Journal of Economics and Sustainable Development www.iiste.org
ISSN 2222-1700 (Paper) ISSN 2222-2855 (Online)
Vol.5, No.11, 2014

The Determinants of Profit Efficiency of Coffee Producing and Marketing Cooperatives (The case study of Sidama Coffee farmers' Union)

Hailemichael Mulie (PhD Candidate)
In Commerce and Management,Department of Management,School Of Business and Economics
Madawalabu University,Addis Ababa, Ethiopia

Abstract
Ethiopia is implementing the plan for modernizing agriculture and eradicating poverty through cooperatives as one of ways to tackle poverty in both rural and urban areas. Consequently, it necessitates to access technical information on strategic cash crops such as coffee, which is the major cash earner for the farmers and the nation at large. The main objective of this study was to explore the major determinants of profit efficiency of coffee producing and marketing cooperatives. Along with plastering objectives of measuring profit efficiency and estimating profit frontier. The research used cross sectional data collected from three districts namely Abela, Howolso and Taramessa in south region Ethiopia. The data used both quantitative and qualitative paradigms .Apart from this, the thesis employee two econometric models of Stochastic Profit frontier Model and Firm specific inefficiency models. The parameters were estimated simultaneously using FROTIER4.1 and STATA 9 softwares. In the research both primary and secondary data were used and more of primary data have been given priority as the model requires primary data. The result showed area/land under coffee and cost of hired labor had positive impact on profit levels while cost of family labor and capital were found to have negative influence on profitability. The analysis reveals that firms were not operating at profit frontier and scored a mean profit efficiency of 57 and it implies there a 43%profit loss due to firm specific and institutional variables. Further analysis showed coffee farmers are losing income due to allocative and technical inefficiency. The established source of inefficiency variables were found limited access to credit extension worker lack of storage after harvest, education level of the farmers and the major determinants were access to extension service, lack of formal education and storage facilities. The research has come up with recommendation That government need to train farmers about basic skills of farming and technology diffusion, establishing and strengthening existing cooperative banks to enable farmers to have access to credit facilities so as to uplift and scale up the lively hood of farmers.

Introduction

Cooperation has been the very basis of human civilization. The enter-dependence and the mutual help among human beings have been the basis of social life. The rise and expansion of the modern cooperative movement has its roots in the far-reaching economic, social and political changes which took place in Europe in the late eighteenth and all through the nineteenth century, especially the Industrial Revolution and the liberation of the peasantry from the former feudalistic system.[Helen,1986.pp.1]. In Ethiopia modern cooperative is traced back to 1960s "Farm workers cooperatives" Decree 44/1960 during the regime of Emperor Haile Sillasie I. the movement and expansion of cooperatives during dergue regime was not based on voluntarism and lacks free market for their products. Currently cooperatives are established as institutions as a means of promoting small holder commercialization and alternatives for eradicating poverty in both urban and rural areas. The significance of marketing as a means of improving firm profitability has never been greater than it is today. Marketing in Ethiopia has been for long neglected area due to the centralized organization of activities and protective controls exercised by the previous government.

Farmers in Ethiopia, where the drinking of coffee originated 3,000 years ago, have begun cutting down coffee bushes and replacing them with the drug Chat. According to report by Oxfam (2002), the British aid group, which reports that the slump in world coffee price is boosting the global drugs trade.

The traditional way of thinking to get profit through large volume and the production concept of marketing is another problem that farmers face in market. (Abraham, 2003). According to the findings of Mekuria (2004) the collapse of world coffee price has contributed to a socio economic decline affecting an estimate of 125 million people worldwide. Ethiopia is the primary victim one.

Coffee production and marketing in cooperatives is the major area where 25% or more than 15 million of the population is directly or indirectly depends on coffee. Ethiopia's largest export crop is the backbone of the Ethiopian economy. High transaction costs; Compromise our competitiveness in the global market, and thus effectively constitute a barrier to market (EEA). Thus, market failure negatively impacts producer and consumer welfare, (*http\\www.i pfri.org*)

Coffee contribution declines from farmer to government amounted to 42%. According to Southern Nation

Nationality Peoples' Region bureau of agriculture reported in 2001/02 price of coffee has been fallen by 62% as compared to 1997/98. Similarly the report from Oromia region depicted that the price of red cherry coffee decreased by 70% and that of dry coffee by 40% between 1998/99&99 and 2001/2(GOE, 2000) showing a negative signal on the livelihood of farmers.

The continuing strong performance of giant coffee roaster companies in striking contrast with ever increasing small scale coffee farmers specially at a time historically low green coffee price during periods 1999-2001 the international coffee price has fallen by almost 50% (www.Fairtrade.net). The situation is such small-scale coffee farmers are receiving bellow 1% share of coffee export as compared to big restaurants and 6% of pack of coffee sold in super markets and groceries. Whereas the top five coffee roasters namely Nestle, Sara lee, Kraft, Protector and Ganbel and Tchibo control more than 40% of the world coffee market (Oxfam international 2002).

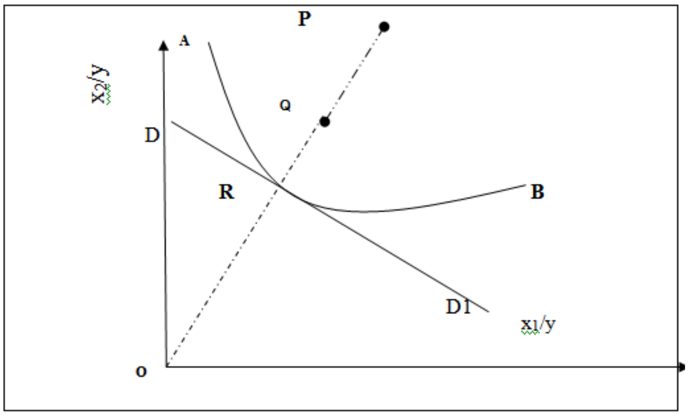
2. Theoretical Backgrounds

2.1. Theoretical basis for measurement of efficiency

2.1.1 Technical, Allocative and Economic Efficiency

Measurement of economic efficiency requires an understanding of the decision making behavior of the producer. A rational producer, producing a single output say coffee from a number of inputs, $\mathbf{x} = x_1 \ldots\ldots x_n$, that are purchased at given input prices, $\mathbf{w} = w_1 \ldots\ldots w_n$ and operating on a production frontier will be deemed to be efficient. But if the producer is using a combination of inputs in such a way that it fails to maximize output or can use less inputs to attain the same output, then the producer is not economically efficient. A given combination of input and output is therefore economically efficient if it is both technically and allocativelly efficient; that is, when the related input ratio is on both the isoquant and the expansion path. These contentions are best illustrated in the figure 1. In figure 1, AB is an isoquant, representing technically efficient combinations of inputs, x_1 and x_2, used in producing output Q. AB is also known as the 'best practice'[1]production frontier. DD1 is an iso-cost line, which shows all combinations of inputs x_1 and x_2 such that input costs sum to the same total cost of production. However, any firm intending to maximize profits has to produce at Q', which is a point of tangency and representing the least cost combination of x_1 and x_2 in production of Q. At point Q' the producer is economically efficiency. Turning to measurement of technical, allocative and economic efficiency, the same figure 1 is employed. Suppose a farmer is producing its output depicted by isoquant AB with input combination level of ($X_1$and X_2) in figure1. At this point (P) of input combination the production is not technically efficient because the level of inputs needed to produce the same quantity is Q on isoquant AB. In other words, the farmer can produce at any point on AB with fewer inputs (X_1 and X_2) in this case at Q in an input-input space. The degree of technical efficiency of such a farm is measured as OQ/OP. OQ/OP is the proportional reduction of all inputs that could theoretically be achieved without any reduction in output. In figure 1, DD1 represent input price ratio or iso-cost line, which gives the minimum expenditure for which a firm intending to maximize profit should adopt. The same farm using (X_1 and X_2) to produce output P would be allocatively inefficient in relation to R. Its level of allocative efficiency is represented by OR/OQ, since the distance RQ represents the reduction in production costs if the farmer using the combination of input (X_1 and X_2) was to produce at any point on D D1, particularly R instead of P. The overall (economic) efficiency is measured as the product of OQ/OP and OR/OQ, which is OR/OP. This follows from interpretation of distance RP as the reduction in costs if a technically and allocatively inefficient producer at P were to become efficient (both technically and allocatively) at Q'.

[1] Coelli (1995) indicates that the production function of the fully efficient firm '**best practice'** is not known in practice, and thus it must be estimated from the sample of the industry concerne



2.1.2. Profit function

A profit function is an extension and formalization of the production decisions taken by a farmer. According to production theory, a farmer is assumed to choose a combination of variable inputs and outputs that maximize profit subject to technology constraint (Sadoulet and De Janvry, 1995). The underlying production function can be generalized as h (**q, x, z**) = 0 where q is a vector of output, **x** is a vector of variable inputs, **z** is a vector of fixed inputs and h is a technology. Assuming the technology to be homogeneous across farms, restricted profit function is specified as follows:

Max **p.q-wx**,……………., s.t. h(**q,x,z**) = 0 (1)

Where: **p** is a vector of prices of outputs and

w is a vector of prices of variable inputs

Considering a set of inputs and outputs the profit maximizing input demand and output supply functions are generally respectively expressed as:

X = x (**p, w, z**) (2)

Q = q (**p, w, z**) (3)

Substituting equation 2 and 3 into1 gives a profit function which is the maximum profit that the farmer can obtain given prices of p and w, availability of fixed factors z and production technology (h). The profit function can be written as

π = p'q(p,w,z) - w'x(p,w,z) (4)

This study uses the normalized profit function outlined in equation 5 given the fact that the study is dealing with a single output, that is, coffee (Sadoulet and De Janvry, 1995). Hence for coffee, we have:

$\pi_i = f(P_{ij}, Z_{ik}).\exp(e_i)$ (5)

This makes profit non-linear in its error term. However, the profit function can be loglinearized to obtain the form : $\ln \pi_i = \ln f(.) + e_i$.

where:

π_i = normalized profit on firm $_i$ defined as gross revenue minus variable cost divided by the output price.

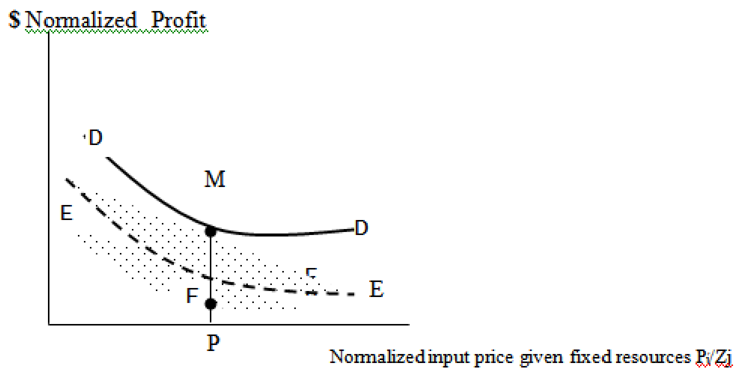
P_{ij} = prices of variable input j on firm i divided by the output price.

Z_{ik} = level of fixed input on firm $_i$ where k are a number of fixed inputs. $_i$ = $_{1,}$……………………………, n number of farms in the sample.

e_i = error term assumed to behave in a manner consistent with the frontier concept (Ali and Flinn, 1989). Figure 2 shows the stochastic profit frontier function adopted from Ali and Flinn, (1989). Including of the farm specific level prices leads to the profit function approach formulation (Ali and Flinn, 1989; Wang et al., 1996a).

The profit function approach combines the concepts of technical, allocative and scale inefficiency in the profit relationships and any errors in the production decision translate into lower profits or revenue for the producer (Rahman, 2003). Profit efficiency is defined as the ability of a farm to achieve highest possible profit given the prices and levels of fixed factors of that farm and profit inefficiency in this context is defined as the loss or short fall of profit from not operating on the frontier (Ali and Flinn, 1989). In the context of frontier literature, DD in figure 2 represents profit frontier of farms in the industry (the best practice firm in the industry with the given technology). EE is the average response function (profit function) that does not take into account the farm specific inefficiencies. All farms that fall below DD are not attaining optimal profit given the prevailing input and output prices in the product and the input markets. In agriculture, a farmer has to pay attention to relative prices of the inputs such that the production is undertaken at the point where the isoquant is tangent to isocost line (Figure1). If that is not done, economic efficiency is not achieved. This inefficiency could arise from a number of sources, which include access to appropriate information in a timely manner or lack of skills to take advantage of modern agricultural inputs. Besides, the farmer's inability to make optimal decisions may be due to external factors, which lie outside his/her prevue. These include untimely input supply, bad weather, non-conducive policies and other random shocks such as wars, floods, pests and diseases, droughts, and statistical errors.

Figure 2: Frontier MLE and OLS Stochastic Profit Function



Source: Ali and Flinn (1989)

Deterministic Versus Stochastic Frontier Models

The SFA approach inquires that a functional firm be specified for the frontier production function while DEA approach uses linear programming to construct a piece-wise frontier that envelops the observations of all firms. According to Taylor and Shonkwiler (1986), Afriat (1972) was the first to propose the formulation and application of a deterministic production frontier model. The basic structure of the model is:

$Y = f(x, ß)\, e^{-\mu}$ .... (6)

Where f (x, ß) denotes the frontier production function and μ is a one-sided non-negative distribution term. This model imposes constraint of $\mu \geq 0$, which implies output is less than the potential or it is equal to the potential, within the given input and output prices. Stochastic models begin with Aigner and Chu (1968) who proposed a composed error term, and since their work much effort has been exerted to finding an appropriate model to measure technical efficiency. The result was the development of a stochastic frontier model (Aigner, et al., 1977, Meeusen and van den Broeck, 1977, Battese and Corra, 1977). The model addressed the weaknesses of the deterministic model by introducing ν into the deterministic model to form a composed error term model (stochastic frontier). The error term of the stochastic model is assumed to have two additive components: a symmetric component accounting for pure random factors and a one-sided component that captures the effects of inefficiency relative to stochastic frontier. The model is specified as follows:

$\boldsymbol{f(x, ß)\, e^{v-\mu}}$ .... (7)

where f (x, ß), is as defined in (6) and ν-μ is error term, ν represents factors external to the farmer and are assumed to be independently and identically distributed (iid) as $N(0,\sigma_v^2)$; μ is half-normal distribution or exponential distribution. The model addresses the weaknesses of the deterministic model. It is also possible to estimate standard errors and test for hypotheses that the observed inefficiency is not due to farmer's practices only as suggested in deterministic model (Thiam et al., 2001). Jondrow et al., (1982) provided an explicit formula to separate the two component error term for both half normal distribution and exponential distribution cases. Though this was an improvement over the deterministic model, it was still constrained by lack of a priori justification for the selection of a particular distributional form for the one-sided inefficiency term μ (Thiam et al., 2001).

2.2. Theoretical profit function and stochastic frontier model

A profit function, under mild 'regularity conditions' is a logical extension of the production function (Sadoulet and Alain de Janvry, 1995). Regularity conditions require that the function must be non-negative, monotonically increasing in output, convex and homogeneous of degree zero in all prices. To estimate the profit function, in the neoclassical theory, it is assumed that the farmer is operating on the frontier and the price of inputs and outputs are known. But in reality some of the farmers operate below and some above the frontier.

Furthermore, Junanker (1989) observed that farmers do not always operate in competitive input and output markets in developing countries and this violates the neoclassical assumptions. Since Junanker's observation, there have been a number of developments to respond to this criticism. First, the assumption of output and input competitive markets is not needed in defining the firm's profit function, especially in developing countries. What is needed is the output and input prices to be exogenous to the farm but be competitively determined (Sevilla-Siero, 1991). Secondly price variation can be handled by including district dummies (Lau and Yotopolous, 1971; Akinwumi and Djato, 1996). Third, it is currently possible to incorporate institutional and environmental factors referred to earlier such as quality of soils and rainfall as shown by (Ali and Flinn, 1989; Coelli ,1995). Fourth, profit function does not suffer from simultaneous equation bias problems as in production function. Fifth, the function has been used before in African context (Saleem, 1988; Akinwumi and Djato , 1996 and 1997). Thus, a stochastic profit function approach is deemed appropriate for this study. This study adopts the Ali and Flinn's model specified in equation 8:

$$\pi_j = f(P_{ij}, Z_{\kappa j}, D_{ij}).^{\exp e_j} \quad \text{.............(8)}$$

Where

π_j = profit of jth farm defined as gross revenue less variable cost, divided by commodity prices from farm j.

P_{ij} = prices of the variable inputs on jth farm,

$Z_{\kappa j}$ = kth fixed factors on jth farm and

D_{ij} = exogenous variables on jth farm,

e^j = an error term, and j = 1,…….n, is the number of farms in the sample.

If equation 8 is estimated using the Ordinary Least Squares (OLS) procedures, an average, instead of best practice frontier is shown by an envelope curve EE (figure 2) given in chapter 2. To attain 'best practice' frontier, an appropriate error structure is appended to equation 8. Following Kmenta (1986), the study by Ali and Flinn (1989) proved that the same error term as that used in production function frontier analysis was relevant to profit frontier. Thus the following error term specified in equation 9 was used:

$$e^j = v_j - \mu_j \quad \text{.............(9)}$$

where v_j and μ_j are random error terms and inefficiency effects of the farm j, respectively. When $\mu_j = 0$, the firm lies on the frontier but if $\mu_j > 0$ the farm is profit inefficient.
The inefficiency effects (μ_j) in equation (9) which are non-negative random variables are assumed to be identically and independently distributed such that μ_j is defined by the truncation (at zero) of the normal distribution with a mean of $\mu_j = \delta_0 + \sum_{d=1}^{n} \delta_d w_d + \omega$ and variance σ_μ^2 where $\omega_{\delta j}$ are the variable representing socio-economic characteristics of farm $_j$ to explain inefficiency and δ_0 and δ_d are the unknown parameters to be estimated. The profit efficiency of the farm in the context of stochastic frontier is given by**:**

$$\zeta_j = E[\exp(-\mu_j)|e^j] = E[\exp(-\delta_0 + \sum_{\delta=1}^{i} \delta_d \omega_{dj})] \quad \text{.............(10)}$$

Where ζ_j is profit efficiency of farmer j and lies between 0 and 1 and is inversely related to the level of profit inefficiency. E is the probability or expectation operator. This is achieved by obtaining the expressions for the conditional expectation μ_j upon observed value of ζ_j.

3. Data and Methods

The major objective of the study is to analyze the determinants profit efficiency with specific objectives of measuring profit efficiency levels and determining major determinants of profit efficiency.

3.1. The Data Set :(Collection methods, type of data, sampling procedures Data Analysis methods).

The research used a cross-sectional data for the year 2009 and both primary and secondary data were collected using a questionnaire from 150 households in three districts. A Simple random sampling technique was employed to collect the required data. Multiple linear regression, stochastic profit frontier model and profit inefficiency models were used for analysis purpose. Statistical Softwares namely **FRONTIER 4.1, STATA9 AND LIMDEP8** were also used to analyze the collected data.

Major Hypotheses

1. Coffee farmers are operating at profit frontier function i.e no in efficiency ($\gamma=0$)
2. There is variability in the level of profit efficiency among farmers in the study area.
3. Access to Credit access, education, experience, market information, extension access, and nonfarm employment positively affect profit efficiency.

Econometric Models

3.2. Stochastic profit frontier model and Profit Inefficiency Models

$$\ln\pi' = \alpha_0 + \sum_{i=1}^{2}\alpha_i \ln p_i + \tfrac{1}{2}\sum_{i=1}^{2}\sum_{k=1}^{2} r_{ik}\ln p_i \ln p_k + \sum_{i=1}^{2}\sum_{l=1}^{2}\phi_{il}\ln p_i \ln z_l + \sum_{l=1}^{2}\beta_l \ln z_l +$$

$$\frac{1}{2}\sum_{l=1}^{2}\sum_{q=1}^{2}\varphi_{lq}\ln z_l \ln z_q + v - \mu \text{ -- } \quad \textbf{(11)}$$

Profit inefficiency model

$$\mu = \delta_0 + \sum_{d=1}^{10}\delta_d w_d + \vartheta \text{ -- } \quad \textbf{(12)}$$

$r_{ik} = r_{ki}$ for all k, i

π' Restricted normalized profit computed for jth farm defined as gross revenue less variable cost divided by farm specific coffee price p_j.

ln = natural log

p_i = price of variable inputs normalized by price of farm get output where (for i =1, and 2) so that:

p_1 = the cost of hired labor normalized by price of coffee (p_y)

p_2 = the cost of "family labor" normalized by price of coffee (p_y)

Where: z_l = the quantity of fixed input (l = 1, 2)

z_1 = land under coffee for each farm j

z_2 = capital used in farm j (sum of total cost of hoes, tikes safees and domas and other farm implements)[1].

μ = inefficiency effects

ϑ = truncated random variable

δ_0 = constant in equation 12

ω_d = variables explaining inefficiency effects and are defined as follows:

ω_1 = Non Farm Employment

ω_2 = Education of the household head

ω_3 = Extension services other than cooperatives

ω_4 = Credit access

ω_5 = Experience

ω_6 = Market information

ω7 = Storage

ω8 = Age of house hold

4. The items were assumed to be used up in one production year therefore no depreciation is necessary

5.The incorporation of the farm specific level prices leads to the profit function approach formulation (Ali and Flinn, 1989; Wang et al., 1996a). A production approach to measure efficiency may not be appropriate when farmers face different prices and have different factor endowment (Ali and Flinn, 1989

ω_9 = House hold size
ω_{10} = Distance from market

α_0, α_i , r_{ik} $\varnothing_{il}$, β_l , , φ_{lq} , δ_0 and δ_d, are the parameters to be estimated.

Table 3.1: Variables Included in the Frontier Profit Function Models and their Descriptions

Variable	Descriptions	Expected sign
π'	Normalized profit of the j th farm defined as gross revenue less variable cost divided by farm specific coffee price (dependent).	
Variables		
p_1	Normalized cost of house hold or family labor divided by price of coffee.	-ve
p_2	Normalized imputed cost of hired labor for the farm divided by price of coffee.	-ve
Fixed factors		
z_1	Land under coffee in hectares on farm j	+ve
z_2	Cost of Capital	-ve

Variables included in the inefficiency model

The variables included the Inefficiency model in equation 12 are presented in table 3.2

Table3. 2: Variables Included in the Inefficiency Model and Descriptions.

List of variables	Descriptions	Expected sign
Model	Inefficiency effects	
δ_0	Intercept term	
ω_1	Nonfarm employment 1= have non-farm employment = 0 other wise	$\pm ve$
ω_2	Education level of a house hold head years	-ve
ω_3	Storage 1 if farmers sell after storing and 0 other wise	-ve
ω_4	Extension service visits to farm j 1= received extension visits 0 otherwise	-ve
ω_5	Credit access by farmer j 1=access 0 = otherwise	-ve
ω_6	Experience measured by years in coffee production by farmer j	-ve
ω_7	Access to market information 1 if farmers have full information about the market price and demand, competition 0 other wise.	-ve
ω_8	Distance from market in kilo meters	-ve
ω_9	Age of house hold head in years the older the age the more the efficiency.	-ve
ω_{10}	House hold size: Number of the house hold including non biological.	-ve

Dependent and Independent Variables

Dependent variable: Normalized profit is the dependent variable.

Independent variables: independent variables are hired labor, family labor, land and capital in model one i.e. ***Stochastic profit frontier model*** and Education, house hold size, credit, market information, distance from market, age of the house hold, nonfarm employment are independent variables in the second model i.e. ***Profit inefficiency model.***

Result and Discussion

Objective 1: Estimating frontier profit function

As explained in chapter 3, the estimation of the stochastic frontier profit function (objectives 1) was undertaken. The dependent variable was normalized profit from an output of one season.

The MLE and OLS results are obtained using FRONTIER VERSION 4.1 computer program.

The results from both OLS and MLE revealed that all variables show the theoretically expected signs except hired labor which shows positive but insignificant sign to profit.

As we can see bellow from the table some of the estimated coefficients of variables in the sample carry the theoretically expected signs in the MLE model and are statistically significant, except in the case of estimates associated with Land and input cost of hired Labor(Table 4.3). However, estimates on cost of hired labor carried unexpected positive sign and this is not surprising that many similar studies have also similar result among these; Theodora Shuwu (2006) in Uganda tororo district and Oguandari Kolawole in Nigeria rice production, cost of hired labor showed positive relation to profit this is because coffee farming is labor intensive and majority of the activities such as Plaughing (kutkuato), which takes 3 to 4 rounds and collecting this also takes substantial days may result in necessitating hired labor and the return from hired labor may outweigh cost paid to the daily workers. Although estimates on cost of hired labor have positive sign, it is not statistically significant. Which implies though hired labor is contributing positively to profit its contribution is very poor. On the other hand in Ethiopia, farmers are employing exhaustively family labor other than hired labor. Most farmers unless they face a very triggering force or situation to employ hired labor, they do not hire labor. Moreover, as we refer from the descriptive statistics the total cost of hired labor is relatively lower than the total cost of family labor suggesting that farmers are employing few hired labor.

The estimates associated with cost of family labor have theoretically expected sign and a statically significant impact on profit. This finding is also supported and consistent with many other results. Theodora S. (2006). Similarly cost of capital has a negative and significant influence on profit efficiency of farmers in the study area. Here the assumption was as the farm implements and other related costs are more and assumed to be bought in the current year and no depreciation is calculated, this may indeed affect profit efficiency negatively. This result contradicts or negates with many similar researches so far done on rice production in Uganda and Bangladesh and poultry production in Nigeria.

The other important explanatory variable which is included in the model is land covered by coffee. It is measured in terms of hectares of land covered by coffee and hypothesized to influence profitability positively. As expected land under cultivation of coffee showed the expected positive sign but it is not statically significant. From economic analysis point of view the coefficient sign has its own power to explain about the direction of the variable about the dependent variable i.e. normalized profit. The result is in consistent with so many findings. To mention some, Theodora Shuwu (2006) for rice producers in Northern and eastern Ugandan, Sanzidur Rahman(1996) on efficiency of rice farmers in Bangladesh, Awudu Abdulai and Wallace E. Huffman.(1998) on efficiency of rice in Ghana.

Table 4.3 MLE estimates from equation11:

Parameters	**Coefficients**	p-v[1]
Beta0 =constant	0.11***	0.00
Beta1 (lnz1)	-0.03**	0.03
Beta2 (lnz2)	0.02	0.87
Beta3 (lnp1)	-0.03**	0.02
Beta4 (lnp2)	0.06	0.74
Beta5 ½ (lnp1*lnp1)	-0.05	0.16
Beta6 ½ (lnp2*lnp2)	0.02***	0.00
Beta7 ½ (lnz1*lnz1)	0.04	0.51
Beta8 ½ (lnz2*lnz2)	0.03	0.82
Beta9 lnp1*lnp2	0.10**	0.02
Beta10 lnz1*lnz2	0.02	0.60
Beta11 lnp1*lnz1	0.02***	0.00
Beta12 lnp1*lnz2	-0.02*	0.08
Beta13 lnp2*lnz1	-0.01***	0.00
Beta14 lnp2*lnz2	0.07 **	0.01

7 p-v1 are p values computed from t-ratios

8 ***, **,* are significant levels at 1%, 5% and 10% respectively

To Analyze the profit efficiency/inefficiency presence two hypotheses were examined to determine whether coffee farmers were operating on the profit frontier or not. If not, how far is each farmer operating from the frontier? The response to this question can be gleaned from the value of (γ). The value of (γ) is close to one indicating that there is inefficiency or that farmers were not operating on the frontier. How far away a given farmer was operating from the frontier is the basic concern of the next section of this study.

The lower section of the table reports the results of testing the hypothesis that the efficiency effects jointly estimated with the profit frontier function are not simply random errors. The key parameter is $\gamma = \delta u^{2/} \delta u^2 + \delta v^2 = 0.67$ which is the ratio of the errors and is bounded between zero and one, where if $\gamma = 0$, inefficiency is not present, and farmers are said to be100% efficient. And if $\gamma = 1$, there is no random noise. The estimated value of γ is close to 1 and is significantly different from zero, thereby, it is possible to deduce the fact that a high level of inefficiencies exists in coffee farming. Above all this, the corresponding variance-ratio parameter γ implies that 67% of the differences between observed and the maximum frontier profits for coffee farming are due to the existing differences in efficiency levels among farmers.

The Null hypothesis that γ =0 is rejected since the calculated gamma is significantly different from zero. γ = *0.67* implies that one-sided random inefficiency component strongly dominates the measurement error and other random disturbance errors indicating that about 67% percent of the variation in actual profit from maximum profit (profit frontier) between farms mainly arose from differences in farmers' practices and socio-demographic factors rather than random variability and noises.

Determinants of profit inefficiency of coffee farmers (inefficiency Model). (Objective 2)

In line with objective number 3, and hypothesis number 3 estimated results based on model 2 or inefficiency model are presented in Table 4.3. The aim was to analyze major factors that explain profit inefficiency. The variables included in the model were in line with theory as explained in chapter 3 and other related empirical findings.

Education: Estimates from inefficiency model reveals an expected negative sign on education and is statistically significant. Therefore, education at least elementary schooling is found to be important for profit efficiency. Similar results support this finding that education contributes positively for profit efficiency. This implies that to an extent more education brings about decrease inefficiency (increase in efficiency) in coffee production. These results are consistent with Theodora Shuwu (1998) for rice production in Uganda, Lockheed et al., (1980), Ali and Byerlee (1991), Ali and Flinn (1989), Bravo-Ureta and Rieger (1991), Abdulai and Huffman (2000) for rice farmers in Ghana and Wang et al., (1996b) for China. Thus, providing at least elementary education to not only coffee farmers but also other farmers in general would be very indispensable in terms of reducing inefficiency.

The result on experience shows an expected negative sign but not statistically significant. This implies that farmers who have ample experience are found to be more profitable and efficient than those who have few years of experience. Oguandari Kolawole. (2006) in his study of identifying the determinants of profit efficiency of rice farmers, Theodora Shuwu (2006).

Extension service which is particularly aimed at diffusing and adopting new technology, experience, knowledge and skills to coffee farmers, seemed to play its part in increasing efficiency. The Table again clearly reveals that farmers who have access to extension services perform significantly better in terms of earning actual profit, incurring less profit loss and operating at higher level of efficiency.

Findings on the non-farm employment variable carry the expected negative sign in the study area. This is also consistent with what was hypothesized in chapter 3. Theodora S. (2006) in Uganda study efficiency of rice production, Abdulai and Huffman (2000) reported similar results for rice farmers in Northern Ghana. Ali and Flinn (1989), Wang et al., (1996b) and Rahman (2002, 2003) reported similar results for farmers in Pakistan, China and Bangladesh, respectively. The other variable hypothesized to influence profit inefficiency negatively was age. However, in this finding age depicts unexpected sign and insignificant result. This implies when farmers get older and older inefficiency gets high. This is mainly because older age farmers are fading up with long years of farming and are reluctant to adopt and introduce new technologies and are inelastic to changes in farming systems.

A negative and statistical significant relationship between inefficiency and credit is also revealed suggesting that farmers who have credit access are better off than those who did not have credit access. The result implies that farmers who have access to credit will purchase inputs such as farm implements, seed, and enable them to hire additional labor for different activities. Whereas farmers who don't have access to credit will not be able to purchase farm implements, and hire variable inputs like hired labor as a result they are found to be less efficient comparatively. Access to credit is expected to ease or overcome the financial constraints, enhance the acquisition of the much-needed inputs, and improve revenue and subsequently profits. Estimated coefficient associated with access to market information revealed un expected positive sin but is not statistical significant this may be basically that farmers as the descriptive statistics depicts 98% of the farmers though they have ample market Information about the prevailing price, demand and competition, they simply sell coffee to their respected cooperative societies. Coefficient estimated associated with house hold size is found to be crucial aspect in coffee farming. The result shows its expected negative sing though it is not statistically significant. The result suggests that farmers who have larger number of family numbers regardless of sex and age, it contributes negatively for profit inefficiency and positively for profitability. Distance from market is another prioritized variable included in inefficiency model to see whether short distance from market contributes positively to profit in efficiency. The result shows unexpected positive sign but not statically significant implying shorter distances from the market contributes positively to profit efficiency. The last but not the least parameter included in inefficiency model and top prioritized is storage. The estimated coefficient associated with storage showed expected negative sign and is statically significant suggesting that farmers who store their coffee until the price gets better are found to be more efficient than farmers that did not store for some time.

Table 4.3 estimation of Inefficiency parameters.

Inefficiency parameters(Model 2)	**Coefficients**	p-v[1]
Constant	0.03***	0.00
Delta1 = Education	-0.01**	0.01
Delta2 Experience	-0.01	0.24
Delta3 Extension access	-0.04*	0.06
Delta 4 Credit access	-0.06**	0.04
Delta 5 Age	0.08	0.67
Delta 6 House hold size	-0.03	0.52
Delta 7 Market Information	0.02	0.80
Delta 8 distance from mkt	0.04	0.32
Delta 9 storage	-0.04*	0.07
Delta 10 nonfarm employment.	-0.03***	0.00
Variance parameters		
sigma-squared $\delta^{2} = \delta u^2 + \delta v^2$	0.44	
Gamma $\gamma = \delta u^{2/} \delta u^2{}_{+} \delta v^2$	0.67	

*9 ***, **,* are significant levels at 1%, 5% and 10% respectively*

Measuring profit efficiency coffee farmers

The lower table exhibits the level of profit efficiency coffee of farmers which answers two hypotheses and one specific objective.

These two hypotheses are set for checking whether farmers in the study area exhibited similar efficiency. The first hypothesis deals with that There is variability among farmers efficiency level here the null hypothesis is that there no variability among coffee farmers in the study area i.e. Ho= f1=f2=fn where, n= 151 f stands for farmers. And second hypothesis is plastered with the previous hypothesis which states that how far farmers are from the frontier if they are not operating at the frontier. Now also let me escape the second hypothesis which wants to test how far from the frontier and begin with the first one. The result ascertains that there is a large variability in efficiency level ranging from 0.17 to 0.95.This implies farmers in the study area perform differently not because of random shocks or by chance or errors such as change in government policy, weather and other disturbance errors. This can be supported by gamma ($\gamma = 0.67$) that assures the observed variability of profit efficiency is mainly because of farmers specific and institutional factors that bring inefficiency.

The distribution of profit efficiency of coffee farmers is presented in table. The mean profit efficiency score is 0.57 implying that the average farm producing coffee can increase profits by 43% by improving their technical efficiency. It also suggests that farmers are losing a profit amounted 43% due to inefficiency. Ali et al., (1994) reported mean profit efficiency level of 0.75 (range 4 to90%) for rice producers in North-West Frontier Province of Pakistan. Wang et al., (1996) reported mean profit efficiency level of 0.62 (range 6 to 93%) for rural farm households in China. Abdulai and Huffman's (2000) These similarities may be a reflection of the low level of economic transformation of many of the third world peasant economies where coffee is grown. This result can clearly show and ascertain the distance or how far coffee farmers are from the maximum or frontier curve**.** As a result it can be sound to say coffee farmers are far from the frontier by 43% and are a bit above the middle of the road. i.e. 50+7.

Table 4.4 Profit Efficiency score Index of coffee farmers.

Efficiency index	number of farms(frequency)	Percentage
0-0 – 0.10	0	0
0.11 - 0.20	3	2
0.21 - 0.30	9	5.95
0.31 - 0.40	16	10.5
0.41 - 0.50	24	16
0.51 - 0.60	24	16
0.61 - 0.70	32	21
0.71 - 0.80	33	22.1
0.81 - 0.90	9	5.96
0.91 – 0.99	1	0.15
Total	151	100
Mea 0.57		
Max 0.95		
Min 0.17		

Source: computed from profit frontier model.

Conclusions and Policy Recommendations

The major objective of the study was to analyze determinants of profit efficiency of coffee producers. The subsidiary objectives were to determine or Measure farm-specific profit efficiency levels and explain inefficiency levels observed, estimate coffee profit frontier function and to characterize coffee production and marketing by descriptive statistics. The study results from the frontier profit function showed that the major variables affecting profit efficiency were imputed wage of family labor and area under coffee. Imputed cost of family labor had a negative influence on profit whereas area under coffee had the opposite effect.

These results, therefore, pin points that in order to improve profit levels in coffee production there is need to increase area under coffee so that many number of coffee trees can be planted and reduce family labor in rice production. As the study revealed currently coffee farmers in the study area are operating on an average of 0.68 hectares of land. But area expansion may not be possible because of the increasing of population and the high density of population in the region and even the possibility necessitates or implies increasing family labor, which negatively affects profit efficiency. Thus, this suggests that land-augmenting technologies such as improved seeds and effective farm management would be the most appropriate approach. This serves to re-emphasize the need for research stations to strengthen the breeding programs in order to come up with high yielding varieties for release to coffee farmers.

The finding also showed that the majority of coffee farmers were not operating on the profit frontier, are even very far from the frontier by 43% given the technology and that there was potential to do so by eliminating the observed inefficiencies. The variables found to explain the observed profit inefficiency levels among coffee producers were lack of extension services, low educational levels lack of credit access, lack of non farm employment and lack of storage. Therefore, coffee farmers have to reduce profit inefficiency, which implies moving them to wards the profit frontier. The results in this study help to reinforce the government's and cooperatives' policy of bringing extension services nearer to the farmers. This can be achieved by assigning extension workers to specific districts and cross check the frequent contact between farmers and extension workers.

Facilitating credit availability and giving at least primary education, advices to engage in additional farm employment and to store their produces price and demand in general to meet time utility.

Regarding extension service primary cooperatives or the union can compliment with **on farm training** which is attainable and not costly so that farmers can benefit out of such short term trainings. To be specific in recommending, both the better off farmers and the penniless or destitute farmers, the nearby or the distant farmers should be treated and visited equally in the eyes of government and cooperatives too. Why I need to emphasize on this issue as an recommendation is mainly because during the interview session it was confusing and pity to hear from the respondents that mostly better-offs only access different opportunities such extension visits and credit facilities and the destitute responded that they are marginalized.

Concerning credit, cooperatives should manage and tackle this problem by the following ways recommended here under.

1. As the cooperative bank established in Oromia similar cooperative banks in south and North must be set up unless it is found to be beyond the capacity to establish. By doing so the destitute farmers can get immediate credit access and meet their immediate obligations.
2. Horizontal and vertical integration of cooperatives must be systematically cultivated as a means saving and Credit cooperative shall create a linkage so that they can invest a huge amount of money. Correspondingly

coffee farmers can be benefited mutually.

3. Different micro finances and the union shall create a linkage to facilitate credit to farmers

Finally, to reduce profit inefficiency levels in the study area the problem of non-farm employment must be combated. One way is create employment opportunities such as trade, outside the farm. This would enable some of the farmers to access jobs from which they can earn income. The income would be used to purchase inputs and hire additional hired labor to use on the farm and hence improve on productivity.

References:

Abdulai, A., and Huffman, W. (2000). Structural adjustment and economic efficiency of Rice Farmers in Northern Ghana. Economic Development and Cultural Change, 504-519.

Abdurehman Amme (1995) on coffee supply response in hareghe high lands in investigates the determinants of elasticity of coffee supply.

Abraham Mukulo, (2003) a manual for cooperative marketing un published hand book.

Aigner, D.J., and Chu, S.F. (1968). On estimating the industry production function. American Economic Review, 58, 826-839.

Akinwumi, A., and Djato, K. K. (1996). Farm size, relative efficiency and agrarian policy in Cote d'Ivoire: Profit function analysis of rice farms. Agricultural Economics, 14, 93-102.

Akinwumi, A., and Djato, K.K. (1997).Relative efficiency of women as farm managers: Profit function analysis in Cote d'Ivoire. Agricultural Economics, 16, 47-53.

Ali, M., and Flinn, J. (1989), Profit efficiency among Basimati rice producers in Pakistan Punjab. American Journal of Agricultural Economics, 71(2), 303-310.

Appleton, S., and Balihuta, A. (1996). Education and agricultural productivity: Evidence from Uganda Journal of International Development, 8, 415-445.

Assefa, A. (1995). Analysis of Production Efficiency and the Use of Modern Technology in Crop Production: A study of Smallholders in Central Highlands of Ethiopia

Baker Michael and John(2003) Marketing; an introductory text Macmillan1991 p.291)

Battese , G.E., and Corra, G.S. (1977). Estimation of a production frontier model: With application to pastoral zone of Eastern Australia. Australian Journal of Agriculture Economics. 21, 169-179.

Battese, G.E.(1992). Frontier production functions and technical efficiency: A survey of empirical applications in agricultural economics. Agricultural Economics, 7, 185-208.

Bravo-Ureta, B.E., and Pinheiro, A.E. (1993). Efficiency analysis of developing country agriculture: A review of the frontier function literature. Agriculture and Resource Economics Review, 22, 88-101.

Coelli, T. Christopher, P. & Battese, G. (2005). An introduction to efficiency and productivity analysis. 2ndedition. Springer.

Coelli, T. J. (1995). Recent development in frontier modeling and efficiency measurement. Austrarian Journal of Agricultural Economics, 39, 219-245.

Damballa Gelo, (2002) Supply response of coffee under imperfect rural market evidence from present house holds of southern Ethiopia.

Dempsey Jim & Campbell Ruth, (2005**)**. A value chain approach to coffee production: linking Ethiopian coffee producers to international market.

Ethiopian Economic Association (2004) Annual report.

Fafchamps, M.(1992). Solidarity networks in pre-industrial societies: Rational peasants with a moral economy. Economic Development and Cultural Changes 41(1), 147-174. Farrell, M.J. (1957).

Gabremadhin, E. (2003). Institutions, contracts, and market exchange in developing
Economies. International Food Policy Research Institute, Washington, DC 20006

Jondrow, J., Lovell, K.C.A., Materov, I. S., & Schmidt, P. (1982). The estimation of technical inefficiency in the stochastic frontier production function model. Journal of Econometrics, 19, 233-238.

Junankar, P.N. (1989). The response of peasant farmers to price incentives: The use and misuse of profit functions. The Journal of Development Studies, 25(2), 162-182.

Kodama Yuka, (2007). New Role of Cooperatives in Ethiopia: the case of Ethiopian coffee farmers' cooperatives, institute of developing economics.

Kotler Philips (1992) principles of marketing 5th edition: prentice Hall of India New Delhi

Meeusen, W., and Van den Broeck, J (1977). Efficiency estimation from Cobb-Douglas production functions with composed error. International Economic Review, 18, 435-44.

Mekdes Tesfaye, (2005) un published BA thesis Addis Ababa University.

Milford Anna, (2004). Coffee, Cooperatives and Competition: The Impact of Fair Trade, Chr. Michelsen Institute Development Studies and Human Rights, Norway.

Moock, P. (1976). The Efficiency of women as farm managers: Kenya. American Journal of Agricultural Economics, 58(5), 831-835.

Nkonya, E. , Pender, J., Jagger, P. Sserunkuma, D., Kaizzi, C. and Ssali, H. (2004) Sratagies for Sustainable land management and poverty reduction in Uganda
Oxfam.(2002) rugged rules and double standards trade globalization and right against poverty make trade fair USA.
Rahman. S. (2003). Profit efficiency among Bangladeshi rice farmers. Food Policy, 28, 483-503.
Rahman. S. (2002). Profit efficiency among Bangladesh rice farmers Manchester: University of Manchester. (School of economic studies. discussion paper series No. 0203).
Robel Gizachew. (2005) unpublished BA thesis Addis Ababa University.
Ross Trump; Essentials of modern marketing 1966 p.72
Sadoulet, E., and De Janvry, A. (1995). Quantitative development policy analysis. Baltimore: The Johns Hopkins University Press.
Saleem, S. T. (1988). Relative efficiency of cotton farms in Sudanese irrigated agriculture World Development, 16(8), 975-984.
Sevilla-Siero, C. A. (1991). On the use and misuse of profit functions measuring the price responsiveness of peasant farmers: A comment. The Journal of Development Studies, 27(4), 123-136.
Thiam, A., Boris Bravo-Ureta, E., and Teodoro, E. R. (2001). Technical efficiency in developing country agriculture: A meta-analysis. Agricultural Economics, 25, 235-243.
Thomas, R., Valerie, K., Eric, C., Thomas, J., Kimseyinga, S. & Daniel, C. (1997). Determinants of farm productivity in Africa. A synthesis of four case studies, USAID Technical Paper No.75
TNHAJELA, (1994) Principles, Problems and Practices 6th edition New Delhi.
Yotopolous, P.A., and Lau, L.J. (1973). A test for relative economic efficiency: Some further results. American Economic Review, 63(1), 214-223.
http\\.www.Fairtrade.net. Accessed on Tuesday August 2008
http://www.addisch77.com date accessed Tuesday 26\ 8\2008
http\\.www. Ipfri.org accessed on Tuesday September 2008-09-03.
http//www.addischamber.com date accessed in Monday August 2008.