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DETERMINANTS OF WOMEN'S TIME ALLOCATION  
IN RURAL BANGLADESH

by

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DETERMINANTS OF WOMEN'S TIME ALLOCATION  
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Shahidur R. Khandker

I. INTRODUCTION

Attempts are increasingly being made to adapt the economic theory of the household, pioneered by Becker and Gronau, to the examination of the time allocation behavior of rural households in developing countries.<sup>1</sup> The time allocation patterns of women in these countries, however, has received particular attention. This is perhaps because of two factors. The first is whether women's time allocation is governed by economic constraints as dictated by the economic theory of the household, or is determined exclusively by local customs such as "patriarchy" as proposed by an alternative theory.<sup>2</sup> The second factor -- since many women in developing countries generate cash income from family enterprises -- focuses on whether the women in the developing countries have a three-way or two-way choice structure for work decision. The three-way choice structure is whether "to work inside" or "to work outside" the family enterprise for cash income, or "not to work" for cash income. This choice structure is significantly different from the two-way choice structure -- whether "to work" or "not to work" for cash income outside the home -- which is typical of women in more developed countries. The need to identify the choice structure is of concern because the observed choice structure of women's work in the developing countries may warrant a more general economic theory than the one developed for the women working in the developed countries.<sup>3</sup>

Time budget studies from rural Bangladesh show that women work for (a) nonmarket production, (b) cash income production from employment in a family enterprise as unpaid family labor and (c) cash income production from paid employment outside the family.<sup>4</sup> An econometric study on the three-way choice structure of women's work in rural Bangladesh found that this structure is not statistically appropriate.<sup>5</sup> Instead, as this study shows, a two-way choice structure (i.e., whether "to work" in the labor force, consisting of self-employment in a family enterprise and paid employment in nonfamilial market production, both producing cash income, or "to work" exclusively for home production) is more appropriate for describing women's work patterns in Bangladesh. Thus, the transactions costs of switching from self-employment in a family enterprise to market wage production are not significant enough that women in rural Bangladesh find it difficult to substitute self-employment for market employment.<sup>6</sup> A woman's decision regarding her participation in the labor force may, however, be endogenously determined. This endogeneity may cause important selectivity bias in estimates of women's time allocation decisions.

The objective of this paper is to estimate a time allocation model for Bangladeshi rural women where both women's labor force participation decision and hours of work are jointly determined. For policy purposes it is more beneficial to examine the factors influencing time allocation of women rather than to note simple presence of women in one type of work category. Moreover, this study will identify whether sample selection bias is important for estimating women's time allocation in nonmarket production, an important category of work where both groups of women spend considerable amounts of their productive time. The study hopes

to shed light on the determinants of the economic roles of rural women in Bangladesh and in similar developing countries.

The paper is organized as follows: Section two outlines an economic framework that shows how labor force participation decision and hours of work are jointly determined and how participation decisions affect women's time allocation decisions. This framework is used to derive an econometric model of women's time allocation in Bangladesh. Section three presents the survey data used to empirically implement the model. Section four reports the results of the econometric estimates of the model. The final section summarizes the results and presents policy implications.

## II. WOMEN'S TIME ALLOCATION AND LABOR FORCE PARTICIPATION: AN ECONOMIC MODEL

The benefits of using the household unit as an organizing concept in studying the economic behavior of economic agents have been established. The household unit is viewed as making collective decisions that determine the behavior of each individual woman.

Assume that a household consisting of only husband (H) and wife (W) derives utility from home produced goods (N), market goods (Z), and leisure ( $L_i$ ,  $i=H,W$ ) of the husband and wife. The production of home-produced goods (N) requires resources, however. Hence, as the household attempts to maximize utility subject to the constraints it faces, home-produced goods competes with other goods, including the husband and wife's leisure. In addition to a time constraint, the household faces market and community constraints. These constraints affect the transaction costs of the goods that the household produces as substitutes for market goods and services.

More formally, the household is assumed to maximize the following utility function (1):

$$(1) \quad U = U (Z, N, L_H, L_W)$$

Assume that the home-produced good (N), is produced by a combination of market-purchased inputs (X), and the time input of only the wife ( $T_{WN}$ ). Thus, the nonmarket production of household is given by the relation:

$$(2) \quad N = N (X, T_{WN})$$

The household faces two separate time constraints, (3a) and (3b), which state that the amount of time spent by each member on market work, home production, and leisure cannot exceed his or her total amount of time ( $\Omega_i$ ,  $i=H,W$ ) available:

$$(3a) \quad \Omega_H = T_{HM} + L_H$$

$$(3b) \quad \Omega_W = T_{WM} + T_{WN} + L_W$$

The household also faces a budget constraint (4) which states that expenditure on market goods, used as inputs in household nonmarket production, cannot exceed the family income (I):

$$(4) \quad P_Z Z + P_X X = W_H T_{HM} + W_W T_{WM} + V = I$$

where  $W_i$  ( $i=H,W$ ) is the market wage rate of the husband and the wife,  $T_{iM}$  the amount of time he or she spends producing the market good,  $V$  the non-earned household income, and  $P_Z$  and  $P_X$ , respectively, the prices of market-purchased inputs  $Z$  and  $X$ .

Furthermore, for simplicity, assume that the production of home good ( $N$ ) is of a fixed-proportion type. This implies that inputs in nonmarket production vary proportionately with the amount of home goods produced:

$$(5a) \quad X_N = \gamma N,$$

$$(5b) \quad T_{NW} = \delta N,$$

where  $\gamma$  and  $\delta$  are, respectively, the marginal productivity of market-purchased input ( $X$ ) and the wife's time ( $T_{WN}$ ) in the production of the home goods. Now, using the relations in (2), (3), and (5) into (4), we rewrite the budget constraint as:

$$(6) \quad P_Z Z + \pi_N N + W_H L_H + W_W L_W = W_H \Omega_H + W_W \Omega_W + V = I^*$$

where  $I^*$  is the household's "full income", defined as the income the household earns if it decides to devote all of its time to market work, and  $\pi_N = \gamma P_X + \delta W_W$  is the shadow price for home-produced goods (N). Since the shadow price is a function of market prices, it follows that a change in market prices, such as the wife's market wage rate will have both direct effects, and indirect effects through the shadow price on the level of demand for the goods.

However, the wife's participation in market work is endogenous in that the household unit may decide on whether the woman participates in the labor market. If the wife does not participate, then the household faces an additional constraint:

$$(7) \quad T_{WM} = 0.$$

The maximization of utility function (1) subject to (6) and (7) yields the following optimum conditions:

$$(8a) \quad U_Z = \lambda P_Z,$$

$$(8b) \quad U_N = \lambda (\pi_N - \delta \mu),$$

$$(8c) \quad U_{LH} = \lambda W_H,$$

$$(8d) \quad U_{LW} = \lambda (W_W - \mu)$$

$$(8e) \quad I^* - P_Z Z - \pi_N N - W_H L_H - W_W L_W = 0,$$

$$(8f) \quad (\Omega_W - L_W - \delta N) = 0,$$

where  $\lambda$  is the marginal utility of income (positive), and  $\mu$  is the ratio of marginal disutility of market work to the marginal utility of income (negative). However, since the constraint (7) is not binding,  $\mu$  is zero if the wife decides to participate in the labor force.

The optimum conditions for the home-produced good (N) and the wife's leisure ( $L_W$ ) vary according to whether she participates in the labor force. A woman who participates in the labor force equates her marginal utility of leisure with the "imputed" market price she gets from market employment. In contrast, a woman who does not participate in the labor force equates her marginal utility of leisure with the "imputed" "virtual" or shadow wage,  $W_{W*} = (W_W - \mu)$  of her labor in self-employment. This is defined as the market wage plus the value assigned for her not supplying labor to market work.

For the woman who does not participate as well as for the woman who does participate in the wage market, the marginal utility of a home-produced good, such as a child, is equated with the "imputed" value of its shadow price. However, a nonparticipant woman evaluates the shadow price differently than does a participant woman. A woman who participates in the wage market evaluates the shadow price of home-produced good in terms of the market wage, while a woman who does not participate evaluates it in terms of the "virtual" price of her labor. Thus, a woman's time allocation is very much influenced by whether she participates in the labor force.

As outlined, the model yields a system of reduced-form equations for endogenous variables as functions of individual, household, market, and community constraints that set prices for goods and services that the household produces and consumes. In most cases, the effects of these constraints have indeterminate signs for most of the home-produced goods.<sup>7</sup> Of particular interest in this paper are the reduced-form equations for a

woman's time allocation in home and market productions, which are the following.

$$(9a) \quad T_{WN} = T_{WN}(W_H, W_W, \gamma, \delta, V, P_X, P_Z, \Omega_H, \Omega_W)$$

$$(9b) \quad T_{WM} = T_{WM}(W_H, W_W, \gamma, \delta, V, P_X, P_Z, \Omega_H, \Omega_W)$$

Note, however, that for a woman who does not participate in the wage market:

$$(9b') \quad T_{WM} = 0$$

#### Explanatory Variables

Different reasons can justify the inclusion of market prices, income earning (individual and household) assets, and individual- and household-level constraints as explanatory variables in women's time allocation.

Market-determined prices are the wages of two categories of labor: adult male and adult female. An increase in the male wages will induce an increase in the supply of the husband's labor to market work. This will induce a corresponding decrease in the wife's time allocation and participation in market work, if husband and wife are substitutes in production. Conversely, an increase in female wages, other things being equal, is expected to increase the wife's labor market participation and her time allocation to market production. However, if income effects from an exogenous wage increase dominate the substitution effects, a backward bending supply curve of labor to market work may result.

If schooling measures some form of child quality, household distance to the nearest school will stand as a proxy variation in the price

of child quality. Moreover, if a trade-off between child quality and child quantity exists, an increase in the school distance represents an exogenous increase in the price of schooling and decreases the quality per child. This induces a corresponding decrease in the shadow price of child quantity, thereby increasing the number of children in the family. Furthermore, if the children and the mother are substitutes in production, this implies that the children can substitute the mother's time in work at home; thus releasing the mother for market work.<sup>8</sup>

Household distance to a town, or market center, may serve as proxy variation in: (i) the transactions cost in purchasing goods for which the household can produce substitutes and (ii) the costs of market-oriented employment. Thus, an increase in the household distance to market center means a higher transactions cost for market-purchased goods and also higher employment costs for market-oriented employment. Together these may imply a decrease in the probability of a woman's participation in the labor force.

An individual characteristic -- education level -- can be treated as an explanatory variable that may indicate productivity potential, both at home and in market productions. Holding wages constant, an increase in the level of a woman's education can increase the probability of a woman's participation and time allocation in market production, if it increases her opportunity costs for staying at home. This may also imply an increase in a woman's time allocation in home production if education increases her home productivity. Thus, the ultimate effect of an increase in a woman's education level is indeterminant. In contrast, a man's education level and

the amount of resources he brought to the marriage affect a woman's time allocation by allowing her more time for home production and less time for market production. This may occur due to the positive wealth effects of potential earnings influenced by physical and human capital endowments.

The household's assets variable, such as landholdings, may act as proxy for productive household assets which exert both a price effect and an income effect on a woman's time allocation. The price effect would raise the marginal product or "shadow wage" of the woman's labor, while the income effect would encourage the household to consume more of the woman's leisure even at its given opportunity cost.

A single cross-section of household observations is unlikely to contain direct price variation of a substantial degree. However, geographical variations of different community-context variables (e.g., household proximity to market center or school) can provide variation in the "implicit" price for many goods and services that households produce for their own consumption. Thus, we can assess the effectiveness of government intervention programs from a data analysis by inferring information about the responsiveness of households to changes in prices which are relevant to household nonmarket production and consumption decision and which have been exogenously varied through government intervention programs.

### III. THE DATA AND ITS CHARACTERISTICS

The data for this paper is drawn from a more expansive sample of 500 households in rural Bangladesh. The sample was randomly drawn from eight Upazilas selected from regions to the north, east, and west of Dhaka as well as from a central part of Bangladesh.<sup>9</sup> Because of the geographical variations, we expect price variations in this dataset.

Data on time allocation of women is classified under two categories: home production and market production. Market production includes work both inside and outside the home for cash income production. Our data analysis focuses on married women between the ages of 15 and 49. This limited our sample from 500 to 444 housewives. Among these 444 women, 195 women participate in the market-oriented production, while the remaining 249 women worked only in home production.<sup>10</sup>

Table 1 present the means and standard deviations of the dependent and independent variables for the two groups of women. As the Table suggests, time use in home production is lower for women participating in market production than for women who work only in home production. This is, however, not unexpected. More interesting are the characteristics that distinguish the two groups of women. For instance, women who participate in market-oriented production are younger than women who do not participate. Women who participate in market production also live closer to a major market center than do women who do not participate. Participating women (and their spouses) also have much more schooling than do women who do not participate in market production. Since schooling levels are much higher for the participant women and their spouses, the

**Table 1:**  
**Mean and Standard Deviation (S.D.) of Variables**  
 (444 observations)

Variable name	<u>Nonparticipant</u>		<u>Participant</u>	
	Mean	S.D.	Mean	S.D.
<u>Endogenous variables:</u>				
Woman's time allocation in home production	278.2	46.66	134.5	64.16
Woman's time allocation in market work	-	-	213.8	63.17
<u>Exogenous variables</u>				
Woman's age (in years)	33.75	8.36	29.95	6.06
Woman's education (years)	2.32	3.15	6.72	5.01
Husband's education (years)	5.15	4.62	8.43	5.01
Husband's premarriage asset (in '000 current Taka)	48.84	75.60	17.98	33.26
Land holding (hectare)	1.23	1.12	0.92	1.70
School distance (km)	1.03	1.13	1.94	3.56
Distance to town (km)	6.94	3.52	4.82	4.55
Predicted male wage (Taka)	33.21	11.33	40.98	12.57
Predicted female wage (Taka)	19.48	7.63	30.36	12.68
Sample size	249		195	

**Note:** Nonparticipant group includes those women who do not participate in the labor force. In contrast, participant group includes those women who participate in the labor force. Time allocation data is expressed in yearly mandays. Distance variables are calculated on the basis of individual household's responses of its distance to the nearest school and nearest major market center. Market center in most cases refers to the Upazila headquarter, the source of all institutional services. Predicted wages of husband and wife are based on the estimates of separate wage functions for the subsample of men and women who participate in the labor force for paid job.

predicted wage offers for both are much higher for the participant group than for the nonparticipant group.<sup>11</sup> However, the husband's premarital assets are almost three times higher for women who do not participate in market production than for women who do. Thus, substantial differences exist across these two groups of women, both in terms of time allocation and specific characteristics. A woman's decision to participate in the labor market influences her time allocation in home production differently than from a woman who decides not to participate. This is, however, an empirical issue which we now address.

#### IV. EMPIRICAL RESULTS

Table 2 presents the probit estimates of labor force participation for women, while Table 3 presents the results of time-use (in man-days) for women in home production. All women in the sample allocate their time in home production so that time-use data for all women in home production is used to first estimate this time allocation equation. However, since whether women participate in nonfamilial market work is an endogenously determined decision, the estimates of home time allocation equation may suffer from possible sample selection bias.<sup>12</sup> If the unmeasured characteristics influencing sample selection and home time allocation are jointly normally distributed, then the influence of the selectivity associated with participation in nonfamilial production can be "taken out" of the home time allocation estimates. This is done by first estimating the participation equation for the whole sample using probit, and then including the Mills-ratio estimate associated with the self-selected subsample in the home time allocation equation. Thus, the inclusion of the Mills-ratio variable in the home time allocation equation not only eliminates the selectivity effects of participation in nonfamilial production, but its coefficient also provides a consistent estimate of the covariance between the unmeasured characteristics in the home time allocation and participation equations.

Although the results in Table 2 suggest that women's labor force participation is a decision endogenously determined, this endogeneity does

Table 2  
**Probit Maximum Likelihood Estimates of  
 Women's Labor Force Participation**

Exogenous Variables	Parameter estimate	t-Statistic
Intercept	-3.502	-0.673
Woman's age	-0.073	-1.066
Woman's education	-2.142	-1.567
Husband's education	0.780	4.023*
Landholding	-0.661	-4.103*
Husband's premarriage assets	-0.014	-3.591*
Distance to schooling	0.175	4.266*
Distance to town	-0.032	-0.854
Predicted male wage	-0.313	-4.345*
Predicted female wage	0.906	1.789*
(-2.0)x Log-Likelihood ratio	211.121	
Sample size	444	

**Note:** Dummy dependent variable = 1, if a woman participates in the labor force (195 observations), 0 (249 observations) otherwise. Asterisk refers to significance level of 10 percent or better.

not, however, yield any significant difference in home time-use behavior between women who do and women who do not participate in the labor market. This is evident in Table 3; the Mills-ratio coefficient is not significant in the equation for either participant or nonparticipant group. Both groups behave similarly when using their time in home production. This implies that in rural Bangladesh a woman's time-use in home production bears a fixed-proportional relationship to the home-produced goods such that sample selection bias in home time allocation is not important.<sup>13</sup> It follows, therefore, that the OLS estimates of home time allocation equation that includes samples of both participant and nonparticipant women are the appropriate estimates of women's time allocation in home production.

In contrast, time allocation to market production is clearly subject to sample selection bias. Since time-use in market production is only positive for women who participate, while zero for those who do not participate, time allocation in a market-oriented production is a censored variable. In this case, a censored regression technique (i.e., a Tobit method) is used to estimate women's time allocation in market production.<sup>14</sup> The censored regression results, presented in Table 4, suggest that women's time allocation in market production is well explained by individual, household, market, and community constraints as dictated by the economic theory of the household.

The predicted male and female wages included in the regression sets are based on separate regressions (not shown in the paper) of wage offers for each group of participant men and women in terms of age, schooling, and household distance to the market center.<sup>15</sup> Apart from its

Table 3: Estimates of Women's Time Allocation in Home Production

Exogenous Variables	OLS estimates of all samples	OLS estimates of nonparticipants	OLS Estimates of participants
Intercept	80.248 (0.336)	-943.892 (-3.816)	351.363 (1.124)
Woman's age	-2.192 (-0.704)	-17.283 (-5.065)*	1.599 (0.391)
Woman's education	-14.233 (-0.244)	-355.186 (-5.292)*	10.539 (0.129)
Husband's education	-19.524 (-2.133)*	18.093 (1.521)	26.178 (1.712)*
Husband's premarriage assets	0.122 (2.111)*	0.022 (0.390)	-0.255 (-1.509)
Landholding	20.552 (2.761)*	0.976 (0.103)	-21.642 (-1.693)*
Distance to town	5.677 (3.299)*	8.078 (4.656)*	1.572 (0.728)
Predicted male wage	8.330 (2.463)*	-6.833 (-1.492)	-9.632 (-1.625)*
Predicted female wage	1.667 (0.073)	138.589 (5.236)*	-5.357 (-0.163)
Mills' Ratio		9.714 (0.393)	38.192 (1.195)
R <sup>2</sup>	0.3642	0.1523	0.2438
Sample size	444	249	195

Note: t-Statistics are in parentheses. Asterisk refers to significance level of 10 percent or better.

Table 4: Censored Regression (Tobit) of Women's Time Allocation in Market Production

Exogenous variables	Parameter estimate	t-Statistic
Intercept	-238.741	-0.393
Woman's age	-6.922	-0.846
Woman's education	-215.386	-1.381
Husband's education	90.435	4.113*
Husband's premarriage assets	-0.899	-4.568*
Landholdings	-79.344	-4.568*
Distance to schooling	17.163	3.108*
Distance to town	-8.745	-1.791*
Predicted male wage	-36.733	-4.453*
Predicted female wage	93.709	1.632*
Log-likelihood	-1373	
Estimation method	maximum likelihood method	
Sample size	444	

Note: Asterisk refers to significance level of 10 percent or better.

significant effects on market productivity, women's education seems to have negligible effects in both the participation and the time allocation equations. In contrast, men's education appears to have significant positive effects both for women's labor force participation and time allocation in market production.<sup>16</sup>

Women's wage and the household distance to school that increase the probability of women's participation in the labor force have significant positive effects on women's time allocation in market production, and negative effects on time allocation in home production. Thus, the factors such as female market wage that increase a woman's market productivity can increase a woman's participation as well as time allocation in labor market production. An increase in the household distance to school means less school enrollment of children, perhaps indicating higher participation and higher time allocation of women in market production, if the children can substitute for the mother's time in home production.<sup>17</sup>

On the other hand, variables such as a husband's premarital assets, landholding, male market wage, and the household distance to market center decrease women's participation in market-oriented production. These have significant negative effects on a woman's time-use in market production, and positive effects on her time-use in home production. These results are consistent with a priori expectations. Thus, the factors such as a man's premarital assets, landholding and male wage that reflect the husband's earnings or wealth effects increase the wife's time allocation in

home production. In contrast, an increase in distance to market center increases the transactions cost of market-oriented production, thereby reducing the probability of a woman's participation and hence, time allocation in market production.

## V. Policy Implications and Conclusions

Determinants of women's work patterns in rural households need to be identified for public policy programs that seek to improve the well-being of the rural population. Since women, who constitute more than half of the total population, are directly involved in the production of both market and nonmarket goods, their participation in development activities through their participation in market-oriented production may be a precondition for economic and social development in a country such as Bangladesh. Understanding the individual, household, market and community factors that cause variations in women's time allocation may lead to more successful government policies aimed at involving rural women in development activities in a rural economy.

This paper investigates one important aspect of women's time-use patterns in rural households, namely, whether women's time allocation in Bangladesh is governed by economic constraints or is determined exclusively by local customs such as "patriarchy". An economic model developed by Becker and Gronau is utilized to test this alternative hypothesis. However, to test the hypothesis, one needs to identify the number of independent categories of work that a rural woman can participate in. This is necessary for two reasons. First is the argument for possible self-selection bias in estimates of a time allocation model to the extent that a woman's presence in any distinct category of work is endogenously determined at the household-level. The second is a possibility that a three-way choice structure, if identified, may oppose a two-way choice

structure, and consequently, may warrant a general economic theory for women working in a country such as Bangladesh than the one developed for the women working in the developed countries.

Based on the empirical evidence that suggests that a two-way choice structure is more appropriate for Bangladeshi rural women, this paper utilizes the economic theory developed within a two-way choice structure to analyze the women's time allocation behavior in rural Bangladesh. The results indicate that a woman's time-use pattern is not fixed exclusively by the society but is partially influenced by individual- and household-level economic constraints. This suggests that the alternative hypothesis that the women's time allocation in rural Bangladesh is inflexibly fixed by local customs can be rejected. This also implies that women in rural Bangladesh respond to market opportunities when such opportunities are available. In other words, it is not the "patriarchy" but the limited market opportunities that restrict women from working either inside or outside a family enterprise for producing cash income. Therefore, if economic development proceeds in rural Bangladesh, it is likely that more women will increasingly participate in the market-oriented production even if "patriarchy" exists in rural Bangladesh.<sup>18</sup>

Sample selection bias due to endogeneity of female participation in the labor force does not affect the estimates of women's time allocation in home nonmarket production. This contradicts a priori expectation that a labor market participant woman and a nonparticipant woman may behave differently in using their time in nonmarket production. This finding

perhaps implies that a woman's time allocation in home production may bear a fixed-proportional relationship such that a woman's time allocation in market production does not affect her time allocation in home production.

Among the important determinants of women's time allocation in Bangladesh, it is the woman's spouse education that affects quite significantly both a woman's labor market participation decision and her time allocation in either market or nonmarket productions. In contrast, a woman's education, apart from its significant effects on market productivity, is not an important determinant for her time allocation. The finding that a woman's time allocation is determined not by her own endowment, but partially by her spouse's endowment, does not necessarily reflect that a husband works as a "patriarch" who determines exclusively his wife's time allocation in Bangladesh. To the extent that an educated woman is married to an educated man, this result may simply reflect a spouse selection bias due to the endogeneity of the wife's and husband's education levels determined partially by the parental characteristics of the wife and the husband.<sup>19</sup>

An increase in women's market wages increases women's participation in labor market production, a finding consistent with expectations. Similarly, modernization programs such as urbanization that increase market opportunities for women to participate in the market-oriented production also increase women's time allocation to labor market production. In contrast, a husband's physical (as opposed to human) endowments such as premarital assets or current landholdings can increase

a woman's home productivity and, hence, keep women away from market-oriented production, perhaps due to their induced wealth effects on women's time-use.

Government provision of schooling in the form of reducing schooling costs for children may increase the quality and reduce the quantity of children. However, since women and children are substitutes in current production, this reduces women's participation in market-oriented production. This need not be the case, however. As children, particularly female ones, receive more education following a decrease in schooling costs, they may choose more market work as adults. As this occurs, it is likely that at some point children will stop being substitutes for women in home production, and instead become pure consumption goods (requiring more home production by the mother). This would mean that more education of today's female children will mean more education for the mother which in turn will mean fewer children and also more participation of mothers in labor market production.<sup>20</sup> This is currently observed in more developed countries, and evidence suggests that this "pure consumption good" effect of children is also present in Bangladesh, although at present it is dominated by the children's labor substitutability effect.

It is indeed important for policy purposes to distinguish the factors that influence women's labor market participation from the factors that keep women away from market-oriented activity. This exercise clearly indicates that it is not the "patriarchy" per se that restrict women from working in labor market production. The other factors, such as limited

market opportunities, that may partially keep rural women in Bangladesh away from market-oriented production. From this perspective, the relevant policy variables of particular interest are clearly the market interventions concerning women's wages, public delivery system of schooling, particularly for the female population, and above all, modernization programs that increase market opportunities for women. However, modernization programs and market interventions may yield more immediate and direct results than the female schooling delivery system. But, nevertheless, it is the human capital investment rather than the market interventions that can increase more sharply women's labor market productivity and hence, labor market participation, and to this effect, investment in female schooling is a necessary long-run policy objective that deserves particular attention from the policymakers.

NOTES

- \* Views expressed in this paper are those of the author, and do not necessarily reflect views of the World Bank. ~~The author acknowledges support from the Ford and Rockefeller foundations and wishes to thank Robert Evenson, Paul Schultz and two anonymous referees for helpful comments, and Paul McGuire for computer assistance. The author retains full responsibility for any remaining errors or shortcomings.~~
1. Gary S. Becker, "A Theory of the Allocation of Time." Economic Journal (September, 1965): 493-517; Reuben Gronau, "The Intrafamily Allocation of Time: The Value of the Housewives' Time." American Economic Review (September, 1973): 634-651; Robert Evenson, "Time Allocation in Rural Philippine Households." American Journal of Agricultural Economics (1978): 322-330.
  2. An alternative theory as opposed to the economic theory of the household is given in Mead Cain, S.R. Khanam, and Shamsun Nahar, "Class, Patriarchy, and Women's Work in Bangladesh." Population and Development Review (1979): 405-438. According to this theory, powerful local norms of female seclusion due to "patriarchy" extend to the labor market and this severely restrict women from working outside the family.
  3. The concern essentially is what makes it important about the distinction between women's self-employment and market employment for cash income and how would the independent variables be expected to affect one differently than the other. Before addressing this concern, however, one needs to identify whether the three-way choice is at all a valid categorization of women's work patterns in a given country context, since it is likely that validity of such a choice structure may vary from country to country.
  4. S.R. Khandker, "Women's Role in household Productive Activities and Fertility in Bangladesh." Center Discussion Paper No. 488 (New Haven: Yale University, Economic Growth Center, 1985), Journal of Economic Development (forthcoming).
  5. S.R. Khandker, "Labor Market Participation of Married Women in Bangladesh." Center Discussion Paper No. 514 (New Haven: Yale University, Economic Growth Center, 1986).
  6. The high substitutability between self-employment and market wage employment may imply that women's market-oriented production in rural Bangladesh remains at its pre-modern level such that a woman does not find it difficult to switch from self-employment to market employment.

This contrasts the findings of a study which shows that a woman in Japan finds it difficult to switch from self-employment to either home production or market wage production. See M. Anne Hill, "Female Labor Force Participation in Developed and Developing Countries -- Consideration of the Informal Sector." Review of Economics and Statistics (1983): 459-468.

7. See, for example, Gronau for comparative static results of some exogenous variables.
8. Another partial effect of an increase in school distance is to increase the mother's time in home production for child bearing, if not for child rearing. Therefore, whether a woman will participate in labor market production due to an increase in school distance depends on two opposing partial effects.
9. Upazilas are "upgraded" Thana administrative units, covering roughly an area of 100 square miles, and consisting of several Unions. Unions in turn are collection of a number of villages. The Upazilas covered under this study are respectively, Baidyerbazar (Dhaka district), Ghatail (Tangail district), Kownia and Kotwali (Rangpur district), Sherpur (Jamalpur district), Laksam (Comilla district), Ishardi (Pabna district), and Gabtali (Bogra district). For more detail of the data collection, see Khandker (1985).
10. The original three-way choice categories of work are, respectively, producing no cash income (i.e., working for non-market home production); producing cash income in family enterprise, and producing cash income from employment outside the family. Producing no cash income involves house chores such as cooking, cleaning, fetching water and firewood, caring for the children and the elderly, washing and serving food. In the rural areas of Bangladesh, it also includes post-harvest operations of crops, such as threshing, drying, winnowing, and sifting for paddy, kitchen gardening, and tending to domestic animals. Producing cash income in family enterprise includes activities such as family business, sewing, handicrafts, and rice husking where a woman works either as a partner or an unpaid family worker. Producing cash income from employment outside the family includes those activities that require women to work outside the home, such as teaching, non-agricultural wage work, and other salaried services. Although these three categories appear distinct, econometric study shows that producing cash income in a family enterprise and market cash employment are highly substitutable in that they are not statistically two distinct categories of work. See Khandker (1986).
11. The predicted wage offers are based on the estimated wage offers for women and men working outside the home for cash using the approach suggested by Heckman. See, James Heckman, "Sample Selection Bias as a Specification Error." Econometrica (1979): 153-161.
12. See James Heckman.

13. In fact, following equation 8(b), home time allocation behavior of a participant woman cannot be different from that of a nonparticipant woman if  $\mu = 0$  for a nonparticipant woman. Since marginal disutility of market work is negative by assumption,  $\mu$  can be zero only if the marginal utility of income of a nonparticipant woman is infinity.
14. See G.S. Maddala, Limited-dependent and Qualitative Variables in Econometrics. (London: Cambridge University Press, 1983).
15. In addition to age, schooling and distance to market center, the mills' ratio coefficient based on the participation equation is included in the wage equation. The inclusion of Mills' ratio then purges out the selectivity effects in wage equation due to participation in cash income production. These results suggest that education level of an individual significantly affect his or her market productivity.
16. This finding seems to contradict a priori expectation that if the husband's education reflects the effect of the husband's earning on women's time-use, an increase in husband's education decreases a woman's labor market participation and, hence, time-use in market-oriented production. See, Gronau, "Leisure, Home Production, and Work -- the Theory of the Allocation of Time Revisited." Journal of Political Economy (1977):1099-1123.
17. Results clearly indicate that a mother and children are substitutes in current production in Bangladesh.
18. This is simply because even a "patriarch" cannot forego a high opportunity cost for keeping women away from market-oriented activities as a result of women's increasing market-opportunities with the pace of economic development.
19. If information on parental characteristics were available, one could have used predicted instead of actual schooling levels of husband and wife in the regressions that would have removed the influence of spouse selection bias from the estimates.
20. One study shows that as a woman's education increases, it reduces fertility and also increases the woman's participation in market-oriented production. See Khandker (1985).

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