



AN ASSESSMENT OF THE MARKET STRUCTURE OF SESAME AMONG FARMERS, WHOLESALERS AND RETAILERS IN NASARAWA STATE, NIGERIA

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ABSTRACT

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The study assessed principally the level of equality/inequality in the sales distribution of sesame among farmers, wholesalers and retailers. The sampling procedure used involved a random selection of 120 sesame farmers, 40 wholesalers, and 60 retailers proportionately drawn from the three agricultural zones of Nasarawa State. The instrument for data collection was a structured questionnaire. Tools of data analysis were descriptive statistics, regression technique and measures of market concentration such as Lorenz curve, Gini coefficient and Herfindahl index. The results which showed Gini coefficient index values of 0.686, 0.331 and 0.589 and Herfindahl index values of 0.115, 0.442 and 0.118 for farmers, wholesalers, and retailers, respectively, were indications of varying levels of inequality in the distribution of sesame sales income and the existence of some monopolistic forces in sesame market. Socio-economic variables which affected sales income (the main determinant of market concentration) positively and significantly ($p \leq 0.01$) were education, total value of investment and non-farm sources of income. As farmers and middlemen are indispensably interdependent, deliberate policy intervention is required in areas such as adequate formal credit, diversification of enterprises and human capital development to make them (farmers and middlemen) more competitive in the rapidly evolving global economy.

Contribution/ Originality: The study is one of very few studies which have investigated the existence or otherwise of monopolistic forces in the marketing of farm products using a combination of analytical tools such as Gini coefficient, Herfindahl index, and Lorenz curve.

1. INTRODUCTION

Sesame (*Sesamum indicum*L), also called beniseed, is believed to have originated from tropical Africa. Major producing areas worldwide include India, China, Malaya, Sudan, Mexico, Pakistan, Venezuela, Uganda and Nigeria. Japan, U.S.A., Italy, Israel and Venezuela are the major importers [1]. In Nigeria, the crop is widely grown in the northern and central zones of the country as one of the major export crops [2]. Average seed yields, ranging from 500-800kg/ha obtained from farmers' fields, are considered relatively low compared to average yield of 1000 kg/ha obtained from research farms [3]. Annual output figures increased from 56000 metric tonnes in 1994 to over 93,250.7 metric tonnes in 2007 [1, 4, 5]. Generally, sesame seed is used in food preparation such as stew and

confectioneries. The oil is used in manufacturing industries as well as substitute for olive oil in salads and cooking oil. Sesame is an important commercial crop, and one of the major crops produced in different locations of Nasarawa State. With its estimated output of over 41570 metric tonnes (about 40% of the national output) from about 46710 hectares under cultivation in the state, an annual estimated foreign exchange earning of US \$12.3 million can be generated [2, 6]. Sesame is marketed mostly in its primary form in the State. The oil extracted by traditional methods and the cakes resulting from the process are used mainly for local consumption. Sesame is a source of income to farmers, middlemen, and service providers involved in its production and marketing. Thus, sesame has the potential to generate foreign exchange earnings for the country, reduce poverty, especially among rural dwellers in the producing areas, and facilitate agro-industrialization and rural development in Nigeria. Market structure defines the nature of competition and pricing within the market [7]. It deals primarily with the number of buyers and sellers of a product, the degree of buyer and seller concentration, the condition of entry to the market and product differentiation [8]. An assessment of market structure reflects market performance and reveals the degree of the existence of competitive forces and how imperfect a market is [9, 10]. A situation of perfect equality in the size distribution of market participants, implying very low market concentration is required for the ideal perfect competition to thrive. Cases of the existence of monopolistic forces and varying levels of inequality in the distribution of sales revenue among market participants have been reported for different commodities other than sesame in Nigeria [11-14]. Study of the market structure of sesame is necessary for policy decisions or initiatives geared towards boosting its production, processing and consequently the earnings of farmers and middlemen. The specific objectives of the study were to: 1) describe the socio-economic characteristics of farmers, wholesalers and retailers, 2) determine the level of equality/inequality in sales distribution of sesame among farmers, wholesalers and retailers, and 3) identify important socio-economic factors that affect sales income, the main determinant of market concentration.

2. MATERIALS AND METHODS

2.1. Study Area

The study area is Nasarawa State, created out of former Plateau State in October, 1996. It lies between latitudes $7^{\circ} 45'$ and $9^{\circ} 25'$ N and longitudes 7° and $9^{\circ} 37'$ E of the Greenwich meridian, and has a land area of 27,137.8 square kilometres with a population of about 1,863,275 people [15]. Mean annual rainfall in the State ranges from 1100 – 1600 mm and temperature could rise as high as 39°C and fall as low as 17°C [16]. The thirteen Local Government areas that make up the state are Akwanga, Awe, Doma, Karu, Keana, Keffi, Kokona, Lafia, Nasarawa, Nasarawa-Eggon, Obi, Toto and Wamba. Major crops produced in the State are rice, yam, cassava, sesame, *egusi*, groundnut and cowpea. Sesame has been a major cash crop produced in commercial quantities in Doma, Lafia and Nasarawa Local Government Areas of the State.

2.2. Sampling Procedure

Sampling was preceded by a reconnaissance survey to determine the sampling frame. The sampling procedure involved a simple random selection of 108 sesame farmers, 40 wholesalers and 60 retailers of the produce. The farmers were proportionately drawn from the main and minor producing areas, and wholesalers and retailers from urban and rural sesame markets in the three agricultural zones of Nasarawa State. Each sample size was determined from a sampling frame of 300 sesame farmers, 112 wholesalers and 213 retailers provided by Nasarawa Agricultural Development Programme (NADP) and listed during the reconnaissance survey.

2.3. Data Collection

Data for the study were collected from primary sources using two sets of questionnaires, one set for farmers and the other for middlemen. Trained enumerators were used to administer them so that information on sales and

the socio-economic characteristics of farmers and middlemen were elicited for sesame produced in 2013, in a duration of about three months.

2.4. Data Analysis

Descriptive statistics were employed to realize the objective on the socio-economic characteristics of the farmers and middlemen. Measures of concentration used in determining levels of inequality/equality among farmers, wholesalers and retailers are Lorenz curve, Gini coefficient and Herfindahl index. Lorenz curve relates the cumulative proportion of income to the cumulative proportion of population, after ordering the population according to increasing level of income [17]. Lorenz curve is obtained by plotting the cumulative proportion of each category of population arranged in order from the smallest number to the largest, against cumulative proportion of their income [9, 11]. The extent to which a Lorenz curve swings away from the line of equal distribution is a measure of inequality of the variables of interest [9]. The degree of inequality in sales revenue is estimated by reading the curve at the point where it lies furthest from line of equal distribution [11]. If the distribution is totally equitable, the curve will fall on the 45-degree line. The greater the inequality the greater the departure from the 45-degree line [9, 14]. Gini coefficient is based on Lorenz curve and is 1 minus the sum of the product of the proportion of market participants of interest and the cumulative proportion of their sales earnings arranged in class intervals from the lowest to the highest [9, 11]. Values of Gini coefficient, which range between 0 and 1 express the degree to which the market is concentrated. Herfindahl index represents the sum of squared ratios of the sales of each individual trader to the total sales of all traders [10]. Lorenz curve, Gini coefficient and Herfindahl index are interconnected as measures of concentration. The interpretation of Gini coefficient is based on the Lorenz curve. The interpretation of Herfindahl index and Gini coefficient are the same but Gini coefficient is particularly sensitive to inequalities in the middle range of the distributions [10].

(a) Gini coefficient

$$GC = 1 - \sum_{i=1}^n P_i C_i \quad \dots (1)$$

where:

GC = Gini coefficient

P_i = proportion of market participant of sesame under consideration in the i^{th} class

C_i = cumulative proportion of the sales of the market participants of sesame under consideration in the i^{th} class. Gini coefficient has a value ranging from 0 to 1. It expresses the degree to which a market is concentrated. If the Gini coefficient value is 0, it implies perfect equality in the size distribution of participants. If it is 1, it implies perfect inequality (imperfect market) [9-11]. The middle values can be similarly interpreted depending on the direction they tilt to.

(b) Herfindahl index (HI)

$$HI = \sum_{i=1}^n \left(\frac{x_i}{x} \right)^2 \quad \dots (2)$$

where:

x_i = volume of sales in the i^{th} class of middlemen

x = total volume of sales in the sample

n = total number of classes

HI tends to be more accurate as the size of the data increases. The highest possible value of HI is 1 which implies that the market is perfectly concentrated (imperfect market). The determinants of sesame sales income was achieved through the use of regression analysis, expressed mathematically in its explicit form as:

$$Y = a + b_1 X_1 + \dots + b_5 X_5 + e \quad \dots (3)$$

Where:

X1 = level of education in years

X2 = experience in sesame marketing in years

X3 = credit accessed by market participants in naira

X4 = total value of investment in sesame marketing in naira

X5= other sources of income in naira

a = constant

b1-b5= coefficients of independent variables

e = error term

3. RESULTS AND DISCUSSION

3.1. Socio-Economic Characteristics of the Farmers

The socio-economic characteristics of farmers are shown in Table 1. All the farmers (100%) were married and 88.9% of them were males, while only 11.1% were females. Although the ages of the farmers were between 20 and 75 years, the mean age of 46.7 years depicted an active farming population. Formal education by farmers was limited to an average schooling duration of 12.4 years. These included farmers who did not go to school and those who spent a maximum duration of 20 years schooling. Education is important in facilitating the response of farmers to the adoption of available technologies that increase productivity. Marketing and production experience spanned for a period of 1 to 35 years. The mean marketing experience of 11.8 years could be a good asset if properly harnessed. Statistics of average distance to the nearest market centre and output, farm size, household size, sales volume, price, quantity sold and yield per farmer provide tools for decision-making by the farmers, marketers and policy-makers.

3.2. Socio-Economic Characteristics of Wholesalers and Retailers

Education, marketing experience and age represent the human capital acquired by the wholesalers and retailers. Table 2 shows the age of 41.1 years, 9.1 years in school, 13.9 years of marketing experience, value of equipment of ₦8472.5, value of investment of ₦877622.0 and sales income of ₦1025096.1, all in mean values for wholesalers. These were in all cases higher than the age of 34.9 years, 3.9 years in school, 10.3 years of marketing experience, value of equipment of ₦1961.7, value of investment of ₦219171.8 and sales income of ₦276829.3, all in mean values for retailers. These variables, consisting of human capital (education, experience and age), physical capital (equipment, investment funds) and earnings (income) affect market performance and partly explain the level of efficiency and inequality reported in the study.

Table-1. Statistics of socio-economic variables of the farmers

Variables	Minimum	Statistics Maximum	Percent	Mean	Standard Deviation
Gender(% male)			88.9		
% married			100.0		
Age (years)	30.0	75.0		46.7	0.8
Education (years)	0.0	20.0		4.8	0.6
Production experience (years)	1.0	35.0		12.4	0.8
Marketing experience (years)	1.0	35.0		11.8	0.7
Distance to the nearest market centre	2.0	40.0		10.3	0.8
Output of sesame (Kg/farmer)	50.0	6500.0		1005.6	123.2
Farm size (Ha)	0.2	12.0		2.5	0.3
Price (₦/ Kg)	110.0	210.0		160.8	2.0
Sales income from sesame (₦/ farmer)	8500.0	1170000.0		161381.3	21640.8
Quantity sold (Kg/farmer)	50.0	6500.0		979.9	122.5
Family size	3.0	37.0		12.8	0.5
Yield (Kg/ha)	100.0	720.0		363.8	11.7

Source: Field Data

Table-2. Socio-economic characteristics of wholesalers and retailers

Variables	Wholesalers		Retailers	
	Mean	Standard deviation	Mean	Standard deviation
Education (years)	9.1	4.4	3.9	3.9
Marketing experience (years)	13.9	5.9	10.3	4.9
Value of equipment used(₦)	8472.5	8220.5	1961.7	958.3
Age in years	41.1	5.9	34.9	4.7
Value of investment (₦)	877622.0	656113.9	219171.8	145145.8
Sales income (₦)	1025096.1	736593.7	276829.3	218139.2

Source: Field Data

3.3. Distribution of Sales Income of Sesame among Farmers, Wholesalers and Retailers

Tables 3, 4 and 5, show prominent features of the distribution of sales income of sesame among farmers, wholesalers and retailers. Most farmers, wholesalers and retailers fell into lower income classes. With the exception of the first class, distribution of sales income in the other four classes was fairly even among wholesalers. Combined sales income of two farmers or firms in the last two classes was about 66% of the total sales income of 66 farmers in the first class. This is an example of the disparity of income among farmers. The distribution among retailers was characterized by sales income per retailer ranging from ₦ 25,689 in one class to ₦ 900,000 in another.

The Lorenz curves of the distribution of income from the sales of sesame among farmers, wholesalers and retailers are presented in Figures 1, 2 and 3, respectively. The further away the divergence of the Lorenz curve is from the line of equal distribution, the less equally the commodity involved is distributed. Thus, the curves depicted that the inequality in the distribution of sales income of sesame was highest among farmers and lowest among wholesalers. The level of inequality among retailers falls in between the two.

The estimated Gini coefficients of 0.686, 0.331 and 0.589 among farmers, wholesalers and retailers, respectively, are shown in Tables 3, 4 and 5. These indicate varying levels of inequality, competition or imperfection and consequently inefficiency in sesame markets in Nasarawa State. The rule of thumb suggested by Dillon and Hardaker [18] is to regard Gini coefficient value greater than 0.35 as an indication of inequitable distribution. The high Gini coefficient values among farmers and retailers are indications of high levels of concentration and inequality in size distribution, while the relatively low Gini coefficient value among wholesalers tended more to equality in size distribution. The highest level of inequality was found among sesame farmers. Similar patterns were portrayed by the Lorenz curves. The large number of resource-poor and predominantly small-scale producers cannot produce and sell as much quantity to earn as much income as their large-scale commercial counterparts.

The Herfindahl index values also exhibited the existence of some inequality in size distribution. Interestingly, the Herfindahl index values of 0.115, 0.442 and 0.188 in Tables 3, 4 and 5 for farmers, wholesalers and retailers, respectively, were different from those of Gini coefficient in size and pattern. The Herfindahl index values were smaller than the Gini coefficient values in size in the cases of the farmers and retailers. It is possible that these Gini coefficient values were exaggerated as a result of being sensitive to inequalities in the middle range of their distributions. For the wholesalers, the Herfindahl index value was higher than the Gini coefficient value. The relatively small sample size of wholesalers could have affected the accuracy of its Herfindahl index value. The lowest point of equality (perfect equality) of the Herfindahl index decreased with sample size and as the sample size increased, the accuracy of the Herfindahl index value also increased. The lowest, middle and highest values of the Herfindahl index are the reverse of the Gini coefficients. The interpretation of the Herfindahl index depends on the lowest point of equality, which is defined as $\frac{1}{n}$, n being the sample size. Comparative analysis of the values of the

Herfindahl index of elements of differing sample sizes can therefore be a futile exercise in determining the degree of inequality in size distribution.

Table-3. Distribution of sales income of sesame among farmers and the estimated Gini coefficient and Herfindahl index values

Sales income (₹)	Number of Sellers	Proportion of Sellers (P)	Cummulative proportion of sellers	Total yearly Sales (₹)	Proportion of total sales (X)	Cummulative proportion of total sales (C _i)	P _i C _i	X _i ²
1, 000 - 100, 000	66	0.611	0.611	3,387, 900	0.194	0.194	0.119	0.038
101, 000 - 200, 000	22	0.204	0.815	3, 253, 900	0.187	0.381	0.078	0.035
201, 000 - 200, 000	5	0.046	0.861	1, 214, 500	0.070	0.451	0.021	0.005
301,000 - 400, 000	4	0.037	0.898	1, 444, 500	0.083	0.534	0.020	0.007
401, 000 - 500, 000	3	0.028	0.926	1, 333, 500	0.077	0.611	0.017	0.006
501, 000 - 600, 000	1	0.009	0.935	507, 500	0.029	0.640	0.006	0.001
601, 000 - 700, 000	1	0.009	0.944	661, 200	0.038	0.678	0.006	0.001
701, 000 - 800, 000	2	0.019	0.963	1, 565, 100	0.090	0.768	0.015	0.008
801, 000 - 900, 000	1	0.009	0.972	880, 000	0.050	0.818	0.007	0.003
901, 000 - 1, 000, 000	1	0.009	0.981	931, 000	0.053	0.871	0.008	0.003
1001, 000 - 1, 100, 000	1	0.009	0.990	1, 080, 000	0.062	0.933	0.008	0.004
1, 101, 000 - 1, 200, 000	1	0.009	1.000	1, 170, 000	0.067	1.000	0.009	0.004
Total	108	1.000	1.000	17, 429, 000	1.000	1.000	0.314	0.115
$GC = 1 - \sum P_i C_i = 1 - 314 = 686$ $\sum X_i^2 = HI$								

Table-4. Distribution of sales income of sesame among wholesalers and the estimated Gini coefficient and Herfindahl index values.

Sales income (N)	Number of Sellers	Proportion of Sellers (P)	Cummulative proportion of sellers	Total yearly Sales (N)	Proportion of total sales (X)	Cummulative proportion of total sales (C _i)	P _i C _i	X _i ²
Below 100,000	33	0.825	0.825	0.637	0.637	0.406	0.076	0.015
1,000,001-2,000,000	14	0.100	0.925	4,968,700	0.121	0.758	0.020	0.003
2,000,002-3,000,002	1	0.025	0.950	2,176,000	0.053	0.811	0.022	0.006
3,000,003-4,000,003	1	0.025	0.975	3,230,000	0.079	0.890	0.025	0.012
4,000,004-5,000,004	1	0.025	1.000	4,500,000	0.110	1.000	0.669	0.442
Total	40	1.000	1.000	41,003,000	1.000	1.000		$\sum X_i^2 =$
$GC = 1 - \frac{\sum P_i C_i}{\sum X_i^2} = 1 - \frac{0.669}{0.331}$								
HI								

Table-5. Distribution of sales income of sesame among retailers and the estimated Gini coefficient and Herfindahl index values.

Sales income (₹)	Number of Sellers	Proportion of Sellers (P)	Cummulative proportion of sellers	Total yearly Sales (₹)	Proportion of total sales (X)	Cummulative proportion of total sales (C _i)	P _i C _i	X _i ²
Below 100, 000	4	0.067	0.067	339, 800	0.031	0.31	0.002	0.001
100, 001 - 200, 000	23	0.383	0.450	3, 156, 300	0.285	0.316	0.121	0.081
200, 001 - 400, 000	18		0.750	462, 400	0.042		0.358	0.107
300, 001 - 400, 000	4	0.300	0.817	1, 312, 500	0.118		0.476	0.032
400, 001 - 500, 000	7	0.067	0.934	3, 011, 500	0.272		0.748	0.088
500, 001 - 600, 000	1	0.117	0.951	548, 800	0.049		0.797	0.014
600, 001 - 700, 000	1	0.017	0.968	610, 000	0.055		0.852	0.002
700, 001 - 800, 000	1	0.017	0.985	748, 100	0.067		0.914	0.003
800, 001 - 900, 000	1	0.017	1.000	900, 000	0.081		1.000	0.004
Total	60	1.000	1.000	11, 089, 000	1.000		1.000	0.411
GC = 1 - Σ P _i C _i		= 1 - 0.411		= 0.589		Σ X _i ²		HI

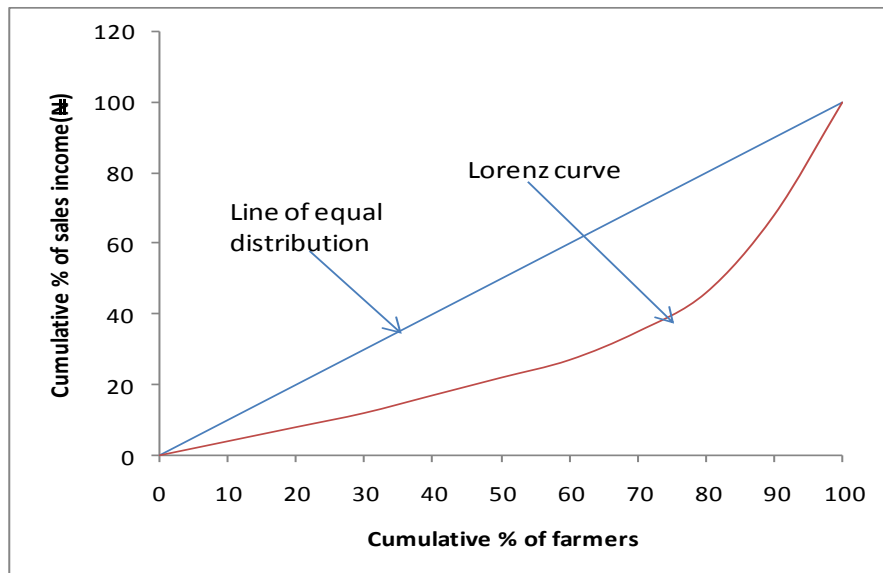
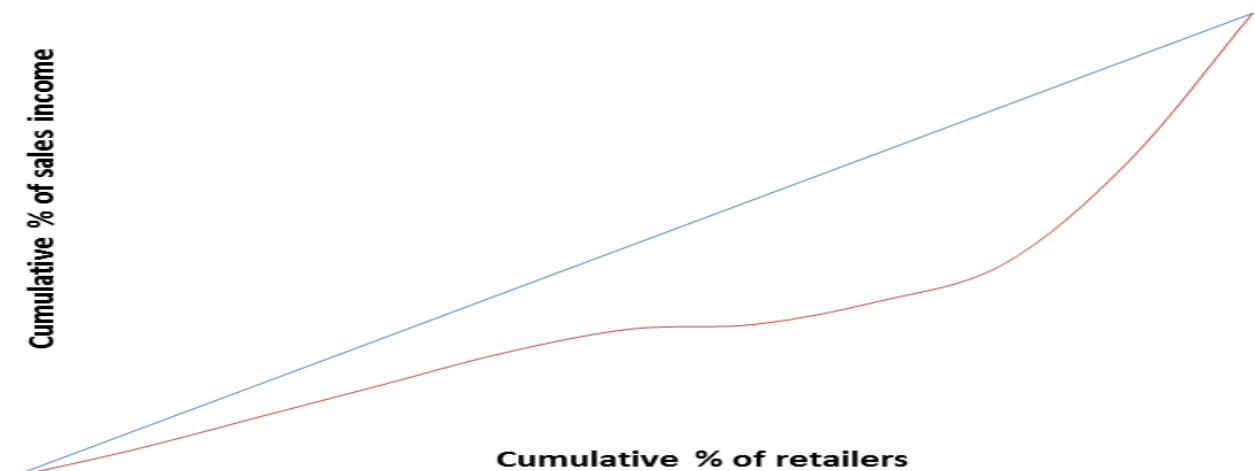


Figure-1. Lorenz curve of the distribution of sales income of sesame among farmers.
Source: Field Data



Source: Field Data

Figure-2. Lorenz curve of the distribution of sales income of sesame among wholesalers.



Source: Field Data

Figure-3. Lorenz curve of the distribution of sales income of sesame among retailers.

3.4. Socio-Economic Factors Affecting Sales Income, the Main Determinant of Market Concentration

Result of the regression between socio-economic characteristics and sales earning of middlemen is presented in Table 6. Socio-economic characteristics used were education, experience, credit accessed, total value of investment and other sources of income. Relationship therefore existed between sales earning and the socio-economic characteristics. Education, total value of investment and other sources of income were the socio-economic variables that affected sales income positively and significantly at 0.01 level of probability. In the circumstance, these variables are important in efforts aimed at improving the market concentration of sesame.

Table-6. Estimated regression coefficients of the relationship between socio-economic variables and sales income of middlemen

Independent Variable	Coefficients
Constant	-13406.543
Education	30399.579*
Experience	-15.170
Credit accessed	-0.392
Total value of investment	0.567*
Other sources of income	0.102*
R ²	0.661
Adjusted R ²	0.642
Durbin-Watson	1.936

Dependent variable – sales income; significant at 1% level of probability

4. CONCLUSION AND RECOMMENDATION

For the study, the marketing system of sesame was not perfectly competitive, evidently as a result of disparity in sales income of sesame among farmers, wholesalers, and retailers. Wide differences in the size and value of output of each farmer and the volume and value of sales of each middleman accounted for the disparity. Unlimited access to adequate formal credit, diversification into other enterprises for free interflow of resources and continual human capital development are measures recommended for making market participants-farmers, wholesalers and retailers, more competitive in the area.

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