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The impacts of price-support program on farm tenancy patterns, income adjustments and market interventions: A case of Malaysian rice farming

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Abstract

Given the price-support program, this paper offers the theoretical explanation for the significant variations among Malaysian rice farmers behaviour towards maximizing profit over time and across farming areas that previous empirical studies have never done. First, we formulate several criteria upon which tenant-farmers, owner-tenants and owner-operators, with the objective to maximize profit, can base their decisions as whether or not to continue working on rice farms. Second, we formulate a procedure which enables us to measure the effectiveness of government intervention in the output and input markets by deliberately imposing on the profit elasticity with respect to output and input prices a reduction of 3%, 5% and 10% in each price, respectively. The results of the formulated criteria are used to explain the changes in farm tenancy patterns and income adjustments among farmers over the 1980-90 period. Overall, the results seem to serve well in explaining the percentage changes in farm tenancy patterns over the 1980-90 period. As for the government intervention, our result tends to suggest that its intervention will be more effective in output than input markets.

Keywords: Price-support program; Farm tenancy patterns; Income adjustments; and Market interventions.

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1. Introduction

When it was first introduced in 1980, the price-support program was set at Ringgit Malaysia or RM (the standard acronymn for Malaysian currency) 33.00 per tonne of paddy sold to the National Rice Board or private rice millers or wholesalers. Due to some grievances expressed by the farmers to this program, however, in the same year the government decided to increase the rate to RM 165.00 per tonne. It has been further increased in 1990 to RM 247.50 per tonne. There are two major reasons for government extending the price-support program to paddy farmers. They are; (i) To encourage a greater marketable surplus (Tan, 1987). (ii) From (i), it is expected that the farmers income will be augmented and as such the incidence of poverty among them will be reduced (Tamim, 1994). It is interesting to note that after four years from its inception, the impact of price-support program on farmers average annual net income was evident. It was estimated that out of RM 1780.00 income received by farmers in 1984, 69% or RM 1228.00 was the price subsidy (i.e., price-support program and other factor inputs subsidies, particularly fertilizers and seeds) given by the government (Fifth Malaysia Plan, 1991). If we assume: (i) the latter figure was deflated by per hectare of planted paddy area; (ii) the average yield per hectare for 1980-90 period was 3 tonnes; and (iii) given the amount of price-support program sets at RM 165.00 per tonne, then we can easily figure out that the price-support program alone made up about 40% of the price subsidy. By slightly changing the computation whereby the amount of price-support is now set at RM 247.50 (as from 1990) per tonne, the share increased to 60% of the price subsidy.

As in the case of American agriculture (Gardner and Pope, 1978), Malaysian rice farmers who are directly benefited from the price-support program have shown an inclination towards enlarging their farm size operation. In fact, as has been shown by Tamim (1988) the enlargement in farm size accounts for about 65% of the growth in output. A similar trend has also been shown by Fujimoto (1991). It is expected that as this kind of structural transformation takes place it will significantly influence the farm tenancy patterns of Malaysian rice farming. As can be seen from Table 1 the farm tenancy patterns have virtually changed over the 1980-90 period. Specifically, in all but one farming areas there was a sharp decrease in the percentage of owner-operators. In the case of Kerian Irrigation Project (KEIP), for example, the percentage was 66.0% in 1980 and then gradually decreased to 43.5% in 1988.[1] Though in the case of owner-tenants the percentage was split among the farming areas - no specific trend, in the case of tenant-farmers the trend was just the opposite of the case of owner-operators. In the exceptional case - North-west Selangor Project (NWSP), the percentage of tenant-farmers decreased from 18.9% in 1985 to 15.3% in 1990. The figures in the bottom half of Table 1 show the annual average compound rates of growth of each farming area's farm tenancy for the two observation years being compared.

Now, from the scenario described above, it seems that in parallel with the implementation of price-support program the farm tenancy patterns of Malaysian rice farming tends to show some perceptible response. Hence, it leads us to hypothesize that there exist some kind of relationship between price-support program and the change in farm tenancy patterns. However, it was not known to us exactly in what manner, if any, the latter was influenced by the former. In the case of NWSP, for example, was it due to larger income received by the owner-operators (i.e., by virtue of government extending the price-support program) which induced them to repossess the farmlands they had previously rented-out to owner-tenants and tenant-famers, and hence led to farm tenancy patterns change? Or, in other farming areas, was it due to stable output price - which also

[1] Due to lack of data, however, Table 1 shows only two observation years. We note further that the initial and terminal years are different from one farming area to another.

means less risk, that induced the tenant-farmers to enlarge their farm operating units by renting-in more farmlands? Since empirical studies which established a link between price-support program and changes in farm tenancy patterns of Malaysian rice farming have never in the past been undertaken, it becomes the objective of the present paper to identify and measure the factor which links the former to the latter. This is the first objective of the paper. Discussion pertaining to the detail procedures of establishing the linkage between price-support program and farm tenancy patterns is deferred to section 3 of the paper.

Next, as noted earlier the price subsidy has significantly augmented farmers' average annual net income by about 69% of which price-support program alone made up between 40-60%. Though this figure provides important indication to justify the successfulness of the program, it is still insufficient particularly to disclose the overall structure of the profitability of each farming area production over the 1980-90 period. In particular, the net income figure did not show how, for example, the change in output and inputs prices over the 1980-90 period affected farm profitability. Moreover, in the context of Malaysian rice farming *zakat*, a tax levied on Muslim farmers whose yields exceed the tax-exempt quantity (*nisab*) of 653 kg[2] was not included in the computation of the net income. If the changes in output and input prices, and the additional cost (*zakat*) are added to the computation of farm profits, it will help us to understand how profitability changes over time and thus income adjustments take place in all farming areas and seasons. This is because, as will be shown in the subsequent section, the prices and cost changes contribute to considerable impact on the magnitudes of shadow values of land and labor. Thus, by incorporating the prices and cost changes into the computation of

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[2] Haughton (1986, pp.218) in his study does not make a distinction betweeen *zakat* levied on farmers in the main- and off-season and he states that the amount of tax-exempt quantity of *zakat* to be about 400 gantang (615kg). Fujimoto (1980, pp.179) also does not take the seasonal factor into consideration and he gives the amount of tax-exempt quantity of *zakat* to be about 375 gantang (577 kg). Kuchiba et.al (1979, pp.119) on the other hand states that the amount of tax-exempt quantity of *zakat* to be about 359 gantang (552 kg). The official figure is, however, 653 kg = 422 gantang and, the tax is levied at the rate of 10% and 5% on Muslim farmers total rice production of the main- and off-season, respectively. We note further that approximately 97% of Malaysian rice farmers are Muslim.

inputs it is the most heavily subsidized by the government where fertilizers and seeds are the major ones.

To make all the three objectives realized a normalized restricted profit function framework will be employed. The reason for choosing this framework is as follows: (i) it allows us to give different treatments to factor inputs involved in the rice production. In particular, in this study factor inputs are classified into two, namely variable and quasi-fixed inputs. The former inputs include machinery, intermediate inputs and *zakat*[3] and the latter inputs include land and labor. By restricting land and labor as quasi-fixed inputs it means that in the short-run they are assumed to be given. By doing so, farm profits can be defined as total revenue minus total variable costs. Defining (restricted) profit as this is tantamount to saying that farm profit is merely composed of income accrued to land and labor and hence allows us to compute directly the shadow values of land and labor; (ii) using the computed values of shadow values of land and labor we can in turn compute the internal rate of returns to land (IRRB) and AVEPH; (iii) finally, the values obtained from (i) and (ii) can be used to measure the impacts of price-support program on farm tenancy patterns, income adjustments and market interventions.

The plan of the paper is as follows. In section 2 the model will be described and followed by discussions on the estimation methods, its applications and data sources in section 3. Section 4 presents the results and findings of the study. Finally, section 5 provides a summary and concluding remarks.

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[3] The reason for treating *zakat* as variable input is that it is a post-harvest cost (see also note 2). It varies from season to season and it relies heavily upon yields per hectare (in this study it is average yields) and output price (i.e., excluding price-support). In short, in this study *zakat* is a function of average yields and output price. Thus, changes in both or either average yields and output price will cause *zakat* to change accordingly.

2. The Normalized Restricted Profit Function Model

The quantity of rice produced from Malaysian major rice farming areas, namely North-west Selangor Project (NWSP), Muda Irrigation Project (MIP), Kemubu Irrigation Project (KIP) and Kerian Irrigation Project (KEIP), is assumed to be a function of variable and fixed inputs

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

where Y is rice output, and X and Z are vectors of variable and fixed inputs, respectively. Using the duality theory as proposed by Lau (1976) a normalized restricted profit function can be derived as

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

where Π is restricted profit and W_i is the price of input i . Both Π and W_i are normalized (i.e., divided) by the price of output, P_y, respectively.

Next, a normalized restricted profit is defined as

$$\Pi = F(X^*, Z) - \sum_{i}^{m} W_i X_i^* \qquad (3)$$

where the asterick indicates the quantities of X which are chosen to maximize the normalized restricted profit. By applying Hotelling's lemma to (2), the variable factor inputs demand equations are obtained as

$$\frac{\partial \Pi\ (W_i, Z_j)}{\partial W_i} = -X_i^*(W_i, Z_j) \qquad (4)$$

where i = M,U,T; j = B,L, and M,U,T,B and L stand for machinery, intermediate inputs, *zakat,* land and labor, respectively. If (2) is differentiated with respect to (w.r.t) the quantity of quasi-fixed inputs, then the shadow values (or the marginal products) of the respective inputs are obtained as

$$\frac{\partial \Pi\ (W_i, Z_j)}{\partial Z_j} = P_j^s(W_i, Z_j) \quad (5)$$

where i and j as defined in (4), and P_j^s is the shadow values of the j^{th} quasi-fixed factor inputs.

3. Estimation Methods, Its Application and Data Sources

3.1. Estimation Methods

Following Sidhu and Baanante (1981)[4] a translog normalized restricted profit function for a single output is specified as

$$\begin{aligned}\ln \Pi = \alpha_0 &+ \sum_{i=1}^{m} \alpha_i \ \ln W_i + 1/2 \sum_{i=1}^{m} \sum_{h=1}^{m} \gamma_i \ \ln W_i \ln W_h \\ &+ \sum_{i=1}^{m} \sum_{j=1}^{n} \delta_{ij} \ \ln W_i \ln Z_j \\ &+ \sum_{j=1}^{n} \beta_j \ \ln Z_j + 1/2 \sum_{j=1}^{n} \sum_{k=1}^{n} \varnothing_{jk} \ \ln Z_j \ln Z_k \\ & \qquad i,h = M,U,T;\ j,k = B,L. \qquad (6)\end{aligned}$$

The definition of each variable and the notation used in (6) remained as before. Applying Hotelling's lemma to (6) we obtain the variable factor inputs expenditure-share in the total profit.

$$\frac{\partial \ln \Pi}{\partial \ln W_i} = \frac{\partial \Pi}{\partial W_i} \cdot \frac{W_i}{\Pi} = - \frac{X_i W_i}{\Pi} = - S_i \ , \qquad i = M,U,T \qquad (7)$$

where S_i are the variable factor inputs expenditure-share in the total profit. From (7) the parameters necessary for estimating each variable input equation as specified in equation (4) can now be obtained.

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4 We are fully aware of Antle (1984) remarks concerning Sidhu and Baanante typographical error in equation (2) of theirs where a minus sign was omitted before S_i.

$$- S_i = \frac{\partial \ln \Pi}{\partial \ln W_i} = \alpha_i + \sum_{h=1}^{m} \gamma_i \ln W_h + \sum_{j=1}^{n} \delta_{ij} \ln Z_j \qquad (8)$$

$i,h = M,U,T \; ; \; j = B,L.$

Using (3) and (7) the output supply share in the total profit is obtained.

$$\begin{aligned} F(X^*, Z) &= \Pi + \sum_{i}^{m} W_i X_i^* \\ &= \Pi \left(1 + \sum_{i}^{m} W_i X_i^* / \Pi\right) = \Pi \left(1 + \sum_{I}^{m} S_i\right) \\ &= S_y \qquad , \quad i = M,U,T \end{aligned} \qquad (9)$$

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

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

$$\begin{aligned} P_j^s &= \frac{\partial \Pi}{\partial Z_j} = \frac{\partial \ln \Pi}{\partial \ln Z_j} \cdot \frac{\Pi}{Z_j} \\ &= \frac{\Pi}{Z_j} \left(\beta_j + \sum_{i=1}^{m} \delta_{ij} \ln W_i + \sum_{k=1}^{n} \varnothing_{jk} \ln Z_k\right) \quad , \quad i = M,U,T \; ; \; j,k = B,L. \end{aligned} \qquad (10)$$

It must be noted here that due to the absence of adjustment constraints on output and three variable factor inputs, coupled with the assumed fixity of two factor inputs, all elasticities in this model are implicitly short term. They correspond to a period of time, say 1 year, that is sufficiently long for farmers to adjust the levels of output and variable inputs but too short for them to adjust their endowments of relatively fixed inputs[5]. The estimates based on (10) are the shadow values of land and labor expressed in real terms. The shadow values of each sample observation can, however, be expressed in monetary terms if the right hand side of (10) is multiplied by output price, p_y.

Before proceeding further we note that: (i) equations (2), (3), (4) and (5) imply that profits and the shadow values of land and labor are functions of prices of output and variable inputs, and the quantities of fixed inputs. This suggests that the impacts of

5 Throughout this paper the terms quasi-fixed inputs and fixed inputs will be used interchangeably

output price on shadow values of labor and land, and profits are measurable; (ii) as discussed in section 1 the changes in farm tenancy patterns, income adjustments and market interventions are all depending upon changes in shadow values of land and labor, and farm profits. Hence, it can be said that changes in the variables of equations (2), (3), (4) and (5) as a result of changes in the output price-support programs should have direct effect on farm tenancy patterns, income adjustments and market interventions. Thus, prior to estimating the changes in farm tenancy patterns, income adjustments and the market interventions, it is imperative to estimate the impacts of output price-support program on shadow values of labor and land, and profits. This can be done by differentiating the shadow values of land and labor, and profits, respectively, w.r.t. output price, holding variable factor input prices constant. In addition to this, since the framework that we choose allows us to measure the impact of intermediate-input price on shadow values of land and labor, and profits, we differentiate the shadow values of land and labor, and profits, respectively, w.r.t. intermediate-input price, holding output and other variable-input prices constant. Each of the estimation procedure is shown as follows.

First, the impacts of output price- support program on shadow values of labor and land can be measured by taking a natural logarithm of both sides of equation (10) and differentiating w.r.t. output price, P_y.

$$\frac{\partial \ln P_j^s}{\partial \ln P_y} = \frac{\partial \ln \Pi}{\partial \ln P_y} - \frac{\partial \ln Z_j}{\partial \ln P_y} + \frac{\partial \ln}{\partial \ln P_y}\left(\frac{\partial \ln \Pi}{\partial \ln Z_j}\right) \quad , \qquad j = B,L. \qquad (11)$$

Second, the impacts of intermediate-input price- support program on shadow values of labor and land can be measured by taking a natural logarithm of both sides of equation (10) and differentiating w.r.t. intermediate-input price, W_U.

$$\frac{\partial \ln P_j^s}{\partial \ln W_U} = \frac{\partial \ln \Pi}{\partial \ln W_U} - \frac{\partial \ln Z_j}{\partial \ln W_U} + \frac{\partial \ln}{\partial \ln W_U}\left(\frac{\partial \ln \Pi}{\partial \ln Z_j}\right) \quad , \qquad j = B,L. \qquad (12)$$

Meanwhile, in order to measure the impacts of output and intermediate-input price-support programs on profit the following procedures are deemed essential. First, since profits as defined before are equivalent to farm income accruing to land and labor, $\Pi = P_B^s Z_B + P_L^s Z_L$, the impacts of output price changes on the profits in elasticity terms can be measured by differentiating both sides of the profit equation by P_y and then multiplying through by P_y / Π. Hence, we obtain

$$\frac{\partial \ln \Pi}{\partial \ln P_y} = \frac{\partial \ln \Pi}{\partial \ln Z_B} \cdot \frac{\partial \ln P_B^s}{\partial \ln P_y} + \frac{\partial \ln \Pi}{\partial \ln Z_L} \cdot \frac{\partial \ln P_L^s}{\partial \ln P_y} \tag{13}$$

where $P_B^S = \frac{\partial \Pi}{\partial Z_B}$ and $P_L^S = \frac{\partial \Pi}{\partial Z_L}$.

Second, by the same token, the impacts of intermediate-input price changes on the profits in elasticity terms can be measured by differentiating both sides of the profit equation by W_U and multiplying through by W_U / Π.

$$\frac{\partial \ln \Pi}{\partial \ln W_U} = \frac{\partial \ln \Pi}{\partial \ln Z_B} \cdot \frac{\partial \ln P_B^s}{\partial \ln W_U} + \frac{\partial \ln \Pi}{\partial \ln Z_L} \cdot \frac{\partial \ln P_L^s}{\partial \ln W_U} \tag{14}$$

where P_B^S and P_L^S are as defined in (13).

This completes the discussion on the estimation methods. Next, we move on to show its application.

3.2. Application of the Estimation Methods

The system of five equations consisted of the translog restricted normalized profit function (6), the three variable factor inputs expenditure-share equations (8) and output supply equation (9) will be simultaneously fitted to the data sets for four farming areas, each with two growing seasons. The data sets are of the time series and cross-section nature which are pooled over 11 years. The initial and terminal years are 1980 and 1990, respectively. The parameter estimates of these equations will be used to estimate the shadow values of land and labor and to derive the estimates of the impacts of price-support program on the shadow values of land and labor, and profits. For efficiency reasons and to avoid the estimation method problem related to singularity - since the expenditure-share (S_i) and the output supply share (S_y) in the total (restricted) profit sum to unity, all but supply share equations will be estimated jointly by Zellner's (1962) iterative seemingly unrelated regressions (ISUR). In other words, we dropped the ouput 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 (10) will be used to investigate farm tenancy patterns, income adjustments and market inteventions.

3.2.1. Farm Tenancy patterns

As explained earlier, in order to measure the changes in farm tenancy patterns of Malaysian rice farming over the 1980-90 period it is essential to obtain the shadow value of land for each observation year. This is because the internal rate of returns to land (IRRB) is defined as a division of shadow value of land (P_B^S) by market price of per hectare of farmland (P_B^M). More formally

$$IRRB = P_B^S / P_B^M \qquad (15)$$

Equation (15) is used in the present study to measure the changes in farm tenancy patterns over the 1980-90 period. The values obtained from the computation of IRRB will subsequently be compared with a commercial bank interest rates (CBIR) given to an amount of money deposited in the bank. Farmers are expected to make a decision whether to continue working on farms or to rent them out according to IRRB $\rangle$ CBIR or IRRB $\langle$ CBIR criteria.

3.2.2. Income Adjustments

In section 1 of the paper we proposed a method of evaluating the impact of price-support program on income adjustments for tenant-farmers and owner-operators based on average profit per hectare of planted paddy area (AVEPH). AVEPH is computed by dividing the restricted profits of each farming area and season (Π) by the planted paddy areas of each farming area and season (Z_B). To state it differently

$$AVEPH = \Pi / Z_B \tag{16}$$

where $\Pi = P_B^s Z_B + P_L^s Z_L$.

In order to evaluate how tenant-farmers, with the objective to maximize profits, adjust their sources of income based on (16), the sum of shadow value of labor per season in monetary terms (i.e., P_L^S is multiplied by man-hours labor per season (Z_L), or $P_L^S Z_L$) will be divided by AVEPH (Π / Z_B) minus market rental rate of per hectare of land (P_B^{MR}). This expression gives rise to what we call NORM1. More formally the criterion can be written in equation form as

$$NORM1 = \frac{P_L^S Z_L}{(\Pi / Z_B - P_B^{MR})} \tag{17}$$

The reason for taking the 'sum' is that P_L^S implies only the per hour shadow value of labor in monetary terms. Furthermore, we assume that tenant-farmers are interested in labor income rather than the price of labor per se, shadow (potential) or actual.

Next, similar to (17) in its objective but now to evaluate how owner-operators adjust their sources of income, the values of shadow land income ($P_B^S Z_B$) and actual land income ($P_B^{MR} Z_B$) are divided by the restricted profit (Π), respectively. A division $P_B^S Z_B / \Pi$ indicates the owner-operators' shadow land income relative to Π.

Dividing this ratio by Z_B yields the expression in terms of per hectare planted paddy area. It is denominated as,

$$\text{SHADOW} = \frac{P_B^S}{\Pi / Z_B}.$$

Following the same procedure as in SHADOW, a division of $P_B^{MR} Z_B$ by Π indicates the owner-operators' actual land income relative to Π, which can be expressed in terms of per hectare of planted paddy area as

$$\text{ACTUAL} = \frac{P_B^{MR}}{\Pi / Z_B}.$$

In order to evaluate the possibility of adjusting their sources of income, owner-operators are assumed to make a comparison between SHADOW, i.e., the expected income derived from self-cultivation, and ACTUAL, i.e., the expected income derived from renting-out farmlands. A division of SHADOW by ACTUAL will give rise to what we call NORM2. More compactly NORM2 can be expressed in equation form as

$$\begin{aligned} \text{NORM2} &= \frac{\text{SHADOW}}{\text{ACTUAL}} \\ &= \frac{P_B^S}{\Pi / Z_B} / \frac{P_B^{MR}}{\Pi / Z_B} \\ &= P_B^S / P_B^{MR} \end{aligned} \qquad (18)$$

Owner-operators are assumed to base their decision as whether or not to rent-out the farmlands on NORM2. Specifically, if NORM2 is smaller than unity, implying that the SHADOW is smaller than ACTUAL, then they may decide to rent-out the farmlands. Otherwise, they may decide to continue working on it.

As far as the decision making is concerned, though equations (17) and (18) are formulated for tenant-farmers and owner-operators, respectively, they are applicable also to owner-tenants.This is because we assume in the formulations of (17) and (18) that farmers will adjust their sources of income according to the following criteria; (1) In the case of tenant-farmers they will continue working on farmlands if NORM1 is less than unity. Otherwise, following Bardhan and Srivinasan (1971), they may decide giving up farming and have to work either as wage-laborers on somebody else's farm or search for off-farm employments. (2) For owner-operators, since they possessed farmlands themselves, if NORM2 is smaller than unity, then they are expected to rent-out the farmlands and the money received is deposited in a bank. In return they will receive interest. In addition to this, as in the case of tenant-farmers, they can also look for off-farm jobs. (3) As for owner-tenants, since they possessed as well as rented-in farmlands they have three options: (i) if NORM2 is smaller than unity, then they are expected to behave similar to that of owner-operators; (ii) as for the rented-in farmlands if NORM1 is less than unity, they are expected to behave similar to that of tenant-farmers; (iii) if the rented-in and the self-cultivated farmlands are profitable (i.e., NORM1 is less than unity and NORM2 is greater than unity, respectively), then they are expected to adjust their sources of income according to criteria (ii) and (i).

3.2.3. Market Interventions

A manipulation of equations (13) and (14) enables us to measure the impacts of output and intermediate-input price-support programs on profits and consequently on the possibility of reducing government intervention in the rice output and factor inputs markets. In particular, a sensitivity analysis will be conducted where a reduction of 3%, 5% and 10%, respectively, in the output and intermediate-input price-support programs is imposed on equations (13) and (14), respectively. The test is equivalent to comparing, in terms of elasticity, the changes in restricted profits due to changes in output and intermediate-input prices. In the case of output if as a result of such imposition the percentage change in profits is reasonably smaller than the percentage change in the imposed output price, then it tends to suggest that there is a possibility for government to allow competitive market to play its role in determining the rice price. On the other hand in the case of intermediate-input if as a result of such imposition the percentage change in profits is reasonably greater than the percentage change in the imposed price, then it tends to suggest that there is also a possibility for government to allow competitive market to play its role in determining the rice factor inputs price.

3.3. Data Sources

The main sources of data used for the analysis of the study were compiled from the published statistics and reports by each farming areas development authority. The initial and terminal years for each farming area are 1980 and 1990, respectively. Since we have 4 farming areas, each with 2 seasons, the total number of observation years is 88. The variables required to estimate the translog restricted normalized profit function are the prices of output and variable factor inputs (machinery, intermediate inputs and *zakat*), the expenditure share of each variable input, the output share, and the quantities of fixed factor inputs (land and labor). We processed the compiled data for each farming area and season according to the variable requirements and specifications of the model. We also note that the basis of computing all these variables was the Christensen, Caves and Diewert (CCD, 1982) proposed procedure.

4. Empirical Results and Findings

The result of parameter estimates of the translog restricted normalized profit function is presented in Table 2. The R_s^2' adjusted for degrees of freedom for the profit function and the three expenditure-share equations, namely machinery, intermediate inputs and *zakat,* were 0.955, 0.745, 0.354 and 0.310, respectively, indicating a rather modest but fairly acceptable measurement of goodness of fit of a model. The regularity conditions such as: (i) monotonocity which requires the predicted output share to be positive and input shares to be negative; (ii) convexity which requires the twice-continuously differentiable profit function to be convex in prices or expressed in terms of Hessian matrix requires the diagonal elements of the matrices to be non-negative, were checked and satisfied at the approximation point. Thus we conclude that the function is well-behaved.

Using the parameter estimates of Table 2 and equation (10) the shadow values of land and labor were computed for each farming area. Furthermore, using the same parameter estimates and equations (11), (12), (13) and (14) the impacts of output price-support programs on the shadow values of land and labor, and profits were computed. In addition to this the impact of intermediate-input price on farm profits was also computed. It was from parameter estimates of equations (11), (12), (13) and (14) that we used to compute equations (15), (17) and (18).

4.1. Shadow Value of Land

As is well known the neo-classical economic theory states that in a competitive market the rental level will be equal to the shadow value of land (or marginal product of land). Our estimate of shadow value of land for four Malaysian rice farming areas shows that none of them satisfies the neo-classical economic theory condition. The estimates of shadow value of land (P_B^S) for NWSP, MIP, KIP and KEIP, the corresponding market rental rates of land (P_B^{MR}) and the ratios of the latter to the former are presented in Table 3 for the main-season (MS) and off-season (OS), respectively. As evident from the table the shadow value and the market rental rate of land were not commensurate with one another over the 1980-90 period. Specifically: (i) irrespective of seasons and with a few exceptional observation years, in general in the NWSP and MIP farming areas the market rental rate was significantly higher than the shadow value of land; (ii) irrespective of seasons and with some exceptional observation years, overall in KIP and KEIP farming areas the shadow value of land was significantly higher than the market rental rate.

Since the estimate of shadow value of land for NWSP and MIP had not previously, to our best knowledge, been undertaken, the first results could not be compared with findings of other studies. Our estimate results of shadow value of land for KEIP and KIP, however, are comparable with, for instance, Ismail (1972) and Horii (1972). While Ismail reports almost a similar finding to ours for Kemubu Irrigation Project (KIP) - the market rental rate was higher than shadow value of land, Horii finds that there exist a considerable variations between shadow value and market rental rate of land for Kerian Irrigation Project (KEIP). Considering Ismail's and our findings we conclude that in KIP farming area the trend where market rental rate is higher than shadow value of land seems to persist even with the implementation of price-support program. As can be seen from Table 3 also, measured in absolute terms, the values of P_B^S of all farming areas and seasons are almost equal and showing increasing trends. However, if measured in relative terms, in comparison to NWSP and MIP the shadow value of land for KIP and KEIP farming areas is higher, implying that land has been more intensively utilized in the latter farming areas. We will point out the reason as to why there exist two distinctive trends in the shadow value of land between NWSP/MIP as one group and KEIP/KIP as another when we discuss the estimate results of shadow value of labor.

4.2. Shadow Value of Labor

The estimate results of shadow value of labor (P_L^S), the corresponding market wage rates of the unskilled (P_L^U) and electronics (P_L^E) workers, and their respective ratios for the 1980-90 period are shown in Table 4 for the main-season (MS) and off-season (OS), respectively. As can be seen from the table there exist two prominent trends among the farming areas' shadow value of labor. While in the case of NWSP and MIP the value shows a decreasing trend, in the KEIP and KIP (except for a few observation years) the opposite trend is prevalent. If, however, the magnitudes of shadow value and the market wage rates of unskilled (and/or electronics) labor are compared, irrespective of farming areas and seasons, the magnitudes of the latter are higher than the former. Since from the table it is obvious that the shadow value of labor is smaller than the wages of unskilled and electronics workers, it is logical for some rice farmers to migrate to urban sector in search of better paid job opportunities. In fact, this is similar to what have been anticipated by Harris and Todaro (1970). They argue that as long as the expected urban wage rate is higher than rural wage rate the rural labor forces will find it worth their while to migrate to urban sector.

The discrepancies in the shadow value of labor between NWSP/MIP as one group and KEIP/KIP as another can be better explained if the degrees or levels of technology adopted by these two farming groups and the shadow value of land are taken into account. First, based on mechanized plowed paddy areas, on average, 90% of the NWSP/MIP areas were mechanically plowed as compared to 45% in KIP and 15% in KEIP. Second, on average, 90% of MIP and 35% of NWSP planted paddy areas were mechanically harvested as compared to 21% and 13% in KIP and KEIP, respectively. This implies that, as far as rice farming technology is concerned, the NWSP/MIP adopted a relatively machinery-intensive technology and the KEIP/KIP adopted a relatively labor-intensive technology. Third, given the differences in the levels of technology adoption between the two groups, it is expected that the differences will in turn lead to different magnitudes of shadow values of land and labor. As is well known, for efficiency reason, when machinery-intensive technology is adopted there is a tendency for land to be increasingly demanded (Gardner and Pope - 1978, Herndt 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 mechanization of land preparation and harvesting process (Said, 1985:ii)." An increase in the demand for land will theoretically lead to a higher land rental rate.

Now, given this fact, the following chain effects are conjectured to exist; a different levels of technology adoption ⇒ different levels of demand for land and labor ⇒ different levels of land rental and labor wage rates ⇒ different trends and magnitudes of shadow values of land and labor. The chain effects seem to take place in Malaysian rice farming, particularly in the two farming groups described earlier. For example, in the KEIP/KIP farming areas due to technology adopted was relatively labor-intensive, labor was relatively highly demanded compared to machinery. Thus, farmers in KEIP/KIP gave a higher weighting to labor than machinery which resulted in higher magnitudes of shadow value of labor. The reverse to the case of KEIP/KIP was, however, true in NWSP/MIP farming areas. We conclude, therefore, the discrepancies in the shadow values of land and labor between the two farming groups are explainable by referring to the differences in the levels of technology adoption.

4.3. Farm Tenancy Patterns

Before we present and discuss the estimate results of equation (15), it is thought wise briefly explaining the nature of Malaysian farm tenancy. As shown in Table 1 the farm tenancy appears in three modes, namely owner-operator, owner-tenant and tenant-farmer. As a matter of fact tenant-farmers, as opposed to owner-operators and owner-tenants, do not have legal rights to the farmlands on which they are working. By virtue of paying a fixed-rental for each hectare of rented-in land, however, they are assumed to have a limited rights to the land, i.e., within the stipulated period as agreed upon between them and the owner-operators or owner-tenants. Therefore, a change in farm tenancy patterns is taken to mean as a movement of per hectare unit of farmland notably from owner-operators to owner-tenants and tenant-farmers. In addition to this the income generated from per hectare farm profit in comparison with the income generated from off-farm employments is regarded as the basis for farmers to decide whether or not to continue working on farmlands.

Having described the nature of Malaysian farm tenancy systems how could we relate it to equation (15) in order to comprehend the impact of price-support program on the change in the farm tenancy patterns? Since farmers are assumed to make a decision whether or not to continue working on farmlands based on IRRB $>$ CBIR or IRRB $<$ CBIR criteria, the impact could be explained as follows. From the estimate results of equation (15) presented in Figures 1(a) and 1(b) for the main- and off-season, respectively, the owner-operators in NWSP would have repossessed the farmlands which they had previously rented-out to owner-tenants or tenant-farmers and cultivating the land themselves. The reason for owner-operators doing this was that IRRB $>$ CBIR. As a consequence, some of the owner-tenants were forced to give up some or all of their previously rented-in farmlands and instead concentrate working on their own farmlands. As for some tenant-farmers they were left with two options, that is either became fulltime farm laborers or migrated to the urban sector and searched for off-farm jobs. However, since in the case of KEIP, MIP and KIP, IRRB $<$ CBIR, an outcome that was opposite of the NWSP was expected to take place. Specifically, some of the owner-operators rented-out their farmlands to owner-tenants and tenant-farmers. Thus, the percentage share of the latter two farm tenancy groups as compared to the former would have increased significantly.

From different behavioral patterns showed by owner-operators, owner-tenants and tenant-farmers of all farming areas in response to the profitability criteria (IRRB against CBIR) discussed above, it was likely that farm tenancy patterns would have been significantly affected. For instance, because in NWSP, IRRB $>$ CBIR, a concentration of farmlands would have been more in the hands of owner-operators than in the hands of owner-tenants or tenant-farmers. On the contrary, because in other farming areas, IRRB $<$ CBIR, it was expected that farmlands would have been more concentrated in the hands of owner-tenants and tenant-farmers than owner-operators. Based on the outlined profitability criteria and its application to NWSP, MIP, KIP and KEIP farming areas it seems that the estimate results, as shown in Figures 1(a) and 1(b), are consistent with the changes in the farm tenancy patterns as presented in Table 1.

4.4. Income Adjustments

When the criterion based on NORM1 is applied to all farming areas, it seems that the results, to a large extent, consistent with the change in farm tenancy patterns as shown in Table 1. As can be seen from Figures 2 (a) and 2 (b), in all but one farming area (i.e., NWSP) NORM1 appeared to be smaller than unity, signifying that tenant-farmers were not expected to adjust their source of income from other than farming. In fact, due to sufficient profit which they earned from farming some of them were expected to acquire or rent-in more farmlands. This has resulted in the increase in their farm tenancy share in MIP, KIP and KEIP farming areas over the under-surveyed periods. More specifically, the increase of tenant-farmers share in MIP, KIP and KEIP farming areas was 4.9%, 13.8% and 8.8%, respectively. Meanwhile, since NORM1 of NWSP showed some peculiar trends, both in the main- and off-seasons, compared with other farming areas where the values of NORM1 of some observation years were either greater than unity or negative, tenant-farmers were expected to give-up farming[6]. They were then expected to adjust their sources of income by either taking up farm jobs or moving out from the rice farming area to take up off-farm jobs as unskilled or electronics workers in the urban/industrial areas. Perhaps, it was due to this fact that the tenant-farmers share of NWSP farming area dropped by 3.6% over the period being compared (Table 1).

Next, when the criteria based on NORM2 are applied to all farming areas the results somehow seem to suggest the followings: (i) with the exception of few observations years, NORM2 of NWSP and MIP appeared to be smaller than unity, suggesting that the owner-operators were adjusting their source of income from farm profits to renting-out farmlands and/or income from off-farm employments.Thus, it was expected that their farm tenancy share would decrease over the under-surveyed period. Nevertheless, the results for NWSP did not seem to be consistent with the change in farm tenancy patterns

[6] In particular, in 1983 (off-season) NORM1 appeared to be negative, implying that in 1983 the tenant-farmers, on average, made negative profit. This is because the AVEPH which they received was smaller than the rental rate of land that they were paying for that year.

as presented in Table 1[7]. In particular, given the NORM2 which was smaller than unity, some of the owner-operators in NWSP were expected to rent-out their farmlands. It turns out, however, that their farm tenancy share increased by 8.7% (Table 1). Therefore, there must be some reasons behind the discrepancy between the finding and general observation such that it needs a lucid explanation. In brief, the discrepancy between the former and latter can be explained as follows. As shown earlier the tenant-farmers in NWSP were, on average, making insufficient profits to enable them to continue working on farming. To reiterate, the NORM1 for some observation years were either greater than unity or negative.

Under such circumtances some of them were left with no option other than giving-up farming. In other words they have to return the rented-in farmlands back to the owner-operators and looked for farm or off-farm jobs such as unskilled or electronics workers in the urban/industrial areas. On the other side of the coin, though unprofitable as indicated by the NORM2 which was smaller than unity, some of the owner-operators were "obliged" to repossess the farmlands. Perhaps, due to the combination of these two forces that have led to the increase of owner-operators farm tenancy share in the NWSP farming area from 72.3% in 1985 to 81.0% in 1990; (ii) with the exception of few observation years, the NORM2 of KIP and KEIP farming areas appeared to be greater than unity, implying that the owner-operators were expected to repossess the previously rented-out farmlands. In other words, some of them were expected not only to rely their source of income on the present self-cultivated farmlands but also to repossess more to be supplemented to the ones they have had. As a consequence, their share in the farm tenancy groups was predicted to increase significantly. Contrary to our prediction, however, the percentage share of owner-operators in both KIP and KEIP decreased by

7 In MIP farming area, instead of owner-operators, the owner-tenants who were the ones mainly benefited from the NORM2 which showed the value of smaller than unity. In this case they took the renting-in farmlands criteria as the basis for maximizing the farm profits. Specifically, by taking the value of NORM1 of the self-cultivated farmlands as the basis for making decision, where they found that the value was smaller than unity, they decided to rent-in more farmlands. This is shown in Table 1 by the percentage change of about 20% in owner-tenants share during the two periods being compared.

13.5% and 22.5%, respectively, during the under-surveyed period. Again, as in the case of NWSP, there exist a discrepancy between our finding and general observation.The following explanations may help bridging the discrepancy. In the case of KIP the discrepancy between our finding and the general observation seems to be fairly acceptable if Fujimoto's (1980) empirical study finding is taken into account. His finding shows that in KIP (or Kelantan) the owner-operators who were already cultivating a large farm would consider renting-out their farms, even at the expense of lower income, to small farmers and landless villagers, particularly to their relatives and fellow villages. This implies that even though owner-operators were fully aware that the NORM2 of their self-cultivated farmlands was greater than unity, some of them for non-economic reasons would prefer not to repossess the previously rented-out land. Perhaps, due to this and the NORM1 of this farming area which was smaller than unity that have led the share of owner-operators to decrease by 13.5% and of tenant-farmers to increase by the same percentage point during the under-survey period (Table 1).

Meanwhile, in the case of KEIP the proximity of this farming area to one of Malaysia's fast growing industrial area, namely Mak Mandin in Penang, might have influenced some of the owner-operators to give-up farming and instead derived their sources of income from renting-out farmlands and wages received as electronics workers. The proximity factor together with sufficient farm profits obtained by the tenant-farmers (i.e., NORM1 was smaller than unity) might have contributed to the decrease in the owner-operators farm tenancy share by 22.5% and the increase in tenant-farmers share by 13.7% during the two observation years being compared.

To conclude, as far as Malaysian rice farming is concerned, though economic reasoning in most cases could explain pretty well the manner in which farmers adjusted their sources of income, in some others the non-economic reasoning superseded the economic reasoning. The case of KIP farming area is one of the classic example to illustrate the point at hand. By and large, our findings seem to concur with Bardhan

(1989) who argues that "The emphasis on the effect of an institutional change on control of surplus by a particular class also suggests that the question of efficiency-improving institutional change cannot really be separated from that of redistributive institutional change particularly when issues of collective action, class capacity, mobilization and struggle in the historical process are important (p.11)."

4.5. Market Interventions

In a competitive market an equilibrium in the price of, say rice, is obtainable if the quantity of rice demanded is equal to that of quantity supplied. However, if it is assumed that the demand for rice is constant and the supply is increasing, then the equilibrium point will change such that the price will be pushed down. How did the theoretical argument fare through in the context of Malaysian rice farming during the 1980-90 period?

First, owing to the implementation of price-support program, farmers tend to increase output (supply). In fact, as has been shown by Abdullah (1995) the elasticity of cost with respect to output (ε_{cy}) of Malaysian rice farming for the 1980-90 period was 0.4. The estimated cost elasticity in turn suggests a scale effect ($1-\varepsilon_{cy}$) of 0.6. This means farmers who wish to increase the rice output (supply) by, say 1%, will be facing an increase of only 0.4% in total cost. However, with less likely there will be an increase in the demand for rice in the near future (Tan, 1987) it is expected that rice price will show a decreasing trend. The question is: will the predicted decrease in rice price take place? Since the government, for welfare reason, would retain the rice price to its present status quo where the Guaranteed Minimum Price (GMP) created by the government became the most powerful hindrance, it is unlikely that the rice price would be affected by the demand and supply forces. Second, as mentioned earlier the intermediate inputs such as fertilizers and seeds are heavily subsidized by the government. Once again for welfare reason it is very unlikely that government would withdraw the material subsidies given to the farmers. Nonetheless, for future policy formulation purposes it is interesting to investigate how farmers profits would be affected if there was a reduction in intermediate-input and output prices.

Now, keeping the welfare reason intact our objective is to investigate how farm profitibility will be affected in the event of without government intervention in the output and factor inputs markets. This is done by evaluating the percentage changes in farm profitability due to percentage changes in rice and intermediate-input prices, as defined in equations (13) and (14), respectively. In particular, we conduct a sensitivity analysis where a reduction of 3%, 5% and 10% in output and intermediate-input prices is imposed on equations (13) and (14), respectively.

In order to save space, instead of presenting a complete set of the estimate results, only the lowest and highest values of the 10% reduction in output and intermediate-input prices are reported. First, it appears from the estimate results that an imposition of 10% reduction on output price led only to a reduction between 1.5 - 2.8% in farm profits. This implies that a reduction of 10% in output price would decrease profits between 1.5 - 2.8%. Second, as a result of imposing a 10% reduction on intermediate-input price there was an increase between 1.3 - 2.2 % in farm profits. This tends to suggest that a reduction of 10% in intermediate-input price led to an increase in farm profits by 1.3 to 2.2%.

Though quite different in methodology but similar in case study (Singh, Squire and Strauss, 1986), and considerably diverse in methodology and case study (Barker and Hayami, 1976), our and their findings are comparable[8]. First, Singh, Squire and Strauss show that while a 10% reduction in output price would reduce real income (of farmers)

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[8] Singh, Squire and Strauss (1986) employ agricultural household models and they apply it to a number of countries of which Malaysia is one. On the other hand, Barker and Hayami (1976) employ a model which is basically based on cost-benefit analysis and they apply it to the case of the Philippine rice sector. We note further that the Plan A and 97.5% self-sufficiency rate finding of Barker and Hayami study is used to compare with ours.

by almost 7%, a 10% decrease in fertilizer price augmented farmers income by almost 1%. Second, Barker and Hayami show that an increase of 9% in the rice price resulted in a negative ($-14 million) net social benefit. Whereas a decrease of 40.6% in fertilizers price resulted in a positive ($10 million) net social benefit. As far as policy implication is concerned, while Singh, Squire and Strauss finding tends to suggest that government intervention will be more efficient/effective in the output market than input (fertilizers) market, Barker and Hayami finding tends to suggest the opposite. Now, taking the findings of: (i) Singh, Squire and Strauss; (ii) Barker and Hayami; and (iii) the present paper together, it seems that ours tends to support Singh, Squire and Strauss. That is to say the government intervention in output market market will be relatively more effective than input market.

5. Summary and Concluding Remarks

In pursuing the objective to measure the impacts of price-support program on farm tenancy patterns, income adjustments and market interventions, a translog normalized restricted profit function framework was employed. This framework was chosen, as shown in sections 2 and 3, because it provides the most convenient procedures to estimate the shadow values of land and labor. The parameter estimates of the shadow values, P_B^S and P_L^S, were in turn used to measure the impacts of price-support program on farm tenancy patterns, income adjustments and market interventions. In section 4 the estimate results and findings of the study were reported. What follows are the summary of the main findings and some concluding remarks.

First, when the impacts of price-support program on shadow value of land (P_B^S) was measured for Malaysian rice farming two distinctive results emerged. While in the NWSP and MIP farming areas the market rental rate of land (P_B^{MR}) was found to be larger than P_B^S, in the KEIP and KIP farming areas the opposite result was found to be true.

Second, the shadow value of labor (P_L^S) of all farming areas was found to be significantly lower than wages of unskilled (P_L^U) and electronics (P_L^E) workers. Thus, it was expected that an outmigration of farm laborers from the respective granary areas to the urban/industrial sectors in search of better paid job opportunities might have taken place during the 1980-90 period. Owing, however, to different levels of technology adoption between NWSP/MIP (machinery-intensive) as one group and KEIP/KIP (labor-intensive) as another, labor was still regarded as one of the most important factors of production in KEIP/KIP. This was proved to be true based on the shadow value of labor of KEIP/KIP that was found to be relatively higher than that of NWSP/MIP (Table 4). Thus, if labor is to be withdrawn from the rice farming sector to fulfill the increasingly demand for unskilled and semi-skilled labors in the urban/industrial sectors' employments, preference should be given to take out the redundant labors from NWSP and MIP farming areas.

Third, in all but one rice farming areas the IRRB was smaller than CBIR. This implies that to some owner-operators in MIP, KIP and KEIP it was not profitable for them to continue working on farmlands. Instead, due to the fact that CBIR was greater than IRRB they were expected to rent-out the farmlands and deposited the money received in a bank. In the NWSP farming area, because IRRB was greater than CBIR, the opposite of the case of MIP, KIP and KEIP was expected to take place. Owner-operators were expected to repossess the farmlands which they previously rented-out to tenant-farmers and owner-tenants. Therefore, in NWSP the farmlands became more concentrated in the hands of owner-operators than tenant-farmers and owner-tenants. This finding proved to be consistent with the changes in farm tenancy patterns as shown in Table 1.

Fourth, in all but one farming areas, the impact of price-support program on farm tenancy patterns was found to be biased towards tenant-farmers and owner-tenants. This has resulted in more rice farmlands being cultivated by these two farm tenancy groups than owner-operators during the 1980-90 period. The finding apart from being consistent with the figures showed in Table 1 also provides a strong basis to nullify part of Mehmet (1988) argument when he says "the average owner-operators and especially the average owner-tenants achieved major income improvements, thanks to their ability to increase their land holding at the expense of small farmers and tenants."

Fifth, in general it was found that as a result of implementing the price-support program, there was increasing number of owner-operators in NWSP farming area who cultivated the farmlands themselves. This was the case even though the value of NORM2 was smaller than unity. The reason for such discrepancy was that many of the tenant-farmers in NWSP were facing a problem related to NORM1 of their farmlands which was less than unity - suggesting that it was not worth their while to continue working on the farmlands which they rented-in. Thus, the owner-operators have somehow "obliged" to receive the farmlands returned to them by the tenant-farmers. This has resulted in an increase of owner-operators percentage share in the farm tenancy groups as shown in Table 1.

Finally, dated back from the colonial era; for welfare, food security and self-sufficiency reasons, government intervention in the rice output and factor inputs markets has persisted. From the estimate results of imposing a 10% reduction on output and intermediate-input prices, respectively, it was found that the effects on farm profitability were fairly small, i.e., the profits decreased between 1.5 - 2.8% in the case of output, and increased between 1.3 - 2.2% in the case of intermediate inputs. Thus, it seems that government intervention in the rice output market will be relatively more effective than intermediate-input market.

Table 1. Farm tenancy patterns of major Malaysian farming areas, selected years

(Unit : %)

Rice Farming Area*	KIP		KEIP		NWSP		MIP	
Observation 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	15.3	28.0	32.9

Annual Average Compound Rates of Growth**

Rice 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	-4.14	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 for the two observation years being compared of each farming area.

Table 2. Parameter Estimates of the Translog Restricted Normalized Profit Function for Malaysian Rice Farming, 1980-90

Parameter	Estimate	t-value
α	0.034	145.650
α_M	-0.151	- 15.227
α_U	-0.283	- 18.557
α_T	-0.093	- 37.629
α_Y	1.526	61.123
β_L	0.176	1.209
β_B	0.985	7.263
γ_{MM}	0.106	0.340
γ_{UU}	0.169	0.645
γ_{TT}	-0.095	- 33.199
γ_{MU}	-0.549	- 2.011
γ_{MT}	-0.023	- 1.668
γ_{UT}	-0.060	- 4.131
γ_{YY}	-1.087	- 3.968
γ_{YM}	0.467	3.248
γ_{YU}	-0.441	- 2.690
γ_{YT}	0.179	9.523
$\varnothing_{LL}$	-0.644	- 1.116
$\varnothing_{BB}$	-0.982	- 1.900
$\varnothing_{LB}$	0.786	1.448
δ_{ML}	-0.233	- 4.133
δ_{MB}	-0.258	- 4.970
δ_{UL}	0.268	3.109
δ_{UB}	-0.164	- 2.071
δ_{TL}	-0.015	- 1.109
δ_{TB}	-0.018	- 0.147
δ_{YL}	-0.517	- 3.656
δ_{YB}	0.424	3.267

Note:

The coefficients for output supply function (Y) were obtained using the parameter restrictions of linear homogeneity.

Table 3 : Shadow Value of Land (P_B^S), Market Rental Rate of Land (P_B^{MR}) and P_B^{MR}/P_B^S for all Farming Areas, Main- and Off-Season

Main Season (MS)	NWSP(MS)			MIP(MS)			KIP(MS)			KEIP(MS)		
YEAR	P_B^S	P_B^{MR}	P_B^{MR}/P_B^S	P_B^S	P_B^{MR}	P_B^{MR}/P_B^S	P_B^S	P_B^{MR}	P_B^{MR}/P_B^S	P_B^S	P_B^{MR}	P_B^{MR}/P_B^S
1980	288	340	1.18	206	507	2.46	260	287	1.10	245	141	0.58
1981	216	414	1.92	164	561	3.42	221	289	1.31	207	199	0.96
1982	224	590	2.63	179	604	3.37	210	292	1.39	234	252	1.08
1983	218	558	2.56	203	628	3.09	252	295	1.17	223	184	0.83
1984	395	576	1.46	398	635	1.60	414	285	0.69	411	216	0.53
1985	399	479	1.20	400	660	1.65	394	282	0.72	404	225	0.56
1986	340	535	1.57	402	655	1.63	381	288	0.76	400	216	0.54
1987	408	497	1.22	411	659	1.60	403	293	0.73	404	218	0.54
1988	399	495	1.24	408	404	0.99	391	297	0.76	415	225	0.54
1989	373	450	1.21	383	330	0.86	403	300	0.74	403	221	0.55
1990	542	524	0.97	608	307	0.51	560	300	0.54	603	211	0.35

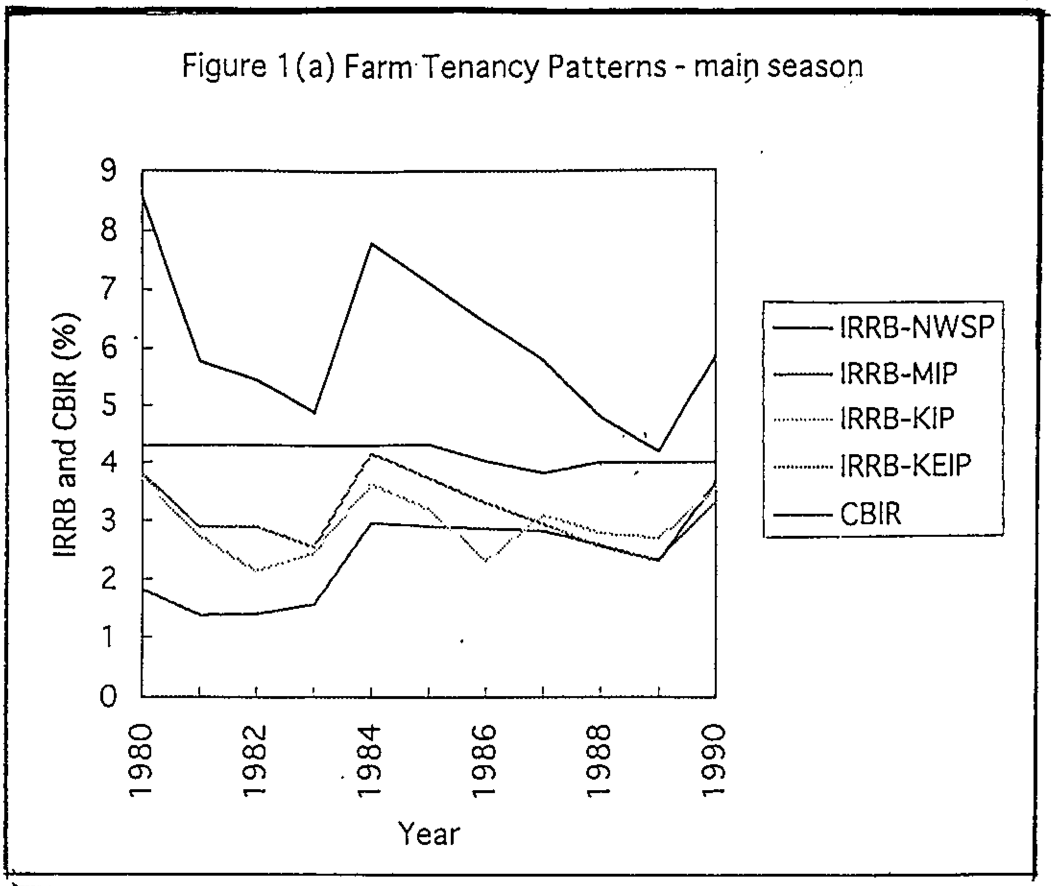
Off Season (OS)	NWSP(OS)			MIP(OS)			KIP(OS)			KEIP(OS)		
	P_B^S	P_B^{MR}	P_B^{MR}/P_B^S	P_B^S	P_B^{MR}	P_B^{MR}/P_B^S	P_B^S	P_B^{MR}	P_B^{MR}/P_B^S	P_B^S	P_B^{MR}	P_B^{MR}/P_B^S
1980	309	434	1.41	242	460	1.90	305	289	0.95	293	158	0.54
1981	264	434	1.64	202	528	2.61	246	291	1.18	237	221	0.93
1982	251	496	1.98	217	599	2.76	246	294	1.20	273	231	0.85
1983	258	563	2.18	236	592	2.51	228	297	1.30	255	212	0.83
1984	444	563	1.27	476	607	1.28	444	289	0.65	444	223	0.50
1985	442	580	1.31	461	608	1.32	422	287	0.68	436	242	0.56
1986	429	484	1.13	467	648	1.39	425	293	0.69	431	214	0.50
1987	450	481	1.07	496	610	1.23	449	296	0.66	446	218	0.49
1988	444	447	1.01	484	356	0.74	439	299	0.68	449	210	0.47
1989	436	473	1.09	459	338	0.74	429	300	0.67	438	218	0.50
1990	606	513	0.85	712	307	0.43	628	301	0.48	615	199	0.33

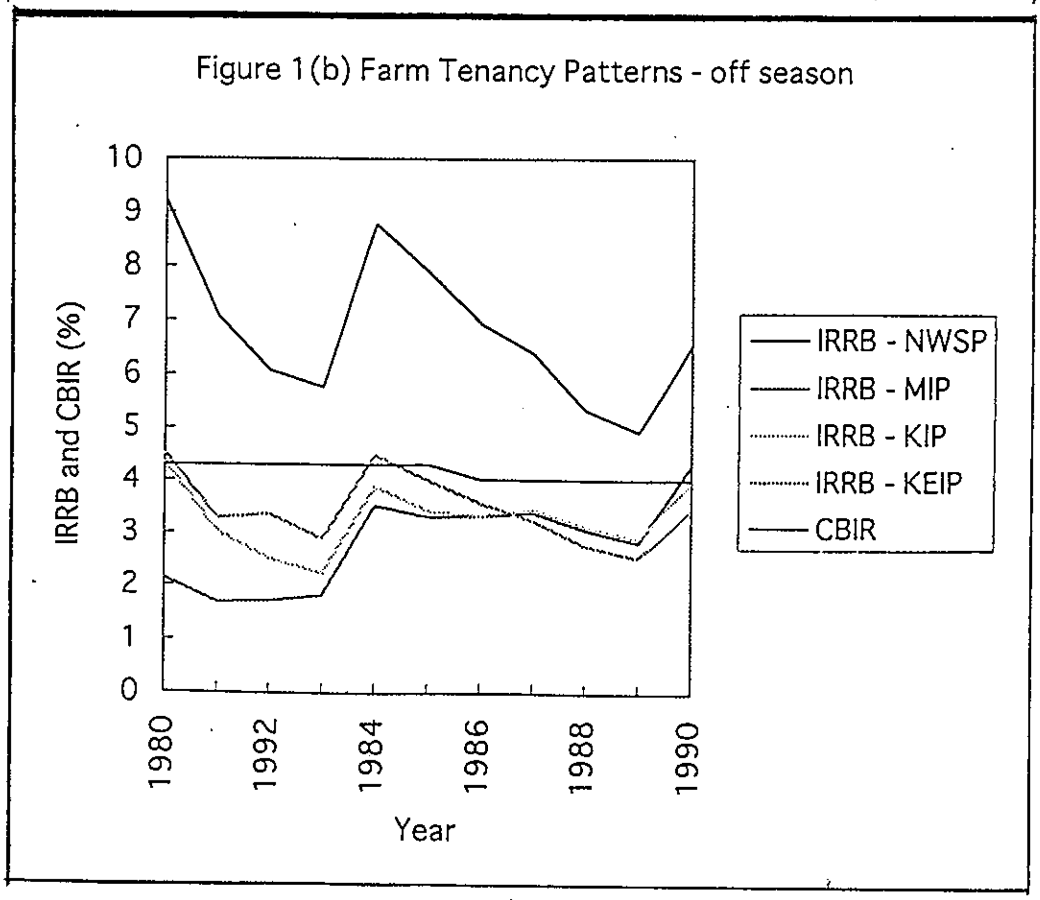
Table 4 : Shadow Value of Labor (P_L^S), Wage Rates of Unskilled (P_L^U) and Electronics (P_L^E), and the ratios of P_L^U and P_L^U to P_L^S

Main Season (MS)			NWSP(MS)			MIP(MS)			KIP(MS)			KEIP(MS)		
YEAR	P_L^U	P_L^U	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	1.23	0.84	0.94	0.86	1.20	1.35	1.03	1.00	1.26	1.19	0.87	0.97
1981	1.08	1.19	0.87	1.24	1.37	0.73	1.48	1.55	0.86	1.26	1.38	0.96	1.12	1.24
1982	1.14	1.22	0.76	1.50	1.60	0.67	1.70	1.82	0.73	1.56	1.67	0.78	1.46	1.56
1983	1.19	1.26	0.79	1.51	1.59	0.50	2.38	2.52	0.79	1.50	1.59	0.78	1.52	1.62
1984	1.25	1.29	0.85	1.47	1.52	0.78	1.60	1.65	0.91	1.37	1.42	0.88	1.42	1.47
1985	1.30	1.33	0.74	1.76	1.79	0.75	1.73	1.77	0.89	1.46	1.49	0.99	1.31	1.34
1986	1.34	1.37	0.77	1.74	1.77	0.69	1.94	1.99	0.94	1.42	1.46	0.99	1.35	1.38
1987	1.37	1.52	0.63	2.17	2.41	0.59	2.32	2.58	0.96	1.43	1.58	0.99	1.38	1.53
1988	1.42	1.67	0.65	2.19	2.56	0.58	2.45	2.88	0.89	1.59	1.88	0.98	1.45	1.70
1989	1.46	2.08	0.62	2.35	3.35	0.61	2.39	3.41	1.02	1.43	2.03	0.91	1.60	2.29
1990	1.51	2.40	0.50	3.02	4.80	0.69	2.19	3.48	0.93	1.62	2.58	1.01	1.50	2.38

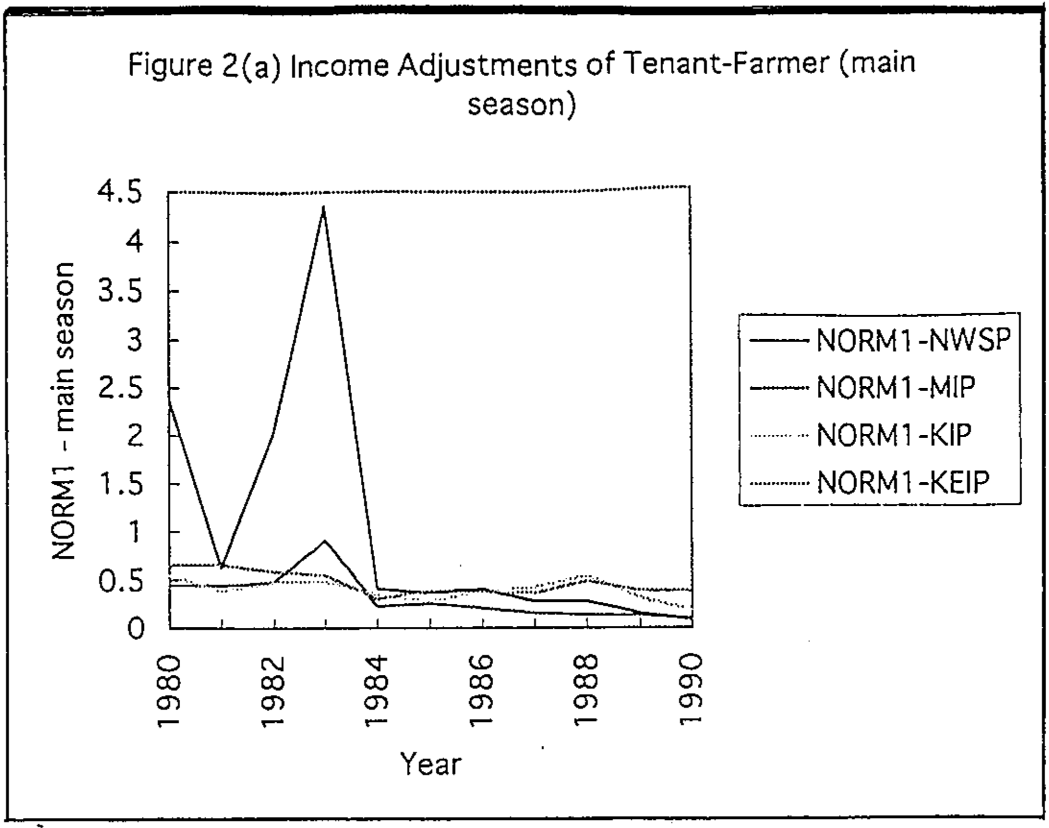
Off Season (OS)			NWSP(OS)			MIP(OS)			KIP(OS)			KEIP(OS)		
YEAR	P_L^U	P_L^E	P_L^S	P_L^U/P_L^S	P_L^E/P_L^S	P_L^S	P_L^U/P_L^S	P_L^E/P_L^S	P_L^S	P_L^U/P_L^S	P_L^E/P_L^S	P_L^S	P_L^U/P_L^S	P_L^E/P_L^S
1980	1.03	1.16	1.35	0.76	0.86	0.94	1.09	1.23	1.01	1.02	1.15	1.28	0.81	0.91
1981	1.08	1.19	0.88	1.23	1.35	0.79	1.37	1.51	0.93	1.16	1.28	1.03	1.05	1.16
1982	1.14	1.22	0.76	1.50	1.61	0.82	1.39	1.49	0.70	1.63	1.74	0.84	1.38	1.45
1983	1.19	1.26	0.87	1.37	1.45	0.45	2.64	2.80	0.75	1.59	1.68	0.84	1.42	1.50
1984	1.25	1.29	0.87	1.44	1.48	0.67	1.87	1.93	0.85	1.47	1.52	0.90	1.39	1.43
1985	1.30	1.33	0.69	1.88	1.93	0.71	1.83	1.87	0.98	1.33	1.36	1.02	1.28	1.30
1986	1.34	1.37	0.91	1.47	1.51	0.76	1.76	1.80	1.01	1.33	1.36	1.01	1.33	1.36
1987	1.37	1.52	0.70	1.96	2.17	0.46	2.98	3.30	1.05	1.30	1.45	1.04	1.32	1.46
1988	1.42	1.67	0.66	2.15	2.53	0.55	2.58	3.04	1.07	1.33	1.56	0.98	1.45	1.70
1989	1.46	2.08	0.52	2.81	4.00	0.62	2.35	3.35	1.02	1.43	2.03	0.94	1.55	2.21
1990	1.51	2.40	0.55	2.75	4.36	0.75	2.01	3.20	0.95	1.59	2.53	1.00	1.51	2.40

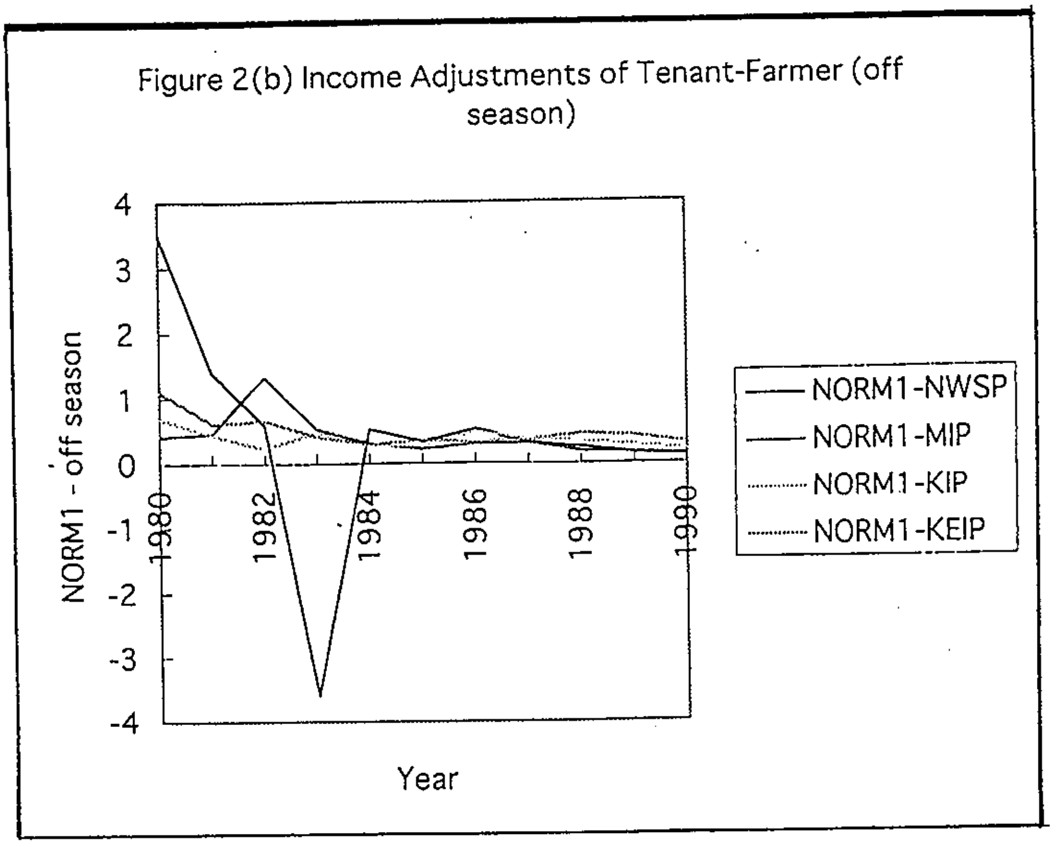
Note: All figures in Tables 3 and 4 are expressed in Ringgit Malaysia (RM). NWSP, MIP, KIP and KEIP are the farming areas as defined in the text.





Note: NWSP = Northwest Selangor Project; MIP = Muda Irrigation Project
KIP = Kemubu Irrigation Project; KEIP = Kerian Irrigation Project
IRRB = Internal Rate of Returns to Land; CBIR = Commercial Bank Interest Rate
MS = Main Season; OS = Off Season.





Note: NWSP = Northwest Selangor Project MIP = Muda Irrigation Project
KIP = Kemubu Irrigation Project KEIP = Kerian Irrigation Project

Table 5 : Owner-operators criteria for adjusting the source of income, NORM2=P_B^S/P_B^{MR}

Main-season	NWSP(MS)	MIP(MS)	KIP(MS)	KEIP(MS)
YEAR	P_B^S/P_B^{MR}	P_B^S/P_B^{MR}	P_B^S/P_B^{MR}	P_B^S/P_B^{MR}
1980	0.85	0.41	0.91	1.74
1981	0.52	0.29	0.77	1.04
1982	0.38	0.30	0.72	0.93
1983	0.39	0.32	0.85	1.21
1984	0.69	0.63	1.45	1.90
1985	0.83	0.61	1.40	1.80
1986	0.64	0.61	1.32	1.85
1987	0.82	0.62	1.38	1.85
1988	0.81	1.01	1.32	1.84
1989	0.83	1.16	1.34	1.82
1990	1.03	1.98	1.87	2.86

Off-season	NWSP(OS)	MIP(OS)	KIP(OS)	KEIP(MS)
YEAR	P_B^S/P_B^{MR}	P_B^S/P_B^{MR}	P_B^S/P_B^{MR}	P_B^S/P_B^{MR}
1980	0.71	0.53	1.06	1.85
1981	0.61	0.38	0.85	1.07
1982	0.51	0.36	0.84	1.18
1983	0.46	0.40	0.77	1.20
1984	0.79	0.78	1.54	1.99
1985	0.76	0.76	1.47	1.80
1986	0.89	0.72	1.45	2.01
1987	0.94	0.81	1.52	2.05
1988	0.99	1.36	1.47	2.14
1989	0.92	1.36	1.43	2.01
1990	1.18	2.32	2.09	3.09

Note:

The values of P_B^S and P_B^{MR} of all farming areas and seasons are shown in Table 3.

References

Abdullah, N., 1995, Measuring Malaysian rice farming sources of growth, 1980-90: a translog cost function approach, Discussion Paper Series No.643 (The University of Tsukuba, Japan).

Antle, J.M., 1984, The structure of U.S. agricultural technology, 1910-78, American Journal of Agricultural Economics, no. 66, 414-421.

Bardhan, P.K., 1989, The economic theory of agrarian institution, (Clarendon Press, Oxford).

Bardhan, P.K. and T.N. Srivinasan, 1971, Crop sharing tenancy in agriculture: a theoretical and empirical analysis, American Economic Review, no. 61, 49-64.

Caves, D.W., L.R. Christensen and W.E. Diewert, 1982, Multilateral comparison of output, input, and productivity using superlative index numbers, Economic Journal , no. 9, 273-86.

Fujimoto, A., 1980, Land tenure, rice production and income sharing among Malay peasants: a study of four villages, Unpublished Ph.D thesis (Flinders University of South Australia, Australia).

Fujimoto, A., 1991, Evolution of rice farming under the New Economic Policy, The Developing Economies 29, no.4, 431-454

Gardner, B.D. and R.D. Pope, 1978, How is scale and structure determined in agriculture? American Journal of Agricultural Economics, no. 60, 295-302.

Government of Malaysia, 1986, Fifth Malaysia Plan, 1986-90 (Kuala Lumpur, Government Printers).

Harris. J.R and M.P. Todaro, 1970, Migration, unemployment and development: a two sector analysis, American Economic Review 60, no. 1, 126-142

Haughton, J., 1986, Farm price responsiveness and the choice of functional form: an application to rice cultivation in West Malaysia, Journal of Development Economics, no. 24, 203-223.

Herndt, R.W. and W.W. Cochrane, 1966, Farm land prices and farm technological advance, Journal of Farm Economics, no. 48, 243-63.

Horii, K., 1972, The land tenure system of Malay padi farmers: a case of Kampong Sungei Bujor in the state of Kedah, The Developing Economies, no. 10, 45-73.

Ismail, A. H., 1972, Production functions for samples of rice farms in West Malaysia, Akademika, no. 1, 1-14.

Kuchiba, M., Y.Tsubouchi and N. Maeda, 1979, Three Malay villages: a sociology of paddy growers in West Malaysia, Monographs of the Center for Southeast Asian Studies Kyoto University, English-language Series, No.14, (The University Press of Hawaii, Honolulu).

Kuroda, Y., 1992, Price-support programs and land movement in Japanese rice production, in : Land issues in Japan, Haley J. O. and K. Yamamura, (1992), 223-241 (Society for Japanese Studies, Honolulu).

Lau, L.J., 1976, A characterization of the normalized restricted profit function, Journal of Economic Theory, no. 12, 131-63.

Mehmet, O., 1988, Development in Malaysia: poverty, wealth and trusteeship, (INSAN, Kuala Lumpur).

Said, M.I., 1985, The evolution of large farms in the Muda area, Kedah, Monograph series no. 8, (Center for Policy Research, Science University of Malaysia, Penang).

Sidhu, S.S. and C.A. Baanante, 1981, Estimating farm-level input demand and wheat supply in the Indian Punjab using a translog profit function, American Journal of Agricultural Economics, no. 63, 237-246.

Singh, I., L. Squire and J. Strauss, 1986, A survey of agricultural household models: recent findings and policy implications, The World Bank Economic Review 1, no. 1, 149-179.

Tamim, M., 1994, The agricultural sector: issues and policies, in: Malaysia's economic vision, Teh, H.Y. and Goh, K.L., 1994, chap. 6, (Pelandok, Malaysia).

Tamim, M., 1988, Development of the rice sub-sector in Peninsular Malaysia: relative economic efficiency, in: Economic performance in Malaysia: the insider's view, Nash, M., chap. 5, (New York).

Tan, S.H., 1987, Malaysia's Rice Policy: A Critical Analysis (Institute of Strategic and International Studies (ISIS), Malaysia).

Zellner, A., 1962, An efficient method for estimating seemingly unrelated regressions and tests for aggregation bias, Journal of American Statistics Association, no. 57, 585-612.