Journal of Biology, Agriculture and Healthcare
ISSN 2224-3208 (Paper) ISSN 2225-093X (Online)
Vol.3, No.3, 2013

Farm Size, Land Tenure Systems and Technical Efficiency of Maize Farmers in Ogbomoso Agricultural Zone of Oyo State

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Abstract
The study was designed to provide an empirical measure of association between land tenure, farm size and Economic efficiency of maize farmers in Ogbomoso Agricultural Zone in Oyo State. The specific objectives are to identify the socio-economic characteristics of the respondents, to determine the size and tenure effect on efficiency, determine efficiency of maize farmers and to estimate the determinant of efficiency among farmers. Structured questionnaire was utilized to collect the relevant data from a sample of 150 farmers within the study areas using multi stage sampling techniques. Out of the 150 copies of questionnaire, 125 were collected and analysed by descriptive statistics and non-parametric techniques
. Data envelopment analysis (DEA) and Tobit were employed to determine the efficiency and to estimate the determinant of efficiency among farmers. The results show that most of the farmers are within the age range of 51 years and above; majority of the farmers (96.8%) are married and about 79.2% have formal education. The results also revealed that 92% of the farmers have farming experience of 11 years and above; the household size of 3 or less 18.4% accounts for the respondents. Problem faced by the farmers are the low number of the extension agents as 72.8% of the respondence were not visited at all by the extension agents. The DEA reveals that there is significant difference between mean technical efficiency of farmers operating under different land tenure systems. . The technical efficiency result suggested that farmers who inherited the land holdings have 51% potential to increase their production and renter 62% while farmers who purchased their land have 19% potential of increasing their production. .
The Tobit model obtained by maximum likehood estimate revealed that the explanatory variables fitted in the model have significant impact on technical indexes. Farm size, chemical inputs, year of experience credit availability were significant at 1% while extensions was significant at 5%.
Keywords : Landtenure ,technical efficiency,farmsize,DEA,Tobit

1.Introduction

Land is the most important economic resource in any country, and is particularly
important in developing countries with largely rural population, where most people earn a living through agriculture. The question of who has the right to cultivate agricultural land, and on what terms is thus of Immense importance both socially and economically.
One of the major obstacles to the Nigerian agricultural development is the land tenure system. It determine the quantum of rights, kinds and nature of access that the farmer may have and consequently the way he uses land. The need for men to satisfy his increasing requirements on an essentially inelastic supply of land, coupled with continuing increase in population growth under the basis of relationship between man and land (Famoriyo, 1979).
Timmons (1972) identified land tenure as right on land and its resources as yield by individuals and by group under rules of the society. Institutional arrangement with respects to the ownership and cultivation of agricultural land vary considerably both between and within countries.

Famoriyo (1971) as quoted by Lawal (1994) group the major form of land tenure in Nigeria into three Viz:
-Customary tenure, which may be based on any criteria such as feudal communal and use – right specifications of the society;
-Contractual tenure, which encompasses tenancy arrangements and ownership;
-Estate tenure systems such as direct labour with share tenancy, direct labor with permanent or short period tenancy and stock – land leases.

Riddell and Dickerma (1986) observed that despite the implementation of Land Use Decree of 1978 in Nigeria, which transformed every individual and society into tenants of the government, the majority of the rural people still hold and occupy their land as they did traditionally. Under the customary tenure, the Nigerian cultivator can be described as a sort of tenant at will who has possessory rights in land by virtue of the fact that he is a member of a given family, clan, lineage, or community. To this extent, a farmer has an unlimited right of a user, thus he can grow any type of crop he wishes to grow on the land both seasonal and cash crops of long term fruitation. However, the traditional values also require that every individual should have a stake in the most important assets of the community. In this case, an individual who does not intend farming also maintain an interest in the family land, and may tie over part of the land for his own indefinite use thus preventing other members from making effective use of the land.(Lawal, 1994).
In Nigeria, there are about 300 ethnic group (Meek, 1957) as reported by Idowu (1990). However, the kind of man – to – land relationship which has been evolved by these groups, the privileges, opportunities, rights and duties associated with membership, the injunctions and penal sanctions established, are the ingredients of the Nigerian land tenure system which greatly influenced development of agriculture in the country over the years.
Udo (1985) opined that the adoption of more input intensive agriculture as a result of population growth and consequently its farm size requirement will necessitate important adaptation in the existing Land Use Act of 1978.
In order to improve maize production and productivity, an efficient use of production inputs has to be adopted by smallholder farmers. An understanding of the relationships between productivity, efficiency, policy indicators and farm-specific practices would provide policy makers with information to design programs that can contribute to increasing food production potential among smallholder farmers (Msuya *et al.*, 2008). In Wolaita and Gofa areas of southern Ethiopia, information on the levels of productivity of maize and farm household technical efficiency in its production is lacking. Therefore, the present study was designed to determine the productivity of smallholder maize production and assess the technical efficiency of maize producer farmers and identify its determinant factors.

3.0 Methodology

The study was carried out in Oyo State of Nigeria. The state is divided into four agricultural zones these are Ibadan, Oyo, Saki and Ogbomoso zones.
Ogbomoso Agricultural Zone was selected for the study. Ogbomoso is among largest cities in Nigeria. It is the second largest in the Oyo state. It played a leading role in the great ethnic wars during the late 19th century. It was formerly a dense and not the open Savannah grass land it is today. This is due to anthropogenic factors such as bush burning and deforestation (Alao et al 2003).
The topography is one of undulating plains. Its transitional location between the forest and savannah vegetational belt places her in a unique position to support both forest tuberous crops like yam and cassava as well as savannah grains like maize, guinea corn and so on.
Ogbomoso Agricultural Zone comprises of five local governments namely: Ogbomoso North, Ogbomoso South, Surulere, Ogo – Oluwa, and Orire Local Governments. The indigenes of these local governments are predominantly Yoruba of Ogbomoso origin punctuated by other inhabitants, which cut across racial, religion and ethnic background.
The study areas is characterized by the two distinct seasons: the rainy season and the dry season. The rainy season is from March/ April to October while the dry season is from November to March/ April. The rainfall pattern has a characteristic bi – modal distribution with peaks in June and September and a period of fewer precipitations in August.

3.1 Sample size/Technique

A total of 150 farmers were selected from the zone, that is farmers from each of the five local governments that make up the zone.
Multistage sampling technique was adopted. The first stage, five block that make up the zone were purposively selected and second stage six cell from the block were randomly selected, then five maize farmers were randomly selected from each cell headquarters to arrive at a total of 30 farmers from each block.
The information needed for this study was gathered through the use of questionnaire. Personal contact and enumerator were used to elicit response from the respondents.
The questionnaire was pre-tested and modified before the final administration. The literate among the respondents posed little or no problem since they were able to comprehend and understand the objectives of the study. The questions were translated to Yoruba for the illiterate respondents and their responses were recorded.

The information required from the farmers included, among others, the socio economic characteristic such as age, level of education attained, marital status, nature of occupation (part time/full), farm size, family. Others include the pattern of land acquisition, rent paid, fertilizer usage, farming operation in their area and yields obtained. A total of 125 workable questionnaires were finally collected and analysed.

Various analyses were carried out on the data collected. These include the use of descriptive statistics and non-parametric statistic (Data Envelopment Analysis and Tobit Regression model).

Descriptive statistics which include the use of frequency counts, percentages, minimum and maximum values to present the socio-economic characteristic of the farmers in the use of resources. These are essentially measures of central tendency and measure of dispersion of the data that were collected and analysed.

3.2 Efficiency Determination (DEA Model)

Dependent variables are:

Y_1 = Yield of maize / tons
Y_2 = Cassava Yield / tons
Y_3 = Yam / tons

Independent Variables are:

X_1 = Farm size in hectare
X_2 = Labour (man days)
X_3 = Fertilizer (kg)
X_4 = Extension contact (nos of visit)
X_5 = Age of the farmer (Yrs)
X_6 = Year of farming experience (Yrs)
X_7 = Education level of the farmers (Yrs)
X_8 = Herbicide (litres)
X_9 = Planting material (#)

Marital status dummy:

X_{10} = Married 1, others 0

3.3 Model specification

Data Envelopment Analysis (DEA) is used to derive technical, scale, allocative and economic efficiencies. Technical efficiency was estimated using different assumptions like Constant Return to Scale (CRS) Variable Return to Scale (VRS) and Non - Increasing Return to Scale (NIRS).

Given data K inputs and Q outputs for each N respondents. The column vectors Xi and Yi represent these respectively. The K.N input matrix, X and the Q * N output matrix, Y represent the data for all N respondents. For each respondent, the ratio of all outputs to overall inputs such as:

$$\frac{U' y_i}{V' X_i}$$

Is obtained where U is a Q* 1 vector of output weight and V is an K *1 vector of output weight. The optimal weights are obtained by solving.

$$\begin{aligned} &\text{Min} \quad \phi\lambda \quad \phi \\ \text{st} \quad - \quad & y_i + y\lambda \geq O \\ & \phi X_i - X\lambda \geq O \qquad \text{----------(1)} \\ & \lambda \geq O \end{aligned}$$

Where ϕ is the scalar and λ is N *! Vector of constant. The value ϕ obtained will be the efficiency score for the ith respondent. It will satisfy $\phi \leq 1$, with a value of 1, indicating point, on the frontier and hence technically efficient according to Farrell (1957) definition. A value of less than 1 indicates technical inefficiency.

Equation (1) can be modified for VRS assumption and this scale efficiency (SE) effects.

$$\begin{aligned} &\text{Min} \quad \phi > \phi \\ &\text{St} \quad - X\lambda \geq O \\ &\phi X_i \quad - X\lambda \quad \geq O \qquad \text{---------- (2)} \\ &NI\lambda \quad = O \\ &\lambda \quad \geq O \end{aligned}$$

To obtain the S.E, technical efficiency (TEcrs) will be decomposed into pure technical and scale inefficiency.

If there is difference between the TEcrs and TEvrs score for a particular respondent, this indicates there is scale inefficiency. According to Shama et al (1998) VRS is more flexible and envelops the data in a more tightly than the CRS analysis.

The TEcrs measure (ϕvrs) is equal to or greater than the TEcrs measure (ϕcrs). This relation is used to obtain a measure of scale efficiency (SE) of the ith respondent.

SE_i = θicrs /θivrs

Where SE = 1 indicates scale efficiency or CRS and SE < 1 indicates scale inefficiency.

The basic model structure which this literature applies is.

Zi = X1β + εi,…… ……(1)

Where Zi denotes a latent economic quantity of interest i Xi Ξ (Xi1,Xi2,…,Xik) denotes a vector of characteristics associated with latent Zi, β Ξ (β , β2, …, βk deipicts the relationship between the characteristics and latent Zi, εi normally distributed with mean Zero and variance δ2, that is, εi ̃N(0, δ)I and for each I = 1,2,…n, e observe

Yi =max [zi,0). … …….(2)

Eqs.(1) and (2) comprise the standard tobit model in which the point censoring –henceforth, Π is assumed to be Zero. The situation we are interested in is when Eq. (1) is applied but, instead of Eq. (2) governing the censoring of data, they are instead governed by the rule. yi =Zi if yi ≥ Π and yi = 0 otherwise……(3)

We refer to Eqs. (1) and (2) as the conventional model and refer to Eqs. (1) and (3) as the true model.

The two models are, of course, identical when Π equals Zero and, although, it may be possible to infer the exact point of censoring in rare situation, usually the value of Π will not be known a priori.

4 .0 Result And Discussion

Socio-economic Characteristic of Respondents and Land Tenure Systems within the Study Area

The information on the age distribution of the respondent farmers are presented in Table 1 From the table it is observed that 43.2% have their age ranging from 25 to 50 years. This represent the most productive age for farming when a lot of farming experience would have been acquired by the farmers and they are still energetic to meet the rigorous demand by farming as a business while 56.8% were in the age 50 years and above (agriculturally less active ages).

. There are many educated farmers in the zone representing 74.4% while 26 farmers representing 20.8% can be regarded as not educated in the zone. Education has been known to influence the adoption of innovation by farmers. The adoption of innovation is also positively related to the level of farm investment.

In summary, a total of 93 farmers, representing 79.2% of the farmers interviewed, have some form of education. This is an encouraging result, because farmers will tend to adopt innovations and new technologies faster and better use of their resources. It is often claimed that any modernization of the rural sector should be rooted to increase in the general level of education, so that rural populace can understand and handle new and more complex farm practices and or technologies, which come with modernization of the rural sectors. Education will induce economic motivation, widen farmers social and economic horizon, and predispose them to greater receptivity of new ideas (Ogunfowora et al; 1974

The number of family member being fed, clothed and housed by a farmer can be an important indicator of his productivity on the farm provided the farmer has no other major business apart from farming.

A,total of 23 farmers representing 18.4% have household size of 3 or less while 40 farmers have between 7-10 family size (representing 32.0%).

The result shows that 55.2% representing 69 farmers sampled had between 1 and 4 hectares of farmland cultivated. Also, 21.6% of the farmers representing 27 farmers cultivated between 5-8 hectares of land. Another 20 farmers representing 16.0% cultivated between 9-12 hectares. This might due to easy accessibility to land acquisition and access to tractors for clearing operation. Only a farmer had between 12 to 20 hectares representing 7.2%. The summary is that great number of Farmers cultivated small farmland

The result shows that no farmer has less than 5year experience, while about 26 farmers (representing 20.8%) had experience of between 6-15years of farming.

The greater proportion (17.6%) of the respondents had between 16-20 years of farming experience, 33 farmers, representing 26% of the total number of the farmers have farming experience of more than 40 years. This is still relatively high, and may be due to the fact that the environment or area is rural. The summary of this is that 92% of the

farmers have farming experience of 11 years and above. This indicates that most of the farmers are well experienced in farming.

According to Preckering (1983) agricultural extension is the vehicle for increasing agricultural productivity since it links the farmers with the outside world, the scientists and the consumer of his product.

it shows that only 18 farmers representing 14.4% of the respondents have contact with extension agent forthnightly, while 30 and 77 farmers representing 24% and 61.6% respectively were having contact with extension agents quarterly or not at all.

Awolola (1986) opined that for farmers to hear of extension service is not enough but also the need to have contact with extension agents, who will deal with each farmers in relation to his problems.

In summary, absence of extension agent reduces the source of information to the farmers on agricultural innovations at all stages of adoption and therefore reduce the efficiency of production.

This result showed that most half of the respondents (57) inherited their farmland, which consequently, results in fragmentation of land, when the land is being shared or divided among various beneficiaries (mostly children of the owner). This is responsible for the small hecterage of land cultivated by farmers. This represents 45.6%of the total respondents. Fifty farmers (representing 40.0% of total number of respondents), acquired their land through rentage. They are restricted to cultivation of certain crops, which are mostly biennials, or crops that mature within a maximum of one year. Tree crops are not cultivated by these groups of farmers. Farmers who acquired their farmlands through purchase represented 14.4% (18 farmers). This may due to high cost of land in the area.

Table 1:Socio-Economics Characteristics of maize Farmers in the study area

Characteristics	**Frequency**	**Percentage %**
Age (years)		
25 – 30	3	2.4
31 – 35	8	6.4
36 – 40	10	8.0
41 – 45	16	12.8
46 – 50	17	13.6
> 50(above)	71	56.8
Marital Status of Respondent Farmers		
Single	4	3.2
Married	121	96.8
Educational Level.		
Non-Formal Education	32	24.6
Primary	37	29.6
Secondary	42	33.6
Tertiary	14	11.2
Family Size Of The Farmers		
≤ 3	23	18.4
4 – 6	41	32.8
7 – 10	40	32.0
>10 (above)	21	16.8
Farm Size Of The Respondent Farmers		
1-4	69	55.2
5-8	27	21.6
9-12	20	16.0
13-16	3	2.4

17-20	6	4.8

Farming Experience Of Farmers.

≤ 5	00	-
6-10	10	8
11-15	16	12.8
16-20	22	17.6
21-25	9	7.2
26-30	14	11.2
31-35	8	6.4
36-40	13	10.6
>50(above	32	26.4

Contact with extension agent

Forthnight	18	14.4
Quarterly	30	24.0
Not at all	77	61.6

Method Of Land Acquisition By The Farmers

Inherited	57	45.6
Rent	50	40.0
Purchased	18	14.4

Source: Field Survey, 2005.

Table 2 Technical Efficiency, scale efficiency of pooled Data of DEA

All the data were pooled together to see if there is any interaction in the method of land acquisition for farming activities.From the table 2 the estimated mean of technical efficiency for CRS,VRS,DRS and SE DEA model are 0.27,0.42,0.31 and 0.62 respectifully.This is an indication that ther are considerably inefficiencies of farming of farming activities in the study area.

Under the CRS model, only 11 farmers representing 10 .O8% of the 120 farmers are fully efficient while the remaining 109 are inefficient .Also VRS DEA model revealed that 23 farmers representing 19.16% are fully efficient .The efficiency measure derived from VRS DEA model is greater than those derived under CRS DEA model

The DRS model revealed that 19 respondents are operating under full efficiency representing 15.83%.The mean scale efficiency is 0.62 .Thirteen of the respondents show constant return to scale, 51 decreasing returns to scale and 56 increasing return to scale. Among the scale inefficiency farmers most of the large scale farmers shows increasing returns to scale

Table 3 Frequency Distribution of Technical Efficiency Scale efficiency of pooled Data on DEA

Efficiency scores Class Interval	CRS Frequency	%	VRS Frequency	%	DRS Freq	%	SE Freq	%
0.10-0.19	67	55.83	43	35.83	60	50	16	13.33
0.20 – 0.29	18	15.00	19	57.83	18	13.33	13	10.83
0.30-0.39	9	7.5	10	8.33	10	8.33	7	5.85
o.40-0.49	5	4.16	5	4.16	5	4.16	11	0.16
0.50-0.59	5	4.16	6	5.00	3	2.50	9	7.5
0.60-0.69	2	1.66	7	5.83	4	3.33	10	8.33
0.70-0.79	2	1.66	5	4.18	1	0.83	10	8.33
0.80-0.89	1	0.83	1	0.83	2	1.66	15	12.5
0.90-0.99	-	-	-	-	-	-	16	13.33
1.00	11	10.08	23	19.16	19	15.83	13	10.83
TOTAL	120	100	120	100	120	100	120	100
MEAN	0.27		0.42		0.39		0.62	
MINIMUM	0.01		0.001		1.33605		0.008	
MAXIMUM	1		1		1		1	
SD	0.29		0’34		0.33		0.51	

Source: Field survey,2005

Tobit model Estimation Result on Determinant of Technical Efficiency of maize farmers.

The tobit regression model was used to assess the factors associated with technical efficiency. The technical efficiency measures were regressed on farm size, chemical inputs, credit, extension, age, year of experience, education and household.

The estimation and identification of specific factors that affect technical efficiency is of profound relevance for formulating strategies necessary to narrow the prevailing efficiency gap and increased productivity. The estimated regression coefficients for the Tobit model reported in Table 4 were obtained by maximum like hood estimation. The variables were tested at 1%, 5% and 10% level. The result revealed that the explanatory variable fitted the model and were significant at 1% and 5%. Farm size, chemical inputs, year of experience, credit availability were significant at 1% while extension was significant at 5%.

The positive coefficient of variables revealed and important determinant of efficiency. Accessibility to credit facilities will cause the efficiency to rise.

The results also showed that estimated coefficient of farm size and chemical were negative and statistically significant at 1%. This mean that for every farm size and chemical inputs used; the farmers' efficiency will rise as a result of economies of size.

Table 4 Tobit model Estimation Result on Determinant of technical efficiency of maize farmers.

Variable	*Coefficient*	*T – ratio*
Farm size (X1)	-0.1228	10.92***
Chemical input (X2)	-0.30734	10.02***
Credit (X3)	0.36252	6.68***
Extension (X4)	0.13282E-01	2.42**
Age (X5)	0.21658	1.32
Year of Experience (X6)	0.12879	13..90***
Education (X7)	-0.15926	1.22
Household (X8)	0.51043E-01	0.55
Log-likehood Function	-15.301821	

Source: Field Survey, 2005.
***Significant at 1%, **Significant at 5%

5.Conclussion

The study attempted to investigate the Technical efficiency of maize farmers operating under different land tenure systems in Ogbomoso Agricultural Zone of Oyo State. Different forms of access to land (inheritance, Rent and outright purchase) are now being practiced throughout the zone, providing an ideal context to study the efficiency of alternative tenure arrangement. The study is based on the data generated through a survey of 125 farmers operating in Ogbomoso Zone. The result showed that 57 farmers inherited their farmlands; 49rented land and the remaining 18 were operating on outright purchased land. Most of the farmers were experienced in farming and were still energetic to meet the rigours of farming business. Majority of these farmers (74.4%) received formal education which is known to influence the adoption of innovations, hence farm investment. More than 90% of the respondents are full time farmers. There are more owner – operator farmers than tenant farmers within the study area. The number of plots of farmland cultivated by the farmers range from one to twelve with 70% cultivating between two to four plots of farmlands. These plots are between 0.5 – 1 hectare of land and not contiguous.

Data envelopment analysis showed substantial production inefficiencies among sampled maize farmers and a potential for increasing production through improved efficiency. On the average, the sampled maize farmers would increase their production efficiency by 45 – 50% if they could operate on the efficiency frontier. Moreover, if all producers operated at full efficiency, the increased farm output could reduce the importation and shortage of maize and increased revenue would compensate producers for high production cost and enhance the profitability of maize production. The technical efficiency result suggested that farmers who inherited their land holdings have 51% potential to increase their production and renters 62% while farmers who purchased their land have 19% potential of increasing their production The study attempted to investigate the economic efficiency of maize farmers operating under different land tenure systems in Ogbomoso Agricultural Zone of Oyo State. Different forms of access to land (inheritance, Rent and outright purchase) are now being practiced throughout the zone, providing an ideal context to study the efficiency of alternative tenure arrangement. The study is based on the data generated through a survey of 125 farmers operating in Ogbomoso Zone. The result showed that 57 farmers inherited their farmlands; 49rented land and the remaining 18 were operating on outright purchased land. Most of the farmers were experienced in farming and were still energetic to meet the rigours of farming business. Majority of these farmers (74.4%) received formal education which is known to influence the adoption of innovations, hence farm investment. More than 90% of the respondents are full time farmers. There are more owner – operator farmers than tenant farmers within the study area. The number of plots of farmland cultivated by the farmers range from one to twelve with 70% cultivating between two to four plots of farmlands. These plots are between 0.5 – 1 hectare of land and not contiguous.

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