The Developing Economies, XXXII-3 (September 1994)

TACKLING RURAL POVERTY: AN ASSESSMENT OF ALTERNATIVE STRATEGIES FOR MIXED-FARMING AREAS IN PENINSULAR MALAYSIA

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A. *Introduction*

This paper seeks to answer the following question: how best might one improve the standard of living of the large number of poor farmers living in the small rice-growing areas scattered throughout Peninsular Malaysia? More generally, what realistic options does a government, even with substantial resources behind it, have in trying to combat rural poverty, and how effective are these possible policies?

The analysis is based on the results of a series of sample surveys, undertaken by the Malaysian Department of Agriculture during 1976–80. The characteristics of the 3,825 households surveyed are set out in Section B. The sample differs from that used by other researchers, such as Barnum and Squire [3], in that all the households in our sample live outside the rice-bowl areas of Muda, Besut, and Krian.[1] Although almost all of them cultivate rice, and have been defined as "rice growers" by the Government of Malaysia, they are more properly thought of as mixed farmers, since they typically earn at least as much from other farm crops as they do from rice.[2]

In order to trace the effects of different policies on household behavior and welfare, it is necessary to construct a farm-household model. The components of the model are set out in Section C, and require one to specify the production technology of the farm, the expenditure system of the household, and the manner in which households divide their time between on- and off-farm work. A variety of such models have been built and applied in other contexts.[3] The estimation of the model is discussed in Section D, and the results are used in the policy simulations in Section E.

B. *Characteristics of the Sample*

Under prompting from the World Bank, the Malaysian Ministry of Agriculture undertook a series of surveys of rice cultivators, outside the rice-bowl areas,

I would like to thank the anonymous referees for their very thorough and helpful comments.

[1] The most important economic study of rice-growing households in Malaysia is [3]. The data were drawn exclusively from the Muda area in northwestern Peninsular Malaysia, which is the major rice bowl of Malaysia.

[2] These farmers are designated as "rice cultivators," for instance, in [13].

[3] For several interesting examples, see [22]. Important applications include [12] [25] [21] [11].

during 1976–80. The expectation was that the resulting information would serve as a benchmark against which to judge the effectiveness of a proposed series of small-scale irrigation projects.

The target group, consisting of households living in the "marginal" rice-growing areas, had been identified as one of the poorest in the country.[4] At least half of the households were estimated to fall below the commonly accepted poverty line used by several authors of M$120 per household per month or M$25 per capita per month.[5] The mean annual income of the households surveyed was M$2,600 (= U.S.$1,000), or almost M$500 per capita. While very low even by Malaysian standards, these incomes were higher than those found, using similar survey techniques, during 1960–72.[6]

The main relevant facts about the households surveyed are as follows:

—Farms averaged 4.2 acres, of which 2.0 acres were gazetted for padi cultivation. Most (86 per cent) of the land was farmed by its owners, but share-cropping and cash rental occurred too.

—Given the small size of farms, it is not surprising that just 15 per cent of income came from rice cultivation, despite the fact that the households were identified, a priori, as rice farmers. A further 27 per cent came from other farm activity, notably rubber tapping; 11 per cent consisted of unearned transfers and remittances, and 47 per cent was earned off the farm. These are thus part-time farmers; four-fifths of working adults hold at least two jobs. Over 85 per cent of the jobs are on the household farm, and of the off-farm jobs, less than 10 per cent were directly agricultural.

—The great bulk of households hired in or out at least some labor. This suggests an active labor market, and makes it plausible to model the household production decisions separately from decisions about labor supply.

—The average wage rate received by family workers off the farm (M$0.95/hour) was approximately twice the average wage paid for labor hired in (M$0.55/hour). Such a pattern is common elsewhere and means that the model needs to explain the division of working time between on- and off-farm work.

The model which is set out in Section C is designed so as to recognize these features, and thus differs from other farm-household models in both its focus and assumptions. For instance, Barnum and Squire [3] model a situation of rice monoculture in Malaysia. In the study of Taiwanese farmers by Lau, Lin, and Yotopoulos [12] off-farm employment was unimportant. Strauss [25] was concerned specifically with the effects of policy interventions on food consumption among farmers in Sierra Leone. Singh and Squire [21] emphasized the effects of price and policy changes on nutrition.

C. *The Farm-Household Model*

The farm-household model has three components. Farmers first decide how

[4] See, for instance, [13] and also [20]. This latter monograph summarizes the results of a number of small-scale surveys of rice-growers undertaken by the Ministry of Agriculture from the early 1960s onwards.

[5] The former poverty line is used by Snodgrass [23], the latter by Anand [1].

[6] The evidence is reviewed by Jonathan Haughton [9].

intensively to cultivate their land, and hence what profits are to be expected. Given these profits, they determine how much rice to consume, how many other goods to buy, and how much labor to supply. They then choose how to divide their working time between on- and off-farm work. The model is first set out on the assumption that the wage rates faced by households are exogenous. A general equilibrium version endogenizes wage rates, and provides the structure for the policy simulations of Section E.

1. *How much to produce*

The structure of production is modelled by input demand equations derived from a quadratic restricted profit function.[7] Let there be n variable inputs and outputs, represented by X_i. The X_i are positive for outputs and negative for inputs. For current purposes all farm output is aggregated into a single measure of total farm output, and the inputs are field preparation (in units of tractor use), labor, and fertilizer. There is one fixed variable Z, representing land, which cannot easily be adjusted in the short-term. It is also possible to add v dummy variables w_m, to pick up such influences as weather or pest infestation.

The input demand (output supply) equations for the first $n-1$ goods thus take the form

$$X_i = a_i + \sum_{j=1}^{n-1} b_{ij} P^*_j + \sum_{k=1}^{r} c_{ij} Z_k + \sum_{m=1}^{v} g_{im} w_m, \tag{1}$$

where the P^*_j are the prices normalized by the price of the nth good. The equation for the nth good, which we took to be output, is given by

$$X_n = a_0 - \frac{1}{2}\sum_{i=1}^{n-1}\sum_{j=1}^{n-1} b_{ij} P^*_i P^*_j - \frac{1}{2}\sum_{k=1}^{r}\sum_{l=1}^{r} e_{kl} Z_k Z_l - \sum_{s=1}^{r} f_s Z_s - \frac{1}{2}\sum_{i=1}^{n-1}\sum_{m=1}^{v} g_{im} P^*_i w_m. \tag{2}$$

2. *Labor supply*

The expenditure decisions are summarized by a Linear Expenditure System (LES).[8] Individuals are assumed to have a utility function of the form

$$u = \sum_i \beta_i \ln(c_i - \tau_i), \tag{3}$$

where c_i is the individual's consumption of good i, there are m goods including leisure, and the β_i and τ_i are parameters. In this study we are only able to distinguish three goods, leisure (L), padi consumption (P), and non-padi goods and services (N) which, being a residual, includes savings. This degree of aggregation is not unusual.[9]

[7] For examples of this approach, see [4] and also [8].
[8] The LES was introduced by J. N. R. Stone in 1954, see [24] and [17] [19].
[9] For examples of aggregation to just three categories, see [12].

Since the available consumption data for rice and non-rice goods and services are for households and not individuals, aggregation is required over the n household members, n_1 of whom work. This aggregation is strictly acceptable only by making the strong assumptions that extra consumption by any family member contributes equally to family welfare, and that all household members face the same prices. Neither assumption is entirely plausible, but data constraints preclude a better resolution of the problem. We therefore get

$$\frac{U}{n}=k\beta_N\ln(c_L-\tau_L)+(1-k)\beta_L\ln(t-\tau_L)+\beta_P\ln(c_P-\tau_P)+\beta_N\ln(c_N-\tau_N), \tag{4}$$

where t refers to the maximum "controllable" hours per person, $k\equiv n_1/n$ is the proportion of the household which works, and the c_i must now be interpreted as average family consumption per capita.

The household faces a budget constraint which may be cast, in per capita terms, as

$$P_Pc_P + P_Nc_N = kP_L(t - c_L) + b, \tag{5}$$

where b gives per capita unearned income (from remittances and other transfers, and restricted farm profit). Note that $t - c_L = s$, which measures the supply of labor per capita. Maximizing (4) subject to (5), using the conventional normalization that $k\beta_L + \beta_P + \beta_N = 1$, setting $\tau^* \equiv t - \tau_L$, and making the appropriate substitutions gives the basic linear expenditure system:

$$P_Ls=P_L\tau^*-\beta_L(b-P_P\tau_P-P_N\tau_N+kP_L\tau^*), \tag{6a}$$

$$P_Pc_P=P_P\tau_P+\beta_P(b-P_P\tau_P-P_N\tau_N+kP_L\tau^*), \tag{6b}$$

$$P_Nc_N=P_N\tau_N+\beta_N(b-P_P\tau_P-P_N\tau_N+kP_L\tau^*). \tag{6c}$$

In estimating these equations, the τ_i are assumed to be affected by demographic factors, and are "translation parameters."[10] These include the size of the family labor force (n_1), the number of dependents ($n - n_1$), the age of the household head (a_1), the gender of the household head (a_2), and the average years of education of family workers (a_3).

3. *Allocation of work time*

Farmers have to determine how many hours to work off the farm. Since this decision is not the main focus of this study, we have modelled it in reduced form, so that the hours of work done off the farm by the household are assumed to be related to total time spent working, the acreage of padi and of non-padi farmed, average years of education, the off-farm/on-farm wage differential, gender, the average years of experience, and the size of the family labor force. In short, we estimate

$$\begin{aligned}\textit{Off-farm work} = f(&T - C_L, P_L^{\textit{off farm}}/P_L^{\textit{on farm}}, n_1, a_1, a_2,\\ &a_3, \textit{work experience}).\end{aligned} \tag{7}$$

[10] For a discussion, see [18] [16].

4. *Tracing the effect of price changes on consumption*

From the Linear Expenditure System, household expenditure on good i is given by

$$C_i = f_i(P_P, P_N, P_L, B; a), \tag{8}$$

where the P_i are the prices of padi, non-padi, and labor, a is a vector of demographic effects, and B gives autonomous income, defined as restricted farm profits (π) plus rent and transfers (R). A change in the price of, say, padi will affect C_i in two ways—directly via P_P and indirectly through its influence on farm profits and hence on autonomous income. Thus

$$\eta_{C_iP_j} = \varepsilon_{C_iP_j} + \varepsilon_{C_iB}\eta_{BP_j}, \tag{9}$$

where the ϵ_{ij} denote partial and the η_{ij} full elasticities. The ϵ_{ij} come from the expenditure system and the $\eta_{B,P}$ terms from the measures of the structure of production. The second term in equation (9), which takes the indirect effect of price changes into account, is where the farm-household model differs from the more conventional approach, in which production and consumption decisions are made separately.

5. *Tracing the effect of price changes on real income*

It is appropriate to define "welfare" as real full expenditure (E/P), where

$$\frac{E}{P} = \frac{B}{P} + T\frac{P_L}{P}, \tag{10}$$

where T is total "available" time and equals the supply of labor (S_L) plus the consumption of leisure (C_L).[11] Full expenditure is deflated by a price index (P), defined by

$$P = w_P P_P + w_N P_N + w_L P_L, \tag{11}$$

where the weights are given by P_iC_i/E, and sum to one. Differentiating (10) with respect to P_i, ($i = N,P$), gives

$$\eta_{E/P,P_i} = \frac{\delta E}{\delta P_i} \cdot \frac{P_i}{E} - \frac{\delta P}{\delta P_i} \cdot \frac{P_i}{P}.$$

For a given wage rate, $\delta E = \delta B = \delta\pi$, and from (11), $\delta P/\delta P_i = w_i$. Hence

$$\eta_{E/P,\,P_i} = \frac{\pi}{E}\eta_{\pi,\,P_i} - \frac{P_i w_i}{P} \tag{12a}$$

for $i = P,N$. In the case of labor we have $E = B + T \cdot P_L$, so $\delta E = \delta B + \delta T \cdot \delta P_L = \delta\pi + T \cdot \delta P_L$ and we get

$$\eta_{E/P,\,P_L} = \frac{\pi}{E}\eta_{\pi,\,P_L} + \frac{P_L T}{E} - \frac{P_L w_L}{P}. \tag{12b}$$

[11] A strong case for measuring welfare in this way is made by Grootaert [7].

Appropriate substitution from the input demand and output supply equations, using the figures from the fourth column of numbers in Table I, gives measurable elasticities for the range of prices facing farm households.

6. *General equilibrium elasticities*

The previous analysis is appropriate if prices change for a few households. This situation does not apply if major policy interventions, such as price supports for padi, influence all households at the same time. In this case it is no longer appropriate to consider all prices facing other farmers as fixed. In particular, wage rates will change; an increase in the price of padi will lead to an increased demand for hired farm labor, and unless such labor is in infinitely elastic supply, this will lead to an increase in farm wages.

To take these general equilibrium effects into consideration we assume that the supply of all inputs is infinitely elastic, except for land (fixed supply) and labor. Then quite generally

$$Y = f[X, P_L(X)], \tag{13}$$

where Y is the dependent variable we wish to examine (e.g., padi consumption, fertilizer demand, income) and X is a vector of explanatory variables. These variables may have a direct effect on Y, or an indirect influence through their effect on the wage rate (P_L). The effects combine to give the general equilibrium elasticities.

From (13) we get

$$E_{Y,X} = \eta_{Y,X} + \eta_{Y,P_L} E_{P_L,X}, \tag{14}$$

where the η_{ij} come from equations (9) and (12). To estimate $E_{P_L,X}$ we note that total labor demand (Q^d) may be satisfied by the supply of household labor (L_F) and hired labor (L_H), so

$$Q_L{}^d(P_L, X) = L_F{}^S(P_L, X) + L_H{}^S(P_L),$$

where X refers to influences other than the wage rate (P_L). Total differentiation gives

$$E_{P_L,X} = \frac{\eta^s_{L_F,X}\frac{L_F}{Q_L} - \eta^d_{Q_L,X}}{\eta^d_{Q_L,P_L} - \frac{L_F}{Q_L}\eta^s_{L_F,P_L} - \frac{L_H}{Q_L}\varepsilon^s_{L_H,P_L}} \tag{15}$$

and this equation gives the responsiveness of wage rates to a change in one of the exogenous X variables.

D. *Estimating the Farm-Household Model*

The results of estimating the production equations, (1) and (2), are shown in Table I. For estimation the sample was split in two. Larger farmers, producing at least 400 gallons of padi rice in a year, pay *zakat*, an Islamic tax which in

TABLE I

RESPONSE ELASTICITIES FOR FARM OUTPUT

	Elasticity of:				
	Field Preparation	Labor Demand	Fertilizer Demand	Profit[a]	Output Supply
With respect to					
Price of output					
—*zakat* paid	0.62	0.05	0.58	13.6	0.24
—no *zakat* paid	0.32	0.01	0.13	11.1	0.15
Price of field preparation					
—*zakat* paid	−0.58	−0.01	−0.02	−3.7	−0.17
—no *zakat* paid	−0.43	0.02	0.04	−3.4	−0.13
Wage rate					
—*zakat* paid	−0.02	−0.05	0.07	−8.9	−0.03
—no *zakat* paid	0.07	−0.03	0.03	−9.3	−0.01
Price of fertilizer					
—*zakat* paid	−0.004	0.01	−0.61	−0.93	−0.04
—no *zakat* paid	0.01	−0.002	−0.16	−0.64	−0.01
Land area cropped					
—*zakat* paid	0.42	0.61	0.82	1.9	0.71
—no *zakat* paid	0.20	0.62	0.35	6.2	1.1
Age of house hold head					
—*zakat* paid	0.28	−0.60	0.12		
—no *zakat* paid	0.23	0.12	0.06		
Number of plots operated					
—*zakat* paid	−0.19	0.27	−0.56		
—no *zakat* paid	0.05	0.42	−0.29		
% change if dummy variable changes					
Tractor used? (Yes=1)					
—*zakat* paid	67%	8%	−18%		
—no *zakat* paid	65%	−13%	12%		
Two-wheeled tractor?					
—*zakat* paid	−34%	−2%	−2%		
—no *zakat* paid	−36%	−2%	3%		
Is water needed?					
—*zakat* paid	10%	10%	−14%		
—no *zakat* paid	17%	2%	−5%		
Did disease hit?					
—*zakat* paid	25%	11%	1%		
—no *zakat* paid	−4%	0%	−2%		
Some land rented?					
—*zakat* paid	−14%	−4%	−4%		
—no *zakat* paid	18%	2%	2%		

Table I (Continued)

	Elasticity of:				
	Field Preparation	Labor Demand	Fertilizer Demand	Profit[a]	Output Supply
Over one acre of padi?					
—*zakat* paid	40%	2%	2%		
—no *zakat* paid	45%	1%	1%		
Some land doublecropped?					
—*zakat* paid	−13%	10%	10%		
—no *zakat* paid	−10%	13%	13%		

Notes: 1. Elasticities in columns 1, 2, and 3 computed from estimates of equations (1) and (2).
2. Sample size: households where *zakat* was paid—1,079 and households where no *zakat* was paid—1,722.

[a] Estimated restricted profit is negative for households which do not pay *zakat*, so elasticity shown here is shown in absolute value.

TABLE II

LINEAR EXPENDITURE SYSTEM: ELASTICITIES

	Elasticity of:		
	Padi Consumption	Non-padi Consumption	Labor Supply
With respect to			
Price of padi	0.39	−0.35	0.06
Price of non-padi	−0.80	−0.59	0.26
Price of labor	0.26	0.59	−0.11
"Full expenditure"	0.66	1.5	−0.34
Number of earners	0.12	0.46	0.47
Number of dependents	0.18	0.28	0.36
Age of household head	0.33	−0.12	−0.03
Gender of household head	[4]	[−204]	[−336]
Mean years education of earners	0.03	0.3	0.43
Autonomous expenditure	0.06	0.13	−0.03

Source: Based on data from [15].

Notes: 1. Elasticities are derived from the simultaneous estimation of equations (6a) through (6c), with restrictions on the τ_i to ensure uniqueness.
2. Numbers in brackets give absolute change only, in M$.

Malaysia is assessed at 10 per cent of total gross output, provided rice production exceeds 400 gallons. This effectively lowers the price such farmers face for padi, and if all farmers were in the same sample one would be in the odd position of observing larger output associated with lower output prices.

Output is fairly responsive to a price increase, with an own-price elasticity of supply of about 0.2. This is a minimum response, as acreage has been assumed to be fixed, and induced innovation is not included either. Labor demand responds

very little to a change in the wage rate; this is in line with the findings of Evenson and Binswanger [4] using Indian data, but is in contrast with the high labor demand elasticities characteristic of Cobb-Douglas estimations. An implication of this finding is that out-migration could have a substantial effect on rural wage rates. The demands for fertilizer and for field preparation are quite price sensitive. The results also show that as the acreage cropped per household rises, the land is farmed less intensively, as labor, fertilizer, and field preparation inputs rise proportionally less quickly. This phenomenon has been widely observed in India and elsewhere.[12]

Equations (6a)–(6c) were estimated simultaneously, with cross restrictions to ensure unique estimates for the τ_i. The relevant elasticities appear in Table II. Most of the elasticities are satisfactory. A higher price for non-padi lowers padi and non-padi consumption. The labor supply curve, *for those already working*, is almost vertical. Families with more earners, more education, or more dependents work and consume more. An increase in unearned income raises the consumption of goods and lowers labor supply slightly.

A comparison between marginal and average budget shares gives the following:

(%)

	Marginal Share of Full Income Going to	Average Share of Full Income Going to
Padi	10 $(=\beta_P)$	14
Non-padi	82 $(=\beta_N)$	53
Leisure	8 $(=k\beta_L)$	33

Thus if incomes were to rise, an increasing proportion would go to buy goods (including savings) at the expense of the proportion going to buy rice and to enjoy leisure. Put another way, households display a certain reluctance to work less even when incomes improve. Our marginal income share for padi (10 per cent) is larger than the value of 5 per cent found by Barnum and Squire [3] for their more affluent Malaysian sample from the Muda area, which is to be expected. Their study found similar values for β_N.

The one disturbing result is the positive own-price elasticity of demand for padi. Padi is not a Giffen good since the expenditure elasticity is positive. One possible explanation is that higher prices reflect better quality rice, which may be strongly preferred. A second possibility is that low padi prices reflect payments to middlemen with whom the farmer has contracted debt. Such households would also tend to consume less rice, even though their reported incomes appear to be fairly high. Fortunately this parameter is of minor importance when assessing the policy options, as will be evident in Section E below.

Equation (7), which relates the hours of family off-farm work to other variables, was estimated using OLS and yielded the results shown in Table III. We may interpret these results as indicating that the main source of work at the margin is off the farm; 94 per cent of extra work time was spent at off-farm jobs,

[12] For just one example, see [2].

TABLE III
CORRELATES OF OFF-FARM WORK

	Coefficient	*t*-statistic
Dependent variable:		
Hours of off-farm work by family members in one year		
Independent variables:		
Constant	−360	
Total hours of work	0.94	81*
Total hours of work, squared	−0.000015	47*
Acreage of padi farmed	−72	11*
Acreage of non-padi farmed	−152	19*
Average years of education of family workers	82	5.3*
Off-farm wage/on-farm wage	−15	2.6*
Average years of work experience of family workers	−4.6	0.63
Experience, squared	0.088	0.82
Gender of household head (Male=1)	8.6	0.34
Size of family labor force	−1.0	0.06

Source: Based on equation (7).
Notes: Sample size: 2,360. R^2=0.81.
* Significant at 5 per cent level.

compared to a mean for the sample of 72 per cent. For every extra acre of non-padi land, families spent 152 hours less working outside the farm. This figure was a markedly smaller 72 hours for rice land, which may reflect lower labor requirements, and also the effect of hiring in labor to help with padi cultivation. The one surprise is that a higher off-farm wage leads to less off-farm work, although the effect is trivially small, since a 10 per cent increase in the wage would reduce off-farm work by less than two hours per year.

It could be argued that since off-farm work is a component of total working hours, the above equation suffers from simultaneity bias. Our interpretation is different; the essence of the argument is that households, after looking at prices, first determine the amount of time they wish to work. This done, they decide how to divide their time between work on, and off, the farm.

Some of the most important full farm-household elasticities, derived using equation (9) and the estimates presented in Tables I and II, are shown in Table IV, along with values of the partial elasticities for comparison. The differences are revealing. For instance, if one were to look at the results of estimating the expenditure system one would conclude that a 10 per cent increase in the price of padi would lower the household's non-padi consumption (by 3.5 per cent), presumably because the higher price of padi reduces the real income of the household and obliges it to cut back on consumption of non-padi goods and services too. This conclusion is reversed once one takes the farm-household as a unit; now we see that a 10 per cent higher price for padi *increases* non-padi consumption by 3.4 per cent, because here the higher rice price raises household

TABLE IV

RESPONSE ELASTICITIES FOR EXPENDITURE SYSTEM AND FOR FARM-HOUSEHOLD MODEL

	Elasticity of:		
	Padi Consumption	Non-padi Consumption	Labor Supply
With respect to			
Price of padi			
—partial elasticity (from LES)	0.39	−0.35	0.06
—full elasticity	0.69	0.34	−0.09
Price of non-padi			
—partial elasticity (from LES)	−0.80	−0.59	0.26
—full elasticity	−0.80	−0.59	0.26
Price of labor			
—partial elasticity (from LES)	0.26	0.59	−0.11 [1.48]
—full elasticity	0.07	0.14	−0.01 [1.58]

Source: Based on data from [15].

Notes: 1. Numbers in brackets are from a linear logarithmic expenditure system applied to the same data, for comparative purposes.

2. The partial elasticities give the values of $\varepsilon_{C_iP_j}$ (from Table II), and the full elasticities give the values of $\eta_{C_iP_j}$, using equation (9). In applying equation (9) the values of $\varepsilon_{C_i,B}$ came from Table II (applied to autonomous income) and the values of η_{BP_j} from the profit elasticities in Table I (adjusted for the fact that only 39 per cent of autonomous income comes from profit, on average). All the figures refer to *zakat*-paying households only.

income through its effect on farm profits. A similar effect occurs to labor supply when the price of padi rises. The expenditure system shows a positive labor supply elasticity, as households work more in response to a price-induced fall in their real income; but in the farm-household context, the higher price of padi raises farm profits and hence household income, causing them to cut back their supply of labor. Barnum and Squire found a similar pattern in their study of the Muda area in the mid-1970s [3]. These differences in response elasticities provide the strongest justification for taking the trouble to develop and estimate a full farm-household model.

It is useful to trace the effects of these variables on real full expenditure for two representative households. The representative "padi-selling" household reflects households which produce a surplus of rice for sale while the typical "subsistence" household does not; profiles of the two household types are given in Appendix Table I. Both have approximately the same level of full expenditure, similar demographic characteristics and total working time. The response elasticities, given in Table V, reveal that a higher wage rate raises income, especially for the

TABLE V
ELASTICITIES OF REAL FULL EXPENDITURE FROM FULL FARM-HOUSEHOLD MODEL

	Full Expenditure Elasticities for	
	"Padi-Selling" Households	"Subsistence" Households
With respect to		
Wage rate	0.26	0.35
Price of padi	0.34	<0
Price of non-padi goods and services	−0.60	−0.45
Price of fertilizer	−0.03	−0.01
Price of field preparation	−0.12	−0.06

Source: Based on data from [15].
Note: Profiles of "Padi-selling" and "Subsistence" households appear in Appendix Table I.

"subsistence" households who already work more off the farm. A higher price of rice is of no value to most subsistence households since they do not sell rice. Fertilizer subsidies, even if substantial, have little effect on real income. In this partial equilibrium context, it is clear that changes in the prices of rice or inputs will have minimal effects on the real income of farmers living in the marginal rice-growing areas.

The most important general-equilibrium elasticities, which are derived from equation (15), are shown in Table VI. In order to calculate these it was necessary to choose a value for ε_{L_H,P_L}, the elasticity of supply of hired labor. In their study of the Muda area in the mid-1970s, Goldman and Squire [6] found that following the introduction of double-cropping, wages there rose substantially; they estimated that the increase in wages was consistent with an elasticity of labor supply to the area of 1. Since our survey data also comes from Peninsular Malaysia, it is plausible to use the same value.[13]

E. *Measuring the Effects of Policy Changes on Rice Farmers*

In this section we review the main policy options open to the Government of Malaysia, if it wanted to raise the real incomes of farmers in the poor rice-growing districts in the late 1970s and early 1980s. The discussion draws heavily on the empirical results presented in Table VI.

1. *Raise the price of padi*

Since independence, Malaysia has typically kept the domestic producer price of padi slightly above the world parity level.[14] By contrast, producer prices are far higher than world levels in Japan and the Republic of Korea, and somewhat

[13] This is the value which Goldman and Squire believe is the most plausible, see [6].
[14] This is documented and discussed in [5].

TABLE
FULL SYSTEM

	Elasticity of				
	Elp	*Pl*	*Cp*	*Cn*	*Sl*
With respect to					
Price of padi					
[1]	1.0	0.47	0.72	0.41	−0.10
[2]	1.0	0.09	0.56	0.04	−0.02
Price of non-padi					
[1]	1.0	−0.73	−0.85	−0.69	0.27
[2]	1.0	−0.73	−0.89	−0.79	0.29
Price of fertilizer					
[1]	1.0	−0.001	−0.02	−0.05	0.01
[2]	1.0	−0.03	−0.01	−0.03	0.01
Acreage farmed					
[1]	1.0	2.60	0.21	0.47	−0.05
[2]	1.0	2.70	0.35	0.83	−0.13
Family labor force					
[1]	1.0	−1.40	0.03	0.26	0.49
[2]	1.0	−1.30	−0.04	0.10	0.52
Number of dependents					
[1]	1.0	−1.10	0.11	0.13	0.37
[2]	1.0	−1.00	0.06	0.00	0.40
Age of household head					
[1]	1.0	−0.18	0.31	−0.18	−0.02
[2]	1.0	0.65	0.40	0.04	−0.06
Average education of workers					
[1]	1.0	−1.30	−0.06	0.12	0.45
[2]	1.0	−1.20	−0.11	−0.04	0.48
Autonomous income					
[1]	1.0	0.07	0.06	0.13	−0.03
[2]	1.0	0.04	0.04	0.10	−0.02
Memo: Price of labor					
[1]			0.07	0.14	−0.01
[2]			0.12	0.28	−0.04

Notes: 1. [1] denotes padi-selling households and [2] denotes "subsistence" house-
2. The elasticities given here are derived from equation (15); estimation proce-
3. The symbols at the head of each column denote the following: *Elp* is and non-padi respectively; *Sl* is supply of household labor; *Ofpr*, *Ql*, and quantity of padi supplied; *Mp* is marketed supply of padi; *E* is full expendi-

higher in Taiwan. In Southeast Asia there is a clear pattern of higher producer prices for padi than in the wealthier countries.[15] If Malaysia were to follow a similar high-price path, what effect would this have on rural incomes, output, and welfare?

[15] For an interesting discussion of this, see [26].

VI

RESPONSE ELASTICITIES

Qfpr	*Ql*	*Qfe*	*Qp*	*Mp*	*E*	*E/P*	*Y*
0.61	0.03	0.61	0.22	0.03	0.64	0.36	0.64
0.33	0.01	0.13	0.15	0.00	0.34	0.05	0.41
0.01	0.04	−0.05	0.02	0.37	−0.29	−0.64	0.06
−0.05	0.02	0.02	0.01	0.00	−0.53	−0.76	−0.15
−0.004	0.007	−0.61	−0.04	−0.05	−0.03	−0.03	−0.04
0.01	−0.001	−0.16	−0.01	0.00	−0.03	−0.03	−0.03
0.37	0.48	1.00	0.62	0.80	1.10	0.40	0.40
0.39	0.53	0.43	0.75	0.00	2.00	1.30	1.50
0.03	0.07	−0.10	0.05	0.05	0.03	0.41	0.22
−0.09	0.04	−0.04	0.01	0.00	−0.32	−0.01	−0.27
0.02	0.05	−0.08	0.04	0.01	−0.44	−0.14	0.13
−0.07	0.03	−0.03	0.01	0.00	−0.73	−0.49	−0.21
0.28	−0.05	0.11	0.01	0.003	−0.09	−0.04	−0.07
0.28	0.10	0.08	−0.01	0.00	0.46	0.31	0.31
0.03	0.06	−0.09	0.04	0.08	−0.52	−0.17	0.08
−0.08	0.04	−0.04	0.01	0.00	−0.88	−0.59	−0.26
−0.001	−0.003	0.01	−0.002	−0.03	0.10	0.08	0.11
0.003	−0.001	0.001	0.00	0.00	0.09	0.08	0.11
−0.02	−0.05	0.07	−0.03	−0.07	0.40	0.13	0.12
0.07	−0.03	0.03	−0.01	0.00	0.73	0.49	0.54

hold; see Appendix Table I for profiles of these groups.
dures are given in the text.
elasticity of supply of hired labor; *Pl* is price of labor; *Cp* and *Cn* are consumption of padi *Qfe* are quantities of field preparation, labor, and fertilizers demanded for the farm; *Qp* is ture and *E/P* is real full expenditure; and *Y* is household income.

The obvious answer is that the incomes of households who produce rice for the market would rise, and would fall for those who are net purchasers, a majority among our sample. This conclusion is not significantly altered by the output and substitution effects of the larger model, working through higher wage rates.

Taking the sub-sample of producers with a marketable surplus of padi, who constitute a fifth of our sample, a 30 per cent increase in the price of padi would

boost nominal income by almost 20 per cent and real full expenditure by over 10 per cent.[16] A tenth of this extra income would come indirectly, via increased wage earnings; part would come as increased leisure, and part as higher consumption of padi and other goods and services. Farm production would be intensified, mainly through the use of more fertilizer, and the demand for hired labor would rise significantly, pushing up rural wage rates. The marketed surplus of these farms would rise by just 1 per cent, a figure which is in line with the low response elasticities found by Barnum and Squire [3] for the Muda area, but probably an understatement given our peculiar demand elasticity for padi.

For a "subsistence" farm household, covering its own needs but with no marketable surplus of rice, real full expenditure would remain essentially unchanged, as padi price increases balance higher (implicit) farm profits, although households would also respond by intensifying production. The main benefit would be as a result of the higher rural wage rate, which would raise real income by just over 1 per cent. For households which buy rice, the higher wage may not always offset the reduction in real expenditure due to higher padi prices.

2. *Replace the zakat*

The *zakat* is levied as a 10 per cent tax on gross padi output, provided this output exceeds 400 gallons per household per annum. It has the effect of reducing the nominal farmgate price by 10 per cent for larger rice producers, and its removal would constitute a price increase for larger padi cultivators, without any equivalent change in the price paid by consumers. Since family income per capita is essentially unrelated to the area of padi cultivated, the distributional effects of removing the *zakat* are unclear within our sample. As padi farmers in Malaysia are significantly less well-off than the average household, the removal of the *zakat* would appear to have an equalizing effect on income distribution nationally.

With the removal of the *zakat,* real income would rise by about 5 per cent for net padi sellers and somewhat less for "subsistence" farmers, who only gain indirectly through higher wage rates. Output would rise 2.5 per cent, and market surplus would expand. This conclusion is incomplete, since it does not consider what alternative might replace the *zakat,* nor how the *zakat* revenues are currently being spent.

3. *Subsidize fertilizers*

Malaysia in the late 1970s already subsidized fertilizers used by rice farmers, largely to help boost rice output but also as an income-enhancing measure. What effect would a further 10 per cent reduction in fertilizer prices have on farm households?

First, farm output would rise, by just 0.4 per cent on commercial padi farms and by less than 0.1 per cent on "subsistence" farms. In the case of the former, the small response is because labor input would be reduced as fertilizer is substituted instead; fertilizer use would actually rise 6 per cent. For "subsistence"

[16] This can be calculated from Table V; $30\% \times 0.64 = 19.2\%$, $30\% \times 0.36 = 10.8\%$.

farms, fertilizer use would rise just 1.5 per cent. In part this may be because many such farmers use traditional varieties of rice, which are usually relatively unresponsive to increased doses of fertilizer. A shift to fertilizer-intensive varieties might occur in some cases, but typically would require more complementary inputs such as water, which are not necessarily available.

As a method of generating a marketable surplus, fertilizer subsidies are more effective than increasing the price of output. A 10 per cent decrease in fertilizer prices will increase the volume of padi brought to the market by commercial padi growers by more than a 10 per cent increase in the price of padi. This is because the higher padi price raises incomes more than the lower fertilizer price. The opposite conclusion would have been reached by looking at production-side data alone.

The 10 per cent reduction in the price of fertilizer would raise real expenditure by about 0.3 per cent overall. There is thus little scope for raising income by subsidizing fertilizer prices. This is not surprising, since *zakat*-paying growers bought on average less than M$100 worth of fertilizer annually, and this represents an upper limit to the amount of possible gain from subsidizing fertilizer.

4. *Irrigation and land clearance*

Irrigation schemes, which would allow farmers to double-crop rice, would have approximately the same effect as land clearance in that they would stretch the available cultivable area. An extra acre of padi land would raise annual income for padi-selling farmers by about M$45 p.a., representing nearly 2 per cent of income.[17] "Subsistence" farmers would get an extra M$90 per year. Thus at a

[17] This calculation is as follows. Extra land generates more net profit. From Table I we have:

	Padi-Selling Households	"Subsistence" Households
One more acre of land represents an increase of	20.8%	33.3%
So, in M$:		
additional value of output	145	203
extra field preparation costs	6	8
extra labor hired	18	8
cost of extra household labor	52	54
extra fertilizer costs	14	12
Therefore		
Additional net profit	54	122

But this in turn causes the family to supply less labor. The extra profit represents a 13.9% increase in autonomous income (measured at the midpoint, and using the numbers in Appendix Table I for autonomous income). Using the elasticity of labor supply with respect to a change in autonomous expenditure reported in Table II, which is −0.03, we have that padi-selling households will reduce their labor supply by 0.42 per cent or by 8.8 hours per year (based on 2,100 hours of work per year, see Appendix Table I). Since each hour is valued at M$1.08, this represents a loss of income of M$9.47, so on balance family income rises by M$44.55, which we have rounded to M$45. A similar calculation

5 per cent real interest rate, it would not be economically worthwhile to spend more than M$900 to M$1,800 to irrigate or clear an extra acre of land for padi, which is well below the cost of most such small-scale projects.[18] Perhaps that is why the World Bank, which requested the survey of rice-growing households, did not ultimately launch a program of small-scale irrigation projects as it had originally intended.

If *every* household had an extra hectare of padi land, then the general equilibrium effects of Table VI would come into play, and the income of padi-selling households would rise by 8 per cent.[19] Three quarters of this increase would be because the additional land would increase the total demand for labor and so pull up the wage rate. However this is not a realistic scenario, since Malaysia could not create additional padi land, even through the mechanism of double-cropping, on such a large scale, as most of the land which is currently suited for growing rice is currently being used for that purpose. Between 1985 and 1990 the total area of padi cultivated in Malaysia rose by a total of just 2.3 per cent, or far short of the roughly 20 per cent increase which would be needed to endow every rice-growing family with an extra hectare of padi land. Indeed under the pressure of rising wages, farmers in some areas are giving up double-cropping, and are farming less intensively, which is why padi output fell by 19 per cent between 1985 and 1990. This process has been going on for some time; some farmers began to abandon land or at least cease to double-crop padi as long ago as the early 1970s near Melaka.[20]

5. *Migration*

When dependents migrate, real full expenditure does not change (by construction), but income per remaining family member rises. Those that remain do less hours of work, so wage rates rise slightly. Income per capita rises, although aggregate rural real income falls, since less remunerative work is being done.

The marginal family earner does not earn enough to cover his or her expenses, so if he or she leaves, spending per remaining family member rises. Rural wage rates will rise, eroding farm profits but boosting wage income. Interestingly, with 1 per cent fewer family earners, the total hours of work done would fall by just 0.5 per cent. This is hard to interpret. If it is because the marginal rural worker

for "subsistence" households shows that annual labor supply falls by 31.1 hours, worth M$33.6. Thus family income rises, on balance, by M$88.4, which we have rounded to M$90. For this calculation to be valid, we have to assume that households are not constrained in the amount of work which they do, so that the only real benefit from more land is the additional net profit it yields; thus no value is put on the greater access to employment which additional land brings with it. Given the flexible and widespread rural labor market in Peninsular Malaysia, this is plausible as a working assumption.

[18] The Government of Malaysia plans to spend about M$2,200 per hectare during the Sixth Malaysia Plan (1991–95) simply to rehabilitate the irrigation and drainage systems on about a third of the area of the "rice-bowl" districts. See [14].

[19] Land area rises 20.8 per cent and the elasticity of income with respect to area cultivated is 0.4 (from Table VI).

[20] This is according to [10].

is *unable* to work more, then this would seem to imply that the shadow price of rural labor which moves to the city is just half of the rural average wage rate. If the low hours reflect an *unwillingness* to work more, then the shadow wage is the full rural wage rate.

6. *Education*

It is sometimes argued that additional years of primary education yield a high rate of return, even for those who remain in farming. A stratightforward regression of (the log of) income against variables such as farm acreage, the log of age, and the log of education, shows that an extra year of education raises annual income significantly, by about M$60 for padi-selling households and by just over M$100 for "subsistence" farm households.[21] The interesting finding is that only about an eighth of this is attributable to higher wage rates; the rest is because *better-educated people work longer hours.* This is evident from Table II, which shows that if the years one spends in education rise 10 per cent, then the amount of labor supplied rises by 4.3 per cent.

It is not clear why those with more education put in more hours of work. One possibility is that the types of jobs filled by those who are more educated are full-time and indivisible, such as teaching, police, nursing, and so on. In this case the price of getting such a job may be that one has to work too much, in which case the welfare improvement could be minimal. A second possibility is that education brings about a change in attitudes which favors hard work. If true, it is impossible to compare the welfare of individuals before and after education. Alternatively, education may bring a greater appreciation of material comforts, which in turn spurs more work.

The third possible explanation is that those who work harder are also the ones who have completed the most education. In this case the provision of more education would not *lead* to more work, and would only raise incomes through its influence on wage rates; this effect, as we have seen, is small. Finally, there may be a limited number of job openings in rural Malaysia. Those with more education may be favored for such jobs as are available, and are hence almost the only people who are working as much as they really want. In this case education may be wasteful, unless it really is the cheapest device for screening one job applicant from another.

The finding that those with more education spend more hours working lies behind some of the apparently peculiar full system response elasticities in Table VI, where greater education is associated with a lower wage rate. The logic is that if everyone had extra education, the total supply of labor would rise and the wage rate would be pushed down. Through this wage effect, more education could actually leave one worse off. The possibility is intriguing, but probably of limited practical importance, since there would be no incentive to acquire additional education under such circumstances, and this would automatically help limit the demand for education (and thus the supply of hours worked).

[21] See [9], for details.

On the other hand all these considerations suggest caution in concluding that education is effective in enhancing the welfare of those *who remain* in the rural areas. It may however be of great benefit to those who migrate to the towns and cities.

7. *Transfers*

One of the main mechanisms for equalizing incomes in more affluent countries is the tax-transfer system, where slightly progressive taxes are coupled with progressive transfer payments. Snodgrass has argued that the fiscal system in West Malaysia was an effective income redistributor in the 1960s [23]. What would happen if transfer payments were made to padi-growing households, for instance as part of a negative income tax system?

Income and real expenditure would both rise. Households would respond by working slightly less and consuming a little more. This in turn would raise the demand for hired farm labor, and push up wages. Thus wage earners would benefit at the expense of land owners. Less output would be marketed. In principle, the provision of more public goods would have a similar effect, although our model has not been designed to reflect the reactions to such changes.

8. *A policy package*

The government, if it wants to raise rural incomes, is more likely to promote a number of actions simultaneously. A package of measures, not very different from what was actually implemented during the mid-1980s, might look like this:

—*A 10 per cent real increase in the producer price of padi, using import restrictions.* Since the late 1960s Malaysia has restricted imports of rice; it does this by setting a price for domestic rice above the world price, and requiring importers to also buy a certain amount of domestic rice for every ton they import. If Malaysia follows the path of Japan, Korea, or Taiwan, then as incomes rise, the divergence between the (high) domestic price of rice and the (lower) price of imports will continue to increase. Restrictions of this nature would not have any direct budgetary implication for the government.

—*A further 20 per cent reduction in the price of fertilizer.* This would cost an additional M$23 million annually for the budget, but even this is somewhat less than the average subsidy of M$66 million paid annually during 1985–90.[22]

—*The introduction of double-cropping for another 5 per cent of households.* If this could be done for the current rehabilitation cost of M$2,200 per hectare, which is optimistic, then the total budgetary cost would come to about M$72 million annually.[23] Between 1985 and 1990 Malaysia spent M$128 million annually on restoring and extending irrigation and drainage, yet the area devoted to rice cultivation rose by just 2.3 per cent. Thus a 5 per cent expansion of the area cultivated to rice would represent a major change.

[22] The cost is estimated at U.S.$135 per ton of urea times M$2.6/U.S.$ times 500 kg of urea per hectare times 650,000 hectares (the acreage of padi land in 1985) times 20% price redutcion.

[23] Calculated as 5% times 650,000 hectares times M$2,200 per hectare.

—*An extra year's schooling for all young people,* which would mean an extra year of school for about 5 per cent of family members. This would call for about 4,000 extra teachers, and cost approximately M$50 million annually.[24] Schooling, at least at the primary level, is now almost universal in Malaysia. The gross primary enrollment rate rose from 90 per cent in 1980 to 93 per cent in 1990 and class size fell from 25 to 20. Secondary enrollment rose from 45 per cent to 56 per cent.[25]

—*Expanded pensions for the old and infirm,* amounting to an extra M$100 per annum for 10 per cent of all households. This would cost about M$36 million annually.[26] In the Sixth Malaysia Plan, which runs from 1990 to 1995, the country plans to spend about M$100 million annually on targeted support for the "hard-core poor," who represent about 5 per cent of the total population. However until recently the country did not feel it had enough resources to provide more significant support for this group.

The combined effect would be to raise average household full expenditure by about 13 per cent over five years, or by almost 1.5 per cent p.a. This effect is appreciable, although not enormous, and is somewhat greater than the effect of the removal of the *zakat* or a 20 per cent increase in real wage rates. A certain amount of experimentation was done to test the sensitivity of these results, but other realistic packages of measures would have a broadly comparable overall effect. By way of comparison, real earnings per employee rose by 2.6 per cent per year in real terms between 1980 and 1990, for a total of 29 per cent during the period.

F. *Conclusions*

In the 1960s and 1970s, the rural poor in Malaysia were greatly aided by the extension of government services to their areas, and there is evidence that their incomes rose.[27] By the late 1970s primary education and basic health care were universal, rural electrification was spreading rapidly, and the provision of piped water and paved roads was fairly common. The government also made substantial investments in land clearance and irrigation, and subsidized fertilizer and agricultural extension.

However there are very real limits to what the government can do to directly raise the incomes of households in the marginal rice-growing areas. A higher price of rice would not help, since most of the households surveyed are net purchasers of rice. Fertilizer subsidies have a small influence on income, although they may be effective in boosting the marketed surplus of rice. The provision of more land, including irrigation schemes which would permit double-cropping, would have a limited effect on income, since access to land does not appear to

[24] 4,000 teachers with associated materials, each costing 2.5 times per capita GDP of M$5,000.

[25] Interpolated from [27].

[26] There were 3.6 million households in Malaysia in 1990.

[27] The case for this is made in [9].

constrain income very much. The removal of the *zakat* would increase incomes appreciably, as could pensions and disability allowances.

Among the more interesting byproducts of this study are the findings that rice output is not very responsive to prices, with a supply elasticity of about 0.2; the wage elasticity of labor demand by small farmers is low, implying that out-migration could cause a large rise in wage rates; and the income elasticity of labor supply was found to be negative (but small), confirming the common finding that leisure is a normal good.

Ultimately the only guarantee of rapidly rising incomes for poor farmers is continued growth elsewhere in the Malaysian economy. This increases the opportunities for work off the farm and, more importantly, raises the wage rate which such work pays. There is also more rapid out-migration, which will eventually permit farm size to increase, although Malaysia has only reached the stage of a declining rural population in the mid-1990s. Rapid economic growth has the further advantage that it provides more tax revenue out of which to finance transfers and public goods. The evidence from our sample indicates that even those who do not leave the rural areas share in this economic growth.

G. *Postscript*

The data on which the analysis in this paper is based were collected during 1976–80, and much of the analysis was completed by 1985. Since then there have been enormous economic changes in Malaysia, and they confirm the basic message: a buoyant economy is the best guarantee of a rising living standard for poor rural households, but government still has a significant role to play in ensuring that they are able to take advantage of the general economic growth.

Between 1980 and 1991 real GDP rose by 5.7 per cent annually, fired mainly by export-oriented manufacturing. Real wages rose by almost a third during this period, and the relative position of poor households improved. In Peninsular Malaysia, while the share of the poorest 40 per cent of households (ranked by per capita income) was 12.8 per cent of income in 1985, this had risen to 14.5 per cent by 1990. The proportion of households falling below the government's official absolute poverty line fell from 18 per cent to 15 per cent, and the number of households in poverty fell from 483,000 to 449,000. The official explanation is that this was the result of "past efforts in raising educational attainment... better income and employment opportunities... [which] enabled rural workers particularly to have greater access to the job market.... The increase in the rate of job creation in the modern sectors...provided alternative income and employment opportunities" [14, p. 10]. On the other hand the government spent 1.6 per cent of GDP on agricultural and rural development during the same period, and this undoubtedly played a useful role in maintaining incomes, along the lines of the policy package discussed in Section E above. Since 1990 the government has changed its focus, reducing the proportion of GDP devoted to agricultural and rural development per se (to 1.1 per cent of GDP), but increasing the allocations targeted narrowly towards improving the position of the poorest households.

REFERENCES

1. ANAND, S. *Inequality and Poverty in Malaysia: Measurement and Decomposition* (New York: Oxford University Press, 1983).
2. BARDHAN, P. K. "Size, Productivity and Returns to Scale: An Analysis of Farm-Level Data in Indian Agriculture," *Journal of Political Economy*, Vol. 81, No. 6 (November/December 1973).
3. BARNUM, H., and SQUIRE, L. *A Model of an Agricultural Household: Theory and Evidence* (Baltimore, Md.: Johns Hopkins University Press, 1979).
4. EVENSON, R. E., and BINSWANGER, H. P. "Estimating Labor Demand Functions for Indian Agriculture," Center Discussion Paper No. 356 (New Haven, Conn.: Economic Growth Center, Yale University, 1980).
5. GOLDMAN, R. H. "Staple Food Self-Sufficiency and the Distributive Impact of Malaysian Rice Policy," *Food Research Institute Studies*, Vol. 14, No. 3 (1975).
6. GOLDMAN, R. H., and SQUIRE, L. "Technical Change, Labor Use, and Income Distribution in the Muda Irrigation Project," *Economic Development and Cultural Change*, Vol. 30, No. 4 (July 1982).
7. GROOTAERT, C. "The Conceptual Basis of Measures of Household Welfare and Their Implied Survey Data Requirements," *Review of Income and Wealth*, Vol. 29, No. 1 March 1983).
8. HAUGHTON, J. "Farm Price Responsiveness and the Choice of Functional Form: An Application to Rice Cultivation in West Malaysia," *Journal of Development Economics*, Vol. 24, No. 2 (December 1986).
9. ————. "The Determinants of Rural Incomes in West Malaysia," *Kajian Ekonomi Malaysia*, Vol. 24, No. 1 (June 1987)
10. HUANG, Y. "Some Reflections on Padi Double-Cropping in West Malaysia," *Malayan Economic Review*, Vol. 17, No. 1 (April 1972).
11. HUFFMAN, W. E. "Farm and Off-Farm Work Decisions: The Role of Human Capital," *Review of Economics and Statistics*, Vol. 62, No. 1 (February 1980).
12. LAU, L.; LIN, W.-L.; and YOTOPOULOS, P. A. "The Linear Logarithmic Expenditure System: An Application to Consumption-Leisure Choice," *Econometrica*, Vol. 46, No. 4 (July 1978).
13. Malaysia. *Mid-Term Review of the Third Malaysia Plan, 1976–1980* (Kuala Lumpur, 1979).
14. ————. *Sixth Malaysia Plan, 1991–1995* (Kuala Lumpur, 1991).
15. Malaysia, Ministry of Agriculture. *Single-crop Padi Cultivation Survey, 1976–80* (Kuala Lumpur, 1980).
16. MUELLBAUER, J. "Testing the Barten Model of Household Composition Effects and the Cost of Children," *Economic Journal*, Vol. 87 (September 1977).
17. POLLAK, R. A., and WALES, T. J. "Estimation of Complete Demand Systems for Household Budget Data: The Linear and Quadratic Expenditure Systems," *American Economic Review*, Vol. 68, No. 3 (June 1978).
18. ————. "Comparison of the Quadratic Expenditure System and Translog Demand Systems with Alternative Specifications of Demographic Effects," Vol. 48, No. 3 (April 1980).
19. ————. *Demand System Specification and Estimation* (New York: Oxford University Press, 1992).
20. SELVADURAI, S. *Padi Farming in West Malaysia* (Kuala Lumpur: Ministry of Agriculture and Fisheries, 1972).
21. SINGH, I., and SQUIRE, L. *A Model of the Agricultural Household: Some Implications for Nutrition Policies in Rural Areas* (Washington, D.C.: World Bank, 1980).
22. SINGH, I.; SQUIRE, L.; and STRAUSS, J., eds. *Agricultural Household Models: Extensions, Applications and Policy* (Baltimore, Md.: Johns Hopkins University Press, 1986).

23. SNODGRASS, D. R. "Trends and Patterns in Malaysian Income Distribution, 1957–1970," Development Discussion Paper No. 2 (Cambridge, Mass.: Harvard Institute for International Development, 1974).
24. STONE, J. R. N. "Linear Expenditure Systems and Demand Analysis: An Application to the Pattern of British Demand," *Economic Journal,* Vol. 64 (September 1954).
25. STRAUSS, J. "Determinants of Food Consumption in Rural Sierra Leone: Application of the Quadratic Expenditure System to the Consumption-Leisure Component of a Household-Firm Model," Discussion Paper No. 118 (Charlottesville, Va.: Jefferson Center for Political Economy, University of Virginia, 1981).
26. TIMMER, C. P., and FALCON, W. P. "The Political Economy of Rice Production and Trade in Asia," in *Agriculture in Development Theory,* ed. L. G. Reynolds (New Haven, Conn.: Yale University Press, 1975).
27. World Bank. *World Development Report, 1993* (Washington, D.C.: World Bank, 1993).

APPENDIX TABLE I

COMPOSITE PROFILE FOR TWO "REPRESENTATIVE" HOUSEHOLDS

	Padi-Selling	Subsistence
Income (M$)	2,200	2,010
of which: farm profits	96	−76
other unearned income	265	262
Family size	5.1	5.1
of which: family earners	3.0	3.0
Age of family head (years)	49	48
Acres of farm operated	4.8	3.0
of which: padi farm	2.9	1.6
Wage rate, off-farm work (M$/hour)	1.08	1.07
Labor hours worked annually:		
Padi	570	370
Other farm work	630	490
Off-farm	900	1,240
Padi output (gallons p.a.)	920	780
of which: consumed by household	441	780
Price of padi (M$/gallon)	1.07	1.10
Fertilizer: total cost (M$/year)	82	43
usage (lb./year)	310	160
Tools and pesticides (M$/year)	19	12
Hired labor: total cost (M$/year)	144	39
usage (hours p.a.)	220	60
Field preparation:		
Total cost (M$/year)	72	56
Usage (tractor hours/year)	4.0	3.6

Source: Based on rice-selling and non-rice-selling subsamples of [15].