Women's Schooling, Home Teaching, and Economic Growth

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April 1997

The research for this paper supported in part by grants NIH HD30907 and NSF SBR93-08405.

Increased investment in schooling is often promoted as a key development strategy aimed at promoting economic growth. Most of the micro evidence that has been used to support the importance of schooling in augmenting incomes in low-income countries comes mainly from data describing the returns to schooling for men (e.g, Psacharopolous (1994)). Given the relatively low rates of participation by women in formal-sector labor markets in such countries, information on the potential contribution of women's schooling to income is less available and where found problematical to interpret due to labor market selectivity. Advocates of development and poverty reduction policies that emphasize investments in female schooling, however, suggest that significant returns to women's schooling are to be found in the household sector, where the schooling of women has important effects on the human capital of future generations (Haveman and Wolfe 1995, Hill and King 1993, Schultz 1993a,b, Summers 1992, UNDP 1996, World Bank 1990, 1992). One argument of development strategists, in particular, is that better educated mothers are superior teachers in the home, so that investments in women's human capital complement those in schools (e.g., Forum for African Women Educationalists 1996).

In principle, estimates of the technology of human capital production provide direct evidence on the extent to which mothers with higher levels of schooling are more productive home teachers. That is, for given investments in children, more educated mothers produce children with higher levels of human capital. Because of the difficulty of obtaining credible information on all human capital inputs, however, almost all of the estimates in the literature do not attempt to identify the production technology but describe the relationship between maternal schooling and child schooling net of the influence of other, more readily measurable, family characteristics, such as income and paternal schooling.[1] The estimated relationship between maternal and child schooling thus reflects not only home technology but also the constraints and preferences of household members. The interpretation of these behavioral relationships therefore depends

[1]Recent examples for low-income countries include Alderman *et al.* (1996) for Pakistan; Barros and Lam (1996) for Brazil; Deolalikar (1993) for Indonesia; Lillard and Willis (1993) for Malaysia; Glewwe, Grosh, Jacoby and Lockheed (1995) for Jamaica; Glewwe and Jacoby (1995) for Ghana; Hossain (1989) for Bangladesh; Parish and Willis (1993) for Taiwan and Murray (1997) for the United States in the 19th century.

on the structure of household decision-making.

An important alternative interpretation of the maternal-child schooling association, based on conceptions of households in which individuals optimize and bargain (Lundberg and Pollak (1996)), is that mothers with higher levels of schooling have superior options outside the household that confer to them greater command of resources within the household, which they choose to allocate to children at higher levels than would men (Folbre (1984, 1986), Haddad, Hoddinott and Alderman (1996), Thomas (1990)). While this view is not incompatible with the hypothesis that schooling actually augments home skills for women, it presupposes that women's schooling has returns outside the household. More importantly, it implies that the expansion of options for women in the labor market along with enhanced investments in women's schooling is necessary to achieve greater investments in children. However, growth in female employment opportunities, which may be difficult to affect via specific program interventions in a short period of time, is not a necessary condition for achieving greater schooling investments if schooling enhances women's productivity in the home production of human capital and there are returns to schooling men.

Of course, the observed positive associations between the schooling of mothers and their children admit to a number of other interpretations. More schooled women may contribute more income to the household, in environments in which their schooling has earning returns, which may lead to increased investments in child schooling even if all household incomes are pooled and schooling has no in-home productivity effects. In this latter case, just as in the bargaining interpretation, a necessary condition for female schooling to induce increased child schooling is that schooling for women reap a return in the labor market. Finally, men with greater preferences for schooling may marry women with higher levels of schooling and invest more heavily in their children's schooling. The schooling of wives and children may be more highly correlated with men's preferences for schooling than men's own schooling in settings where own schooling is principally determined by parents.

In this paper we develop a model of household decision-making in order to assess empirically the

contribution of maternal schooling to investments in children's schooling while taking into account the roles of preferences for schooling in the home and in the marriage market; the effects of schooling on home productivity, household bargaining power, and the time costs of household activities; and differential returns to schooling for men and women in the labor market. The framework is used to demonstrate, among other results, that the returns to female schooling in the marriage market mirror those in the labor market and in the home. These linkages are exploited using data describing the demand for educated wives and household investments in schooling in rural India before and during the "green revolution," a time when the returns to men's but not women's schooling rose substantially in the farming sector, investments in the schooling of both boys and girls increased at comparable rates, but in which the apparently limited role of women in agricultural decision-making or in rural formal-sector employment activities remained unchanged. We show that in this context, in which the schooling of women appears not to contribute directly to household earnings or to enhance their opportunities outside the household, it is possible to establish a number of tests, using information from both the marriage market and from the household, of the hypothesis that schooling enhances women's ability as home teachers that are robust to the influences of schooling on household bargaining and of unobserved preference heterogeneity.

In section I we develop the model of household schooling investment incorporating individual decision-making consistent with household bargaining models, differential preferences for child schooling between men and women, and marital choice. In particular, we allow maternal schooling to be endogenously chosen, to affect household income, and to affect a woman's bargaining position, in addition to potentially augmenting child schooling in production. We specify the model in two stages, first in a one-period model in which maternal schooling is taken as exogenous and children's schooling does not directly affect household income. We then extend the model to two stages to allow marital choice and an income producing sector in which son's schooling has a return. The two-stage version incorporates key features of the Indian setting that we study to develop tests that identify the mechanisms by which increases in the schooling of women affect the schooling of children. Section II describes the Indian setting and the data and

sections III and IV present results of the tests.

The estimates indicate that despite the absence of any evident increase in employment activities by women in sectors in which schooling is rewarded and the lack of participation by women in farm decisions associated with the new technologies, the demand for schooled, in particular literate, wives increased more rapidly in the high agricultural growth areas, where returns to evidently male-dominated farm management skills rose. Consistent with the interpretation of this as derived demand for female schooling as an input in the production of child schooling, estimates that exploit the extended structure of Indian households to reduce the influence of male preferences for schooling, variation in market returns to schooling, and wealth effects indicate significantly higher levels of study hours among children with literate mothers. Finally, estimates of the determinants of dowry values indicate that, consistent with female literacy having value to men rather than providing an improved post-marriage bargaining position for women, literate women command a premium in the marriage market. Schooling achievement by women beyond levels that enable literacy, however, are not associated with higher levels of child study nor with enhanced value in the marriage market. The results from the Indian green revolution experience, which suggest that literate mothers are better teachers for children in the home, thus imply not only that investments in female schooling payoff where there are returns to schooling anywhere in the market sector, no matter how segmented by sex, but help explain why after the onset of the green revolution in India there was increased investment in both boys and girls schooling at approximately the same rates, despite very low returns in the labor market to investments in girl's schooling.

I. Theoretical Framework

A. The Generic Model: Maternal Schooling, Household Bargaining and Household Production

We initially assume that each family in the economy is exogenously formed and composed of two parents, the mother and father, and a single child. Each parent cares about his or her own private consumption as well as a child good. In particular, the utility for each parent i in family j is

$$u_i(c_{ij}, z_j) = \ln(c_{ij}) + \eta_i z_j \qquad \textbf{(1)}$$

where c_{ij} denotes private goods consumption by parent i in j; i=M,F for mother and father, respectively; and z_j denotes the level of the composite child good. Note that preferences for the child good, captured by η_i, may differ between men and women.[2] The child good is produced according to a production function z() that has as inputs the level of human capital h_j of the child and the level of market goods x_j provided to the child:

$$z_j = z(h_j, x_j) \quad \textbf{(2)}$$

We assume that the time of parents and children and school goods in the human capital production function are perfect complements, and the function has the form

$$h_j = \min(e^H(h_{Mj})H_{Mj} + \zeta e^H(h_{Fj})H_{Fj}, H_j, b_j) \quad \textbf{(3)}$$

where H_{ij} is the own time of parent i in j devoted to child human capital production, H_j is the time of the child spent in his or her own human capital production, and b_j denotes school goods purchased in the market such as books and supplies as well as school fees. Equation (3) incorporates the possibility that the efficiency of each parent's time in the production of human capital depends on his or her own level of schooling h_{ij}, as reflected in the functions $e^H()$. If $e^{H'}(h)>0$ then an individual with higher human capital is more efficient in the production of child schooling - the schooling-production effect. We have assumed for simplicity that maternal and paternal time in human capital production are perfect substitutes in efficiency units, allowing for any differences in the relative productivity of the two sexes through the parameter ζ.

Parents may work in two income-generating sectors for wages, which we will denote as unskilled (e.g., agricultural wage work) and skilled (e.g., non-agricultural salary jobs). Analogously to the treatment of parental time in (3) we allow a parent's human capital to affect his or her productivity as a worker, with the extent of this effect being different by sector. Output per unit time of an individual with human capital h in (non-entrepreneurial) unskilled or agricultural labor is $e^A(h)$ while that in the skilled wage sector is $e^N(h)$. Labor markets are assumed to be competitive with the time-specific wage per efficiency unit of labor in

[2]Preferences for the child good may also differ among men and women. We defer the discussion of the implications of preference heterogeneity for identifying the effects of parental schooling on child schooling in section III below.

sector s being w^s for s=N and A.

Because of the assumption that workers are indifferent to the sector they work in given its wage, the total labor time $T_{ij}^T=T_{ij}^A+T_{ij}^N$ of parent i will be allocated to that sector in which he or she receives the highest wage per unit time. Thus, the wage of an individual i with human capital h is $w^*(h) = \max(w^A e^A(h),w^N e^N(h))$ and i devotes his or her labor time if any to sector N if $w^A e^A(h_{ij})<w^N e^N(h_{ij})$ and sector A otherwise. We denote the preferred labor market sector of individual i in family j by s_{ij}^*. We assume that children have no effective human capital, and that their wage is w^c. To further simplify, we also assume that parental productivity is log-linear in schooling $e^H(h)=\exp(\phi^H h)$, $e^A(h)=\exp(\phi^A h)$ $e^N(h)=\exp(\phi^N h)$, a specification comparable to that used by Foster and Rosenzweig (1996b) to study comparative advantage and allocation to tasks within agriculture. With $\phi^N>\phi^A$ and assuming positive employment in both activities, individuals with low schooling will allocate themselves to sector A, that is $s_{ij}^*=A$. Assuming that all members of family j may work up to T units of time and that the household has R_j units of exogenous income, full-income is

$$y_j=T\ [w^*(h_{Mj})+w^*(h_{Fj})+w^c]+R_j \qquad \textbf{(4)}$$

It is easily seen, given this structure, that the minimized cost to the household of producing each unit of human capital for the child h_j given $h_j<\exp(\phi^H \min(h_{Mj},h_{Fj}))T$ is:

$$\omega_j=\omega(h_{Mj},h_{Fj})=\min(w^{s_{Mj}^*}\exp((\phi^{s_{Mj}^*}-\phi^H)h_{Mj}),\frac{1}{\zeta}w^{s_{Fj}^*}\exp((\phi^{s_{Fj}^*}-\phi^H)h_{Fj})))+w^c+p_b \qquad \textbf{(5)}$$

If, as we shall assume, parental differentials in schooling are sufficiently large given ϕ^s and ζ to ensure that the cost per efficiency unit of mother's time in the production of human capital is less than that of father's time, then all schooling time will be provided by the mother and the unit cost of schooling will be

$$\omega_j=\omega(h_{Mj},h_{Fj})=\exp((\phi^{s_{Mj}^*}-\phi^H)h_{Mj})+w^c+p_b \qquad \textbf{(6)}$$

Note that the effect of an increase in maternal schooling on the unit price of schooling depends critically on the relative magnitudes of ϕ^H, ϕ^N, and ϕ^A and may well be non-monotonic. If, as appears to be the case based on the evidence presented below, $\phi^N>\phi^H>\phi^A$ then the shadow price of schooling will be decreasing in

maternal human capital at low levels of maternal human capital and increasing at higher levels.

We characterize the programming problem in terms of optimization by the father, who maximizes his own utility, given by (1), subject to (2) through (6) and to the additional constraint that he must provide his wife a given level of utility $v_{Mj}=v_M(h_{Mj})$. The budget constraint is then

$$p_x x_j + p_{cM} c^*_M(z_j, v_{Mj}) + p_{cF} c_{Fj} + \omega_j h_j = y_j \qquad \textbf{(7)}$$

where, given (1), $c^*_M(z_j,v_{Mj})=\exp(v_{Mj} - \eta_M z_j)$ is the minimum level of private consumption that must be provided to the mother so that she achieves her reservation utility v_{Mj} for some given level of the child good z_j.

The first-order condition for the father's problem with respect to the schooling of the child is:

$$\eta_F \frac{\partial z_j}{\partial h_j} = \lambda(\omega_j - p_{cM}\eta_M c^*_M \frac{\partial z_j}{\partial h_j}) \qquad \textbf{(8)}$$

where λ is the father's marginal utility of income. This expression indicates that the shadow price of a son's schooling is affected by the opportunity cost of the child's and mother's time as reflected in ω_j. In addition, the marginal cost of child schooling is influenced by the bargaining position of the mother, as determined by her reservation utility, and her preferences. The second term on the right-hand side of (8) is the marginal savings for the father associated with the reduction in the amount of his wife's private consumption that she must be provided to maintain her at her reservation utility when there is an increase in the child's schooling. In particular, the more the mother prefers child schooling, i.e., the greater is η_M, the cheaper is investment in schooling for the optimizing father.

It is clear from (8) that if a mother's schooling affects either her reservation utility or her value of time in the labor market then variations in maternal schooling will result in variations in child schooling even if1 there is no schooling production effect. The effect of an increase in maternal schooling on the education of the child is:

$$\frac{\partial h_j}{\partial h_{Mj}} = \Delta_{Mj} w^{s^*_{Mj}} \exp(\Delta_{Mj} h_{Mj}) \frac{\partial h^c_j}{\partial p_b} + w^{s^*_{Mj}} \exp(\phi^{s^*_{Mj}} h_{Mj})[\Delta_{Mj} H^{s^*_{Mj}} + \phi^H T] \frac{\partial h_j}{\partial R_j} + \frac{\partial v_{Mj}}{\partial h_{Mj}} [p_{cM} \frac{c_{Mj}}{c_{Fj}} (\frac{\eta_M}{\eta_F} - 1) \frac{\partial h^c_j}{\partial p_{cF}}] \qquad \textbf{(9)}$$

where the superscript c denotes a compensated effect (i.e., holding both husband's and wife's utility constant) and $\Delta_{Mj}=\phi^{S^{*}_{Mj}}-\phi^{H}$, the difference in the effects of maternal schooling on her market wage and on her productivity in human capital production.

Equation (9) indicates that the effect of maternal schooling on child schooling can be divided into three parts. The first two conform to the standard substitution and income effects whose sign and magnitude in this case depend on the sign and magnitude of Δ_{Mj}, the difference between the productivity effect of maternal schooling in the market and in the home. The third term arises from the necessity of providing the wife her reservation utility - the "bargaining" effect. It can be seen from (9) that if higher levels of maternal schooling are associated with higher reservation utilities for women, then the sign of the bargaining term depends on the relative preferences of men and women for the child good z; i.e., on the ratio η_M/η_F. Expression (9) shows that the usual assumption (e.g., Thomas (1990)) that a greater claim by the mother on household resources tends to result in greater child schooling requires asymmetric preferences, and in particular that $\eta_M/\eta_F>0$. For $\eta_M=\eta_F$, in which case preferences exhibit transferable utility, the schooling of the child is invariant to changes in either the relative well-being or bargaining power of the two parents.[3]

Expression (9) makes clear that in settings in which a women's schooling strongly affects her market work value it is difficult to identify the home productivity effect ϕ^H from the association between a mother's and her child's schooling estimated from a child schooling demand equation, because that relationship reflects both the effect of schooling on the opportunity cost of home time and its effect on maternal bargaining power (given asymmetric preferences between men and women). There are two special cases that provide identification of either the bargaining power/reservation utility or home productivity effects of maternal schooling on child schooling: (i) maternal schooling "neutrality," where the home and market schooling productivity effects are equal ($\Delta_{Mj}=0$), in which case the reservation utility effect is

[3]This is a standard implication of transferable utility in the presence of household public goods (see Bergstrom 1997).

identified, given knowledge of income effects, and (ii) absence of labor market effects of women's schooling, in which case the home productivity effect ϕ^H is identified, assuming that where increased schooling does not augment market earnings for women, women's reservation utility levels are invariant to schooling. Given that the first case is unlikely, and difficult to prove in any case, it is therefore desirable to carry out tests of the presence of maternal schooling-productivity effects in a population with low labor-market schooling returns for women.[4]

B. Endogenizing Maternal Schooling: Marital Choice, Agricultural Production and Productivity Change in the Indian Context

The simple one-period model illustrates the difficulty of identifying the routes by which increases in women's schooling affect investments in child schooling, and in particular whether maternal schooling augments efficiency in human capital production. It is possible, however, to draw additional inferences about home productivity and bargaining power effects of maternal schooling by examining the demand for wives' schooling in the marriage market, and in particular how the demand for schooled wives is influenced by changes in the returns to schooling for men unaccompanied by changes in the market returns to women's schooling. To examine these issues, we need to allow for spouse choice in the model. We therefore extend the model to two stages and add a marriage market and an agricultural production sector. The model reflects the characteristics of the Indian setting to which our data pertain in which sons typically stay with the family head and daughters leave the household for marriage.

At the beginning of the first stage each adult male is assumed to choose a spouse and to have two children, one of each sex. He then chooses the allocation of time across activities and private good consumption for himself and his spouse and time allocation for his two children subject to (i) time and budget constraints and (ii) the reservation utility requirement for his wife. In the second stage he marries off his daughter and allocates his and his wife's time and that of his grown son, providing both his son and

[4]We discuss below identification of home productivity effects on schooling in settings in which direct labor market returns to woman's schooling are low but schooling may have bargaining effects.

wife with sufficient consumption to keep the household intact.

The household is assumed to own a farm asset A_j. Farm profitability depends on the level of technology θ and on the speed with which technology is changing. As established in Foster and Rosenzweig (1996a), the effect of technological change τ on profitability is assumed to be influenced by the maximum schooling within the household, h_i^{max}, as would be expected if the more schooled individuals in a given household have a particular advantage in the management and adoption of new agricultural techniques and there is no market for these entrepreneurial activities.[5] Under these conditions, agricultural profits given A_j are

$$\pi_j = \pi(A_j, h_j^{max}, \theta, \tau) \quad \textbf{(10)}$$

with

$$\frac{\partial \pi}{\partial \tau \partial h} > 0 \quad \textbf{(11)}$$

In the first stage children have no human capital, and, by assumption, the father has at least as much schooling as the wife.[6] In the second stage, the son and daughter have completed their schooling and the daughter has been married out. Marriage by the daughter has resulted in a net marital payment (dowry) of $\delta_G(h_{Gj}, \zeta)$ that depends on her level of human capital and a parameter ζ that summarizes conditions in the marriage market (i.e., the characteristics of the relevant marriage-market area affecting supply and demand for brides by schooling). Also the son must be provided a level of consumption c_{Bj} sufficient to keep him from setting up a separate household in which he would receive an indirect utility $v_B(h_{Bj}, A_{Bj}, \theta_j, \tau_j)$ that depends on his schooling, his claim on household assets A_{Bj}, and technology. Letting the second stage

[5]This joint management of the land contrasts with the very different production structure in many African households, where men and women cultivate separate plots (Udry (1996)).

[6]In the data set used in this paper wife's schooling exceeds husband's schooling in only 3 % of cases. Although we are not aware of any Indian data that directly assesses the roles of men and women in agricultural decision-making, recent survey data from Bangladesh (Rahman et al. (1997), where, as in India, within households men's schooling attainment is almost universally greater than women's, indicate, on the basis of responses by married women, that in only 20% of farm households were women at all involved in farm-management decisions.

utility of the unmarried son be $u_B(c_{Bj})$, we may define the function $c_B^*()$ as:

$$c_{Bj}=c_B^*(h_{Bj},A_{Bj},\theta,\tau)=u_B^{-1}(v_B(h_{Bj},A_{Bj},\theta,\tau)) \quad \textbf{(12)}$$

If t corresponds to the first stage and thus period t+1 the second stage, the full-income budget constraints in each stage are:

$$y_{jt}^F=\pi(A_j,h_{Fj},\theta,\tau)+T\ [w^*(h_{Mj})+w^*(h_{Fj})+2w^c]+R_j \quad \textbf{(13)}$$

$$y_{jt+1}^F=\pi(A_j,h_{Bj},\theta,\tau)+T\sum_{i\in M,F,B} w^*(h_{ij})-c_B^*(h_{Bj},A_{Bj},\theta,\tau)-\delta_G(h_{Gj},\zeta) \quad \textbf{(14)}$$

The lifetime budget constraint is then

$$p_x x_j+p_{cM}c_M^*(z_j,v_{Mj})+p_{cF}c_{Fj}+\omega_j\times(h_{Bj}+h_{Gj})=y_{jt}^F+y_{jt+1}^F+\delta_G(h_{Mj},\zeta) \quad \textbf{(15)}$$

where the subscripts B and G on h index the son and daughter, and we have assumed for notational simplicity that income can be transferred costlessly across periods. The final term on the right hand side of (15) is the net dowry received by the man upon marriage and is analogous to the expression for the net marital transfer out made upon marrying off a daughter.

The solution to this optimization problem may be characterized in terms of (i) demand equations conditional on maternal schooling for the set of post-marriage goods K, including child schooling ($K=h_B$, h_G), child and parental time by activity ($K=H_{kj}^s$), paternal consumption ($K=c_{Fj}$) and the composite child good (K=z), of the form:

$$K_j=K^*(h_{Mj},h_{Fj},A_j,R_j,\boldsymbol{p},\boldsymbol{w},\eta_M,\eta_F,\theta,\tau,\zeta) \quad \textbf{(16)}$$

and (ii) the unconditional demand for maternal schooling

$$h_{Mj}=h_M(h_{Fj},A_j,R_j,\boldsymbol{p},\boldsymbol{w},\eta_F,\theta,\tau,\zeta) \quad \textbf{(17)}$$

In this expanded model, the effect of local technical change on the demand for maternal schooling in the marriage market, from (17), can provide additional information on the bargaining and home productivity effects of maternal schooling. Given the patrilocal set-up in which boys remain on the farm and wives are imported to (daughters exported from) the local area, locality-specific technological change

increases the return to schooling boys, but not girls, if agricultural technological change and men's schooling are complements and women do not participate in farm decision-making.

For notational simplicity, we assume for the purpose of deriving comparative statics that the household only has a boy child. This assumption does not alter the qualitative implications of the model given the export of daughters. Then it can be shown that the effect of technical change on the demand for maternal schooling in the marriage market is given by:

$$\frac{\partial h_{Mj}}{\partial \tau} = \frac{(\frac{\partial h_{Bj}^{*}}{\partial \tau})\Delta_{Mj}\exp(\Delta_{Mj}h_{Mj}) - p_{cM}\eta_{M}c_{Mj}\frac{\partial v_{Mj}}{\partial h_{Mj}}(\frac{dz_{j}^{*}}{d\tau})}{\Psi} \qquad \textbf{(18)}$$

where Ψ is the derivative of the first-order condition for maternal schooling with respect to h_{Mj}, with $\Psi<0$ for an interior maximum, and

$$\frac{\partial h_{Bj}^{*}}{\partial \tau} = (-\frac{\partial^2 \pi_{j}}{\partial h_{Bj}\partial \tau} + \frac{\partial^2 c_{Bj}^{*}}{\partial h_{Bj}\partial \tau})\frac{\partial h_{Bj}^{c*}}{\partial p_{b}} + (\frac{\partial \pi}{\partial \tau} - \frac{\partial c_{Bj}^{*}}{\partial \tau})\frac{\partial h_{Bj}^{*}}{\partial R_{j}} \qquad \textbf{(19)}$$

is the derivative of son's schooling with respect to technical change conditional on maternal schooling (i.e., from equation (16)). Assuming that an increase in the speed of technical change raises farm profits more than it raises the son's income claim[7] and that this differential is increasing in child schooling, both the income and substitution effects in (19) will be positive.[8] Because it can also be shown that the demand for the child good z increases with τ, the sign of the effect of an increase in technical change on the demand by men for schooled farm wives (18) will be determined by the relative magnitudes of the differential home and labor-market productivity effects of maternal schooling (Δ_{Mj}), the bargaining power effect of women's

[7]A plausible sufficient condition for this assumption is that the son's reservation utility is determined by the income he could earn by separately farming his own claim of the family land and the son and father do not have the same level of schooling.

[8]This follows if there are constant returns to scale in production, the son in autarchy faces the same technology as the father, and the son's schooling exceeds the father's. The reason is that the difference between profits under joint production and those under separate production will be higher when there are larger differences in schooling and when τ is larger. For further discussion of this issue and evidence see Foster and Rosenzweig (1996a).

schooling ($\partial v/\partial h$), and the willingness of women to trade off private consumption for child schooling (η_M).

Note that, in contrast to the relationship between child and maternal schooling in (9), the sign of the bargaining power effect of technical change on the demand for maternal schooling is not dependent on the relative magnitudes of husbands' and wives' preferences for the child good: it is always positive.[9] This follows from the fact that with technological change men will demand higher levels of schooling for their children for any given level of maternal schooling. As child schooling also is valued by the wife, this implies that at higher levels of technical change the incremental private good consumption required to compensate a woman with incrementally higher reservation utility is lower ($\partial^2 c_{Mj}^*/\partial z_j \partial v_{MJ} = -\eta_M c_{Mj}^* < 0$) in high technical-change areas. The technological change effect on wives' schooling in the special case of maternal schooling neutrality ($\Delta_{Mj}=0$) identifies whether female schooling improves the bargaining position of mothers in the household without any assumptions about sex differences in preferences. In the case in which labor market effects of women's schooling are absent, one should observe both a positive relationship between maternal and child schooling, as in expression (9), and a higher demand for schooled wives in high technical-change areas, as in expression (17), only if there is a home productivity effect.

It is possible that more schooled women have better opportunities outside marriage even where there are (locally) low and stagnant labor market returns to schooling for women and/or low levels of labor market participation by women. Such features of the local setting do not always imply that such returns would not arise if the women were to leave the household, either through the marriage market or through movement to other sectors of the economy than those typically entered by a women married into agricultural households. If so, then even in settings in which women do not work it can be seen from (9) and (17) that it is not possible to distinguish between a schooling-based bargaining effect and a home productivity effect of maternal schooling from evidence on the relationship between maternal and child schooling, given that women are child-biased (i.e., they more highly value the child good than do men), or

[9]More generally, the finding of a positive bargaining effect depends only on the assumption that z is normal for the wife.

from the relationship between agricultural technical change and the demand for schooled wives even if women are not child-biased.

One method of identifying the existence of a productivity effect of maternal schooling in child schooling investment when the effect of schooling on maternal bargaining power cannot be ruled out, with some added structure, is to examine the effect of maternal schooling on child goods for which there is no direct own productivity effect of maternal schooling. One example is child consumption x. The assumption that parents care about x only through its effect on the composite child good z, along with the additional assumptions that the production of the child z-good is characterized by homotheticity, the human capital production function is CRS, and the childrens' financial return to schooling are constant[10] imply that the difference in the elasticities of child human capital and the child good with respect to maternal schooling is

$$\epsilon_{h_B h_M} - \epsilon_{x h_M} = \Delta_{Mj} w^{s^*_{Mj}} \exp(\Delta_{Mj} h_{Mj}) \left[\epsilon^c_{h_B p_b} - \epsilon^c_{x p_b} \right] \qquad \textbf{(20)}$$

where ϵ_{ij} is the elasticity of i with respect to j and ϵ_{ij}^{c} the corresponding compensated elasticity, and we have again assumed for simplicity that the couple only has a son. Because changes in the wife's reservation utility have the same percentage effect on the demand for x and the child schooling input under these assumptions, the elasticities of the two inputs with respect to maternal schooling will be equal only if maternal schooling does not directly influence the cost (efficiency) of schooling production. Moreover, because the difference in compensated elasticities on the RHS of (20) must be negative, the sign of the LHS of (20) provides the sign of Δ_{Mj} and thus the relative magnitude of the maternal schooling effect on home and labor market productivity. For settings in which maternal schooling does not affect market returns the sign of the home productivity effect ϕ^H is identified from (20) even if there are bargaining effects of schooling.

Where maternal schooling effects on labor market returns are low, it is also possible to test for the existence of a bargaining effect by examining the pricing of schooled women in the marriage market. The

[10]That is, δ_G must be linear in h_G and π, and c_B^* must be linear in h_B.

model implies that in the absence of market returns to female schooling or of a productivity effect of maternal schooling within the home, female schooling, by increasing women's bargaining power, imposes a cost on men. In particular, if the maternal schooling effect operates only by requiring an increase in transfers from the husband to the wife within marriage in order to meet the reservation utility requirement, then an optimizing man would not find it in his interest, *ceteris paribus*, to select a more educated wife. To see this we note that the first-order condition for the optimal maternal schooling chosen by the man is

$$2Tw^{s^*_{Mj}}\phi^{s^*_{Mj}}\exp(\phi^{s^*_{Mj}}h_{Mj})-\Delta_{Mj}(h_{Bj}+h_{Gj})\exp(\Delta_{Mj})+\frac{\partial\delta_{Mj}h_{Mj}}{\partial h_{Mj}}-p_{cM}c^*_{Mj}\frac{\partial v_{Mj}}{\partial h_{Mj}}=0 \qquad \textbf{(21)}$$

where h_{Bj} and h_{Gj} are the human capital levels of the son and daughter determined in the first-stage. The first term is the marginal contribution to household full income from an increase in maternal schooling that arises from any labor-market return. The second term captures the effect of an increase in maternal schooling on the shadow cost of child schooling, which will contribute positively to the LHS of (21) if Δ_{Mj} <0 or $\phi^H>\phi^{s*}$, in which case schooling has a greater effect on productivity in schooling production than in the labor market. The third term reflects the market relationship between dowry and schooling. The final term captures the effect of the wife's schooling on her reservation utility and thus on the level of her claim on private consumption in the household. This term is negative where a woman's schooling increases her bargaining power.

Expression (21) shows that, for a given dowry payment δ_{Mj} and with maternal schooling having no productivity benefits (ϕ^{s*} and ϕ^H=0), the net value of maternal schooling *to men* is negative if schooling has positive bargaining power effects for women in marriage that do not arise from labor market productivity effects. That is, in the presence of bargaining effects but not market or home productivity effects of women's schooling, men would require higher levels of transfers (net dowry) to marry more schooled women. Bargaining power effects would be manifested in a positive relationship between net dowry and wife's schooling. Indeed, where female schooling is unproductive in the home and in the market the dowry-female schooling gradient should exactly equal the marginal value of the loss to the man's utility

from marrying a women with an additional year of schooling. The presence of a negative female schooling-dowry gradient where labor market schooling returns for women are low, however, would suggest that the contribution of women's schooling to home production is positive.[11]

II. The Setting: Women and the Indian Green Revolution

The "green revolution" in India began in the mid to late 1960's with the importation of new, high-yielding seeds developed outside of India that substantially augmented agricultural productivity and economic growth where soil and weather conditions within India were hospitable. Agricultural incomes rose fastest in those areas with the most appropriate soil and climate characteristics and, within those areas, among farmers who adopted the new seeds most rapidly and most efficiently. Foster and Rosenzweig (1996a) and Rosenzweig (1995) have shown that the schooling of farmers played a key role in new seed adoption and in increasing the profitability of the new seeds.[12] In particular, there was a substantial increase in the returns to primary, but not higher, schooling levels for farmers in areas in which potential farm productivity rose fastest because of the sustained supply of suitable new seeds with improved characteristics over time.

Foster and Rosenzweig did not examine the role of women's schooling or its returns. However, as we show below, the direct contribution of women's schooling to agricultural productivity appears to have been minimal in the first 15 years after the introduction of the new seeds. The early green revolution setting therefore has potential for illuminating the home schooling production effect of women's schooling. We use data from the two surveys used by Foster and Rosenzweig, which describe rural households across India over the period 1968-1982. The first data set, the National Council of Applied Economic research

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[11]Note that consideration of the demand for maternal schooling in the marriage market suggests that where the schooling of mothers is productive in producing child schooling, the relationship between maternal schooling and children's schooling will be attenuated by the fact that families with more schooled women have lower income (from lower dowry) compared with households, otherwise similar, containing less schooled women.

[12]See also Pitt and Sumodiningrat (1991) for evidence on the effect of schooling on the adoption and profitability of new-technology seeds in Indonesia.

(NCAER) Additional Rural Incomes Survey (ARIS), was initiated in the first years of the green revolution and provides longitudinal information for a national sample of 4,118 households pertaining to the crop years 1968-69, 1969-70 and 1970-71 on use of high-yielding seed varieties, household structure, schooling, income, and agricultural inputs and outputs. The villages (250), districts (96) and states in which the households reside are also identified in the coded data, enabling identification of spatial differentials in productivity growth.

In the crop year 1981-82, NCAER conducted a resurvey of the 1970-71 households, the Rural Economic Development Survey (REDS), as well as a survey of newly-formed households to obtain a stratified representative sample of all Indian households in 1981-82. These data thus provide panel information on a subset of the original 1970-71 households covering the period 1971-82 and a second data set describing the rural population in India in 1982 based on the same survey design as in the ARIS. A useful element of the REDS data for the purpose of this analysis is detailed information on the allocation of time, by season, of all women and children during the crop year 1981-82. Unfortunately, comparable information is not available in the earlier ARIS survey.

As is evident from the discussion of the model, the interpretation of estimates of the relationship between children's human capital and maternal schooling depends importantly on the extent to which maternal schooling influences household income and/or a woman's bargaining position. It is therefore important to determine the extent to which women's schooling yields direct financial returns and how any such returns are influenced by technical change. To assess the direct effects of women's schooling in agricultural production in the context of the green revolution, we modify and reestimate the new seed adoption equation in Foster and Rosenzweig (1996a) and the farm profit equation in Rosenzweig (1995) from the early ARIS data to include the schooling of adult women in the household as well as the schooling of adult men. Table 1 reports, for a sample of 2532 farm households residing in districts in which at least one sample farmer was cultivating with HYV seeds, maximum-likelihood logit estimates of the relationship between the probability that a farm household ever adopted the new high-yielding seed varieties (HYV

seeds) by 1970-71, the highest level of schooling attainment of any adult man and adult woman in the household, the amount of owned land, and variables indicating residence in a district with a government program designed to facilitate the adoption of the new seeds, the Intensive Agricultural District Program (IADP), or a village with an extension program. The highest schooling level is divided into two categories - primary schooling and literacy. The logit estimates reported in column one replicate the finding in Foster and Rosenzweig that farm households containing at least one adult who had completed primary schooling were significantly more likely, controlling for land size, farm equipment and irrigation facilities, to have adopted the new seeds by 1970-71. However, as shown in columns two and three, having a primary-schooled or literate adult women in the household does not appear to significantly affect whether a household adopted the new technology.

The data also indicate that the schooling of women did not contribute to the efficient use of the new seeds once adopted, in contrast to the schooling of men. Table 2 reports results, based on a similar methodology to that used in Foster and Rosenzweig (1995), from the ARIS panel data that relate the profitability of HYV seeds to the maximum schooling of adult men and women in the household among farm households who had adopted the new seeds in the 1969-70 and 1970-71 crop years. The estimation procedure exploits the panel dimension of the data to eliminate the influence of fixed, household-level unmeasured attributes such as land quality and farmer skills as well as lagged shocks to profitability by differencing across years and instrumenting the differenced variables. In this interactive specification, the differential effects of the planting (acreage) of HYV seeds on farm profits by male and female schooling is identified. The results indicate that HYV profitability was significantly higher in farm households in which at least one adult male had completed primary schooling, as found in Rosenzweig (1995), but HYV profitability was evidently no higher in households in which any adult women had completed primary schooling or was literate given male schooling.

The results from Tables 1 and 2 indicate that female schooling played a minimal role in the agricultural production sector even during the green revolution, although such effects were evident for male

schooling. It is possible, however, that female schooling importantly contributed to household income and to the bargaining position of married women through the non-agricultural sector. It appears, however, that there was only a limited increase in the participation of women in the nonagricultural wage and salary sector in which schooling-augmented skills are potentially rewarded, and no increase for literate women. Figure 1 displays non-agricultural sector participation rates in 1970-71 and 1981-82 for married adult men and women in farm households for three schooling groups - illiterate, literate, and completed primary schooling. As can be seen, in 1970-71 less than three percent of married farm women participated in this sector in all schooling groups, with no discernible pattern by schooling. In contrast, there is a positive relationship between schooling level and non-agricultural work participation by farm men in the same year, with the participation rate of primary schooled men in the non-agricultural sector 40% higher than that of literate men and almost five times higher than that of women who were primary school graduates. In 1981-82, schooling level and non-agricultural labor force participation are positively related for both farm men and women, with women who are primary school graduates having almost twice the participation rate of women who are only literate, although in this later period less than five percent of farm women who are primary school graduates are working outside of agriculture.

Another possible source of financial returns to women's schooling is urban employment. Although such returns would obviously not affect the incomes of rural farm households, they could influence household resource allocations through their effects on the reservation utilities of women in these households. Recent evidence suggests, however, that in urban areas of India women with primary or lower levels of schooling, who account for 97% of women with any schooling in rural areas as of 1982, do not receive higher wages than unschooled women. Kingdon (1997) finds no significant differential between the wages of non-schooled women and women who were primary school graduates but with no additional schooling among women who worked in 1996 in urban Uttar Pradesh, taking into account the selectivity of

women's (very low) rates of labor force participation,[13] although women with higher levels of schooling earned significantly more than either group.[14] Unni (1995) obtained similar results based on household surveys in urban Tamil Nadu and Madhya Pradesh, in which returns to female primary school graduates who had no further schooling were insignificantly different from zero. In these latter two urban areas, returns to primary schooling among men with no further schooling were on the order of 3% and were statistically significant.

III. The Demand for Wives' Schooling and Technical Change

The data thus suggest that while the green revolution enhanced the value of men's schooling in farm production and was associated with increased participation by men residing in farm households in non-agricultural employment, the contribution of women's schooling to household income from the farming sector or from the rural non-agricultural sector remained minimal. If there were no other contribution of women's schooling, we would expect a widening of the gap between male and female schooling attainment subsequent to the arrival of a steady stream of new, more productive seeds that evidently raised the return to male schooling. However, despite the absence of any significant increase in returns to female schooling or literacy in the labor market caused by the green revolution, rates of both female literacy and male literacy rose in rough parallel after the onset of the green revolution.

The marriage histories provided in the 1970-71 ARIS and 1981-82 REDS data permit the construction of aggregate time-series data on the schooling of newly-wed men and women in farm households, men at approximately age 25 and women at age 20, prior to and after the start of the green revolution. Figure 2 displays by quinquennia from 1962-66 through 1977-81 the literacy rates of newly-married men and women in farm households for all of India, except the state of Assam, based on the

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[13]Only 14.5% of women 15-59 who were not students worked for pay in the week preceding the survey; 77.1% of men worked in the same week.

[14] Urban areas thus would appear to provide improved opportunities only for the 2.5% of rural women (as of 1982) who had obtained schooling above the primary level.

retrospective marriage histories merged from the two data sets.[15] The graph indicates that rates of young farm men's literacy rose from 51% to 63% while that of their brides rose from 28% to 41% between the 1962-66 and 1977-81 quinquennia. Bride's literacy remained essentially unchanged between the 1962-66 and 1967-71 period but rose by almost a third by 1972-76 and continued to rise in the next five years by about ten percent. Thus, despite the almost 25% percent increase in literacy rates in the 15-year period after the onset of the green revolution for young farm men and the evident absence of any increases in the market returns to female schooling, the gap between bride and groom literacy rates in farm households remained roughly constant at about 22 percentage points.

One possible reason why male and female schooling rose in parallel is that large discrepancies in schooling within a marriage are undesirable. As suggested by expression (18), however, the demand for maternal schooling should increase in particular in high technical-change areas for given levels of men's schooling, even in the absence of any increased labor market return to women's schooling, if women's schooling facilitates the production of child education and there is an increase in the returns to and therefore the demand for men's schooling in such areas. The ARIS and REDS marital histories can be used to construct a time-series on the schooling of newlyweds at the village level that can be used to assess whether the schooling of brides in high technical-change areas, for given schooling of young men, rose more than the schooling of brides marrying in slow-growth areas. Note that given the spatial differentials in the productivity-enhancing effects of the availability of new seeds caused by differences in agroclimatic conditions, the schooling of brides is a more sensitive and immediate indicator of changes in the locale-specific demand for female schooling than that of grooms given the common practice of village exogamy: while it is not possible to instantaneously increase adult male or female schooling attainment in response to perceived increases in schooling returns in any locality, the schooling attainment of brides can be increased quickly in an area by importing educated women from other areas (with presumably lower rates of

[15]Specifically, information on marriages prior to 1970-71 are from the ARIS data; that for marriages occurring after 1970-71 are from the REDS data.

technical change).

The analogue to (17), in linear form, is

$$h_{Mj} = \sum_k \beta_k S_{jkt} + \beta_\theta \theta_{jt} + \beta_\tau \tau_{jt} + \mu_j + \nu_{jt} \quad \textbf{(22)}$$

where h_{Mjt} is the schooling of a bride in village j at time t; the S_{jkt} are family composition variables, such as the age and schooling composition of the groom's household and the groom's age and schooling; θ_{jt} is the level of agricultural technology in j at time t; τ_{jt} is technical change at t in j; μ_j captures time-invariant village characteristics such as land quality, soil and weather conditions, marriage customs and groom preferences; the v_{jt} are i.i.d. errors and the β are coefficients.

We assume, as in Foster and Rosenzweig (1996a), that technology shocks are autocorrelated. In particular, we assume that technical change in village j at time t, $\tau_{jt}=\theta_{jt}-\theta_{jt-1}$, exhibits first-order autocorrelation: $\tau_{jt}=\rho\tau_{jt-1}+\epsilon_{jt}$. Assuming $\rho>0$, this expression captures in a relatively simple way the notion that areas that are well suited to the adoption of new seeds in one period are also likely to be well-suited to the adoption of seeds that become available in subsequent periods. This structure is consistent with the evidence that in the Indian green revolution, areas benefitting from early growth exhibited more rapid growth in subsequent periods.

It is difficult to measure θ_{jt} and τ_{jt}; in particular, to distinguish in the cross-section between the level of technology and local fixed endowments in an area, as reflected in μ_j. However, the ARIS panel data can be used as in Foster and Rosenzweig (1996a) to estimate area-specific measures of technical change τ_{jt} for the initial green-revolution period 1968-1971 by estimating in first differences, and thus eliminating the influence of μ_j and time-invariant components of local agricultural technology, a conditional, farm-level profit function incorporating village dummy variables and individual farm assets, inclusive of schooling. The coefficients on the village dummy variables measure village-specific differences in profit growth rates net of changes in farm assets; i.e., the τ_{jt}, for the period 1968-71.

To obtain estimates of the determinants of the schooling of brides, we use data describing

newlyweds' schooling and farm household characteristics for 227 villages for which we could estimate the τ_{jt} for the first three quinquennia depicted in Figure 2. Assuming that there was no significant technical change in the pre green-revolution period 1962-66 and that the profit-function estimates from the ARIS panel provide τ_{jt} for the first green-revolution (1967-71) period, then in first differences (22) becomes

$$Dh_{Mjt} = \sum_k \beta_k DS_{jkt} + D\gamma_t \tau_{j0} + Dv_{jt} \qquad \textbf{(23)}$$

where D is the first difference operator, τ_{j0} is the village-level measure of technical change in 1967-71, and $\gamma_{62\text{-}66}=0$, $\gamma_{67\text{-}71}=\beta_\theta+\beta_\tau$ and $\gamma_{72\text{-}76}=\beta_\theta(1+\rho)+\beta_\tau\rho$, given the autocorrelated technology structure. By estimating (23) we can eliminate the influence of the fixed factor μ_j and the pre green-revolution technology and still identify whether the technological change effect on bride's schooling is positive ($\beta_\tau>0$) whatever the value of the technology level effect β_θ, given positive autocorrelation in technology shocks, if $\gamma_{67\text{-}71}>\gamma_{72\text{-}76}$. Indeed, if the effect of the level of technology on the demand for schooled wives β_θ is negligible, the autocorrelation coefficient ρ is identified from the ratio of the two period-specific τ coefficents. However, because brides become mothers, shocks to wives' schooling in an earlier period may influence the characteristics of grooms and the groom's household composition contained in the S_{jkt} in a subsequent period. To eliminate the covariance between the differenced family variables and the lagged errors contained in Dv_{jt}, we apply instrumental variables to (23), where the prior level of the differenced family state variables serve as instruments.

Table 3 reports the fixed-effects IV estimates of the determinants of wives' schooling based on the aggregate village quinquennial time-series. We use three categories of wives' schooling - literate, literate without completion of primary schooling, and primary schooling completion - and two categories for the groom's schooling - literate and completed primary schooling. Also included in the specification, besides the technical change measure and the schooling and age at marriage of the groom, are variables that measure the importing groom's current household composition, including the total number of adult men and married women and the number of literate men and married women. The combined technology change and

level effect on the demand for literate wives is statistically significant (.05-level, one-tailed) and positive in all specifications. The point estimates from column 2, where both period-specific technical-change parameter estimates are significantly greater than zero at the .05 level, indicate that $\gamma_{67\text{-}71}>\gamma_{72\text{-}76}$, which implies that $\beta_\tau>0$ as long as technical change is positively autocorrelated (and $\rho=.55$ if $\beta_\theta=0$). An interesting feature of Table 3 is that across the three columns, the differences in the τ coefficient estimates are consistent with the hypothesis that there is a greater demand for literate, but not primary schooled, wives in high-τ areas, given the schooling attainment of the groom.

IV. Mother's Schooling and Children's Study Hours

The evident absence of any significant rise in the returns to women's literacy in the labor market after the onset of the green revolution suggests that the increase in demand for schooled (literate) wives in high-growth areas, net of the effects of the rising schooling levels of men, indicated in Table 3 may reflect the existence of increased returns to the schooling of women in the household sector, as implied by (18). In this section we directly examine the relationship between maternal schooling and the time allocation of children and mothers in the household to assess whether, in particular, maternal literacy plays a productive role in the schooling of children. The REDS data provide information on time allocation - hours per day in three seasons of the crop-year 1981-82 for "typical" days in those seasons - for women and children in eleven categories, one of which is study hours (including time in school and homework).

As noted, a striking feature of the estimates in Table 3 is that demand for literate wives increased relative to the demand for wives who were either illiterate or who had higher levels of schooling in high-τ villages. One plausible route by which mothers may aid in children's schooling is via help in homework, in which a mother's ability to read and write is essential, but for which higher schooling levels may be less important. Indeed, the REDS data on the study hours of children in farm households also indicate the special importance of maternal literacy. Figure 3 presents the average number of study hours per day (averaged over the three seasons) for school-age farm children aged 7-14 by three levels of mother's

schooling and for fathers who are either literate or who have completed primary school.[16] These graphs suggest two patterns: first, whether fathers have completed primary school or are just literate does not appear to matter much for children's study hours. Second, farm children with literate mothers but who have not completed their primary schooling study almost one hour more per day than children with illiterate mothers and slightly less than one-hour more per day than children with mothers who have completed primary school. This non-linear pattern with respect to children's study habits is consistent with the non-linear demand for schooled wives, for which literacy appeared to have the highest marriage market premium.

Examination of the time allocation of the mothers also reveals non-linear relationships with respect to their schooling level that appear consistent with a complementary relationship between literacy, but not higher levels of schooling, and maternal child development. There are three time-allocation categories in the data that characterize the mother's non-market time - (i) "home care," which includes child care, cooking, and cleaning; (ii) "domestic production," which includes grinding and pounding grain, collecting fuel, and fetching water, and (iii) "leisure," which includes sleeping and bathing. Figure 4 depicts the average hours per day in which married farm women spend their non-leisure time for the three schooling classes. As can be seen, there is an inverted-u shaped relationship for the principal time allocation category "home care" - married literate farm women who are not primary school graduates evidently spend 1.5 hours more per day in home care than illiterate women and about one hour more than women who are primary school graduates. As a consequence, literate non-graduate women on net spend less time than either illiterate women or women who are graduates in other combined work activities. In particular, literate married farm women spend less time in both domestic production and off-farm salary and wage work than other married farm women, although on average such women spend more time than primary-school graduates in very small amounts, on average, of on-farm work. These time-allocation data thus confirm our earlier findings

[16]Only 7.2% of all illiterate male farmers who are also fathers were married to a woman who had any schooling. More than two-thirds of male farmer-fathers are at least literate.

that unless literate women are more productive than primary school graduates in non-home care activities it is unlikely that the enhanced marriage market demand for literate wives reflects their greater contribution to household income.

Figures 3 and 4 may be misleading as evidence of a productive role for maternal schooling in schooling production in the home, even in the context in which off-farm market work is relatively unimportant, for a number of reasons. First, the schooling level of the mother may simply reflect the preferences of the father for his children's schooling; maternal schooling is endogenous in the model, and its demand has as a determinant η_F which is positively related to both the mother's and the child's schooling, conditional on the mother's schooling. Second, preferences may be intergenerationally correlated, so that the schooling preferences of the father for his children may be correlated with his own schooling, which was determined in the same household. Third, the schooling of the wife (and the husband) may be related to wealth levels, which may also directly affect child schooling as well as maternal work patterns.[17]

To see the problem for estimation of the existence of correlated household preferences within the male's household, assume that the intergenerational transmission of the child preference parameter within the family of the father η_F is characterized by a random walk. Then the preference parameter η_{Fij} for the ith father in family j is given by:

$$\eta_{Fij} = \eta_j + \eta^*_{Fij} \qquad \textbf{(24)}$$

where η_j is the preference parameter for family j and η_{Fij}* is the i.i.d. idiosyncratic (across individual fathers in j) component to i's preferences.

The linear analog to (16), the conditional demand equation for the schooling of the child in the family of father i in family j, is:

[17] There may also be a relationship between a mother's schooling and the age of her children, which is highly correlated with schooling.

$$h_{ij} = \alpha_F h_{Fij} + \alpha_M h_{Mij} + \alpha_A A_{ij} + \alpha_\theta \theta_j + \alpha_\tau \tau_j + \eta_{Fij} + \kappa_j + e_{ij} \quad \textbf{(25)}$$

where the α_k are coefficients, κ_j captures all household attributes in equation (16) and e_{ij} is a father-specific random error. Given (24), a father ij's own preferences will be correlated with his schooling h_{Fij}, since his schooling is a function of his parents' preferences which are correlated with his own. In addition, of course, his preferences will be correlated with his wife's schooling h_{Mij}, which is chosen by him in the marriage market. Because the preference parameters are unmeasured, estimation of (25) will yield biased and inconsistent estimates of the coefficients for both the mother's and father's schooling effects.

We can exploit the fact that many farm households in India are extended and eliminate the influence of own father's preferences on own schooling (as well as the effects of local technology and its change) by differencing across coresident fathers (sons or brothers of the household head) in the same family, resulting in:

$$Dh_{ij} = \alpha_M Dh_{Mij} + \alpha_F Dh_{Fij} + \alpha_A DA_{ij} + D\eta^*_{Fij} + De_{ij} \quad \textbf{(26)}$$

where D is the difference operator for fathers within in a family j. Equation (26) now only contains in the residual the idiosyncratic components η_{Fij}* of fathers' preferences, which by assumption are not correlated with own schooling.[18] As indicated in the model, these preference components are, however, correlated with wives' schooling h_{Mij} via the marriage market. One method of eliminating this correlation is to use

[18]We are assuming that maternal preferences are not transmitted to sons or that the preference parameter for women does not vary. If both maternal and fraternal preferences are heterogeneous and both influence children's preferences, then it is necessary to difference between fathers who are siblings, not just among all fathers who are relatives in the same household. For example, if we assume that the relationship across generations in preferences is described by the Galton-Pearson blending model, which has been used to approximate the genetic transmission of physical traits implied by modern genetic theory (Cavalli-Sforza and Feldman (1981)), then the preference parameter $\eta_{Fji} = (r/2)(\eta_{Fj} + \eta_{Mj}) + \eta_{Fji}$*, where r is the intergenerational correlation in parental preferences. The sum of parental preferences is then a fixed effect among siblings in any generation. We therefore report below results based on sibling, rather than just family differences. Note that if female preferences are heterogeneous and grooms also know each potential bride's preferences at the time of marriage, then the possibility arises that female preferences are chosen. In that case the instrumental variables procedure discussed below is not sufficient and a complete general-equilibrium model of the marriage market is required (Foster, 1996).

instruments that will predict wives' completed schooling and that are not correlated with children's contemporaneous schooling investments. One set of candidates consists of variables known at the time of the father's marriage that affected his choice of a marital partner. An important example is technical change in the local area that was experienced prior to the marriage, that varies across areas, and which, from Table 3, affects the mate-schooling choice of grooms. Because current values of τ_j that affect current schooling choices are eliminated from (26), prior values of τ_j at the time of marriage are valid instruments and vary across fathers because of differences in their years of birth and thus when they married. We create dummy variables representing three periods of technical change: years prior to the onset of green revolution (before 1966), the immediate post-green revolution period 1967-71, and the subsequent period 1972-76 (all fathers with children over age 6 in 1982 married prior to 1976). The instruments for Dh_{Mij} in (26) are then interactions between village dummy variables and one of the three technical change interval dummies corresponding to the period in which the father reached age 24, the mean age at marriage for men in the sample.

In addition to variables characterizing the father and mother's schooling, in the three categories (illiterate, literate, and primary school graduate), we also include in the child study hours specification the age and sex of the child as well as the child's years of schooling completed prior to the current year. The latter is included because the dependent variable is a flow measure of schooling, which will depend on the child's accumulated stock of human capital. A child's achieved schooling is also likely to be correlated with the parental preferences, however. We therefore also treat this state variable as endogenous, using as instruments interactions between village dummy variables and the year in which the child was born. These variables reflect the local history of technical change and school access experienced by children born in different years that should have influenced their prior schooling investments.

Finally, we include total household wealth in the specification and a variable characterizing whether the child's father is a son of the household head or the head's brother. Because a father's relationship to the head, given partible inheritance rules, affects his claim on household assets, the variable

may pick up his bargaining power within the extended household. For example, a co-resident brother of the head has a contemporaneous claim on the household's assets that is equal to that of the designated household head, and is thus a primary claimant, while a son of the head only has a claim on his father's asset share at his father's (head's) death. Because changes in total household wealth may therefore have different effects depending on familial asset claims, we also interact household wealth with the relationship variable.

Table 4 reports in the first column, for comparison, OLS estimates of the determinants of average study hours per day. This specification also includes a measure of the district-level technical change for the period 1970-71 through 1981-82, from Foster and Rosenzweig (1996a), and the household's total wealth, all of which are otherwise impounded in the household fixed effect in subsequent columns. The sample consists of all farm households with children aged 7 through 14. The OLS estimates indicate, again, that children with literate mothers spend on average one hour per day more in study compared with other children of the same age, sex and prior schooling but who have mothers who are not literate. Moreover, children of mothers who are both literate and who have completed primary schooling study no more hours than the children whose mothers are literate but are not graduates of primary school. The OLS estimates also suggest, however, that whether or not the child's father completed primary school also affects study habits - children with such fathers spend .7 hours more per day in study, an estimate that is also statistically significant.

In the second column we report the within-household estimates, based on those farm households with at least two subfamilies (fathers) who have children in the relevant age range. These estimates eliminate the family component of father schooling preferences that is potentially correlated with the father's own schooling. As can be seen, while the estimate of the maternal literacy effect is reduced by less than 15%, the primary school coefficient for the father is reduced to less than one-fifth its OLS counterpart and is not statistically significantly different from zero. The schooling coefficients for the father, moreover, are not jointly significant by conventional standards in this specification. These estimates suggest that the

OLS results indicating a role for paternal schooling in augmenting the human capital of children may be spurious, reflecting the operation of paternal preferences for schooling.[19]

When the endogeneity of the mother's schooling and child's schooling from mate choice and prior household investments, respectively, are also taken into account, the influence of the schooling of the father on children's allocation of time to study is reduced still further, while that of the literacy of the mother is augmented and is statistically significant. The within-household IV estimates, reported in the third column, still indicate a non-linear pattern for maternal schooling and little role for paternal schooling. The point estimates suggest that the children of literate mother's devote 1.8 hours more to study than otherwise identical children of illiterate mothers in the same household and 1.1 hours more than similar children with mothers who are primary school graduates, although the latter estimate is not statistically different from zero.[20] In contrast, children with literate fathers only spend a statistically insignificant third of an hour more in study than children with illiterate fathers, and less than a few minutes more than that if the father has completed primary school.

Estimates of the relationship between maternal schooling and maternal time allocation that take into account differences in paternal preferences and mate choice suggest that the association between maternal literacy and children's study hours reflects what mothers do in the home. The model implies that

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[19]Another possibility is that the father's primary school OLS coefficient reflects a household income effect, which is eliminated because the within-household estimates control perfectly for contemporaneous household income. Moreover, the Foster-Rosenzweig (1996a) profit-function estimates suggest that farm profits depend on the maximum schooling of an adult male in the household, which is also impounded in the household fixed effect. Note, however, given that male schooling is at least potentially productive if the sub-household splits off from the joint household, differences in schooling among fathers in the household could affect their differential bargaining power in allocating total household income and thus can affect sub-household resources.

[20]To eliminate the possible influence of heterogeneous maternal preferences, as discussed in fn. 18, we also estimated (26) using only fathers who are sons of the head (fathers with the same parents). Sample size was reduced to 190 households with 613 children but the estimates were similar to those obtained using all family members, although less precise, and a Hausman test indicates non-rejection of the hypothesis that the set of within-household IV and within sibling IV estimates are identical ($\chi^2(7)=8.32$). In particular, the maternal literacy coefficient was 1.72 with a standard error of 1.3 and the maternal primary school coefficient was -.997 with a standard error of 1.4.

as long as maternal time is an important input in the production of child schooling maternal schooling will also be related to the mother's allocation of time to the child schooling activity. In particular,

$$\frac{\partial H_{Mj}}{\partial h_{Mj}} = \frac{H_{Mj}}{h_{Mj}}\left[\frac{h_{Mj}}{h_j}\frac{\partial h_j}{\partial h_{Mj}} - h_{Mj}\phi^H\right] \qquad \textbf{(27)}$$

Expression (23) indicates that the sign of the relationship between maternal time in home schooling production and maternal education depends on the sign of the effect of maternal education on child schooling, given by (9), and the magnitude of the child schooling maternal schooling elasticity relative to the elasticity of home efficiency units with respect to maternal schooling. Given (9), the effects of maternal schooling on child schooling and on her own time devoted to child schooling will have the same sign if the own price elasticity of demand for child schooling in the household is sufficiently large.

The first three columns of Table 5 present within-household IV estimates of the determinants of the time allocated by farm wives to home care, which is the only time-allocation category that includes child care. As in the estimates for the allocation of children's time for study, the wife's (mother's) schooling variables are treated as endogenous along with the average schooling attainment (in years) of any children. The estimates in column one, obtained from farm households with at least two married women, replicate the inverted u-shaped pattern for maternal schooling and average home care hours seen in Figure 4, with literate farm wives spending 1.4 hours more in this activity than illiterate wives and .9 hours more than primary-school graduate wives.[21] These differentials in time allocation by maternal schooling appear to be related to child care, as they are more pronounced for mothers with children less than 15 (column 2). Indeed, among wives with no children under 15, there is no significant relationship between wives' schooling and their average hours devoted to home care (column three). The point estimates in columns two and three suggest that within the same household literate mothers with similarly aged young children devote

[21]One possible reason for the marginally significant decrease in home time for primary-schooled relative to literate women is primary schooled women are devoting more of their time to activities in which schooling has a return, such as in non-agricultural employment as shown in Figure 1.

almost 2 hours more to home care than do illiterate mothers. In contrast, among wives with no young children in the household, those who are literate appear to spend .6 hours *less* per day in home care than their illiterate counterparts.

V. Maternal Schooling and Household Power

The within-household IV estimates of Table 4, which indicate a pronounced role for maternal literacy in affecting the study hours of children while taking into account the influence of paternal schooling preferences, and the estimates in Table 3 showing an increase in the demand for literate wives in high-τ areas despite the absence of any evident significant agricultural-sector or rural, non-agricultural return to female literacy are both consistent with the theoretical predictions of the model in which maternal schooling (literacy) plays a productive role in augmenting the human capital of children. As noted, however, it may still be possible that more schooled, in this case literate, mothers have superior options outside of marriage that are not adequately measured by labor market returns in the rural (or urban) sector, in which case, as was demonstrated, it is not possible from those estimates to distinguish between productivity and bargaining or reservation-utility interpretations of the role of maternal schooling in the household sector.

In this section we carry out the two additional tests suggested by the model that provide evidence on the productivity of maternal schooling in producing human capital. First, we assess whether the relationship between maternal schooling and clothing expenditures on children, for which a productivity effect of maternal schooling is unlikely, looks similar to that for child schooling. In the last column of Table 5, we present within-household IV estimates of the determinants of per-child clothing expenditures, using the sample of households with at least two mothers who coreside with one or more children aged less than 15. The model suggested that if a mother's schooling improves her bargaining power only, then given that women prefer child services relative to men, the elasticities of any child input, whether clothing or schooling, with respect to maternal schooling should be equal. The estimates in Table 5, however, suggest that there is essentially no relationship between maternal literacy and expenditures on children's clothing - literate mothers spend a statistically insignificant 15 rupees more per year per child on their clothing, less

than 5% of average per-child expenditures, compared with illiterate mothers. If mothers cared more about children than fathers and literacy raised their ability to influence household decisions then we would have expected to see maternal literacy to be significantly associated with this type of expenditures, given the marked effect of maternal literacy on their hours in home (child) care and on their children's hours in study.

The second test uses additional information from the marriage market, exploiting the fact that in India the value of brides is reflected in dowry and bride prices.[22] As was shown (expression (21)), given the absence of contributions from schooled wives to household income and assuming that more schooled women have higher reservation utility levels and thus must be allocated more resources by husbands, dowry payments to grooms must increase with bride schooling in equilibrium. Alternatively, if a bride's literacy will have sufficient productive value in the household she joins even if it is not associated with earnings contributions, literacy will command a premium in the marriage market, in the form of lower dowry.

Neither the REDS nor the ARIS data provide information on dowry. However, 1984 survey data from the households that participated in the Village Studies Surveys of the International Crops Research Institute of the Semi-Arid Tropics (ICRISAT) of India provide dowry information as well as characteristics of marital partners and their parents. The survey, undertaken in ten villages in four districts in the semi-arid tropics of India, provides the dowry associated with the marriages of the household heads and their daughters in each of the 40 surveyed households in nine of the ten villages, the schooling of the head and wife, the schooling of the parents of the head, and the landholdings of the head's parents when the head was age 15.

An interesting feature of the ICRISAT survey is that qualitative information was ascertained on the principal reason why the dowry associated with each of the head's daughters differed from the average across daughters. There are 365 daughter marriages recorded in the data. In 34.1% of these, schooling differences among daughters was given as the reason for the dowry differential. The next highest category,

[22]Jacoby (1995) reports that the demand for farm wives is affected by their agricultural productivity in West Africa, where women manage farm plots and labor markets are almost absent.

property of the groom, was given in 32.7% of the responses, followed by the physical characteristics of the daughter, in 8% of responses. Thus, the data indicate that among the respondents schooling is a salient bride attribute determining dowry amounts. It is necessary, however, to estimate the direction of the relationship between a bride's schooling and her dowry from the marriages of the heads of households, as there is no information on the actual schooling of daughters who married, as they are not resident in the household.

The data suggests that the ICRISAT survey area is not atypical of rural India as a whole in the early 1980's with respect to the role of women. Information on the occupation of family members indicates that none of the wives of the heads participated in non-agricultural wage or salary jobs, and schooling was not related to whether or not a farm woman also carried out craft or trading activities. Moreover, the relationships between parental schooling and, in this case, son's schooling are similar to those observed in the NCAER REDS survey data, although it is not possible with the ICRISAT data to eliminate the role of head preferences.[23] Table 6 reports logit estimates of the determinants of the probability that a farm head had completed primary school. The determinants are the head's mother's literacy (no mothers of the head had completed primary school), his father's literacy, whether the head's father had completed primary schooling, the landholdings of the head's family at age 15, the head's age and it's square, and dummy variables for the individual villages. The estimates indicate that, as in the NCAER-REDS data, maternal literacy has the strongest relationship with the schooling attainment of the son - a son with a literate mother has more than twice the probability of finishing primary school than does a head with average family characteristics. The effect of the father's literacy is one-third that of the mother, and the effect on the probability that the head completes primary school of his father having completed primary school is

[23]This is because there is no information on the schooling of daughters-in-law of the heads, so that within-household estimates cannot be obtained. Also, the semi-arid tropics was an area little affected by the green revolution, so that spatial and temporal variation in technical change cannot be used to identify the effects of maternal schooling in the presence of preference heterogeneity. Note, however, that the estimates in Table 4 suggest that single-equation estimates tend to underestimate maternal schooling effects and overestimate those associated with the father's schooling.

essentially zero.

The association between maternal literacy and son's schooling does not appear to merely reflect improved maternal bargaining power, as the information on the dowries associated with the heads' marriages suggests that female literacy is positively valued by men despite the absence of a prominent non-household role for female literacy. Table 7 presents within-village estimates of the determinants of dowry paid to the grooms' families for farm households in the nine villages with complete information, and for marriages taking place as early as 1940 and as late as the survey year, 1984. The specification includes, in addition to the schooling of the husband and wife, in the three categories, the owned dry and wet landholding of the husband's family when he was age fifteen, and the schooling of the husband's parents, as in Table 6.

The results reported in Table 7 are consistent with the qualitative survey data ascertained from daughters, which indicated a role for both schooling and groom household resources, among the measured variables, in determining dowry levels.[24] The most striking feature of the estimates in Table 7 is the importance of female literacy and the lack of importance of female primary schooling, which parallels what was observed both in the relationship between technical change and the demand for bride's schooling and between maternal schooling and children's study hours. In particular, the estimates indicate that men are willing to forgo a substantial amount of dowry for a literate bride, almost three fourths of the average dowry payment, but do not pay any additional premium for a bride who has also completed primary school. In contrast, men with primary schooling command a substantial premium in the ICRISAT-area marriage market, but husbands who are merely literate are not valued. The importance of schooling, although at different levels, in determining dowry, is consistent with the qualitative survey data. The fact that greater resources in the head's family attract higher dowries, with landholdings that are irrigated being valued at 3.5 times those that are not, is also consistent with these data. Finally, the schooling of the head's parents,

[24]Rao (1995) obtains similar results using these data based on a very different specification. Schooling is not differentiated by level in that study, however.

given his own schooling and land, does not have any effect on the dowry payment. The schooling of parents was not mentioned by respondents as being important in differentiating dowries.

VI. Conclusion

In this paper, we have examined the hypothesis that increases in the schooling of women enhance the human capital of the next generation and thus make a unique contribution to economic growth. We pay particular attention to whether and how educational opportunities for women in the labor market affect the relationship between the schooling of mothers and school investments in children. Based on a household model incorporating individual optimization, differences in parental preferences for child schooling, a marriage market and a labor market, we established conditions under which it is possible to evaluate the relative importance of earnings and bargaining effects of maternal schooling and thus the extent to which any observed relationship between maternal and child schooling reflects the productivity of home teaching.

The framework is applied to data describing green revolution India, a setting which has a number of features that provide insights into the precise mechanisms by which increases in female schooling are manifested in augmented human capital investments in children. In particular, due to relatively low levels of female non-agricultural employment and evidently low levels of involvement of women in management decisions in agriculture over the sample period studied, we are able to rule out important effects of female schooling on earnings, particularly for women with less than primary schooling. This absence of labor market returns to schooling for women, coupled with evidence of increased demand for literate women in high technical change areas, a significant effect of maternal literacy on the study hours of children that is robust to variation in the schooling preferences of fathers, lower dowries received on average by men marrying literate women, and the absence of an effect of maternal schooling on child clothing expenditures indicates that any bargaining effects, if present, also had a limited impact on household decision making. Thus, we conclude that at least some component of the significant and positive relationship between maternal literacy and child schooling in the Indian setting reflects the effects of maternal schooling on the efficiency of maternal time in the production of child human capital and that the existence of this effect,

combined with the increase in returns to schooling for men, importantly underlies the expansion of female literacy following the onset of the green revolution.

These results thus suggest that increasing labor market opportunities for women is not a necessary condition for households to invest in female schooling, which have payoffs even in settings in which there is increased demand for schooling solely in male-dominated occupations. These findings also suggest therefore that differentials in the market opportunities between men and women do not necessarily measure well the incentives for households to invest in girls and boys, as assumed, for example, in Rosenzweig and Schultz (1982).

Finally, it is important to recognize that our conclusions about the productive role of maternal schooling, and in particular female literacy, in home teaching in India in this period do not necessarily generalize to all times and places. Our framework suggests that in other low-income areas where female participation in non-agricultural employment is high or women are directly involved in farm management decisions it is quite possible, even likely, that a significant fraction of any relationship between maternal schooling and child outcomes reflects both the earnings contributions of educated women to the household and the implications of enhanced female earnings opportunities for the ability of the mother to influence household decisions. Indeed, our approach opens the question as to whether the substantial conformity in findings in the vast empirical literature examining the effects of maternal schooling on child outcomes is misleading in that it may obscure substantial variability across settings in the underlying mechanisms, differences which have important implications for the growth consequences of specific interventions targeting female education.

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Table 6
ICRISAT Data: Probability that a Household Head Has Completed Primary Schooling,
Logit Estimates with Village Effects

Variable	Coefficient	Robust t-ratio	Mean Derivative
Mother literate	3.15	2.47	.504
Father literate	1.09	1.43	.174
Father completed primary schooling	.0939	0.09	.015
Owned family dry land when head was age 15 (acres)	.0146	2.55	.002
Owned family irrigated land when head was age 15 (acres)	.0336	1.33	.005
Head's age in 1984	.0744	2.19	-.014
Head's age squared	-.0012	2.36	-
Number of households (villages)		265 (9)	

Table 3
Quinquennial Village Observations: Determinants of the Schooling and Literacy of Newly-Married Farm Wives, 1961-1976: FE-IV Estimates

Variable	Proportion of New Wives Literate	Proportion of New Wives Literate But Not Primary School Graduates	Proportion of New Wives Completed Primary Schooling
Proportion new husbands completed primary schooling[a]	.276 (2.26)[b]	-.00829 (0.10)	.282 (3.30)
Proportion new husbands literate[a]	-.0069 (0.04)	.240 (1.96)	-.118 (1.98)
Average age of new husbands at marriage[a]	.0174 (1.86)	.0141 (1.71)	-.00137 (0.25)
$\gamma_{1967\text{-}71}$	.0000430 (1.76)	.0000361 (1.67)	.0000055 (0.36)
$\gamma_{1972\text{-}76}$	.0000368 (1.40)	.0000198 (1.71)	.0000016 (0.09)
Average number of men in the household[a]	-.817 (1.07)	-.541 (1.67)	.431 (1.00)
Average number of literate men in the household[a]	1.95 (1.43)	-.440 (0.57)	.244 (0.25)
Average number of married women in the household[a]	.453 (1.40)	.0164 (0.08)	.163 (0.57)
Average number of literate married women in the household[a]	-1.70 (1.22)	.657 (1.16)	-.164 (0.21)

[a]Endogenous variable.
[b]Absolute value of robust t-ratio in parentheses.

Table 2
Contributions of Male and Female Schooling and Literacy to HYV Profitability:
FE-IV Estimates, 1969-71

Variable			
HYV area planted	-.145 (0.78)	-.144 (0.77)	-.0306 (0.14)
HYV*any adult male with primary schooling	.277 (2.54)	.262 (2.14)	.303 (2.18)
HYV*any adult male literate	-	-	-.0972 (0.61)
HYV*any adult female with primary schooling	-	.0393 (0.24)	.234 (0.98)
HYV*any adult female literate	-	-	-.241 (1.13)
Farm equipment value	6.00 (2.72)	5.93 (2.73)	5.97 (2.73)
Irrigation equipment value	.199 (0.29)	.211 (0.26)	.480 (0.53)
Adverse village weather	-405.1 (2.22)	-402.1 (2.23)	-415.7 (2.25)

Number of farm households=1756.
a. Absolute values of robust t-ratios in parentheses.

Table 1
Relationship of Male and Female Schooling and Literacy to HYV Adoption:
ML Logit Estimates, 1971

Variable			
Any adult male with primary schooling	.846 (6.15)	.845 (6.23)	.822 (5.83)
Any adult male literate	-	-	.0745 (0.41)
Any adult female with primary schooling	-	.00586 (0.04)	.0789 (0.40)
Any adult female literate	-	-	-.0907 (0.49)
Owned land area	.00370 (0.67)	.00371 (0.67)	.00360 (0.65)
Farm equipment value($x10^{-3}$)	.113 (1.72)	.113 (1.73)	.113 (1.73)
Irrigation equipment value($x10^{-3}$)	.0531 (1.89)	.0531 (1.89)	.0533 (1.89)
IADP district	.613 (2.47)	.612 (2.46)	.615 (2.48)
Agricultural extension service in village	.167 (0.77)	.167 (0.77)	.167 (0.77)
Constant	-1.59 (8.88)	-1.59 (8.89)	-1.62 (7.81)

a. Absolute values of asymptotic t-ratios in parentheses.

Table 5
Determinants of Farm Wive's Average Daily Home Care Hours and Household Per-Child Clothing Expenditures: Within-Household IV Estimates, 1982

Dependent variable:	Wife's Average Daily Home Care Hours			Per-Child Clothing Expenditures
Subsample: Coefficient	All Wives	Wives with some children	Wives with no children	Wives with some children
Wife literate[a]	1.36 (2.89)[b]	1.96 (3.25)	-.643 (0.53)	15.1 (0.89)
Wife completed primary school[a]	-.911 (1.68)	-1.04 (1.50)	.655 (0.34)	-28.1 (1.57)
Husband literate	-.241 (0.82)	-.375 (1.02)	-1.41 (1.19)	-31.9 (2.47)
Husband completed primary school	.190 (0.71)	.152 (0.45)	1.94 (1.83)	19.1 (1.69)
Husband primary wealth claimant	.126 (0.37)	-.351 (0.77)	.890 (1.17)	-5.19 (0.48)
Primary claimant x household wealth	-.0281 (2.10)	-.0317 (1.38)	-.0395 (1.28)	.000240 (3.20)
Wife's age	-.139 (2.06)	-.238 (2.16)	-.284 (1.69)	3.61 (0.90)
Wife's age squared	.00194 (1.88)	.00383 (2.20)	.00412 (1.53)	-.0492 (0.84)
Average schooling attainment of children 7-14[a]	-.116 (1.62)	.0055 (0.02)	-	1.47 (0.46)
Proportion own children 0-6 male	.372 (1.70)	.421 (1.67)	-	.567 (0.08)
Proportion own children 7-14 male	.0782 (0.27)	.103 (0.34)	-	7.62 (0.71)
Any own children 0-6	.0474 (0.30)	-	-	-
Any own children 7-14	.323 (1.43)	.220 (0.77)	-	13.6 (1.93)
Number of wives	2602	1452	248	1452

[a]Endogenous variable.
[b]Absolute values of robust asymptotic t-ratios in parentheses.

Table 4
Determinants of Farm Children's Average Daily Study Hours in 1981-82

Variable/ Estimator	OLS	Within-Household	Within-Household-IV
Mother literate[a]	1.03 (5.29)	.855 (1.91)[b]	1.78 (2.02)
Mother completed primary school[a]	.0581 (0.25)	-.535 (1.00)	-1.05 (0.91)
Father literate	.260 (1.42)	.416 (0.90)	.339 (0.68)
Father completed primary school	.706 (3.83)	.138 (0.32)	.0217 (0.05)
Child's years of schooling[a]	.812 (34.1)	.620 (11.7)	.721 (7.39)
Child's age	-.420 (21.1)	-.310 (6.37)	-.382 (5.46)
Child is girl	-.621 (6.81)	-.672 (3.50)	-.487 (2.29)
Father primary claimant	.054 (0.36)	-1.59 (2.84)	-1.23 (1.99)
Primary claimant x household wealth ($x\ 10^{-3}$)	.000959 (0.81)	.00895 (2.10)	.00868 (1.98)
Household wealth ($x10^{-3}$)	.000564 (0.57)	-	-
$\tau_{1971\text{-}82}$	.0291 (3.13)	-	-
Constant	6.39 (25.4)	-	-
Number of children (households)	5595(2473)	965(267)	965(267)

[a]Endogenous variable.
[b]Absolute value of robust t-ratios in parentheses.

Table 7
ICRISAT Data: Determinants of Dowry Paid to Husband's Family
in Nine Villages, 1940-84

Variable	Means (Standard Deviation)	Village Fixed-Effects Coefficients
Dowry paid in (1983 rupees)	6455 (11466)	-
Wife literate	.0502 (.219)	-4816 (1.74)[a]
Wife with primary schooling	.0618 (.241)	-394 (0.19)
Husband literate	.108 (.311)	25.8 (0.01)
Husband with primary schooling	.205 (.404)	7659 (3.04)
Owned family dry land when husband age 15 (acres)	12.5 (24.3)	156 (3.57)
Owned family irrigated land when husband age 15 (acres)	1.19 (4.04)	544 (2.36)
Father literate	.0849 (.279)	4025 (1.03)
Mother literate	.0154 (.124)	-4177 (0.76)
Father with primary schooling	.0618 (.241)	1501 (0.30)
R^2	-	.58
Number of households (villages)	259 (9)	259 (9)

[a]Absolute values of robust t-ratios in parentheses.

Figure 1

Percent Married FarmWomen and Men Working for Nonagricultural Wages or Salaries: 1970-71 and 1981-82

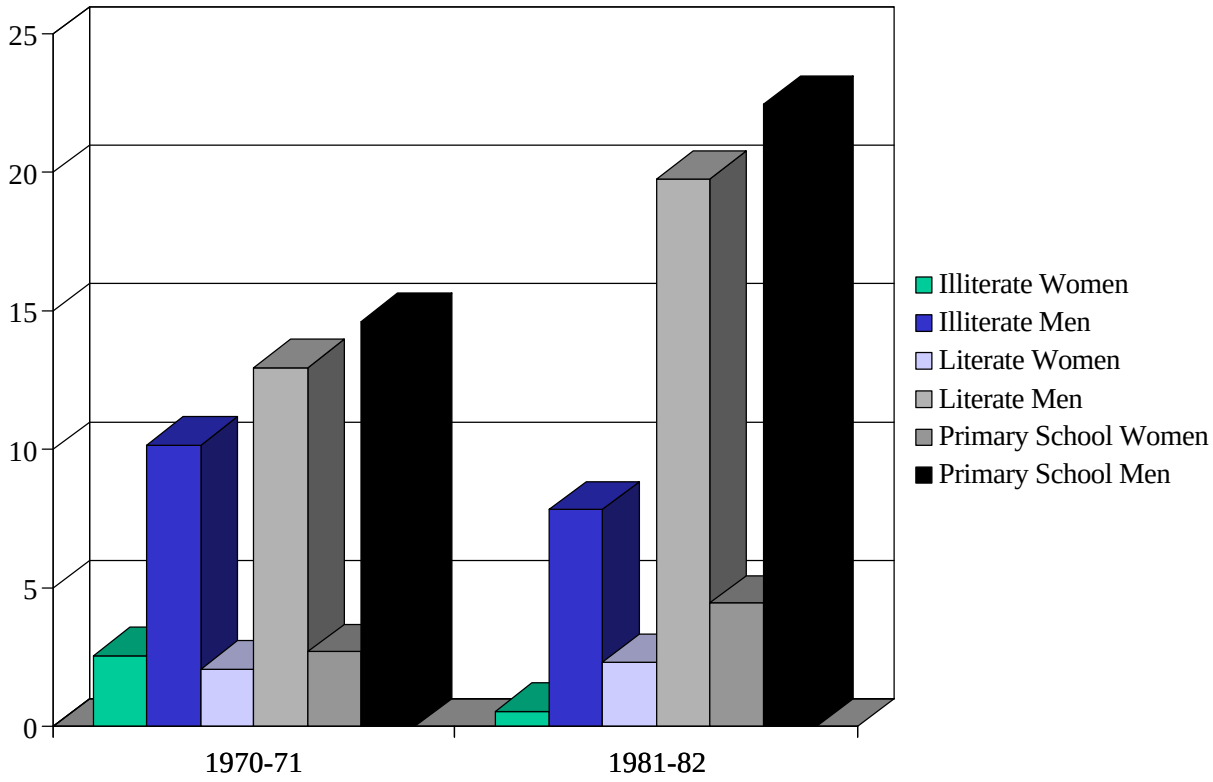

Figure 2

Literacy Rates of Farm Newlyweds,
by Sex and Date of Marriage: 1962-81

Figure 3

Average Study Hours per Day Among Farm Children, by Schooling level of Mother and Father

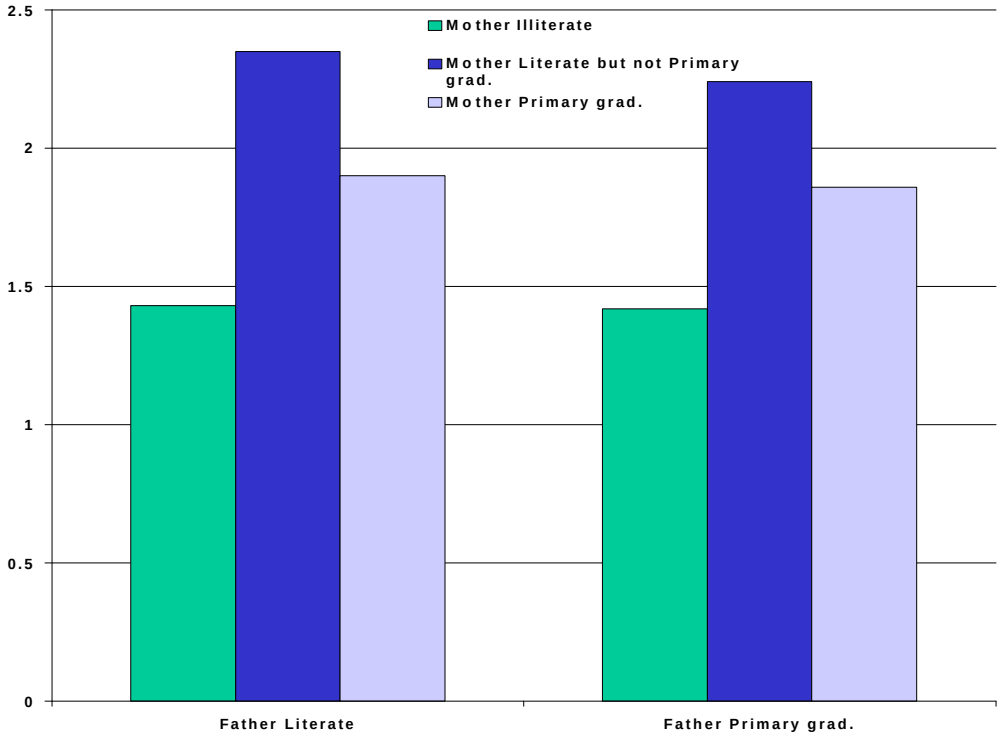

Figure 4

Time Allocation of Married Farm Women, by Literacy and Schooling: Average Hours per Day in 1981-82