

# LONG-RUN PRICE INTEGRATION IN THE NIGERIAN FRESH FISH MARKET

## IMPLICATIONS FOR MARKETING AND DEVELOPMENT

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**T**HIS study assesses the Nigerian fresh fish market for presence and extent of long-run integration using descriptive, inferential statistics and special regression models. Empirical results revealed that some markets had prices that were either too high or too low compared with the mean. There was a high variability in prices ranging from 62.1% for Uyo market to 95.5% for Enugu market. The price series in all the markets, except those of Akure and Owerri, accepted the null hypothesis of non-stationarity at their levels at 5% significance level. The integration test showed that only 41% of markets examined had prices which are tied together in the long-run. The Granger-causality model revealed that Bauchi, Kano and Makurdi markets occupy leadership position in price formation and transmission. The implications of the empirical results for marketing and development were discussed. The study concludes that the level of competitiveness is low in fresh fish marketing in Nigeria and recommends that market information dissemination be improved upon while experimental pricing policy for reduced delivered price of fresh fish commences at the identified leader markets.

**Key Words:** Price determination, Fresh Fish Marketing, Nigerian Fresh Fish Market.

### Introduction and Problem Description

The agricultural sector has long been recognized as the key to economic development. Within the sector, however, the role of agricultural marketing has often been neglected in favour of production because of the erroneous belief that only production or physical transformation matters while agricultural marketing passively adapts to stages of economic development. Economics scholars and planners have re-assessed this traditional belief to accord agricultural marketing its rightful place in economic development. The need for an efficient marketing system for sustaining and accelerating agricultural production and thereby promoting economic growth in developing and developed countries is now widely recognized (Mafimisebi 2001).

In terms of nutrient consumption, animal protein has come to assume a worrisome position in Nigeria probably because of its high cost relative to carbohydrate foods. The level of animal protein consumption per day is estimated at less than 7.0g compared with the recommended 35.0g. Shaib et al. (1997) puts it at 3.25g per *caput* per day in the poor socio-economic class. Compared with other sources of animal protein in Nigeria, fish is regarded as occupying a prominent place in alleviating the protein shortage problem owing to its wide acceptability, high nutritional quality and easily metabolizable proteins. Observations in the markets show that fresh fish landed in Nigeria is very expensive to the extent that its consumption is almost an exclusive preserve of the rich. The reported dichotomy in prices between other protein sources and fresh fish may not be unconnected with the special marketing problems associated with fresh fish distribution in Nigeria. The consequence of this is the high delivered price of

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fresh fish with serious negative implications for animal protein consumption especially among poor households who spend more than four-fifths of their income on food items alone (Okorie 2002).

The ability of a marketing system to efficiently carry out its development function is contingent on the ease with which price changes and responses are transmitted spatially and temporally at different market levels. When data on transactions costs are unavailable or their quality is suspect as is often the case in developing countries, a proxy for measuring marketing efficiency is synchronous movement overtime of prices in contiguous markets for a given commodity. A market system in which there is synchronous movement of prices over time is described as being integrated and market integration enhances efficient allocation of productive resources, static agricultural efficiency, short-term food price stability and long-term growth (Baulch 1995).

This paper examines the relationship between price levels in fresh fish markets across Nigeria and seeks to determine (a) whether or not they are linked and (b) which market(s), if any, constitute(s) the price leaders in the country.

## Methodology

### Sources and Scope of Data

The data for this paper were got from secondary sources. The bulk of the data was from the monthly fresh fish price series collected by the Federal Office of Statistics (FOS). The data collected represent the average for 15 most important fresh fish species which account for over 90% of total volume of fresh fish consumed in Nigeria.

Monthly retail prices covering between January, 1994, to December, 2005 inclusive (i.e 144 months) were obtained for twelve spatial state capital markets across the six geo-political zones of Nigeria at the rate of two markets per zone. These markets were Akure (Aku), Bauchi (Bau), Enugu (Enu), Kano (Kan), Lagos (Lag), Maiduguri (Mad), Minna (Min), Makurdi (Mak), Owerri (Owe), Port-Harcourt (Por), Uyo (Uyo) and Sokoto (Sok). The prices quoted for each state market corresponds to the average prices for all the major fish markets in the state capital.

### Analytical Procedure

Both descriptive and econometric analyses were adopted in the study reported in this paper. Mean, coefficient of variation, percentages and tables were the tools employed under descriptive statistics. Other tools used in analyzing the data collected were inferential statistics and special regression models.

### Mean Spatial Prices and Variability Index

Average monthly retail prices, for the whole period considered, were computed as were coefficients of variation.

### Test for Stationarity

A series is said to be stationary if the means and variances remain constant over time. It is referred as I(0), denoting "integrated of order zero". A stationary series tends to constantly return to its mean value and fluctuations around this mean value have broad amplitudes, hence, the effects of shocks is only transient. Other attributes of stationary and non-stationary data and their implications in econometric modeling are as discussed by Adams (1992), Gujarati (1995) and Juselius (2006). Thus the first step in the test for co-integration is to investigate the order of stationarity or econometric integration to avoid spurious relationships. The Dickey Fuller (DF) and Augmented Dickey Fuller (ADF) unit root tests of stationarity were used in this study. The DF test is applied to the regression of the form below.

$$\Delta P_{it} = \beta_1 + \beta_{2t} + \delta P_{it-1} + \ell_{it} \quad (1)$$

$\Delta$  = first difference operator

$P_{it}$  = fish price series being investigated for stationarity

$t$  = time or trend variable

The null hypothesis that  $\delta = 0$  implies existence of a unit root in  $P_{it}$  or that the time series is non-stationary. The number of lagged difference terms, in equation 1 was increased. The DF test is, in this particular case, called the ADF test and equation 1 modifies to

$$\Delta P_{it} = \beta_1 + \beta_{2t} + \delta P_{it-1} + \alpha_1 \sum_{t=1}^m \Delta P_{it-1} + \ell_{it} \quad (2)$$

The null hypothesis of a unit root or non-stationarity is still that  $\delta = 0$ . The critical values which have been tabulated by Dickey and Fuller (1979), Engle and Yoo (1987) and Mackinnon (1990) are always negative and are called ADF statistics rather than t-statistics. If the value of the ADF statistics is less than (i.e more negative than) the critical values, it is concluded that  $P_{it}$  is stationary i.e  $P_{it} \sim I(0)$ .

When a series is found to be non-stationary, it is first-differenced (i.e the series  $\Delta P_{it} = P_{it} - P_{it-1}$  is obtained and the ADF test is repeated on the first-differenced series. If the null hypothesis of the ADF test can be rejected for the first-differenced series, it is concluded that  $P_{it} \sim I(1)$ . The price series for all the twelve markets included in this study were investigated for their order of integration. The maximum number of lags used in the stationarity test was six (6) and the optimal lag for each price series was selected using the Akaike Information Criterion (AIC).

### Co-integration Test

Two or more variables are said to be co-integrated if each is individually non-stationary (i.e. has one or more unit roots) but there exists a linear combination of the variables that is stationary. Other attributes of co-integration are as shown in Engle and Yoo (1987) and Silvapulle and Jarasuriya (1994). After the stationarity test, the study proceeds by testing for co-integration between market price series that exhibited stationarity of same order.

The maximum likelihood procedure for co-integration propounded by Johansen (1988), Johansen and Juselius (1990, 1992) and Juselius (2006) was utilized. This is because the two-step Engle and Granger procedure suffers from the simultaneity problem and the results are sensitive to the choice of dependent variables (Baulch 1995). Adopting a one-step vector auto-regression method avoids the simultaneity problem and allows hypothesis testing on the co-integration vector,  $r$ . The maximum likelihood procedure relies on the relationship between the rank of a matrix and its characteristic roots. The Johansen's maximal eigenvalue and trace tests detect the number of co-integrating vectors that exist between two or more time series that are econometrically integrated. The two variable systems were modeled as a vector auto-regression (VAR) as follows:

$$\Delta X_t = \mu_t + \sum_{i=1}^{k-1} \Gamma_i \Delta X_{t-i} + \pi X_{t-k} + \varepsilon_t \quad (3)$$

where

$X_t$  is a  $n \times 1$  vector containing the series of interest (fresh fish spatial price series)

$\Gamma$  and  $\pi$  are matrices of parameters

$K$  = number of lags and should be adequately large enough to capture the short-run dynamics of the underlying VAR and produce normally distributed white noise residuals.

$\varepsilon_t$  = vector of errors assumed to be white noise.

**Test for Causality**

When two series are stationary of the same order and co-integrated, one can proceed to investigate for causality. This is because at least, one Granger-causal relationship exists in a group of co-integrated series (Alexander and Wyeth 1994; Chirwa 2001 and Nielson 2006). The causality test is represented by the error correction equation below:

$$\Delta P_{it} = \beta_0 + \beta_1 P_{i(t-1)} + \beta_2 P_{j(t-1)} + \sum_{k=1}^m \delta_k \Delta P_{i(t-k)} + \sum_{h=1}^m \alpha_h \Delta P_{j(t-h)} + \ell_t \tag{4}$$

Where

m and n are number of lags determined by Akaike Information Criterion.

Rejection of the null hypothesis (by a suitable F-test) that  $\alpha_h = 0$  for  $h = 1, 2, \dots, n$  and  $\beta = 0$  indicates that prices in market j Granger-cause prices in market i. If prices in i also Granger-cause prices in j, then prices are determined by a simultaneous field-back mechanism (SFM). This is the phenomenon of bi-directional causality. If the Granger-causality runs one way, it is called uni-directional Granger-causality and the market which Granger – causes the other is tagged the exogenous market.

In the study, there was a test of the evidence of Granger-causality separately for pairs of fresh fish markets that had price series stationary of same order and co-integrated.

**Results and Discussion**

This section presents the results and discussion of findings directly emanating from the study. It also contains additional discussions relating to the broader implications of market integration for marketing and development.

**Average Retail Prices**

Five markets recorded the highest average monthly retail prices (Table 1). They are Por, Mak, Enu, Bau, and Lag. The reason for this may not be unconnected with the fact that these markets (except Mak) are in states which are mainly fish consuming centres. They are also highly urbanized and industrialized locations. A pool of the local elitist class and expatriates who are mostly high-income earners, live and work in the cities/towns housing these markets. It is however a surprise that Lagos had a price lower than that of Mak, Enu and Bau.

It is also interesting to note that Kan does not belong in the group of markets with the top five average retail prices. In terms of urbanization and industrialization in Nigeria, Lagos is the first followed by Kano. Lagos is a very important seaport in Nigeria and there is therefore a generous availability of the cheaper imported frozen fish of all types. This may tend to have a depressing effect on price of local fresh fish since the imported frozen fish may be a more affordable substitute to fresh fish. In Kano, on the other hand, beef and local chickens are likely to be the more affordable substitutes for fresh fish causing the price of fresh fish to be low. The market locations with the lowest mean retail prices are Sok, Owe, Kan and Mad (in descending order). One will be surprised that Maiduguri (a market location very close to the Lake Chad and in a state which records a yearly production figure higher than those of ten other northern states put together excluding Sokoto (FOS 1997)), does not record the lowest average monthly retail price. The same puzzle arises from the observation that Por market in Rivers State- a state that produces the highest quantity of fish in the Southern part of Nigeria, recorded the highest mean price. It thus seemed that the quantity of fish produced in the state (corresponding to a market location) plays little or no role in the determination of fish price. Thus, there must be other factors that are stronger than volume of production in price setting.

**Table 1: Fresh Fish Average Retail Price And Its Variability (1994 – 2005)**

Market Location	Retail Price (N/kg)	Coefficient of Variation (CV)
Akure	133.84	87.81
Bauchi	147.23	87.95
Enugu	155.38	95.46
Kano	90.91	63.40
Lagos	144.72	81.33
Maiduguri	116.48	73.99
Makurdi	196.68	80.53
Minna	120.64	90.84
Owerri	105.78	76.12
Port-Harcourt	263.49	75.72
Uyo	130.46	62.09
Sokoto	105.92	65.45
Overall Mean	142.63	78.39

*Source: Computed from nominal price series data.*

### **Variability in Average Retail Prices**

Variability in average monthly retail price was quite high for the period covered by the study. It varied between 62.1 percent for Uyo to 95.5 percent for Enugu (Table I). High variability index indicates that the price of fresh fish fluctuates widely in the period and markets analyzed. High variability in prices translates into unstable producer incomes, which adversely affect production planning (Olayemi 1973, Mafimisebi 2001). It would also negatively impinge on consumers' welfare especially in a country like Nigeria where majority of the people live below the poverty line (FOS 1999) and food expenditure alone accounts for up to 80 percent of households' disposable income.

### **Order of Integration and Co-integration in Fish Price Series**

#### ***Stationarity of Fish Price Series***

The result of the unit root test by the DF and ADF method is shown in Table II. The price series in all the markets accepted the null hypothesis of non-stationarity at their levels at 5% significance level. When first-differenced, however, the null hypothesis of non-stationarity was rejected in favour of the alternative in all the markets except Akure and Owerri (Table 2).

Akure and Owerri price series were stationary at second difference and thus, they could not be included in the co-integration analysis because they were generated by different stochastic processes (Baffles 1991; Palaskas and Harriss-White 1993; Baulch 1997; Franco 1999; Chirwa 2001; Mafimisebi 2001 and Nielson 2006). The findings here corroborate earlier findings that food commodity price series are mostly stationary of order 1 i.e I(1) (Alexander and Wyeth 1994; Ogundare 1999; Franco 1999; Okoh and Egbon 2003; Chirwa 2001; Mafimisebi 2001 and Oladapo 2003). The result is probably explained by the fact that most food price series have trends in them because of inflation and therefore exhibit mean non-stationarity. They need to be first-differenced to become stationary.

**Table 2: Results of Unit Test of Price Series**

Variable (market price series)	Price Level I(0)		First Difference I(1)		Second Difference I(2)	
	DF statistics	ADF statistics	DF statistics	ADF statistics	DF statistics	ADF statistics
Akure	-2.6631 NS	-2.8632 (1) NS	-2.0026 NS	-2.2960(1) NS	-6.9498 S	-7.1521(2) S
Bauchi	-1.2102 NS	-1.2127 (1) NS	-9.3268 S	-9.4462(5) S	–	–
Enugu	-2.4508 NS	-3.0201 (2) NS	-7.1724 S	-6.6848(4) S	–	–
Kano	-3.3225 NS	-3.4055 (3) NS	-7.0212 S	-8.2452(5) S	–	–
Lagos	-3.1866 NS	-3.3604 (3) NS	-4.9774 S	-5.8267(4) S	–	–
Maiduguri	-3.1486 NS	-3.2831 (1) NS	-9.0167 S	-9.7746(5) S	–	–
Makurdi	-1.9472 NS	-3.1040 (3) NS	-4.9646 S	-6.9646(4) S	–	–
Minna	-1.2848 NS	-1.7312 (6) NS	-4.4263 S	-6.8102(5) S	–	–
Owerri	-2.9792 NS	-3.0978 (3) NS	-2.0063 NS	-2.0756(5) NS	-6.0245 S	-6.3745 S
Port-Harcourt	-1.2732 NS	-2.8874 (4) NS	-4.4688 S	-4.9876(4) S	–	–
Sokoto	-1.8876 NS	-1.9687 (1) NS	-5.2312 S	-6.1245(6) S	–	–
Uyo	-2.9642 NS	-3.2615 (2) NS	-3.8014 S	-4.2496(2) S	–	–

**Source: Compiled from result of stationarity test.**

Notes: 1. Critical values are  $-3.4519$ ,  $-3.4523$ , and  $-2.8877$  at the 95 percent confidence level for price level, first difference and second difference series respectively.

2. The numbers in parentheses indicate the optimal number of lags as dictated by the Akaike Information Criterion
3. If the absolute value of the DF or ADF is lower than the 5 percent critical ADF statistics, we fail to reject the null hypothesis of non-stationarity
4. NS means Non-stationary and S means stationary.
5. Dickey- Fuller regressions involve an intercept and a linear trend.

### **Co-integration Analysis (Vector Auto-Regression (VAR) Model)**

Results from two very powerful tests of co-integration (maximal eigenvalue and trace tests) are shown in Table 3. Out of the 45 ( $^{10}C_2$ ) market pairs investigated for co-integration, only 27 rejected the null hypothesis of co-integration at less than full rank at the 5% level of significance. They accepted the alternative that there is full rank in the co-integrating vectors. Both the maximal eigenvalue and trace tests are perfectly in agreement as to the number of co-integrating vectors that attained full rank despite differences in the value of the tabulated test statistics. Thus, by the co-integration analysis, 40.9 percent of fresh fish market pairs were co-integrated of the order I(1). This is the proportion of fresh fish market pairs in which prices are tied together in the long-run in spite of short-run divergences between them.

The long-run notion of equilibrium of market price series has recently become of more interest to development economists because markets with price series stationary at same order and co-integrated, are spatially economically integrated. Modern developments in econometrics have shown that such series cannot drift far apart without bounds and hence, the existence of long-run equilibrium between them (Adams 1992; Silvapulle and Jarasuriya 1994; Franco 1999; Chirwa 2001; Mafimisebi 2001 and Nielson 2006).

**Table 3: Johansen Maximum likelihood Tests & Parameter Estimates for I(1) Market Pairs**

Market Pairs $P_i - P_j$	Maximal Eigenvalue Test			Trace Test		
	Hypothesis		Test Statistics	Hypothesis		Test Statistics
	Null	Alternative		Null	Alternative	
Bau – Enu (741)	$r \leq 2$	$r = 2$	17.392*	$r \leq 1$	$r = 2$	17.392*
Bau – Kan (321)	$r \leq 2$	$r = 2$	60.769*	$r \leq 1$	$r = 2$	60.769*
Bau – Lag (1147)	$r \leq 2$	$r = 2$	13.491*	$r \leq 1$	$r = 2$	13.491*
Bau – Mad (464)	$r \leq 2$	$r = 2$	39.842*	$r \leq 1$	$r = 2$	39.842*
Bau – Mak(471)	$r \leq 2$	$r = 2$	15.443*	$r \leq 1$	$r = 2$	15.443*
Bau – Sok (778)	$r \leq 2$	$r = 2$	29.619*	$r \leq 1$	$r = 2$	29.619*
Bau – Uyo (948)	$r \leq 2$	$r = 2$	23.628*	$r \leq 1$	$r = 2$	23.628*
Enu – Kan (924)	$r \leq 2$	$r = 2$	21.774*	$r \leq 1$	$r = 2$	21.774*
Enu – Mad (1179)	$r \leq 2$	$r = 2$	19.551*	$r \leq 1$	$r = 2$	19.551*
Enu – Sok (1149)	$r \leq 2$	$r = 2$	17.788*	$r \leq 1$	$r = 2$	17.788*
Enu – Uyo (233)	$r \leq 2$	$r = 2$	15.808*	$r \leq 1$	$r = 2$	15.808*
Kan – Lag (1156)	$r \leq 2$	$r = 2$	18.512*	$r \leq 1$	$r = 2$	18.512*
Kan – Mad (614)	$r \leq 2$	$r = 2$	53.693*	$r \leq 1$	$r = 2$	53.693*
Kan – Mak (760)	$r \leq 2$	$r = 2$	30.878*	$r \leq 1$	$r = 2$	30.878*
Kan – Min (550)	$r \leq 2$	$r = 2$	16.982*	$r \leq 1$	$r = 2$	16.982*
Kan – Por (1179)	$r \leq 2$	$r = 2$	24.269*	$r \leq 1$	$r = 2$	24.269*
Kan – Sok (583)	$r \leq 2$	$r = 2$	33.517*	$r \leq 1$	$r = 2$	33.517*
Kan – Uyo(1133)	$r \leq 2$	$r = 2$	38.424*	$r \leq 1$	$r = 2$	38.424*
Lag – Mad (1606)	$r \leq 2$	$r = 2$	12.799*	$r \leq 1$	$r = 2$	12.799*
Mad – Mak (935)	$r \leq 2$	$r = 2$	23.862*	$r \leq 1$	$r = 2$	23.862*
Mad – Por (1460)	$r \leq 2$	$r = 2$	15.102*	$r \leq 1$	$r = 2$	15.102*
Mad – Sok (1204)	$r \leq 2$	$r = 2$	29.088*	$r \leq 1$	$r = 2$	29.088*
Mad – Uyo (1412)	$r \leq 2$	$r = 2$	29.654*	$r \leq 1$	$r = 2$	29.654*
Mak – Sok (985)	$r \leq 2$	$r = 2$	12.691*	$r \leq 1$	$r = 2$	12.691*
Mak – Uyo (479)	$r \leq 2$	$r = 2$	15.493*	$r \leq 1$	$r = 2$	15.493*
Por – Sok (1404)	$r \leq 2$	$r = 2$	13.026*	$r \leq 1$	$r = 2$	13.206*
Sok – Uyo (1358)	$r \leq 2$	$r = 2$	23.729*	$r \leq 1$	$r = 2$	23.729*

**Source: Compiled from result of Co-integration Test**

Notes: 1. Only the 27 market links with significant parameter estimates are shown.

2.  $r$  = number of co-integration vectors.

3. \* means significant at 5% level.

4. The 95 percent critical values are 19.220 and 12.390 respectively for  $r = 0$  and  $r \leq 1$  for eigen maximal value test. The corresponding values for the trace test are 25.770 and 12.390 respectively.

5. The value shown in parenthesis before each market pair represents the approximate distance (in km) between them.

6. Co-integration likelihood ratio tests is based on maximal eigenvalue and trace of the stochastic matrix.

There is therefore perfect transmission of information in only four of every ten fresh fish market pairs in Nigeria. When there is perfect transmission of price information in a network of markets, producers, marketers and consumers will realize the appropriate gains from trade because correct price signals will be transmitted down the marketing chain thus enabling producers to specialize according to comparative advantage. Markets that are not integrated will convey inaccurate price information that has the tendency to distort production and marketing decisions and contribute to inefficient product movements. If markets are integrated, the price differential or spread between markets cannot exceed transfer costs. The arbitrage activities of traders, who ship commodities between low and high price locations, will raise price in some markets whilst lowering them in others until price differentials equal transfer costs and all opportunities for earning excess profit have been exhausted (Baulch 1997). In short, if getting prices right is seen as the crucial policy prescription for agricultural (and marketing) development, the presence of market integration is a vital precondition for it to be effective (Timmer 1986, emphasis mine).

#### ***Granger-Causality and Exogeneity in Fish Markets***

The result of the pair-wise Granger-causality test is shown in Table 4. Out of the 54 market pairs tested for Granger-causality, only 11 pairs rejected the null hypothesis of no causality. Four (4) market links of the 11 displayed bi-directional Granger-causality. These market links are Bau-Kan, Kan-Bau, Kan-Mak and Mak-Kan. Bauchi was stronger in the first link as it Granger-caused Kano at 1% significance level while Kano prices Granger-caused Bauchi prices at 5%. In the third

**Table 4: Result of Pairwise Granger-causality Test for Fresh Fish Markets (1994-2005)**

<b>Null hypothesis</b>	<b>F – Statistics</b>	<b>Probability</b>
Bau?Kan	4.845**	0.013
Kan ? Bau	3.027*	0.050
Mak ?Bau	8.431**	0.0004
Bau ? Uyo	3.927*	0.022
Kan ? Enu	5.882**	0.004
Kan ? Lag	4.267*	0.016
Kan ? Mak	5.700**	0.004
Mak ?Kan	7.585**	0.001
Kan?Por	4.985**	0.009
Kan ? Sok	3.229**	0.041
Mak ? Uyo	3.967*	0.022

**Source: Compiled from Result of Granger-Causality Test**

- Notes: 1. Only the 11 market links with significant parameter estimates are shown.  
 2. \*\* and \* mean significant at 1 percent and 5 percent respectively.  
 3. Market pairs with same level of significance indicate bi-directional Granger-causality. Where only one market pair carried a sign of significance, there is exogeneity in favour of the former market.  
 4. A maximum of two lags were used in the augmentation.  
 5. Horizontal arrows between two market pairs indicates that price in the market to which the arrow is pointing does not Granger-cause price in the other market.

and fourth market pairs, both markets demonstrated equal strength as they Granger – caused themselves at 1%. The remaining seven (7) market pairs exhibited uni-directional (one-way) Granger-causality. Thus, Bauchi, Kano and Makurdi are the markets occupying leadership positions in fresh fish price formation and transmission. The analysis here provides a sufficient ground to permit the conclusion that exogeneity occurs in fresh marketing in Nigeria in favour of these three markets. The case of Kano was strong exogeneity while that of Bauchi and Makurdi could be classified as weak exogeneity.

The finding that Bauchi, Kano and Makurdi markets (all in the northern region) have been the origin of stochastic trends driving the market for fresh fish has the implications that these markets play dominant roles in the Nigerian fresh fish market. This may be consistent with the importance of fish production capacity in these states. Thus, causation between regional prices mainly originates in the fish-consuming southern states, likely reflecting that demand rather than supply forces are driving the market. The Nigerian fresh fish market is thus oligopolistic in structure with the tendency to exhibiting characteristics of imperfect market where the cross-sectional aggregation of demand and supply loses its foundation.

The general implications of the findings of this study is that agricultural commodity markets in developing countries may be subject to a high degree of market inefficiency owing to regional market segmentation. It also shows that the tendency for price differentials between different areas to reach their equilibrium values quickly is low as is the ability of price differences to converge to their long-run equilibrium levels. A similar modeling approach and use of co-integration analysis could provide equally useful tools in analyzing the integration of fish markets in other countries as well. This is made possible by the fact that the methodology is highly generalizable once product-surplus and product-deficient areas or regions are clearly discernible. Inferences drawn from the present study are applicable to and can help address similar market failures in agricultural commodity markets to enhance stakeholders' welfare and economic development in other countries.

Studies on spatial market integration are potentially rich in policy implications and important lessons for marketing and economic development. Higher degrees of market integration can have important implications for economic development according to Gonzalez-Rivera and Helfand (2001). They argued that the process of increasing the degree of integration of isolated or segmented markets, or market locations that are only weakly linked into a national market can bring significant benefits to local residents and market stakeholders. The income of producers can be raised through increased specialization and trade and it can increase the welfare of risk-averse consumers by reducing the variability of prices of goods that were previously non-tradable. To the extent that rapidly adjusting and well-functioning microeconomic markets are an important ingredient for macroeconomic growth, increased market integration can bring wider benefits as well.

Empirical evidence emanating from Gonzalez-Rivera and Helfand (2001) showed that with regard to market integration and economic development, a principal component representing the level of development was strongly associated with the degree of integration in the Brazilian rice market. In addition to income per capita, this component was highly correlated with measures of human capital proxied by illiteracy and rural schooling, variables related to communications infrastructures and the relative size of the transportation sector. Thus, in the same way that less developed regions have been shown to have greater imperfections in their factor markets, this study provides evidence of similar effects in a product market. More developed states in Brazil were reported to have more unified rice markets. However, the study did not provide an answer as to the direction of causality between market integration and economic development. The authors noted that in some cases, higher degree of market integration might contribute to economic development, while in some cases, it could be a by-product of the development process.

The economic performance of many countries today can, according to Keller and Shiue (2004) be attributed to market-oriented reforms introduced in the last two decades. A long-run perspective of marketing efficiency, proxied by the degree of market integration in a country's marketing system is germane for understanding the process of development occurring today. In a study on rice market integration in China, findings indicate that the degree of market integration, even as far back as the 1720s, is a very good predictor of per capita income in the 1990s. This suggests that income differences across regions and provinces today can to some extent be traced back at least three centuries. In the case of Europe, suggestive evidence now abounds that market integration and trade led to growth effects that materialized in a time period of decades and sometimes centuries (O'Rourke and Williamson 2004; Acemolgu, Johnson and Robinson 2002).

In countries with large provincial differences, market integration investigations concentrate on how market integration and trade has changed by distinguishing between local and aggregate sources of price variations. This is the approach now being widely adopted in economic history, development as well as international economics (Clark 2002, Crucini 1999). Also, since economists nowadays view markets as economic institutions, then it is understood why there is a new emphasis on the importance of institutions for growth (Acemolgu, Johnson and Robinson 2002; Banerjee and Iyer 2002). Both local and global shocks influence local prices. Conditional on demand, if markets are fully unified, only global supply shocks determine how prices move in all regions of a country. This is because even if there are region-specific supply shocks, the region can achieve full risk sharing through trade. By contrast, the existence of trade barrier will give rise to partial segmentation of markets. In this case, local supply shocks will be a determinant of local price movements. When there is more trade and better market integration, the consensus report is that there will be higher per capita income. This is usually the case both contemporaneously and over time.

The spatial dimension of increasing economic integration has posed a profound challenge to traditional economic growth and trade theories predict a process of inter-regional convergence (Rodriguez and Faber 2005). The analytical starting point to this is the observation that firms, goods and people have become more mobile through a sharp fall in inter-regional transactions costs in recent times. From the perspective of firms, this has implied a much wider choice of potential production locations to serve the growing market areas. This was referred to by Dicken (1998) as the 'global scanning' of footloose firms for specific 'locational assets' that make particular locations more attractive than others. The key to spatial dynamics of integration becomes that these locational assets are linked to the localized spill-over effects or 'external economies of scale' arising from the spatial agglomeration of economic activity, and, thus, tend to work in favour of the market core. On this conceptual backdrop, the nexus between market integration and economic development comes to the forefront.

The role of pecuniary or market-driven localized linkages between economic agents, so called supply and demand linkages is focused on in demonstrating this interplay. As market integration proceeds, a powerful process of spatial reconfiguration, whereby footloose firms have incentive to produce in close proximity to the economic centres of the market areas, is given rise to. Also, contemporary evidence abounds in favour of the notion that human capital and skill abundance and formal and informal institutional arrangements have become key drivers of innovativeness and economic growth (Dunning 2000). As integration proceeds, the principal spatial dynamics tends to foster the dominant economic position of the diverse and skill-abundant regions at the relative detriment of the periphery and ultra-periphery. Finally, Dinh Tho, Shultz and Westbrook (2006) found that in an economy dominated by agriculture and which is starting from a very low base like that of Vietnam, there can be remarkable macroeconomic stability and growth if market reforms which translate into

efficiently operating marketing network are implemented. They concluded that where inequality is on the increase and the rural-urban gap is particularly of concern, decisive trade reforms which enhance market linkage through bilateral and multi-lateral trade agreements should be embarked upon. Even though, in the survey which generated the data that led to this conclusion, increased market activity was not listed among the potential reasons for changes in the quality of life, Dinh Tho, Shultz and Westbrook (2006) regarded it as potentially important. They concluded that "a vibrant goods market enhances consumer's choice, a vibrant labour market enables workers to seek rewarding employment; a vibrant private sector invites entrepreneurship, which is a strong predictor of life satisfaction."

### **Summary and Recommendations**

This study is an evaluation of spatial price integration in fresh fish marketing in Nigeria. The study delineated long-run and Granger-causal relationships between market price series. In the analysis of dynamic price relationships in the long-run, the study investigated order of integration of the time series data so that spurious regression estimates could be avoided.

Five markets recorded average monthly prices far above the overall mean for all markets while another four recorded low prices far below the overall mean. Variability in mean retail price was high indicating that fresh fish price is unstable. All the price series, except Akure and Owerri, exhibited stationarity after first-differencing. Akure and Owerri price series were stationary after the second-difference. Only 41% of market pairs examined had price series tied together in the long-run and hence exhibit efficiency in price formation and transmission in relation to supply-demand situation. There was evidence of price leadership in fresh fish marketing in Nigeria. The policy implication of this is that when it is desired that a national pricing policy for increased consumption of fresh fish be implemented, the identified leader markets should be the targets. This is because prices formed in them are efficiently transmitted to the other (follower) markets with very minor distortions during the transmission process. If the same policy commences from a follower market as first point of implementation, the effects will be aborted during the transmission stage and the benefits will not reach the target beneficiaries which include the fisher-folk, fish processors, makers of fishing gears and other inputs, market intermediaries, transporters and end-users. The high variability in prices calls for an improvement in basic marketing information especially in relation to prices. Weekly or more preferably, daily collection, collation and dissemination of fish price information can be provided by an arm of the Federal Ministry of Agriculture adequately equipped in terms of finance, facilities and personnel to carry out this function. A wide dissemination of price and market supply information will permit effective arbitraging among markets, reduce uncertainties in market supplies in different locations and considerably reduce the risks associated with inter-market trade. The result of this will be an efficiently functioning network of markets that delivers fish to consumers at an affordable cost with elimination of exploitative tendencies by any group of market intermediaries.

### **Conclusion**

There is a low level of long-run integration in fresh fish marketing in Nigeria with the implication that end-users are paying more for fresh fish than what should have been dictated by demand-supply and other conditions. This low level of price integration probably also reflects the low level of economic development in the country. Only 41% of fresh fish markets show prices which differ by an amount exactly equal to the transfer cost of one unit of fish between markets in the long-run. This is the proportion of the Nigerian fresh fish markets that are functioning efficiently in terms of synchronous movement of prices. Thus, there is a need for a nation-wide policy to improve fresh fish marketing efficiency and increase affordability and consumption of fresh fish by end-users.

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