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FOOD PRICE DIFFERENCES AND MARKET INTEGRATION IN OYO STATE

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ABSTRACT

The paper 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 Connection (IMC) to measure the degree of spatial market integration. The IMCs for cassava, yam, white maize and yellow maize were, 0.3074, 0.0814, 0.027 and 0.16 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.

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 most 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; Adekanye,1988; Afolami, 1998; 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 extends the study of market integration in two aspects. Previous studies on market integration focused on single products. The study compares the market integration of different product markets and measures the de-

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gree of market 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.

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 and 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, and Owode markets, while the rural markets include Akanran, Towobowo, Anko, Irepodun, Oje, Obada, Ipapo and Igbeti.

The integration of different product markets 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

There have been various measures of market integration. These include correlation coefficients (Farru, 1970; Lele, 1972; Jones, 1972; Blyn, 1973;). Short and long-term tests of integration Ravallion (1986); Long-term multipliers and times to adjust Boyd and Brorsen (1986) Goodwin and Schroeder (1991) Wyeth (1992) Palaskas and Harriss (1991) Causality and Centrality test (Mendoza and Rosegrant, 1991). However, the best known model was by Ravallion (1986). This has become known as Ravallion Model. The 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 and is adequate for the determination of short and long-term tests of integration.

Ravallion's approach was used to develop a structural model of prices. 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:

$P_i = f_i (R,X_1)$ for i= 1 …….., N …… (1)

$R = f(P_1 \ldots P_N X)$ ……... (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 equations (1) and (2) if expressed in a linear form are

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

$R_t = aR_{t-1} + \beta_{10}P_{it} + \beta_{20}P_{2t} + \ldots\ldots \beta_{NO}P_{NE} + \beta_{11}P_{it-1} + \beta_{N1} P_{Nt-1} + CX_t + \in_t$

Where $\in_{it}$ and $\in_t$ are suitable error processes

Note the followings about the equations

(i) 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.

(ii) Because of the nature of transport costs, the model was estimated with actual prices rather than their lags.

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

So $\Delta P_t = P_t - P_{t-1}$. Thus $\Delta P_{it} = (a_r 1)(P_{it} - 1\text{-}R_{t-1}) + b_{i0}\Delta R_t + (a_i + b_{i0} + b_i 1\text{-}1) R_{t-1} + C_i X_{it} + \in_{it}$ (5)

Since there is likely to be less collinearity in equation (5) than the equivalent equation (3) this error correction form of equation (3) 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 market, Timmer (1984) established the following formula to calculate IMC:

$P_t = \beta_0\ \beta_1 P_{t-1} + \beta_2 (R_t - R_{t-1}) + \beta_3 R_{t-1} + \in_t$

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
$\in_t$ = 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

$IMC = \underline{\beta_1}\ 0 \leq IMC \leq \infty$
β_3

According to the model, IMC equals to the coeffiicient of lagged price in local markets divided by the coefficient of lagged prices in reference market. The interpretation of the IMC is as indicated.

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 to zero the value of the IMC, the higher the degree of market integration and by extension the higher the marketing efficiency. In order to capture how the IMC values are to zero, the values were approximated first to two decimal place.

METHODOLOGY

Study Area

The study area is Oyo State which is one of the thirty-six states in Nigeria. The state is located within latitudes $2^0\ 38^1$ and $4^0\ 35^1$ east of the Greenwich Meridian and longitudes $7_0 5^1$ and $9^0 10^1$ north of the equator.

Oyo State covers 35,743 square kilometers and has an estimated population of 11.5 million as at 1996. The state consists of thirty-three local government area (LGAs). There are two distinct seasons namely wet and dry seasons. The wet season covers

between April to October, while the dry season covers the period November to March. The topography is about 0-5m above sea level and the mean annual rainfall is within the range of 1000 – 1400mm (MANR, 1999).

Agriculture is rain-fed. Mixed cropping is the common farming system in the state. Farm sizes range from 2.5 to 3 hectares. Land clearing takes place in January/ February while land preparation is done late in February or early March. Planting starts in late February with yams followed with maize vegetables in March/April after the first rains have stabilized. The major crops grown are maize, yam and cassava. The minor once are cowpea, sorghum, melon groundnut, cocoyam, sweet potato and vegetables, livestock production is predominantly small scale in nature. These include poultry, goats, sheep, rabbit, pigs and cattle. Cattle-rearing is limited to few households. The stocks are managed on a free range basis.

Marketing of agricultural products in Oyo State has three outlets; the immediate village farm. This is usually done on daily basis. The scale of operation is small. The second type of market is the periodic market, which may follow a 5,7 and a day cycle. The 4-day market is common in Oyo State.

RESULTS AND DISCUSSION

The results obtained are presented in this section. 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 were approximately equal to two for the crops covered by the study. The F-test indicates that the regression equation is significant at 10%. Table 1

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 of the IMCs were 0.3074, 0.0814, 0.02712 and 0.1648 respectively. The IMCs for these market pairs are all less than 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 kilometers 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.

CONCLUSION

Through this analysis of cassava, yam, yellow and white maize market integration it is concluded that the maize 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= 0) and complete market segmentation did not exist (B_3= 0). Using the Indices of Market Connection as a proxy for marketing efficiency, we infer that the maize 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 which facilitates information flow between reference and rural markets.

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

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Table 1: Regression Analysis Result for Oyo State

Market Pairs	Crops	Constant	Coefficient			Diagnostic Statistic				
		B_0	B_1	B_2	B_3	R^2	Adj. R^2	F	DW	IMC Classification
Akanran, To-wobowo, Anko, Bodija	Cassava (t-value)	-0.181 (-0.698)	0.229** (2.380)	0.447*** (7.677)	0.745*** (5.772)	0.883	0.879	228.806***	2.166	0.3074, high S/R market Intergration
Irepodun, Obada Ipapo – Ilora	Yam (t-value)	0.886 (1.135)	6.793E-02 (0.643)	0.837*** (14.524)	0.834*** (8.039)	0.860	0.856	187.089***	1.940	8.1451E-02, high S/R Market integration.
Akanran To-wobowo, Ank, Obada Ipado- Bodija	White maize (-value)	0.391 (1.069)	2.460E-02 (0.235)	0.916*** (17.132)	0.907*** (9.157)	0.966	0.965	854.664***	2.001	2.7122E-02, high S/R Market intergration
Akanra, Towobowo, Anko, Irepodun, Obada Ipap – Bodia	Yellow Maize (t-value)	0.938* (1.655)	0.131 (1.244)	0.859*** (10.968)	0.795***	0.925	0.923	376.523***	1.990	0.1648, high S/R Market integration

Source – Data Analysis 2005

1. Figures in Parentheses are t-value calculated
2. *** - Coefficient significant @ 1%α
3. ** - Coefficient significant @ 5% α
4. * - Coefficient significant @ 10% α
5. S/R – Short run

Table 2: IMC and Classification of Markets in Oyo State

Crops	Central Market	Rural Market	Distance	IMC and Classification
1 Cassava	Bodija	Akanran, Towobowo	15 km	0.3074. High short run market integration.
2 Yam	Ilora	Irepodun, Obada, Ipapo	12 km	0.0814, High short run market integration.
3 White maize	Bodija	Akanran, Towobowo, Anko, Irepodun, Obada, Ipapo.	60 km	0.0271. High short run market integration.
4 Yellow maize	Bodija	Akanran, Towobowo, Anko, Irepodun, Obada, Ipapo.	60 km	0.164.8. High short run market integration.