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THE LABOUR RESPONSE OF QUASI-SUBSISTENT VILLAGE CRAFTSMEN IN RURAL PAPUA NEW GUINEA*

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In this study of labour-leisure choice, a labour supply equation is derived from a Stone-Geary utility function and extended to incorporate several 'non-economic' variables. Such variables are made functions of the 'minimum subsistence' quantities which characterise the standard Stone-Geary model. The model is then estimated on cross-sectional data obtained from a field survey of quasi-subsistent piece rate producer-consumers living and working in a number of New Guinean villages. Approximately two-thirds of the observed variation in the weekly work commitment of the sampled workers was explained by the model. The response of cash work commitment to variation in earning rates was found, on average, to be highly inelastic and slightly negative in direction. The econometric approach adopted herein is offered as an alternative to the less formal analyses of Melanesian labour response hitherto undertaken by economic anthropologists.

Introduction

So that New Guineans may reap the basic productivity gains that accrue from the division of labour and the specialisation of productive activity, economic planning in that country calls for the eventual transition from traditional, non-monetary and self-subsistent forms of economic activity towards a full and complete participation in the monetary exchange economy. Many attempts to facilitate and hasten this transition have met with puzzlingly slow responses. It is contended that, after an initial bout of enthusiasm, participation in cash cropping, wage labour and other entrepreneurial pursuits tends to wane and the transition to a total reliance on monetary production and consumption remains incomplete. The supply of labour to such cash earning activity is thus only partial and somewhat less than the 'potential' that the Western-trained economic planners feel is warranted by the 'opportunities' provided.

During the last 17 years, a number of models pertaining to the economic response of transitional peasant households have appeared in the literature. Fisk (1962, 1964, 1975) initiated much of the inquiry with a series of models developed to explain the principles of self-subsistent non-monetary production of the type found in Papua New Guinea. Later, Stent and Webb (1975) took Fisk's concept of 'subsistence affluence' and developed the implication for production-consumption behaviour when a point of demand satiation (or 'bliss' point) is introduced into the familiar indifference curve models of constrained equilibrium. These models have international relatives and

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the more general problem of the subjective equilibrium of peasant-type farm households has been taken up by Mellor (1963) and Nakajima (1969) amongst others.

Such models usually combine aspects of both demand and production theory. A two-dimensional choice is made between monetary income (or goods and services) on one hand and 'leisure' (or its complement, labour-effort) on the other. The subjective equilibrium of the household is reached at the familiar point of tangency between the product of labour function and an indifference curve. When income is derived from wage labour rather than the sale of farm produce, the product of labour function becomes a linear budget line and the analysis simply becomes one of consumer demand.

Despite the adherence of each of these models to the notion of utility maximisation and the resemblance to the more conventional expressions of demand and utility theory, they contain some shortcomings. Demand (or supply) equations which are consistent with the behaviour implied in their graphically represented indifference sets have not been presented. Therefore, it is not possible to apply the models to a particular data set, assess their theoretical validity and attempt a computation of the fundamental elasticities that correspond to the 'labour responses' they supposedly engender. In fact, analytical models pertaining to the labour response of subsistence and transitional households and empirical investigations of labour response in Melanesian economies appear to have been formulated independently of the advances which have taken place in applied consumption analysis over the last 25 years or so (see Brown and Deaton 1972 and, more recently, Howe 1977). Although 'the response of labour to monetary incentive' implies an elasticity of monetary work effort with respect to earning rates, there do not appear to have been any studies based on Melanesian data that have sought to estimate such an elasticity.

Elsewhere, demand functions for various subcategories of goods and services, including leisure, have for long been expressed in equational form, permitting the estimation of the parameters by appropriate econometric techniques. The earlier pragmatic single equation specifications have gradually given way to specifications which meet stringent theoretical restrictions and more recently it has become the vogue to specify a particular utility function at the outset and then derive a set of estimating equations from it by constrained maximisation. The empirical demand equations so obtained are known to be theoretically plausible as all the general restrictions of theory are automatically satisfied when this procedure is adopted. Furthermore, recent developments in applied consumption analysis have shown how various 'socio-demographic' or 'non-economic' variables may be incorporated in such models without detracting from their theoretical consistency. Some of these advancements appear particularly suited to the modelling of primitive societies where there may be any number of behavioural peculiarities and unfamiliar institutional factors to contend with. It has also been shown that the choice of utility function and hence the specification of the estimating equations is of considerable importance, since the values of the estimated coefficients and elasticities derived therefrom are sensitive to the model specification adopted (see Manser 1976).

The collection of household data in primitive and transitional economies of the type found in Papua New Guinea poses a number of difficulties not faced in familiar Western situations. Because of the general illiteracy, reliable income, expenditure and work activity data can be obtained only by regular repeat surveying over some defined period, thus limiting the size of the sample that one researcher can study. It is not surprising therefore, that large and consistent national data sets are simply unavailable.

Another basic inadequacy of most of the work activity data used to date has been that, because of institutional work arrangements, the individual worker has had very little, if any, freedom in his work-leisure choice. Furthermore, the cash income earned from employment is not always, in the short-run period of a sample study, closely related to the amount of work effort committed. Such data may indeed be quite spurious in estimating models which are claimed to relate to the labour-leisure choice of individual worker-consumers. Wales (1973), for one, has attempted to overcome some of these difficulties by sampling only self-employed businessmen for whom, presumably, the work-leisure choice is less restricted by institutional rules.

The present paper reports an attempt to analyse the labour response of a rather small cross-section of New Guinean workers who were all engaged in a common productive pursuit, and to calculate the appropriate elasticities of work effort with respect to cash earning rates. The analysis is designed to be consistent with modern consumption theory while at the same time incorporating some socio-economic and institutional variables that may assist the explanation of choice behaviour in the non-Western economic setting of rural Melanesia. The aim is to move towards a bridging of the gap that appears to exist between the theoretical and empirical analyses of Melanesian labour response undertaken to date and the more recent developments in applied consumption analysis. Furthermore, the workforce sample was selected to avoid, where possible, the basic discrepancies between the theoretical and observed variables of the type noted above.

The Sample and the Data

Data were collected from a sample of 57 handloom wool weavers and their families. The weavers were distributed over 13 separate weaving cells (workshops) and 20 separate settlements throughout the eastern central highlands of New Guinea and the surrounds of Port Moresby. Most weavers retained a considerable degree of contact with their traditional agrarian economy and, for many, weaving represented an initial contact with the monetary exchange economy. This particular workforce group was selected because various characteristics pertaining to the organisation and operation of the weaving industry in PNG allowed some experimental control to be exerted over the study. Major variables could be measured quite accurately, thus making it possible to retain a high degree of consistency between the observed and the theoretical variables of the model. Furthermore, as these New Guineans only paid a fixed head tax rather than a progressive income tax, the usual endogenous effect on the net wage rate was not present to complicate the analysis.

In almost all cases and because of institutionai arrangements, the weavers only had access to their looms between the hours 8.00 a.m. and 4.00 p.m., Mondays to Fridays. Within that period, however, they had an unusually high degree of work-leisure choice. They produced a fairly standardised set of articles and were paid for their labour on a piece-rate basis. The pay rate per unit varied among the weaving cells. A detailed time and motion study determined the average time taken by each weaver to produce a given unit of cloth and, together with an accurate production check over a defined period, all the data necessary to convert physical units of product into units (hours) of effective work time were available. As per unit pay rates were known and the effective work time required to produce each unit of cloth could be determined, it was then a short step to calculate each weaver's cash return per unit of effective work time (i.e. his 'wage rate').[1]

For the purposes of this study, the effective cash work-leisure choice period was defined as those 40 hours per week during which the weavers had access to their looms. This is in lieu of the rather unrealistic limit of 168 hours per week used in some other analyses. Whilst 12 of the weavers spent a small amount of time involved in other (non-weaving) cash earning activities and all except 9 weavers performed some subsistence garden work, it was ascertained from separate activity surveys[2] that nearly all such work was performed outside the 40-hour period when weaving work was possible. In fact, apart from four individual and rather exceptional cases, none of the non-weaving cash work and less than 3 per cent of the total subsistence work performed by the weavers was undertaken during the defined choice period. Within the choice period, however, the weaver could actively and effectively engage himself in the making of woven articles and for this receive a piece-rate cash payment or else he could remain idle, chat, smoke, play cards and other games with his friends, wander around the village and/or engage himself in other forms of social activity. Time spent on such activities is defined as 'leisure' and did not earn the worker a cash income.

The analysis has, in fact, been simplified. There is no attempt to explain the total allocation of time between all the various forms of monetary and non-monetary work, traditional social activity and leisure, etc. Rather, the analysis is concerned with how and why the members of a particular workforce group with a high degree of choice allocate a given period of time, which they know and accept to be available for the earning of cash, between effective work effort that will enable them to do so and some alternative use of this time that will not. Consequently, it is also necessary to assume that all other (non-weaving) monetary and non-monetary income acquired by the weaver or members of his household is exogenous with respect to the cash labour-leisure choice being considered.

Data were also obtained relating to various sociological and demographic characteristics of each weaver and his household, the

[1] The mean effective work time per weaver sampled was 14·6 hours per week and the range from 6·8 to 26·2 hours per week. The mean earning rate was \$0·44 per hour and the range from \$0·12 to \$1·32 per hour.

[2] For details see Philp (1976, chapter 8).

household's non-weaving cash incomes, its net income transfers (including traditional exchanges), the physical quantities and monetary values of garden produce produced by the household or received as gifts from kin and, wherever possible (but to a limited extent), the household's cash expenditure pattern over the survey period. A considerable regional variation in food prices was noted and a regional price index for food items relating to six different regional centres was constructed.

The Choice of a Utility Function

In their analyses of the subjective equilibrium of subsistence and transitional households three previous writers, namely Nakajima (1969), Mellor (1963) and Fisk (1962), introduced the concept of a 'minimum subsistence' level of consumption or income. Preferences were not defined for any commodity bundle that fell below this minimum level. The concept was expressed earlier by Wharton (1963) as

$$S_{ms} = f(P,E,C) \tag{1}$$

The minimum subsistence standard of living per person (S_{ms}) depends not only on a minimum physiological level (P) but also on 'economic well-being' (E) and 'cultural' (C) factors. In an economy where the intrusion of cash is both recent and incomplete and where cash incomes are relatively low, it might be expected that cash expenditure decisions often are made close to this minimum subsistence level and that the labour committed to cash earning activity is conditioned by these decisions.

When analysing cross-sectional data it is assumed that the preference orderings (or taste patterns) of each individual in the sample are the same. This is a very limiting assumption if a sample is drawn from people of different cultural and socio-economic backgrounds, for such factors may be important in affecting economic choice. In these circumstances a model should contain some shift parameters which take account of taste change or taste variation. The concept of a minimum subsistence level and the use of shift parameters have now been included in a number of econometric models of consumer demand. Stone's (1953, 1954) analysis using a linear expenditure system of equations derived from the Stone-Geary utility function, was the first such study to include a subsistence component. Later, a minimum subsistence bundle was incorporated by Pollak (1970) in the CES utility function and by Manser (1976) into the homogeneous indirect translog utility function. Taste changes were incorporated in a number of shift hypotheses. For example, Pollak (1970) made the 'minimum subsistence' component of the Stone-Geary utility function a linear function of previous consumption. More recently, Howe (1977) reviewed his own and other attempts to introduce and estimate the effects of socio-demographic variables with cross-section data. Scope exists to extend this procedure to a variety of socio-demographic and/or 'non-economic' variables.

The Stone-Geary function is

$$U = \Sigma_i \beta_i \log (q_i - \gamma_i) \tag{2}$$

$$0 < \beta_i < 1,\ \Sigma_i \beta_i = 1,\ \gamma_i > 0,\ (i = 1, \ldots, n).$$

The function is defined only for the range where $q_i - \gamma_i > 0$. When this function is maximised subject to the familiar constraint

$$\Sigma_i \, p_i q_i = y \tag{3}$$

it yields demand equations of the following form:

$$q_i = \gamma_i + \beta_i / p_i (y - \Sigma_j \, p_j \, \gamma_j), \tag{4}$$

where q_i is the quantity of the i-th good and p_i is its price.

The parameter, γ_i, is interpreted as some 'minimum subsistence' or 'precommitted' quantity of each good and can be taken to correspond to the minimum subsistence quantities found in the models of Nakajima, etc. After the purchase of the 'precommitted' bundle, the consumer's residual or 'supernumerary' income ($y - \Sigma_j p_j \gamma_j$) is assumed to be spent in fixed proportions, β_i, between the goods. The model can be extended quite simply to labour supply analysis by including 'leisure', or non-work, as the $(n + 1)$-th good in the system. γ_{n+1} or γ_l thus represents a precommitted consumption of 'leisure' within some defined work-leisure choice period.

In standard presentations of Stone-Geary based demand functions the precommitted quantities, γ_i, are assumed to be fixed over time or invariant over households. However, by taking an additional step and making the precommitted quantities themselves a function of some other social, demographic or institutional factors, variables can be incorporated that may have considerable explanatory power in particular situations.

The Stone-Geary utility function is not without limitations. Since it is a transformation of the Cobb-Douglas function, it implies that all goods must be Hicks substitutes. Because only broad aggregates of goods are considered in the present study, this restriction is quite acceptable. More particularly, the 'minimum subsistence bundle' embodied in the Stone-Geary function contradicts the notion of a 'bliss point' that several writers have hypothesised as affecting response behaviour in primitive societies. However, there is, as yet, little empirical evidence to suggest that the 'subsistence bundle' concept is any less plausible as an explanation of response behaviour in transitional economies.

An Extended Stone-Geary Model of Labour-Leisure Choice

A single-period utility maximisation with no uncertainty or inter-period borrowing or lending is assumed. The aim is to maximise the utility function of the form

$$\begin{aligned} U = U(q_i, \ldots, q_n, q_{n+1}) &= \sum_{i=1}^{n+1} \beta_i \log (q_i - \gamma_i) \\ &= \sum_{i=1}^{n} \beta_i \log (q_i - \gamma_i) + \beta_l \log (q_l - \gamma_l) \end{aligned} \tag{5}$$

subject to the budget constraint

$$\sum_{i=1}^{n+1} p_i q_i = I \tag{6}$$

where q_i is the quantity of the i-th good;
p_i is the price (or price index) of the i-th good.

All goods $q_i, \ldots, q_n$ are assumed to be *current* goods and services. I is 'potential' income, where $I = wH + E$, and $w = p_{n+1}$ is the weaver's average hourly earning rate ('wage'), H is the length of the labour-leisure choice period, and E is the net (exogenous) non-weaving income of the worker household. E consists of other (non-weaving) cash income *plus* subsistence (garden produce) income *plus* net transfers received.

$$H = q_l + S_L \tag{7}$$

where q_l denotes hours spent on 'leisure' within H, and S_L denotes the hours of effective work within H.

The basic model is extended by a number of hypotheses concerning γ_i, the precommitted component of the demand for i. In the current study two commodity groups plus 'leisure' are considered. Hence, $i = 1, 2, l$, and

$q_1 =$ food items;
$q_2 =$ other items (including savings);
$q_l =$ 'leisure'.

It is hypothesised that the precommitted demand for food items by each household is a simple function of household size. Hence,

$$\gamma_1 = \lambda_1 N, \quad \lambda_1 = \text{constant}. \tag{8}$$

N is the number of adult-equivalent consumption units in each weaver household. This strict proportionality is a simplifying assumption but, in as much as it refers to a minimum or subsistence level of food consumption, it is likely to be adequate.

Similarly, the precommitted demand for other items is assumed to be a simple function of the availability of, and the relative access to, such items. Hence,

$$\gamma_2 = \delta_2 A, \quad \delta_2 = \text{constant}. \tag{9}$$

A is an 'index of accessibility'[3] pertaining to each weaver household.

Finally, there is γ_l, the precommitted demand for 'leisure'. Three factors, two of which relate quite specifically to the particular work-force sample being investigated, were hypothesised to affect γ_l.

(a) A subset of 15 weavers worked in a government sponsored factory and were observed to have been subjected to more supervision than weavers elsewhere.
(b) Another subset were young (under 20 years) and were unmarried. Their expected participation in village ceremony and their elected engagement in other social activity (i.e. their 'taste' for 'leisure') differed from that of their older and married colleagues.
(c) Effective labour effort was defined and measured to include only that time directly associated with the production of cloth. Any other use of time within the decision period was defined as 'leisure'. As weavers lived at greatly varying distances from their place of work, variations in commuting times were likely to affect γ_l.

[3] For a full description of both N and A see Philp (1976, chapter 4).

Thus

$$\gamma_l = \gamma_l (S^*, D^*, T)$$

or specifically,

$$\gamma_l = \alpha_0 - \alpha_1 S^* + \alpha_2 D^* + \alpha_3 T \tag{10}$$

where α_0 to α_3 are constants, and

$S^* = 1$, if the weaver was supervised in his work,
0 otherwise;

$D^* = 1$, if the weaver was both young and unmarried,
0 otherwise;

$T^* =$ the time taken (in hours) for a weaver to walk between his residence and the weaving workshop.

The constrained maximisation of the utility function (5) subject to the budget constraint (6), and prior to any substitution, yields the following commodity demand functions.

$$q_i = (1-\beta_i)\gamma_i - \beta_i \sum_{j \neq i} \gamma_j \, p_j/p_i + \beta_i \, I/p_i. \tag{11}$$

$$i = 1, \ldots, n+1.$$

The equation for the demand for 'leisure', q_l, can be written as

$$q_l = (1-\beta_l)\ \gamma_l - \beta_l \sum_{j \neq l} \gamma_j \, p_j/w + \beta_l \, I/w. \tag{12}$$

Now, substituting back into (12) for $I = wH + E$ gives

$$q_l = (1-\beta_l)\ \gamma_l - \beta_l \sum_{j \neq l} \gamma_j \, p_j/w + \beta_l \, H + \beta_l \, E/w. \tag{13}$$

The estimating equation for labour effort supplied is then obtained by substituting equations (8) to (10) into (13), with $j = 1, 2$ and respecifying in terms of S_L (the effective labour effort supplied) as per equation (7). This yields

$$\begin{aligned} S_L = {} & (1-\beta_l)\ (H-\alpha_0) + (1-\beta_l)\ \alpha_1 S^* - (1-\beta_l)\ \alpha_2 D^* \\ & -(1-\beta_l)\ \alpha_3 T - \beta_l \, E/w + \beta_l \lambda_1 p_1 N/w + \beta_l \delta_2 p_2 A/w. \end{aligned} \tag{14}$$

The Estimation and Results

The complete Stone-Geary model yields a set of $n + 1$ (or three) demand equations, not merely the single equation in (14) above.

Because of incompleteness in the household expenditure data collected in the survey, it was felt that the data set generally could not support a full system estimation which would include two commodity demand functions in addition to the labour supply function. Hence, the single equation (14) was extracted from the system and estimated by ordinary least squares. By proceeding with a single equation estimation and, hence, not enforcing the cross-equation restriction, viz. $\sum_{i=1}^{n+1} \beta_i = 1$, there is likely to have been some loss in efficiency.

The model, expressed in its estimating and stochastic form, is

$$\begin{aligned} S_L = {} & b_0 + b_1 \, (S^*) + b_2 \, (D^*) + b_3 \, (T) + b_4 \, (E/w) \\ & + b_5 \, (p_1 N/w) + b_6 \, (p_2 A/w) + u, \end{aligned} \tag{15}$$

where
$$\begin{aligned} b_0 &= (1-\beta_l)\ (H-\alpha_0), & b_0 &> 0 \\ b_1 &= (1-\beta_l)\ \alpha_1 & , b_1 &> 0 \\ b_2 &= (1-\beta_l)\ \alpha_2 & , b_2 &< 0 \\ b_3 &= (1-\beta_l)\ \alpha_3 & , b_3 &< 0 \\ b_4 &= \beta_l & , b_4 &< 0 \\ b_5 &= \beta_l\lambda_1 & , b_5 &> 0 \\ b_6 &= \beta_l\delta_2 & , b_6 &> 0. \end{aligned}$$

The expected signs of coefficients b_0, b_4, b_5 and b_6 are determined by theory. Those pertaining to b_1, b_2 and b_3 are based on the hypotheses advanced in the previous section.

An initial estimate, using all six variables and the constant, produced a set of regression coefficients which, whilst all having the theoretically expected signs, did not all have low standard errors. The constant and five of the coefficients were found to be significant at the 5 per cent confidence level but b_6 was not significant at any acceptable level of confidence. The notion of an 'index of accessibility' and its effect on the precommitted demand for other items was thus unable, in the way it was defined and measured herein, to contribute to the explanation of variability in the main dependent variable. As the basic data used in the construction of the price index, p_2, were also sparse and somewhat spurious, this too may have contributed to the inaccuracy of the attempt to quantify the relevant variable. Thus, the final variable p_2A/w was dropped from the equation and it was re-estimated. The result was the revised regression equation:

(15a)
$$\begin{aligned} S_L = {} & 14{\cdot}57 + 5{\cdot}18\ S^* - 2{\cdot}99\ D^* - 0{\cdot}21\ T \\ & (0{\cdot}98)\ \ (1{\cdot}26)\ \ \ (1{\cdot}12)\ \ \ (0{\cdot}06) \\ & - 0{\cdot}20\ E/w + 0{\cdot}63\ P_1N/w. \\ & (0{\cdot}05)\ \ \ (0{\cdot}19) \\ & R^2 = 0{\cdot}66, \quad F = 19{\cdot}90. \end{aligned}$$

Standard errors are given in parentheses.

In this estimation all coefficients were significant at the 1 per cent level or better. The independent variables in the model explained approximately two-thirds of the variation in the effective labour effort supplied by members of the sampled workforce. An R^2 of this magnitude (0·66) appears acceptable for an analysis of cross-sectional data of the type used in this study. It is likely that part of the unexplained or random component is related to various complex and non-quantifiable behaviour embedded in the mores of traditional New Guinean culture.

From the regression coefficients it is possible to derive values for the underlying structural coefficients. These are presented in Table 1.

TABLE 1

Estimated Values of Structural Coefficients

α_0	α_1	α_2	α_3	β_l	λ_1
21·78	6·47	3·73	0·26	0·20	3·15

The marginal budget share, or marginal propensity to consume leisure, β_l, has a value of 0·20. However, in as much as a full system estima-

tion was not attempted and the cross-equation restriction not applied, the integrity of this value cannot be assured and it cannot be compared with estimates obtained when a more sophisticated technique is used. However, it is remarkably similar to Betancourt's (1977) value of 0·21 for a low income group of Chilean households when he, too, used an ordinary least squares estimation procedure.

Given values for α_0 to α_3 it is possible to estimate values for γ_l, the 'precommitted' or 'minimum socially acceptable' demand for leisure. Because S^* and D^* are both dummy variables, there are four values for γ_l. Likewise, using mean sample values for all other independent variables yields four estimated values for the dependent variables, $\hat{S}_L$ and $\hat{q}_l$. These values are given in Table 2.

TABLE 2

Estimated Values for γ_l, $\hat{S}_L$ and $\hat{q}_l$ *(hours per week)*

	$S^*=0, D^*=0$	$S^*=1, D^*=0$	$S^*=0, D^*=1$	$S^*=1, D^*=1$
γ_l	23·59	17·12	27·32	20·85
$\hat{S}_L$	14·44	19·62	11·47	16·64
$\hat{q}_l$	25·56	20·38	28·53	23·36

Note: $\hat{S}_L$ and $\hat{q}_l$ are the estimated values of the dependent variables when mean sample values of the independent variables are taken and values for S^* and D^* are as indicated.

It is interesting to note the particularly high proportion of 'precommitted' or non-discretionary leisure, γ_l, to total leisure demanded, q_l, amongst this sample of New Guinean workers. The proportion ranged from a high of 95 per cent for the unmarried and unsupervised youths to 84 per cent for the older, married and supervised weavers.

Two elasticities are of special interest:

(a) work effort with respect to variation (change) in earning rates, (η_w); and
(b) work effort with respect to variation (change) in other (non-weaving) household income (η_E).

The equations for the two elasticities are:

$$\eta_w = \partial S_L/\partial w \,.\, w/S_L = w^{-2}\,\beta_l\,[E-\lambda_1 p_1 N]\,.\,w/S_L. \tag{16}$$

$$\eta_E = \partial S_L/\partial E \,.\, E/S_L = -\beta_l/w \,.\, E/S_L. \tag{17}$$

Because of the particular form of the model, elasticities have to be calculated at specified values for the relevant variables. Initially, both elasticities are calculated using the mean sample value for all relevant variables (x_i) used in equations (16) and (17) and the estimated values of $\hat{S}_L$ when the mean sample values of T, E, w, p_1 and N are inserted in equation (15a). As this equation contains two dummy variables (S^* and D^*), there will be four possible values for $\hat{S}_L$. Furthermore, because the elasticity, η_w, represents the 'labour response' estimate which is central to this paper, η_w will also be calculated, using,

in turn, values for E, N, p_1 and w which are, alternatively, one standard deviation (s) above and below their mean sample values. The matrix of values for η_w is presented in Table 3. Values for η_E are given in Table 4.

TABLE 3

Elasticity η_w: Work Efford ($\hat{S}_L$) with Respect to Hourly Earning Rates (w) at Indicated Values of Relevant Variables

For $\hat{S}_L$ and x_i when:	$S^* = 0$ $D^* = 0$	$S^* = 1$ $D^* = 0$	$S^* = 0$ $D^* = 1$	$S^* = 1$ $D^* = 1$
$\overline{T}, \overline{p_1}, \overline{N}, \overline{w}, \overline{E}$	−0·09	−0·06	−0·11	−0·08
$\overline{T}, \overline{p_1}, \overline{N}, \overline{w}, \overline{E} + 1s$	+0·04	+0·03	+0·06	+0·04
$\overline{T}, \overline{p_1}, \overline{N}, \overline{w}, \overline{E} - 1s$	−0·19	−0·15	−0·24	−0·18
$\overline{T}, \overline{p_1}, \overline{E}, \overline{w}, \overline{N} + 1s$	−0·14	−0·11	−0·18	−0·13
$\overline{T}, \overline{p_1}, \overline{E}, \overline{w}, \overline{N} - 1s$	−0·02	−0·01	−0·02	−0·02
$\overline{T}, \overline{E}, \overline{w}, \overline{N}, \overline{p_1} + 1s$	−0·12	−0·09	−0·15	−0·10
$\overline{T}, \overline{E}, \overline{w}, \overline{N}, \overline{p_1} - 1s$	−0·05	−0·03	−0·06	−0·04
$\overline{T}, \overline{E}, \overline{N}, \overline{p_1}, \overline{w} + 1s$	−0·06	−0·04	−0·07	−0·05
$\overline{T}, \overline{E}, \overline{N}, \overline{p_1}, \overline{w} - 1s$	−0·16	−0·12	−0·20	−0·14

TABLE 4

Elasticity η_E: Work Effort ($\hat{S}_L$) with Respect to Non-weaving *Income* (E)

$S^* = 0$ $D^* = 0$	$S^* = 1$ $D^* = 0$	$S^* = 0$ $D^* = 1$	$S^* = 1$ $D^* = 1$
−0·04	−0·03	−0·05	−0·04

Note: At values of $\hat{S}_L$ and x_i when all other variables are at mean sample values.

For the particular workforce group studied herein, the elasticity of effective work effort with respect to variation in hourly earning rates was found, on average, to be negative and highly inelastic. A 1 per cent increase in the hourly earning rate would tend to reduce the work effort supplied by the average (representative) weaver by between 0·06 and 0·11 per cent. The reduction in work effort would be less for supervised and older married weavers and greatest for the unsupervised single youths. Whilst own-price inelasticity is characteristic of the Stone-Geary model, the degree of inelasticity obtained in these estimates is particularly high.

From (16) above it can be seen that the sign and size of the elasticity η_w depends on the relative values of E and $\lambda_1 p_1 N$. The supply curve of

effort will be either positively or negatively sloped depending on whether $(\bar{E} - \lambda_1 p_1 \bar{N})$ is greater or less than zero. In the Stone-Geary model it will always be of the same sign regardless of the wage rate and we cannot, therefore, have a supply curve which is 'backward bending' in the strict sense. By estimating η_w at values of E which are one standard deviation above the mean sample value, the sign of the elasticity changes. Although η_w becomes positive at these above average values for E, it is still highly inelastic. The below average sample values for p_1 and N, however, were not sufficient to produce a similar change in the sign. Whilst η_w can be seen to vary in magnitude with different values of the main variables, the range of values was limited to between $+0{\cdot}03$ and $-0{\cdot}20$.

The other elasticity of interest is that of labour supply with respect to non-weaving income, η_E. In this study it was assumed that such income was exogenous to the work-leisure choice being considered. Whilst the response is in the anticipated direction, i.e. negative, it too was highly inelastic, having values within the range $-0{\cdot}03$ to $-0{\cdot}05$. A 1 per cent increase in the weaver household's non-weaving income produced, on average, a decrease in the weaver's main monetary work effort of 0·05 per cent or less.

Conclusions

The application of modern consumer and utility theory to an empirical study of labour supply response in an economic setting of the type found in rural Melanesia can be shown to offer a desirable and operational alternative to less formal analyses hitherto undertaken by economic anthropologists. Whilst developments in applied consumption analysis have not been aimed at understanding consumer behaviour and work response in primitive societies, nonetheless, models based on particular utility functions often have characteristics which make them quite applicable and adaptable to these less familiar settings. The Stone-Geary based model and its incorporation of 'minimum subsistence' levels of consumption is one such case. A simple extension of the basic model allows the introduction of some 'non-economic' variables that field observation may suggest to be of considerable explanatory power. Theoretical consistency does not have to suffer as a result of their inclusion.

In the present study of a rather selective workforce sample, some interesting results emerge. The results indicate that the work response of the average weaver to variation in earning rates was highly inelastic and even slightly negative, thus supporting the supposition of a 'backward sloping' supply curve in respect of individual work effort in rural Melanesia. Such a conclusion is consistent with other reports of a slow response to cash earning activity in transitional Melanesian economies. The high inelasticity reported herein, however, results partly from the particular cross section selected for study and the specification of the model. Some weavers may have been responding positively and others negatively to changes in earning rates with the mean response converging to zero. Elasticity estimates for a representative weaver household having above average non-weaving income indicate that this

might be so. A larger sample would have permitted separate estimation for particular subgroups and indicated the actual extent to which this occurred.

The basic proposition can be accepted that more labour would be committed to productive cash activity if the level of 'incentive' was perceived to be worthwhile. Hence, for these craftsmen generally, the range of cash earning potential appears either too low or was considered insufficiently secure to encourage a more complete reliance on the cash exchange economy and its material goods *vis à vis* the other alternatives (including the consumption of leisure) that they had available to them.

Whilst it might be hypothesised that the amount of work the main household worker commits to cash earning work is strongly and inversely related to the value of the household's alternative income sources (including the value of his garden produce), the measured elasticity of work effort with respect to net non-weaving income (for which subsistence income is the main component) did not give this hypothesis much support. The response was negative but, again, highly inelastic. It suggests that, under present circumstances and for the sampled range of values of the relevant variables, the relative value of an individual's other net income (including the average value of his own weekly garden production) has little effect on his willingness to work for cash. The household cash earners appear to have regarded their principal monetary work (weaving) and their subsistence sector activities as quite separate functions, having different rewards and fulfilling different needs. Because of the characteristically high productivity of male labour in Melanesian subsistence agriculture and the institutional arrangements that limit the potential cash-work period to certain defined times, these village craftsmen were able to keep their two worlds separate and relatively free from any conflicting choice in the use of their time. Under such circumstances a partial and cautious response to the 'monetary incentive' is hardly irrational and variation in factors other than cash earning rates and exogenous income become far more important in explaining the observable variations in cash-leisure choice.

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