An Econometric Analysis of Factors Affecting On Paddy Cultivation in Ampara District

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Abstract

Paddy cultivation of the Ampara district was affected by several factors meantime the farmers of this district did not know about the factors that are affecting on the paddy cultivation. In this situation, this study explored the affecting factors on the paddy cultivation. For this purpose, the sample of 514 farmers was selected based on multi stage sampling and Nyman Optimum Allocation method. The collected data were analyzed by the econometrics regression method. According to the econometric regression method, Cobb – Douglas production function was selected for this study. Based on the statistics of this function, seven factors such as labor use, paddy field extension, fertilizer using, seeds, plant protect chemical, weed control chemical, and quality of seeds were statistically significant on the paddy cultivation.

Keywords: *Cobb – Douglas production function, Factors, Paddy cultivation, multistage sampling method, Nyman optimum allocation*

Background of the study

Sri Lanka is predominantly an agricultural country. As rice is the staple food of Sri Lanka and it provides about half of daily calories requirement (Abeyratne, 1986; Dhanapala, 1998; Prasanna, Gunaratane and Withana, 2004). Every government has given the first priority for self-sufficiency in paddy at the national level. At present, the paddy occupies the large extent of the cultivated area of the domestic agriculture.

On the independence in 1948, eighty five percent of the people were living in rural village, they engaged in agriculture mainly in the cultivation of paddy, cottage industries and a variety of traditional agro - based service activities (Dhanapala, 1998).

Agricultural sector is economically important sector, it contributed to Gross Domestic Production and total employment around 11% and 30% in 2012 (Central Bank of Sri Lanka, 2012). The agricultural sector is divided into sub-sectors such as paddy cultivation, tea plantation, coconut cultivation, livestock, and fisheries (Department of Agriculture, 2012).

The paddy cultivation sector contributed around 20% to Gross Domestic Product in 2012 (Central Bank of Sri Lanka, 2012). It is livelihood of 1.86 million families and 72 percent of household depends on agriculture (Henegedera, 2000). In 2010, the total demand of rice was 3.46 metric tons and also it will be increased to 3.83 metric tons in 2020 (Jayawardana, 2010).

Sri Lanka is divided into twenty five districts and this study is conducted in Ampara district. The Ampara district is situated in Eastern Province of Sri Lanka. The Eastern Province consists of three districts such as Ampara, Batticalloa and Trincomalle. When we compared Ampara district with other districts, this district contributed 29.7 per cent of paddy cultivation to domestic agricultural sector in 2012 and also, this district is contributing around 59 percent of paddy cultivation to total provincial paddy cultivation of Eastern Province (District Planning Secretariat 2012).

However, Ampara district did not achieve its optimum level of paddy cultivation (Mahroof and Rafeek, 2004). The department of agriculture recommends for getting 157 – 172 bushel of paddy

per acre but farmers of this district get 125 – 140 bushel of paddy from per acre. The reasons for this situation, the farmers of this district do not know about influencing factors and its significance level on paddy cultivation (Department of Agriculture, 2012). Therefore, the important thing is that the paddy sector is needed to recover the above loss of paddy cultivation of Ampara district, So that, this research is needful.

Objective

The objective of this study is to identify the factors affecting on the paddy cultivation and to test the statistical significance level of the factors influencing on the paddy cultivation in Ampara district.

Methodology

Sample selection

A number of 514 farmers were selected as sample for this study. They cultivated paddy in 2013Yala season and also the multi stage sampling method was used for the purpose of this study and sampling stages are mentioned bellow:

Stage – I

Purposely four divisional secretariats (such as Akkaripattu, Addalaichenai, Sammanthurai and Navithanvelli) were selected out of twenty divisional secretariats in Ampara district.

Stage – II

There are six agrarian service centers (stage - I) in four selected divisional secretariats such as Akkaripattu west, Addalaichenai, Palamunai, Sammanthurai, Malwatha and Chavallakada. All these agrarian service centers were considered for the sample selection.

Stage – III

The Nyman Optimum Allocation method was used for the selection of sample. According to this method, the following equation was used to provide the sample allocation among the Agrarian Service Center.

$$n_h = \left(\frac{N_h}{N}\right) * n.$$

Where

n_h: Sample of each agrarian service center

N_h: Total paddy cultivating families of each agrarian service center

N: Total paddy cultivating families of all agrarian service centers.

n: Total numbers of sample.

Table1: Sample allocation among the selected Agrarian Service Centers

Divisional Secretariats	Agrarian Service Centers	Sample size (n)	Sample allocation among the selected Agrarian Service Centers (n_h)
Akkaripattu	Akkaripattu west	514	104
Addalaichenai	Addalaichenai		100
	Palamunai		67
Sammanthurai	Sammanthurai		76
	Malwatha		85
Navithanvelli	Chavallakada		82
		Total Sample size (n)	**514**

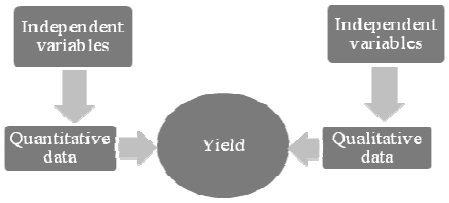
Stage - IV

The required data for this study were collected randomly from each selected farmer from each agrarian service center based on the above table. These data consist of qualitative and quantitative type. The data were gathered by various types of sources such as field survey (questionnaires), interviews, group discussions, and direct observations.

Conceptual Framework

The conceptual framework provides a basic idea to determine the relationship between the independent and dependent variables and also to assess the influence of the independent variables on the dependent variable illustrated bellow:

Figure 1: The conceptual frame work of the study



Analytical Techniques

The collected primary data were analyzed by econometric Ordinary Least Square regression method and MINITAB software was used for this data analysis.

Econometric Regression Method

The production process means the relationship between inputs and output (Aigner, Lovell and Schmidt, 1977; Meeusen and Broeck, 1977). This statement can be written in the following functional form:

$$Q = f(x_1, x_2, x_3, x_4 \dots \dots \dots x_n)$$

Where:

Q: Output

f: Function,

$x_1, x_2, x_3, x_4 \dots \dots \dots x_n$: Inputs

The econometric regression model which was obtained by above functional form, it is given below.

$$Y = \beta_0 + \beta_i \sum_{i=1}^{n=7} x_i + \alpha_i \sum_{i=1}^{n=2} D_i + u_i$$

Results and Discussions

To achieve the objective of this study, four types of econometrics regression models such as Linear Regression Model, Log – Linear Regression Model, Double Log Regression Model, and Linear - Log Regression Models were estimated. Based on the collected data of these variables, the results of these models are given in table -2.

Table 2: The statistics of estimated models

Regression Models	Statistics			
	R^2	F Value	Probability value	VIF
Linear Regression Model	82.7%	240.48	0.000	< 5**
Log – Linear Regression Model	83.9%	261.75	0.000	
Double Log Regression Model	92.9%	653.65	0.000	
Linear - Log Regression Model	76.8%	166.81	0.000	

In the table 2, the Double Log Regression model was selected because this model satisfies all statistical requirements for the model selection criteria. Moreover, when the gathered data are scattered and plotted on the diagram, it represents the type III model and also the most of the econometricians used this model for their researches.

Usually double log regression model is also called Cob – Douglas production model or constant elasticity production model, this model is used in this study. The general form of Cob-Douglas production function is $Q = f(K, L) = AK^{\alpha} L^{\beta} e^{u}$. However, the researchers enlarged this function according to considered variables of this study.

Where:

Y: Production (Bushel)

X_i: Quantitative data

X_1 –Labor use (Numbers of the Labors)

X_2 – Paddy field extension (acre)

X_3 – Fertilizer using (Kg)

X_4 – Seeds (Kg)

X_5 – Plant protect chemical (ml)

X_6 – Weed control chemical (ml)

X_7 – Farmer's Education (Years)

D_j: Qualitative data

D_1: Experience of farmers

D_1 = 0 (1-10 Years); 1 (Above 10 years)

D_2: Quality of seeds

D_2 = 0 (Normal); 1 (Registered and recommended)

D_3: Ownership of paddy land

D_3 = 0 (Tenant); 1 (personal paddy land)

β_i: Coefficient of quantitative variables

θ_j: Coefficient of qualitative variables

According to the table 2, the Cob – Douglas production model was selected for getting the results of the study, the selected model and its statistics are given bellow:

$$\hat{Y} = -0.328 + 0.0519 X_1 + 0.294 X_2 + 0.0327 X_3 + 0.300 X_4 + 0.278 X_5 + 0.0694 X_6 + 0.00015 X_7 + 0.0120 D_1 - 0.0314 D_2 + 0.0103 D_3$$

Table 3: The statistics of the selected model

Variables	X_1	X_2	X_3	X_4	X_5	X_6	X_7	D_1	D_2	D_3
SE Coefficient	0.0132	0.02642	0.0086	0.0200	0.0209	0.0090	0.0178	0.0075	0.0067	0.0064
Probability value	0.000	0.000	0.000	0.000	0.000	0.000	0.933	0.111	0.000	0.111

R^2 = 92.9% F = 653.65 (0.000) SE – Standard Error

based on the statistics of the above model, the paddy cultivation of the study area is determined by the labor use (X_1), paddy field extension (X_2), fertilizer using (X_3), seeds (X_4), plant protect chemical (X_5), weed control chemical (X_6), farmer's education (X_7), experience of farmers (D_1), quality of seeds (D_2), and ownership of paddy land (D_3).

However, the labor use (X_1), paddy field extension (X_2), fertilizer using (X_3), seeds (X_4), plant protect chemical (X_5), weed control chemical (X_6), and quality of seeds (D_2) are statistically significant on determination of the paddy cultivation. Mean time, other factors are not significant.

Conclusions and Recommendations

The objective of this study is to explore the factors that are affecting on the paddy cultivation in Ampara district. To achieve this objective, the enlarged Cobb – Douglas production function was used, based on the estimated model, labor use (X_1), paddy field extension (X_2), fertilizer using (X_3), seeds (X_4), plant protect chemical (X_5), weed control chemical (X_6), and quality of seeds (D_2) were significantly influencing on determination of the paddy cultivation in the study area. However, farmer's education (X_7), experience of farmers (D_1), and ownership of paddy land (D_3) were not significant. But, R^2 of the selected model was 92.9, it tells that 92.9 percent of the explanatory variables influenced on output. The farmers of the study area have to consider and cultivate their paddy based on these identified factors' influence

on the paddy cultivation. Mean time, the policy makers of the agricultural sector have to make possible awareness program to farmers about factors influence on paddy cultivation in the study area.

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