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***The Labour Allocation in Multi-worker Family
Enterprises: Bangladesh***

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92/4

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economics Division Working Papers

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***The Labour Allocation in Multi-worker Family
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Rushidan Islam Rahman

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abstract



In a multi-worker family enterprise, completely independent decisions about labour allocation for each worker are not possible because the marginal product of labour of the workers is interdependent. As a consequence, the characteristics of a family and the family enterprise may have different influences on the labour input of workers from the same family. Whether these influences differ among family workers depends on whether or not they have identical utility functions, and whether they cooperate in the decision making process, or whether one person dominates. Empirical tests of workers in family enterprises in Bangladesh financed by loans from a specialized financial institution called the Grameen Bank and organized by female members of the Bank show that male and female labour inputs are influenced in different ways by family and enterprise characteristics. No one characteristic dominated the others in the allocation of labour input.

Parts of this article include contents from the author's Ph.D. thesis at the Australian National University. The author is thankful to her supervisors Professor Helen Hughes and Professor J.G. Gregory for their comments on the analysis. The author is grateful to Winrock International for financing her stay in Cambodia while writing the paper.

the labour allocation process in multi-worker family enterprises: Bangladesh*

Price theory in general and the theory of labour allocation in particular traditionally relate to individuals' decision making processes. The assumption of one working family member being the consumption decision maker forms an inadequate basis for analysis, even if only one person is in income earning employment, when housework is recognized as a component in the labour allocation process and there are other family members engaged in housework. This involves a multi-worker decision making process. Initial theories of labour allocation relied on individual decisions because housework was not taken into account and it was usual to have only one working member in a household.

The presence of multiple workers has different implications for the interdependence of decision making processes depending on what options are available for employment.

The interdependence of labour allocation decisions among workers in multi-worker households has been addressed for the case of economies based on wage labour (Becker 1981; Manser and Brown 1979, 1980). When labour allocation choice is limited to leisure and wage employment, it is not difficult to account for multi-worker households. If the workers cooperate, they will maximize a household utility function. Completely independent decision making is also possible if each worker has an independent utility function, where own leisure and own income are the only opportunity costs and enter as the only arguments in each individual's utility function and consumption decisions are dependent on labour allocation decisions. In such cases each worker independently maximizes his/her utility function subject to their own availability of time and the given wage rate. Even in these cases, the workers may constitute a family if their consumption decisions are taken jointly.

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In contrast, when labour is allocated between family employment including housework¹, and leisure, independent decision making is not possible even if the family workers have independent utility functions. The returns to labour input of workers in the family enterprise or in the housework production functions, are interdependent in contrast to the fact that the wage rates for each worker are independent since they are given exogenously. Formally, each worker maximizes their utility function subject to availability of time, the family production function and the housework production function. The utility function and the availability of time may be independent for each worker, but the production function constraints include labour inputs of all workers, making their marginal products, the opportunity costs of labour, interdependent. There is no scope to avoid the issue of interdependence of labour allocation in family enterprises.

Previous discussion of labour allocation in self employment has not adequately addressed the issue of multiple workers in the household. The objective of this paper is to examine the labour allocation process in multi-worker households for whom housework and family employment are the relevant opportunity costs. A theoretical framework is developed to analyse the implications of different types of equilibria in multi-worker enterprises and these are tested with data from rural families in Bangladesh. This is done specifically to analyse the labour allocation decisions of families where women borrow from the Grameen Bank, which lends to the poor. An analysis of interdependence will reveal whether women are at a disadvantage in the decision making process for labour allocation, even if loans are made available to give them control over financial resources and in organizing economic activities.

The following section discusses how this issue had been addressed in earlier discussions of labour allocation amongst self employed peasants. This is followed by an analysis of possible means of achieving an equilibrium when workers cooperate to choose the optimal allocation of labour. Particular focus is given to the factors influencing female labour input and male labour input respectively. The hypotheses are tested using data from household enterprises in Bangladesh. The final section formulates an alternative procedure for achieving equilibrium in multi-worker households in the absence of cooperation, and tests the predictions from this equilibrating process.

¹The difference between wage employment and other types of work is straightforward: no wage is paid for the others. The difference between housework and family employment is that the output of housework is consumed by the family itself and no market price is obtainable. The output of family employment commands a market price even if some of the output is consumed by the family.

Existing theories of peasant labour allocation and multi-worker households

Research on peasant labour allocation theories did not take intra-family division of labour into account. The theories of Chayanov (1966); Sen (1966); Mellor (1969) and Nakajima (1969, 1986) have one common feature: they work on the basis of a family utility function, and, thus, bypass the possibility of distinct utility functions among workers within a family.

The only place where the issue of multiple workers is mentioned is Sen (1966). According to Sen (1966:426) the allocation problem is solved by the head of the family who 'takes the decision on behalf of the entire family and tells the individual members what to do'. A second interpretation suggested by Sen is that the individual members cooperate to choose the labour allocation so that for total labour input, equality between the marginal product of labour and the marginal rate of substitution between leisure and income is achieved.

Chayanov (1966) and Nakajima (1969, 1986) analyse the effect of a change in the number of workers on family's labour input. They simply take into account that when an additional worker contributes labour input, there may be an effect analogous to an income effect. The existing workers can reduce labour input and family income may not fall. The assumption implicit in this analysis is that the family maximizes a family utility function and the total labour input is shared by all workers, presumably in certain proportion.

This view of harmonious cooperation in the family economy has recently been questioned (Folbre 1986; Guyer and Peters 1987; Sen 1983; Bruce and Dwyer 1988; Evans 1989). The criticism relates to both behavioural and psychological aspects of workers who may demonstrate the tendency to be 'free riders' and selfishness as well as the technical problem of aggregating preferences. In his later paper Sen (1983) recognizes the importance of taking into account the intra-family division of labour and allocation of consumption goods.

Alternative processes of achieving equilibrium in a multi-worker family farm

This section sets out possible ways of achieving equilibrium in labour allocation in a family enterprise where there are two workers who have different utility functions, and are faced with a three-way choice among housework, family employment and leisure. Housework is included to make the analysis more general so that it can be applied to women workers. Until now, most work in

peasant economics has failed to mention women and housework because of the typical view of a 'peasant' as a male figure.

In recent periods, theories of family labour allocation have been pushed into the background because of increasing use of wage labour in agriculture, believed to have reduced the applicability of peasant economics. An analysis of family labour based enterprises may still be useful for farms which mainly use family labour, using hired labour only in specific peak season operations, and of which family workers do not participate in wage employment. Many medium sized farms in Bangladesh and India fall into this category.

Activities financed by the Grameen Bank provide cases where the theory of family labour based enterprises applies. Grameen Bank financed enterprises do not use hired labour. The workers are free to take up wage employment, but wage employment is not usually compatible with self employment and housework, especially for female Grameen Bank members, and they are not usually found to be employed in this manner. For these workers the choice is limited to the alternatives of family employment, housework, and leisure.

The following analysis works out firstly (Model A) a situation of equilibrium where the workers cooperate to take into account each others' individual preferences. Structural equations for labour allocation obtained from the cooperating model are estimated for a given set of data. These estimates may be compared with the predictions of a structural equation obtained from identical utility functions, or a family utility function, to examine whether distinct utility functions or identical utility functions are more acceptable.

Second, in the case of separate utility functions, possibilities other than a cooperating equilibrium will be examined (Model B). In this respect, predictions will be worked out for a situation where one of the workers is dominated by another.

Model A Cooperating equilibrium between two workers (a list of notations follows)

Worker 1

$$\text{Max } U_1 = U_1(Y, H, L_1; A_1)$$

Subject to:

$$\text{The family production function} \quad Y = f(Ts_1 + Ts_2, C)$$

$$\text{Housework production function} \quad H = F(Th_1 + Th_2, E)$$

$$\text{And, availability of time} \quad Ts_1 + Th_1 + L_1 = D_1$$

Worker 2

$$\text{Max } U_2 = U_2(Y, H, L_2; A_2)$$

Subject to:

$$\text{The family production function } Y = f(Ts_1 + Ts_2, C)$$

$$\text{The housework production function } H = F(Th_1 + Th_2, E)$$

$$\text{And, availability of time } Ts_2 + Th_1 + L_2 = D_2$$

The subscripts 1 and 2 refer to the two workers. The equilibrium is given by a simultaneous solution of the first order conditions for the two workers:

$$\text{Worker 1 } MU_{L1} = MU_{Y1} \cdot f' \quad (a)$$

$$MU_{L1} = MU_{H1} \cdot F' \quad (b)$$

$$\text{Worker 2 } MU_{L2} = MU_{Y2} \cdot f' \quad (c)$$

$$MU_{L2} = MU_{H2} \cdot F' \quad (d)$$

From these first order conditions, the structural equation for the supply of labour hours to family enterprises by each worker may be solved as a function of the characteristics of each worker which influence their marginal utility of income, marginal utility of leisure, marginal utility of housework and the marginal productivities of the two types of activities: housework and self employment.

$$Ts_1 = h(A_1, A_2, C, E) \quad (1)$$

$$Ts_2 = g(A_1, A_2, C, E) \quad (2)$$

If this model of distinct utility function is valid, since the two workers have separate structural equations describing their family employment, family characteristics are likely to have different influences in determining their labour inputs.

In this model the labour inputs of the two workers are taken as perfect substitutes in each type of production and they are entered additively in the production function. The same process of achieving equilibrium may be described when labour inputs are not perfect substitutes. Even then, the workers will decide their labour inputs simultaneously as long as each one's labour input affects the marginal productivity of the other.

Model B The equilibrium process where workers maximize a family utility function (a list of notations follows)

$$\text{Max } U = U(Y, H, L, A)$$

Subject to:

The family production function $Y = P_f \cdot f(T_f, C)$

Housework production function $H = F(T_h, A, B)$

And, availability of time $T_f + T_h + L = D$

Prices (P_f) are assumed to be the same for all enterprises.

The equilibrium conditions that maximize the utility function subject to the given constraints are:

$$MU_L / MU_Y = f'$$

and $MU_L / MU_H = F'$

The above two conditions together give:

$$F' \cdot MU_H = f' \cdot MU_Y = MU_L$$

In this case, the value of the marginal product in self employment and housework will determine the amount of income generating employment. The equilibrium conditions may be solved to obtain the labour allocation to various activities.

$$T_f = g(A, B, C) \quad (3)$$

$$T_h = h(A, B, C) \quad (4)$$

The variations in self employment will depend on factors which influence marginal productivity of self employment, marginal utility and the marginal product of housework and the marginal utility of income and leisure. These factors include family characteristics like family size, number and age of children etc., denoted by A and B and capital and other supplementary productive resources, represented by C.

The amount of family labour input chosen will be shared among the family workers. Whatever the criterion used to decide the proportion taken by each worker, each individual's labour input will have a similar relationship with the factors that determined total labour input (e.g. productivity of the enterprise, family size, etc.). Estimating the determinant of labour inputs of individual workers tests whether this is happening or whether the impact of family characteristics on the labour inputs of the workers are different, indicating non-

identical utility functions. Estimations in the following section are presented to test these two contesting predictions obtained from Model A and Model B above.

Description of the notations used in Models A and B

Notation	Description
A	Characteristics of a worker influencing the utility function and housework productivity
B	Characteristics of the worker influencing housework productivity
C	Given amount of capital
D	Total time available during a day
E	$A + B$
F	Marginal productivity of time in housework
f	Marginal productivity of time in self employment
H	Output of housework
L	Time spent on leisure
MU_H	Marginal utility of housework output
MU_L	Marginal utility of leisure
MU_Y	Marginal utility of income
P_f	Price at which home produced commodity is sold
T_f	Time spent on family employment
T_h	Time spent on housework
U	Utility
Y	Total income from self employment

Labour input determinants of male and female workers in family employment

Data used in these estimations relate to households of women who have borrowed from the Grameen Bank of Bangladesh to finance family labour based enterprises. The families include all the loan user women from five villages. To select the villages, 20 per cent of the Bank branches which had been operating for more than three years were randomly selected. From each of the selected branches one village was then randomly selected. Data were collected through a survey of these families on the basis of structured questionnaires. The survey was conducted during September and October, 1986. Data was collected on the family

characteristics and the details of the enterprises financed by the Bank, and relate to the month of August. The households involved in the survey are all very poor even though they are recipients of funding from the Grameen Bank. They are therefore an appropriate base for a model of peasant household behaviour in the context of labour allocation.

Table 1 presents the results of the OLS regression intended to explain the variations in labour input of the female members of the Grameen Bank. Explanatory variables are chosen to test the effect of family characteristics and factors influencing productivity.

Table 1 Factors influencing the labour input of female members of the Grameen Bank into Bank financed enterprises: OLS regression results

Explanatory variable	Dependent variable: GB female member's labour input into the enterprise in previous month (hours)	
	Coefficient	t-value
Number of dependents	-2.74	-1.43*
Dummy for having a small baby	12.35	1.81**
Total number of earners in family	1.78	0.55
Dummy for marital status (widowed or divorced = 1)	20.11	1.98**
Total capital in the enterprise	0.04	3.55***
Square of capital	-0.000004	-2.55***
Per cent of capital in paddy activity (prcpdy)	1.73	5.50***
Square of prcpdy	-0.01	-4.10***
Years of Grameen Bank membership	-5.37	-1.36*
Dummy for area 1	14.46	1.48*
Dummy for area 2	36.97	3.92***
Dummy for area 3	-38.90	-2.97***
Dummy for area 4	-8.43	-0.86
Constant	13.31	0.65
Adjusted R ²	0.55	
Value of F	13.28***	
RESET2 t-value	-1.05	
B-P test-statistic (chi-sq.d.f3)	2.24	
Sample size	132	

Note: *** ** * denote one tailed significance at 0.01, 0.05, 0.10 probability levels respectively.

Source: Survey of Grameen Bank villages, 1985.

The number of dependent members has a significant negative influence on female labour input (Table 1). The negative influence of dependents on the marginal utility of housework outweighs its positive influence on the utility of income. When the equation was re-estimated after excluding the square of total capital and the square of capital i paddy from the explanatory variables, since they were suspected of causing problems of multicollinearity, this variable was significant at the less than 5 per cent level. The results of this from are presented in Table 2. The following discussion, unless otherwise mentioned, is based on the results reported in Table 1.

Table 2 Factors influencing the labour input of female members of the Grameen Bank into Bank financed enterprises: OLS regression results excluding the quadratic forms of variables from the equation presented in Table 1

Explanatory variable	Dependent variable: GB female member's labour input into the enterprise in previous month (hours)	
	Coefficient	t-value
Number of dependents	-3.50	-1.69**
Dummy for having a small baby	13.68	1.85**
Total number of earners in family	1.84	0.52
Dummy for marital status (widowed or divorced = 1)	22.61	2.03***
Total capital in the enterprise	0.01	4.50***
Per cent of capital in paddy activity	0.46	4.26***
Years of GB membership	-5.05	-1.16
Dummy for area 1	21.46	2.02***
Dummy for area 2	35.30	3.42***
Dummy for area 3	-44.71	-3.18***
Dummy for area 4	-0.77	-0.07
Constant	43.34	2.34***
Adjusted R ²	0.45	
Value of F	10.88***	
RESET2 t-value	-2.56***	
B-P test-statistic (chi-sq.d.f3)	3.04	
Sample size	132	

Note: ***, **, * denote one tailed significance at 0.01, 0.05, 0.10 probability levels respectively.

Source: Survey of Grameen Bank villages, 1985.

The other variable which influences the marginal utility of housework and, through that, the amount of employment in economic activity, is the presence of a small child. A dummy variable having a value of one for women with a small baby under the age of five years contrary to expectation, has a significant positive coefficient. This is at odds with the findings for industrial countries (Miller and Volker 1983; Ross 1983; Beggs and Chapman 1988; Cogan 1980; Schultz 1980).

The negative influence of small children is more likely to be observed for women in industrial economies who work for a wage, taking them out of the home and thus creating a child care problem. Self employed women do not face this problem and the negative influence may not occur. The presence of a child may encourage the mother to work more in order to be better able to provide for the child. This effect is similar to that of an increase in the number of dependent members, but is stronger.

The influence of the number of earners in the family on a woman's labour input was also examined. With a larger number of workers the same income may be produced with less labour per worker. If the number of workers has a negative income effect, it will be reflected in a negative coefficient on this variable. In the equation for female labour input, this variable has a positive coefficient which is not significantly different from zero. It shows the non-negative income effect of total earning members in the family.

Next, the factors influencing the marginal productivity of labour are considered. These factors may have positive or negative effects depending on whether the income effect of higher productivity, or the substitution effect, earnings forgone from an hour of wage labour, is larger. The amount of capital is the most important variable in this respect. Capital has a significant positive coefficient showing that the income effect of capital in raising productivity is not large enough to outweigh the substitution effects of increasing capital.

A recent empirical study (Kumar and Hotchkiss 1988) of the determinants of labour allocation among women in family farms of Nepal shows a similar positive impact of land (which is equivalent to capital in non-agricultural enterprises) on farm labour allocation by women in Nepal.

The square of capital had a significant negative coefficient implying that the rise in labour input associated with the rise in capital continues only up to a certain limit. From the coefficients of these variables, this limit is calculated as 4200 taka.

The percentage of capital invested in paddy processing is used as an explanatory variable because this activity has a relatively higher rate of return to

labour and the effect of this needs to be assessed. It has a significant positive coefficient implying that a rise in the return to labour input has a stronger substitution effect than income effect.

The positive influence continues up to a certain limit and then has a negative impact indicated by the negative coefficient on the square of this variable. This may be, to some extent, due to the nature of the work. This kind of activity is physically exhausting and after a time, sharply rising disutility of work offsets the utility of income generated by the process.

Table 3 Factors influencing the labour input of female members of the Grameen Bank into Bank financed enterprises: OLS regression results including all variables on a priori grounds

Explanatory variable	Dependent variable: GB female member's labour input into the enterprise in previous month (hours)	
	Coefficient	t-value
Number of dependents	-2.154	-1.07
Dummy for having a small baby	9.393	1.22
Total number of earners in family	2.214	0.67
Dummy for marital status (widowed and divorced = 1)	26.006	2.20***
Total capital in the enterprise	0.035	3.28***
Square of capital	-0.000004	-2.37***
Per cent of capital in paddy activity (prcpdy)	1.725	5.40***
Square of prcpdy	-0.014	-4.08***
Years of GB membership	-4.984	-1.25
Age of the member	-0.489	-0.99
Years of schooling of the member	1.22	0.68
Amount of land owned by the household	-0.022	-0.18
Dummy for area 1	13.93	1.40*
Dummy for area 2	36.693	3.85***
Dummy for area 3	-39.74	-2.99***
Dummy for area 4	-9.484	-0.94
Constant	30.024	1.13
Adjusted R ²	0.54***	
Value of F	10.73	
RESET2 t-value	-0.53	
B-P test-statistic (chi-sq.d.f3)	2.38	
Sample size	132	

Note: *** ** * denote one tailed significance at 0.01, 0.05, 0.10 probability levels respectively.

Source: Survey of Grameen Bank villages, 1985.

The length of time a woman has been a member of the Grameen Bank may be interpreted to have an income effect because a family's economic situation improves with the length of membership. This variable has a negative coefficient which is significant at the 10 per cent level. In the equation in Table 2, this variable is insignificant. Therefore, its negative effect is not certain.

The other factors considered, namely, age and education did not have any influence on productivity at all, with very low t-statistics. The results of the equation containing these variables are reported in Table 3. The amount of land owned by the household as a supplementary resource to raise productivity, or as an alternative source for using a woman's labour, did not have any influence on women's labour inputs into the Grameen Bank enterprises (Table 3). These variables were, therefore, excluded in the final equation (Table 1).

Four area dummies were included to capture regional differences. It is difficult to assess the implications of these differences. Three of the area dummies are significant. There may be some difference in the motivation factors associated with cultural differences or even a difference in the effectiveness of the staff of the Grameen Bank branch associated with loan operations.

The test for functional form given by RESET2 t-values are insignificant for the equations in Tables 1 and 3. This test gives a significant t-value for the equation in Table 2 where the squared value of the variables are excluded. This indicates that there is scope for improving this form in Table 2 but that the forms in Tables 1 and 3 are acceptable. None of the equations had a problem of heteroschedasticity; B-P tests in all the equations are insignificant.

The determinants of male labour inputs are examined to see whether family characteristics and factors related to productivity have the same type of influences on male labour input as they had on female labour input. If the type of influences are dissimilar, it establishes that their utility functions are not identical or that they are not guided in their choices by a family utility function.

There are additional complications in the analysis of the determinants of male labour input into the Bank financed enterprises of female members of the Grameen Bank. The models of labour allocation are based on the assumption of no market-based opportunity cost of labour. This poses no problem for the analysis of women's labour. Women in Bangladesh are culturally constrained from working and as such the Grameen Bank financed enterprises were their only source of employment. Many of the male workers were, however, involved in employment for wages.

Table 4 Factors influencing male labour input into Grameen Bank financed enterprises: results of OLS regression including all variables on a priori grounds

Explanatory variable	Dependent variable: average male labour input into the enterprise in previous month (hours)	
	Coefficient	t-value
Total number of earners in family	-10.12	-2.34***
Total capital in the enterprise	0.007	0.51
Square of capital	0.0000008	-0.38
Per cent of capital in paddy activity (prcpdy)	0.34	0.82
Square of prcpdy	-0.01	-1.39*
Amount of cultivable land owned	-0.05	-0.36
Number of dependent members	-1.31	-0.54
Dummy for having a baby	6.84	0.76**
Dummy for area 1	-19.80	-1.67**
Dummy for area 2	-11.01	-1.00**
Dummy for area 3	-29.64	-1.78**
Dummy for area 4	-10.13	-0.82
Constant	71.78	3.17***
Adjusted R ²	0.09	
Value of F	1.98**	
RESET2 t-value	1.98***	
B-P test (chi-sq.d.f.3)	3.72	
Sample size	125	

Note: *** ** * denote one tailed significance at 0.01, 0.05, 0.10 probability levels respectively.

Source: Survey of Grameen Bank villages, 1985.

Analysis of male labour supply on the basis of models of self employment is possible on the assumption that the amount of other employment is given exogenously. This assumption is not unreasonable in view of widespread underemployment and non market clearing wages. Wage employment of women is determined exogenously and not chosen by the workers. The amount of such exogenously given wage employment determines the amount of time available for other activities and therefore needs to be taken into account in analysing the variation in labour input into Grameen Bank financed activities. In the absence of such data the present analysis uses area dummies to capture some of this influence as regional variations may be responsible for differences in the amount of wage employment obtained by a worker.

Another complication is that some of the male workers worked on a family farm. Since labour allocation among different types of family employment is based on the equality of marginal productivities, factors which influence marginal productivity of farm employment will influence the labour input of male workers into the Grameen Bank financed enterprises. In this respect, farm size is one of the crucial variables.

The same variables as included in the equation for female labour input (Table 1), with farm size as an added regressor, are included as explanatory variables in the equation for determinants of labour input by male workers. The dependent variable is labour input per male worker in a family and the sample consists of only those families which have male working members.

Tables 4 and 5 present the results of the regression analysis of the determinants of average labour input per male worker. Many of the explanatory variables do not have significant coefficients (Table 4).

Table 5 Factors influencing male labour input into the Grameen Bank financed enterprises: OLS regression results, final equation

Explanatory variable	Dependent variable: average male labour input into the enterprise in previous month (hours)	
	Coefficient	t-value
Total number of earners in family	-11.26	-2.76***
Total capital in the enterprise	0.003	0.93
Per cent of capital in paddy activity	-0.21	-1.73**
Dummy for area 1	-17.17	-1.52*
Dummy for area 2	-12.11	-1.12
Dummy for area 3	-32.15	-2.04***
Dummy for area 4	-6.48	-0.56
Constant	80.20	5.42
Adjusted R ²	0.10	
Value of F	2.97***	
RESET2 t-value	1.41	
B-P test (chi-sq.d.f.3)	4.62	
Sample size	125	

Note: ***, **, * denote one tailed significance at 0.01, 0.05, 0.10 probability levels respectively.

Source: Survey of Grameen Bank villages, 1985.

The number of dependent members, the dummy for having a baby and the size of cultivated land are not significant and have very low t-statistics. The inclusion of irrelevant variables may be responsible for the fact that the RESET2 test is significant, suggesting that the variables are not properly formulated. The most insignificant ones were therefore excluded and the equation was re-estimated. The results are presented in Table 5 which forms the basis of the following discussion.

Total capital is included as an explanatory variable in the final equation (Table 5) because it is a variable of central concern. It is retained to examine whether its significance improves after excluding irrelevant variables. This equation is statistically acceptable because the results of the econometric tests are favourable. The RESET2 t-value and B-P test are insignificant, although the value of adjusted R^2 is still low.

In this equation, the number of earners in the family has a significant negative coefficient in contrast to the equation for women's labour input. The influence of total capital on average male labour input is positive but not significant. These coefficients suggest that the negative income effect dominates male workers' labour allocation decisions. In conformity with these negative influences, the percentage of capital in paddy processing, which implies higher rates of return, has a negative and significant coefficient. This may also be due to the fact that paddy processing takes place within the household and, thus, compatible with other employment outside the household. Two of the area dummies are significant. This may mean, as noted, that the dummies capture the regional differences in the availability of wage employment.

The differences in the impact of various parameters on the labour allocation pattern of male and female workers reflects that the utility functions guiding their choices are different.

A cooperative or a bargaining solution?

When the utility functions are different for the two workers, it may be difficult to achieve cooperative equilibrium. Various authors (Pencavel 1986; Manser and Brown 1979, 1980; Becker 1981) recognize that labour allocation and other family affairs like marriage and fertility may involve bargaining as a decision making process.

In the analysis of labour allocation in the multi worker case, as in Model A, it was assumed that total income and their own leisure only enter into each person's utility function and that the marginal utility of income and leisure are both

positive. It then pays an individual to maintain their income level with an increase in the amount of his/her leisure, that is, at the cost of raising the labour input of the other worker, and each person will be motivated to do so.

Each person may try to reduce their own labour input as much as possible, with the assumption that the other worker will continue to supply what she/he would do if she/he were the only worker in the family. If there is no cooperation, the limiting case will be that no one works and there is no output. The non-cooperative zero income situation is not likely to be observed in practice because it is a minimum utility giving situation for both workers. The strategies will be revised by allocating labour on the basis of the actual utility function and a cooperative solution may be achieved.

In the case of lack of cooperation, a more likely scenario is that one worker will dominate the labour allocation decision. This will work through dictating the amount of labour input to be contributed by the other person and then choosing own labour input to maximize his/her own utility function.

Let worker 1 in a family have a higher bargaining power, while worker 2 has a lower bargaining power. Worker 1 with the higher bargaining power may decide that worker 2 should contribute a specific amount of labour input which is higher than the labour input worker 2 would contribute if they cooperated to arrive at an equilibrium solution by meeting the equality conditions a, b, c, d.

Worker 1 then chooses his/her labour input to equate his/her marginal utilities of labour and leisure. His/her choice is made on the basis of the following maximization process.

$$\text{Max } U_1 = U_1(Y, H, L_1, A_1)$$

Subject to:

$$\text{The family production function} \quad Y = f(T_{s1} + T_{s2}^*, C)$$

$$\text{Housework production function} \quad H = F(T_{h1} + T_{h2}^*, E)$$

$$\text{And, available of time} \quad T_{s1} + L_1 + T_{h1} = D_1$$

where T_{s2}^* and T_{h2}^* are the labour inputs of self employment and housework dictated to worker 2 and all other notations have the same meaning as in Models B and C.

The structural equation for his labour input in self employment will be

$$T_{s1} = g(A_1, A_2, C, E, T_{s2}^*, T_{h2}^*) \quad (5)$$

Even if the stronger party effectively dictates the amount of labour input from the other, this may be viewed as bargaining rather than coercion as long as the

weaker party is not compelled to contribute labour in excess of what she/he would voluntarily do if the other worker was not working.

Whether a bargaining solution prevails, and who would dominate that solution, is an empirical question. When a person is bargaining for a larger labour input from the other person, he/she does not reveal actual preferences. How far this can be done depends on a worker's capacity to 'wait and see'. The stronger party compels the other worker to contribute labour hours greater than the cooperative solution and this may rise up to a maximum of as much labour as he/she would do if he/she were the only worker in the family.

In a dominating solution, the labour input by the lower bargaining power worker will not depend on his/her own choice and would not satisfy the marginal criteria in conditions a, b, c, and d in Model A above.

The person who is dominating will equate his/her marginal utilities, thus, his/her labour allocation will conform to the predictions of labour allocation following from the equilibrium conditions. The labour input of the other person will have a negative impact on the dictating person's labour input. These conclusions may be empirically tested.

On a priori grounds it may be postulated that in a patriarchal society women will have lower bargaining power. In the case of Grameen Bank financed activities of this study, the female borrower is responsible for the repayment of loan instalments. Her need to generate more income may place her in a weaker bargaining situation, so she may be persuaded to contribute more labour input. In general, women in a family have to look after the day-to-day essential needs of the family, especially of the children, and therefore may be more eager to generate income and thus be in a weaker bargaining situation.

This question may be resolved empirically from the determinants of male and female labour input in these enterprises.

The possibility of bargaining as a determinant of labour allocation: empirical tests

It has been noted that if the labour input of one worker is dictated by others, then the labour input of that worker will not depend on her personal or family characteristics as it would have in the case of her own decision regarding labour input. Since the labour input of the female members of the Grameen Bank are found to be explained by variations in personal characteristics, the amount of capital, etc., it is likely that labour input was not dictated by others. A few

variables have similarly been identified to explain variations of labour input by male workers. It has also been noted that the same factors influencing the marginal rate of substitution between labour and leisure, have different types of influences on male and female labour input (Tables 1 and 5). This indicates that these workers do not have identical utility functions. The evidence suggests a cooperative solution prevails.

Table 6 Influence of female labour input on male labour input into the Grameen Bank financed enterprises: OLS regression to test whether female labour input has been dictated

Explanatory variable	Dependent variable: average male labour input into the enterprise in previous month (hours)	
	Coefficient	t-value
Total number of earners in family	-11.59	-2.83***
Total capital in the enterprise	0.002	0.52
Per cent of capital in paddy activity	-0.26	-2.01**
Dummy for area 1	-19.45	-1.69*
Dummy for area 2	-14.47	-1.31*
Dummy for area 3	-26.88	-1.63*
Dummy for area 4	-5.23	-0.45
Total female labour input	-0.10	-1.07
Constant	75.80	4.94***
Adjusted R ²	0.10	
Value of F	2.75***	
RESET2 t-value	1.41	
B-P test (chi-sq.d.f.3)	3.37	
Sample size	125	

Note: *** ** * denote one tailed significance at 0.01, 0.05, 0.10 probability levels respectively.

Source: Survey of Grameen Bank villages, 1985.

The hypothesis that labour allocation is based on a cooperative situation is confirmed by testing the interdependence of male workers' labour input with the female workers' input. If the labour input is dictated, the labour input of the person who dictates it will depend negatively on the labour input of other workers, controlling for the other factors which determine the dictating person's labour input. The labour input from other workers is included as an independent

variable in the OLS regression, along with the other factors that have been postulated to be relevant in determining labour input. The same exercise is carried out for labour input of female members of the Grameen Bank and labour input of male workers in those enterprises.

This variable did not have a significant negative influence. In the equation for labour hours of female members of the Grameen Bank, the coefficient of male labour input was positive. In the equation for male labour inputs the coefficient of female labour hours was negative though not significant. These results are presented in Tables 6 and 7. The evidence once again suggests that cooperative solutions decide the labour inputs in the Grameen Bank enterprises.

Table 7 Influence of male labour input on labour input of female members of the Grameen Bank: OLS regression estimates to test whether labour input of male workers has been dictated

Explanatory variable	Dependent variable: GB female member's labour input into the enterprise in previous month (hours)	
	Coefficient	t-value
Number of dependents	-2.54	-1.33*
Dummy for having a small baby	11.72	1.72**
Total number of earners in family	1.63	0.51
Dummy for marital status (widowed or divorced = 1)	21.59	2.12***
Total capital in the enterprise	0.035	3.43***
Square of capital	-0.0000042	-2.44***
Per cent of capital in paddy activity (prcpdy)	1.71	5.45***
Square of prcpdy	-0.01	-3.93***
Years of Grameen Bank membership	-5.08	-1.19*
Dummy for area 1	16.92	1.71**
Dummy for area 2	37.24	3.96***
Dummy for area 3	-35.38	-2.66***
Dummy for area 4	-8.06	-0.83*
Labour input of male workers	0.10	1.39*
Constant	7.99	0.38
Adjusted R ²	0.55	
Value of F	12.57***	
RESET2 t-value	-0.48	
B-P test (chi-sq.d.f.3)	1.97	
Sample size	132	

Note: *** ** * denote one tailed significance at 0.01, 0.05, 0.10 probability levels respectively.

Source: Survey of Grameen Bank villages, 1985.

Concluding comments

This study demonstrates the need to take into account the presence of multiple workers and their non-identical utility functions in determining labour allocation. Since male and female labour input are found to be influenced differently by the enterprise and family characteristics, it is not desirable to aggregate them and analyse only total family labour input. This study has important practical and policy making relevance, especially for a developing society like Bangladesh where the usual contention is that patriarchal pressure may not enable women to make independent labour allocation decisions. This study shows that such pressure is absent among a group of female entrepreneurs in Bangladesh. It also provides a methodology for testing the determinants of labour allocation in multi worker family enterprises.

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