Technical Efficiency of Paddy Farmers in Batticaloa District of Sri Lanka

T Bhavan and S Maheswaranathan
Department of Economics, Faculty of Commerce and Management, Eastern University, Sri Lanka

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Introduction

Batticaloa District in the Eastern Province of Sri Lanka is heavily dependent on agriculture for its economic survival. The majority of the population is engaged paddy production and approximately 58,374 hectares are utilized for paddy production. However, experiencing a low productivity in the agriculture sector, especially in paddy farming, is the major factor causing poverty in the District (Eastern Development plan 2012-2016, Eastern Provincial Council). In considering poverty issues in Sri Lanka, Batticaloa District require more attention which has been identified as the country's poorest District in 2009/10 (HIES, 2009/10). Therefore, timely more studies in productivity and efficiency of the farming activities in the District are needed. Technical efficiency is the form of productive efficiency and is concerned with the maximization of output with a given set of input. Productivity is defined as the ratio of output to input for a particular production situation. Increase in productivity reveals that either more output is produced with the same amount of input or less input is required to produce same level of output. Thus, the concept of productivity is closely associated with efficiency, which means if a production unit is operating with full of efficiency, its production process is operating on the production frontier (Masteron, 2007). In literature several scholars have already addressed this issue. Radam et al. (2010) studied technical efficiency of Malaysian wooden furniture industry, and concluded that many firms are still operating below the efficiency level. Lambarra et al. (2007) investigated technical efficiency and decomposition of productivity growth of Spanish Olive farm found that farm location, age of manager and composition of work force affect efficiency level. Omonona et al. (2010) studied technical efficiency in Cowpea production in Nigeria, and concluded that the inputs used in production process is appreciable level and however, the authors further emphasized for more attention to enjoy optimum level of productivity. Kyei et al. (2011) analysed efficiency in Coco farming in Ghana, and found that most of the important factors such as labour, age of farms and capital would lead better output if they are properly managed.

In that line, this paper also estimates production function and technical efficiency of paddy farmers in Batticaloa District.

Objectives

The principal objectives of the study are to explore the potential for improving production efficiencies of farmers in Batticaloa District, and to identify the socio-economic factors that influence such efficiencies.

Methodology

The data were collected in the area of *Eravur Pattu* and *Manmunai West* D.S Divisions of Batticaloa District because these D.S Divisions consist of significant paddy growing farmers. A structured questionnaire was used to collect relevant information from hundred randomly selected paddy farmers. Incorporating cross-section data from a sample of 100 small-and medium-scale farmers, stochastic frontier analysis and Tobit regression were employed to obtain an efficiency score and the factors that determine the efficiency of the farmers respectively.

Assuming a Cobb-Douglas production function, we define the stochastic production frontier as:

$$\ln y_j = \ln \beta_0 + \sum_{i=1}^{m} \beta_i \ln x_{ij} + \varepsilon_j$$

Thus, the empirical model specified as:

$$\ln y = \ln \beta_0 + \beta_1 \ln x_1 + \beta_2 \ln x_2 + \beta_3 \ln x_3 + \beta_4 \ln x_4 + \varepsilon$$

where, y is level of output for jth farmer, x is a vector of input i used by farmer j, and β is a vector parameter. $\varepsilon_j = v_j + u_j$ indicates the composed error term, and v_j is the two-sided error term whereas u_j is the one-sided error term. The independent variables in the vector are as follows:

x_1= size of land in acres
x_2= number of labour
x_3= quantity of fertilizer
x_4= quantity of pesticide

The linear Tobit regression model was employed to obtain an efficiency score and the factors that determine the efficiency of the farmers respectively. The model was employed because the dependent variable technical efficiency scores are censored having values ranging between 0 and 1. The model specification is given as:

$$Te = f(x_1, x_2, x_3, x_4, x_5, x_6, x_7, e_i)$$

Where,

Te = technical efficiency index for farmer i

x_1= training for farmers (yes =1, otherwise = 0)

x_2= age of farmer

x_3= fertilizer subsidy (yes =1, otherwise = 0)

x_4=irrigation (tank =1, otherwise = 0)

x_5= farmers experience (in years)

x_6= family size

x_7= house hold head (female headed =1, otherwise = 0)

e_t= the error term

Results

Table 1 gives the results of stochastic production frontier analysis incorporating inputs for paddy production such as land, labour, fertilizer and pesticide.

The finding reveals that 10% increase in the factors of land, fertilizer and pesticide would correspond to an increase in output of paddy with 0.01, 4.92 and 3.59 percent respectively. It is noted that the labour factor is not significant anymore, which means that an increase in number of labour in the field would not support for more paddy yield.[3]

Table 1. Results of Stochastic Production Frontier Analysis

Variables	Coefficients	t-statistics
lnland	0.001***	14.78
lnlabour	0.05	0.89
lnfertilizer	0.492***	10.81
lnpest	0.359***	6.29
Intercept	1.003***	2.37
Log Likelihood		-31.095
Wald Chi-square		632.08

*** *indicates statistically significant at 1% level*

[3] This is what is reflected in the Lewis model where he considered the rural agrarian sector as having surplus labour, and thus, its marginal productivity of labour could be zero.

Technical efficiency of paddy farmers ranges from 0.274 and 0.945 with a mean value of 0.732, implying that on average the paddy farmers in the study area incur about a 27 percent of loss in output reported due to technical inefficiency.

Table 2. Results of Determinants of Technical Efficiency

Variables	Coefficients	t-statistics
Training	0.117***	2.17
Age	0.002	0.13
Fertilizer subsidy	0.175***	2.74
Irrigation	0.140*	1.61
Farmers experience	0.003*	1.51
Family members	0.010*	1.60
House hold head	0.044	0.90
Intercept	-0.093	-0.37
Log likelihood function	26.417	
LR Chi-square	14.20, N= 81	

**** and * indicate statistically significant at 1% and 5% level respectively*

Taking the determinants of efficiency into account, Table 2 reveals the results that training for farmers and getting fertilizer subsidies are statistically significant at 1% level whereas irrigation, farmers experience and number of family members are statistically significant at 10% level. The factors of farmers' age and household head are found to have no significant effect anymore.

Conclusion

This study estimates stochastic frontier production for paddy farmers in Batticaloa District. The analysis shows that land, fertilizer and pesticide have positive effect on the paddy yield. However, the labour factor is not effective. This implies that for greater yield, fertilizer and pesticide needs to be intensified. Training for farmers, fertilizer subsidies, irrigation system, farmers experience and family size are the major contributing factors to the efficient production of paddy in the region. In comparing with other determinants of efficiency, extension services by giving training for farmers, and the fertilizer subsidy program are much effective. The inefficiency components such as household head and farmers' age also have positive characteristics that show a positive relationship.

Reference

Kyei, L., Foli,G. and Ankoh, J (2011) Analyses of Factors Affecting the Technical Efficiency of Cocoa Farmers in the Offinso District- Ashanti Region Ghana. *American Journal of Social and Management Sciences*, ISSN online: 2151-1559.

Lambarraa, F., Serra, T. and Gil, J.M (2007) Technical Efficiency Analysis and Decomposition of Productivity growth of Spanish Olive Farms. *Spanish Journal of Agricultural Research*, Vol.5(3), pp. 259-270.

Masteron, T (2007) Productivity, Technical Efficiency, and Farm Size in Paraguayan Agriculture. Working paper no.490, The levy Economist Institute of Bard College.

Omanona, B.T, Egbetokun, O.A and Akanbi, A.T (2010) Farmers Resource- Use and Technical Efficiency in Cowpea Production in Nigeria. Economic Analysis and Policy, Vol.4(1), pp.87-95.

Radam, A., Yacob, M.S and Mohd Muslim H.F (2010) Technical Efficiency of Malaysian Wooden Industry: A stochastic Frontier Production Approach. *International Business Research*, Vol.3 (3), pp. 10-15.