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Credit Use and Production Efficiency of Cocoa Farms in Ondo State Nigeria

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Abstract

This study analyzed credit use and its effect on production efficiency of cocoa farms in Ondo State. Primary data were collected in a cross-sectional survey of 183 randomly selected cocoa farms. These were drawn in a multi-stage sampling process that covered the five dominant cocoa producing Local Government Areas of Ondo State Nigeria. Data collected were analyzed using descriptive statistics and stochastic frontier. The study found that most (95.1%) of the cocoa farms were operated by males, with a mean age of 49.8years. The mean cocoa farm size was 1.28 hectares. Only 58.5% cocoa farmer's procured credit during the 2009/2010 production season, of which (83.2%) procured credit mainly from produce merchants. The mean credit request was ₦238,738.30, only ₦113,321.50 (47.5%) were granted. Farmers that used credit had significantly ($p<0.01$) higher farm size (1.44Ha) and recorded significantly ($p<0.01$) higher net farm income (₦292, 107.23/Ha) than those that could not secure credit (1.05Ha and ₦183, 046.83/Ha respectively). The empirical results revealed that cocoa farmers were operating at a point of decreasing return as depicted by the return to scale of 0.153 with mean technical efficiency of 0.44. Hire labour has positive and significant effect on output at $p<0.01$. Increase in credit use brings about significant reduction in technical inefficiency among the cocoa farms. The result revealed a direct relationship between access

to credit and technical efficiency level. The study recommended that government and other stakeholders should support farmers to form virile farmer's organization that will improve credit delivery through the produce merchant.

Introduction

Agriculture has continued to play dominant role in the provision of food, employment, raw material for the industries and foreign earning, which are used in financing development activities. During the past four decades, industrial tree crops, notably cocoa, oil palm, and rubber, have dominated the export agriculture in Nigeria. Among the perennial tree crops, cocoa, which is used in chocolate industries, is of particular importance in the humid forest agro-ecology of West and Central Africa. (Joachim, et al. 2007). However, agricultural productivity contribution to GDP in Nigeria has declined from about 90 percent before independence to about 41 percent between 2001 and 2005. (CBN, 2005). This scenario has induced tremendous increase in the country's import bills from about 8 billion naira in 1996 to over 183 billion naira in 2005 (CBN 2005). It also lost its status as a net exporter of cash crop like cocoa, oil palm and groundnut (Verheye, 2000).

Credit is an essential instrument to finance working capital and investment in fixed capital, particularly among farmers that are too poor to accumulate much saving. It is important for smoothing consumption, in a context where incomes typically experience large seasonal fluctuations. Availability of credit reduces reluctance to adopt technologies that raise both mean levels and riskiness of incomes (Aghion, 1997). A significant fraction of credit transactions in underdeveloped countries still takes place in the informal sector, in spite of serious Government efforts to channel credit directly via its own banks, or by regulating commercial banks (Aleem, 1993). This is largely due to the fact that poor farmers lack sufficient assets to put up as collateral a usual prerequisite for borrowing from banks. Interest rates are much higher on average than bank interest rates, and also show significant dispersion, presenting apparent arbitrage opportunities, such as significant credit rationing, whereby borrowers are unable to borrow all they want, or some loan applicants are unable to borrow at all (Clay, 1997).

Problem Statement

Government has made several efforts to raise and return agriculture to its past enviable position. One major crop that has received the attention of Nigeria government is cocoa production. The contributions of cocoa to the

nation's economic development are vast and have been reported by many authors (Olayemi, 1973). Because of its importance, the recent Federal Government's concern of diversifying the export base of the nation has placed cocoa in the centre-stage as the most important export tree crop. Evidence has however shown that the growth rate of cocoa production has been declining, which has given rise to a fall in the fortunes of the sub-sector among other reasons. ((Olayide,1969)). Folayan et al. (2006), noted that cocoa production in Nigeria witnessed a downward trend after 1971 season, when its export declined to 216,000 metric tons in 1976, and 150,000 metric tons in 1986, therefore reducing the country's market share to about 6% and to fifth largest producer to date. All effort is to no avail because, most of the government agricultural credit programmes are only good on paper but the implementations are faulty (Berger, 2002). There are also high cost of input and instability of commodity prices which are some factors that affect income and production efficiency of farmers. (NRI, 2004).

Specifically, this study attempted to:

- Describe the socio-economic profile of the Cocoa farmers,
- Describe the sources of credit available to the cocoa farmers,
- Determine the effect of credit on production efficiency of the cocoa farmers.

Literature Review /Conceptual Framework

Empirical evidence suggests that stochastic production frontier is widely employed both in developed and in the developing countries of the world. Tran et al. (1993) examined the Technical Efficiency (TE) of state rubber farm in Vietnam. They estimate a time varying stochastic frontier, production function for 33 farms. They obtained a mean TE of 0.59 for the farm. Their results further showed that 21% of the farms have high TE (above 0.80) while 40% attained TE of more than the average but less than 0.80. The remaining farms (39%) have low TE below the mean value. Ojo and Imoudu (2000) conducted a comparative study on productivity and TE of oil palm farmers in Ondo State of Nigeria and found out that training of farm settlers increases their TE than those not trained and concluded that TE positively correlates with training. In another work conducted by Girroh (2007) to analyze the TE of rubber tapping in Rubber Research Institute of Nigeria, Benin city, using stochastic frontier production function. He found out that tappers operated at 0.72% below the stochastic frontier production function with the least and best tapper operating at 0.38 and 0.99 respectively. Nyemeck et al. (2007) conducted a

survey on the role of credit access in improving cocoa production in West African countries using econometric models. They found out that, cocoa farmer's capacity such as, the cocoa farm size, and the mutuality status of the farmer are more important as a determinants of cocoa farmers access to credit. Nkamleu et al. (2010) used Meta frontier function technique to investigate productivity potentials and efficiencies in cocoa production in West and Central Africa. The analysis of the data support the view that TE in cocoa production is globally low and technology gap plays an important part in explaining the ability of cocoa sector in one country to compete with cocoa sectors in other countries in the West and Central Africa region.

Efficiency improvement is an important source of production growth in any economy. It is concerned with the relative performance of the processes used in transferring given input into output. The study of productive efficiency started with the pioneering work of Farrell in 1957. He distinguishes between technical and allocative efficiency through the use of a frontier production and cost function respectively. However, over the years, Farrell's methodology has been applied widely, while undergoing many refinements and improvements. Such improvement is the development of stochastic frontier model that enables one to measure firm level of efficiency using maximum likelihood estimate. The stochastic frontier model incorporates a composed error structure with a two sided symmetry and one sided component. The one sided component reflects inefficiency while the two sided component capture random effects outside the control of production unit including noise typically of empirical relationship. Economic or total efficiency is the product of technical and allocative efficiencies. An economically efficient input-output combination would be on both the frontier function and the expansion path (Ogundari and Ojo, 2006, Okoruwa and Ogundele, 2006).

The Study Area

The study was carried out in Ondo State. The state covers an area of 14,788.723 sq km. It lies in between longitude $4^{0}31$ and $6^{0}00'$ East and latitude $4^{0}15^{1}$and 8^{0} 15^{1} North. There are three distinct ecological zones within the state. These are the mangrove forest to the south, the rainforest to the middle belt and the Savannah to the North. The state has an annual rainfall ranging from 2,000mm in the southern parts to 1200mm in the Northern areas with the raining season running between March and October.

Sampling Procedure and Sample Size

The population for the study was cocoa farmers in the selected Local Government Areas (LGAs) of Ondo State, namely; Idanre, Ondo West, Odigbo, Owo and Akure South LGA. The above LGAs were chosen because they fall within the first five highest cocoa producing LGAs in Ondo State (ADP, 2010). Random sampling technique was used to select four villages from each LGAs and Purposive sampling technique was used to select ten farmers in each villages making a total of two hundred respondents. Data were collected through the interviewer administered questionnaire and only 183 valid questionnaires were returned for analysis.

Analytical Procedures

Descriptive Statistics

Frequency distribution tables and percentages were used to describe the socio-economic characteristics of the respondents.

Stochastic Frontier Model

The stochastic frontier production function derived from the composed error model of Aigner et al. (1977); Bettese and Coelli (1995) was applied in the data analysis. This model is made up of disturbance term which builds hypothesized efficiency determinants into the inefficiency error component so that one can identify focal points for action to bring efficiency to higher levels.

$Yi = F(xi, \beta i) + (vi - ui)$ ..... (4)

Where: Yi is the output of the ith farm

X_i is a vector of input quantities of the ith farm.

β = is a vector of unknown parameters to be estimated

V_i are random variables which are assumed to be normally distributed. An independent of the U_i. It is assume to account for measurement error and other factors not under the control of the farmers.

U_i are non-negative random variables, called technical inefficiency effects which are assumed to be half normally distributed $N(0,\sigma^2_u)$ (Aigner et al. 1977).

A Cobb – Douglas production form of the frontier that was used for this study is presented as follows:

$$\ln Y = \beta_0 + \beta_1 \ln x_1 + \beta_2 \ln x_2 + \beta_3 \ln x_3 + \beta_4 \ln x_4 + vi - ui$$

Where Y_i = output of farmers (kg) , X_i = farm size (ha), X_2 = Household labour (man day),

X_3 = Hired labour (₦), X_4 = Cost of Intermediate material (₦), β_0, β_1, β_2, β_3, β_4, are parameters to be estimated. The inefficiency model is represented by Ui which is defined as follows:

$$U_i = \delta o + \delta_1 z_1 + \delta_2 z_2 + \delta_3 z_3 + \delta_4 z_4 + \delta_5 z_5 + \delta_6 z_6 + \delta_7 z_7 + \delta_8 z_8$$

U_i = Technical inefficiency

Z_i = Age of respondent (years), Z_2 = Gender (Male=1, Female = 0), Z_3 = Age of cocoa farms (years)

Z_4 =Age of cocoa farms square (years), Z_5 = Level of Education (years)

Z_6 = Experience of cocoa farmers (years), Z_7 = Member of saving group (yes = 1, no = 0)

Z_8 = Cash credit (₦), δ_0, δ1, δ2, ------δ_8 are parameters to be estimated.

Since the dependent variable of the inefficiency model represents the model of inefficiency, a positive sign of an estimated parameter implies that the associated variable has a negative effect on efficiency but positive effect on inefficiency and vice versa (Rahji, 2005).

Results and Discussions

Personal Characteristics of Respondents

Table 1 show that approximately 11% of the cocoa farmers were below 31 years of age, while 89% are above 40 years. The average age of the farmers that were sampled is 49.8 years. This result agrees with the baseline survey conducted on cocoa production in Ondo state which stated that 74% of cocoa farmers in the state were between 41-70 years (CIBA 1997). The cocoa farmers were predominantly male, making up of approximately 95% of the total respondents while the female cocoa farm owners are 4.9%. The reason why male respondents dominated the total population in our results was that, cocoa production activities is tedious and so almost all the respondents were married for the purpose of additional family support on the farm.

Table 1: Distribution of Respondents by personal Characteristics

Description	Frequency	Percent
Age Group		
30 or less	20	10.9
31-40	51	27.9
41-50	37	20.2
51-60	30	16.4
Above 60	45	24.6
SEX		
Female	9	4.9
Male	174	95.1

Source: **Field survey 2010**

The credit use pattern, gives a description about respondents access to credit and the different sources where they obtained the credit. Table 2 shows that approximately 59% of the respondents have access to credit facilities while 41.5% of the respondents do not have access to credit. This result conform to the findings of Nyemeck, et al. (2007) on the role of credit access in improving cocoa production in West Africa countries, they found out that approximately 54% of cocoa farmers surveyed in Nigeria have access to credit facilities. Our result also reveals that 44.3% of the respondents obtained their credit from produce merchant. This has implication on the main source of credit facilities available to cocoa farmers in the study area, most farmers' sourced credit from cocoa produce merchant for their production activities as the merchant does not charge interest on any amount given to the farmers.

Table 2: Sources of Credit Available to Cocoa Farmers

CREDIT USE PATTERN	FREQUENCY	PERCENT
No access	76	41.5
Had access	107	58.5
Credit Source		
Friend and Relative	11	6.0
Produce Merchant	81	44.3
Corporative	7.0	3.8
Friend, Relative and Merchant	7.0	3.8
Friend, Relative, Merchant and coop	1.0	0.5

Source: Field Survey, 2010

The empirical result of the stochastic frontier production function is presented in Table 3. The variance parameters of the stochastic frontier production function are represented by sigma squared (δ^2) and gamma (γ). The sigma squared is 8.9983 for the production function and significantly different from zero at one percent level. This indicated a good fit and correctness of the distributional form assumed for the composite error term. Gamma indicates that the systematic influences that are unexplained by the production function are the dominant sources of random error. The gamma estimate which is 0.9718 shows the amount of variation resulting from the technical inefficiencies of the cocoa farmers. This means that 91 percent of the variation in Cocoa farmers output in the study area is due to difference in TE. This implies that, the Ordinary Least Squares estimate (OLS) will not be adequate in explaining the inefficiencies of Cocoa production and therefore justifying the specification of the stochastic frontier production function.

Typical of the Cobb-Douglas production function, the estimated coefficients for the specified function can be explained as the elasticity of the explanatory variables. Except for farm size and household labour, the sign of the slope coefficients of the stochastic production frontier are positive. The mean TE of Cocoa farmers is 0.44 which implies that the farmers are not efficient as the observed output is 56% less than the maximum output. The estimate of the parameters of the stochastic production frontier indicate that elasticity of output with respect to hire labour is positive and approximately 0.0605 and it is statistically significant at $p<0.01$ level. This

implies that hire labour is a positive and significant factor that influences the output of Cocoa farmers. An increased of one percent in hire labour will result in an increase in output by 0.0605% depending on the management of the Cocoa farm.

The coefficients of the variables associated with farm size, household labour and costs of intermediate materials were 0.0119, 0.0554 and 0.0252 and were positive but not statistically significant. The return to scale was 0.153 which indicated decreasing return to scale. This is the rational stage at which production should normally take place because addition to output is positive with an increasing input utilization.

Table 3 Maximum Likelihood Estimates of Parameters of Cobb-Douglas Stochastic Frontier Production Function for Cocoa Farmers in Ondo State.

Variable	Parameters Stochastic frontier	Coefficient	t-value
Constant	β_0	6.7347***	10.1261
Farm size (X1)	β_1	0.012	0.048
Household labour (X2)	β_2	0.055	0.099
Hire labour(X3)	β_3	0.0605***	2.967
Cost of intermediate materials	β_4	0.0252	0.4017
INEFFICIENCY MODEL			
Constant	δ_0	-2.9081	-1.1185
Age	δ_1	0.0257	0.8422
Gender	δ_2	-8.9595***	-4.0174
Age of cocoa farm	δ_3	-0.3609***	-3.2548
Age of cocoa farm square	δ_4	0.0081***	3.5705
Education	δ_5	-3.2815***	-3.5327
Experience	δ_6	0.0632*	1.8029
Member of saving group	δ_7	1.9579**	2.1259
Cash credit	δ_8	-0.0004***	13.0894
DIAGNOSTIC STATISTICS			
Sigma square	δ^2	8.9983***	4.1651
Gamma	γ	0.9718***	57.5349
Mean Technical Efficiency	0.44		
Number of observation	128		

Source: Computed from **Field Survey, 2010**.

Technical Inefficiency Measurement

The result of the inefficiency is presented in table 4; the signs and coefficients in the inefficiency model are interpreted in opposite way such that a negative sign means that the variable increases efficiency and vice versa. The result of the inefficiency model shows that the coefficients of the inefficiency variables with the exception of age of farmers, age of cocoa farm square, experience of farmers and member of a saving group have the expected signs. The coefficient for gender variable is estimated to be negative and statistically significant at P<0.01. This implies that male cocoa farmers are more efficient than their female counterparts. This is in conformity with the finding of Giroh, et al. (2008) as regards the analysis of profitability and TE of rubber latex production in Southern Nigeria. The coefficients of the age of cocoa farm, education and cash credit were estimated to be -0.3609,-3.2815 and -0.0004 respectively; implying that they affect efficiency and were all statistically significant at (P<0.01). This result agrees with the findings of Amaza et al. (2001) in his research work on the factors influencing TE of cotton farmers in Nigeria. He found out that credit and educational status of the farmers positively correlated with TE.

Test of Hypothesis

Hypothesis was tested on the relationship between TE of cocoa farmers who have access to credit and cocoa farmers who do not have access to credit. The result as shown in Table 5 reveals that there is a significant difference between the TE of the two groups of farmers. Therefore the null hypothesis is rejected. This showed that cocoa farmers that access credit are more technically efficient than cocoa farmers who do not have access to credit facilities in the study area.

Table 5: T-test for Technical Efficiency difference between farmers that have access to credit and farmers without access to credit.

Technical Efficiency	Mean	Standard deviation	N	t-value	Decision
Access to Credit	0.401816	0.2376	107	2.390	Reject H_0
No Access To Credit	0.485049	0.2114	76		

Source: **Field Survey, (2010)**

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