Labour use Efficiency of Rice farming in Thailand with Emphasis on The Central Plain

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Abstract

This study was on labour use in rice farming in Thailand. Thailand is still a predominantly agricultural country and farmers form a large part of its labour force. Although an average of 75 percent of farmers in agriculture are engaged in rice farming, rice output accounted for only 1.8 percent of GDP. The cause of the low contribution of rice production to GDP may be due to the low productivity of labour in rice farming. The research question in this study was what was the efficiency level of labour use in rice farming in Thailand? The main objective of the present study was to investigate the labour input use in rice production by comparing the value of the marginal product of labour with the wage rate. Primary data were collected through the method of stratified sampling from the sample farms for 2002/2003 crop year. The sample comprised 400 farmers from five provinces which had the biggest planted areas in Central Region of Thailand. Cobb-Douglas production function was utilized in the estimation of labour use efficiency.

The result of the study showed that labour use was inefficient in Thai rice farming since VMP_L was less than W. The result also indicated that there were decreasing returns to scale in rice production.

Keywords: Efficiency, Labour use, The Central Plain of Thailand

Introduction

The growth of the labour force is an important source of economic growth in Thailand (Jansen, 2001: 348). The total labour force in Thai agriculture increased from 13.5 million in 1960 to over 35 million in 2003. It is interesting to note that, whereas the share of agriculture in GDP declined from around 50 percent in the 1950s to around 10 percent in 2003, the share of agriculture in employment only fell from over 80 percent in the 1950s to around 41 percent in 2003. In Thailand, the share of agriculture in GDP is the second lowest of all economic activities, but the share of

agriculture in employment is the second highest. This reflects the low productivity in agriculture. The labour productivity of Thai rice farming decreased from 3.44 kilograms per man-hour during 1920-1950 to 2.52 kilograms per man-hour in the period of 1965-1970 (Manarungran, 1989: 171). Pitiyanon (2003: 87) stated that labour productivity in Thai agriculture was very low. In 1997, the labour productivity in Thai agriculture was only 12,000 baht per person per year.

The cultivated area increased to about 66.71 million rai in 2003 from around 31.25 million rai in the 1950s. Slightly more than 50 percent of the cultivated areas were used for planting paddy. Although the government has invested in developing irrigation schemes, the availability of irrigation remains limited. In 2001, the cultivated land was 66.55 million rai, but only 30.77 million rai were under irrigation. Furthermore, many irrigation schemes were not effective because they were poorly maintained or because water was used for urban/industrial uses rather than for irrigation. In other words, water was provided more for the non-agricultural sectors than for the agricultural sector. One of the consequences of this relatively low investment in agriculture compared with investment in the non-agricultural sectors was that the yield in agriculture remained rather low. Compared to other Asian countries, the proportion of land under irrigation and used for high yielding varieties is relatively small and fertilizer use is limited.

Rief and Cochrane (1990) found that the agricultural workforce was pushed into working outside their farms because of the availability problems of land and water for farming. While other agricultural production factors are used to capacity, labour in Thailand is in surplus. A major objective of economic development in Thailand is to achieve a more efficient use of labour.

Plath (1959) who studied agricultural productivity in Southeast Asia stated that productivity in most Asian countries was low. His study suggested that remedial measures for a better utilization of labour be carried out.

As stated earlier, farmers form a large part of the labour force in Thailand. In 2000, for instance, more than 50 percent of the workforce was employed in the agricultural sector and 75-80 percent of those workers was rice farmers. However, agricultural output and rice production accounted for only about 10 percent and 1.8 percent of GDP respectively. This suggests that the productivities in both agriculture in general and rice farming in particular are very low. The productivity of Thai rice production remained at a low level. For example, the average output per rai during 1996/97 to 2003/04 was only 395 kilograms. In comparison, in the same period, the average output in other major rice producing countries, namely, Vietnam, India, Pakistan, China and the USA, were 665, 462, 465, 1,012 and 1,070 kilograms per rai respectively.

As labour utilization is crucial in Thai rice farming, research and empirical studies on this issue are necessary. There should be studies to see the workforce is efficiently utilized. The findings of such

studies will have important implications especially for planners who design and implement policies to improve the competitiveness of Thai rice.

Objectives of the Study

A major objective of this study was to examine labour use in rice production. In this study, the value of the marginal product of labour (VMP_L) with the wage rate (W were compared in order to shed light on labour use efficiency in rice production. Labour use is efficient when VMP_L = W. Otherwise, it is not.

Methodology

1 Data Sources

Primary data were used for this study. The data were collected from a sample of 400 farms in the Central Plain of Thailand in 2002/2003 crop year. The Central Region was chosen because it has the highest yield per rai and is a suitable geographical region for rice plantation. For example in 2004, yield per rai of rice output in the Central plain equal 535 kgs. While it was 437, 313 and 393 kgs per rai in the North, the Northern and the South respectively. Furthermore it has superior irrigation systems and is also rain fed. The farmers in that area produce rice mainly for commercial purposes.

Administratively, the Kingdom of Thailand is classified into four regions. They are the Southern, the Northern, the Northeastern and the Central Regions. The South is on the Malayan peninsula and has more rain than the other regions. The North consists mainly of mountainous areas. The Northeast or the Korat Plateau has poor and relatively dry soils and contains the biggest population. Its population was the most subsistence-oriented in the period covering 1850-1950. The Central Region is, in practice, divided into 3 sub regions: the Central Plain located in the Chao Phraya basin (the most important rice producing area), the western mountains and the eastern coast. The Central Plain has 26 provinces. Most of the population in this region work in the agriculture sector and are mainly engaged in rice production. The government established the Central Region area as a special area for national rice production and has been supporting the food security program since 1955, a hundred years after the Bowring Treaty. Since the Bowring Treaty between Thailand and Britain in 1855, the Central Region has been the principal rice-growing region (Turton, 1987: 18). The government has established the infrastructure for supporting the farmers' activities. For instance, the government constructed a big dam to irrigate the whole rice planting area and provided a special scheme to help the farmers fund their agriculture activities. Thailand has a monsoon climate with a rainy season, which starts around May and ends in October. It is relatively dry and cool between November and February, and hot in March and April. Cultivation, especially rice growing, is mainly done in the rainy season.

2. Data Collection

Stratified sampling was used and it involved dividing the population of farmers in the

Central Plain into 5 subgroups. They were the five provinces used in the study. The provinces were Suphan Buri, Chai Nat, Chachoengsao, Ayutthaya and Lop Buri. The total planted areas in these provinces form around a half of the total planted areas in the Central Plain (Table 1).

Table 1: Planted Area of Rice (in rai) in the Central Plain for the Period 1994/95-2001/02

Province	Crop Year							
	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02
Suphan Buri	1614336 (12.48)	1689566 (12.50)	1713761 (12.56)	1858952 (13.74)	1835383 (13.42)	1989667 (15.02)	1923344 (13.93)	2043621 (14.10)
Chai Nat	1145491 (8.86)	1396898 (10.34)	1438427 (10.55)	1351027 (9.99)	1295571 (9.47)	1236050 (9.33)	1280293 (9.27)	1366469 (9.43)
Chachoengsao	1172992 (9.07)	1225243 (9.07)	1151809 (8.44)	1160225 (8.56)	1211651 (8.86)	1144332 (8.64)	1139908 (8.25)	1104357 (7.62)
Ayutthaya	1133313 (8.76)	10841119 (8.02)	1132786 (8.30)	1142860 (8.45)	1102934 (8.06)	1099466 (8.30)	1152679 (8.35)	1424668 (9.83)
Lop Buri	961047 (7.43)	1142718 (8.46)	1082561 (7.94)	975654 (7.21)	966662 (7.06)	897106 (6.77)	1055838 (7.65)	1116624 (7.71)
Total	6027179 (46.6)	6538544 (48.39)	6519344 (47.79)	6488718 (47.95)	6412201 (46.87)	6366621 (48.06)	6552062 (47.45)	7055739 (48.69)
Central Plain	12209711	12808089	13609360	13465788	13680681	13247202	13807718	14490043

Source: Office of Agriculture Economics, Thailand (2003). Agricultural Statistics of Thailand, various issues (numbers in brackets indicate proportion of total planted area in the Central Plain).

The sample comprised four hundred farmers from the 150,000 households of population in the five provinces as stated earlier. The sample size was calculated by using the procedure as proposed in Krejcie and Morgan (1970). The determination of the sample size is four hundreds households. The number of the respondents from each province was computed by using proportional or quota random sampling (see Table 2). Random sampling was then used to select households in an identified district of each province, which had the largest number of rice farmers.

Table 2: Sample Size

Province (District)	Population (Household)	Sample (Household)
Suphan-Buri (Bang-Plama)	33,500	90
Chai Nat (Manorom)	36,064	95
Chachoengsao (Muang)	19,805	55
Ayutthaya (Phak-Hai)	26,353	70
Lop Buri (Ban Mee)	34,064	90
Total	150,000	400

Labour Efficiency Measures

Empirical measurements are difficult in the agriculture industry. The greatest difficulty arises because not all products are traded in the market and some are derived directly from resources. For example, the satisfaction or utility, which the farmer realizes from "living in the country" or being "his own boss", is difficult to measure. However, the production economist is faced with the same problem, whether he is analyzing efficiency from the standpoint of a single farm or from the industry. Despite this, however, many empirical studies used returns in value terms as an efficiency criterion for the individual farm. It may be possible to use the productivity value of labour or return on labour input as the criterion for assessing farming efficiency. Thus, the value term or productivity value may be used as the efficiency criterion. As it is the only tangible or measurable criterion which can be obtained, money income in terms of the productivity value of labour will undoubtedly continue to be a commonly used index of economic efficiency for either individual farms or the agricultural industry. The value of product per unit of labour is thus employed to provide a notion of labour efficiency.

Model (Cobb-Douglas Production Function)

The Cobb-Douglas (CD) production function was used in this study for analysing rice production because it has several advantages: (i) It can handle multiple inputs, (ii) it does not introduce distortions of its own even in the face of market imperfections, (iii) the unrestricted CD function can handle different scales of products, (iv) econometric estimation problems such as serial correlation, heteroscidasticity and multicolinearity can be handled easily, (v) it facilitates computations and has the properties of explicit representability, uniformity, parsimony and flexibility and (vi) the problem of simultaneity can be accounted for through the use of a stochastic CD production function. The relationship between labour and output of rice crop could be explained by using the following Cobb-Douglas production function. The first model of this study can be expanded as follow:

$$Y = CX_1^{\beta_1}X_2^{\beta_2}X_3^{\beta_3}X_4^{\beta_4}X_5^{\beta_5}e^{u} \qquad (1)$$

After transformation of the function using double log, the following is obtained:

$$\text{Log } Y = \text{Log } C + \beta 1 \text{Log } X1 + \beta 2 \text{Log} X2 + \beta 3 \text{Log} X3 + \beta 4 \text{Log} X4 + \beta 5 \text{ Log} X5 + u \quad (2)$$

$$= \beta 0 + \beta 1 \text{Log } X1 + \beta 2 \text{Log} X2 + \beta 3 \text{Log} X3 + \beta 4 \text{Log} X4 + \beta 5 \text{ Log} X5 + u$$

where: Y = output of rice crop (kg. per rai)
X1 = labour (persons per rai)
X2 = the planted area under irrigation (rai)
X3 = fertilizer (Baht per rai)
X4 = seed (Baht per rai)
X5 = insecticide (Baht per rai)

$\beta 0$, $\beta 1$, $\beta 2$, $\beta 3$, $\beta 4$ and $\beta 5$ are the parameters.

Efficiency of Labour Utilization in the Central Plain

The model used to analyze labour utilization in the Central Plain using primary data is as follows. To determine the value of marginal product of labour on rice output in the five provinces in the sample, all variables that appeared in equation (2) were used in the model. The results showed that labour and fertilizer are an important variable, which have a significant impacted to rice output. The regressed on output are as follows:

$$\text{Log } (Q) = \beta 0 + \beta 1 \text{Log (workers)} + \beta 2 \text{ Log (fer)} \quad (3)$$

where: Q = output of rice crop (kg. per rai)
workers = labour (persons per rai)
fer = fertilizer (Baht per rai)

The regression is estimated and the results are given in Table 3

Table 3: Regression Model for Rice Production for Central Plain

Dependent Variable: LOG(Y)
Method: Least Squares
Date: 12/02/03 Time: 04:23
Sample: 1 400
Included observations: 400

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.300900	0.286625	15.00531	0.0000
LOG(WORKERS)	0.048345	0.023331	2.072146	0.0389
LOG(FER)	0.488494	0.046335	10.54260	0.0000

R-squared	0.223195	Mean dependent var	7.358032
Adjusted R-squared	0.219282	S.D. dependent var	0.332731
S.E. of regression	0.293995	Akaike info criterion	0.396965
Sum squared resid	34.31398	Schwarz criterion	0.426901
Log likelihood	-76.39305	F-statistic	57.03400
Durbin-Watson stat	1.409597	Prob (F-statistic)	0.000000

$$MP_L = \hat{\beta}_1 \left(\frac{\overline{Q}}{\overline{workers}} \right)$$

$$= 0.048345 \left(\frac{1606.44}{9.50} \right)$$

= 0.048345 (169.0987) = 8.176 kg.

$VMP_L = MP_L \times P$

= 8.176 x 4.30

= 35.15 baht

The average wage rate = 78 baht.

Results of the study

1. The VMP_L and wage rate in the five provinces of the Central plain are 35.15 baht and 78 baht per rai respectively. As expected, the labour use is inefficient since VMP_L is less than wage rate.

2. The partial elasticity of rice output with respect to workers is 0.048345. When the number of workers increases by 1 percent, rice output increases by 0.048345 percent. The p-value indicates that the estimated coefficient is significant. However, labour is not the most important input in rice farming. Several previous studies showed that land is the most important input in rice farming followed by labour.

3. The estimated coefficient of fertilizer is 0.488494. When fertilizer increases by 1 percent, rice output increases by 0.488494 percent. The p-value indicates that the null hypothesis, H_0: $\beta_2 = 0$ is rejected. Thus, the estimated coefficient is significant and conforms to expectation. Fertilizer appears to be more important than labour in Thai rice farming. As stated earlier in the Central Plain, apart from the fertile soil which is very suitable for the growing of rice, fertilizer is the important factor to improve the quality of the land. The variety of rice as well as insecticides has an influence on rice output. The results from several other empirical studies also showed that circulating capital (include fertilizer) is important in rice farming. Janprasert (1975) computed the various output elasticities of inputs in rice production: the output elasticity of land is the highest, followed by human labour and animal labour respectively. Pinkeaw (1983) indicated that the factors affecting rice production are land, fertilizer and irrigation. He showed that land has the highest partial elasticity of production followed by fertilizer. Similarly, Piromvong (1983) showed that the factors affecting rice production are land and chemicals (fertilizer and insecticide). Phonyiem (1987) confirmed that the significant factors affecting rice production on large farms are area planted, labour and amount of rainfall, while those for small farms were area planted, expenditure (includes all land, labour costs as well as the expenditure on chemicals, fertilizers and insecticides) and amount of rainfall.

The results indicate that the production function does not exhibit decreasing returns to scale. Fertilizer has a greater impact on rice output in the Central Plain. The estimated coefficient for fertilizer is 0.488. In contrast, the estimated coefficient for labour is only 0.048. For the Central Plain it appears that workers have less

impact in rice output than circulating capital (fertilizer). This may possibly be due to the fact that in this region there are more facilities for rice farmers than the other regions. The facilities include the irrigation scheme, seed variety, fertilizer, insecticide and transportation.

The above empirical results conformed to many previous studies. Janprasert (1975) did an economic analysis of rice production in Suphan Buri province from 1972 to 1973. His analysis shows there were decreasing returns to scale in the production of paddy. Similarly, Piromvong (1983) analyzed the productivity of rice production from 1981 to 1982. The estimated Cobb-Douglas production function reveals decreasing returns to scale. Furthermore Janprasert and Piromvong concluded that the output elasticity of land is the highest.

With reference to the government support scheme provided for the rice farmers, it is found to be very limited particularly regarding the wage rates. These rice-farming labourers receive a very low wage. Their pay is not yet in accordance with the labour law of lowest pay scale.

Discussion

This research shows that the Thai government must pay more attention to the matter of wages, the need for technological progress and education. If the farmers are properly taken care of, their efficiency will increase. This would in turn increase their income level and well-being. Of course, the gains the farmers enjoy will ultimately lead to an increase in welfare of the entire nation.

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