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The Effects of Price-support Programme on Farm Tenancy Patterns and Farm Profitability: Some Evidence from Malaysia

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Translog normalised restricted profit function model is specified and estimated for the four rice granary areas, each administered by a local government body, namely, the MIP, the KIP, the NWSP, and the KEIP, in which the price-support programme has some noticeable effects on farm tenancy and farms profitability. So far, there have been no empirical studies that have used this methodological framework to analyse such economic phenomenon in Malaysia. This, in fact, is the main contribution of the present paper. From the estimated function, the shadow values of land and labour are computed, which in turn are used to elucidate the behaviour of rice farmers in Malaysia. Together, the estimated and computed results, to a large extent, are successful in explaining the observed changes in farm tenancy patterns and the way the farmers (comprised of owner-operator, owner-tenant, and tenant-farmer) are "economically" responding to the sum of profits generated from rice farming and, subsequently, from the programme. Further, given the price-support programme, the results also point to the fact that rice farming in Malaysia is as lucrative a job as any other sub-sector outside this, in particular unskilled urban workers and electronics workers, and thus this programme could be pursued further.

1. INTRODUCTION

The price-support programme for Malaysian paddy farmers was first introduced in 1980. There were two major reasons for the government to implement the price-support programme: (i) to encourage a greater marketable surplus [Tan (1987)] and (ii) to augment the farmers' income so that the incidence of poverty among them might be reduced [Tamim (1994)]. When it was first introduced in 1980, the price-support rate was set at RM (Ringgit Malaysia, the Malaysian currency) 33.00 per ton of paddy sold to the National Rice Board or private rice millers or wholesalers. However, due to some grievances expressed by the farmers, the government decided to increase the rate to RM165.00 per ton in the same year. In 1990, it was further increased to RM247.50 per ton.

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The price-support programme had some noticeable impacts on the farmers' average income. In 1984, four years after its inception, it was estimated that 69 percent, or RM1228.00, of the farmers' average net income of RM1780 was due to price subsidy (price-support programme and other factor-input subsidies) from the Government. If the average yield per hectare is 3 tons [Malaysia (1986, p. 106)] and the price-support rate is RM165.00, the price-support per hectare being RM495.00, it accounts for about 40 percent of the total price subsidy; if the rate is RM247.50, it accounts for 60 percent of the price subsidy.

In Malaysia, there are three types of farmers, namely, owner-operator, owner-tenant, and tenant-farmer. The tenant-farmers cultivate only the farmlands they rent in; the owner-operators cultivate only the farmlands they own; and owner-tenants cultivate both the lands they own and rent in. The tenant-farmers do not have legal rights to the farmlands on which they work. By paying a fixed rental, they have a limited right to cultivate the land within a stipulated period as agreed upon with the owner-operators or owner-tenants.

As in the case of American agriculture [Gardner and Pope (1978)], the price-support programme affected the behaviour of Malaysian rice farmers. As shown by Tamim (1988), the farmers who directly benefited from the programme showed inclination towards enlarging their farm size, and the enlarged farm area accounted for 65 percent of the growth in output. A similar trend was also shown by Fujimoto (1991). Such structural transformation influences the farm tenancy patterns significantly. As shown in Table 1, all but one farming area experienced a sharp

Table 1

Farm Tenancy Patterns and Growth Rate of Major Malaysian Farming Areas, Selected Years

(Unit %)

Farming Area*	KIP		KEIP		NWSP		MIP	
Year	1984	1990	1980	1988	1985	1990	1980	1990
Farm Tenancy								
Owner-operator	55.0	41.5	66.0	43.5	72.3	81.0	54.0	29.3
Owner-tenant	27.0	26.7	15.0	28.7	8.8	4.7	18.0	37.8
Tenant-farmer	18.0	31.8	19.0	27.8	18.9	14.3	28.0	32.9

Annual Average Compound Rates of Growth**

Farming Area	KIP	KEIP	NWSP	MIP
Farm Tenancy				
Owner-operator	–4.58	–5.07	2.30	–5.93
Owner-tenant	–0.03	8.45	–11.79	7.70
Tenant-farmer	9.95	4.87	–5.43	1.63

Note: * KIP = Kemubu Irrigation Project. KEIP = Kerian Irrigation Project. NWSP = North-West Selangor Project. MIP = Muda Irrigation Project.

** Figures in the bottom half of Table 1 show the annual average compound rates of growth of each farming area for the two observation years being compared.

decline in the percentage of owner-operators over the 1980–90 period. For example, in the case of the Kerian Irrigation Project (KEIP), the percentage of owner-operators decreased from 66.0 percent in 1980 to 43.5 percent in 1988.[1] The changes in the percentage of owner-tenants were mixed, but the percentage of tenant-farmers increased sharply in contrast to the owner-operators, the only exception being the North-West Selangor Project (NWSP).

The above discussion shows that there was a noticeable change in the farm tenancy pattern of Malaysian rice farming in response to the implementation of the price-support programme.The purpose of the present paper is to investigate the relationship between the price-support programme and the structure of Malaysian rice farming. In particular, we focus our analysis on two questions. First, was it the change in tenancy patterns due to the changes in incomes of the respective farmer groups? For example, in the case of NWSP, was it the change due to higher incomes received by the owner-operators by virtue of the price-support programme which induced them to repossess the farmlands they previously rented out to owner-tenants or tenant-farmers? Or, in other farming areas, was it due to stable output price which induced the tenant-farmers to rent in more farmlands? So far, there have been no empirical studies to address this question, and we wish to establish a link between the price-support programme and the changes in tenancy patterns in Malaysian rice farming.

The second question concerns farm profitability in Malaysia. As mentioned above, the price subsidy amounted to 69 percent of the farmers' net income, of which 40–60 percent is due to the price-support programme. Still, how profitable is Malaysian rice farming? In order to answer this question, we need to take into account not only the farmers' annual net income but also the changes in output and input prices and *zakat*, the tax levied on Muslim farmers whose yield exceeds the 635 kgs tax-exempt quantity (*nisab*).[2] By incorporating the price and cost changes

[1]Due to lack of data, Table 1 shows data for only two observation years. Also the initial and terminal years are different for different farming areas.

[2]Haughton (1986, p. 218) does not make a distinction between *zakat* levied on farmers in the main- and off-season, and states that the amount of tax-exempt quantity of *zakat* is about 615kgs. Fujimoto (1980, p.179) does not take the seasonal factor into consideration either, and reports the amount of tax-exempt quantity of *zakat* to be about 577kgs. Kuchiba *et al.* (1979, p. 119), on the other hand, state that the amount of tax-exempt quantity of *zakat* is about 552kgs. The official figure, however, is 653 kgs and the tax is levied at the rate of 10 percent and 5 percent on Muslim farmers' total rice production of the main- and off-season, respectively. Approximately 97 percent of Malaysian rice farmers are Muslims. *Zakat* is incorporated into the model in the following manner. In the computation of the restricted profit, *zakat* has been deducted from the sum of market price and price-support of rice. This gives rise to the definition of net unit price. Then, multiplying the net unit price by output minus the sum of the variable inputs cost (i.e., intermediate inputs and machinery) we obtain the restricted profit. Mathematically, it can be shown as follows:

$$\prod = [(P_Y + P_{SU} - ZAKAT.\ Y] - \sum_{1}^{m} W_i X_i$$

where $\prod$ is the restricted profit, P_Y is the price of output, P_{SU} is the price-support, *ZAKAT* is the *zakat*, *Y* is the output, and *W* and *X* are the price and quantity of variable inputs, respectively.

into the computation of farm profits, we shall be able to better understand how farm tenancy groups react to the changes in their incomes. To our knowledge, there are no past studies to have quantitatively investigated the impact of the price-support programme on farm profitability in Malaysia. We expect that the findings from this study would be useful to policy-makers to formulate policies related to, for instance, labour movements between the rice farming sector and the urban/industrial sectors.

The framework that we use to address these questions is that of normalised restricted profit function. This framework is chosen because it allows us to directly estimate the shadow values of land and labour, which in turn allows us to compute the shadow rental rate of land and the average profit per hectare. These estimates permit us to measure the impact of the price-support programme on farm tenancy patterns and farm profitability.

The paper proceeds as follows. In Section 2 we describe the methodology, and in Section 3 we present the results of empirical analysis and the findings of the study. Finally, in Section 4, there is a summary and the conclusion.

2. MODEL SPECIFICATION

The Normalised Restricted Profit Function Model

In analysing the Malaysian rice production we assume that the production function is given by

$$Y = F(X,Z) \\ = F(X_1, \ldots\ldots., X_m;\ Z_1, \ldots\ldots. Z_n) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

where Y is rice output, and X and Z are the vector of variable and fixed inputs, respectively. In this analysis, we take land and labour to be fixed inputs. We note in passing that, except for urban wage rates, an explicit labour market does not exist in Malaysian rice sector. By introducing a profit function with labour as a quasi-fixed input, however, enables us to compute the shadow value of labour.

Using the duality theory as proposed by Lau (1976), a normalised restricted profit function can be derived as

$$\Pi = \Pi\ (W_1, \ldots\ldots., W_m\,; Z_1, \ldots\ldots, Z_n) \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

where Π is the restricted profit and W is the vector of variable-input prices. Both Π and W are normalised (i.e., divided) by the price of output, P_Y. The normalised restricted profit is the maximum profit given the levels of fixed inputs and the variable-input prices. That is,

$$\Pi\ (W, Z) = F(X^*, Z) - \sum_1^m W_i X_i^* \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

where * indicates the quantities of X which maximise the normalised profit, given Z. By applying Hotelling's lemma to (2), the variable-input demand functions are obtained as

$$\frac{\partial \Pi(W,Z)}{\partial W_i} = -X^*_i\ (W, Z) \quad \ldots \quad \ldots \quad \ldots \quad \ldots. \quad \ldots \quad (4)$$

where i denotes machinery (M) and intermediate inputs (U). If (2) is differentiated with respect to (w.r.t.) the quantity of fixed inputs, i.e., land and labour, then the shadow values (or the marginal products) of the respective inputs are obtained as

$$\frac{\partial \Pi(W,Z)}{\partial Z_j} = P^s{}_j\ (W, Z) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

where j denotes land (B) and labour (L), and $P^s{}_j$ is the shadow value of the jth fixed factor input.

Following Sidhu and Baanante (1981)[3], we approximate (2) by a translog normalised restricted profit function as

$$\begin{aligned} ln\ \Pi\ &= \alpha_0 + \sum_{i=1}^{m} \alpha_i ln\ W_i + ½ \sum_{i=1}^{m}\sum_{h=1}^{m}\ \gamma_{ih}\ lnW_i\ W_h \\ &+ ½ \sum_{i=1}^{m}\sum_{j=1}^{n}\ \delta_{ij}\ lnW_i\ lnZ_j + \\ &+ \sum_{j=1}^{m}\ \beta_j\ lnZ_j + ½\ \sum_{j=1}^{n}\ \sum_{k=1}^{n}\ \varphi_{jk}\ lnZ_j lnZ_k \quad \ldots \quad \ldots \quad (6) \end{aligned}$$

By differentiating the left-hand-side of (6) and applying Hotelling's lemma, we obtain the variable-input expenditure shares in the total profit, S_i, as

$$\frac{\partial ln\Pi}{\partial lnW_j} = -\ \frac{X_j\ W_i}{\Pi} = -\ S_i\ ,\ i = M,\ U \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (7)$$

Equating this with the derivative of the right-hand-side of (6) w.r.t. lnW_i yields

$$-S_i\ = \alpha_1 + \sum_{h=1}^{m}\ \gamma_{ih}\ lnW_h\ + ½ \sum_{j=1}^{n}\ \delta_{ij}\ lnZ_j\ , \qquad i = M,U \quad \ldots \quad \ldots \quad (8)$$

Using (3) and (7), the output supply share in the total profit can be obtained as

[3]Antle (1984) remarks on Sidhu and Baanante's typographical error in Equation (2) where a minus sign was omitted in front of S_i.

$$\frac{F(X^*, Z)}{\Pi} = 1 + \sum_{i}^{m} W_i X^*_i / \Pi$$

$$= 1 + \sum_{i}^{m} S_i = S_y \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (9)$$

where S_y denotes the output supply share in the total profit.

Next, using (5) and (6), the shadow value equations are obtained as

$$P^s_j = \frac{\partial \Pi}{\partial Z_j} = \frac{\Pi}{Z_j} \bullet \frac{\partial ln\Pi}{\partial lnZ_j}$$

$$= \frac{\Pi}{Z_j} \left(\beta_j + \sum_{i=1}^{n} \delta_{ij}\, ln\, W_i + \sum_{k=1}^{n} \varphi_{jk}\, lnZ_k\right), \quad j = B, L \quad \ldots \quad \ldots \quad (10)$$

Note that due to the assumed fixity of two inputs (land and labour), all elasticities in this model are of short-term nature. They correspond to a period of time, which is sufficiently long for farmers to adjust the levels of output and variable inputs but too short for them to adjust the levels of fixed inputs. The estimates based on (10) are the shadow values of land and labour expressed in real terms. We multiply both sides of (10) by output price*, PY*, to express the shadow values in monetary terms.

Before proceeding further, two remarks are in order. First, Equations (2), (3), (4), and (5) imply that the profits and the shadow values of land and labour can be measured as functions of prices of output and variable inputs and the quantities of fixed inputs.

Second, the chances in farm tenancy patterns and farm profitability all depend upon changes in the shadow values of land and labour and farm profits. Hence, any changes in these variables as a result of changes in the output price-support programmes will have a direct effect on farm tenancy patterns and farm profitability. In other words, the effects of output price-support programme can be captured by estimating its impacts on the shadow values of land and on profits. The latter can be done by differentiating the shadow values of land and labour and profits w.r.t. the output price, holding variable factor input prices constant. We can similarly measure the impact of intermediate-input price on the shadow values of land and labour and profits, by differentiating the shadow values and profits w.r.t. the intermediate-input price, holding output and other variable-input prices constant.

These estimation procedures can be formally described as follows. First, the effect of output price-support programme on the shadow values of land and labour can be measured by log-differentiating Equation (10) w.r.t. output price, P_y:

$$\frac{\partial lnP^S_j}{\partial lnP_y} = \frac{\partial ln\Pi}{\partial lnP_y} - \frac{\partial lnZ_j}{\partial lnP_y} + \frac{\partial ln}{\partial lnP_y} \bullet \frac{\partial ln\Pi}{\partial lnZ_j} \qquad j = B, L \quad \ldots \quad \ldots \quad (11)$$

Second, the effect of intermediate-input-price support programme on the shadow values of labour and land can be measured by log-differentiating Equation (10) w.r.t. Intermediate-input price, W_U:

$$\frac{\partial ln P_j^S}{\partial ln W_U} = \frac{\partial ln \Pi}{\partial ln W_U} - \frac{\partial ln Z_j}{\partial ln W_U} + \frac{\partial ln}{\partial ln W_U} \bullet \frac{\partial ln \Pi}{\partial ln Z_j} \quad j = B, L \quad \ldots \quad \ldots \quad (12)$$

If the translog restricted normalised profit function (6) is estimated, all these effects can be measured from the empirical data.

Empirical Application of the Model

The system of three equations consisting of (6), (8), and (9) will be simultaneously fitted to the data sets from four Malaysian major rice farming areas, namely, the North-West Selangor Project (NWSP), the Muda Irrigation Project (MIP), the Kemubu Irrigation Project (KIP), and the Kerian Irrigation Project (KEIP), each with two growing seasons. The data are the time series and cross-section data, which are pooled over 11 years from 1980 to 1990. The parameter estimates of these equations will be used to estimate the shadow values of land and labour and to derive estimates of the impacts of the price-support programme on the shadow values of land and labour and on profits. For efficiency reasons, all except supply share equations will be estimated jointly by Zellner's (1962) iterative seemingly unrelated regressions (ISUR). That is, we drop the output supply equation from the estimation but later the coefficients will be computed using the parameter relationships of the linear homogeneity restrictions. The parameter estimates obtained from (6), (8), and (9) will be used to investigate the effects on farm tenancy patterns and farm profitability.

Farm Tenancy Patterns

To measure the changes in farm tenancy patterns, it is essential to obtain the shadow value of land for each observation year. This is because the shadow rental rate of land (SRRB) is defined as the shadow value of land (P^S_B) divided by the market price per hectare of farmland (P^M_B). That is,

$$\text{SRRB} = P^S_B / P^M_B \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (13)$$

Equation (13) is used to measure the changes in farm tenancy patterns over the 1980–90 period. The values obtained from the computation of SRRB will be compared with the commercial bank interest rates (CBIR).[4] A rational owner-operator will decide whether to continue working on farms or not according to SRRB > CBIR, or SRRB < CBIR.

[4]Although, theoretically, the CBIR expressed in real terms should be taken for comparison with the SRRB, in the context of our study, the CBIR expressed in nominal terms is used. The reason for taking the nominal terms is that the farmers' attitude towards depositing their money in a bank seemed not to be affected by the inflation rate.

Farm Profitability

The impact of price-support programme on farm profitability for the tenant-farmers and owner-operators can be measured based on the average profit per hectare of planted paddy area (AVEPH). AVEPH is computed by dividing the restricted profits of each farming area and season ($\prod$) by the planted paddy area (Z_B). That is,

$$\text{AVEPH} = \prod / Z_B \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (14a)$$

where $\prod = P_B^S Z_B + P_L^S Z_L$

Equation (14a) can also be expressed as

$$\text{AVEPH} = P_B{}^S + P_L{}^S (Z_L / Z_B) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \qquad (14b)$$

To evaluate how tenant-farmers (who maximise profits) adjust their sources of income based on (14), we define NORM1 as follows:

$$\text{NORM1} = P_L{}^S Z_L{}^{Sh} \ / \ (\prod / Z_B - P_B{}^{MR})$$
$$= P_L{}^S Z_L{}^{Sh} / P_B{}^S - P_B{}^{MR} + P_L{}^S (Z_L / Z_B) \quad \ldots \quad \ldots \quad \ldots \qquad (15)$$

Here, $P_L^S Z_L^{Sh} = P_L^S (Z_L / Z_B)$ is the sum of shadow value of labour per hectare planted paddy area, and the denominator is the shadow value of land minus market rental rate of land plus the shadow value of labour, or tenant-farmers' net profit. That is, NORM1 is the ratio of total shadow value of labour to net profit per hectare. If this value is smaller than unity, the tenant-farmers will continue working on farmlands. Otherwise, they will decide to give up farming and work either as wage-labourers on other farms or search for off-farm employment [Bardhan and Srinivasan (1971)]. Note that apart from NORM1, there are several other factors which may determine the occupational choice of the tenant-farmers like the level of education, the economic transformation that was taking place, etc.

Next, we evaluate how owner-operators adjust their sources of income. A rational owner-operator will make a comparison between the shadow value per hectare of land or SHADOW (i.e., the expected income derived from self-cultivation) and the actual income per hectare of land or ACTUAL (i.e., the expected income derived from renting-out farmlands). The ratio of the former to the latter will be defined as NORM2:

$$\text{NORM2} = \text{SHADOW / ACTUAL} = P^S{}_B / P_B{}^{MR} \quad \ldots \quad \ldots \quad \ldots \qquad (16)$$

A rational owner-operator will base his/her decision on NORM2. Specifically, if NORM2 is greater than unity, he/she will continue to work on the farmlands. Otherwise, he/she will decide to rent-out the farmlands. The money received is deposited in a bank on which he/she will receive interest in return. As in the case of tenant-farmers, he/she may also look for off-farm jobs.

Although Equations (15) and (16) are defined for tenant-farmers and owner-operators, they are applicable also to owner-tenants. Since owner-tenants possess as well as rent-in farmlands, they have three options: (i) if NORM2 is smaller than unity, they will rent out the farmlands; (ii) if NORM1 is less than unity, they will continue to work on their rented-in farmlands; and (iii) if NORM2 is greater than unity and NORM1 is less than unity (i.e., if the self-cultivated and rented-in farmlands are profitable), they will continue to work on both the self-cultivated and rented-in farmlands.

Data Sources

The data used for the present analysis were compiled from the published statistics and reports of four farming area development authorities, namely, the North-West Selangor Project (NWSP), the Muda Irrigation Project (MIP), the Kemubu Irrigation Project (KIP), and the Kerian Irrigation Project (KEIP). The data were collected for two growing seasons, namely, the main- and off-seasons. The initial and terminal years for each farming area are 1980 and 1990. Since we have 4 farming areas, each with 2 seasons, the total number of observations is 88. The variables required to estimate the translog restricted normalised profit function are the prices of output and variable factor inputs, (machinery and intermediate inputs), the profit share of each variable input, and the quantities of fixed factor inputs (land and labour). We processed the data compiled for each farming area and season according to the specification of the model. In computing the variables, we followed the Caves, Christensen and Diewert (1982) procedure. A detailed explanation on how the variables were generated is given in Appendix 1.

3. EMPIRICAL RESULTS AND FINDINGS

The results of parameter estimates for the translog normalised restricted profit function are presented in Table 2. The adjusted R^2 for the profit function and the expenditure-share equations for machinery and intermediate inputs were 0.92, 0.35, and 0.28, respectively. The regularity conditions such as monotonicity and convexity were checked and found to be satisfied at the approximation point.[5] Thus, we can say that the estimated functions are well-behaved.

Using the parameter estimates of Table 2 and Equation (10), the shadow values of land and labour were computed for each farming area. Furthermore, using the same parameter estimates and Equations (11), (12), (13), (14), (15) and (16), the impacts of output price-support programme on the shadow values of land and labour, and on profits, farm tenancy patterns, and farm profitability of different tenure arrangements were computed.

[5]Monotonicity requires that the predicted output share is positive and input shares are negative. Convexity requires that the profit function is convex in prices. That is, its Hessian matrix must have non-negative diagonal elements.

Table 2

Parameter Estimates of the Translog Restricted Normalised Profit Function for Malaysian Rice Farming, 1980–90

Parameter	Estimate	*t*-value
α	0.119	5.725
α_M	–0.247	–21.321
α_U	–0.441	–29.034
α_Y	1.688	73.701
β_L	0.517	43.469
β_B	0.495	28.249
γ_{MM}	1.132	2.677
γ_{UU}	1.381	4.106
γ_{MU}	–1.025	–2.808
γ_{YY}	0.464	2.629
γ_{YM}	–0.107	–0.726
γ_{YU}	–0.357	–2.727
φ_{LL}	0.179	4.709
φ_{BB}	0.288	7.801
φ_{LB}	–0.198	–5.911
δ_{ML}	0.219	4.559
δ_{MB}	–0.301	–6.749
δ_{UL}	–0.296	–6.536
δ_{UB}	–0.229	–5.438
δ_{YL}	–0.516	–9.363
δ_{YB}	0.531	10.281

Note: The coefficients for output supply function (Y) were obtained using the parameter-restrictions of linear homogeneity. In addition, while subscripts M and U denote machinery and intermediate inputs, B and L denote land and labour, respectively. All of them were treated in the model as independent variables.

Estimation Equation	Adj-R^2
Restricted Profit Function	0.92
Machinery Share Equation	0.35
Intermediate Inputs Equation	0.28
Labour Equation	0.27
Land Equation	0.58

Shadow Value of Land

The estimates of shadow value of land (P^S_B) for the NWSP, MIP, KIP, and KEIP are presented in Table 3 along with the corresponding market rental rates of land (P_B^{MR}), for the main-season (MS) and off-season (OS). As evident from the table, the shadow value and the market rental rates of land were not commensurate over the 1980–90 period. Specifically, (i) irrespective of seasons and with a few exceptional years, the market rental rates in the NWSP and the MIP areas were in general higher than the shadow values of land; and (ii) irrespective of seasons, the shadow values of land in the KIP and the KEIP areas were higher than the market rental rates.

Since there have been no previous estimates of shadow values of land for the NWSP and the MIP, our results cannot be compared with findings of other studies. However, the results for the KEIP and the KIP can be compared with those of Ismail (1972) and Horii (1972). While Ismail reports a similar finding to ours for the KIP, that is, the shadow value was higher than the market rental rate of land, Horii finds that there exists a considerable variation between the shadow value and market rental rate for the KEIP. From our and Ismail's findings, we can conclude that in the KIP farming area, the tendency for the shadow value to exceed the market rental rate seems to persist even after the implementation of the price-support programme. As can be seen from Table 3, the values of P^S_B in all farming areas and seasons show an increasing trend. However, with the exception of the period 1980-82-3, the values of P^S_B in the KIP and the KEIP are higher than those in the NWSP and the MIP, implying that land has been more intensively used in the former farming areas. The reason for the difference in the shadow value of land between the two groups of farming areas will be examined further when we discuss the shadow value of labour below.

Shadow Value of Labour

Table 4 shows the estimates of shadow value of labour (P^S_B), the corresponding urban wage rates of the unskilled (P^U_B) and electronics (P^E_L) workers, and their respective ratios for the 1980–90 period. In all farming areas, the shadow value shows an increasing trend. Note that, with the exception of 1989–90, the shadow value of labour in the NWSP and the MIP is lower than the wage rates of unskilled (and/or electronics) labour. However, in the KIP and the KEIP, starting from 1985-86, the shadow value of labour (P^S_L) is equal to or greater than the unskilled wage rates (P^U_L), though the former is still lower than the electronic wage rates (P^E_L) in most of the years.

The discrepancies in the shadow value of labour between the NWSP/MIP as one group and the KEIP/KIP as another can be better explained if the levels of technology and the shadow value of land are taken into account. First, on average, 90 percent of the NWSP/MIP areas were mechanically ploughed as compared to 45

Table 3

Shadow Value of Land (P_B^S) and Market Rental Rate of Land (P_B^{MR}) for all Farming Areas, Main- and Off-season

Main-season (MS)	NWSP (MS)		MIP (MS)		KIP (MS)		KEIP (MS)	
Year	P^S_B	P_B^{MR}	P^S_B	P_B^{MR}	P^S_B	P_B^{MR}	P^S_B	P_B^{MR}
1980	361	340	429	507	376	287	403	141
1981	378	414	451	561	381	289	419	199
1982	405	590	459	604	418	292	410	252
1983	437	558	432	628	383	295	440	184
1984	419	576	387	635	429	285	418	216
1985	427	479	406	660	458	282	456	225
1986	456	535	418	655	497	288	485	216
1987	450	497	417	659	507	293	505	218
1988	479	495	440	404	545	297	528	225
1989	484	450	461	330	548	300	528	221
1990	448	524	407	307	506	300	503	211
Off-season (OS)	**NWSP (OS)**		**MIP (OS)**		**KIP (OS)**		**KEIP (OS)**	
Year	P^S_B	P_B^{MR}	P^S_B	P_B^{MR}	P^S_B	P_B^{MR}	P^S_B	P_B^{MR}
1980	372	434	431	460	361	289	398	158
1981	367	434	442	528	398	291	411	221
1982	398	496	469	599	398	294	391	231
1983	422	563	412	592	441	297	418	212
1984	416	563	369	607	417	289	420	223
1985	415	580	393	608	468	287	460	242
1986	484	484	421	648	492	293	491	214
1987	456	481	389	610	512	296	506	218
1988	474	447	425	356	539	299	528	210
1989	455	473	452	338	539	300	534	218
1990	453	513	410	307	490	301	521	199

Table 4

Shadow Value of Labour (P_L^S), Wage Rates of Unskilled (P_L^U) and Electronics (P_L^E), and Ratios of P_L^U and P_L^E to P_L^S

Main-season (MS)			NWSP (MS)			MIP (MS)			KIP (MS)			KEIP (MS)		
Year	P_L^U	P_L^E	P_L^S	P_L^U / P_L^S	P_L^E / P_L^S	P_L^S	P_L^U / P_L^S	P_L^E / P_L^S	P_L^S	P_L^U / P_L^S	P_L^E / P_L^S	P_L^S	P_L^U / P_L^S	P_L^E / P_L^S
1980	1.03	1.16	0.40	2.60	2.92	0.44	2.34	2.64	0.40	2.60	2.92	0.41	2.52	2.84
1981	1.08	1.19	0.51	2.11	2.33	0.60	1.78	1.98	0.50	2.17	2.39	0.53	2.03	2.24
1982	1.14	1.22	0.62	1.84	1.97	0.71	1.61	1.72	0.62	1.85	1.98	0.62	1.83	1.96
1983	1.19	1.26	0.75	1.60	1.69	0.63	1.89	1.99	0.61	1.96	2.07	0.75	1.60	1.69
1984	1.25	1.29	1.09	1.14	1.18	0.96	1.31	1.35	1.11	1.13	1.16	1.09	1.14	1.18
1985	1.30	1.33	1.12	1.16	1.19	1.04	1.25	1.28	1.25	1.04	1.07	1.32	0.98	1.01
1986	1.34	1.37	1.25	1.07	1.10	1.09	1.23	1.26	1.47	0.91	0.93	1.47	0.91	0.93
1987	1.37	1.52	1.18	1.16	1.28	1.06	1.29	1.43	1.57	0.86	0.97	1.60	0.86	0.95
1988	1.42	1.67	1.3	1.10	1.29	1.13	1.25	1.47	1.70	0.85	0.99	1.68	0.85	1.00
1989	1.46	2.08	1.46	1.00	1.43	1.38	1.06	1.51	1.98	0.74	1.05	1.82	0.80	1.14
1990	1.51	2.40	1.59	0.95	1.51	1.56	0.97	1.54	2.26	0.66	1.06	2.28	0.66	1.05

Off-season (OS)			NWSP (OS)			MIP (OS)			KIP (OS)			KEIP (OS)		
Year	P_L^U	P_L^E	P_L^S	P_L^U / P_L^S	P_L^E / P_L^S	P_L^S	P_L^U / P_L^S	P_L^E / P_L^S	P_L^S	P_L^U / P_L^S	P_L^E / P_L^S	P_L^S	P_L^U / P_L^S	P_L^E / P_L^S
1980	1.03	1.16	0.42	2.46	2.76	0.44	2.35	2.64	0.37	2.82	3.17	0.4	2.54	2.86
1981	1.08	1.19	0.48	2.26	2.49	0.59	1.85	2.04	0.52	2.10	2.31	0.52	2.07	2.28
1982	1.14	1.22	0.59	1.93	2.07	0.75	1.53	1.64	0.56	2.03	2.18	0.6	1.91	2.05
1983	1.19	1.26	0.72	1.65	1.75	0.56	2.12	2.25	0.72	1.65	1.75	0.71	1.67	1.77
1984	1.25	1.29	1.07	1.17	1.21	0.83	1.52	1.56	1.04	1.19	1.23	1.10	1.14	1.17
1985	1.30	1.33	1.03	1.26	1.29	0.95	1.36	1.39	1.30	1.00	1.02	1.34	0.97	1.00
1986	1.34	1.37	1.42	0.95	0.97	1.09	1.22	1.25	1.46	0.92	0.94	1.49	0.90	0.92
1987	1.37	1.52	1.23	1.11	1.23	0.87	1.58	1.75	1.62	0.83	0.94	1.60	0.86	0.95
1988	1.42	1.67	1.29	1.10	1.30	1.04	1.37	1.61	1.75	0.78	0.95	1.66	0.85	1.00
1989	1.46	2.08	1.25	1.17	1.66	1.31	1.17	1.59	1.94	0.73	1.08	1.85	0.79	1.12
1990	1.51	2.40	1.66	0.91	1.45	1.57	0.96	1.53	2.16	0.70	1.11	2.37	0.64	1.01

Note: All figures in Tables 3 and 4 are expressed in Ringgit Malaysia (RM). NWSP, MIP, KIP and KEIP are the farming areas as defined in the text percent in the KIP and 15 percent in the KEIP. Second, on average, 90 percent of the MIP and 35 percent of the NWSP planted areas were mechanically harvested as compared to 21 percent and 13 percent in the KIP and the KEIP, respectively. This implies that, so far as rice farming technology is concerned, the NWSP/MIP adopted a relatively machinery-intensive technology while the KEIP/KIP adopted a relatively labour-intensive technology. Given the differences in the levels of technology, the shadow values of land and labour will naturally be different. When machinery-intensive technology is adopted, the land will be increasingly demanded [Gardner and Pope (1978); Herdt and Cochrane (1966); Kuroda (1992) and Said (1985)]. In the case of Malaysian rice farming, Said specifically points out that the growth of "large farms has been facilitated by mechanisation of land preparation and harvesting process" [Said (1985), p. ii]. An increase in the demand for land will theoretically lead to a higher rental rate.

From these above observations, the following chain of effects should likely occur: different levels of technology adoption lead to different levels of demand for land and labour, which result in different levels of land rental rates and wage rates and consequently bring about different trends and magnitudes of the shadow values of land and labour. This chain of effects seems to have occurred in the two rice-farming groups in Malaysia. In the KEIP/KIP farming areas (especially, in the later half of the observation years), because the technology adopted was relatively labour-intensive, there were more demands for labour than for machinery. Thus, farmers in the KEIP/KIP attached a higher weight to labour than machinery, which resulted in a higher shadow value of labour. The opposite was true in the NWSP/MIP areas. We conclude, therefore, that the discrepancies in the shadow values of land and labour between the two farming groups are explainable by referring to the differences in the levels of technology adoption.

Farm Tenancy Patterns

How does the price-support programme effect the farm tenancy patterns? Since the farmers are assumed to make a decision as to whether or not to continue working on farmlands based on the SRRB > CBIR or SRRB < CBIR, the impact can be explained as follows. From the estimated result of Equation (13), presented in Figures 1 and 2, we see that the SRRB > CBIR in NWSP. Hence, the owner-operators should have repossessed the farmlands which they had previously rented-out to other farmers. As a consequence, some of the owner-tenants should have given up some or all of their previously rented-in farmlands and instead concentrated on working on their own lands. Some tenant-farmers might have been left with two options, namely, either to become full-time farm labourers or to migrate to the urban sector. On the other hand, in the

Farm Tenancy Patterns: Decision Made Based on SRRB and CBIR (Main- and Off-season)

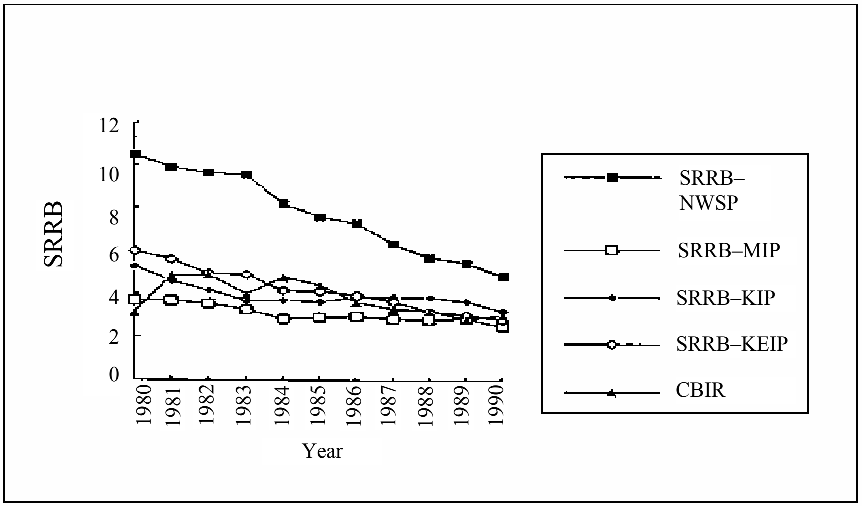

Fig. 1. Main-season.

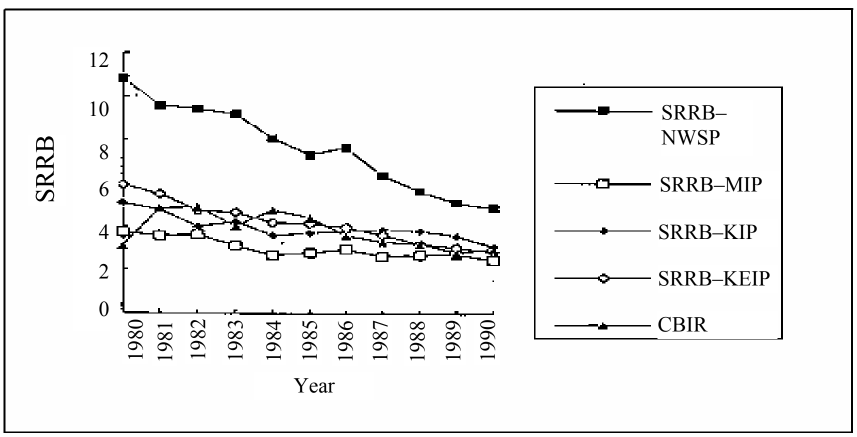

Fig. 2. Off-season.

Note: NWSP = North-West Selangor Project. MIP = Muda Irrigation Project.
KIP = Kemubu Irrigation Project. KEIP = Kerian Irrigation Project.
IRRB = Imputed Rental Rate of Land. CBIR = Commercial Bank Interest Rate.
MS = Main-season. OS = Off-season.

case of the MIP, we observe from Figures 1 and 2 that the SRRB > CBIR, which is opposite from the outcome for the NWSP. Thus, some of the owner-operators should have rented-out their farmlands to owner-tenants and tenant-farmers, and as such the percentage share of the latter tenancies should have increased significantly. Meanwhile, in the case of the KIP and the KEIP, the trend is not so obvious. Hence, it seems that the empirical results of comparing the SRRB with the CBIR for the NWSP and the MIP are consistent with the changes in the farm tenancy patterns as presented in Table 1.

Farm Profitability

Tenant-farmers

As can be seen from Table 5, the NORM1 of the NWSP (main-season) is in most cases greater than unity. In addition, four out of eleven of its off-season

Table 5

Farm Profitability Criteria of Tenant-farmers, NORM1

Main-season	NWSP(MS)	MIP(MS)	KIP(MS)	KEIP(MS)
Year				
1980	–10.76	1.65	0.40	0.32
1981	3.19	13.85	0.44	0.52
1982	–1.49	19.24	0.81	0.63
1983	–1.93	–1.59	0.85	0.69
1984	1.14	0.62	0.54	0.48
1985	1.06	0.83	0.53	0.69
1986	1.31	0.79	0.88	0.76
1987	1.01	0.65	0.95	0.80
1988	1.17	0.51	1.49	1.05
1989	0.88	0.55	0.08	1.01
1990	0.51	0.36	0.61	1.03
Off-season	NWSP(OS)	MIP(OS)	KIP(OS)	KEIP(OS)
Year				
1980	2.73	0.30	0.32	0.39
1981	1.64	0.58	0.28	0.36
1982	0.72	2.74	0.24	0.52
1983	–1.74	1.80	0.61	0.41
1984	0.84	0.47	0.37	0.39
1985	0.64	0.39	0.41	0.53
1986	1.01	0.56	0.83	0.55
1997	0.70	0.79	0.63	0.63
1988	0.62	0.41	0.63	0.84
1989	0.47	0.43	0.63	0.90
1990	0.45	0.34	0.52	0.80

NORM1 are greater than unity.[6] Because the tenant-farmers normally rented-in the farmlands for a period of one year (i.e., two seasons), the farm profitability of one season might possibly effect the other. That is to say, on the whole, due to insufficient profit, which they earned from farming, some of the tenant-farmers must have decided to quit farming. Consequently, they must have adjusted their sources of income by either taking up farm jobs or moving out of the rice-farming areas to take up off-farm jobs. Presumably reflecting this fact, the tenant-farmers' share in the NWSP dropped by 3.6 percent over the period (Table 1).

Now, except for a few observation years, the NORM1 of the MIP, the KIP, and the KEIP is smaller than unity. This means that the tenant-farmers do not have reasons to adjust their sources of income other than from farming. In fact, due to sufficient profit which they earned from farming, some must have acquired or rented-in more farmlands. This has resulted in an increase in their farm tenancy share by 4.9 percent, 13.8 percent, and 8.8 percent, in the MIP, the KIP, and the KEIP, respectively.

Owner-operators

The calculated results of NORM2 presented in Table 6 suggest the following: (i) except for a few observation years, NORM2 and the NWSP and the MIP are smaller than unity, suggesting that the owner-operators were adjusting their sources of income from farm profits to renting-out farmlands and/or income from off-farm employment. This implies that their farm tenancy share would have decreased over the period. However, this result does not seem to be consistent with the data shown in Table 1.[7] In particular, with NORM2 being smaller than unity, some owner-operators in the NWSP would have rented-out their farmlands. However, in reality, their tenancy share increased by 8.7 percent. This discrepancy needs further clarification. One possible explanation is as follows. We showed earlier that the tenant-farmers in the NWSP were, on average, making insufficient profits to continue working on farming. Under such circumstances, some of them are left with no option but to quit farming. In other words, they must have returned the rented-in farmlands to the owner-operators and looked for off-farm jobs. The opposite of this phenomenon is that, although it may be unprofitable, as indicated by the NORM2 figures, some of the owner-operators might have been "obliged" to repossess the previously rented-out farmlands. The combination of these

[6]In particular, in 1983 (off-season) and in 1980, 1982, and 1983 (main-season) the NORM1 is negative, implying that the tenant-farmers, on average, made negative profit. This is because the AVEPH they received was smaller than the rental rate of land that they paid for that year.

[7]In the MIP farming area, instead of owner-operators, the owner-tenants mainly benefited from the value of NORM2, which were smaller than unity. In this case, the NORM1 (i.e., less than unity) criterion was used as the basis to maximise their farm profits. This is shown in Table 1 by the percentage change of about 20 percent in owner-tenants' share during the period under study.

Table 6

Farm Profitability Criteria of Owner-operators, NORM2 = $P^B{}_S / P_B{}^{MR}$

Main-season	NWSP(MS)	MIP(MS)	KIP(MS)	KEIP(MS)
Year	$P^S{}_B / P_B{}^{MR}$	$P^S{}_B / P_B{}^{MR}$	$P^S{}_B / P_B{}^{MR}$	$P^S{}_B / P_B{}^{MR}$
1980	1.06	0.84	1.31	2.85
1981	0.91	0.81	1.32	2.11
1982	0.69	0.76	1.43	1.63
1983	0.78	0.69	1.30	2.39
1984	0.73	0.61	1.50	1.93
1985	0.89	0.62	1.62	2.03
1986	0.85	0.64	1.73	2.22
1987	0.91	0.63	1.73	2.32
1988	0.97	1.09	1.83	2.35
1989	1.07	1.40	1.83	2.40
1990	0.86	1.32	1.69	2.38
Off-season	NWSP(OS)	MIP(OS)	KIP(OS)	KEIP(OS)
Year	$P^S{}_B / P_B{}^{MR}$	$P^S{}_B / P_B{}^{MR}$	$P^S{}_B / P_B{}^{MR}$	$P^S{}_B / P_B{}^{MR}$
1980	0.86	0.94	1.25	2.52
1981	0.85	0.84	1.37	1.86
1982	0.80	0.78	1.35	1.69
1983	0.75	0.70	1.49	1.97
1984	0.74	0.60	1.44	1.88
1995	0.72	0.65	1.63	1.90
1986	1.00	0.65	1.68	2.29
1987	0.95	0.64	1.73	2.33
1988	1.06	1.19	1.80	2.51
1989	0.96	1.34	1.80	2.44
1990	0.88	1.33	1.63	2.63

two forces would have resulted in an increase in the owner-operator share in the NWSP farming area from 72.3 percent in 1985 to 81.0 percent in 1990; (ii) with the exception of a few observation years, NORM2 of the KIP and the KEIP are greater than unity, implying that the owner-operators are expected to repossess the previously rented-out farmlands. In other words, some of them must not only have relied on the present self-cultivated farmlands but also repossessed more lands to increase their income. However, contrary to our expectation, the share of owner-operators in both the KIP and the KEIP decreased by 13.5 percent and 22.5 percent, respectively.

Further elaboration of this interesting finding seems to be necessary. From the discussion of the farm profitability of the KEIP and KIP's tenant-farmers (NORM1) and owner-operators (NORM2), it is obvious that: (i) both tenancy groups made sufficient profits out of farming; and (ii) while the percentage share of the owner-operators has decreased, that of the tenant-farmers has increased over the period of study.

Given the scope of the present study, this peculiar trend (which is inconsistent with the figures shown in Table 1) is difficult to ascertain and, thus, left for future scrutiny. Nevertheless, one possible explanation is that some of the owner-operators are willingly giving up more of their farmlands to be rented-out by the tenant-farmers. In return, the owner-operators received a higher rental rate of land. This makes sense if one refers to Table 5 where the ($P^{MR}{}_{B}$) of the KEIP and the KIP is increasing over time.

4. SUMMARY AND CONCLUSION

In this paper we used a translog normalised restricted profit function approach to measure the impacts of price-support programme on farm tenancy patterns and farm profitability in Malaysian rice farming. The main findings are as follows.

1. The effects of the price-support programme on shadow value of land show two distinctive patterns. While in the NWSP and the MIP farming areas the market rental rate of land was found to be larger than the shadow value, in the KEIP and the KIP farming areas the opposite pattern was observed.
2. The shadow value of labour of all farming areas showed an increasing trend. However, with the exception of 1989-90, in the NWSP and the MIP the shadow value of labour was lower than the wages of unskilled and electronics workers. In the KIP and the KEIP, starting from 1985-86, the shadow value of labour was greater than the unskilled wage rate, but still lower than the electronics wage rates (in most of the years).
3. In the MIP the shadow rental rate of land was smaller than the commercial bank interest rate, while the opposite was true in the NWSP. This implies that some owner-operators in the MIP would have quit working on farmlands, whereas those in the NWSP would have repossessed the farmlands which they previously rented-out. These results are consistent with the data shown in Table 1. In the case of the KIP and the KEIP, the trend was not so obvious.
4. As a result of the price-support programme, the number of owner-operators in the NWSP who cultivated the farmlands themselves increased. This was the case even though the expected income from self-cultivation was smaller than the expected income from renting-out farmlands. The reason was that many tenant-farmers in the NWSP were facing the problem of insufficient net profits. Thus, it was not worthwhile for the farmers to continue working on the farmlands which they rented-in, and, hence, the owner-operators were

"obliged" to repossess the farmlands which they had previously rented-out. This has resulted in an increase in the owner-operator share, as shown in Table 1.

Appendix

Appendix 1

Data Generation

The restricted profits (∏) were obtained by subtracting the variable costs $(\sum_{i=1}^{3} W_i X_i, i = M, U,)$ from the gross revenue (*PY*). The output price (i.e., including price-support) is the price index for total rice. The base year for this and the following indexes was set at 1984. What follows is the list of rice market price, price-support rate, and the ratio of the latter to the former for the entire period under survey.

Season/Year	Rice Market Price	Price-support Rate/ton	Ratio (%)
I/1980	RM449.00	RM33.00	0.73
II/1980	RM448.80	RM165.00	36.76
I/1981	RM450.00	RM165.00	36.67
II/1981	RM451.50	RM165.00	36.54
I/1982	RM449.00	RM165.00	36.75
II/1982	RM467.80	RM165.00	35.30
I/1983	RM467.80	RM165.00	35.30
II/1983	RM468.10	RM165.00	35.25
I/1984	RM466.10	RM165.00	35.40
II/1984	RM469.40	RM165.00	35.15
I/1985	RM469.30	RM165.00	36.16
II/1985	RM469.20	RM165.00	36.17
I/1986	RM467.20	RM165.00	35.32
II/1986	RM473.00	RM165.00	34.88
I/1987	RM463.30	RM165.00	35.61
II/1987	RM465.40	RM165.00	35.45
I/1988	RM465.30	RM165.00	35.46
II/1988	RM465.30	RM165.00	35.46
I/1989	RM466.90	RM165.00	35.34
II/1989	RM475.40	RM165.00	34.71
I/1990	RM475.80	RM247.50	52.02
II/1990	RM476.00	RM247.50	52.00

Source: MADA (1990).
Note: I and II imply the off- and main-season planting, respectively.

The cost of machinery input ($W_M X_M$) was defined as the sum of the expenditures on machinery. The procedure employed to compute the price index for this input is as follows. First, the costs of ploughing and harvesting were multiplied by the number of mechanised ploughed and harvested areas, respectively. Second, adding these two costs gave rise to the definition of total machinery costs. Finally, the price index of machinery was obtained by aggregating the price indexes of ploughing and harvesting.

The cost of intermediate-input ($W_U X_U$) was defined as the sum of the expenditures on fertilisers, seeds, agri-chemicals, and irrigation costs. The price index was obtained aggregating the price indexes of the respective inputs.

The quantity of labour (Z_L) was defined as the total man-hours of family and hired-workers. The quantity of land (Z_B) was defined as the total of planted areas for paddy production of each farming area.

All the variables were transformed into multilateral indexes using the Caves, Christensen and Diewert (1982) method. This method is an extension of the Tornqvist approximation method of the Divisia index to multilateral data and time-series of cross-section data.

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