava value chain in Ondo State, Nigeria. *Unpublished Ph.D Thesis in the Department of Agricultural and Resource Economics, The Federal University of Technology, Akure, Ondo State, Nigeria.*

Alam, M. J., McKenzie, A. M., Begum, I. A., Buysse, J., Wailes, E. J., Sarkar, M. A. R., ... & Van Huylenbroeck, G. (2022). Spatial market integration of rice in Bangladesh in the presence of transaction cost. *Agricultural and Food Economics, 10*(1), 20.

Aturamu, O. A., Ogunbusuyi, O. P., Etamesor, E. O., & Olutumise, A. I. (2021). Price transmission and causality in rural and urban meat markets in Ondo State, Nigeria. *Nigerian Journal of Animal Science and Technology, 4*(2), 13–27.

Bailey, D., & Brorsen, B. W. (2009). Asymmetric price transmission in agricultural markets: A review of the literature. *Agricultural Economics Review, 20*(1), 1–11.

Barboza Martignone, G., Behrendt, K., & Paparas, D. (2022). Price transmission analysis of the international soybean market in a trade war context. *Economies, 10*(8), 203.

Barrett, M. P., Chen, S., Lin, M. L., & Weber, M. A. (2024). The dynamic effects of local labor market shocks on small firms in the United States. *International Monetary Fund.*

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Blinder, A. S. (2012). Inventories and sticky prices: More on the microfoundation of macroeconomics. *The American Economic Review, 72*(3), 334–348.

Ekundayo, B. P., Olutumise, A. I., & Akinrinola, O. O. (2021). A time series analysis of the nexus between climate change and cassava production in Southwest Nigeria. In *Handbook of Climate Change Management: Research, Leadership, Transformation* (pp. 1347–1363). Cham: Springer International Publishing.

Gardner, B. L. (1975). The farm-retail price spread in a competitive food industry. *American Journal of Agricultural Economics, 57*(3), 399–409.

Gujarati, D. N., & Porter, D. C. (2009). *Basic econometrics* (5th ed.). New York, NY: McGraw-Hill.

Heien, D. M. (1980). Markup pricing in a dynamic model of food industry. *American Journal of Agricultural Economics, 62*(10–18), 608.

Ibrahim, A. T., Sekumade, A., & Owoeye, R. Analysis of spatial price transmission of cassava products between rural and urban markets in Ekiti State, Nigeria. *International Journal of Economics, Business and Management Research, 5*(8), 168 – 184.

Ikuemonisan, E. S., Mafimisebi, T. E., Ajibefun, I., & Adenegan, K. (2020). Cassava production in Nigeria: Trends, instability and decomposition analysis (1970–2018). *Heliyon, 6*(10).

Jena, S. K., Tiwari, A. K., Abakah, E. J. A., & Roubaud, D. (2023). Integration between emerging market equity and global markets: Is it fundamental or noisy? Evidence from wavelet denoised volatility spillover analysis in time and frequency domain. *Applied Economics, 55*(12), 1312–1327.

Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration—with applications to the demand for money. *Oxford Bulletin of Economics and Statistics, 52*(2), 169–210.

Juselius, K. (2006). *The cointegrated VAR model: Methodology and applications.* Oxford University Press.

Kinnucan, H. W., & Forker, O. D. (1987). Asymmetry in farm-retail price transmission for major dairy products. *American Journal of Agricultural Economics, 69*(3), 285–292.

Liu, S., Wang, J., & Sun, C. (2022). Asymmetric price transmission and market power: A case of the aquaculture product market in China. *Sustainability, 14*(22), 15253.

Mafimisebi, T. (2008). Price dynamics in Nigerian agricultural markets. *African Journal of Agricultural Research, 3*(5), 372–382.

McCorriston, S., Hemming, D., Lamontagne-Godwin, J. D., Osborn, J., Parr, M. J., & Roberts, P. D. (2013). What is the evidence of the impact of agricultural trade liberalisation on food security in developing countries? (pp. 127). EPPI-Centre, Social Service Research Unit, Institute of Education, University of London.

Munyeka, W. (2014). Price mediation in tomato commerce of Limpopo Province of the Republic of South Africa. *Mediterranean Journal of Social Sciences, 5*(20), 778.

Nielsen, B. (2006). Order selection and model selection in cointegration analysis. *Journal of Econometrics, 137*(2), 731–748.

Okoh, R. N., & Egbon, P. C. (2003). Market integration and price transmission in Nigerian food markets. *Nigerian Journal of Economic and Social Studies, 45*(2), 241–256.

Olutumise, A. I., Okogbue, E. C., & Omonijo, A. G. (2017). Assessing relationship between selected climate variables, human diseases and crop production using ARDL

IJO - INTERNATIONAL JOURNAL OF AGRICULTURE AND RESEARCH
(ISSN 2814-189X)
https://ijojournals.com/
Ajolola Taibat IBRAHIM (Ph.D)*
Volume 08 || Issue 01 || January, 2025 ||

approach: The example of Ondo State, Nigeria. *Scientific Paper Series Management, Economic Engineering in Agriculture and Rural Development, 17*(3), 253–264.

Omosehin, O. O., Ekundayo, B. P., Aturamu, O. A., & Olutumise, A. I. (2021). Price variation and transmission in beans consuming markets of Southwest Nigeria. *Journal of Perspectives on Financing and Regional Development, 8*(6), 609–618.

Ozturk, O. (2020). Market integration and spatial price transmission in grain markets of Turkey. *Applied Economics, 52*(18), 1936–1948.

Peltzman, S. (2022). Productivity, prices, and concentration in manufacturing: A Demsetzian perspective. *The Journal of Law and Economics, 65*(S1), S121–S153.

Reagan, P. B., & Weitzman, M. L. (1982). Asymmetries in price and quantity adjustments by the competitive firm. *Journal of Economic Theory, 27*(3), 410–420.

Sadiq, M. S., Singh, I. P., Suleiman, A., Umar, S. M., Grema, I. J., Usman, B. I., ... & Lawal, A. T. (2016). Extent, pattern and degree of integration among some selected cocoa markets in West Africa: An innovative information delivery system. *Journal of Progressive Agriculture, 7*(2), 22–39.

Serra, T., Gil, J. M., & Goodwin, B. K. (2016). Local polynomial fitting and spatial price relationships: Price transmission in the EU pork markets. *European Review of Agricultural Economics, 33*(3), 415–436.

Ward, R. W. (1982). Asymmetric price transmission in food marketing systems: A review of theory and evidence. *American Journal of Agricultural Economics, 64*(3), 212–221.

Xu, P., Lone, T., & Torres, N. (2022). Market integration and price discovery in California's almond marketing: A vector auto-regressive (VAR) approach. *International Journal of Business and Management, 17*(9).

Yilmaz, K. (2014). Stationarity and its implications in time series analysis. *Journal of Econometric Theory and Practice, 45*(4), 367–385.