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Food Price Differences and Market Integration in Oyo State, Nigeria

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Abstract: The study tests the market integration of main staple agricultural commodities in Oyo State. Monthly prices in N/kg covering a period of 8 years (1994-2001) were obtained from Oyo State Agricultural Development Programme (OYSADP) and analyzed using Ravallion Model. The study also calculated the Indices of Market Concentration (IMC) to measure the degree of spatial market integration. The IMCs for cassava, yam, white maize and yellow maize were, 0.3074, 0.0814, 0.02712 and 0.1648, respectively. The IMCs imply high short-run market integration between the reference and rural markets. The market integration indices confirm that price changes in the urban markets (Bodija and Ilora) translated to changes in the price of cassava, yam, maize, yellow maize in rural markets (Akanran, Towobowo, Anko, Irepodun, Oje, Kajola, Akala and Aberu). It is concluded that agricultural commodity arbitrage is working. The degree of market integration can be enhanced by the provision of not only transport infrastructure but by provision of adequate formal marketing information and standardization of weights and measures in the system.

Key words: Market integration, ravallion model, indices of market concentration

Introduction

Prices are the most readily available and reliable information that guide farmers' planting decisions in Nigeria. A farmer's planting decisions depend on anticipated profits which in fact depends on anticipated prices of planted crops. This has made prices an important tool in the economic analysis of markets.

Market integration refers to the co-movement of prices and more generally to the smooth transmission of price signals and information across spatially separated markets. In a developing economy like Nigeria, the dynamics of the exchange of information and its effects on the pricing processes are not well understood. This has made prices the must reliable information source in Nigeria's agricultural marketing systems.

Most studies of agricultural product prices in Nigeria focused on vertical dynamic analysis (Olayemi, 1977; Oludimu, 1982; Mobolaji, 1977; Adekanye, 1988; Afolami, 1988; Adeyokunnu, 1973; Okunmadewa, 1990; Ladipo and Fabiyi, 1982). Of recent, a growing number of studies on agricultural market integration in Nigeria have focused on different aspects of agricultural marketing (Dittoh, 1994; Mafimisebi, 2000; Oladapo, 2004). This paper will extend the study of market integration in two aspects. Previous studies on market integration focused on single product. The study compares the market integration of different product markets and measures the degree of market integration by using the Index of Market Concentration (IMC). Studies of market integration can help policy makers design appropriate agricultural product supply across the state so as to avoid too much instability in the rural economy.

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Study Area

The study area is Oyo State which is one of the thirty six states in Nigeria. The State is located within latitude 3° and 5° North of the equator and between longitude 7° and 9° 3^1 East of the Greenwich Meridian.

Oyo State covers 35,743 square kilometers and has an estimated population 11.5 million as at 1996. The state consists of thirty three local government area (LGAs).

The State is characterized by equatorial climatic conditions. There are two distinct seasons namely wet and dry seasons. The wet season covers between November to March and is characterized by hot weather. The topography is about 0-5 m above sea level and the mean annual rainfall is within the range of 1000-1400 mm (MANR, 1999).

The soil resources of Oyo State may be divided into two broad groups. These are the poorly drained soils and the well-drained soils. The alluvial or poorly drained soils are found on the flood plains of Ofiki, Opeki, Ona, Oba and Sasa rivers. These soils are widely cultivated to grow yam, maize and sugar cane. They are most useful during the dry season when farming activities have stopped on higher grounds. They are three main types of well-drained soils. These soils support most of the farming activities in Oyo State. The crops grown include both annual and perennial crops such as yams, cassava, oranges, cocoa, tobacco, cashew, etc.

The vegetation consists of the savanna woodland and the forestlands. Savanna woodlands covers over half of the land area of Oyo State. It is often divided into the derived savanna and the gallery forests. The only forests found in the state are along river valleys and the called gallery forests.

Data Collection

The data for the study were sourced from the Oyo State Agricultural Development Programme (OYSADEP). It is one of the MSADP I projects approved by the World Bank for assistance in Nigeria. Average commodity market price data was collected through the Planning Monitoring and Evaluation (PME) unit of OYSADEP. For the price survey, four zonal extension offices with 20 block extension offices served as contact points for the collection of rural and urban market prices. Average monthly prices in Naira per kilogram (N/kg) for cassava, tuber, yam, yellow and white maize were collected for 8 years; 1994 to 2001 for both urban and rural markets. The urban markets in Oyo State include Bodija, Oje, Gambari, Ilora, Owode markerts, while the rural markets include Akanran, Towobowo, Anko, Irepodun, Oje, Obada, Ipapo and Igbeti.

The integration of different product markets and measure the degree of integration by using the Index of Market Connection (IMC). Studies of market integration can help policy makers design appropriate agricultural product supply across the state so as to avoid too much instability in the rural economy.

Model Specification

The Ravallion Model seeks to determine whether a change in the price of a product in a local market is influenced by the change in the central market. Ravallion's approach was used to develop a structural model of prices (Ravallion, 1986). Formation in N local markets by assuming that local prices (P_1......, P_N) are dominated by one central or reference market price (R). The static form of the model can be represented as follows:

$$P_i = f_i\,(R, X_1) \text{ for } I = 1\ \ldots, N \qquad (1)$$

$$R = f\,(P_1 \ldots P_N X) \qquad (2)$$

Where X_i = vector of seasonal or other exogenous variables which might influence price formation in market I and central market.

The dynamic structure of Eq. (1) and (2) if expressed in a linear form are:

$$P_{it} = a_i\ Pi_{t-1} + b_{io}R_t + b_{i1}\ R_{t-1} + C_iX_{it} + \epsilon_{it} \quad (3)$$

Where:

$$R_t = \alpha R12_{t-1} + \beta_{10}P_{it} + B_{20}P_{2t} + \ldots \beta_{NO}P_{NE} + \beta_{11}P_{it-1} + \beta_{N1}\ P_{Nt-1} + CX_t + \epsilon_t$$

(ϵ_{it} and ϵ_t are suitable error processes)
Note the followings about the equations

- Only one lag of each endogenous variable has been included, but a general model with 'n' lags of local prices and 'm' lags of the central price is possible.
- Because of the nature of transport costs, the model was estimated with actual prices rather than their lags.

If Eq. (3) is re written in the form of error correction mechanism, that is using 'Δ' for the difference operator.

$$\Delta p_t = P_t\text{-}P_{t-1}.\ \text{Thus}$$

$$\Delta p_{it} = (a_r1)(P_{it} - 1\text{-}R_{t-1}) + b_{i0}\Delta R_t + (a_i + b_{i0} + b_i1\text{-}1)R_{t-1} + C_iX_{it} + \epsilon_{it} \quad (5)$$

Since there is likely to be less collinearity in Eq. (5) than the equivalent Eq. (3) this error correction form was estimated. Tests for market segmentation is given by

$$b_{io} = b_{i1} = 0$$

On the other hand tests for long run integration is indicated by

$$b_{io} = 1,\ b_{it} = a_i = 0$$

Index of Market Connection Analysis

Index of Market Connection (IMC) is used to measure price relationship between integrated markets and following formula was used to calculate IMC:

$$P_t = \beta_0\ \beta_1P_{t-1} + \beta_2\,(R_t - R_{t-1}) + \beta_3R_{t-1} + \epsilon_t$$

Where:

R_t	=	Urban or reference price
P_t	=	Rural price
R_{t-1}	=	Lagged price for urban markets
R_t-R_{t-1}	=	Difference between urban price and its lag
ϵ_t	=	Error term or unexplained term
β_0	=	Constant term
β_1	=	Coefficient of rural lagged price
β_2	=	Coefficient of Rt-Rt-1
β_3	=	Coefficient of urban lagged price
IMC	=	$\frac{\beta_1}{\beta_3}$ where $0 \le IMC \le \infty$

According to the model, IMC equals to the coefficient of lagged price in local markets divided by the coefficient of lagged in reference market interpretation of the IMC.

IMC <1 implies high short-run market integration
IMC >1 implies low short-run market integration
IMC = ∞ implies no market integration
IMC = 1 high or low short run integration (theoretically)

The closer the value of the IMC to zero, the higher the degree of market integration and by extension the higher the marketing efficiency. In order to capture the IMC values better, the values were approximated to two decimal places.

Results and Discussion

Table 1 shows the regression results for the market pairs for four crops, cassava, yam, white maize and yellow maize.

The coefficient of multiple determination (R^2) shows the percentage of the rural price (P_t) that is explained by the lagged rural price (P_{t-1}), difference between urban price (R_t) and its lag (R_{t-1}). The regression equation explained 88.3, 86, 96.6 and 92.5% of all the variabilities in the rural prices of cassava, yam, white maize and yellow maize, respectively. The Durbin Watson test was conducted on the data to detect the existence of serial correlation. The result in Table 1 indicate the non-existence of serial correlation since the Durbin Waston values we re either approximately equal to two for the crops covered by the study. The F-test indicates that the regression equation is significant at 10% .

The Indices of Market Connection (IMC)

The indices of market connection (IMC) is used to measure price relationship between integrated markets. For the cassava, yam, white maize and yellow maize market pairs the IMCs were 0.3074, 0.0814, 0.02712 and 0.1648, respectively (Table 2). The IMCs for these market pairs are all less than

Table 1: Regression analysis results for Oyo state

			Coefficients		
Market pairs	Crops	Constants B_0	B_1	B_2	B_3
Akanran, Towobowo, Anko-Bodija	Cassava	-0.181	0.229**	0.447***	0.745***
	(t-value)	(-0.698)	(2.380)	(5.772)	(7.677)
Irepodun, Obada, Ipapo-Ilora	Yam	0.886	6.793E-02	0.837***	0.834***
	(t-value)	(1.135)	(0.643)	(14.524)	(8.039)
Akanran, Towobowo, Anko, Obada, Ipapo-Bodija	White maize	0.391	2.460E-02	0.916***	0.907***
	(t-value)	(1.069)	(0.235)	(17.132)	(9.157)
Akanra, Towobowo, Anko, Irepodun, Obada, Ipapo-Bodija	Yellow maize	0.938*	0.131	0.859***	0.795***
	(t-value)	(1.655)	(1.244)	(10.968)	(7.9381)

		Diagnostic statistics				
Market pairs	Crops	R_2	Adj. R^2	F	DW	IMC classification
Akanran, Towobowo, Anko-Bodija	Cassava (t-value)	0.883	0.879	228.806***	2.166	0.3074, high S/R market integration
Irepodun, Obada, Ipapo-Ilora	Yam (t-value)	0.860	0.856	187.089***	1.940	8.1451E-02,high S/R market integration
Akanran, Towobowo, Anko, Obada, Ipapo-Bodija	White maize (t-value)	0.966	0.965	854.667***	2.001	2.7122E-02,high S/R market integration
Akanra, Towobowo, Anko, Irepodun, Obada, Ipapo-Bodija	Yellow maize (t-value)	0.925	0.923	376.523***	1.990	0.1648, high S/R market integration

Source-Data Analysis 2004, Figures in parentheses are t-value calculated,*** - Coefficients significant at the rate of 1% ∝, ** - Coefficients significant at the rate of 5% ∝, * - Coefficients significant at the rate of 10% ∝, S/R-Short run

Table 2: IMC and classification of markets in Oyo state

Crops	Central market	Rural market	Distance (km)	IMC and classification
Cassava	Bodija	Akanran, Towobowo	15	0.3074, High short run market integration
Yam	Ilora	Irepodun, Obada, Ipapo	12	0.0814, High short run market integration
White-maize	Bodija	Akanran, Towobowo, Anko, Irepodun, Obada, Ipapo.	60	0.0271, High short run market integration
Yellow maize	Bodija	Akanran, Towobowo, Anko, Irepodun, Obada, Ipapo.	60	0.164.8, High short run market integration

Source: Field data analysis, 2004

unity and very close to zero thus indicating high degree of short run market integration. The IMC for white maize

indicate a higher degree of market integration than yellow maize. This may be explained by the high demand for white maize for the preparation some local foods in the area.

These results confirm that price changes in the urban markets (Bodija and Ilora) immediately cause a price change in the rural markets (Akanran, Towobowo, Anko, Irepodun, Oje, Obada, Ipapo). The high degree of integration in these markets is explained by the short distances between the rural and urban markets and the channel of distribution of these staples. Bodija and Ilora serve as terminal markets for the nearby rural markets covered by the study.

These food crops reach the market from the farm in four principal ways; by means of direct sales to rural and urban consumers; direct sales to rural assemblers, direct sales to retailers and direct sales to terminal markets. Farmers transport these food crops to the terminal markets using pick-up trucks over relatively short distances up to 20 km and they sell directly to wholesalers. Farmers also sell small quantities to rural assemblers. These assemblers finally sell to urban based wholesalers who move from one village market to the other; to assemble these products.

Conclusions

Through this analysis of cassava, yam, yellow and white maize market integration, it is concluded that the grains and the tuber markets in Oyo State are highly integrated. Thus, price signals are transmitted from food deficit urban markets to food surplus rural areas. The study did not indicate a fully integrated market ($B_1 \neq 0$) and complete market segmentation did not exist ($B_3 \neq 0$). Using the Indices of Market Connection as a proxy for marketing efficiency, we infer that the grain and tuber markets in Oyo State are highly efficient in the short run, thus the market pairs are not characterized by much market imperfections. This is due to the short distances between the reference and the rural markets as well as the direct interaction of urban wholesalers with the farmers facilitated information flow between reference and rural markets.

Despite the progress in market performance, some inefficiency remain. However these inefficiencies and absence of the necessary storage infrastructures, storage, market information, standardized weights and measure and other market support services still impair further free flow of goods and services.

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