Economic Efficiency of Small Scale Farmers in Ogun State, Nigeria

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Keywords: Cassava- Production efficiency- Profitability- Nigeria

Summary

Cassava holds a prominent position as a food and industrial crop in the Nigerian economy. Thus, there are government initiatives to support its mass production for domestic use and export. This study investigated the efficiencies of cassava production in Odeda Local Government of Ogun State. A random sample of 200 cassava producers was taken and subjected to budgetary and stochastic frontier analyses. Results indicated that most of the farmers were male (90%) with more than half (53%) above 50 years of age. Land holding by inheritance (78%) was prevalent. The gross margin and profit were ₦105, 775 and ₦95. 738,10 respectively. Cost ratio (1.8) and percentage profit (80%) indicated that cassava farming was profitable in the area. Total variable and labour costs were 91.6% and 68.2% of the total cost respectively. The return to scale was 1.024. Farm size (0.771) and quantity of planting stakes (0.203) significantly ($p \leq 0.01$) affected cassava production. Age and farming experience contributed to technical inefficiency while cost of fertilizer, cost of herbicides, membership of cooperative and level of education enhanced technical efficiency. Efficiency of cassava growers ranged between 88.69 and 100 with a mean of 89.4. It was concluded that cassava production was highly profitable in the area and farmers operated with maximum efficiency given the current technology. Farmers were advised to reduce labour costs and thus increase profit margin.

Résumé

Efficacité économique des petits fermiers dans l'Etat d'Ogun, Nigeria

Le manioc comme culture alimentaire et industrielle joue un rôle important dans l'économie nigériane. Ce qui justifie les interventions gouvernementales en vue de sa production massive pour la consommation domestique et l'exportation. Cette étude analyse l'efficacité de la production du manioc dans le Gouvernement Local d'Odeda dans l'Etat d'Ogun. Un échantillon aléatoire de 200 producteurs de manioc était sélectionné et les analyses de budgétisation et de frontière stochastique étaient utilisées. Les résultats indiquaient que la plupart des fermiers étaient masculin (90%) avec plus de la moitié (53%) âgés de plus de 50 ans. L'accès à la terre par héritage était prédominant (78% des enquêtés). La marge brute et le profit étaient respectivement de ₦105.775 et ₦95.738,10. Le ratio bénéfice-coût (1,8) et le taux de rentabilité (80%) indiquaient que la culture de manioc était profitable dans la région. Le coût total variable et le coût de main-d'œuvre représentaient respectivement 91,6% et 68,2% du coût total. Le rendement d'échelle était de 1,024. La taille de l'exploitation (0,771) et la quantité de boutures (0,203) influençaient significativement ($p \leq 0.01$) la production de manioc. L'âge et l'expérience contribuaient à l'inefficacité technique cependant que les coûts d'engrais et d'herbicides, l'adhésion à une coopérative et le niveau d'éducation améliorent l'efficacité technique. L'efficacité technique des producteurs de manioc varie entre 85,69 et 100, avec une moyenne de 89,4. Il pouvait être conclu que la production de manioc était très profitable dans la région et que les producteurs opéraient à efficacité maximale étant donné le niveau de technologie disponible. Il est recommandé que les producteurs réduisent le coût de main-d'œuvre pour accroître leur marge de profit.

Introduction

Cassava (*Manihot spp*.) is listed along with yams, rice, maize, sorghum, and millet as the main food crops in Nigeria (12). It is cultivated majorly for its carbohydrate rich edible root tubers. Because of the high costs of production of other food crops (coupled with their high agro-climatic requirements), they are more expensive compared to cassava, and may not be accessible to the urban poor at some periods of the year (15). Thus, with the growing population in Nigeria and declining real incomes, cassava has the potential to become a highly demanded food crop. Various parts of cassava such as the leaves, stem and roots are used for different purposes. The leaves are common vegetables among the Sierra Leoneans while the stem is used as planting material during cassava production. The root tuber which is the most desirable

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Received on 14.12.09 and accepted for publication on 12.04.10.

component is processed into various products like garri, cassava flour (lafun), fufu and tapioca. It is a rich source of industrial alcohol (ethanol) and starch. The export drive for the crop increased the demand for cassava and promoted its cultivation (4). Although Nigeria is one of the largest producers of cassava, it is yet to meet the potential demand both in the local and international markets. There is evidence of increase in efficiency of cassava production in Nigeria because national output of cassava increased by 12.1% from 31.7 million tons in 2003 to 36.1 million tons in 2005 while the land cultivated to cassava declined by 11.6% from 4,001 million hectares to 3,535 million hectares during the same periods (11). However, the low range of farm gate price between ₦17.59/kg in 2003 and ₦19.97/kg in 2005 (11) could act as disincentive to farmers.

Efficiency is a very important factor of productivity growth especially in developing agrarian economies, where resources are meager and opportunities for developing and adopting better technologies are dwindling. Such economies can benefit from efficiency studies which show that it is possible to raise productivity by improving efficiency without increasing the resource base or developing new technologies. Raising productivity and output of small farmers would not only increase their incomes and food security, but also stimulate the rest of the economy and contribute to broad-based food security and poverty alleviation (9).

The main objective of the study is to determine the efficiency of cassava production in Ogun State. Specifically, the study estimates the costs and returns to cassava production and determines the factors that affect cassava production efficiency in the area.

Methodology

The study was carried out in Odeda Local Government Area (LGA) of Ogun State. Ogun State is located in Southwestern part of Nigeria. Odeda LGA is purposively selected for the study because it has one of the largest number of producers and processors of cassava in the Ogun State. Two hundred cassava farmers were randomly selected for the interview. The data obtained were analyzed using descriptive statistics, budgetary technique and the stochastic frontier analysis. Budgetary technique is expressed as:

GM= TR – TVC; Л= GM – TFC,

Where, GM= Gross Margin, Л= profit, TR= Total Revenue, VC= Total Variable Cost, TFC= Total Fixed Cost.

The production efficiency (PE) per cassava farmer was calculated as:

PE= ATR/ATC.

Where, ATR= Average Total Revenue, ATC= Average Total Cost.

Stochastic Production Frontier Model

Since the pioneering work of Farrell (5), production efficiency has been measured as the distance between an observation and an estimated ideal referred to as an efficient frontier (13). According to Lawson (7) the parametric frontier approach to efficiency measurement involving the specification and estimation of a parametric representation of the technology (frontier production, cost or profit function) has been applied extensively in many industries, including agriculture. Forsund *et al.* and Schmidt (6, 14) each provide a valuable overview of the modeling and estimation of parametric frontier functions and their relationship to efficiency measurement. In addition, Battese (2) provides a survey of empirical applications of the parametric frontier production approach to technical efficiency measurement in the agricultural sector. The specification of explicit Cobb-Douglas production function for cassava farms in the study area is therefore given as:

$$LnQ = \alpha_0 + \alpha_1 LnX_{1i} + \alpha_2 LnX_{2i} + \alpha_3 LnX_{3i} + \alpha_4 LnX_{4i} + \alpha_5 LnX_{5i} + (v_i + \mu_i) \quad \ldots\ldots\ldots (1)$$

Where, Q= Total output (tonnes); X_1= Fertilizer (kg/ha); X_2= Labour (man-days)/ha

X_3= Farm size (Ha); X_4= Herbicides (litres)/ha;

X_5= Planting stakes (number of stem cuttings/ha).

The choice of the Cobb-Douglas is based on the fact that the methodology of the function is self dual in the case of production function (8). The efficiency model (μ_i) is expressed thus:

$$\mu_i = \delta_1 Z_{1i} + \delta_2 Z_{2i} + \delta_3 Z_{3i} + \ldots + \delta_7 Z_{7i} \quad (2)$$

Where, $Z_{1\text{-}7}$ represent age, household size, cost of fertilizer, cost of herbicides, membership of cooperatives, farming experience and level of education respectively.

The estimates for all parameters of the stochastic production frontier model and inefficiency model are simultaneously obtained using the program - Frontier Version 4.1c.

Results and discussion

Most (90%) of the cassava farmers are male while 56% of them have formal education. It was discovered that the women and children are mostly involved in processing of cassava into various products like garri, lafun and starch. They are also involved in the marketing of these products within and outside the community.

Forty-seven percent of the farmers are 50 years or below while 53% are older than fifty years. Thus, more than half of the cassava growers are passing their productive farming age. There is the need to encourage youth to take up farming in the area. Most of the farmers (78%) acquired their land for cassava production through inheritance while the remaining (22%) got theirs by leasing. This is typical of core

rural communities in the region as opposed to urban and peri-urban areas where land ownership through purchase is more prominent.

Majority of the farmers interviewed (93%) have more than 10 years experience in cassava cultivation. Thus they are expected to be well grounded in the best practices of the enterprise. More of them (62%) planted improved varieties of cassava as against 38% that planted the local varieties. They got these planting materials from their own farm (70%), from friends and relative (6%) or by purchase (24%). The farmers attested that getting planting materials is not a problem in the area. The size of their farm revealed that they are smallholders as 79% grew 5 hectares or less of cassava per season.

Costs and returns

The budgetary analysis (Table 1) showed that the TVC formed the bulk 91.6% of the TC while the TFC was just 8.4%. This implies that farmers who want to be cost efficient have to reduce TVC especially the cost of labour that is more than three quarter (68.2%) of the total cost. TFC is small (8.8%) probably because of very low cost of land rent (1.6%) in the area. This is typical of core rural communities in Southwestern Nigeria where most lands are currently held by inheritance as presented in the result. The total profit of ₦95, 738.10 per hectare and percentage profit of 80% shows that cassava farming is a highly profitable venture in the area. All things being equal, farmers should be able to pay back loans even at commercial bank interest rate of 40% per annum. The cost ratio showed that a farmer that invested ₦1 realized ₦1.80 as revenue or gained 80k on each Naira expended.

Profitability measures

(a) Profit= Total revenue – Total cost
₦215, 296 – ₦119, 557.90= ₦95, 738.10

(b) Gross margin= Total revenue – Total variable costs
₦215, 296 – ₦109, 515 = ₦105, 775

Table 1
Budgetary analysis

S/N	Description	Value (₦)*	Percentage
	VARIABLE COSTS		
I	Cost of labour	81, 580.00	68.24
II	Cost of fertilizer	18, 285.00	15.29
III	Cost of herbicides	9, 650.00	8.07
IV	Total variable cost (TVC)	109, 515.00	91.60
	FIXED COSTS		
V	Land rent	1, 930.00	1.61
VI	Implement cost	8, 112.90	6.79
VII	Total fixed cost (TFC)	10, 042.90	8.40
VIII	Total cost (TC)	119, 557.90	100.00
IX	Total revenue (Income) (TR)	215, 296.00	
X	Profit (TR – TC)	95, 732.10	

* - $1= ₦120 in 2008; Source: Data analysis, 2008.

(c) Cost ratio= TR/TC= ₦215, 290/₦119, 557.90= 1.80

(d) Gross ratio= TC/TR= ₦119, 557.90/₦215, 290= 0.56

(e) Percent profit= Profit/Total cost x 100%
= ₦94, 732.10/₦119, 557.90 x 100%= 80%

The stochastic production frontier estimates

The maximum likelihood estimate of the Cobb-Douglas production function is presented in table 2. The lambda value of 1.179 and gamma value of 1.502 which are significantly different from zero suggest that the model is a good fit.

The return to scale of 2.622 implies an increasing return to scale. Any additional input will lead to more than proportionate change in the output. This shows that the farmers are in stage 1 of production function. The coefficient of various variables in the model and their interpretation are as follows:

$$\text{Ln } Q = 1.598 - 0.013X_1 + 0.050X_2 + 0.771X_3 + 0.031X_4 + 0.203X_5$$
$$(2.978)(-0.152) \quad (0.769) \quad (7.630)^{***} \quad (0.230) \quad (2.690)^{***}$$

The two significant variables ($p < 0.01$) in this model are farm size and the quantity of planting stakes. The coefficient of farm size (0.771) is positive and inelastic. This implies that increasing the farm size by one hectare will bring about 77% increases in output of the cassava growers in the area. Similarly, the quantity of planting stakes (0.203) has positive relationship

Table 2
The maximum likelihood estimates of parameters of the Cobb Douglas frontier function

Variable	Estimate
General model	
Constant	1.595*** (2.79)
Quantity of fertilizer	-0.013 (-0.152)
Labour (Man-days)	0.050 (0.077)
Farm size	0.771*** (7.630)
Quantity of herbicides	0.013 (0.230)
Quantity of planting stakes	0.203*** (2.69)
Inefficiency model	
Constant	1.776*** (6.527)
Age	-0.004** (2.045)
Household size	0.031 (1.483)
Cost of fertilizer	-0.009*** (-2.773)
Cost of herbicides	-0.001* (-1.892)
Cooperative	-0.041** (-2.113)
Farming experience	0.005* (1.654)
Educational level	-0.052*** (-3.241)
Variances parameter	
Sigma-square	0.010
Gamma	1.502 (2.874)
Lambda	1.179 (3.501)
Log likelihood function LLR	110.013
Return to scale	2.622

Figures in parenthesis are the t-ratios; *, **, *** Significant at 10, 5 and 1% levels respectively; Source: Data analysis, 2008.

with output. This implies that increasing the quantity of cassava stem cutting planted will increase output. This may come as a result of reducing the spacing within and between rows of cassava stands on the field.

$$\gamma = 1.776 - \underset{(6.524)^{***}}{0.004Z_1} \underset{(-2.045)^{**}}{+0.0031Z_2} \underset{(1.483)}{-0.009Z_3} \underset{(-2.778)^{***}}{-0.001Z_4} \underset{(-1.892)^{*}}{-0.041Z_5} \underset{(-2.113)^{**}}{+0.005Z_6} \underset{(1.654)^{*}}{-0.052Z_7} \underset{(-3.241)^{***}}{}$$

The figures in parenthesis are the t-ratios of the variables.

For farm specific characteristics, the significant variables include: age ($p< 0.05$), cost of fertilizer ($p< 0.01$), cost of herbicide ($p< 0.1$), membership of cooperatives ($p< 0.05$), farming experience ($p< 0.1$) and educational level ($p< 0.01$). Only age and farming experience are positive meaning that they contribute to technical inefficiency in cassava production in the area. This could be due to earlier result that indicated that the respondents are fairly old. Such people may not easily adopt improved technology that can enhance their efficiency. Cost of fertilizer, cost of herbicides, membership of cooperatives and educational level are negative and contribute to efficiency in cassava production. This means that as the cassava farmer procures more fertilizer and uses more herbicides on his farm, his efficiency improves. Also, when he joins himself to self-help groups that could assist in obtaining inputs or marketing his produce, he is rendered more efficient. Education obviously will improve his production efficiency as it will enable him to access improved technology and best practices available to the enterprise.

It is shown in table 3 that efficiency of the cassava growers ranged between 85.69 and 100 percent with a mean of 89.04 percent. Thus, they are all operating at very high levels of efficiency (more than 89 percentages) given the cassava production technology available to them. This may be a contributing factor to the high level of profitability of cassava production in the area.

Table 3
Distribution of farmers by their technical efficiency

Technical efficiency (%)	No. of farmers	Percentage
85 – 90	126	62
>90	74	38
Total	200	100
Mean	89.04	
Minimum	85.69	
Maximum	100	

Source: Data analysis, 2008.

Summary and conclusion

This study aimed at examining the efficiency of cassava production in Ogun State. Primary data were collected from 200 cassava growers in Odeda Local Government Area of the State. The data were subjected to descriptive, gross margin and stochastic production frontier analyses. It was discovered that men (90%) dominated cassava farming and about half (54%) of them have formal education. Many of the farmers (53%) were above fifty years of age and most of them (78%) accessed land through inheritance. They had over ten years of experience in cassava production and 62% of them plant improved varieties in small land holdings below 5 hectares. With profit of ₦95, 738.10 per hectare and percentage profit of 80%, the venture is considered to be highly profitable. Farmers who invested ₦1 realized revenue of ₦1.80. There is increasing returns to scale of 2.6 in cassava production. Farm size (0.771) and quantity of planting stakes (0.203) are positive and significant ($p\leq 0.01$) variables in the production function estimated. Age of farmers, cost of fertilizer, cost of herbicide, membership of cooperatives, farming experience and level of education are the farm specific variables that affect efficiency of the cassava growers. Age and farming experience contributed to technical inefficiency while cost of fertilizer, cost of herbicides, membership of cooperative and level of education contributed to technical efficiency in cassava production. In conclusion, cassava has the potential for achieving twin objectives of poverty alleviation and food security for the growers in the core rural community of Odeda Local Government in Ogun State because it is highly profitable and leaves farmers with high returns on their investments. The farmers are highly efficient in its production at the present level of technology available to them. The level of efficiency 99% holds good prospect for the success of the cassava initiatives of the government. Farmers have to cut down the variable costs in order for them to increase their profit. Since the bulk of the variable cost is incurred on labour, attempts at reducing this cost will lead to greater gross margins and hence the profitability of the enterprise.

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