Gender Analysis of Allocative Efficiency in Small Scale Maize Production in Kogi State, Nigeria.

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Abstract

The study examined gender analysis of allocative efficiency in small scale maize production in Kogi State, Nigeria. The primary data for the study were obtained using structured questionnaire administered to one hundred randomly sampled male and female maize farmers from two Local Government Areas. Descriptive statistics, gross margin, net farm income, gross ratio, operation ratio, return on capital investment and production function using regression model were used to analyze the data. The study showed that female farmers were more profitable and efficient in maize production than their male counterpart with operating ratio, gross ratio return on capital investment of 0.23. 0.30 and 3.36 respectively. The result from the production function analysis revealed that the R^2 value for men were 54.9% while that of women were 57.1%. Variable inputs such as farm size, seed and fertilizer were found to be significant at 1%, 5% and 5% level of probability respectively for male farmers while seed, fertilizer and agrochemical were found to be significant at 5% and labour at 10% level of probability for female farmers. Elasticity of production (return to scale)for both male and female farmers showed an increasing return to scale and that maize production was in stage I of the production region in the study area. Estimated efficiency ratio(r) shows that the resources used were not efficiently utilized. It is recommended that the present level of allocative efficiency of maize production in the study area should be increased by using more of these productive resources. Farmers should also be encouraged to take into the advice of the adequately trained extension advisers on improved techniques of maize production such that there will be increase in yield per hectare.

Keywords: Gender, allocative efficiency and maize production

INTRODUCTION

Maize is one of the main cereal staples in Nigeria. It originated from a directed domestication of a Mexican annual grass known as *Zea mays*. Maize is widely cultivated throughout the South, West, East and Middle Belt of Nigeria (Ojo, 2004). Maize is also a staple food of great socio-economic importance in the Sub-Saharan Africa of which Nigeria is inclusive with per capita kg production per year of 40 (FAO, 2003). In Nigeria, it is the third most important cereal crop after sorghum and millet (Ojo, 2000). The total land area planted to maize in Nigeria is above 2.5 million hectares with an estimated yield of about 1.4 metric tones per hectares (Agboola and Tijani, 1991). Ironically, the demand for maize as a result of the various domestic uses shows that a domestic demand of 3.5millon metric tons outweighs supply of 2million metric tonnes (Akande, 1994). However, the unfolding performance of maize can be attributed to the fact that over 90% is dependent on subsistence agriculture (small holder farmers) with rudimentary farm system, low capitalization and low yield per hectare(Olayemi,1994).

Moreover, price fluctuation, diseases and pest outbreaks, poor storage facilities and inefficient resources utilization were identified as problems of low maize production in Nigeria (Ojo, 2000). In view of this, production efficiency of smallholder farms has important implications for development strategies adopted in most developing countries, especially Nigeria where the primary sector is still dominant. An improvement in the understanding of the levels of production efficiency and its relationship with a host of farm level can greatly aid policy makers in creating efficiency enhancing policies as well as in judging the efficacy of present and past reforms. One of the objectives of any production unit is to utilize factors of production efficiently in order to earn high profit. The importance of

maize production to Nigerians economy is already well known and therefore need not to be over-emphasized. Based on socio-economic points of view, maize makes significant contribution to economy in terms of employment and income generation to various people. However, many factors have been militating against the efficiency of resource use in maize farming which may lead to a reduction or fluctuation of its production output. This fluctuation in production output can have a serious implication not only on the maize farmers' incomes but also on their abilities to use the available resources efficiently. In trying to compare the resources use efficiency of male and female maize farmers, problems also arise because of inequality in the use of certain resources. Therefore, this study is set to determine gender allocative efficiency of maize farmers in Kogi State.

The specific objectives are to:

(i). describe the socio-economic characteristics of male and female maize farmers in Kogi State.

(ii). determine input and output levels in maize production among the male and female maize farmers.

(iii). determine the profitability in maize production among men and women maize farmers and

(iv). determine gender resource use efficiency in maize production in the study area

METHODOLOGY

Study Area: This study was carried out in Kogi State. The state lies between latitude 06º 30´N and longitude 08º 51´N. with land area of 29,833km² and population of 2,009,046 (Wikipedia, 2008). Kogi State is known to be very productive in agriculture. The main crops grown are maize, coffee, cocoa, and palm oil, cashew, cassava, peanuts, melon and rice among others. The state is also known to be rich in mineral resources like coal, limestone, iron, petroleum and tin.

Sampling Techniques: The data mainly from primary sources were collected from two Local Government Areas (LGAs) which were purposively selected because of the prevalence of the crop in the area using multistage sampling technique. The LGAs include Yagba East and Mopa Amuro LGAs. The second stage involved a simple random selection of 50 farmers (25 men and 25 women) out of the maize farmers from each of the two LGAs, thus, making 100 respondents. The data were collected with the use of structured questionnaire designed in line with objectives of the study. The information collected from the farmers include demographic characteristics of maize farmers and resources used in the production of maize e.g. labour (mandays), agro-chemicals (litres), variable and capital inputs costs (naira), land (ha) and fertilizer (kg).

DATA ANALYSIS

Descriptive Statistics: The method employs arithmetic mean, frequency distribution and percentage. The technique was used to group and summarize the data obtained from the field.

Gross margin: This is the difference between the Gross Farm Income (GFI) and the Total Variable Cost (TVC). It is a useful planning tool in situations where fixed capital is negligible portion of the farming enterprises in the case of small scale subsistence agriculture (Olukosi and Erhabor, 1988).

GM = GFI – TVC (1)

Where GM = Gross Margin, GFI = Gross Farm Income, TVC = Total Variable Cost.

Gross margin analysis is one method of calculating profitability of small scale cropping enterprises (Olukosi *et-al*, 2006).

Net Farm Income (NFI) = Gross Margin (GM) – Total Fixed Cost (TFC)

Gross ratio: This is a profitability ratio that measures the overall success of the farm. The lower the ratio, the higher the return per naira.

$$GR = \frac{TFE}{GI} \quad (2)$$

Where GR = Gross Ratio, TFE = Total Farm Expenses and GI = Gross Income.

Operating Ratio*:* The operating ratio is directly related to the farm variable input usage. The lower the ratio, the higher the profitability of the farm business.

$$OR = \frac{TOC}{GI} \quad (3)$$

Where OR = Operating Ratio, TOC = Total Operating Cost and GI = Gross Income.

***Return on Capital Invested**:* This is defined as gross margin divided by total variable cost.

$$RI = \frac{GM}{TVC} \quad (4)$$

Where RI = Return on Capital Invested, GM = Gross Margin and TVC = Total Variable Cost

Production Function Analysis: Regression model was used to examine input-output relationship and the implicit form of the model is given by:

$$Y = f(X_1, X_2, X_3, X_4, X_5 U_i) \quad (5)$$

Where
Y = Output from maize production (kg)
X_1 = Farm size (ha)
X_2 = Quantity of seeds (kg)
X_3 = Quantity of fertilizer (kg)
X_4 = Labour input (manday)
X_5 = Agrochemical (liters)
U_i = Error term.
The explicit form of this function takes the following forms:

$$Y = a + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + U_i (linear) \quad (6)$$

$$Y = a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + U_i (semi\log) \quad (7)$$

$$\ln Y = a + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + U_i (double\log) \quad (8)$$

$$\ln Y = a + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4 + b_5 X_5 + U_i (\exp onential) \quad (9)$$

***Efficiency of Resource-use**:* This was determined by the ratio of marginal value product (MVP) to marginal factor cost (MFC) of inputs based on the estimated regression coefficients. Following Rahman and Lawal (2003) efficiency of resource (r) is given as

$$r = \frac{MVP}{MFC} \quad (10)$$

The rule provides that when r = 1, there is efficient use of resource; r > 1 and r < 1 indicate underutilization and overutilization of a resource respectively. The values of MVP and MFC were estimated as follows:

$$MVP = MPP \bullet P_Y$$

$$MFC = Px_i$$

Where
MVP = Marginal Value Product of variable input;
MPP = Marginal Physical Product;
Py = Unit Price of output;
Px_i = Unit Price of input Xi
r = Efficiency ratio.

Economies of Scale: This is the measure of farm's success in producing maximum output from a given set of inputs. The return to scale (RTS) was estimated using the formula

$$\sum {}^{k} Epx_i = RTS$$

Where Epx_i refers to the elasticity of production derived from the regression results.

RESULTS AND DISCUSSION

Socio-economic characteristics of sampled farmers: Some socio-economic characteristics of farmers influenced maize production in the study area. The variables considered include marital status, age, education, household size and years of farming experience.

Table 1 (below) shows that majority of the maize farmer were married men (76%) and women (50%). It is also shown in the table that

the mean ages of male and female maize farmers were 47 and 48 years respectively. This implies that majority of the sampled farmers were at their middle ages and were economically active. The modal class of educational level of men and women were secondary and primary schools respectively.

It is also shown that men had the highest household size of 74% while that of women were 70%.

TABLE 1
Socio- economic characteristics of men and women maize farmers in the study area

	Male farmers			Female farmers		
Variables	**Freq**	**Percent**	**Mean**	**Freq**	**Percent**	**Mean**
Marital Status						
Married	38	76		25	50	
Single	7	14		2	4	
Widow(er)	3	6		21	42	
Divorced	2	4		2	4	
Age (years)						
Less than 21	0	0		0	0	
21-30	8	16	47	1	2	48
31-40	7	14		11	22	
41-50	13	26		18	36	
51-60	20	40		18	36	
Above 60	2	4		2	4	
Highest educational attainment						
Primary	18	36		19	38	
Secondary	19	38		13	26	
Tertiary	2	4		1	2	
Informal adult education	4	8		1	2	
Quranic education	7	14		16	32	
Household size						
1-5	3	6		7	14	
6-10	12	24	4	18	36	5
11-15	10	20		15	30	
16-20	14	28		6	12	
Above 20	11	22		4	8	
Years of farming experience						
1-5	11	22		15	30	
6-10	9	18		6	12	
11-15	13	26	25	9	18	20
16-20	7	14		11	22	
Above20	10	20		9	18	

Gross Margin Analysis of Male and Female Maize Farmer

The estimated gross margin analysis for both male and female maize farmers is shown in Table 2. The table shows that total variable costs constituted 55.53% and 58.99% of the total cost of production for male and female maize farmers respectively, while the total fixed cost constituted 44.47% and 41,01% for both male and female maize farmers respectively. The confirmation of profitability of maize for both male and female farmers is shown by the net farm income of N11,714.27/ha and N12,755.84/ha respectively.

TABLE 2
Estimated gross margin analysis for maize production in Kogi State

	Male farmers		Female farmers	
Cost Items and Revenue	**Cost (N /ha)**	**% of Total cost**	**Cost (N /ha)**	**% of Total cost**
Variable Cost				
Hired labour cost	1150.53	10.44	1236.11	15.24
Fertilizer cost	2975.53	26.99	2132.41	26.28
Herbicide cost	858.77	7.79	496.30	6.12
Seed cost	476.32	4.32	437.96	5.40
Insecticide cost	659.65	5.98	482.41	5.95
Total variable cost	**6120.80**	**55.53**	**4785.19**	**58.99**
Fixed cost				
Farm tools	2182.54	19.80	1578.27	19.45
(Depreciation)	220.09	1.20	0.00	0.00
Interest on loan	2,500.00	22.68	1750.00	21.56
Land rent	**4,902.63**	**44.47**	**3,328.27**	**41.01**
Total fixed cost	**11,023.43**	**100.00**	**8,113.46**	**100.00**
Total Cost				
Returns	**22,737.70**		**20,869.30**	
Gross income	**16,616.90**		**16,084.11**	
Gross margin	**11,714.27**		**12,755.84**	
Net farm income	**2.71**		**3.36**	
Return on naira invested	**0.27**		**0.23**	
Operating ratio	**0.37**		**0.30**	
Gross ratio				

Also the return on a Naira invested is N2.71 for men and N3.36 for women, while the gross and operating ratios for men were 0.37 and 0.27 respectively, and that of their women counterpart were 0.30 and 0.23 respectively. This showed that women were more profitable and successful in maize production than their men counterparts. The profitability ratio for women was less than that of their men counterpart, indicating that women return per naira was higher than that of their men counterpart.

Production analysis

The summary statistics of the variables for the allocative efficiency estimation is presented in Table3. They include the sample mean and the standard deviation for each of the variables. The average output of maize for men farmers was 1041.40 kg obtained from about 1ha while their female counterparts recorded an average output of 586kg from about 1ha which suggested that the study covered small-scale family managed farm units. The average labour for both male and female farmers were 41.88 and 31.10 man- days respectively showing that maize farmers relied heavily on human labour to do most of the farming operations in the study area. All these findings exemplified the nature of subsistence farming which dominates agricultural production in Nigeria. The minimum and maximum ages of men farmers were 25 and 58 years respectively while the minimum and maximum ages of their women counterparts were 30 and 60 years respectively. Also, Table 3 showed that men farmers were relatively younger in age (mean age of about 47 years) when compared with their women counterparts mean age of about 48 years).

TABLE 3
Summary statistics of the variables for maize farmers in Kogi State.

	MEN				WOMEN			
Variables	**Mean**	**S.D**	**Min.**	**Max.**	**Mean**	**S.D**	**Min**	**Max**
Output (kg)	1041.40	1068.0	100.00	6000.00	586.40	260.50	100.00	1800.00
Farm size (ha)	1.14	0.53	0.50	2.00	1.10	0.90	0.50	7.00
Seed (kg)	11.10	4.17	8.00	18.00	9.60	3.20	8.00	16.00
Fertilizer (kg)	124.92	72.36	50.00	550.00	93.1	24.10	50.00	150.00
Labour (ha)	41.88	1.18	20.10	109.50	31.10	13.80	16.30	104.40
Agrochemical (litres)	2.29	0.93	1.00	7.00	1.70	0.70	1.00	3.00
Age (years)	46.98	11.38	25.00	58.00	47.9	8.40	30.00	63.00
Years spent in school	7.68	4.44	0.00	16.00	5.3	4.70	0.00	13.00
Farming experience (yrs)	25.16	12.78	6.00	50.00	19.7	9.50	7.00	50.00
Household size	4.36	1.76	2.00	9.00	4.9	1.70	2.00	9.00

S.D = Standard Deviation, MIN = Minimum, MAX = Maximum

TABLE 4
Estimated Double-log production function (lead equation)

	MEN		WOMEN	
Variables	**Regression coefficients**	**t-values**	**Regression coefficients**	**t-values**
Constant	-4735.02	-1.975*	-2468.352	-3.121***
Farm size (X_1)	308.42	2.798***	-74.416	$-0.955^{N.S}$
Seed(X_2)	176.45	2.357**	281.460	2.099**
Fertilizer (X_3)	102.49	2.348**	330.735	2.249**
Labour (X_4)	216.71	$0.630^{N.S}$	235.849	1.990*
Agrochemical (X_5)	-375.26	$-0.917^{N.S}$	182.981	2.144**
R^2	0.549		0.571	
F-ratio	2.918***		3.274***	

*** = *Significant at 1% level of probability,* ** = *Significant at 5% level of probability*
* = *Significant at 10% level of probability and NS: Not significant.*

The production function that was used to determined the nature of input –output relationship in maize production is shown in the table 4 (double-log production function as the lead equations). The values of coefficients of determination (R^2) for men and women were 0.549 and 0.571 indicating that 54.90% and 57.10% variation in the outputs of men and women maize farmers respectively were explained by the inputs indicated in the regression model (Table 4). The F-ratio for men was 2.918 and significant at 1% level of probability while that of women was 3.274 and significant at 1% level of probability, implying that the variables significantly explained variations in the gross output. The table also shows that farm size (X_1), seed(X_2), fertilizer (X_3) were significant in men farmers regression model while seed (X_2) fertilizer (X_3), labour (X_4) and agro-chemicals (X_5) were significant in their women counterpart.

Allocative Efficiency: The efficiency indicator in Table 5 revealed that all the significant variables in the regression models for both male and female farmers were under-utilized. Efficiency and productivity could be improved if the farmers use more of these resources.

TABLE 5
Estimated efficiency ratio

	MEN			WOMEN		
VARIABLES	**MVP**	**MFC**	**r**	**MVP**	**MFC**	**r**
Farm size	281744	7500	37.56			
Seed	16554	110	150.49	17192	110	156.29
Fertilizer	8544	110	77.67	2083	110	18.94
Labour				4447	350	12.71
Agrochemical				63117	950	66.44

NA= Not Applicable (i.e. the variables are not significant)

Elasticity of production inputs and returns to scale: Findings in Table 6 showed that the estimated elasticity of land was positive which implies that the use and allocation of land by male farmers was in the stage of economic relevance of the production function (that is stage 1). However, the estimated elasticity of land for women farmers was negative, indicating over-utilization and in stage III. The summation of the elasticities of 428.84 and 956.61 for men and women respectively obtained showed an increasing return to scale and that maize production was in stage I of the production region in the study area.

TABLE 6
Elasticity of production resources and return to scale for men and women maize farmers in the study area.

Input	MEN Elasticity	WOMEN Elasticity
Farm size	308.45	-74.42
Seed	176.45	281.46
Fertilizer	102.49	330.735
Labour	216.71	235.85
Agrochemical	-375.26	182.98
Return to scale	**428.84**	**956.61**

CONCLUSION AND RECOMMENDATIONS

This study examined allocative efficiency of men and women maize farmers in Kogi State, Nigeria. The profitability analysis revealed that women farmers were more profitable in maize production than their male counterpart. The study also showed that farm size (X_1), seed(X_2), fertilizer (X_3) were significant in male farmers' regression model while seed (X_2) fertilizer (X_3), labour (X_4) and agro-chemicals (X_5) were significant in their women counterpart. The study also revealed that all the significant variables in the regression models for both male and female farmers were under-utilized. The return to scale values showed that that maize production was in stage I of the production region in the study area.

It is recommended that the present level of allocative efficiency of maize production in the study area should be increased by using more of these productive resources. Farmers should also be encouraged to take into the advice of the adequately trained extension advisers on improved techniques of maize production such that there will be increase in yield per hectare.

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