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*Original Research Articles*

# Structure, Causality and Price Transmission Tests in Marketing of *Irvingia* Seed (Ogbono) in Enugu State, Nigeria

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**Abstract**

This study examined the marketing of *Irvingia* seeds (ogbono) in Enugu state, Nigeria, especially as it concerns margins, structure and causality as well as price transmission tests. Primary data were collected from 180 respondents composed of 36 producers, 54 wholesalers and 90 retailers. Data were analysed with descriptive and inferential statistical tools including the Gini coefficient. *Irvingia* seed marketing margins were generally high, apparently due to poor socioeconomic environments of the actors. The margins were, however, on the average, lower than the producer's share of the consumer spending. The result of the analysis also suggests a competitive market structure for *Irvingia* seed in the study area. Prices were determined at the production level of the chain, but producers were asymmetric in their price transmissions to the wholesale level. These observations suggest that policy intervention in the form of improving the socioeconomic environment under which marketing agents operate and facilitation of market information flow (which could reduce the asymmetric behaviour of producers) could improve *Irvingia* seed marketing in the study area.

**Key words:** *Irvingia* seeds; structure; causality; transmission tests; marketing.

## INTRODUCTION

*Irvingia* seeds (Ogbono) are obtained from *Irvingia* species (*wombolu* and *gabonensis*) which are forest trees found in most West African countries. Forests and tree resources are of extreme importance to mankind because they contribute significantly to sustainable livelihood, especially of the poor. They are the greatest generator of environmental income for thee poor (World Resources Institute, 2005). Referred to as dika nut/bush mango, *Irvingia* species are valued for their wood and edible nuts. While the kernels (Ogbono) are used as thickening agent in traditional soups and stews in West and Central Africa (Leakey et al., 2003), they are also source of oil for making soap and for medicinal purposes (Abbiw, 1990). *Irvingia gabonensis* and *Irvingia wombolu* are two species that produce edible kernels. The fruit of the former has a sweet mesocarp and is eaten fresh while that of the latter is sour and not consumed.

International Center for Research in Agro-forestry (ICRAF) (1995) puts the volume of trade in *Irvingia* seed products in the West African sub region to be about $US50 million. Falconer (1990) put the figure of *Irvingia* seeds marketed in Nigeria annually at over 78,000 tonnes. Processed kernels of *Irvingia* are traded within Nigeria and between countries in West and Central Africa. The products are also transported to Europe and the United States and to other areas where African immigrants abound in large numbers (Ladipo and Boland, 1994). The volume of production and trade in *Irvingia* seeds and its contribution to the sustenance of livelihoods of the rural households in the study area has been tremendous over the years (Ike, 2008).

Marketing involves all those legal, physical and economic services which are necessary to make products from the farm available to the consumers in the form, amount, place and time they desire and at the price which the consumers and middle men are willing to pay to take possession. The marketing of *Irvingia* seeds therefore becomes a very vital component of the industry. The marketing system performs vital functions one of which is the allocation of resources through the price system. Like other agricultural products, *Irvingia* seed prices determine the income and economic welfare of the *Irvingia* seed business households, which in turn influence their investment and production decisions.

Available information show that most of the research effort on *Irvingia* seed have tended to concentrate on its use as a forest product (Abbiw, 1990; Leakey et al., 2003) and also on efficiency in production and processing of the seeds (Ike, 2008). Not much research work has been done on *Irvingia* seed marketing in Nigeria.

### Objectives of the Study

The general objective of this study is to examine the marketing of *Irvingia* seeds (ogbono) in Enugu state, Nigeria. Specifically the study was set out to:

(i) examine the socioeconomic characteristics of *Irvingia* seeds (ogbono) marketers in the study area,
(ii) ascertain the market structure and organization of

*Irvingia* seeds (ogbono),

(iii) estimate the marketing margins of *Irvingia* seeds, and

(iv) explore the dynamic relationship among prices at different levels of the marketing channel.

## MATERIALS AND METHODS

The study was carried out in Enugu state located in south east, Nigeria. The state occupies an estimated land area of 240 square kilometers and has a population of 3.25 million people among which 1.62 million or 49.85% are males while 1.63 million or 50.15% are females (NPC, 2006). The state is composed of 17 local government areas spread into three agricultural zones of Agwu, Enugu and Nsukka. Majority of her population live in rural areas as in most other states of the country and farming is the predominant enterprise. Farming activities such as livestock production including poultry and goat rearing and crop enterprises such as yam, cassava, cocoyam, maize, vegetables of all sorts are common and are engaged in by small holder farmers in the area.

### Sampling Procedure

Three local government areas each from the three agricultural zones of the state were selected for the study as *Irvingia* seeds are produced and traded in all parts of the state. This gave nine local government areas selected for the study. Two markets were selected from each of the sampled local government areas and this gave 18 markets. With the assistance of ogbono market dealers Association in the various markets, the list of wholesalers and retailers of *Irvingia* seeds were compiled to form the sample frame. Three wholesalers and five retailers were randomly selected from each of the sampled markets. This gave a sample size of 54 wholesalers and 90 retailers. With the information obtained from the wholesalers or distributors on their source (village) of supply of *Irvingia* seeds, a total of four *Irvingia* seed producers were randomly selected from each of the sampled local government areas to give a sample of 36 producers. A total number of 180 respondents comprised the sample size of the study.

### Data Collection

A structured questionnaire was employed to collect primary information from the selected respondents. In addition, information was collected through oral discussions and direct measurement. A daily time series data, covering duration of one month which is the peak period of production (10th May to 10th June, 2012) was collected at three levels of the marketing channel – producer, wholesaler and retailer levels.

### Data Analysis/Analytical Procedure

In addition to the static analysis of the marketing margins and structure, the study also explored the dynamic relationship among prices at different levels of the marketing channel by conducting causality and price transmission tests. With regards to the market structure for *Irvingia* seed dealers, the Gini coefficient was used to measure degree of inequality in their volume of trade. Gini coefficient is a number or an index varying between zero and one; zero signifying perfect equality and one perfect inequality. According to the United Nations Development Programme (1992), Gini coefficients for countries with high inequality typically lie between 0.5 and 0.7.

Gini coefficient is given by the formula

$$G\left|1-\sum_{k=0}^{k=n-1}(\delta Y_{k-1}+Y_k)(\delta X_{k-1}-X_k)\right|$$

where:

G = Gini index

X = Marketing Agents

Y = Volume of trade

$\delta$ X = Cumulated Proportion of Marketing Agents

$\delta$ Y = Cumulated Proportion of Sales (Volume of trade)

n = Number of Observations

K = n – 1

Sales volume is the volume of *Irvingia* seed sold by dealers in the market at each level of the chain. The volume was computed by adding all the sales generated by market participants at each level. The marketing agents signify the number of respondents at each level i.e., producers, wholesalers and retailers.

Causality test was used to establish the direction of the price flow between *Irvingia* seed producers and wholesalers, and between wholesaler and retailers. This is in order to establish the point of *Irvingia* seed price determination along the marketing chain.

Granger (1969) developed and applied the first widely used statistical test of causality. Presuming that future cannot cause the past, past information of one variable is used to predict or forecast the other. If the past and present price information at one level of the marketing channel is used to improve the forecast of future prices at another level, then the former level is said to Granger-cause the later level. The test is based on the following model:

$$PP_t = \sum_{i=l}^{n} a_i WP_{t-i} + \sum_{i-i}^{n} d_i PP_{t-i} + u_{1t} \quad (1)$$

$$WP_t = \sum_{i=l}^{n} c_i WP_{t-i} + \sum_{i-l}^{n} d_i PP_{t-i} + u_{2t} \quad (2)$$

where PP and WP are, respectively, producer price and wholesale price. In other words, the first equation postulates that current producer prices ($PP_t$) are dependent on past producer prices ($PP_{t-i}$) and past and present wholesale price ($WP_{t-i}$). The second equation postulates the same as wholesale price ($WP_t$). The error terms ($u_{1t}$ and $u_{2t}$) are assumed to be uncorrelated. Placing the appropriate restrictions on the model and using the F-test to test for statistical significance can test any one of the following causality relationships.

1) *Unidirectional causality from $WP_t$ to $PP_t$* if the estimated coefficients on the lagged $WP_t$ in the first equation are as a group, statistically different from zero ($\Sigma a_i \neq 0$) and the estimated coefficients on the lagged $PP_t$ in the second equation are, as a group, statistically are not different from zero ($\Sigma d_i = 0$).
2) *Unidirectional causality from $PP_t$ to $WP_t$* is suggested when estimated coefficient on the $PP_{t-1}$ in the second equation are as a group, statistically different from zero ($\Sigma d_i \neq 0$) and the estimated coefficient on the $WP_{t-1}$ in the first equation are jointly statistically not different from zero ($\Sigma a_i = 0$).
3) *Independence* is suggested when both sets of the lagged exogenous variable are not statistically different from zero ($\Sigma a_i = 0$ and $\Sigma d_i = 0$). This implies that no causal relationship exists between the variables.
4) *Bilateral causality or feedback* exists when both sets of the lagged exogenous variables are, as a group, statistically significantly different from zero in both equations ($\Sigma a_i \neq 0$ and $\Sigma d_i \neq 0$).

Having established the direction of causality the analysis proceeded to test the hypothesis of asymmetric price transmission in the market. The goal of such tests is to establish if increases and decreases in prices at the point determined above are transmitted symmetrically to the next level. The presence of asymmetric price transmission is an indicator of an ill-performing market, as Tomek and Robinson (1990) argue that asymmetric or stick price behaviour suggests imperfectly competitive markets.

### The Model

To run the relevant model and perform the tests, the following new variables were created:

$CWP_t$ = Change in wholesale price = $WP_t - WP_{t-1}$

$PPI_t$ = Producer price increase = $PP_t - PP_{t-1}$, if $PP_t > PP_{t-1}$ and = 0 otherwise

$PPD_t$ = Producer price decrease = $PP_t - PP_{t-1}$, if $PP_t < PP_{t-1}$ and = 0 otherwise

$CRP_t$ = Change in retail price = $RP_t - RP_{t-1}$

Houck (1977) applied the technique to detect asymmetric price transmission in what has come to be known as the "Houck procedure". Assuming that the results of this study's causality tests indicate unidirectional causation from producer prices ($PP_t$) to wholesale price ($WP_t$), Houck tests the hypothesis that a unit increase in producer prices will have a different absolute effect in farm prices from a unit decrease in producer prices. The Houck procedure consists of estimating the following equation in the first differences by ordinary least squares (OLS):

$$CWPt = a_0 + a_1 PPI_t + a_2 PPD_t + U_t$$

Where:

$a_0$ is the intercept term, $a_1$ is the effect of producer prices on wholesale prices when producer prices are increasing, $a_2$ is the effect of producer prices on wholesale prices when producer prices are decreasing, and $U_t$ is the error term.

A non-reversibility or asymmetry occurs in $CWP_t$ if the coefficient for a price increase is different from that of a price decrease ($a_1 \neq a_2$). An F-test is used to test for the statistical differences between the two coefficients.

## RESULTS AND DISCUSSION

### Socioeconomic Characteristics of *Irvingia* Seeds (Ogbono) Marketers

The result of the socioeconomic characteristics of the respondents is as presented in Table 1. The result shows that 57.4% of the wholesalers as well as 63.3% of the retailers were aged between 31 to 50 years. This implies that they were all at their energetic productive age. This is against the *Irvingia* seed producers that have over 69% of them aged more than 50 years. This is in line with the findings of Ike (2008) which showed that ownership of *Irvingia* trees is dominated by older farmers. This according to the findings is explained to be a result of the time it takes the trees to reach maturity. In particular *Irvingia wombolu* species according to the respondents take upwards of 10-15 years or more before producing fruits and this is why most of the farmer-owners are of older generation except for those who acquired theirs through inheritance.

There is male dominance in wholesale business of *Irvingia* seeds. This is expected as this type of business requires more capital than retailers. Also, over 83% of the respondents are married while a few of them (11%) did not have formal education. The bulk of those without formal education are the producers. This importance of proper formal education in marketing business cannot be overemphasized.

### Structure and Organization of *Irvingia* Seed Market

The Gini coefficient calculated for *Irvingia* seed producers was 0.36 or 36% (Table 2). This implies that the concentration of sales volume among the producers was

**Table 1.** Socioeconomic Characteristics of Respondents (n =180)

| Parameters | Wholesalers n = 54 | Retailers n = 90 | Producers n = 36 | Total n = 180 | Cumul. Percent |
|---|---|---|---|---|---|
| **Age Range** | | | | | |
| 20-30 years | 13(24.1) | 5(5.6) | - | 18(10.0) | 10.0 |
| 31-40 years | 13(24.1) | 19(21.1) | 3(8.3) | 35(19.4) | 29.4 |
| 41-50 years | 18(33.3) | 38(42.2) | 8(22.2) | 64(35.6) | 65.0 |
| 51-60 years | 8(14.8) | 20(22.2) | 15(41.7) | 43(23.9) | 88.9 |
| 61 years + | 2(3.7) | 8(8.9) | 10(27.8) | 20(11.1) | 100.0 |
| **Gender** | | | | | |
| Males | 36(66.7) | 22(24.4) | 29(80.6) | 87(48.3) | 48.3 |
| Females | 18(33.7) | 68(75.6) | 7(19.4) | 93(51.7) | 100.0 |
| **Marital Status** | | | | | |
| Married | 48(88.9) | 68(75.6) | 34(94.4) | 150(83.3) | 83.3 |
| Single | 6(11.1) | 20(22.2) | 2(5.6) | 28(15.6) | 98.9 |
| Divorced | 0(0.0) | 2(2.2) | - | 2(1.1 ) | 100 |
| **Education Experience** | | | | | |
| Zero yrs | 0(0.0) | 5(5.6) | 15(41.7) | 20(11.1) | 11.1 |
| 1- 6yrs yrs | 12(22.2) | 29(32.2) | 17(47.2) | 58(32.2) | 43.3 |
| 7-12yrs | 36(66.7) | 46(51.1) | 4(11.1) | 86(47.8) | 91.1 |
| Above 12 yrs | 6(11.1) | 10(11.1) | 0(0.0) | 16(8.9) | 100.0 |
| **Mkt/Farming Experience** | | | | | |
| 1-5 years | 3(5.6) | 13(14.4) | 2(5.6) | 18(10.0) | 10.0 |
| 6-10 years1 | 23(42.6) | 27(30.0) | 15(41.7) | 65(36.1) | 46..1 |
| 1-15 years | 18(33.3) | 35(38.9) | 12(33.3) | 65(36.1) | 82.2 |
| 16-20 years | 10(18.5) | 15 (16.7) | 7(19.4) | 32(17.8) | 100 |
| **Household Size** | | | | | |
| 1 – 5 persons | 15(27.8) | 34(37.8) | 5(13.9) | 54(30.0) | 30.0 |
| 6 – 10 persons | 35(64.8) | 45(50.0) | 23(63.9) | 103(57.2) | 87.2 |
| 11 - 15 person | 4(7.4) | 9(10.0) | 5(13.9) | 18(10.0) | 97.2 |
| 16 + persons | 0(0.0) | 2(0.0) | 3(8.3) | 5(2.8) | 100.0 |

**Table 2.** Gini Coefficient by Level of Marketing Agents

| Marketing agent | Gini coefficient | STD | Minimum | Maximum |
|---|---|---|---|---|
| Producer | 0.356517 | 0.027073 | 0.301881 | 0.411154 |
| Wholesaler | 0.244510 | 0.025296 | 0.193496 | 0.295525 |
| Retailer | 0.347858 | 0.337050 | 0.279887 | 0.415830 |

**Source**: Computed using E-view from the Field Data, 2012

low. According to UNDP (1992), Gini coefficient with high inequality typically lies between 0.5 and 0.7. This suggests that most producers were not able to control large shares of *Irvingia* seed supply in the study area. So that none could influence supplies by increasing or decreasing the quantity he or she produces. Each producer's output was insignificant part of volume of trade in the market such that it could not affect the market price.

The Table also shows that the concentration of sales volume among wholesalers was 0.24 or 24%. Thus, indicating low concentration as well. Therefore none of the wholesalers controlled a significant proportion of the *Irvingia* seed market. This is unlike the marketing of sweet potato in which Akinpelu et al. (2012) estimated a Gini coefficient of 0.819, implying inequality in the distribution of income among the wholesalers, thus showing the market to be an imperfect market.

In the same vein, the concentration for the retailers

as shown also followed similar trend, that is, none of the retailers controlled the market.

Overall, the structure of the *Irvingia* seed market indicated that there were many small scale dealers such that none could control the market. This market structure is competitive, because the individual agents have little influence on the market price. Enete and Agbugba (2008) as well as Hayami et al. (1999) made similar observations with charcoal marketing in Nigeria and rice marketing in the Philippines, respectively.

**Organization**

Organization here implies the channel of marketing operations, as well as existence of *Irvingia* seed marketing association. Marketing channel is the chain that links the producers and consumers of *Irvingia* seed.

From the analysis of data generated, this market flows through (4) major marketing channels represented diagrammatically in Figure 1. It shows that the intermediaries between the *Irvingia* seed producer and consumer are two; wholesaler and retailer. The wholesale dealers buy from producers and sell to retailers. The retailer in turn sells to the consumer in small quantities.

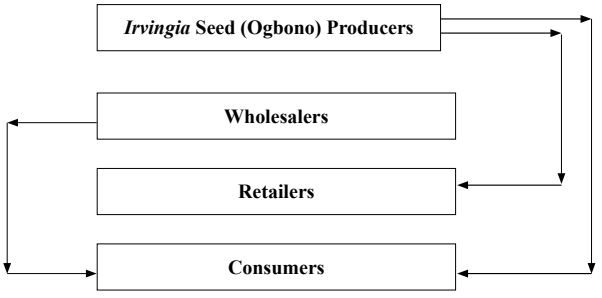


**Figure 1.** Channels of *Irvingia* seed marketing

**Marketing Costs and Margin**

Marketing margin is defined as the difference between the producer price and the retail price. The wholesalers' and retailers' marketing margin were expressed as percentages of the retail price. On the other hand, the producers' share of the retail price is the retail price less the value of the (wholesale and retail) marketing margin.

The result of the analysis shows that the wholesale marketing margin was (22.3%), while that of the retailers marketing margin was 21.29%. The producers' share of the consumers' spending was 56.41%. This implies that for every ₦1 spent by a consumer on 1 kg of *Irvingia* seed, about 56 kobo goes to the producers, while about 44 kobo goes to cover the middlemen's' marketing cost (1 USD = about 160 Nigerian naira).

From the result, the sum of marketing margin for the middlemen (43.59%) was lower than the producers' share (56.41%). Iheanacho (2005) reported a marketing margin of 14.44% per crate of eggs in Borno state, Nigeria while Akinpelu et al. (2012) reported a marketing margin of 15.75% and 8.79% for wholesalers and retailers respectively for marketers of sweet potato in Abia state, Nigeria. The marketing margin of 44% as reported in this study could be considered high. Riley (1972) had reported that as a rule of thumb, efficient markets in developing countries must have a retail margin of less than 10% of the consumer price. However, high marketing margins often reflect poor socioeconomic environment of the actors as observed by Goossens (1996) whereas Harrison et al. (1987) reported lack of competition, cost inefficiency and greater degree of uncertainty to be likely responsible for higher marketing margins recorded by wholesalers.

**Relationship among prices at different levels of the marketing channel**

Granger Causality test was conducted to explore the relationship among prices at different levels of the marketing channel. The Granger Causality results for the test of hypothesis are as presented in Table 3.

**Producer-Wholesaler Price Causality**

Results on Granger causality between producer and wholesale price indicate an interrelationship between their

**Table 3.** Pairwise Granger Causality Results

| Null hypothesis | Observations | F-Statistics | Probability |
|---|---|---|---|
| **1. Producer-Wholesaler** | | | |
| WSP does not granger cause PP | 1302 | 2.64683 | 0.10400 |
| PP does not granger cause WSP | 1302 | 11.6037 | 0.00068 |
| **2. Wholesaler-Retailer** | | | |
| RP does not granger cause WSP | 1355 | 10.6606 | 0.00112 |
| WSP does not granger cause RP | 1355 | 15.5293 | 0.000085 |

**Source:** Computed using E-view form Field Data, 2012
Note: PP = Producer prize, WSP = Wholesale prize, RP = Retail prize

present and past values. The F-statistic probabilities indicate that using a decision rule of a = 0.05, the second hypothesis that PP does not granger cause WSP is rejected while the first hypothesis is accepted. In other words, PP causes WSP but not the reverse. This suggests that changes in producer price drive changes in wholesale price and hence prices are determined at the producer's level. This result is against the general belief that middlemen exploit producers of agricultural products and consumers through monopoly pricing and usury (Hayami et al., 1999), such that prices are determined at the middlemen level. This finding also supports that of Enete and Agbugba (2008) that producer prices in charcoal marketing influences wholesale price.

**Wholesaler-Retail Price Causality**

Results for Granger causality tests between wholesale and retail price indicates even a stronger interrelationship between their present and past values. Using the same decision rule of a = 0.05, both hypotheses are rejected (WSP does not granger cause RP, and RP does not granger cause WSP) and conclude with 95% confidence that there is a feed back or bilateral causality relationship existing between the wholesale and retail price. Importantly, the study concludes that there was a unidirectional flow from PP to WSP, while there was a bilateral flow between WSP and RP.

**Asymmetry in Price Transmission**

Having established that *Irvingi*a seed price is determined at the producer's end of the marketing chain, the asymmetry in price transmission from producer to wholesaler was tested and the result is as presented in Table 4.

To test for asymmetry in price transmission, equality in the coefficients of PPI and PPD was tested. Asymmetry in price transmission occurs when the coefficient for price increase is statistically different from the coefficient for price decreases.

The calculated F-value (100.96) exceeded the critical F-value (50.58) at 5% level of significance. Hence, the null hypothesis that the coefficient $a_1$ and $a_2$ are equal is rejected and it is concluded that with 95% confidence that the effect of increasing producer price is statistically different from decreasing producer prices on wholesale price. Price transmission from producer to wholesale level is therefore asymmetric.

According to the regression result, 84% of a ₦1 increase at producer price level is immediately transmitted to the wholesale level, whereas 70% of a ₦1 price decrease at producer level would immediately be transmitted to the wholesale level. The implication of this is that producers transmit price increases faster to wholesalers than price decreases. Guwheya et al. (1998) observed for horticultural market in Zimbabwe that wholesale transmit price increases faster to the producers than price decreases.

## CONCLUSION

*Irvingia* seed marketing margins were generally high, apparently due to poor socioeconomic environment of the actors. The margins were however on the average, lower than the producer's share of the consumer spending. The result also suggests a competitive market structure for *Irvingia* seed in the study area. Prices were determined at the production level of the chain, but producers were asymmetric in their price transmissions to the wholesale level. These observations suggest that policy intervention in the form of improving the socioeconomic environment under which marketing agents operate and facilitation of market information flow could improve *Irvingia* seed marketing in the study area as well as Nigeria in general.

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**Table 4.** Houck Procedure for Producer-Wholesaler Price Transmission

| Variables | Coefficient | Standard Error | T-Statistic | Probability |
|---|---|---|---|---|
| Constant | -7.7449 | 15.3148 | -0.51 | 0.616 |
| PPIt | 0.8365 | 0.1345 | 6.11 | 0.0000 |
| PPDt | -0.7030 | 0.1324 | -5.31 | 0.00 |

$R^2$ = 0.72; Adjusted $R^2$ = 0.70; Probability (F-statistics) 0.000

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