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Why Governments Should Invest More to Educate Girls

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Summary. — Women and men often receive the same percentage increase in their wage rates with advances in schooling. Because these returns decline with more schooling, the marginal returns for women will tend to exceed those for men, especially in countries where women are much less educated. The health and schooling of children are more closely related to their mother's education than father's. More educated women work more hours in the market labor force, broadening the tax base and thereby potentially reducing tax distortions. These three conditions, it is argued, justify the disproportionate allocation of public expenditures toward women's education. © 2002 Elsevier Science Ltd. All rights reserved.

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1. INTRODUCTION

Evidence from a growing number of countries in all regions of the world demonstrates that increasing investments in women's human capital, especially education, should be a priority for countries seeking to increase both economic growth and human welfare. The case for directing educational investment to women is stronger, the greater the initial disparity in investments between women and men. Although gender equity is one possible reason for supporting a reallocation of public educational resources to favor females, the arguments advanced in this paper are based only on economic *efficiency*—or, in other words, maximizing social output—which can also justify governments investing *more* in women than in men.

Enrollment in school represents the largest component of the investment in human capital in most societies, and arguably the component over which public policy has the most immediate control through its administration of public schools and regulatory capacity. This paper summarizes the mounting empirical evidence from around the world that the social returns to the years of schooling of females are greater than the return to males. The evidence comes primarily from representative household surveys and censuses. Given the diversity of cultures, differences in production techniques employed at different stages of economic development, different resources available to complement the labors of men and women, and marked differences in skill specializations that women and men pursue in different parts of the world, there will inevitably be some exceptions to these predominant patterns and empirical regularities (Behrman, 1997; Boserup, 1970; King & Hill, 1993; Schultz, 1995b). But there are few instances in international quantitative social science research where the application of common statistical methods has yielded more consistent findings than in the area of gender returns to schooling. Therefore, most of my conclusions seem warranted for most settings in the world, with, of course, differences in degree.

This evidence may explain why regions of the world which have achieved the most economic and social progress over the past several decades are those—among other things—that have most successfully promoted equal educational achievements for men and women. East Asia, Southeast Asia, and Latin America are

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examples of regions in which significant progress has been made. Conversely, regions that have lagged behind in their growth—notably South and West Asia, the Middle East and North Africa, and sub-Saharan Africa—have lagged badly in their relative investments in women's schooling, thus limiting women's contributions to economic and social progress.

Although general conclusions about the impacts of social investments in men versus women are consistent and reliable in most parts of the world, economic, social, and political conditions do vary in particular countries and subpopulations. Therefore, strategies for responding and designing efficient social policies to redistribute education by gender must be developed through research in particular settings. Coordinated and focused country-specific programs of research are needed to evaluate policy options within the institutional and cultural constraints of each country. While this paper reviews the reasoning and research behind the policy initiative proposed here—laying out their qualifications, limitations, and statistical assumptions—much new applied research will be needed to chart the most promising policy options. Section 2 examines the evidence of the private wage returns to schooling for women and men, and the general problems of assessing the productivity of male and female workers with different amounts of education. Section 3 considers social externalities or benefits from schooling that are not captured by the private individual or family, and asks how these differ for male and female schooling. Section 4 explores briefly some of the public finance implications of reallocating human capital from men to women. Section 5 reviews some of the institutional options which could accomplish this reallocation of resources, and Section 6 concludes.

2. PRIVATE WAGE RETURNS TO SCHOOLING OF WOMEN AND MEN

The gap between men's and women's years of completed schooling is a rough but informative indicator of the gender difference in many forms of human capital. [1] The literature on human capital returns was first built on evidence of wage differences among males in the US 1940 Census crosstabulated by their schooling and age (Becker, 1964). This first step of empirically implementing the calculation of a lifetime private rate of return to schooling avoided the ambiguities posed by women and the problems of inferring labor productivity for persons outside of the wage labor force. In most of the poorest populations of the world women rarely work for a wage. Thus, the foremost problem in constructing a satisfactory measure of the productivity of women with different amounts of schooling is to be able to explain which women decide to work outside of their family for a wage (Heckman, 1980). Only with such an explanation in hand, is it then possible to correct estimates of the wage function (which implies a return on schooling) for the potential sample-selection bias due to the researcher only having data on the productivity of wage earners.

Fortunately, the movement of women into the labor force over the last 50 years has been the most significant development in labor economics of high-income countries. It has therefore been subjected to much analysis. The three variables emphasized in models of the determinants of female labor force participation are (a) the woman's own market wage opportunities (often proxied by her schooling and age), (b) her sources of nonearned income that reduce her dependence on her own market earnings and thus her market labor supply, and (c) the wage opportunities of her husband or extended family. Since the woman's own wage is only observed if she works for a wage, it is the censored variable we want to correct for sample selection bias. In addition, many women do not have a husband or do not reside with other working family members, although they may have access to a family support network. These family composition variables, along with her fertility, should be treated as jointly determined with her allocation of time over her lifetime, and thus they are not strictly independent of her labor supply, and cannot serve as an exogenous basis for predicting whether she participates in the labor force. In other words, if she has more children in the home, she tends to have paid a price in terms of her experience and productivity in the market labor force, and she is also less likely to participate in market work, other things being equal. But unless fertility is due to random arrivals of twins, for example, it cannot be used to infer the causal "effect" of fertility or the presence of a young child on her time allocation. That leaves variables representing the woman's claims on nonearned income, inherited assets, dowries, or social capital as the most likely source of information to predict her probability of working in a wage

job. This empirical approach to identifying a sample selection model for women wage earners assumes that these nonearned income claims of the woman do not affect the wage rate she could expect to receive in the market labor force. The greater her nonearned income resources, the less likely she is to be in the wage labor force (Schultz, 1995a; Smith, 1980). Although this nonearned income variable may be difficult to assess in some settings and represents a small fraction of a person's lifetime wealth, it provides, in many studies, a significant predictor for which women (and men) participate in the wage labor force, and allows one to implement a statistical technique for dealing with the potential sample-selection bias encountered in analyzing wage functions for women (and men) (Heckman, 1980).

The wage-determining function of women is specified in the same form as proposed by Mincer (1974) for men, except that in the case of women the variable representing years of post-schooling experience does not approximate with the same precision as for men the accumulation of labor market experience that is expected to affect current productivity in wage employment. This is because women may be less permanently attached to the labor force than men and spend more of these years after schooling ends engaged in home production and child care activities which may not increase proportionately their productivity in the wage labor force. Differences in the parameters of the wage function for women and for men should, therefore, be approached with caution, and not presumed to reflect labor market discrimination, for they may be measuring different things (e.g., Birdsall & Sabot, 1993). In this case at hand, the postschooling experience variable measures the underlying concept of wage earning skills with greater measurement error for women than for men, imparting a downward bias to its coefficient in women's compared to men's wage function estimates. [2]

For representative samples, the logarithm of the hourly wage rates has been analyzed in many countries in association with the schooling and postschooling experience of wage earners. An empirical description of wage structures in countries in all regions of the world has emerged from which several generalizations can be drawn. When the log wage is regressed on years of schooling, the estimated coefficient on schooling indicates the percentage change in wages received for attending an additional year of school. This schooling coefficient has the additional interpretation of a private internal rate of return on the family's investment in that individual's schooling, if the opportunity cost of the time of the student while she is attending school for that extra year approximates the private family cost of going to school, and other simplifying assumptions are maintained (Mincer, 1974). This proportionate increase in wages associated with an additional year of schooling tends to be about the same magnitude for women and men, whether or not one performs the justified correction for sample-selection bias discussed in the previous paragraph. If there is a systematic difference between these estimates of the private return on schooling for men and women, it tends to favor women more often than men, particularly in populations where women have in the past received substantially less education than men (Duraisamy, 2000; King & Hill, 1993; Schultz, 1988, 1995a). Even when private internal rates of return to schooling are higher for women than for men, the overall level of wages tend to be lower for women than men. In other words, the absolute magnitude of both the opportunity cost of not working to attend school, and the wage gains associated with completing an added year of school tend to be smaller for women than men, but the ratio of the wage gain to the opportunity cost of schooling is roughly similar for men and women at each specific level of schooling, e.g., primary, secondary, tertiary.

There has been a long debate on how to get beneath this partial correlation between years of schooling and log wages to disentangle the true causal effect that should inform public policy and would represent the labor productivity effect that society could expect when it increases the schooling of representative members of the population (Griliches, 1977). The most widespread worry is that other factors affecting labor productivity are omitted from the analysis when estimating the effect of human capital on wage rates, and these omitted factors may themselves be correlated with the observed measure of human capital, i.e., years of schooling. The most frequently mentioned omitted variable is the "ability" of the individual which is expected to raise productivity and to be positively related to schooling. The omission of ability from the wage function leads in this case to an upward bias in the estimates of the return to schooling. An analogous argument is made that family wealth may permit richer parents to borrow at lower in-

terest rates to invest in their children's schooling, and thus poorer families face a constraint on their credit which leads them to invest less in their children's schooling than the rich (Becker, 1967; Jacoby, 1994; NaRanong, 1998). Family wealth could also merely increase the demand for children's human capital for consumption purposes, and this plausible hypothesis would also encourage the same tendency for relative "over investment" by richer families in the schooling of their children compared to those of the poor. It is less clear than in the case of omitted "ability," what the direction of the bias introduced by the omission of parental wealth. If imperfect labor markets allow wealthy families to obtain for their children jobs for which they are paid wages in excess of their marginal product, this omission of family wealth might bias upward estimates of the wage returns to schooling, or conversely, the "overinvestment" of wealthy families in less promising students could introduce a downward bias.

This commonplace statistical problem of omitted-variable bias is compounded by an errors-in-measurement bias that arises if the human capital stock variable, i.e., education, is itself not reported accurately or measured precisely. Griliches (1977), among others, has illustrated how efforts to "control for" omitted-variable bias which might be expected to otherwise overstate the wage returns to human capital will also augment the errors-in-measurement bias that attenuates the estimates of the wage returns to the poorly measured human capital input. The net effect of these generally offsetting sources of bias is not obvious on *a priori* grounds. A proposed solution to this dilemma in econometrics is to specify a suitable instrumental variable that is correlated with schooling, but is not likely to be related to the worrisome omitted variables. [3] For example, a locality-specific price for an input to produce the form of human capital, such as a monetary price of school tuition or time price of attendance is often approximated by the distance of the child's residence from the closest school. It would be desirable if this local price or program variation across the sample that is used to predict schooling was closely related to the policy instrument that society would be inclined to manipulate to change the demand for schooling. In other words, if the wage returns to schooling exceeded or fell short of some equilibrium return, the natural policy variable would be to build (or close) more neighborhood schools. It is also critical that this locality "price of schooling" not be correlated with omitted determinants of the demand for schooling. In contemporary program evaluation studies, estimates of the returns to schooling may be based on variation in school attainment associated with an otherwise random policy variable should approximate the school returns for those segments of the population who are most likely to be influenced in their school decision by the program changes. Using this source of policy variation as the instrumental variable allows the researcher to interpret the estimated return as not the average returns for an entire population but the marginal returns for those treated and most likely to respond to the treatment by changing their schooling decisions.

A series of studies of returns to education in the United States using this instrumental variable methodology has yielded estimates which are similar to those obtained by ordinary regression (least squares), or sometimes as much as 10–20% higher. One might conclude that both sources of parameter bias are relatively unimportant or they happened to cancel each other in standard statistical fits of wages to schooling. Another possibility is that school returns differ at the margin for various segments of the population, and this heterogeneity in wage response to the treatment provided by schooling accounts for why different instrumental variables imply different estimates of returns; in other words, the different instruments affect the schooling of different groups whose returns actually differ from the average (Card, 1999). There are fewer investigations in low-income countries using instrumental variables to predict schooling levels and wage functions for women and men. Parallel investigations of World Bank Living Standard Measurement Surveys from Ghana and Côte d'Ivoire from the end of the 1980s, for example, did not find the instrumental variable estimates of schooling returns were significantly different from those reported by standard regressions (ordinary least squares), whereas wage returns to health, proxied by height and weight-to-height-squared, tended to increase substantially when estimated by instrumental variables, suggesting that heterogeneity and measurement error are more serious sources of bias in the case of health than they are for schooling (Schultz, 1995b).

These problems of estimation bias are potentially as serious for the study of male or fe-

male wage returns to schooling, and few indications have yet emerged that they operate to a different degree for men and women. As noted earlier, there is some suggestive evidence that correcting for sample-selection bias does increase schooling returns for women more than it does for men, but further research will be needed to confirm the generality of this empirical regularity (Schultz, 1995a).

In conclusion to this section, it should be noted that there is an alternative to estimating wage functions for men and women and comparing their returns to schooling. It involves estimating production functions or cost functions, and deriving from these estimates the marginal products of male and female labor inputs with more and less schooling. I do not know of production functions that have sought to extract both the marginal product of male and female labor, where labor inputs are disaggregated by levels of school attainment. It has proven difficult to disaggregate labor by gender when estimating production functions, perhaps because the labor input allocations are in fact endogenous, and likely to be related to unobserved endowments of the workers or other omitted production input variables (e.g., Fafchamps & Quisumbing, 1999; Huffman, 1976; Quisumbing, 1996; Schultz, 2001, Chapter 8). To perform the further disaggregation of labor inputs by gender, age, and by schooling, may not yield precisely defined production function estimates, and thus is not yet a source of insight into male and female returns on schooling which are comparable to those widely derived from wage functions.

From the earliest investigations of the market returns to schooling it was taken on faith that rates of return to additional years of schooling would have a tendency to decline at more advanced levels of schooling. Individuals were assumed to first acquire the schooling skills that were most highly rewarded in the labor market, and continue to invest in more skills until returns fall to the cost of borrowing further capital (Becker, 1964, 1981). Psacharopoulos and Woodhall (1985) note that the highest returns to schooling in the low-income world occur at the primary school level, where most of the world's population reside, and that returns tend to decline at secondary and higher educational levels, particularly when social returns include public school expenditures. This general pattern of diminishing returns to schooling justifies expanding first basic education in low-income countries, before making large investments in more costly higher education. [4] If women tend to be concentrated at lower levels of education than men, and the returns are generally higher at these lower levels of schooling, then closing the gender gap in years of schooling will purchase higher returns than raising the overall distribution of schooling that leaves the existing differentials between men and women unchanged.

3. EXTERNALITIES OF WOMEN'S AND MEN'S SCHOOLING

A standard reason to expend public resources on an activity is that the individuals who determine how much of that activity to demand (produce) do not take into account some social benefits and costs associated with the activity, because they do not privately capture them or pay for them, respectively. Social benefits and costs of schooling that are not borne privately by students or their families have been discussed in the initial conceptualizations of human capital by Schultz (1961) and Becker (1964). But they have not often been quantified so as to inform calculations of the social returns to schooling. Studies have generally quantified only the public costs of education. Factoring these additional costs into the private wage return calculation, of course, reduces the calculated social returns to schooling, most dramatically for tertiary levels of schooling, where the public costs tend to be many times larger than the public costs of primary or even secondary schooling per year per student (Psacharopoulos & Woodhall, 1985). But discussions of social benefits of education remain abstract (e.g., they enhance the operation of democracy) and not monetized in a form that they can be incorporated into the economic calculations of social returns. At the macro economic level, schooling has been the most powerful "nontraditional" input discovered to explain the puzzle of modern economic growth (Denison, 1962; Jorgenson, 1995; Kuznets, 1966; Schultz, 1961). Some crosscountry regressions explaining aggregate growth with economic inputs and institutions do not always find the anticipated partial correlation with measured changes in schooling (e.g., Benhabib & Spiegel, 1994). But Krueger and Lindahl (1998) have argued that aggregate measures of adult schooling are dominated by long-run trends, and short-run changes over time in these measures are mostly measurement error,

and not surprisingly, uncorrelated with growth rates.

Although there are few widely accepted empirical estimates of the macroeconomic externalities of schooling on economic growth, there is microeconomic evidence of intergenerational externalities in the production of human capital. [5] The most salient examples are a number of home production processes coordinated by the family that are affected by the schooling of its members, and for which society often assigns a special value, or a social value in excess of the private benefits which individuals in these families capture. Most of these exceptions relate to the formation of human capital in children, or investments in the *productivity of future generations*. It is not obvious that societies should always be inclined to encourage investments in future generations, for to sacrifice current consumption for future generations, whose income might be greater than those currently living, is not necessarily desirable. But most societies appear to view such human capital investments in children as an activity it is willing to subsidize. Consequently, if the schooling of parents contributes to their children attaining more education, the parent schooling also warrants a subsidy due to its externalities.

The conclusion of many empirical studies of child development is that increased schooling of the mother is associated with larger improvements in child quality outcomes than is the increased schooling of the father. This has been studied with birth outcomes (e.g., birth weight), child survival, good nutrition, earlier entry into school, increased school enrollment adjusted for age, and more years of schooling completed on reaching adulthood. [6]

There is a substantial empirical literature suggesting that adding to a mother's schooling will have a larger beneficial effect on a child's health, schooling, and adult productivity than would adding to a father's schooling by the same amount. This finding is consistent with recent studies grounded in the bargaining models of family resource allocation which report increments to the nonearned income of mothers (that empowers them) have a larger beneficial effect on the consumption and human capital of children than a similar increase in the nonearned income of fathers (see reviews in Alderman & King, 1998; Haddad, Hoddinott, & Alderman, 1997; Quisumbing, 1995; Schultz, 2001; Strauss & Beegle, 1996; Thomas, 1990, 1994). [7]

In assessing this interdisciplinary literature it is important that the schooling and resources controlled by women are appropriately evaluated, and that confounding factors are suitably controlled. Some early studies relied on the labor market earnings or total income of women to measure women's control of economic resources (Blumberg, 1988; Kennedy & Cogill, 1986). These measures of "women's bargaining resources" are less than satisfactory because they are affected by the women's market labor supply decisions, and time allocation could also be affected by her fertility and correlated with her compensatory child expenditure patterns. For example, using our previous results, women with more inherited wealth and nonearned income may allocate less of their time to working in the wage labor market and thus have less earnings, but allocate more time to child care and coordination of home production. This should not be interpreted to indicate that these women had less economic control of resources in the family.

In both the unified family model and bargaining family models the productive value of the husband's and wife's time are expected to modify consumption and investment patterns, because the value of the time of family members enters into the opportunity costs of many consumption commodities and investment activities, and thereby modifies the entire structure of family demands (Becker, 1981). Augmenting a mother's schooling could increase her capacity to produce child human capital by a larger amount than does the father's schooling increase his corresponding capacity. He also may spend less time than she does in child care. Thus, if the mother's schooling produces more favorable child outcomes than does the father's schooling, that is evidence of a favorable social externality associated with public investments in female schooling. It is not by itself evidence, however, that women have different preferences for child human capital, or that the unified model of family behavior must be rejected in favor of the bargaining model of the family that can accommodate a world where men and women pursue different objectives with their own separable resources.

A better approach to distinguishing between the unified family model and forms of the family bargaining model involves testing whether the personal distribution of nonearned income in the family affects the allocation of

household resources to child consumption and human capital investments. Perhaps the most readily interpreted evidence of this form is when an individual's own nonearned income is associated with a greater increase in child height, weight-for-height, and calorie intake, holding constant for the family's *total* nonearned income and the shadow value of the time (i.e., wage rates) of both spouses. This empirical regularity strongly suggests that the pooling of family resources is less than perfect. When women control more nonearned income, indicators of child development improve by a greater amount than when men control these resources, holding constant the total budget constraint for the family.

The next analytical problem in relating the schooling of mothers and fathers to child development is caused by the modification of family composition with changes in the schooling of the parents. Family living arrangements express the parents' preferences for patterns of consumption and investment. Marriage, separation, divorce, and childbearing are all, to some extent, choices made by adults to improve their expected welfare. How is one to deal with the self-selection of those women who are living with a spouse, or living on their own, or living with another relative? How is one to treat the potential earnings or nonearned income of a man resident in her household, if he is not currently married to her? All these ambiguities in what constitutes the appropriate evaluation of the child development externalities of mother's and father's schooling should caution us from drawing definitive conclusions from the existing empirical evidence, because most of this evidence is estimated from only husband–wife coresidential units. I would conjecture that the conclusions noted earlier will not be reversed, if we learn how to control more adequately for the joint determination of family composition and child development. But the challenge to "endogenize" the family's composition within our models of household production needs further research.

Most empirical studies of the effect of parent schooling on child development are flawed for the purposes of this paper, because they include control variables that are likely to be affected themselves by parent schooling. For example, a common practice is to control for family income, husband and wife earnings, or fertility in assessing the effect of parent schooling on child development. But if these control variables are thought to affect child human capital, and also are jointly determined by the mother's or father's schooling, what can be learned from existing data? It is certainly no longer a "total" effect of schooling on the child outcome, nor is it an acceptable estimate of a "net" effect. If the intervening variable, such as family market income, is positively affected by the father's schooling, then it might be expected that some of the beneficial effect of father's schooling would be captured by family income and the "net" effect of father's schooling controlling for family income would be algebraically smaller than the total effect (not conditioned on family income). If as seems more likely, family income is itself a family choice variable that incorporates husband and wife labor supply decisions and joint specialization and reflects the preferences of both father and mother, the direction of the (simultaneous equation) bias is not clear (Becker, 1981; Schultz, 1981). Nonearned income, land, inherited assets may potentially serve as controls for nonhuman wealth of the family, if they are not affected themselves by the schooling of the parents. These nonhuman capital variables can then be used as instrumental variables to estimate the effect of lifetime family income levels, approximated by variables such as total family expenditures per adult. As with family composition variables discussed earlier, most direct controls for family incomes, parent earnings, or fertility make estimates of effects on child human capital development difficult to interpret as an indication of the total effects of mother's and father's schooling.

This interpretation of the empirical record needs much more nuanced study. One strategy postulates the roles of unobservable variables, such as preferences for child schooling which differ for men and women. Suppose men who prefer to have fewer children and better educated children seek wives who are better educated and thus more productive in producing human capital in their children. These (unobserved) preferences of men for lower fertility and higher "quality" children would lead them to make the necessary sacrifices in other areas (i.e., reduce their other consumption) to marry better educated women. Or more specifically, it would lead them to marry better educated women than they would be expected to marry, on average, in the normal functioning of the marriage market without such heterogeneous preferences. In this case, it becomes ambiguous whether the lower fertility and increased child schooling associated with a mother's schooling

is a causal effect of the enhanced home productivity of a woman's schooling, the preferences of women for higher quality children, or an incidental outcome of the marriage matching process, which involves men's and women's preferences.

In rural Bangladesh and India empirical evidence has been assembled, conditional on a structural model, which suggests part of the correlation between women's schooling and their children's schooling is due to the marriage matching process, and consequently can be attributed to men's preferences rather than to women's differential productivity in schooling their children (Behrman *et al*., 1997; Foster, 1996). The Indian study first notes that women's schooling does not contribute to increased agriculture productivity, whereas men's schooling is strongly linked to the adoption of new agricultural technologies since the 1960s and consequently to increases in rural incomes (Foster & Rosenzweig, 1995). Women's and men's schooling may also not earn much of a private return in the daily rural wage labor market in India. A remaining possible economic reason for sending girls to school in increasing numbers by rural Indian and Bangladeshi families is that the better educated women are able to increase the schooling (and health) of their children. Men who want better educated (healthier) children are thus motivated to marry a better educated women with increased capacity to produce child human capital. An improved understanding of the joint determination of the marriage market and these home/child human capital production processes could affect the magnitude of estimates of the technological productivity of female education on child human capital, and plausibly reduce them in circumstances where women's schooling is privately valued by men mainly for its productive effects on childrearing.

Another dimension of the marriage market, the quality of match between partners, could have additional implications for private and social welfare. In this case there is also very little theoretical or empirical research to build on, and the implications are thus speculative. It is necessary to make a number of simplifying assumptions to illustrate the nature of the problem, although they can, in some cases, be relaxed later. Suppose that an individual benefits not only from the increased production possibilities that a more educated spouse brings to a marriage, as assumed in standard economic models of marriage (Becker, 1981), but also is rewarded by a positive consumption complementarity between the husband's and wife's schooling. For simplicity this matching benefit from the interaction of husband's and wife's schooling might be assumed loglinear as are the schooling effects in the wage equation. Suppose further that the marriage market matched the most schooled man with the most schooled woman, and so on down through the schooling-ranked men and women, so that the rank correlation between the spouses education is perfect, i.e., rho = 1.0. Then, if the years of schooling were distributed similarly for men and women, the summed welfare of the matched couples would be greatest given any total stock of schooling available to the population, when the average gender gap in schooling was zero. This result depends on market returns to schooling for men and women being the same, a pattern widely observed and noted in Section 2. Of course, the match correlation of schooling of husband and wife is not 1.0, as assumed, but perhaps between 0.4 and 0.6 (Kremer, 1997). Nonetheless, there is a tendency for the gender gap in schooling to diminish with economic development in this century, and perhaps for the correlation between the schooling of husband and wife to increase. [8]

The final potential externality of schooling relates to fertility, which is widely found to be inversely related to women's schooling (Cochrane, 1979; Schultz, 1973, 1981, 1997). If family planning programs are currently subsidized by the state because a reduction in fertility is thought to bring a social benefit, then increasing the schooling of girls should be subsidized for it is clearly associated, in a decade or less, with diminished fertility. Not all societies support family planning because they desire to reduce fertility; some endorse these programs to improve women's lifetime opportunities and strengthen their reproductive rights. There is also a handful of instances in Africa where the first few years of female education seem to have little effect on a woman's fertility, perhaps because of the low quality of available primary education, or the counterbalancing effect of education on improved reproductive health and reduced sexually transmitted diseases that contribute to subfecundity and thus prevent some women from having the number of births they want. On balance, the evidence suggests that increments to the schooling of men, holding constant the educational attainment of

women, are associated in low-income countries with increases in fertility, although this pronatal effect of male education seems to diminish as the country develops (Schultz, 1973, 1994, 1997). The social costs of high fertility and rapid population growth are difficult to quantify scientifically (National Research Council, 1986), but many countries have concluded that their society stands to gain in the long run by slowing rapid population growth, and this conclusion would justify assigning a higher priority to women's education than to men's.

To conclude this section, if the private market wage returns are of comparable magnitudes for men and women, but the social externalities associated with reduced child mortality, increased child anthropometric capacities, increased child school enrollments, and decreased fertility are all linked more positively to women's schooling than they are to men's schooling, and these outcomes are valued by society, it is *efficient* for society to invest more in the schooling of women than of men. Whether these social externality benefits associated with women's schooling vary by the level of her schooling has not been systematically explored across countries and levels of development. One investigation of contemporary rural India found that mother's literacy and some primary schooling had a larger effect on the child's school work and attainment than did her post-primary schooling, suggesting higher social returns for the most basic levels of female schooling (Behrman *et al.*, 1997). A deeper understanding of the marriage market may sharpen our insights into these connections and how to manipulate them efficiently, but is unlikely to reverse these basic findings. The magnitude of the subsidy that would be socially optimal would depend on the value society assigns to slowing population growth and formation of more human capital among its youth. Where female school enrollments are markedly lower than male, there is a *prima facie* case for greater subsidies for female education. The only reason to revise this rule of thumb is if market wage returns for female schooling fall substantially below those of male schooling, presumably due to an overproduction of women's human capital given the social institutions prevailing in the labor market and the derived demands for various types of labor in the economy. I have not found a compelling empirical study that reports evidence of such an "overproduction" of women's schooling.

4. PUBLIC FINANCE AND IMPLICATIONS FOR TAXATION

Individuals are expected to weigh taxes as they do wages and prices in allocating their time and determining the composition of their consumption and investments, to the extent that taxes differ among productive activities, outlays, and persons. Because governments must realistically obtain their revenues from taxes on readily monitored activities, such as work in the market that produces earnings, most taxes discourage, although differentially, engaging in market production activities and thereby impose a deadweight efficiency loss on society. There are two ways that this loss due to taxes can be affected by the gender gap in schooling. First, by increasing the share of social activities that are taxed, government can lower the overall tax rate. Second, the tax rate can be raised on labor for which the supply is more inelastic or unresponsive to the tax, in order to reduce the tax rate on activities which exhibit elastic responses to the tax rate and hence are more distorted by the tax. Differences between the market labor supply elasticity of men and women could, therefore, influence the efficient design of a tax system for individuals and families and thereby modify social priorities for subsidizing the schooling of women versus men (Apps & Rees, 1988; Boskin & Sheshinski, 1983).

Some demographic groups in the population tend to increase, on average, their supply of labor to taxable market activities as they become better educated, as do married women, whereas other groups are less responsive, as with adult men. This empirical regularity occurs presumably because the elasticity of women's market labor supply with respect to their own wage (and education) tends to be algebraically greater than it is for men (Killingsworth, 1983; Schultz, 1981). This empirical regularity may be partly understood in terms of men generally working full time in the market, and they are thus unable to increase greatly their market labor supply when their education and wages rise. In contrast, women have until the 20th century allocated most of their time to work focused in their home, which is often readily combined with child care responsibilities, and thus women have been observed to increase their market labor supply when their educational levels are higher or rising (Fogel, 1999; Schultz, 1990).

Moreover, estimates of family labor supply which allow for the simultaneous determination of a couple's labor supply find that the cross-effect of the husband's wage (or schooling) tends to reduce his wife's market labor supply, whereas the effect of the wife's wage (schooling) on her husbands labor supply is not substantial or statistically significant (Killingsworth, 1983; Schultz, 1981). Consequently, the female schooling effect is to increase directly women's own labor supply and market earnings tax base. The cross-effect of male schooling on her labor supply is negative, reinforcing the previous conclusion that the market earnings tax base would expand more rapidly in a society given its average education level, if the schooling of women were able to catch up to that of men.

If school administrators could accept more girls rather than boys at the margin to enroll in school, this reallocation of education by gender would thereby contribute to increase the share of adult time allocated to market work, and thus to broadening the tax base. This increment in the taxable share of social output allows the government, in principle, to lower the overall tax rate and thereby reduce the deadweight loss associated with raising any specified amount of revenue.

A second objective in the optimal design of taxes is to set rates on different factors of production to tax more heavily the inelastically supplied resources, such as Henry George's tax on land, in order to reduce the overall deadweight losses from a tax regime. The greater elasticity of women's labor supply compared with that of men's would, according to this second objective of public finance, encourage governments to tax more heavily the inelastically supplied source of labor—that provided by adult men—and thereby be able to reduce the tax rate on women's market labor supply. This less distorted structure of differential taxes on the market earnings of women and men is ironically the opposite of the structure adopted in some societies. In the United States, for example, married women pay the progressively higher tax rate based on her husband's earnings when she enters the labor force as a "secondary worker," perhaps to encourage married women to specialize their production within the home, rather than in the labor market (e.g., McCaffery, 1997).

Thus, a redirection of human capital toward women should broaden the tax base and thereby reduce tax distortions of consumption and production between market and nonmarket activities. In addition, the market labor supply response associated with an increase in own schooling is more positive for women than for men. This regularity may help explain the large increase in female market labor supply in this century, first in the industrially advanced countries, and more recently throughout most other parts of the world, at least in the nonagricultural sector of the economy (Schultz, 1981, 1990). One interpretation of this regularity in labor market behavior of women is that it is due to the positive (uncompensated) wage effect caused by increasing the schooling and hence market productivity of female workers. In the case of male labor supply, increasing schooling and productivity is associated with little change in hours of labor supplied to the market labor force, and in many countries there has been an actual contraction in male work hours (Fogel, 1999; Killingsworth, 1983; Schultz, 1981). Moreover, estimates of family labor supply models suggest that the cross-effect of the husband wage (schooling) on wife's labor supply tends to be negative and substantial in magnitude, whereas the effect of the wife's wage (schooling) on husband labor supply is not substantial nor statistically significant (Killingsworth, 1983). Consequently, the female schooling effect on the women's own market earnings tax base is positive, and the cross-effect of male schooling is negative, reinforcing the earlier conclusion that the market income tax base would expand in most settings with a redirection of human capital formation or schooling from men to women.

5. POLICY OPTIONS TO INCREASE THE SCHOOLING OF WOMEN

The objective of increasing educational opportunities for women is probably as old as the gender gap in schooling. Euripides may have even advanced some proposals for Greek Athens to open their schools to women, as did Plato in his utopian *Republic*. The search for policy instruments to accomplish this increase in women's education has a long social history. But, as with many forms of social policy, rigorous evaluation of the success of various policy interventions are often neglected. As with many praiseworthy goals, most policy reforms to advance the education of women have resulted in legislation without mechanisms for

enforcement, incentives to change behavior, or delineation of indicators of success. Although there may be some successful policy initiatives, most are probably not effective, and the program evaluation literature has made little progress in sorting out which policy strategies are more effective or efficient. With their passage into law and with sequestered appropriations, the public need for action is generally satisfied. Nevertheless, a number of countries in different regions—notably in East Asia and Latin America—have achieved considerable success in promoting women's education. The purpose of this section is to collect a list of possible mechanisms that might advance women's schooling, to consider which policies hold the greatest promise, to identify the information needed to monitor progress, and finally to structure policy evaluation studies to refine the design of these initiatives (World Bank, 2001).

Differences in enrollments of boys and girls could arise because of either the decisions of families or the operations of schools, or in other words, due to either private demands or public supplies. Schooling can of course also be provided in the private sector, if public supplies are not responsive to private demands. Conversely, gender discrimination in the operation of schools may exist because there is widespread support for it in the community or in those segments of the community that have the political power to modify educational institutions. This dichotomy between private demands and public supplies may facilitate analysis of the determinants of schooling decisions, first at the level of individuals and families, and then at the aggregate community level, where a more complex social equilibrium framework may offer a fuller understanding of why some societies such as India, Sri Lanka and Thailand have pursued such different priorities in public education.

Families are thought to weigh the costs and benefits of sending their children to school. In some settings they decide it is more important for them to educate their boys than their girls. This could be explained because the expected private rates of return, as discussed in Section 2, are larger for boys than for girls over their children's lifetimes. Alternatively, the decision-making parents may not be altruistically willing to view their children's lifetime gains as equivalent to their own, and they will discount these expected productive gains of their children, unless the parents stand to benefit personally from these gains. In some cultures, such as South Asia, sons are customarily responsible for supporting their parents in old age and daughters are not. This would seem to suggest how cultural arrangements of marriage and intergenerational support systems among kin could depress the incentives for parents to invest in the schooling of their daughters compared with their sons. This plausible hypothesis is widely accepted, but it neglects a role of the marriage market to assign a value to the daughter's schooling. Parents should then be rewarded by the family of the husband of their daughter for rearing a daughter who has more schooling, if indeed female schooling increases the woman's lifetime productivity and contributes to the welfare of her husband's family.

If noneconomic cultural constraints or social norms preclude the wife from working in productive activities, e.g., if she is confined by purdah to labor only within her family's household, such cultural impediments to labor mobility might reduce the economic contribution of an educated wife and curb parental investments in the schooling of girls. A cultural system that promotes such an inefficient allocation of resources should be subject to market pressures to change. If this explanation for low levels of female schooling is plausible, say in areas of South and West Asia, how might public policy accelerate the cultural shift to allow labor markets to allocate more of women's time to activities where her schooling enhances her productivity? If a woman's only option in the rural labor force is to perform casual manual work by the day, the wage premium for schooling may be limited. Women will need to engage in some farm management tasks which involves the allocation of modern technological inputs for them to employ productively their schooling. Culture-specific institutions may be designed to demonstrate how family welfare is enhanced by educating females and allowing them access to managerial, nonagricultural, and extra-familial jobs. Perhaps farm extension activities can directly assist in facilitating the off–farm employment and migration process for better educated daughters?

The traditional approach to increase female enrollments has been to reduce the cost of schooling to parents, by building schools closer to the population they serve, reducing tuition fees specifically for females, providing girls with subsidies for their school uniforms or school feeding programs, and extending fellowships for girls to attend boarding school where local secondary schools are not available.

Bangladesh has experimented since 1994 with fellowships for girls to continue in secondary school. Some of these educational grants are treated as a bond which is forfeited if the girl marries before the age of 18 (Arends-Kuenning & Amin, 2000). Mexico has provided poverty alleviation grants to poor rural mothers to keep their children enrolled in school in a program called "Progresa." The Mexican grants are roughly pegged at local child wage rates, but are marginally higher for girls than boys, because the gender gap in enrollments in these poor Mexican communities emerges at the secondary school level. Evaluation studies have found that in the communities that were randomly selected to receive the initial phase of the Progresa educational grants starting in 1998, the enrollment rates of girls increased by more than boys, especially for children after finishing primary school and first entering the junior secondary school (Schultz, 2000). More than two million Mexican households were participating in Progresa by the end of 1999, and the new government of Fox plans to expand the scheme to involve poor families in urban areas as well.

Three states of Brazil have experimented with educational grants for mothers in poor households who enroll all of their children between the ages of seven and 14 in school. In 2001, the Federal government of Brazil plans to expand this approach, Bolsa Escola, to the national level, and coordinate it with two other poverty alleviation programs. One program provides cash transfers for nutrition, while another expands a youth program to discourage children from working in hazardous circumstances and to involve them in additional educational activities, or PETI (Sedlacek, 2001). At the national level, Brazil's enrollment rates are relatively low, but completed schooling in the past few years is somewhat higher for girls than for boys. Therefore, the Bolsa Escola makes cash transfers to poor mothers contingent on the enrollment of their children in compulsory primary school, but does not explicitly favor girls.

There should also be administrative means to reduce gender inequalities in schooling within families. For example, to be accepted at school an elder male child might be required to have his (younger) sister(s) enrolled. Such quantitative restrictions can, however, neglect differences between children in ability and motivation, and can place costly monitoring burdens on schools. Communities could be rewarded when the female proportion of their graduating students exceeds a threshold, but this could have the side effect of lowering the standards for a female compared with a male graduate, and such quota targets could be misrepresented by teachers unless strictly audited by central authorities.

Another strategy assumes that parents in some cultures do not want their daughters educated *with* boys. In South and West Asia and North Africa the schooling of girls may be restricted by the lack of sex segregated schools, particularly at the secondary level. Are girls schools, which avoid mixing of the sexes after the primary level, more successful? Do female teachers succeed to a greater degree in enrolling and advancing girls compared with male teachers? Do particular facilities or qualitative features of schools contribute to raising female enrollment rates by a larger percentage than male enrollment rates? There are few studies of such school quality or supply interventions which are randomly allocated across communities and confirm that public expenditures on female schools, female teachers, and female-oriented facilities contribute cost-effectively to increase the educational attainment of women. But these are propositions that could be tested within educational programs in Pakistan, Bangladesh, and some Middle Eastern countries. A word of caution is nonetheless needed to indicate that any evaluation of interventions must not only succeed in introducing the intervention on a *randomized basis*, it must also collect representative surveys of the local household population and link this information to the school with its measurement of student standardized performance on tests along with information on teachers and classroom inputs. The matched background population survey will determine which children enroll in school, as well as which students do poorly and well within school. The population survey must measure the home economic and social factors which affect private demands for schooling, such as the mother's and father's schooling, nonearned income and asset of both parents, etc. For every dozen studies of gender differences in student classroom performance, there is perhaps one that analyzes matched information about the school system's inputs, and the characteristics of local families of both the children who are enrolled and those who are not enrolled in school. Without analyzing these more difficult to collect, overlapping school and population samples, most policies designed to

modify the gender balance of schools cannot be evaluated.

6. CONCLUSIONS

In many international statistical studies of the wage structure, it has been found that the increase in logarithms of wage rates associated with an additional year of a worker's schooling is of about the same magnitude for women as it is for men. Corrections for many statistical and conceptual problems that could make this wage comparison misleading, such as sample-selection bias, omitted-variable bias, and measurement-error bias, have not been found to alter systematically this general comparability of female and male wage returns to schooling. The current balance of evidence indicates that these estimates of the private wage returns to schooling tend to be, if different, somewhat higher for women than for men, holding constant the level of education being compared. Since women tend to have less education than men, on average, and returns tend to be higher at lower levels of schooling, the returns to schooling of the average girl are higher than the average boy. This ranking in private returns is strengthened if the private direct costs of education are added to the private opportunity costs, because boys often receive more family educational expenditures (e.g., Sipahimalani, 1999). Consequently, private returns to an additional year of schooling for the representative female exceed those for the representative male, and social returns that factor in public expenditures on schooling are even more favorable to a general increase in female relative to male enrollments.

Social benefits or positive externalities related to investments in the human capital of children in the form of child health, stature, and schooling are larger with an increment in the schooling of their mother than their father. Fertility is also inversely related to female education in virtually all populations and often fertility is directly related to male education in low income agricultural societies. Consequently, when population growth is thought to impose social costs, female schooling should be assigned a higher priority than male schooling, other things being equal.

Combining the larger private wage returns and the beneficial social externalities associated with female schooling, there is a strong economic *efficiency* case to reduce the gender gap in schooling, particularly where child survival is relatively low and fertility is relatively high. From a public finance perspective, the increased schooling of women can be expected to increase the participation of women in the market labor force (and not reduce that of men) and thereby broaden the society's tax base. The effects of taxes on the distortion of the allocation of time and resources between market and nonmarket production can thus be reduced, given the public sectors revenue requirements.

The economic efficiency case for redirecting social investments toward the education of women is strong, but the mechanisms that can accomplish this objective have not been rigorously studied. They involve primarily understanding more precisely how the family responds to different inducements. Would subsidies for girls' education repay the public sector and shift the gender balance of enrollment rates in families, or is the family demand for male relative to female schooling price inelastic? If women are largely restricted from working outside of their family and reaping many of the productive advantages that come from their schooling, how does a society intervene and design a culturally acceptable program to change this pattern of lifetime allocation of women's time? One strategy may be to encourage rural industries that employ locally more educated women, as occurred in Taiwan and China, and to some degree in Korea and Thailand, and may now be occurring in Bangladesh. A few decades ago these factories were viewed by some observers as exploiting rural women by paying them excessively low wages. Another assessment of this situation may be in order. How effective is such rural industrialization in increasing women's employment in the wage labor force in South and West Asia and the Middle East? How do rural employment opportunities in nonagriculture influence the gender gap in schooling? Can such a pattern of development be sustained in sub-Saharan Africa? Will this pattern of development in rural areas have the expected effect on the investment of rural families in female schooling and will it also accelerate the rural–urban migration of these better-educated women?

In conclusion, it should be emphasized that macro indicators of development confirm the conclusions drawn here from the micro economic studies of individuals and families. Countries that have equalized their educational

achievements for men and women in the last several decades have on average grown faster. Except for the indigenous populations in which a substantial disparity persists between the schooling of boys and girls, Latin America has provided nearly as many years of schooling to females as to males (if not always of the same quality), and the growth record of this continent until the 1980s debt crisis was impressive (Birdsall & Graham, 2000). East Asia has increased the schooling of women much faster than that of men, closing a historically pronounced gender gap in these patriarchal societies in a few short decades. Southeast Asia draws on Malay cultural roots that were less gender-biased, and sometimes even matriarchal, and the schooling of women increased in this region more rapidly than that for men, but the initial gaps were often smaller than in East Asia. Despite recent financial crises in the region, the economic growth record remains one of great success. South and West Asia has achieved less uniform and lower average growth. This region is notable for investing relatively less in basic education and much less in women relative in men, possibly accounting for their subpar growth performance until the 1990s, despite high investment rates in nonhuman capital. Sub-Saharan Africa has had the worst growth record, the most political turmoil, highest rate of population growth, lowest domestic investment rates, and has attracted the least foreign investment. Africa, with the exception of South Africa, provided schooling mainly to males, although women were heavily engaged in the subsistence and market economies, and should therefore have had as much to gain from schooling as did men. Why African women received such a small share of schooling resources is a puzzle which has not been accounted for by analysis. This traditional disparity is changing in Africa as young women are catching up to men in terms of schooling, and even surpassing them in such countries as Kenya. This paper has focused on the microeconomic evidence from household surveys and censuses of the private productive returns and social externalities of human capital and schooling by gender. Merging school administrative and household survey information on the school and family inputs, enrollments, and test scores should provide a firmer basis for evaluating national policy options to equalize educational opportunities between females and males, and also between the poor and rich families, and rural and urban areas. The improvements in time series on educational attainment and earnings of the adult workforce by age and sex should provide countries with a reliable monitoring mechanism to assess private returns to schooling. At an aggregate level such merged administrative/survey data may also improve crosscountry analyses of the contributions of education and health to modern economic growth, which are currently limited by poor data and ad hoc frameworks that lead to fragile and implausible growth regressions (Krueger & Lindahl, 1998). Eventually, intercountry differences in economic growth may shed light on the determinants of and consequences of the gender gap in schooling and even help to quantify the value of the social externalities associated with female schooling, which remains an important, if controversial, element of the microeconomic case surveyed here, which justifies increased public subsidies for female schooling in many parts of the world.

NOTES

1. The gender gap in schooling tends to mirror a host of other, more difficult to measure gender differences in human capital, such as (a) early childhood nutrition and health care (e.g., often proxied by reduced adult height, called stunting), (b) nutritional status determined by nutrient intakes relative to energy demands of work, as modified by protective health care (e.g., often proxied at low income levels by weight-for-height or BMI, called wasting), (c) different types of years of schooling for which the market returns differ (e.g., training to be teachers or nurses versus engineers and doctors, and other indicators of quality or resource intensity of that training), and (d) on-the-job training opportunities (often associated with sex segregation of jobs and promotional ladders), etc.

2. On the other hand, if postschooling experience of a woman is measured by her realized years of experience working in the labor force, then this more precisely measured experience variable is also a choice variable of the adult woman, which is likely to be "endogenous" to the wage function (i.e., correlated with the wage error), because it is jointly determined with lifetime specializations between home and market production and hence realized market wages. An analogous problem arises when studying the determinants of men's wages, when

researchers want to estimate the productive returns to job tenure or seniority on the job (Altonji & Shakotko, 1987).

3. Another approach is to estimate wage returns to schooling using only the variation between individuals who share the same omitted variables, when these unobserved variables might otherwise bias the resulting cross sectional estimates. For example, between siblings the relationship between education and wages may not be modified by shared variables representing their parents' wealth and some common family genetic endowments, and between fraternal and identical twins, which share even more aspects of their early childhood environment and genetic predispositions (Griliches, 1977; Solon, 1999).

4. Although this empirical generalization may still be valid for most countries, there are now documented exceptions where virtually all members of young birth cohorts have completed primary schooling, and a shortage of secondary educated workers has emerged. Wage returns at this intermediate level of schooling are then likely to exceed the returns earned at the primary level (Schultz, 1988). See the case cited of Egypt in Birdsall and O'Connell (1999).

5. There are aggregate growth theories that assume an externality due to human capital formation, but I am familiar with only a few empirical analyses of modern growth performance of national (or regional) economies that find evidence of externalities, or in other words that find income growth effects of schooling at the aggregate level exceed systematically the income growth which is privately realized by individuals in the form of wage differences of workers according to their schooling.

6. The literature on these issues is enormous and full of complexities that cannot be adequately examined in the scope of this paper. The evidence of mother's education lowering her child mortality was widely accepted after the Latin American Census samples of the 1960s and 1970s were cross tabulated and World Fertility Surveys became available for a widening sample of low-income countries in the 1980s (e.g., Barrera, 1990; Behm, 1976, 1980; Caldwell, 1979; Cochrane, Leslie, & O'Hara, 1980; Farah & Preston, 1982; Mensch, Lentzner, & Preston, 1985; Rosenzweig & Schultz, 1982a,b; Schultz, 1980; Thomas, Strauss, & Henriques, 1990). The studies of anthropometric indicators (i.e., height and weight) of child health began somewhat later, but also clearly indicated that better education of the mother was correlated with better height and BMI indicators for her children (summarized in Behrman & Deolalikar, 1988, 1989; Behrman & Wolfe, 1984, 1989; Strauss & Thomas, 1995, 1998). Schooling of children is commonly related positively to maternal education (e.g., Behrman, 1997; Behrman, Foster, & Rosenzweig, 1997; Chernichovsky, 1985; Duraisamy, 1988; Duraisamy & Malathy, 1991; Glewwe & Jacoby, 1994, 1995; Haveman & Wolfe, 1995; Holmes, 1997; Jacoby, 1994; King, Peterson, Adioetomo, Domingo, & Syed, 1986; Lavy, 1996; Lloyd & Blanc, 1995; Malathy, 1993; NaRanong, 1998; Rosenzweig & Evenson, 1977; Rosenzweig & Wolpin, 1994; Sipahimalani, 1999; Subbarao & Ramey, 1995; Tansel, 1997). Going beyond education, studies differ in how they measure women's control over resources, employing first labor market productivity and then wealth and non-earned income (Blumberg, 1988; Engel, 1988; Haddad & Hoddinott, 1994; Hoddinott & Haddad, 1995; Kennedy & Cogill, 1986; Kennedy & Peters, 1992; Senauer, Sahn, & Alderman, 1986; Thomas, 1990, 1994; Thomas & Chen, 1994). The studies also control in different ways for the endowments of the husband, family income, and family composition. As argued in this paper, there are serious analytical problems with most methods for dealing with family composition, and consequently there is an ongoing search for better methods to model explicitly marriage matching and marital status (e.g., Behrman, Birdsall, & Deolalikar, 1995; Behrman *et al*., 1997; Boulier & Rosenzweig, 1984; Foster, 1996; Schultz, 1994).

As in most empirical generalizations, there are exceptions where the positive partial correlation of the father's schooling with the child's schooling is higher than that of the mother's schooling, often in populations where there is more variation in father's than mother's education, due to the majority of mothers having little or no schooling, as in a study of Pakistan or sub-Saharan Africa (King *et al*., 1986). Other studies have excluded families without both a father and mother in residence, which can reduce sample size substantially and alter the estimated effects of mother's and father's schooling on child development indicators (e.g., Lam, 2000).

7. Assessing the effect of health status on worker productivity poses a parallel issue that increases in the intake of nutrients or anthropometric proxies for the stock of health tend to have a larger effect on worker productivity at lower levels (Strauss, 1986; Strauss & Thomas, 1995, 1998). Evidence on gender differences in health status are more fragmentary. Certainly in population of South and West Asia where the gender gap in schooling is large, we might expect the gender gap in health to also be relatively large. The low ratio of female to male child survival (after the first month of life) in India is now well studied and coherently linked to women's low productivity and high dowries. In this case, one would expect a given increment in health status

might yield a greater market productivity return for women than for men, although I know of no analysis confirming this pattern, perhaps because of the limitations on women working in manual labor outside of their families.

8. For example, in Taiwan the difference between the average years of schooling completed of men and women born during 1917–21 was 4.2 years according to the 1976 Family Income and Expenditure Survey. By 1995, men and women born during 1966–77 reported a gender gap in schooling of 0.23 years. By age 30 virtually all women in Taiwan were married, and the correlation of schooling of wives age 30–34 and their husbands was about 0.4 in 1976 and this correlation had increased to nearly .6 by 1995. (Schultz, 2001). Measurement of the match correlation is complicated when, as in most modern societies, virtually all women are not currently married. Then it is necessary to again correct the estimate of the match correlation for the selection of the sample of currently married couples.

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