TECHNICAL EFFICIENCY OF ARABLE CROP FARMING IN IJEBU DIVISION OF OGUN STATE

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ABSTRACT
The objective of this study was to estimate the efficiency of arable crop farming in Ijebu Division of Ogun State with Ijebu North East and Odogbolu Local Governments selected as the study area. To achieve this objective, primary data were collected with the use of well structured questionnaires from 120 respondents. Of these, 90 were usable for the analyses. Frontier production function was used in analysing the data. The results show that 56 male and 34 female respondents were interviewed, out of which 73 per cent had formal education and 53 per cent had less than 10 years of farming experience. The computed technical efficiency index shows that maize had the highest number of variables with high technical efficiency index. Based on the fact that the seed input was positively significant for all three crops, a policy implication stemming from this is that government should improve on the availability of these inputs in order to increase the production level of arable crop farmers in the study area.

Keywords: Technical efficiency, Frontier analysis, Maize

INTRODUCTION

Agriculture plays a significant role in the economic development of Nigeria. It provides food for the growing population, employment for over 65 per cent of the population and raw materials and foreign exchange earnings for the development of the industrial sector (Ojo, 1990). In this respect, the Nigeria small-scale farmers have been the focus of agricultural policy formulation since the country gained independence in 1960. The reason for this is not far-fetched as the nations agriculture has always been dominated by small-scale farmers who produce a substantial portion of Nigeria's food requirements (Okuneye, 1989). These farmers are known to be characterised by low level of production.

At independence in 1960, agriculture was the most important component of Nigeria's economy. The sector was the principal provider of employment, income and raw materials for the burgeoning industrial sector. It was in fact the major earner of foreign exchange for the nation. The discovery of oil led to an astronomical increase in the national revenue. This impacted negatively on the agricultural sector. By the late 1970s, the food importation bill as a percentage of the total importation was increasing. By 1980, the share of food as a percentage of total importation was 15.8 per cent. As at 1993, the share of total importation was 8.4 per cent and by the year 2000, it had risen to 11.80 per cent (Federal Office of Statistics, Various Issues). Spencer (1990) lucidly captured this scenario when he argued that there was much need to increase food output in order to feed the increasing population. This is so given that Nigeria has been projected to become one of the world's most populous countries. The sector is also expected to earn the foreign exchange needed to import non-food items; generate savings for investment in other sectors of the economy and preserve and conserve the natural resource base to enhance productivity.

In spite of the preponderance of these policies, however, the food situation in Nigeria has become critical as domestic food production cannot keep pace with the rapidly growing population. Past studies have shown that Nigeria's food production on the aggregate has been growing at the rate of about 2.5 per cent per annum while the demand for food on the other hand has been growing at over 3.5 per cent per annum (Ojo, 1990, FOS, 1996 and NISER, 2001). This scenario has led to the widening gap between domestic food requirement and total food supply, increase in food importation due to excess demand and the loss of hard earned foreign exchange and increase in the price of food due to deficit in local production.

Ogunfowora (1970a, b), Olayide et al (1971) and Heady and Ogunfowora, (1971) in the periods after independence had pointed out the fact that the Nigerian farmer had a low capacity to improve production

without using ever greater units of inputs. In recent times, some other studies on efficiency of production in Nigerian agriculture have corroborated these earlier researches. These include Ajibefun et al (1996), Ajibefun and Abdulkadri (1999) and Olowofeso and Ajibefun (1999). This study intends to build on these previous researches with a view to examine critically the efficiency of production of the Nigerian small-scale farmer who constitutes the greater portion of participants in the agricultural sector. This study intends therefore to asses the efficiency of resource use among farming households in Ijebu Division of Ogun State. To achieve this, the study will determine the level of mean resource endowment of farming households and estimate the contribution of production inputs to the output of the different crops cultivated.

METHODOLOGY

Area of Study

The setting for the study is Ijebu-Division of Ogun State, Nigeria. The state was created in February 1976 as a state in the southwestern part of Nigeria. The division has six local government areas. The estimated population is about 587,764, based on the 1991 census of 429,684 people and estimated annual population growth of 2.83% (Federal Office of Statistics, 1991). The study area is noted for the production arable crops such as maize, cassava, melon, etc

Methods of Data Collection and Sampling Procedure

Multi-stage sampling techniques were used in selecting the study sample. In the first stage, two local government areas from the six in the division were selected randomly. Thereafter, 10 farming communities were randomly selected from each local government. The last stage had to do with the selection of six farming households from each farming community to make a total of 120 respondent farming households. Primary data were collected using structured questionnaires.

Analytical Techniques

The analytic tools used for the study are descriptive statistics and stochastic frontier model. This tool was used in estimating the contribution of production inputs to the output of the different crops. The frontier production function differs from the OLS estimation in the structure of the error term. The error term is divided into two parts; a symmetric random error associated with measurement error, random noise and contribution of omitted variables from the model, and a non-negative random error associated with technical efficiencies of production.

This function is described by:

$$\ln Y_{it} = \alpha_0 + \sum \alpha_m \ln X_{mit} + \alpha_i t + \tfrac{1}{2}\sum\sum \beta_{mn} \ln X_{mit} + \tfrac{1}{2}\beta_{tt} t^2 + \sum \beta_{tm} \ln X_{mit} tk + V_{it} - U_{it} \quad \ldots(1)$$

V_{it} assumes independent and identically distributed random errors which have normal distribution with mean zero and variance.

U_{it} - non-negative random variance to measure technical inefficiency effects.

$$\sum_m = \delta \ln \frac{f(x_j t)}{\delta \ln X_m} = \alpha_m + \sum \beta_{mn} \ln X_n + \beta_{mn} \ln X_m + \beta_{tm} t \quad \ldots(2)$$

An estimate of TC will give an idea of the additional output produced due to technological innovation while traditional inputs are held constant Technical efficiency is defined as

$$TE_{it} = \exp(U_{it}) \quad \ldots(3)$$

In this analysis, this model assumes that inefficiency effects are a function of a vector of explanatory variables (Battese and Coelli, 1995). The mean is assumed to be non-negative truncation of the normal distribution with mean, Uit and variance σ^2, mean is defined by

$U_{it} = \sigma z_{it}$

Where Z_{it} - vector of explanatory variables associated with technical inefficiency effect and σ - vector of unknown parameter to be estimated.

The specification of the production relationship is as seen below;

Y = Crop output (kg)
X_1 = Land (hectares)
X_2 = Number of hoes used in production
X_3 = Number of cutlasses used in production
X_4 = Number of baskets used in production
X_5 =Average number of labourers who worked full season
X_6 = Fertiliser (kg)
X_7 = Chemicals (litres)
X_8 = Rent (naira)
X_9 = Tractor (hours used)
X_{10} = Crop seeds (kg and bundles)

RESULTS AND DISCUSSION

Socioeconomic Characteristics of Survey Respondents

Table 1 shows the results of the socioeconomic analysis of the survey respondents. The greater proportion of respondents is in the 30-50 year age group. This is the period when people are their prime and most able to undertake the many strenuous activities associated with farm work. Education is an important factor which influences farm productivity. It determines the farmers access to information and adoption of new farming ideas, skills and technology. Results show that 73.33 per cent of the respondents have some form of formal education. None of the respondents had post secondary education and the males are generally better educated than the females. This is a throwback to the traditional belief that women do not need education as well as men. The results also reveal that 53.33 per cent of the respondents have less than 10 years farming experience. About 53 per cent of the female respondents have above 11 years of farming experience compared to 43 per cent of male respondents. The percentage of all farmers with more than 11 years of farming experience is 46.67 per cent. Such experience is desirable as the greater the experience, the better the farmers are able to cope with shocks and stresses.

The hectarage of land cultivated by arable crop farmers has always been known to have a direct relationship with output. Most increases in food production have always resulted from increases in hectarages of land cultivated. Fifty per cent of the female respondents have less than 1ha of farm land while 36 per cent of male have equivalent hectares. This shows that output/ produce of the females would generally be low compared to that of the males due to smaller pieces of land been cultivated. This could be as a result of the landholding pattern not favouring the acquisition of large hectarages by the female farmers. The source of land is an important factor in the determination of farm size of farmers. The less cumbersome the process of acquiring farm land, the greater the ease with which the farmers can increase their scale of production. Almost 70 per cent of the respondents acquired their farm land on freehold basis i.e. they either purchased or inherited it, while 32.2 per cent acquired their farm land by either leasing, allotment by the community or other means. A greater percentage of the female respondents acquired their farm land on freehold basis. The major occupation determines the importance attached to farming as a source of livelihood. Those who have farming as their major occupation are more likely to expend more hours and energy towards the success of their farming operations. Female farmers are engaged more in full-time agriculture than their male counterparts. This is due to the fact that most male respondents are into part-time artisanship or commercial motorcycling as a means of increasing their total income.

Determinants of Farm Output

The results of the frontier regression analyses are as seen in Table 2. The results are discussed herewith:

Cassava: The result of the frontier regression analyses shows that the following variables are significant in the production of cassava. They include hoe; this variable was found to be significant at 10 percent having a direct relationship with output. Labour used in the cassava production process also had a direct relationship with output; therefore an increase in quantity of labour used would result in an increase in output. Other significant variables at 1 per cent significant level are tractor and crop seed quantity.
Maize: The significant variables in the maize frontier regression analyses are land; this variable was found to be significant at 1 per cent with a direct relationship with output, indicating that an increase in land area cultivated would result in increased output. Hoe is another variable, which was found to be significant at 10 per cent. Cutlass is another implement found to have a direct relationship with output level at 10 per cent level of significance. Other variables such as chemicals and tractor use were found to be significant at 1 per cent. Labour and fertiliser use have a direct relationship with output, indicating that an increase in use of these production variables would result in greater quantity of maize produced. Finally the crop seed was also found to have a direct relationship with output of maize at 1 per cent.
Melon: There is only one significant variable for melon production. This is the crop seed planted. This was found to have a direct relationship with output quantity at 1 per cent level of significance indicating that an increase in the quantity of seed planted would result in an increase in the output of melon produced.

Technical Efficiency of Arable Crop Farmers
Details of the efficiency indices of the significant variables in the frontier analyses are as seen in Table 3.
Cassava: The crop has four significant variables, noting the fact that variables with efficiency index of 1 operates on the frontier and are fully technically efficient, the deviation from the frontier shows the inefficiency level). Tractor is the only variable, having an index which is above average (0.54). Labour has a technical efficiency of 0.34, hoe with the lowest is 0.12. The cassava seed itself has an index of 0.27. This could be as a result of the poor seedling (stem cutting) quality. Most farmers use the local variety of stems, which are characteristically poor yielding. The on-going cassava revolutions programme should seek to provide high-yielding variety of cassava by setting up stem multiplication centres at the grassroots level.

Maize: This crop has eight significant variables with all having technical efficiency index above average. Hoe has the lowest index of 0.54. Other variable indices are labour (0.57) and land (0.61). Cutlass has the highest efficiency of 0.93, followed by fertilizer, tractor and chemical with 0.82, 0.81 and 0.80 respectively. The maize seed has an index of 0.79 which is appreciable compared to the cassava stem cuttings. The result also shows that the efficiency of cutlass use is very close to the frontier, with an index of 0.93. Chemicals, ferterlizer and tractor all have indices greater than 0.80 showing that the relationship of these inputs use to output is very close to the frontier. Seed used for maize has the highest technical efficiency of all three crops grown with an index of (0.79).
Melon: The crop seed is the only significant variable and it has a technical efficiency index of 0.72. This is considerably efficient.

CONCLUSION
This research assessed the determinants of arable crop output in Ijebu Division of Ogun State. Based on the results of the research, the following policy measures would improve the efficiency of production of arable crops in the study area. Given the positive and significant effect of crop seed on crop output, measures that improve quality and accessibility of improved seed varieties to farmers will be beneficial. Provision of subsidy on farming tools would also have a positive effect on the output of the crops. However, given that the traditional tools are not technically efficient, efforts at educating the farmers on production tools and methods would not be amiss. Lastly, the seed of the cassava crop is technically inefficient. This, against the backdrop of recent government efforts to sell the commercial production of the crop to smallholder farmers, points out the need to redouble efforts at improving the quality of the

seed planted by the farmers. Contact between the farmers and research institutes with improved seed varieties should also be enhanced.

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Table 1: Socioeconomic Characteristics of Survey Respondents

Socioeconomic	Male		Female		All	
Characteristics	Freq.	%	Freq.	%	Freq.	%
Age in years						
Less than 30	8	14.28	1	2.94	9	10.00
31-40	18	32.14	18	52.94	36	40.00
41-50	19	33.93	10	29.41	29	32.22
Above 50	11	19.65	5	14.71	16	17.78
Educational attainment						
None	20	35.71	4	11.76	24	26.69
Primary	24	42.86	25	73.53	49	54.49
Secondary	12	21.43	5	14.71	17	18.89
Farming experience in years						
10 or 60	32	57.14	16	47.06	48	53.33
11-20	18	32.14	14	41.18	32	35.56
21 and above	6	10.72	4	11.76	10	11.11
Farm size in hectares						
<1ha	20	35.71	17	50.00	37	41.11
1-1.99ha	21	37.50	8	23.53	29	32.22
2-3ha	6	10.71	4	11.76	10	11.11
>3ha	9	16.08	5	14.71	14	15.56
Source of land						
Freehold	35	62.50	26	76.50	61	67.80
Other	21	37.50	8	23.50	29	32.20
Degree of participation in farming						
Full-time	30	35.57	20	58.82	50	55.56
Part-time	26	46.43	14	41.18	40	44.44
Total	56	100	34	100	90	100

Source: Computed from Survey Data, 2006

Table 2: Results of Frontier Production Function Analyses

Variables	Cassava	Maize	Melon
Constant	12.827	-0.047	7.190
	(92.047)	(2.514)	(19.479)
Land	-0.461	1.601***	-1.031
	(2.385)	(0.167)	(0.930)
Hoe	5.452*	1.192*	-1.418
	(2.802)	(0.717)	(1.127)
Basket	-0.691	-1.716	0.200
	(1.071)	(0.283)	(0.425)
Cutlass	-5.467	1.295*	0.300
	(2.854)	(0.694)	(1.141)
Chemicals	3.100	4.709***	0.776
	(2.792)	(0.759)	(1.130)
Rent	-10.032	0.288	-2.069
	(4.485)	(0.050)	(1.786)
Tractor	8.367***	8.341***	-0.397
	(2.900)	(0.765)	(1.148)
Labour	2.160*	0.851***	0.394
	(1.112)	(0.135)	(0.396)
Fertiliser	-9.449	18.758***	1.192
	(6.147)	(1.169)	(2.430)
Seed	1.126***	2.020***	8.001***
	(0.247)	(0.069)	(0.652)
V	172.470	3.56e - 06	184.184
	(172.470)	(0.002)	(27.488)
U	0.006	21.246	0.006
	(17.660)	(1.584)	(3.661)
Log likelihood	-445.084	-340.375	-362.422

Source; Computed from Survey Data, 2006.

Standard errors are in parentheses
***…… Significant at 1% **……. Significant at 5% *……. Significant at 10%

Table 3: Technical Efficiency Indices of Significant Variables in Frontier Analyses

Variables	Cassava	Maize	Melon
Land	-	0.61	-
Hoe	0.12	0.54	-
Basket	-	-	-
Cutlass	-	0.93	-
Chemicals	-	0.80	-
Tractor	0.54	0.81	-
Labour	0.34	0.57	-
Fertilizer	-	0.82	-
Seeds	0.27	0.79	0.72

Source; Computed from Survey Data, 2006.