Productivity of Maize Farmers' in Surulere Local Government Area of Oyo State

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Abstract: Low productivity in Agriculture has been observed to be a problem militating against increased and sustainable farm income. The study therefore undertakes the analysis of maize farmers' productivity in Surulere local government area in Ogbomoso agricultural zone of Oyo State. A multistage sampling technique was used to select 30 maize farmers in the study area. The study used a stochastic frontier production model to estimate the efficiency of the farmers. Results revealed that farm size was statistically significant at 5% level while Seed was positive and statistically significant at 1 percent level. The estimated gamma parameter (γ) of 0.56 in the study, indicates that 56% of the total variation in maize output is due to the technical inefficiencies of the maize farmers in the study. The mean technical efficiency (χ) of the farmers was 0.669 while the return to scale (RTS) in maize farming was 2.302;It was therefore concluded that there is a positive and significant relationship between farm size, quality of seed used and maize output in the study.

INTRODUCTION

Recently, the bulk of maize grains produced in Nigeria were from the southwest zone. Although large proportion of the green maize is still produced in all the southwestern part of the country, there has been dramatic shift of dry grain production to the savanna, especially the Northern Guinea savanna. This can now be regarded as the maize belt of Nigeria; in this zone farmers tend to prefer maize cultivation to other grain species. This trend may have been brought about by several reasons including availability of streak resistant varieties, high-yielding hybrid varieties, increase in maize demand coupled with the federal government imposed ban on importation of rice, maize and wheat. Local production had to be geared up to meet the demand for direct human consumption, breweries, baby cereals, livestock feeds and other industries (Iken and Amusa, 2004).

The importance of sustaining agricultural production to improve standard of living has been recognised by all countries throughout the world. However, in the economic literature of the 1950s and 1960s the role of agriculture in development was considered ancillary to that of the modern industrial sector where most of the accumulation and growth was expected to take place. Subsequent theoretical investigations and the very disappointing performance of agriculture in many developing countries have led to the belief that the role of agriculture in development should be re-examined. Erratic and in-egalitarian growths, persistence of malnutrition, periodic famines together with

increased dependence on food from abroad, have continued. The situation is, however, substantially worse than highlighted by these trends. Indeed, the initial conditions from which low growth has taken place were already quite distressing. Average per capita food supply was conspicuously lower than requirement, while food consumption was traditionally much skewed. Recent investigations have shown that such inequality would appear to have increased even in countries experiencing relatively rapid agricultural growth. Thus, the combined effects of low starting points, slow or negative growth of food output per capital and the worsening of income distribution and food consumption explain the increase in the number of people suffering from deficient food intake and why the food threat continues to hang over many developing countries.

Nowadays, there is a large consensus on the need for increasing agricultural output and improving nutritional standards among farmers. However, views and policies differ widely on how to attain such objectives. A large number of strategies have been proposed ranging from the technology option, which stresses the increased use of modern machinery, pesticides and fertilisers, to others which consider that the existing economic and power structure in agriculture is the major obstacle to rural development. According to the latter view, the provision of more and improved inputs, although necessary, would not be sufficient to ensure a fast and egalitarian growth capable of eliminating rural poverty. The increase in input supply should be accompanied by measures ensuring broadly equal access to land and other productive assets to the rural population; this could be achieved through land redistribution (Giovanni, 1996).

Objective of the Study

The main objective of this research is to analyze the productivity of maize farmers in Surulere Local Government Area of Oyo State. The specific objectives are to:

i.   determine the technical efficiency of maize production in the study area and

ii. examine the determinants of maize output in the study area.

Hypotheses of the Study

The hypotheses of the study, stated in null form (H_0), are as stated below:

i.   There is no significant relationship between farm size and maize output.

ii. There is no significant relationship between the quality of seed used and maize output.

LITERATURE REVIEW

Concept of efficiency and production

Efficiency is the act of achieving good result with little waste of effort. It is the act of harnessing material and human resources and coordinating these resources to achieve better management goal. Farrell (1957) distinguished between types of efficiency (a) Technical Efficiency (TE), (b) Allocative Efficiency (AE) and (c) Economic Efficiency (ER), by saying that farm efficiency can be measured in terms of all these type of efficiency. The appropriate measure of technical efficiency is input saving which gives the maximum rate at which the use of all the inputs can be reduced without reducing output. Technical efficiency is defined as the ability to achieve a higher level of output, given similar levels of inputs. Allocative efficiency deals with the extent to which

farmers make efficient decisions by using inputs up to the level at which their marginal contribution to production value is equal to the factor cost. Technical and allocative efficiencies are components of economic efficiency (Abdulai and Huffman, 2000).

Production is defined as the transformation of goods and services into finished products (that is input-output relationship) and this is also applied to every production process, maize production inclusive. Olayide and Heady (1982) defined production process as one whereby some goods and services called inputs are transformed into other goods and services called output. In agriculture, the physical inputs which we use are: land, labour, capital and management. Pitt and Lee (1981) have estimated stochastic frontiers and predicted firm-level efficiencies using these estimated functions, and then regressed the predicted efficiencies upon firm –specific variables such as managerial experience, ownership characteristics etc in an attempt to identify some of the reasons for differences in predicted efficiencies between firms in an industry. This has long been recognized as useful exercises, but the two-stage estimation procedure has also been long recognized as one, which is inconsistent in its assumptions regarding the independence of the inefficiency effects in two estimation stages. The two-stage estimation procedure is unlikely to provide estimates, which are as efficient as those that could be obtained using a single stage estimation procedure.

Stochastic Frontier Production Function

Empirical estimation of efficiency is normally done with the methodology of stochastic frontier production function. The stochastic frontier production model has the advantage of allowing simultaneous estimation of individual technical and allocative efficiencies of the farmers as well as the determinants of technical efficiency (Battese and Coelli, 1995). Economic application of stochastic frontier model for efficiency analysis include Aigner *et al*., (1977) in which the model was applied to US agricultural data, Battese and Corra (1977) applied the technique in the pastoral zone of eastern Australia, Ogundari and Ojo (2005), Ajibefun *et al*., (2002), Bravo Ureta and Pinheiro (1993) and Ali and Byerlee (1991) in which they offer comprehensive review of the application of the stochastic frontier model in measuring the technical and economic efficiencies of agricultural producers in developing countries. Technical efficiency is the ability of the firm to produce the maximum output from its resources. One firm is more technically efficient if it produces a level of output higher than another firm with the same level of input usage and technology. Measures of technical efficiency give an indication of the potential gains in output if inefficiencies in production were to be eliminated. Recent measures of technical efficiency in the Soviet Union have been incongruous with the presumption that bureaucratic obstacles in the command-economy system inherently foster waste in resource utilisation and inefficiencies in production. Koopman (1989), in his analysis of time-series data of aggregate Soviet Republic agricultural production, estimated that the average level of technical efficiency in Soviet Agriculture is almost 95 percent, with little variability among the republics.

Technical efficiency was also defined by Koopmans (1951), as the ability to minimize input use while maintaining a given output level, or the

ability to maximize output production while fixing the amount of input use. The ideas of production function can be illustrated with a farm using n inputs: X_1, X_2 … X_n, to produce output Y. Efficient transformation of inputs into output is characterized by the production function f (Xi), which shows the maximum output obtainable from various inputs used in production. Therefore, for the sake of this study, the stochastic frontier production function in which Cobb-Douglas was proposed by Battese and Coelli (1995) and confirmed by Yao and Liu (1998) represents the best functional form of the production frontier and was used for data analysis in order to better estimate the inefficiency of the maize farmers in this study.

METHODOLOGY

The study area - The study was carried out in Surulere Local Government area in Ogbomoso Agricultural zone of Oyo State; this LGA comprises of different villages, which are rural in nature. Ogbomoso is located approximately on the intersection of latitude $8^0 08'$ North and longitude $4^0 15'$ East. It is about 105 km North East of Ibadan (State capital), 58 km North West of Osogbo, 53 km South West of Ilorin and 57 km North East of Oyo town. The population was approximately 166,034 as of 2006 census, an area of 3542.82 square kilometres with about 60% of the dwellers being civil servants and also engaged in farming (both crops and animal production), Ogbomoso is regarded as a derived Savannah vegetation zone and a low land rain-forest area.

Sampling procedure - Maize farmers are the respondents for this study; forty small holder maize farmers were selected from the local government, but only thirty was used for the study.

The sampling technique employed is a multi-stage stratified random sampling technique. The first stage involved purposive selection of small scale maize farmers from these rural areas such as, Gambari, Igbon, Saba ode, Arolu, Araromi and Sadiwin respectively because the farmers are more concentrated in this area. The second stage involved a systematic simple random sampling to draw thirty maize farmers from the constructed sample frame through random selection of five farmers per settlements.

Research instrument - Questionnaire and interview schedule were the research instruments used for this study to collect information such as the physical quantities of production inputs and outputs from the farmers. While the test retest method was used to determine the consistency of the research instrument, the instrument was administered thrice on an interval of one week.

Data collection - Primary data were obtained with the interview schedule administered to the maize farmers. Also, observations and additional information given by the farmers that were not covered by the interview schedule were also recorded.

Data analysis

The data obtained from the field were subjected to analysis using inferential statistics. The Stochastic frontier production model was used to determine the relationship between the dependent variable (maize output) and the independent variables as well as to determine the technical efficiency in farmers operation in the study area.

Model Specification

Y = f (X_1, X_2 …Xn) ………………equation (1)

Y = Output, value of total maize produced (kg)

X_1 = Farm size (hectares)

X_2 = Family labour (man day)

X_3 = Hired labour (man day)

X_4 = Seeds (kg)

X_5 = Fertilizer (kg)

The stochastic frontier production model

Linear function

$$Y = b_0+b_1X_1+b_2X_2+b_3X_3+b_4X_4+b_5X_5+\mu+v....$$ equation (2)

Cobb-Douglas Production Frontier Function

$$LnY_i = LnA+\sum_{I=1}^{5}\beta_iLnX_i+V-U \ldots\ldots\ldots equation (3)$$

$$lnY = b_0+b_1lnX_1+b_2lnX_2+b_3lnX_3+b_4lnX_4+b_5lnX_5+\mu+v \ldots\ldots equation (4)$$

Inefficiency model

$$U_i = \delta_0 + \sum \delta_i Z_i \ldots\ldots\ldots\ldots equation (5)$$

$$U_i = \delta_0+\delta_1Z_{1i}+\delta_2Z_{2i}+\delta_3 Z_{3i}+\delta_4Z_{4i} \ldots equation (6)$$

Where

Z_1 = level of education

Z_2 = Years of farming (year)

Z_3 = Family size (number)

Z_4 = Land right (dummy, with land right=1, without land right=0)

Where Y = dependent Variable,

X_i = independent Variables

μ and v = error term, b_1's = parametric estimates and b_0's = the intercept term

A and B_i = parameters to be estimated (i = 1, 2... 5)

X_i = the vector of (transformations of the) *i*th input used by *j*th farm

β = is a vector of unknown parameters and

V = random variables

U = non-negative random variables which are assumed to account for technical inefficiency in production.

δ_0 and δ_i = parameters to be estimated (i = 1, 2,........4) together with the variance parameter.

$$\sigma^2_s = \sigma^2 + \sigma^2_v$$
$$\sigma^2 = \sigma2v + \sigma^2_u$$
$$\lambda = \sigma_u / \sigma_v$$
$$\gamma = \sigma2u /\sigma^2_v$$

This measures the effect of Technical Efficiency variation of observed output.

γ >1 this indicates that one-sided error dominates the symmetry error indicating a good fit and correctness of the specified distribution and assumption.

On the assumption that V_i and U_i are independent and normally distributed, the parameters β, σ^2_u,σ^2_v, σ^2, γ and λ were estimated by the method of Maximum Likelihood Estimates (MLE), using the computer FRONTIER Version 4.1 (Coelli, 1996) which also computed the estimates of Technical Efficiency.

RESULTS DISCUSSION

Estimates of the stochastic frontier function

The cobb Douglass production function was adopted for this result compare to the Ordinary Least Square (OLS) functional form because of the higher number of significant variables and it also caters for both increasing and decreasing returns to scale unlike the linear functional form which considers only the constant returns to scale which rarely exist in agricultural production activities.

The parameters and related statistical test results obtained from the stochastic frontier production function analysis are presented in Table 1.There is a positive and significant relationship between farm size and maize output in this local

government area. Land is therefore a significant factor associated with changes in output in this local government area. The coefficient of seeds is positive and statistically significant in the local governments' area. This implies that seed is a positive factor influencing maize output in the study area. In other words, the more the quality (variety) of seeds used in kilogram, the more the output of maize produced.

Sources of inefficiency

The sources of inefficiency were examined using the estimated (δ) coefficients associated with the inefficiency effects in Table 1, the inefficiency effects are specified as those relating to education, experience, family size and land right.

The estimated coefficient of education is appropriately signed (apriori expectation) in this study and statistically significant. The implication is that farmers with more years of formal education tend to be more technically efficient in maize production, presumably, due to their enhanced ability to acquire technical knowledge, which makes them closer to the frontier output.

The estimated coefficient of farming experience is positive and statistically significant at 5 % in this Local Government Area. The positive coefficient indicates that farmers with more years of farming experience are relatively less technically efficient or more inefficient in maize production.

The estimated coefficient of family size is positive and insignificant in the study. This implies that maize farmers with more family size tend to be more technically efficient in maize production.

Return to Scale

The Return to Scale (RTS) in maize farming was 2.302 in Surulere LGA; this indicates a positive increasing return to scale in this area, which implies that maize production was in stage I of the production surface. This shows that effort should be made to expand the present scope of production to actualize the potential in it. That is, more of the variable inputs should be employed to achieve more output.

The diagnostic statistics

The estimated sigma square for maize production in Surulere LGA (0.017) is significantly different from zero at 1 percent. This indicates that one sided error term dominates the symmetry error indicating a good fit and the correctness of the specified distributional assumptions. Therefore if γ is statistically different from zero implies that traditional average (OLS) function is not an adequate representation for the analysis.

Determinants of technical efficiency

The determinants of technical efficiency of the maize farmers in the study area include farm size, seed, and year of maize farming experience. The implication is that the variables greatly impact on the TE of the maize farmers in the Local Government Area, which means that the tendency for any maize farmer to increase his productions depend on the amount of farm size and seed available to him in the study area.

Gamma parameter (γ)

The estimated gamma parameter (γ) of 0.56 in the study area indicates that 56% of the total variation in maize output is due to the technical inefficiencies in the Local Government Area.

Table 1: Results of the frontier estimates for the Study area
Ordinary Least Square result

Variables	Parameter	Coefficient	T-ratio
Constant	β_0	-1.584	-1.541
Farm size	β_1	0.332**	2.433
Family labour	β_2	0.019	0.263
Hired labour	β_3	0.096	1.117
Seeds	β_4	0.306 ***	3.152
Fertiliser	β_5	1.262 ***	2.105

Maximum Likelihood Estimator result

Variables	Parameter	Coefficient	T-ratio
Constant	β_0	1.851	-2.167
Farm size	β_1	0.324 *	2.973
Family labour	β_2	0.003	0.050
Hired labour	β_3	0.087	1.305
Seeds	β_4	0.233 ***	2.719
Fertiliser	β_5	1.655	3.346
Inefficiency Model			
Level of education δ_1		-0.060 *	-1.708
Years of farming δ_2		0.009**	1.956
Family size δ_3		0.039	1.464
Land right δ_4		-0.089	-1.113
RTS		2.302	
Sigma squared σ^2		0.017 ***	3.610
Gamma γ		0.56	0.424
Mean efficiency χ		0.669	
Log Likelihood Function		19.655	

Notes: * =10%; ** = 5%; *** = 1% level of significance
Source: Result from data analysis, 2007.

N.B: if the estimate for the γ (gamma) parameter in the stochastic frontier production function is quite large, which means that the inefficiency effects are highly significant in the analysis of the value of output of the maize farmers.

Technical efficiency for the study area

In Surulere local government, the predicted technical efficiencies differ substantially among the maize farmers; ranking from 0.484 and 0.895 with the mean technical efficiency estimated to be 0.669, a frequency distribution of the technical efficiencies is presented in Table 2 and figure 1. This shows that the highest numbers of farmers have technical efficiencies of between 0.6 and 0.7; this also indicated that there is a wider distribution of

technical efficiencies among the maize farmers in the area, which revealed that there is a considerable room for effecting improvements in the technical efficiencies of maize farmers in the local government.

Therefore, there is scope for increasing maize production in this LGA by 33.1 percent with the present technology.

Table 2 showing the frequency and decile range of farmers' efficiency

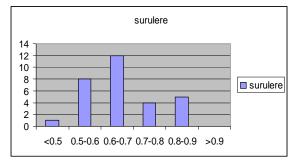| Range	Frequency	Percentage
< 0.5	1	3.3
0.5 – 0.6	8	26.7
0.6 – 0.7	12	40.0
0.7 – 0.8	4	13.3
0.8 – 0.9	5	16.7
> 0.9	0	0.0
Total	30	100.0

Source: Result from data analysis, 2007.

Figure 1. Graph showing decile range of farmers in the study area
Source: Result from data analysis, 2007.

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

The study undertakes the analysis of maize farmers' productivity in Surulere LGA in Ogbomoso Agricultural Zone of Oyo State. A multistage sampling technique was used to select 30 farmers in the study area. Data were collected and subjected to inferential statistics and the Stochastic frontier production model which was used to determine the relationship between the dependent variable (maize

output), the independent variables and the technical inefficiency in farmers' operation in the study area.

The regression results revealed that farm size was statistically significant at 5 % level while Seed was positively and statistically significant at 1 percent level in the Local Government area. The estimated gamma parameter (γ) of 0.56 in the study area, indicates that 56% of the total variation in maize output is due to the technical inefficiencies in the study. The mean technical efficiency (χ) was 0.669 and the return to scale (RTS) was 2.302 in the area.

It was inferred that there is a positive and significant relationship between farm size, seed used and maize output in the study area.

CONCLUSION

It can therefore be concluded that there is a positive and significant relationship between farm size, quality of seed used and maize output in the study area therefore, the Null hypothesis were rejected and also availability and access to good quality seed have positive impact on output and increase in size of production resulting in better output.

Recommendation

Based on the findings in the study area, the following are recommended.

i. Farmers need to organize themselves into groups for easy access to formal sources of credit to acquire the needed farm implements, quality seeds etc.

ii. Also more efforts should be intensified on the part of extension agents in educating the farmers so as to boost their efficiencies in maize production.

iii. Results of better researches of improved agronomic practices should be extended to the farmers by the extension agents.

Contribution to knowledge:

i. The study confirmed that more land can still be open for maize production in the study area with the current level of input because the production is at stage 1 of the production phase.

ii. The study also provides policy recommendations of relevance to maize production in the agricultural zone and the nation at large.

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