

The Economic Contribution of Children in Peasant Agriculture and the Effect of Education: Evidence from the Philippines

GEORGE J. MERGOS

Issues of consumption-leisure choice and of the effect of education are at the centre of the debate on labour supply and on the economic value of children in peasant agriculture. This paper provides empirical evidence on how education affects child labour supply in an extended commodity demand-labour supply framework, using farm-household survey data from the Philippines. The empirical results of this paper point out that adult and child labour respond normally to changes in wages, that a complementarity exists between adult and child labour in farm operations, that children have a positive economic contribution to farm households in peasant agriculture, and that education may have a limited impact in reducing fertility in rural households.

1. INTRODUCTION

The economic value of children in peasant agriculture and the interaction of fertility with economic variables has attracted considerable attention in the literature concerning population growth and development [see, e.g., Rosenzweig and Evenson (1977); Yotopoulos and Kuroda (1988)]. Central to this issue is the concept of consumption-leisure choice in rural households, and, in particular, children's labour supply and its relation to adult labour supply and to farm-household characteristics.

Education is ranked high among several socio-economic characteristics affecting family size, and mass education is considered an important factor in the attainment of demographic transition [Caldwell (1980); Coale (1984), p. 547]. Reviewing the literature on fertility behaviour, it is concluded that education has been used as a proxy measure of modernisation, of tastes and preferences and socio-economic status, and also of the housewife's time [Harvey (1979)]. Thus, the relation between fertility and many of the social and economic processes is so complex that its true nature remains obscure. Although education may affect fertili-

George J. Mergos is Assistant Professor, Department of Economics, University of Athens, Greece.

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ty in several ways, research has concentrated mostly on female or parents' education or modernisation [see, e. g., Ali (1981); Sathar (1984); Sathar and Irfan (1984)], overlooking, to some extent, the fact that mass education cannot be achieved unless it is consistent, from a private point of view, to peasant household choices [Caldwell, Reddy and Caldwell (1985), p.29].

The hypothesis of a backward-sloping labour supply curve has been extensively tested in various contexts and a rational response to price and wage changes in agricultural decisions is now widely accepted [Barnum and Squire (1979), p. 9]. In addition, several studies reveal that children's labour is indispensable to agricultural production in developing countries [Mueller (1976)]. Yet, there has been a limited effort to study child labour supply and the demand for education within an agricultural household model, although it is well-known that children's education and labour supply are two conflicting objectives at the farm-household level in peasant societies.

Hence, the question is still open as to how education and child labour supply are related in peasant agriculture; especially (a) how labour supply of children is related to farm-household characteristics (number of adults, number of children, farm size, educational level, etc.); (b) how adult and child labour supply and the cost of schooling are related in the agricultural household; and (c) how the cost of schooling affects labour supply decisions for children. The objective of this paper is to extend the framework of Yotopoulos and Kuroda (1988) to examine these questions in the context of a commodity demand-labour supply (leisure demand) framework using similar methodology and data.

The paper starts by presenting briefly the behavioural model of consumption-leisure choice. The novelty of the paper is the joint consideration of adult and child labour supply and of the cost of education, distinguishing expenditure on educational goods (cost of schooling) in addition to own produced and purchased commodities in household consumption in an extended commodity demand-labour supply framework.¹ In addition, some of the characteristics of the household, such as the demographic composition of the household (number of adults and number of children), the educational level of the household, and farm size, are explicitly considered.

The model is estimated empirically, using an LLES specification. The LLES, despite some undesirable properties, e. g., its unitary elasticity with respect to full income, has other attractive characteristics, such as linearity in the parameters, that make its estimation simpler. After presenting the estimation results, the paper continues with a discussion of the results and the conclusions.

¹Readers primarily interested in the results may skip Sections 2 and 3 that are mainly methodological and refer directly to Section 4.

2. CONSUMPTION-LEISURE CHOICE IN THE FRAMEWORK OF A DEMAND SYSTEM

The theoretical basis of our analysis is the subjective equilibrium model of the agricultural household [see Singh *et al.* (1986); Yotopoulos and Kuroda (1988)]. The consumption side of the model can be analysed independently from the production side when an active labour market is observed to operate [Singh *et al.* (1986)].

As it is well-established by now in the literature [Deaton and Muellbauer (1980), p. 87], labour supply decisions can be analysed within the framework of utility maximisation subject to a budget constraint. This is accomplished by extending the consumption bundle to include leisure. Labour supply is then obtained as the difference between the available time minus consumption of leisure. Thus, labour supply can be analysed within the traditional demand analysis framework.

By further distinguishing adult and child leisure in the consumption bundle, one can analyse labour supply of adults and children of the farm-household separately. There are several advantages in making such a distinction. In addition, the effects of the various socio-economic characteristics of the farm-household on consumption behaviour (and hence on labour supply) can be analysed in a convenient way.

Children's labour supply is considered as their economic contribution to the farm-household. In fact, one of the many important and controversial issues considered by *The World Development Report, 1984*, in the context of population change and development, is whether the choice of large families by peasant farm-households in developing countries is economically rational, from a private point of view.

Education, on the other hand, is considered to have a reducing effect on fertility, and the attainment of mass education is thought to be contributing significantly to the demographic transition [Caldwell (1980); Coale (1984) and Harvey (1979)]. Nevertheless, sometimes school is thought of as a place for children who have nothing better to do; as education and labour supply compete for children's time. In addition, the cost of schooling is substantial for the farm-households' meagre resources. Two aspects of the costs are central, the partial or complete withdrawal of labour during school and the extra cost incurred by going to school. School-children contribute less work to the farm by taking time to attend classes and prepare homework. Nonetheless, the cost of books, stationery, fees, etc., may be substantial for a poor household's resources.

Making use of the subjective equilibrium model of the household [Yotopoulos and Kuroda (1988)], the issue of the economic contribution of children in peasant agriculture (and of the cost of schooling) can be conveniently analysed and assessed as shown next.

We assume that the farm household's utility function is well-behaved, and is

specified as

$$U = U(z_1, z_2, A, C, E; a_1, a_2, a_3, a_4) \quad \dots \quad \dots \quad \dots \quad (1)$$

where z_1 is leisure of adult members of the household, z_2 is leisure of child members of the household, A is consumption of own-produced agricultural products, C is consumption of purchased final consumer goods, E is consumption of educational goods (expenditure on education), a_j is a vector of household characteristics, i. e., educational level, number of adults, number of children, and farm size of the farm households (as a proxy for farm income). The utility function is assumed to have the usual regularity properties.

The time allocation of household members is given as

$$\begin{aligned} z_1 &= Z_1 - L_1 \text{ for adult workers} \\ z_2 &= Z_2 - L_2 \text{ for child workers} \end{aligned}$$

where Z_1 and Z_2 is the maximum of the time to be allocated between work and leisure, z_1 and z_2 is consumption of leisure respectively, and L_1 and L_2 is the labour time.

The income and expenditure constraint is given as:

$$\pi + q'_1 L_1 + q'_2 L_2 + I_A = P_A A + P_C C + P_E E \quad \dots \quad \dots \quad (2)$$

where π is maximum money profits from the production side, q'_1 is wage rate for adult labour, q'_2 is wage rate for child labour, P_A is the price of home-produced agricultural commodities, P_C is the price of purchased final consumer goods, P_E is the price of educational goods, $P_A A$ is the market value of consumption of own-produced agricultural goods, $P_C C$ is the expenditure on purchased final consumer goods, $P_E E$ is the expenditure on educational goods, I_A is other income.

Following Becker [see Yotopoulos and Kuroda (1988), p. 235] we may rewrite (2) to include time allocation as

$$\Pi + q'_1 Z_1 + q'_2 Z_2 + I_A = q'_1 z_1 + q'_2 z_2 + P_A A + P_C C + P_E E \quad \dots \quad (3)$$

where the left-hand side is the "full income" and the right-hand side is the "full expenditure" concepts of Becker [see Yotopoulos and Kuroda (1988)]. By normalizing prices as $p^*_i = p_i/M$ we have

$$\sum_i p^*_i X_i = 1 \quad \dots \quad \dots \quad \dots \quad (4)$$

where M is full expenditure of the agricultural household, X_i stands for z_1, z_2, A, C, E , and p_i stands for $q'_1, q'_2, P_A, P_C, P_E$, and the income constraint can be transformed as in (4). Therefore, the household maximises utility (1) subject to the income constraint (4), assuming profit maximisation on the production side. However, given the usual assumptions about the utility function, there exists an indirect utility function giving the maximised value of U as a function of normalised prices. Then,

$$V^* = V^*(q^*_1, q^*_2, P^*_A, P^*_C, P^*_E; a_1, a_2, a_3, a_4) \quad \dots \quad \dots \quad (5)$$

is the indirect utility function which corresponds to maximised utility function (1) subject to constraint (4).

Thus, without loss of generality, the analysis of consumption behaviour of the farm-household can start from the indirect utility function [Yotopoulos and Kuroda (1988)]. The household consumption demand functions so derived are consistent with utility maximization.

The advantage of the approach is that the derived demand functions are explicit functions of only the exogenous variables, which is of major empirical importance. Assuming that the indirect utility function is homogenous, transcendental, and logarithmic, one can obtain the simplest version of the Linear Logarithmic Expenditure System [Yotopoulos and Kuroda (1988), p. 241]. Applying a second-order approximation of Taylor's expansion around the true V^* , the translog function corresponding to the indirect utility function (5) is obtained.

The commodity demand functions are obtained using Roy's Identity as

$$-S_i = a_i + \sum_{j=1}^5 c_{ij} \ln p^*_j + \sum_{k=1}^4 e_{ik} \ln a_k \quad \dots \quad \dots \quad \dots \quad (6)$$

where S_i is share of i th commodity in "full expenditure", $i, j = 1$ to 5 and $k, 1 = 1$ to 4.

The system of (6) is estimated using Zellner's Seemingly Unrelated Regressions (SUR) procedure in its stochastic form imposing the homogeneity restriction [Zellner (1962)]. These restrictions are imposed in the actual estimation of the demand system. For homogeneity we have the restrictions

$$\sum_{i=1}^5 a_i = -1 \quad \dots \quad \dots \quad \dots \quad (7.1)$$

$$\sum_{j=1}^5 c_{ij} = 0, \quad i = 1 \text{ to } 5 \quad \dots \quad \dots \quad \dots \quad (7.2)$$

$$\sum_{j=1}^5 e_{kj} = 0, \quad k = 1 \text{ to } 4 \quad \dots \quad \dots \quad \dots \quad (7.3)$$

In addition, symmetry is tested and imposed in the estimation.

3. DATA AND ESTIMATION

The data set used for the empirical estimation is a subset of the sample of a household survey conducted in Mindanao, the Philippines, in 1978-79, funded by the Food and Agriculture Organisation and the United Nations Fund for Population Activities. A more detailed description of the data is given elsewhere [Yotopoulos (1983) and Yotopoulos and Kuroda (1988)]. Some basic statistics of the data are given in Table 1. Prices are assumed to vary spatially since farm-households are sampled from a large number of villages, often far away from each other, with diverse economic and infrastructure conditions.

Table 1

Data Description

Variable/Group	All	Tenants	Landholders
Sample Size	(94)	(34)	(60)
Expenditure			
Own-produced Food	3,764	3,450	3,945
Purchased Goods	3,098	2,464	3,461
Educational Goods	742	477	894
Total Expenditure	7,604	6,393	8,302
Expenditure Share			
Share of Own-produced Goods	0.605	0.661	0.574
Share of Purchased Goods	0.321	0.285	0.341
Share of Educational Goods	0.073	0.054	0.084
Land Owned	1.11	0.0	1.75
Size of Farm	2.15	1.84	2.33
Number of Children	2.82	3.28	2.55

Note: Expenditures are in pesos, land owned and size of farm in hectares.

Assuming an additive error term for Equations (8) above, and assuming zero covariance of the errors of each equation corresponding to different farm households, Zellner's method of Seemingly Unrelated Regressions gives efficient estimates [Yotopoulos and Mergos (1986)]. The system is estimated initially without imposing any restrictions. On the basis of these estimates, we test the following hypotheses: (a) Utility maximisation; (b) Effect of household characteristics; (c) Effect of farm size. The results are reported in Table 2.

Table 2

<i>Test Statistics (F Tests)</i>					
Hypothesis	Degrees of Freedom		Level of Significance	Critical F-Value	Actual Value
Symmetry	6	296	0.01	3.02	2.35
Conditional on Symmetry					
Effect of Household Characteristics	12	302	0.01	2.04	91.11
Effect of Farm Size	10	296	0.01	2.20	4.88

It is shown that symmetry is not rejected, which implies that farm-households behave as utility maximisers. Conditional on the hypothesis of utility maximisation, the hypothesis of no effect of household characteristics on consumption expenditure shares was tested and rejected. Next, the system is estimated by imposing symmetry, with the results presented in Table 3.

We proceed to calculate the elasticities of the demand for leisure and consumption goods and, indirectly, the elasticities of the supply of labour [Yotopoulos and Kuroda (1988), p. 260]. One particular set of values of interest is the sample means of the independent variables. Given the way in which the data are scaled, the means of the independent variables are identically zero. Using this information and the estimated parameters of the LLES, we can compute the numerical values of the elasticities which are given in Table 4.

4. RESULTS AND POLICY IMPLICATIONS

Before we proceed in the discussion of the results based on the values of the elasticities in Table 4, we have to emphasize that these elasticities were calculated with full income constant. The interpretation can be based in the usual framework

Table 3

Estimation of the Linear Logarithmic System with Symmetry Imposed

	Const.	$\ln q_1^*$	$\ln q_2^*$	$\ln P_A^*$	$\ln P_C^*$	$\ln P_E^*$	$\ln a_1$	$\ln a_2$	$\ln a_3$	$\ln a_4$
$-q_1^*z_1$	-0.3807	-0.1968					0.0349	-0.1910	0.1109	-0.0057
$-q_2^*z_2$	-0.3071 (59.86)	0.1305	-0.1866 (7.134)				0.0216 (1.891)	0.1348 (12.36)	-0.1771 (-21.18)	-0.0015 (-1.393)
$-P_A^*A$	-0.1833 (28.06)	0.0347	0.0421 (2.604)	-0.0760 (-3.051)			-0.0434 (-1.778)	0.0334 (2.08)	0.0207 (1.686)	0.0033 (2.083)
$-P_C^*C$	-0.0964 (17.01)	0.0866	-0.0020 (-0.1863)	-0.0091 (-1.709)	-0.0780 (-5.977)		-0.0147 (-0.7987)	0.0118 (0.9817)	0.0346 (3.743)	0.0047 (3.864)
$-P_E^*E$	-0.0325 (7.494)	-0.0550	0.0160 (4.061)	0.0083 (1.507)	0.0025 (1.6063)	-0.0282 (-8.173)	0.0016 (0.1162)	0.0110 (1.781)	-0.0109 (1.815)	-0.0008 (-0.8743)

Note: a_1 : Level of education of the household.

a_2 : Number of adults workers.

a_3 : Number of child workers.

a_4 : Farm size.

Figures in parenthesis are computed asymptotic t -ratios.

The coefficients of $-q_1^*z_1$ were obtained making use of symmetry restrictions.

Table 4

Estimates of Elasticities of the Demand for Leisure, Commodities, and Supply of Labour

	Wage of Adults	Wage of Children	Price of Food	Price of Non-food	Price of Educational Goods	Educational Level	Number of Adults	Number of Children
Leisure of Adults	-0.48	-0.34	-0.09	-0.22	0.14	-0.09	0.50	-0.29
Leisure of Children	-0.42	-0.39	-0.13	0.00	-0.05	-0.07	-0.43	0.57
Food	-0.18	-0.22	-0.58	0.04	-0.04	0.23	-0.18	-0.11
Non-food	-0.89	0.02	0.09	-0.19	-0.02	0.15	-0.12	-0.35
Educational Goods	1.69	-0.49	-0.25	-0.07	-0.13	-0.04	-0.33	0.33
Adult Labour Supply	1.65	1.17	0.31	0.77	-0.49	0.31	-1.71	0.99
Child Labour Supply	5.04	5.57	1.94	-0.09	0.74	1.00	6.24	-8.19

of Slutsky's decomposition of the effect of a change in a price variable into substitution and income effects.

The economic implications of the elasticity estimates in Table 4 can be analysed as follows. First, an increase in the wage rates of adults and children increases the supply of labour and decreases the demand for leisure. This means that the hypothesis of surplus labour cannot be established at the micro-economic level, i.e., the supply of labour of both adults and children is upward-sloping and elastic.

However, there seems to be a difference in the responsiveness of the supply of labour between adults and children, the supply of child labour being more elastic. This fact – and also the observation – that cross-elasticities of the demand for leisure are negative implies that the substitutability of leisure of adults and children is not satisfied. This can be extended to imply that adult and child labour are complements in production.

This finding is similar to direct observations in the sample that child labour patterns are not independent of adult labour patterns [Yotopoulos and Mergos (1986)], and means that child labour is indispensable to the farm household in the peak season of operations and not a substitute for adult labour. Adults may gain leisure by having larger families but the substitutability hypothesis is not supported in this case. This observation is consistent with the findings of other studies [Rosenzweig and Evenson (1977), p. 119].

The own price elasticities of demand for home-produced agricultural goods and purchased final goods are rather small, but they have expected signs. The demand for educational goods reveals some interesting patterns; (a) it is positively and elastically related to the adult wage rate; (b) it is negatively and inelastically related to the child wage rate; (c) it is inelastic with respect to own price and with respect to the prices of own produced and of purchased goods.

Using a decomposition analysis, Yotopoulos and Mergos (1986) find that a complementarity exists between adult and child labour in farm operations. This finding is supported by the results of the present analysis. The number of adults and the number of children in the household seem to be very important factors in determining the household's consumption behaviour. The supply of adult labour is positively and elastically related to the number of adults in the household, but also positively and almost elastically related to the number of children in the household. Furthermore, the supply of child labour is positively and elastically related to the number of adults and negatively to the number of children. The above observations reinforce the argument of complementarity between adult and child labour in peasant farming.

The effect of farm size (as a proxy for farm income) was found to affect significantly the consumption behaviour. Consumption of leisure by adults and by children as well as consumption of educational goods increases with farm size. This

observation is consistent with other findings asserting that "larger farmers do not make full use of women and children in their households as do small farmers" [Rosenzweig and Evenson (1977), p. 124].

The demand for educational goods is very inelastic with respect to its own price. In addition, the elasticity of demand with respect to the number of adults and the number of children of the household has expected signs (negative and positive, respectively). What seems surprising, at least intuitively, is the negative sign of the elasticity of demand for educational goods with respect to the educational level of the household. This effect, however, is expected since the educational level variable reflects mainly the education of children. Therefore, the higher the educational level, the greater the number of children out of school and into economic activity; the lower the educational level of the household, the younger the children and, therefore, the higher the expenditure for schooling.

The positive, though small, effect of farm size on the demand for educational goods fits with the previous analysis of labour supply. Households with large farms can afford to send their children to school while in small farm-households children have to work to supplement household income. This finding conforms to the evidence from direct observation in South India, suggesting that the least convinced about the benefits of schooling are the small farmers [Caldwell *et al.* (1985)]. Thus, on the basis of the results it can be concluded that since the elasticity of demand for educational goods with respect to own price is very low, a policy which aims at universal education – making available educational facilities in rural areas as an instrument for the reduction of fertility – might not work. Instead, a policy that operates through the demand for child labour and the provision of income opportunities at the household level might be more appropriate.

Finally, the results support the view that to the household the economic value of higher parity children is smaller, since the elasticity of supply of child labour is negative with respect to the number of children. An intuitive explanation, which is relevant to our analysis is that child and adult labour have a complementarity relation in the family farm in peak seasons when certain operations have to be completed within certain time limitations as discussed earlier. However, the higher parity children are not as crucial in relaxing the acute labour constraint of the farm-household in peak-season operations.

Overall, the results support the view that the desired family size in low-income peasant households is large, because for many of the rural poor a large family is the main source of survival [Kazi and Sathar (1986)]. It is because of this reason that the simple presence of educational or health institutions in rural areas has no impact on fertility [Sathar and Irfan (1984), p. 216]. Hence, mass education in rural areas will be difficult to achieve without changes in the economic organisation of production at the peasant household level.

5. CONCLUSIONS

It is widely accepted that rapid population growth slows economic development. Hence, the focus on the peasant household is justified because of the undisputed fact that the largest part of population growth takes place in rural areas of developing countries. Yet, it is not clear why peasant households in developing countries choose to have large families, and whether such choice is economically rational from a private point of view. Several studies based on direct observation reveal that children's labour is indispensable to agricultural production in developing countries. However, the economic contribution of children in peasant agriculture is not clearly understood; that is, how adult and child labour supply are related in the agricultural household, and how the cost of schooling affects labour supply decisions. The findings of this paper on these issues are the following.

The surplus labour hypothesis that has attracted so much attention in the literature cannot be established at the farm-household level. Labour supply of adults and children responds normally to changes in wage rates. Also, the results support the view that a complementarity exists between adult and child labour in farm operations. This is consistent with direct observation, and implies that in certain peak seasons, when certain operations have to be completed by the farm-household within certain time limits, children's labour is extremely important in accomplishing such agricultural tasks.

Education is considered as having a reducing effect on fertility, and universal education of both males and females will lead to a smaller family size. However, education involves direct and indirect costs (expenditure on books, fees, etc., and withdrawal from the labour force, respectively). The analysis in this paper finds a low own-price elasticity of expenditure on educational goods and a positive effect of farm-size (i. e., farm income) on the expenditure on education.

Taking into account the complementarity between adult and child labour in farm operations, as discussed above, it can be concluded that a policy operating through the provision of education, as an incentive to eventually attain a lower fertility level, might not be appropriate. Instead, as it is indicated by the results, a policy aiming to reduce the demand for child labour in agricultural operations or to provide income-generating opportunities for peasant households with interventions in the organisation of peasant farming may be more conducive to attaining mass education and, hence, to a decrease of the desired family size in peasant households.

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