MEASUREMENT OF TECHNICAL EFFICIENCY OF PRIVATE COCOA FARMERS IN IDDO LOCAL GOVERNMENT AREA OF OYO STATE

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Abstract

This study measures the technical efficiency of the private cocoa fanners in Iddo Local Government Area of Oyo State. Farm level information were collected from 55 farmers from the Local Government Area and were analyzed using descriptive statistics and stochastic frontier production methodology. The result shows that the technical efficiency of the farmers varies from 91% to 98% with a mean of 97%. The factors that increase the technical efficiency in the study area are years of schooling, farming experience, innovation adoption and age of the farms. The study recommends the need to assist these resource poor hut technically efficient fanners. The assistance can be in form of mass literacy campaign and provision of farm technologies that are available and affordable.

Introduction

Productive efficiency means the attainment of production goal without waste. Beginning with this basic idea of 'no waste' economists have built up a variety of theories of efficiency. However, the fundamental idea underlying all efficiency measures is that of the quantity of goods and services per unit input. Consequently, a farm is said to be technically inefficient if too little output is being produced from a given bundle of inputs. Hence, enterprise inefficiency involves the disproportionate and excessive usage of all inputs.

There are two basic methods of measuring technical efficiency: the classical and frontier approach. The classical approach is based on ratio of output to a particular input, termed partial productivity measure in the sense that output is compared with only one input at a time. The most commonly used ratios are output per-man-hour, i.e. the labour productivity, and output per unit of capital, i.e. the capital productivity as well as crop yield from a unit of farm land (Upton, 1996). One of the major shortcomings of the classical approach is that efficiency measurement is partial in the sense that it is only possible to measure efficiency in relation to one input at a time. Dissatisfaction with shortcoming of the classical approach has led economists to develop advanced econometric statistical and linear programming methods. Consequently, the frontier approach emerges and stimulates great interest among researchers and policy makers. All these methods have in common the concept of a frontier. It implies that efficient farms are those operating on the production frontier, while inefficient farms are those operating below the production frontier. The amount by which a farm lies below its production frontier is regarded as the measure of inefficiency. The early work on the frontier approach goes back to Farrell (1957). The two primary methods for estimating frontier production function are the parametric and non-parametric methods.

For the parametric method, the stochastic frontier production is the main approach, while the Data Envelopment Analysis (DEA), which is a linear programming method, is the non-parametric approach for estimating frontier (Coelli, 1995). The limitation with the use of non-parametric approach is that its estimates cannot be tested statistically (Seiford and Thrall, 1990).

The modeling and estimation of stochastic frontier productions, originally proposed by Aigner, Lovell and Schmidt, 1997; Battese and Corra, 1997; Meeusen and van den Broeck (1977), has been an important area of economic study in the last two decades. Various models have been proposed for the inefficiency effects in stochastic frontier production functions. They include those of Kumbhakar; Ghosh and Meguekin 1991; Reifschneider and Stevenson (1991); Huang and Lui 1995' Battese and Coelli (1995).

Economic applications of stochastic frontier models in African settings include Adesina and Djato (1997); Ajibefun and Abulkadri (1999). These two studies did not model technical efficiency with farmers socio-economic variables as determinants of technical efficiency. The only known study that model technical efficiency of the farmers using socio-economic variables as determinants in Ajibefun, Battese and Kada (2002). However, the study used food crop farmers. This study is an improvement on Ajibefun,

Battese and Kada (2002), in that some omitted socio-economic variables of the farmers such as age of the farms, household size, innovation adoption and disease incidence are included in modeling the technical efficiency of the farmers. Moreover, the study was carried on cocoa (tree) farming, not food crop farming as considered by Ajibefun, Batlese and Kada, (2002),

Objectives of the Study

The objective of this paper is the quantitative determination of the technical efficiency of cocoa fanners in Iddo Local Government, Area of Oyo State. The subsidiary objectives are: to examine the socio-economic characteristics of the farmers:

To determine the effects of factors of production on output of the farmers; to examine the effects of socio-economic variables of the farmers on their technical inefficiency and to estimate technical efficiency of each farmer. Methodology

The study was carried out in Oyo State, south west of Nigeria. Southwestern Nigeria produces 85 percent of total cocoa produced in the country. Oyo State has 33 Local Government Areas (LGAS) with state capital in Ibadan. Oyo State Agricultural Development Project OYSADEP *has grouped the* state into four zones *on ecological basis. The* four zones are (1) Ibadan/ Ibarapa zone, (2) Ogbomosho zone, (3) Saki zone and (4) Oyo zone. The study concentrates on Ibadan/lbarapa zone where cocoa fanning is popular. The major cocoa producing L.G. A. in Ibadan /Ibarapa zone are Lagelu L. G A, Oluyole L. G. A, Ona Are L. G A, Egbeda L. G. A, Akinyele L. G. A. and Iddo L. G. A. To obtain the relevant farm household data required for this study, farm management survey was conducted. The main instrument for collecting the primary data is structured questionnaire that was administered by trained enumerators from OYSADEP. Data collected include socio-economic characteristics of the fanners such as age, education level, gender, marital status, experiences, household size, and extension contact/year, production inputs; farm output and their farm gate and market prices. The target population for this study is cocoa fanners in Iddo Local Government Area of Oyo state. The sampling technique used is multistage sampling. Ibadan/lbarapa zone was purposively selected for this' study because it has the highest concentration of cocoa farmers in the state. Iddo Local Government Area (LGA) was randomly selected from six LGAs that make up Ibadan/lbarapa zone. Three villages were also randomly chosen from the list of the villages in the L. GA obtained from Oyo State Agricultural Development Project (OYSADEP) in Ibadan. Twenty farmers were further selected from each village that subsequently gave 60 farmers that constituted the sample size for the study. Only 55 of the returned questionnaire were found useful. The relevant information in the 55 returned questionnaires were coded and analyzed using descriptive statistics and stochastic production frontier.

In this study, a variant of Battese and Coelli (1995) model was applied in the analysis of data to capture the efficiency of the farmers.

The empirical model of the stochastic production frontier is specified as: $\ln Q = a_o + a! \, mxlj + a_2 l \, nx_2 i + a_3 \, Inx3i + a_4 \, Inx_4 1 + a_5 \, Inx_5 i + a_6 Inx_6 i + (Vi - Ui)$—— (1)

The subscript i refer to the ilh farmer, where

In = natural logarithm

Q = Total value of farm output (N)

X] = Land area under cultivation (ha)

X_2 = Total quantity of family labour (man-day)

X_3 = Total quantity of hired labour (man-day)

X_4 = Expenses on fertilizer and agrochemical (N)

X_5 = Cost of farm implement (N) (Depreciation)

X_f, = Volume of credit used in production process

V, = a random error term with independent and identical normal distribution with mean zero and variance $8"_v$, intended to capture events outside control of the farmers, such as weather, e. t. c. Ui = Non-negative random variable called technical inefficiency effects associate with technical inefficiency of the farmers involved. It is assumed to arise from a normal distribution with mean u and variance 5^2_{Vj} which truncated at zero. If ui = O no allocative inefficiency occurs, the production lies on (he stochastic frontier. If Ui >O, production lies below the frontier and is inefficient.

The average level of technical efficiency measured by the mode of truncated normal distribution (i. e. Ui) is a function of socio- economic factors as shown in equation 2 below. $Ui = ao + a, Z, + a_2 Z_2 + a_3 Z_3 + a_4 Z_4 + a_5 Z_5 + a_G Z_0 + a_7 Z_7$ -—(2)

Where :

Zi = Age of the farmer (years)
Z_2 = Years of formal education (years)
Z_3 = Experience (years)
Z_4 ' = Household size
Z_5 = Number of innovations adopted (count 1 to 6)
$Z_{„}$ = Age of the farm
Z_7• = Disease incidence (Black pod Disease) 1.
For effected farm, 0 otherwise.

A's and y coefficients are unknown parameters to be estimated along with the various parameter which are expressed in term of $8^2_S = 8^2_V + 5^2_{IL} = y\ 5^2_V/5^2_S$

Where the y - parameter has value between zero and one. The parameters of stochastic frontier production function model are obtained by maximum likelihood estimation method, using the computer program, **FRONTIER VERSION 4.1** (Coelli, 1994), where equations 1 and 2 were simultaneously estimated. Battese and Coelli (1995) defined technical efficiency of a farmer as the ratio of the observed output to the frontier output, which could be produced by a farm operating at 100% efficiency, in which the inefficiency is zero. This could be expressed mathematically as $Tei = _{exp}(Ui)$.-(3).

Results and Discussion

Table 1: Summary of the Socio-Economic Variables of the Farmers.

Variables	Mean
Age of the farmers	53. 76 years
Years of formal education	2,12 years
Farming experience	25.91 years
Household size	8.48
Farm size	3.24 ha
Age of the farm	14.98 years.
Volume of credit	N 12582
Farm income	N126785

Source: Computed from field survey data, 2002.

Table 1 shows that the mean age of the farmers is 5376 years. This indicates that the farmers are relatively old, a factor that may affect their productivity. The mean years of schooling implies that many of the fanners are illiterate. In fact, Appendix 1 shows that 84% of the farmers are illiterate. Low education level may hamper development activities. Table 1 shows further that the farmers are experienced in fanning activities. The mean years of farming experience of 25.91 years will enable them to evolve a farming system adaptable to their local environment. The household size of 8.48 is on the high side, the large size can be both asset and liability to the farmers. They can also drain the financial resources on the farming. Farm size of 3.2ha indicates the fanners are small scale farmers, the size may determine their output. The farms are 14.98 years old, which means that they are still productivity will start to decline as from 25 years of age (Wood and Lass, 1989). The credit volume of ₤₤12582 to each fanner may not be enough to purchase necessary input on the farm. The annual income of the fanners is Ml 26,785; this is higher than N 53,559,33 estimated for food crop farmers by Ajani and Olayemi (2000).

Table 2: Maximum Likelihood Estimate of Equation 1 and 2.

Variable	Coefficient	T-ratio
Constant	103716.93	22091.93
Farm size	5031.87	445.83*
Family labour	88.13	5.7*
Hired labour	4.90	0.41
Chemical + fert. Cost	-1.06	-2.72*
Cost of implement	-212	-2.99*
Volume of credit	0.83	1.2
	Inefficiency parameters	
Age of the farmers	303.16	0.38
Years of formal education	-1109.15	-0.54
Farming experience	-819.03	-051
Household size	265.73	0.56
Innovation Adoption	-241.59	-0.55
Age of the farm	-298.34	-0.51
Disease incidence	72.78	0.53

^significant at 5% Source: Computed from field survey data 2002:

Table 2 indicates that while costs of chemical fertilizer and implement have negative but significant relationships with the output of cocoa farms, farm size, and family labour have positive and significant effects on the output. Hired labour and volume of credit though positive not statistically significant at 5%. The non-significance of the two variables may be due to the low level of their usage in the study area. The above result implies that farm size, family labour are the positive determinants of output of cocoa farms. Which means that increase in farm size and labour will result in more than proportionate in output. Since, farm size has the highest positive elasticity increase in farm size will bring about increase in output of cocoa farms more than increase in any other factors specified above. The negative relationship between cost variables and output of cocoa farms shows that increase in cost elements will reduce the output of cocoa in the study area. Inefficiency parameters reveal that education, experience, innovation adoption and age of the farms have negative relationship with technical inefficiency of the farmers, while age of the farmers, household size and disease incidence have positive effects on technical inefficiency of the farmers. Ajibefun, Battese and Daramola (2002); Battese and Coelli (1995) have reported that education, farming experience reduce technical inefficiency of farmers, while age of the farmers increase it. The negative relationship between number of innovations adopted and technical inefficiency of the farmer decreases as the number of innovations adopted increases. The age of the farms is negatively related to the technical inefficiency because productivity increases with age of the cocoa trees until they reach 25 years. The positive relationship between age of the farmer's household size and disease incidence and technical inefficiency implies that old farmers, fanners with large household size and infected farms are less technically efficient than young farmers, with small household size and healthy farms.

Table 3: Technical Efficiency of Cocoa Farmers in Iddo Local Government Area of Oyo State

Interval	Technical Efficiency
Minimum	0,91
Maximum	0.98
Mean	0.97

Source: Computed from field survey data, 2002:

Table 3 shows that the technical efficiency of the fanners varies from 0.91 to 0.98 with mean of 0.97. this indicates that the farmers are 97% efficient in the use of their inputs. The estimated value of 97% is higher than 82% technical efficiencies estimated for food crop farmers in Oyo State, and NDE food crop fanners in Ondo State respectively (Ajibefun, Battese and Kada, 2002). Reason for the difference in technical efficiency estimate for the food crop farmer and cocoa farmers can be explained by the fact that cocoa farmers are involved in agroforestry system that make judicious use of available resources. The fact that agroforestry system is more economical has been established by various scholars (Moseley, 1994; Kerkof, 1990).

Conclusion

They study shows that the determinants of cocoa farmers are, farm size, family labour, costs of chemical, fertilizers and implement., while the determinants of efficiency are age of the farmers, years of formal education, farming experience, household size, innovation adoption, age of the farm and incidence of disease. While the age of the farmers, household size and incidence of disease the technical inefficiency of the farmers years of formal education, experience, adoption and age of the farms decrease the technical inefficiency of the fanners. It means that increase in the inefficiency of the farmers can reduce their estimated technical inefficiency of 97% to higher values. Therefore, efforts should be made to increase the technical efficiency-enhancing factors in the study area. These include increase in the educational level of (he fanners through mass literacy campaign and making farm technologies available and affordable.

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