Title

How Do Women's Educational Attainments Affect the Educational Attainment of the Next Generation?

Authors
Mare, Robert D.
Maralani, Vida

Publication Date
2005-08-15

California Center for Population Research
University of California - Los Angeles

How Do Women's Educational Attainments Affect The Educational Attainment of the Next Generation?

Robert D. Mare
Vida Maralani

CCPR-018-05

August 2005

California Center for Population Research
On-Line Working Paper Series

HOW DO WOMEN'S EDUCATIONAL ATTAINMENTS AFFECT THE EDUCATIONAL ATTAINMENT OF THE NEXT GENERATION?*

Robert D. Mare and Vida Maralani
University of California, Los Angeles

August 15, 2005

Word Count: 11,917

Running Head: "Educational Attainment of the Next Generation"

*Address correspondence to Robert D. Mare, Department of Sociology, University of California, Los Angeles, CA 90095 (**mare@ucla.edu**). Earlier versions of this paper were presented at the meetings of the Research Committee on Social Stratification of the International Sociological Association in Tokyo in March 2003; the conference on "Frontiers of Socioeconomic Mobility: Conceptual and Methodological Challenges" in Ithaca, NY in March 2003; and the meetings of the Population Association of America in Minneapolis, MN in May 2003. We are grateful to Elizabeth Frankenberg, Judith Seltzer, Elizabeth Bruch, and the anonymous reviewers for advice at various stages of this research. We also benefited from the comments of participants in workshops at Northwestern University, Nuffield College, and the University of Wisconsin-Madison. This research was supported by the John D. and Catherine T. MacArthur Foundation and the Russell Sage Foundation. The authors used the facilities of the California Center for Population Research, which is supported by the National Institute of Child Health and Human Development.

HOW DO WOMEN'S EDUCATIONAL ATTAINMENTS AFFECT THE EDUCATIONAL ATTAINMENT OF THE NEXT GENERATION?

ABSTRACT

The effect of the socioeconomic characteristics in one generation on the socioeconomic achievement of the next generation is the central concern of social stratification research. Researchers typically address this issue by analyzing the associations between the characteristics of parents and offspring. This approach, however, focuses on observed parent-offspring pairs and ignores that changes in the socioeconomic characteristics of one generation may alter the numbers and types of intergenerational family relationships that are created in the next one. Models of intergenerational effects that include marriage and fertility, as well as the intergenerational transmission of socioeconomic status, yield a richer account of intergenerational effects at both the family and population levels. When applied to a large sample of Indonesian women and their families, these models show that the effects of women's educational attainment on the educational attainments of the next generation are positive. However, the beneficial effects of increases in women's schooling on the educational attainment of their children are partially offset at the population level by a reduction in the overall number of children that a more educated population of women bears and enhanced by the more favorable marriage partners of better educated women.

HOW DO WOMEN'S EDUCATIONAL ATTAINMENTS AFFECT THE EDUCATIONAL ATTAINMENT OF THE NEXT GENERATION?

INTRODUCTION

The study of intergenerational social mobility is centrally concerned with estimating the effects of the positions, statuses, and resources of a family on persons born and raised in the family. By showing who gets ahead in a society and the benefits to children of improvements in their parents' socioeconomic positions, these effects cast light on the persistence of social hierarchies, the rigidity of stratification, and mechanisms of social change. For example, in a developing society, it is important to know the possible effects of parents' educational attainment on the education and general well-being of their children. These effects shape patterns of educational opportunity within the society and reveal the benefits to children of efforts to improve the education and socioeconomic level of their parents.

In this paper we argue that most studies of intergenerational mobility and the effects of parents on children are inadequate for assessing the intergenerational impact of socioeconomic characteristics. We propose alternative models that provide improved estimates of intergenerational effects. To elucidate these ideas and models, we focus on the effects of women's educational attainment on the education of the subsequent generation, although our argument applies to all aspects of family background that affect the life circumstances of the next generation. We show how to estimate the effects of expansions in women's schooling in the maternal generation and how these effects work through marriage, fertility, and intergenerational transmission. This enables us to go beyond most other research, which relies on estimates of the effects of mothers' schooling that ignore the effects that accrue through changes in family formation and family size.

Researchers have explored social background effects and social mobility extensively, including variations across time, place, and dimensions of socioeconomic inequality (e.g., Erickson and Goldthorpe 1992; Featherman and Hauser 1978; Hout 1988; Mare 1981; Shavit and Blossfeld 1993; Treiman and Ganzeboom 1999). However, almost all discussions of intergenerational mobility give an inadequate account of how generations of men and women affect the socioeconomic attainment of subsequent generations. To see how parents' characteristics affect those of their offspring, it must be possible, in principle, to change those characteristics to yield an outcome different from what would otherwise occur. But conventional mobility studies are ill-suited for assessing the effects of this type of intervention because these analyses typically focus on relationships between parents and offspring *conditional on existing mother-father and parent-child relationships, rather than on the unconditional relationships between parent and offspring generations*.

The study of observed family relationships fails to account adequately for the impact of the intervention on the formation of families. Existing mother-father or parent-child pairs are conditional on previous marital and fertility choices. Unconditional effects, however, include the effects of the intervention on marital and fertility choices as well. Thus, even if random assignment of children to families were somehow achieved, the resulting inferences from otherwise conventional approaches to the study of intergenerational relationships may still be of questionable value for practical and theoretical questions about the impact of family background on the next generation. Even in descriptive studies of intergenerational relationships, conventional approaches yield incomplete results. A more encompassing social and demographic model that reveals the unconditional relationships between the characteristics of successive generations is needed for either causal inference or adequate description.

UNCONDITIONAL INTERGENERATIONAL EFFECTS

The intergenerational effects of changes in the socioeconomic characteristic of adults occur partly through individual and family level variables that intervene between those characteristics and the characteristics of the offspring generation (e.g., Blau and Duncan 1967; Jencks *et al.* 1972). Research on educational attainment and the transition to adulthood has focused on the role of social psychological factors (e.g., Sewell, Hauser, and Portes 1969), family size (Blau and Duncan 1967; Blake 1989), family structure (Duncan and Duncan 1969; McLanahan and Sandefur 1994), the childrearing behavior of parents (Astone and McLanahan 1991), and families' strategic responses to incentives (Breen and Goldthorpe 1997) in efforts to show how families transmit their unequal positions, statuses, and resources to subsequent generations. Throughout this rich body of intergenerational research, these mechanisms are inferred from observations on the characteristics of parents and children in existing families. In this paper, we refer to this approach as the standard approach. By themselves, these are *conditional* effects in that they depend on existing mother-father and parent-child relationships. In the study of intergenerational occupational mobility, for example, researchers typically focus on the associations between the occupational classifications of fathers and sons. These are conditional relationships in that they are based on observed father-son pairings in the population.

Intergenerational effects, however, may also occur through mechanisms that alter the numbers and types of families in which children are raised. If changing people's characteristics alters their propensity to marry, the types of persons they marry, whether they survive through their childbearing years, or the number of their children who survive to adulthood, these mechanisms will alter the distributions of socioeconomic outcomes in subsequent generations. These full effects, however, cannot be inferred from existing mother-father and parent-child relationships alone. Unconditional effects require that one consider both family-level and aggregate processes that govern the reproduction of inequality from one generation to the next.[1]

The Effects of Increases in Women's Educational Attainment

Consider the effect of a mother's educational attainment on the attainment of her child. Mother's schooling is often viewed as a key determinant of the welfare of her children. In populations with low average maternal education or a large gap in education between men and women, it may be possible to improve the lives of both women and their children by removing barriers to their advancement in school (e.g., Caldwell 1986; King and Hill 1993; Schultz 2001; Summers 1994).[2] If a mother's attainment is a cause of her child's attainment, then one may ask: What is the effect on children of a policy that changes the schooling of an individual woman, an entire cohort of women, or some targeted subgroup of women?

This question raises important research design issues. Regression estimates based on samples of offspring, which are the most common tool for answering this type of question, can at best show the impact of changing a woman's schooling conditional upon her giving birth to the sampled child and, if father's or other family characteristics are controlled in the analysis, upon her marriage. Even if all important confounding factors are controlled, these conditional estimates may be quite unsatisfactory for many purposes, including assessing the effects of interventions in women's lives on subsequent generations. Women complete most of their schooling prior to childbearing and, in most societies, prior to marrying the fathers of their children. A change in a woman's educational attainment may alter whether, when, and whom she marries; the number and timing of the children she bears; how many of these children survive to adulthood; and the education of her surviving children. Thus, the estimate of the impact of mother's education depends on whether it is assumed that she has already given birth, has not yet given birth but has formed a union with a child's (potential) father, or has not yet taken a partner.

It is impossible to discern the full impact of changing a woman's educational attainment by observing a sample of existing families. At the individual level, marriage and fertility are intervening mechanisms between a woman's educational attainment and the attainment of her children. At the population level, the impact of a change in the average level or the distribution of women's schooling must take account of both the intergenerational correlation of educational attainments and also the changes in population composition that result from the population renewal process. These processes alter the relative numbers of children who achieve various levels of educational attainment. For a given distribution of women's educational attainment and conditional effects of mothers on children, the resulting distribution of offspring's schooling may differ between populations that have different patterns of differential fertility by mother's schooling. Thus, to assess the impact of a change in women's education in the parents' generation on the distribution of education in a later generation, it is necessary to examine its separate effects on marriage, childbearing, and the educational attainment of children.

In addition to fertility and marriage, differences among women in the timing of fertility, their rate of marital disruption, their rate of survival through the childbearing years, and their children's rate of survival to adulthood are also potentially important demographic factors that contribute to intergenerational reproduction. These mechanisms often depend on women's schooling as well, and are part of the full accounting of the intergenerational effect of women's educational attainment. In most societies, however, the fertility and marriage processes emphasized in this paper are likely to be the most important demographic mechanisms governing the intergenerational impact of women's schooling. Although we have excluded the effects of fertility and marriage timing and differential mortatlity from our empirical analyses in order to make our models more tractable, each of these can be added to the models shown here.

Differential Fertility

An association between women's educational attainment and their levels of fertility is observed in virtually all societies (e.g., Bledsoe *et al.* 1999). The most prevalent relationship is a negative correlation, typically interpreted as arising from delays in marriage, improved labor market opportunities, increased use of contraception, and a weakening of women's traditional childbearing roles. Yet the strength and form of this relationship vary considerably across societies and over time. Some societies exhibit positive associations between women's educational attainment and their children ever born whereas others have a non-monotonic pattern in which women with some primary schooling have higher fertility than those who have either no education or secondary and tertiary schooling (Diamond, Newby, and Varle 1999; Jeejeebhoy 1995). These alternative patterns may reflect relatively low levels of family resources, or poor health or marriage prospects for women with very low levels of educational attainment.

For a given pattern of differential fertility, the impact of a change in the distribution of women's educational attainments occurs at two levels, the individual/family level and the population level. For children within a family, variation in their mother's level of fertility may affect their well-being and eventual socioeconomic attainment because of the differential advantages and disadvantages associated with variations in number of siblings. In most developed and low fertility societies, children's attainments typically vary inversely with number of siblings, a result of either the more severe resource constraints experienced by larger families (Blake 1989) or the tradeoffs that parents make between having larger families with relatively lower social, economic, and cultural resources for each child or smaller families with relative higher resources for each child (Becker 1991). In less developed and higher fertility societies, the relationships between sibship size and children's achievements are varied. Although having many siblings may limit the resources available to a child, it may also enhance family wealth and provide access to broader social networks for children. As a result the association between sibship size and children's schooling may be weak or even positive in these contexts (Mueller 1984; Shavit and Pierce 1991; Lloyd 1994; Maralani 2004). Whatever the context, a change in a woman's educational attainment may affect the educational attainment of her offspring because it may change her eventual fertility, her children's number of siblings, and the family resources available to each child.

Differential fertility also affects changes at the population level by altering the *numbers* and characteristics of male-female and mother-child relationships. Within a population, the effect of a change in the distribution of women's education on the educational attainment of the next generation may depend on whether this increases the relative numbers of children born to highly or less educated women. If fertility and educational attainment are negatively correlated, the beneficial effect of increases in women's schooling will be dampened by the tendency of more educated women to have fewer children than their less educated counterparts.[3] Thus, whereas an improvement in women's average educational attainment may benefit whatever children they bear, they may bear fewer children overall. This implies that the individual and population level effects of an improvement in women's schooling may be offsetting.

In contrast, if the relationship between education and fertility is nonlinear, the size of the effect of increasing women's education will depend on where in the education distribution changes occur. For example, if fertility follows a non-monotonic pattern in which women at intermediate levels of schooling have the highest birthrates, efforts to improve the attainment of those with little or no schooling to an intermediate level may have a twofold benefit for the next generation: This cohort of more educated women will bear more children, and these children will be more educated. In contrast, efforts to move women from intermediate to high levels of schooling may have offsetting effects at the individual and population composition levels. Thus, differential fertility among women with varying educational attainments may lead to a mixture of individual effects that depend on particular family relationships and population-level effects that work through relative numbers of different family sizes. A full assessment of intergenerational effects must take both of these processes into account.

Marriage and Assortative Mating

Marriage also affects the educational reproduction process in several ways. For individual families, mother's marital status and father's educational attainment affect the educational attainment of offspring. For an individual woman, a change in her characteristics may alter her opportunities and incentives for the timing of her marriage, the type of partner she marries, and the stability of her marriage. An increase in her attainment will typically raise the educational attainment of the man she marries, which further increases the advantages that accrue to the couple's children.

At the population level, marriage alters the education distribution of the next generation both directly through changes in the joint distribution of mothers' and fathers' schooling and indirectly through its effect on levels and differentials in fertility. The size and direction of this effect, however, depends on the organization of the marriage market and how men respond to aggregate improvements in women's educational status. If improvements in women's schooling induce men to acquire more schooling themselves, then the association between husband's and wife's schooling is unlikely to change. Both fathers and mothers will be more educated on average and the offspring generation will benefit from average improvements in both parents' educational attainments. But women's educational gains may not be matched fully by corresponding gains by men if, for example, women benefit from targeted government subsidies or experience other improvements in their lives that are not enjoyed by men. In this case, the association between wife's and husband's educational attainments may change because, at any given level of education, women may partner with men who have somewhat lower average attainment than would have been available had the number of more educated women remained unchanged. The resulting change in the joint distribution of mothers' and father's schooling and its impact on their children's schooling will depend on the shape of the educational distribution of men and where in the distribution of women's schooling the greatest changes occur.

The aggregate effect of marriage also affects the next generation through fertility. If nonmarital fertility is negligible and highly educated women are relatively more likely to remain single or marry later, an increase in women's schooling will reduce fertility and dampen the aggregate benefit for the next generation. Similarly, patterns of educational resemblance between women and their husbands may modify differential fertility patterns in a complex way, depending on the pattern of differential fertility among couples with varying levels of wives' and husbands' schooling. If the educational attainments of wives and husbands are strongly associated, an increase in women's average attainment may enhance or suppress the effects of women's educational differentials in fertility, depending on how the attainments of wives and husbands jointly affect numbers and timing of children ever born.

Related Literature

Our effort to embed intergenerational mobility in a demographic model that includes fertility and marriage builds on prior research. Over the past 50 years, researchers have attempted to examine the implications of differential fertility for the study of social mobility and, conversely, attempted to incorporate intergenerational and assortative mating into the study differential population growth (Mukerjee 1954; Matras 1961, 1967; Duncan 1966; Preston 1974; Lam 1986; Johnson 1980; Preston and Campbell 1993; Mare 1997, 2000; Musick and Mare 2004). We extend this research by using a model of socioeconomic and demographic reproduction to develop new methods of estimating the *effects* of family socioeconomic background on educational attainment. That taking account of marriage and fertility may alter assessments of intergenerational effects is only implicit in these prior studies. By modeling these processes explicitly, we link standard sociological efforts to determine the effects of family background on achievement with formal demographic studies of intergenerational processes.

Empirical Context: Women's Education and Demographic Change in Indonesia

We investigate these issues using data for Indonesia, the world's fourth most populous nation. Indonesian women have historically obtained relatively low levels of schooling, although levels have increased markedly in recent cohorts. Moreover, the historically large gender gap in schooling has all but closed in recent decades as a result of extensive school expansions, gender-specific government policies and expansions in women's socioeconomic welfare. Indonesia has undergone huge demographic changes during the past 30 years, including massive declines in fertility and mortality rates and substantial rural to urban migration. Total fertility has declined from 5.6 children per woman in 1971 to 2.6 in 1999 (Badan Pusat Statistik, Republik Indonesia 2004). Women's mean age at first marriage has increased from 19.3 in 1971 to 21.6 in 1990 (Jones 1994). Despite these changes, marriage remains nearly universal. In 1997, nearly 80 percent of 25-29 year olds, 91 percent of 30-34 year olds, and 96 percent of 35-39 year old women were married (tabulations from the Indonesia Family Life Survey, described below).

During this period, schooling levels and sex differences in schooling have changed dramatically as well. For example, among men born in 1930-34, 27 percent had no formal schooling and 92 percent had no more than primary school. For women in this cohort, 56 percent had no formal schooling and 97 percent had no more than primary school. In contrast, only 5 percent of men born in 1960-64 had no formal schooling and 36 percent had more than primary schooling. For women, these corresponding percentages were 10 and 23 percent, respectively (Cobbe and Boediono 1993). More recent cohorts show still higher levels of educational attainment and smaller differences between men and women.

Fertility in Indonesia varies by women's educational attainment, although it does not follow a simple inverse relationship. Among Indonesian women in the 1970s, fertility was highest for women with primary education, lowest for the small proportion of women with post-secondary schooling, and at an intermediate level for women with no schooling or secondary schooling (Hirschman and Guest 1990). This non-monotonic pattern has persisted in more recent years, albeit in a somewhat attenuated form, as shown below.

Although our approach is adaptable to any population, Indonesia is a good context for this research. Its comparatively low levels of educational attainment and historically large gender gap in attainment make it a realistic setting for considering the effects of hypothetical interventions to raise the educational attainment of women and improve the life chances of their children. Moreover, its near universal marriage, moderate mortality, and low nonmarital fertility make the relatively simple models of intergenerational effects considered in this paper more realistic for this population than for populations with either very high parental mortality during the childbearing years or high nonmarital fertility.

MODELS FOR THE INTERGENERATIONAL EFFECTS OF WOMEN'S EDUCATIONAL ATTAINMENT

We focus on how a population of women with varying amounts of schooling produces a generation of offspring who also vary in their educational attainment. We take account of three processes: (1) marriage, focusing on whom women of varying education levels are likely to marry; (2) differential fertility, as affected by mother's and father's education; and (3) the intergenerational transmission of educational status. Most research on intergenerational mobility is focused exclusively on (3), but (1) and (2) are also essential parts of the reproduction process.

In developing our models we make a number of simplifying assumptions. We assume that all women marry; ignore divorce, remarriage, mortality, and the timing of fertility and marriage; and assume that everything happens all at once for a given cohort or, equivalently, a generation at a time. We also ignore intercohort changes in the processes that we study. That unmarried women bear and raise children is obviously true in general, but occurs at such a low rate in Indonesia that is it safely ignored here. The remaining assumptions serve to reveal the workings of several basic demographic processes. Moreover, these assumptions are in keeping with most standard analyses of intergenerational mobility and socioeconomic attainment that ignore differential fertility and assortative mating as well.[4]

Our approach provides a way of assessing the contribution of women and mothers to the reproduction of the population, but allows assortative marriage to affect fertility and intergenerational transmission. It is not a two-sex model because the marriage market is female-dominated. For the purpose of estimating the model we assume that whatever kind of man a woman wants (with respect to his schooling), she can get. As discussed below, however, in estimating the effects of a change in women's schooling, we also explore the implications of alternative assumptions about how men's educational attainments change in response to improvements in women's status.[5]

Let D_j be the number of persons in the offspring generation with education level *j*, M_i be the number of women in the mother generation with education level *i*, and $r_{jk|i}$ be the number of children who attain education level *j* with fathers with education level *k* per woman who has attained education level *i*. The $r_{jk|i}$, therefore, are the rates at which women at given levels of educational attainment marry men and produce children with various levels of educational attainment. These rates incorporate the effects of marriage, fertility, and intergenerational transmission on intergenerational reproduction. Let $i = 1, \ldots, 5$; $j = 1, \ldots, 5$, $k = 1, \ldots, 5$. Thus, education has five discrete, but ordered levels. Then:

$$(1) \qquad D_j = \sum_{i=1}^{5}\sum_{k=1}^{5} r_{jk|i} M_i \ .$$

Given the $r_{jk|i}$ we can compute the expected number of children of education level *j* born to a woman with education level *i*. If the processes governing the $r_{jk|i}$ are time-invariant, and we know the education distribution of women at a given date, then this equation can project the education distribution of offsprin in successive generations. We can also simulate what would happen to the distribution of children's schooling (D_j) if the distribution of women's schooling (M_i) were modified.[6]

We can express how marriage, fertility, and intergenerational transmission affect the $r_{jk|i}$ as follows:

$$(2) \qquad r_{jk|i} = p^{H}_{k|i} r_{ik} p^{D}_{j|ik}$$

where $p^{D}_{j|ik}$ denotes the probability that a child with a mother at the i^{th} education level and a father at the k^{th} education level will attain the j^{th} level of education; r_{ik} is the expected number of children born to women in the i^{th} education category who are married to men in the k^{th} education category; and $p^{H}_{k|i}$ is the probability that a woman in the i^{th} education category marries a man in the k^{th} education category. We compute the components of equation (2) as follows. We estimate the child attainment probabilities $p^{D}_{j|ik}$ as an ordered logit model that includes mother's and father's educational attainments and child's sex as covariates. We compute the fertility rates r_{ik} using a poisson regression model in which the covariates include mother's and father's educational attainment. We estimate marriage probabilities $p^{H}_{k|i}$ using an ordered logit model in which the covariates include categories of women's educational attainment.[7]

These models are recursive in that (a) mother's schooling precedes marriage and father's schooling, which precedes fertility, which precedes offspring's schooling, and (b) the unobserved factors that affect the three processes are assumed to be independent. Thus, it is possible to estimate each of the three models separately. This specification assumes that individuals and families are homogeneous within categories of the independent variables included in the models and that no common unmeasured variables affect marriage, fertility, and intergenerational transmission. Although recursive models are used in most studies of stratification processes, the assumption of uncorrelated errors is often violated. Extensions of our models that take account of these complications are discussed in the conclusion of this paper.[8]

DATA AND METHODS

Indonesia Family Life Survey

Our analyses are based on the Indonesia Family Life Survey (IFLS), a longitudinal household sample first interviewed in 1993 then followed up in 1997, 1998, and 2000. The IFLS is a comprehensive socioeconomic and health survey, containing detailed information on demographic and socioeconomic characteristics, household economy, health, fertility and marriage histories, and child cognitive and health assessments. Almost everyone in the household was interviewed directly, although when necessary, the survey collected information by proxy. The survey represents an area that includes 83 percent of Indonesia's population. We use the public domain data from the 1993 and 1997 waves. The surveys achieved very high response and follow up rates: 93 percent of the sampled households were successfully interviewed 1993 and 94 percent of the households interviewed in 1993 were reinterviewed in 1997. For documentation of the IFLS, see Frankenberg et al. (2000).

Our analytic samples include ever-married female respondents aged 41 and older in 1997 and their adult children. For 1993 respondents not interviewed in 1997 (either because they died between the two waves or because the 1993 household was not located in 1997), we use information from 1993 whenever possible to retain these cases in our sample. For each ever-married woman, we assemble a full count of all live births, the schooling level of each living child age 20 and older, and the schooling of her husband (either current or previous). Only observations with complete data on woman's, husband's, and children's schooling and woman's age, marital status and fertility are included. Our samples of women and children are restricted in age to capture completed fertility and completed schooling. Our analyses use two interdependent subsamples of IFLS women and their offspring described below.

Husband's Education/Fertility Sample. This sample includes 3,938 ever-married female respondents aged 41 and over. These observations are used for assessing the effects of women's educational attainment on the educational attainment of the men whom they married and their number of children ever born. For the approximately 30 percent of ever-married female respondents who married more than once, we use the educational attainment of the husband to whom she was married for the longest period between her ages 15 and 40.[9] When weighted, this sample is intended to represent ever-married Indonesian women ages 37 and over in the target sample areas of the IFLS in 1993.[10]

Intergenerational Transmission Sample. This sample includes 10,820 offspring aged 20 and over of ever-married female respondents aged 41 and over. Some but not all off these offspring were themselves IFLS respondents. The offspring have a median age of 30 years, with an interquartile range from 25 to 36 years. The mothers of these sampled children are a subsample of the women included in the husband's education/fertility sample described above, namely those who had at least one surviving child aged 20 or older with valid information on the necessary variables. This corresponds to 3,236 of the 3,938 women included in the husband's education/fertility sample described above. Women with more than one eligible child contribute multiple observations to this offspring sample. When weighted, this sample is intended to represent approximately the offspring aged 20 and over of ever-married women in the target sample areas of Indonesia in 1993.

For each respondent the IFLS asks the highest level of school attended (no school, elementary, junior secondary, senior secondary, post secondary), which is the education classification used in our analyses. Table 1 summarizes the education distributions of women, husbands, and children for each of the relevant samples. These distributions show the sizable education differences by gender and the intergenerational increase in educational attainment between parents and their adult children. Nearly half of the mothers in our sample have no formal schooling and less than two percent achieve any post secondary education. In contrast, less than one third of husbands have no formal schooling whereas more than twice as many husbands as wives have post secondary schooling. The children of these parents reach much higher levels of attainment: only 11 percent of adult female children and 6 percent of adult male children fail to attend any school whereas 8 and 11 percent, respectively, go beyond secondary school. Although the gender gap in schooling remains in the sample of adult children, differences in schooling by sex diminish greatly between generations. The ratio of the proportion of females women to males in each schooling category is closer to one in the offspring sample than in the parent sample at all levels of educational attainment except the lowest.

Table 2 summarizes the distributions of the three outcome variables by women's educational attainment. The distribution of husband's educational attainment shows strong positive assortative mating on formal schooling in Indonesia, with a pronounced tendency for a woman to marry a man who is at the same or next level of schooling higher than her own. The fertility distribution reflects Indonesia's non-monotonic pattern of fertility by mother's educational attainment. The distribution of offspring's education shows a strong positive association between mother's and offspring's schooling but also substantial upward intergenerational educational mobility.

Estimation and Simulation

We estimate the statistical models for marriage, fertility, and offspring's educational attainment by maximum likelihood, applied to each equation separately. We use the parameter estimates from our models in a series of simulations that compute the expected distributions of offspring's schooling implied by alternative assumptions about the education distribution of women and the ways that women's attainment affects marriage, fertility, and the attainment of children. We use predicted probabilities of a woman marrying a man at each level of educational attainment, predicted number of children born, and predicted probabilities of children achieving each level of educational attainment that are implied by parameter estimates and actual or hypothetical values of observed characteristics of women and their husbands. That is,

(3) $$\hat{r}_{jk|i} = \hat{p}^{H}_{k|i}\hat{r}_{ik}\,\hat{p}^{D}_{j|ik}\ ,$$

where ^ denotes predicted values and all other notation is as defined above. Given the $\hat{r}_{jk|i}$ for each woman in the initial generation, the expected number of persons in the offspring generation who attain the *j*th education level is $\hat{n}_j^d = \sum_i \sum_k \hat{r}_{jk|i}$. The $\hat{r}_{jk|i}$ are computed for scenarios that vary by (a) the change in the education distribution of the mothers' generation, (b) the presence or absence of variation in the three components of $\hat{r}_{jk|i}$ that are included in equation (3) (that is, which of the women's education effects on marriage, fertility, and child's schooling are taken into account), and (c) alternative assumptions about the marriage market.

EMPIRICAL RESULTS

Parameter Estimates

Table 3 reports parameter estimates for the three parts of our model. Our samples include only married women over age 40 or their adult children. Women's, husbands', and children's schooling are measured in the five categories discussed above. In the fertility equation, the model assumes discrete, additive effects of women's and husband's schooling. We report ratios of coefficients to robust standard errors for all models. For the transmission model, we report ratios of coefficients to robust standard errors that also correct for clustering of multiple children born to the same woman. The equation for the educational attainment of offspring includes the additive effects of mother's and father's schooling plus an indicator for sex of offspring. Preliminary analyses indicated no important interactions of mother's and father's schooling in their effects on either fertility or the educational attainment of their children. The effects of father's educational attainment differed somewhat by sex of child; that is, contrasts between the children of highly and moderately educated fathers are greater for female than for male offspring. Although these differences are of interest in a detailed analysis of Indonesian educational patterns, their inclusion does not affect our estimates of the effects of changes in women's educational attainments. For the sake of simplification, therefore, we base our calculations on the additive models shown in Table 3.[11]

Indonesian couples show extremely strong evidence of positive assortative mating. The coefficients show that the odds of marrying into the next highest husband's educational category are more than seven times greater both for women with elementary schooling versus those with no schooling [exp(2.014)] and for women with junior secondary schooling versus those with elementary schooling [exp(4.072 – 2.014)]. The odds of marrying into the next highest husband's education category are about four times greater for women with senior secondary schooling than for those with junior secondary schooling [exp(5.571 – 4.072)] and for women with post secondary schooling than for those with senior secondary schooling [exp(6.94 – 5.571)]. This model predicts that the proportion of women who marry men with at least a senior secondary education increases monotonically from less than two percent for women with no formal schooling to more than 90 percent for those with post secondary schooling. Given the gender gap in educational attainment in Indonesia for this generation, women tend to marry men who have more schooling than they do. For example, the model predicts that among women with senior secondary education, 30 percent marry men with post secondary schooling. In contrast, among women with elementary schooling, only 12 percent marry men with no schooling.

The estimates of the effects of parents' schooling on number of children ever born follow the non-monotonic pattern of differential fertility found in other research on Indonesia. Holding husband's education constant at the elementary level, women's expected number of children is approximately 5.0 for women with junior secondary education or less and declines sharply across the higher education categories to 3.7 for women with post secondary education. The effect of husband's education on fertility is much smaller than the effect of wife's education. Holding constant women's educational attainment, husbands with primary, secondary, or post secondary schooling all have approximately 5.3 children, whereas men at the bottom of the education distribution average somewhat fewer children.

The educational attainments of mothers and fathers both have strong positive effects of approximately equal size on the attainments of their children. The predicted probabilities of boys' and girls' schooling by levels of mother's schooling, holding constant father's schooling, increase substantially between each successive level of mother's attainment. For example, approximately 55 percent of male children and 65 percent of female children born to women with no education attain elementary school or less, whereas only 20 percent of males and 30 percent of females born to women with senior secondary schooling have predicted levels of education this low.

These results provide a partial picture of the effect of mothers' educational attainment on their offspring's attainment. In most analyses of intergenerational effect, the parameters of equations predicting children's schooling from parents' schooling are used to evaluate the effect of a hypothetical change in mother's schooling on the schooling of her children. To assess the overall effect of an increase in women's educational attainment, however, it is necessary to take account of the joint compositional effects of marriage and fertility as well.

Simulations

We assess the effects of women's schooling on the schooling of the next generation through a series of simulations. The simulations use expected rates and probabilities, which correspond to the components of equation (3), calculated from the parameter estimates shown in Table 3. Each simulation has three parts: (a) a hypothetical change in women's schooling, (b) a selected subset of transmission, marriage, and fertility processes, and (c) whether men's schooling increases when women's schooling increases or whether the men's educational distribution is held fixed. We combine these parts as follows. For each simulation, we draw a random subsample of five percent of the women in the marriage/fertility sample (3938 * 0.05 = 197 women) subject to a hypothetical change in the women's education distribution that we consider. For example, to estimate the effect of moving five percent of the sample women from no schooling to elementary schooling, we randomly draw without replacement 197 women from the no schooling category and change their schooling from none to elementary. The other 95 percent of the women retain their observed educational attainments.[12] We then use the estimated parameters in Table 3 and the remaining assumptions of the scenario (specifically, whether fertility and/or marriage are taken into account and the way in which men respond to changes in women's educational patterns) to predict a husbands' education distribution and the number of children born in each educational category in the subsequent generation. We form a ratio of the simulated offspring educational distribution to the baseline distribution predicted by our sample women's observed schooling to see whether a given simulation increases or decreases the proportion of children in each schooling level (relative to making no changes in women's schooling).[13] We describe each component of the simulations in more detail below.

Changes in Women's Education Distribution. We simulate the effect of changing women's schooling by computing the expected offspring education distribution under six scenarios for women's educational attainment. Scenario one is the education distribution of the sample women, as observed. In scenarios two through five, we move 5 percent of sample women from one education category to the next one up while retaining observed values for the remaining 95 percent of the sample. For example, in scenario two, we randomly draw 197 women from education category one (no schooling) and reassign them to education category two (elementary schooling). In scenario six, we move 197 women from no schooling to post secondary schooling. We compare each expected education distribution to the distribution of children's schooling predicted by the observed women's schooling represented by scenario one.

Combinations of Effects. Each of the scenarios above is carried out for each of four combinations of processes using the components of equation (3): (a) intergenerational transmission only; (b) intergenerational transmission plus differential fertility; (c) intergenerational transmission plus educational assortative mating; and (d) intergenerational transmission plus fertility plus educational assortative mating. Estimates from part (a) (transmission only) correspond to conventional estimates of the effect of mothers' schooling on offspring's schooling based on the conditional joint distribution of parents' and offspring's schooling. Effects estimated from combinations (b) through (c) modify conventional estimates by taking account of either fertility or marriage or both.

Alternative Marriage Markets. The effect of a change in the distribution of women's schooling depends on changes in women's preferences and opportunities for marriage. How a change in women's attainment affects the next generation may depend on how the attainments of *men* respond to changes for women because men's aggregate responses determine the possible combinations of men and women who marry, and bear and raise children. A range of male responses is possible. At one extreme, men's attainments are entirely endogenous to those of women. That is, men respond to changes in women's educational attainments so as to maintain the prior conditional distributions of husband's educational attainment given wife's attainment. In this case, women's increased educational attainments do not constrain their marital opportunities. After a shift in women's attainments, women at each level of educational attainment have the same expected distribution of husband's educational attainment that their counterparts would have faced before the aggregate change. This extreme case is only realistic if men are given the same inducements and opportunities to increase their schooling as women. We call this market the "Unconstrained Marriage Market."

At the other extreme, men's educational attainments are unaffected by shifts in the education distribution of women. Instead, their marginal education distribution remains constant. In this case, women's marital opportunities are constrained by the available distribution of men. Given the strong positive association between wife's and husband's education, an increase in women's educational attainments will make the distribution of expected husband's attainments less favorable after the aggregate shift in women's attainment than before. This extreme case is only realistic if the norms, costs, and rewards connected to men's schooling are independent of the educational status of women.[14] To show the range of possible effects of assortative marriage, we simulate the expected education distributions of offspring under each of the two extreme assumptions. We call this market the "Constrained Marriage Market."[15]

Results. Taken together, these combinations of alternative hypotheses produce 48 simulations. We report key findings in Figures 1 and 2 and the full results in Appendix Tables A1 and A2. The figures show estimates for the females in the next generation, but similar patterns are observed for males (see Tables A1 and A2). Each line on the figures corresponds to a single comparison (in the form of a ratio) of the expected proportion of offspring in each education category for a given simulation to the expected proportion in the absence of a shift in the education distribution of women (the baseline distribution). A ratio greater than 1.0 indicates an increasing proportion of offspring in that education category.

The top and bottom panels of Figure 1 show the estimated effects of moving five percent of women from senior secondary to post secondary schooling and from no education to the elementary school level, respectively. Moving five percent of women from senior secondary to post secondary schooling raises the proportion of children who themselves attain post secondary schooling. The size of this effect, however, depends considerably on which aspects of the educational reproduction process are taken into account. In the unconstrained marriage market (shown on the left of Figure 1), the change implied by the conditional intergenerational effect of mother's schooling on daughter's schooling is almost ten percent ("transmission only" line). [16] This is, however, an overestimate of the total effect because it ignores the offsetting effects of differential fertility. When the effects of fertility as well as intergenerational transmission are both included, the expected effect on the next generation is about three percent, only one third of the original estimate ("transmission + fertility" line). In contrast, assortative mating tends to reinforce the effects of intergenerational transmission. Transmission and marriage together raise the proportion of daughters with post secondary education by almost 13 percent ("transmission + marriage" line). Taking all effects into account, the net impact of a transfer of five percent of women from senior secondary to post secondary schooling is an increase in the proportion of the daughter generation with post secondary schooling of approximately six percent ("transmission + fertility + marriage" line). These patterns show that marriage, fertility, and intergenerational transmission combine to affect the next generation in a complex way. At the upper end of the women's education distribution, increases in attainment bode well for the next generation because more of these women will marry highly educated husbands and these improvements in both mother's and father's education benefit their children. These effects in the next generation, however, are offset by reduced fertility of highly educated women. The net impact of the change in women's education is positive, but not nearly as great as an analysis of intergenerational transmission alone would imply.

Moving five percent of women from no education to elementary education also improves the education distribution of the next generation, but the pattern of effects is different here. Unlike at the top of the schooling distribution, where the effect is concentrated in a single education category, at the bottom of the distribution the effect is more modest and spread over several categories. In the unconstrained market, it reaches maximum values for those with no schooling, where the proportion of daughters is expected to decrease by about seven percent, and at senior secondary schooling, where the proportion of daughters is expected to increase by approximately five percent. These results reflect the overall tendency for daughters to exceed the education level of women in the previous generation, which is reinforced by improvements in women's schooling at the bottom of the distribution. Unlike at the top of the education distribution, the estimated effects due to intergenerational transmission alone are similar to those when transmission, fertility, and marriage are considered together. Because women's fertility is nearly constant across the lower strata of women's educational attainment, the benefits to children of improvements in women's education in those strata are not offset by corresponding declines in fertility. In this simulation, differences in effects are driven by the improved marriage prospects that accrue to women when their educational attainment improves. This mechanism has a net positive effect on the education of the next generation, but these effects are small relative to those that occur for improvements at the top of the women's education distribution.

The graphs on the right side of Figure 1 show that the effects of improvements in women's status at either the top or the bottom of the education distribution are robust to alternative extreme assumptions about the marriage markets that women face. Our findings are similar whether or not we assume that men obtain more schooling in response to increases in women's schooling. The expected education effects are similar in the two marriage markets, although the effects are attenuated for scenarios that include marriage. That these alternative marriage market assumptions represent extremes in how men might respond to improvements in women's schooling suggests that, at least for marginal changes in women's educational attainment, our findings for Indonesia do not depend on specific marriage market assumptions.

Figure 2 reports the estimated effects of a more extreme change in the distribution of women's educational attainment, namely a redistribution of five percent of women from the lowest to the highest education category. This is tantamount to examining the effect of implementing simultaneously all four shifts of five percent of women to the next highest education category. Because this is a larger change in the distribution of women's schooling, the estimated effects are much larger, especially for the proportion of offspring that achieve post secondary schooling. In the unconstrained marriage market, the expected proportion of offspring in the elementary through senior secondary education categories implied by fertility, marriage, and intergenerational transmission combined is lower than implied by intergenerational transmission alone. In contrast, at the post secondary level, the combined effect of all three processes implies a much larger growth in the proportion of the next generation than the effect of intergenerational transmission alone (approximately 30 percent versus 12 percent). This pattern of effects results from the reinforcing positive impact of assortative mating and the offsetting negative effect of fertility on the education of the next generation. The redistribution of five percent of women from the lowest to the highest education category results in a very large increase in the expected educational attainment of their husbands. This implies much higher educational attainment for the couples' daughters. This effect, however, is offset to some degree by the lower fertility of these highly educated women. In the absence of fertility reductions for these women, the expected increase in the proportion of daughters achieving post secondary schooling would be even higher (38 percent versus 30 percent).

In the constrained marriage market the effects of redistributing five percent of women from the no education category to post secondary schooling produces several notable differences. The educational attainments of daughters are dampened throughout the education distribution in scenarios that include marriage effects, especially at the highest and lowest education levels.

This pattern results from the constrained marital opportunities implied by this simulation. The large redistribution of women's educational attainment, combined with a fixed distribution of men's educational attainment, implies that not all women will be able to marry the highly educated men that they would otherwise expect to marry. Because women at the highest level of educational attainment get "first choice" in the constrained marriage market, the marriage opportunities for women in the lower education categories are made worse and their offspring's educational attainment is lowered beyond the level that they would obtain in an unconstrained marriage market. This results in nearly no change in the distribution of girls in the no education category relative to the predicted baseline distribution (ratio of about one for the "transmission + marriage" and "transmission + fertility + marriage" lines). When the marriage market is not constrained or when marriage effects are excluded in the constrained market, the predicted proportion of girls with no schooling is about 10 percent less than in the baseline distribution (ratio of about 0.9). [17]

SUMMARY AND CONCLUSIONS

How one views the effects of family background on socioeconomic attainment depends on how one thinks about assessing the consequences of changing the characteristics of individuals' families of orientation. Many changes in the socioeconomic characteristics of parents – especially those that change the educational attainments of mothers or fathers – occur relatively early in their lives. These early changes affect their fertility and marriage as well as the attainments of their offspring. But changes that affect fertility and marriage cannot be adequately assessed from observations of parent and offspring socioeconomic characteristics alone. Changing women's schooling changes their fertility and marriage behavior, which alters the relative numbers of offspring born to women with varying education levels. Even in the absence of change in the individual level effects of mother's schooling on offspring's schooling, these compositional effects alter the distribution of schooling in the offspring generation. Our models reveal how various components of intergenerational change contribute to the total effect of women's education on the education of the next generation.

The approach proposed here is only a single step in assessing the aggregate intergenerational effects that are typically ignored in standard analyses of parent-child associations. It can, however, be extended to take account of a richer set of mechanisms, including the timing of fertility and marriage, the instability of marriage, mortality of parents and children, sex-specific effects of family background characteristics on offspring, unobserved factors that commonly affect fertility and offspring's educational attainment, and more complex marriage market effects. Increases in women's schooling may affect whether and when they marry, the timing of fertility, and whether women have children outside of marriage. These mechanisms may have relatively larger effects in low fertility societies than the assortative mating and fertility level effects considered in this paper. In poor, high fertility societies, in contrast, the impact of a change in women's schooling may affect the next generation through changes in the survival probabilities of both women and their children. Improving women's survival through their childbearing years increases their total exposure to childbearing, the care they can provide for their children, and the likelihood that their children themselves survive to adulthood. Additional individual and family effects may be important in some societies, including sibship size and interactions between sex of child and sex of parent (Thomas 1994; Mare and Chang [forthcoming]). If mothers and fathers have distinct effects on their daughters and sons, then changes in women's educational attainments may, depending on patterns of educational assortative marriage and the degree to which the supply of education is constrained, differentially alter the education distributions of men and women in the next generation.

Our analyses assume that, given the variables included in the models, the marriage, fertility, and intergenerational transmission processes are independent. If, however, women vary systematically on unmeasured factors that jointly affect marriage, fertility, and childrearing, then the estimated effects of parents' educational attainments on their offspring's schooling may be subject to a "selection bias," created by differential fertility (Winship and Mare 1992). If, for example, among women with the same educational attainment, those who can provide the best environments for their children are also those who, because of their other opportunities, have the fewest children, then the estimated effects of mother's schooling on offspring's schooling may be biased downwards. Although we typically regard "family background" as exogenous to socioeconomic success, in this case it may be necessary to treat family background as jointly determined with the outcomes of family effects such as offspring's educational attainment and economic success.

A full account of how marriage contributes to the intergenerational effects of a change in young women's schooling requires the development of two-sex models of marriage entry and assortative marriage that make explicit the interdependence of the male and female populations (Logan, Hoff, and Newton 2001; Mare 2000). Although our estimates for the effects of some changes in women's education distributions are robust to alternative assumptions about marriage markets, for other effects alternative assumptions about marriage yield different predictions. A fuller understanding of these effects requires models that enable one to estimate rather than assume the parameters of the marriage process.

Although these refinements to our approach are desirable lines of future research, our present analysis demonstrates, in the Indonesian context, several important mechanisms of educational reproduction. The effects of women's educational attainment on the next generation are more complex than conventional analyses of mother-offspring educational mobility reveal.

Positive educational assortative mating tends to reinforce the beneficial effects of increased women's schooling. Better educated women advantage their children both directly and indirectly by marrying better educated men. At higher levels of educational attainment, however, education's dampening effects on fertility tends to offset the beneficial effects of marriage and women's education itself on the next generation. The long run effects of interventions to raise women's schooling may depend on where in the education distribution these efforts are applied. Interventions among the most poorly educated women appear to have an unalloyed benefit for both the current and future generation. Interventions among better educated women may benefit them directly but have limited or even negative effects on the schooling of offspring if these are offset by other intergenerational mechanisms.

Unlike more conventional models of intergenerational transmission, our approach is suitable for assessing the long run, intergenerational consequences of interventions in the lives of teenagers and young adults. In low education populations, which still characterize large parts of the developing world and many immigrant groups in the developed world, efforts to increase women's education continues to be a promising avenue of human betterment. Models of the type presented in this paper may prove to be a good way to assess these effects. But these contexts certainly are not the only ones to which our approach applies. Differences in marriage, fertility and offspring's schooling by women's schooling are also important features of populations with relatively high levels of educational attainment such as the United States. Finally, in addition to their descriptive and practical value, these models have the potential to advance mobility studies beyond a static focus on who gets ahead to a more dynamic view of how populations and societies change.

FOOTNOTES

[1] We refer to the *distribution* of socioeconomic outcome variables to emphasize that intergenerational effects result from not only the effects of an individual parent on an individual child but also the relative numbers of different types of family backgrounds that result from differential fertility and assortative mating. As in most conventional analyses of intergenerational effects, however, we are interested in the marginal effects of changes in the characteristics of an individual or of a relatively small fraction of member(s) of the parents' generation on members of the offspring generation. The validity of using a model of family effects to extrapolate to large changes in the distributions of family characteristics depends on whether it is the actions of families or exogenous factors such as economic growth or institutions that mainly determine the distribution of an outcome. For outcomes such as occupational attainment, parents' characteristics usually affect only the relative position of their offspring (although see Matras 1967). For other outcomes, such as cognitive development, health, or educational attainment, the relative effects of family and exogenous factors on outcome distributions vary from time to time and place to place.

[2] This view, however, is not without critics. Some argue that the correlation between women's schooling and the well-being of children is spurious (and explained by genetic or marriage market sorting effects, e.g., Behrman and Rosenzweig 2002), whereas others argue that mechanisms other than raising women's schooling may be more effective avenues of social change (e.g., Knodel and Jones 1996).

[3] This part of the discussion assumes a positive individual level effect of mother's educational attainment on child's attainment. If a child's number of siblings also affects his or her attainment positively, the individual level effect of raising mother's educational attainment may be a mixture of positive net mother's education effects and negative effects through the reduction of

siblings. Even in this case, however, the total effect of mother's educational attainment on child's attainment is likely to be positive.

[4] These additional demographic effects, however, can be incorporated into the approach discussed in this paper, albeit at the cost of increased complexity.

[5] A complete treatment of this issue requires a two-sex model of the marriage market, which is beyond the scope of this paper. Logan, Hoff, and Newton (2001) propose a model for the analysis of two-sided matching in the marriage market, albeit outside of the demographic framework discussed in this paper.

[6] This notation, which conditions all variables on women's educational attainment, emphasizes a key feature of our model, namely that women's education is the sole exogenous variable and the education of husbands and children depend on women's schooling levels.

[7] The probabilities for offspring's education and husband's education can also be represented by a multinomial model. In our sample, the ordered logit model yields predictions that are similar to those from the multinomial model. For populations in which marriage is not universal, either a multinomial logit or an ordered logit combined with an additional binary logit model for marital status may be used.

[8] Models that relax the assumption of independence of unobserved variables in our equations present serious problems of identification. Without making strong assumptions that some measured independent variables do not affect some of the endogenous variables, it is not possible to identify correlations among the errors of our equations. In models of this kind, therefore, it is necessary to choose among alternative assumptions about the associations between measured and unmeasured variables.

[9] That a number of IFLS female respondents have multiple husbands introduces a small amount of measurement error into our estimates of father's educational attainments. The correlation between the educational attainments of women's first and second husbands is about 0.74.
[10] The descriptive statistics are based on sample data weighted to account for attrition and disproportionate stratification by geographic areas. Our estimated models and simulations are based on unweighted data. Using weights in estimating the models had negligible effects on our results. The IFLS weights yield population counts that agree with independent sources. See Frankenberg et al. (2000, p. 20) for a description of how the IFLS weights were constructed.
[11] We also considered models that included number of siblings as a regressor in the equation for children's educational attainment. This would seem to be a key variable to include both because of its pervasive association with educational attainment (e.g., Blake 1989) and because it captures the family-level impact of a change in women's fertility on the educational attainment of offspring. We nonetheless exclude number of siblings because its effects on educational attainment in Indonesia are extremely small and range over cohorts from slightly *positive* to slightly negative (Maralani 2004). In Indonesia, therefore, the family level effect of sibship size does not contribute to the overall effect of changes in women's education on the next generation. In most other societies, number of siblings should be included models of educational attainment.
[12] Although the choice of redistributing five percent of the population is arbitrary, this proportion is large enough to reveal a discernable pattern of effects, yet small enough that it can be applied to each of the first four categories of women's schooling. For example, a redistribution of 10 percent of women from senior secondary to post secondary schooling is not feasible because fewer than 10 percent of the women achieve senior secondary education in the first place. Note that moving five percent of the women in the total sample (about 197 women) is not the same as moving five percent of a given category of schooling. Moving 197 women from no schooling to

elementary schooling upgrades the schooling of about 11 percent of that level while moving 197 women from senior secondary to post secondary upgrades the schooling of about 69 percent of that schooling category. Similarly, a redistribution that results in moving 197 into the postsecondary category amounts to a nearly four-fold increase at that level. Done this way, a five percent change in the women's schooling distribution does not necessarily result in a five percent or lower change in the children's schooling distribution because the relative changes in the children's distribution depend on the number of women in the schooling categories to which each simulation is applied.

[13] Our simulations are done at the micro level. We do not simulate errors for individuals because these cancel out on average. However, because the transformation from the latent variable form to predicted probabilities in the ordered logit models is nonlinear, there may be some bias in not including a simulated error term. Although in the linear case these expectations are on average zero, this is not always the case in nonlinear formations.

[14] In neither of these extreme cases do we allow for women to forego marriage altogether, an assumption that is in keeping with historical marriage patterns and education change in Indonesia. Nonetheless, the models discussed here can be extended to allow for changes in marriage timing and the incidence of nonmarriage.

[15] We constrain the marriage market by adjusting the predicted marriage probabilities $\hat{p}^{H}_{k|i}$ to conform to the existing men's educational distribution under the assumption that marriage is a competitive process in which more educated women are more successful in marrying highly educated men than less educated women. Our model predicts marriage probabilities and numbers of marriages for each combination of women's and men's schooling. If the predicted number of marriages within a category of men's schooling exceeds the number of men in that category in

the original sample, we allow women in the higher education categories "first pick" of the most educated men. Depending of the number of remaining men in each education category, this forces less educated women to take husbands with less schooling than would be available in an unconstrained marriage market. Our algorithm redistributes marriages in this way, with highly educated women always having first pick of men with the highest schooling available (within the range predicted by our baseline marriage probabilities) until equilibrium is reached. We then calculate the revised marriage probabilities implied by this redistribution and use these adjusted marriage parameters in the simulations.

[16] These estimates are the effects of mother's schooling controlling for father's schooling.

[17] This pattern is also apparent to a smaller degree in the bottom panel of Figure 1.

REFERENCES

Astone, Nan Marie, and Sara S. McLanahan. 1991. "Family Structure, Parental Practices, and High School Completion." *American Sociological Review* 56: 309-20.

Badan Pusat Statistik, Republik Indonesia (Statistics Indonesia of The Republic of Indonesia). 2004. (http://www.bps.go.id/sector/population/tables.shtml).

Becker, Gary S. 1991. *A Treatise on the Family*. (2nd Ed.) Cambridge, MA: Harvard University Press.

Behrman, Jere R., and Mark R. Rosenzweig. 2002. "Does Increasing Women's Schooling Raise the Schooling of the Next Generation." *American Economic Review* 92: 323-34.

Blake, Judith. 1989. *Family Size and Achievement*. Berkeley: University of California Press.

Blau, Peter M., and Otis Dudley Duncan 1967. *The American Occupational Structure*. New York: John Wiley and Sons.

Bledsoe, Caroline H., John B. Casterline, Jennifer A. Johnson-Kuhn, and John G. Haaga. 1999. *Critical Perspectives on Schooling and Fertility in the Developing World*. Washington, D.C. National Academy Press.

Breen, Richard, and John H. Goldthorpe. 1997. "Explaining Educational Differentials: Towards a Formal Rational Action Theory." *Rationality and Society* 9: 275-305.

Caldwell, John C. 1986. "Routes to low mortality in poor countries." *Population and Development Review* 12:171-220.

Cobbe, James, and Boediono. 1993. "Education, Demographics, the Labor Market, and Development: Indonesia in the Process of Transition?" *Journal of Asian and African Studies* 28: 1-29.

Diamond, Ian, Margaret Newby, and Sarah Varle. 1999. "Female Education and Fertility: Examining the Links." Pp. 23-48 in Caroline H. Bledsoe, John B. Casterline, Jennifer A. Johnson-Kuhn, and John G. Haaga. 1999. *Critical Perspectives on Schooling and Fertility in the Developing World*. Washington, D.C. National Academy Press.

Duncan, Beverly, and Otis Dudley Duncan. 1969. "Family Stability and Occupational Success." *Social Problems*. 16: 273-85.

Duncan, Otis Dudley. 1966. "Methodological Issues in the Analysis of Social Mobility." Pp. 51-97 in N. J. Smelser and S. M. Lipset (eds.), *Social Structure and Mobility in Economic Development*. Chicago: Aldine.

Erikson, Robert, and John H. Goldthorpe. 1992. *The Constant Flux: A Study of Class Mobility in Industrial Societies*. Oxford: Clarendon Press.

Featherman, David L., and Robert M. Hauser. 1978. *Opportunity and Change*. New York: Academic Press.

Frankenberg, Elizabeth, P. Hamilton, S. Polich, W. Suriastini, and D. Thomas. 2000. "User's Guide for the Indonesia Family Life Survey, Wave 2." RAND DRU-2238/2-NIA/NICHD.

Hirschman, Charles, and Philip Guest. 1990. "The Emerging Demographic Transitions of Southeast Asia." *Population and Development Review* 16: 121-52.

Hout, Michael. 1988. "More Universalism, Less Structural Mobility: the American Occupational Structure in the 1980s." *American Journal Of Sociology* 93:1358-1400.

Jejeebhoy, Shireen J. 1995. *Women's Education, Autonomy, and Reproductive Behaviour*. Oxford: Clarendon Press.

Jencks, Christopher, Marshall Smith, Henry Acland, Mary Jo Bane, David Cohen, Herbert Gintis, Barbara Heyns, and Stephan Michelson. 1972. *Inequality: A Reassessment of the Effect of Family and Schooling in America*. New York. Basic Books.

Johnson, Robert A. 1980. *Religious Assortative Marriage in the United States*. New York: Academic Press.

Jones, Gavin. 1994. *Marriage and Divorce in Islamic South-East Asia*. New York: Oxford University Press.

King, Elizabeth M., and M. Anne Hill. 1993. *Womens' Education in Developing Countries: Barriers, Benefits and Policy.* Washington D.C.: The World Bank.

Knodel, John, and Gavin W. Jones. 1996. "Post-Cairo Population Policy: Does Promoting Girls' Schooling Miss the Mark? *Population and Development Review* 22: 683-702.

Lam, David. 1986. "The Dynamics of Population Growth, Differential Fertility, and Inequality." *American Economic Review* 76: 1103-16.

Lloyd, Cynthia. 1994. "Investing in the Next Generation: The Implications of High Fertility at the Level of the Family." Pp. 181-202 in *Population and Development: Old Debates and New Conclusions*, edited by Robert Cassen. New Brunswick, NJ: Transaction Publishers.

Logan, John Allen, Peter D. Hoff, and Michael A. Newton. 2001. "A Parametric Two-Sided Model of Marriage." Working Paper No. 15. Center for Statistics and the Social Sciences. University of Washington, Seattle WA.

Maralani, Vida. 2004. "Family Size and Educational Attainment in Indonesia: A Cohort Perspective." California Center for Population Research Working Paper 017-04, (http://www.ccpr.ucla.edu/ccprwpseries/ccpr_017_04.pdf).

Mare, Robert D. 1981. "Change and Stability in Educational Stratification." *American Sociological Review* 46: 72-87.

Mare, Robert D. 1997. "Differential Fertility, Intergenerational Educational Mobility, and Racial Inequality." *Social Science Research* 26: 263-91.

Mare, Robert D. 2000. "Assortative Mating, Intergenerational Mobility, and Educational Inequality." California Center for Population Research Working Paper CCPR 004-00. http://www.ccpr.ucla.edu/ccprwpseries/ccpr_004_00.pdf

Mare, Robert D., and Huey-Chi Chang. (forthcoming). "Family Attainment Norms and Educational Stratification in the United States and Taiwan: New Models for School Transitions." In G. Fields, D. B. Grusky, and S. L. Morgan (eds.) *Frontiers in Economic and Social Mobility.* Stanford, CA: Stanford University Press.

Matras, Judah. 1961. "Differential Fertility, Intergenerational Occupational Mobility, and Change in Occupational Distribution: Some Elementary Interrelationships." *Population Studies* 15: 187-97.

Matras, Judah. 1967. "Social Mobility and Social Structure: Some Insights from the Linear Model." *American Sociological Review* 32: 608-14.

McLanahan, Sara S., and Gary D. Sandefur. 1994. *Growing Up With a Single Parent*. Cambridge: Harvard University Press.

Mueller, Eva. 1984. "Income, Aspirations, and Fertility in Rural Areas of Less Developed Countries." Pp. 121-150 in *Rural Development and Human Fertility*, edited by Wayne A. Schutjer and C. Shannon Stokes. New York: Macmillan Publishing Company.

Mukherjee, Ramkrishna. 1954. "A Further Note on the Analysis of Data on Social Mobility." Pp. 242-59 in D. V. Glass (ed.), *Social Mobility in Britain*. London: Routledge and Kegan Paul.

Musick, Kelly, and Robert D. Mare. 2004. "Family Structure, Intergenerational Mobility, and the Reproduction of Poverty: Evidence for Increasing Polarization?" *Demography*,

Preston, Samuel H. 1974. "Differential Fertility, Unwanted Fertility, and Racial Trends in Occupational Achievement." *American Sociological Review* 39: 492-506.

Preston, Samuel H., and Cameron Campbell. 1993. "Differential Fertility and the Distribution of Traits: The Case of IQ." *American Journal of Sociology* 98: 997-1019.

Schultz, T. Paul. 2001. "Why Governments Should Invest More to Educate Girls." Economic Growth Center, Yale University, Discussion Paper No. 836.

Sewell, William H., Archibald O. Haller, and Alejandro Portes. 1969. "The Educational and Early Occupational Attainment Process." *American Sociological Review* 34: 89-92.

Shavit, Yossi, and Hans-Peter Blossfeld. 1993. *Persistent Inequalty: Changing Educational Attainment in Thirteen Countries.* Boulder, CO: Westview Press.

Shavit, Yossi and Jennifer L. Pierce. 1991. “Sibship Size and Educational Attainment in Nuclear and Extended Families: Arabs and Jews in Israel.” *American Sociological Review* 56:321-30.

Summers, Lawrence H. 1994. *Investing in All the People: Educating Women in Developing Countries.* Washington, D.C. World Bank.

Thomas, Duncan. 1994. “Like Father, Like Son; Like Mother Like Daughter: Parental Resources and Child Height.” *Journal of Human Resources* 29: 950-88.

Treiman, Donald J., and Harry B. G. Ganzeboom. 1999. “The Fourth Generation of Comparative Stratification Research.” In *Sociological Research at the End of the Century*, edited by Stella Quah and Arnaud Sales. London: Sage.

Winship, Christopher, and Robert D. Mare. 1992. "Models for Sample Selection Bias." *Annual Review of Sociology* 18: 327-50

Table 1. Educational Attainment Distributions for Selected IFLS Samples (Percent)[ab]

	Marriage/Fertility Sample		Transmission Sample					
Educational Attainment	Woman	Husband	Woman	Husband	W/H	Daughters	Sons	D/S
None	47.2	29.2	48.0	29.2	1.64	11.0	6.2	1.77
Elementary	39.8	50.6	40.3	51.3	0.79	47.5	42.2	1.13
Junior Secondary	6.1	8.7	6.2	8.7	0.71	12.7	15.3	0.83
Senior Secondary	5.3	8.1	4.5	7.9	0.57	20.8	25.1	0.83
Post Secondary	1.5	3.4	1.0	2.8	0.34	7.9	11.2	0.71
Total	99.9	100.0	100.0	99.9		99.9	100.0	
# Observations	3938	3938	3236	3236		5417	5403	

[a] Data are weighted to adjust for oversampling and attrition.

[b] Totals do not sum to 100 percent due to rounding.

Table 2. Distribution of Outcomes by Women's Educational Attainment[ab]

	Husband's Education (%)						Children Ever Born	Offspring's Education (%)					
	None	Elem.	Jr. Sec.	Sr. Sec.	Post Sec.	Total		None	Elem.	Jr. Sec.	Sr. Sec.	Post Sec.	Total
Women's Education:													
None	51.8	44.6	2.2	1.3	0.1	100.0	4.8	16.4	59.9	9.9	11.4	2.5	100.1
Elementary	11.5	69.2	12.0	5.8	1.4	99.9	5.2	1.9	39.1	19.8	30.7	8.6	100.1
Junior Secondary	2.4	23.4	32.4	35.9	5.9	100.0	5.0	0.4	4.8	16.2	48.9	29.7	100.0
Senior Secondary	0.3	7.3	14.1	49.2	29.2	100.1	4.1	0.4	1.4	4.5	39.5	54.3	100.1
Post Secondary	0.0	8.5	7.1	23.6	60.9	100.1	3.5	0.0	0.0	2.3	20.9	76.8	100.0
Total	29.2	50.6	8.7	8.1	3.4	100.0	4.9	8.6	44.8	14.0	23.0	9.6	100.0
# Observations				3938			3938				10820		

[a] Data are weighted to adjust for oversampling and attrition.

[b] Totals do not sum to 100 percent due to rounding.

Table 3. Parameter Estimates for Models of Marriage, Fertility, and Intergenerational Transmission[ab]

	Husband's Schooling (Ordered Logit*)		Children Ever Born (Poisson)		Offspring's Schooling (Ordered Logit*)	
	β	z	β	z	β	z
Women's Education						
None (reference)						
Elementary	2.014	24.3	0.008	0.3	0.936	12.8
Junior Secondary	4.072	31.2	-0.064	-1.6	1.725	14.0
Senior Secondary	5.571	35.5	-0.210	-4.5	2.346	16.4
Post Secondary	6.940	22.6	-0.418	-5.6	3.160	6.9
Husband's Education						
None (reference)						
Elementary			0.090	3.5	0.969	11.3
Junior Secondary			0.093	2.4	1.776	14.5
Senior Secondary			0.086	2.2	2.348	18.1
Post Secondary			0.019	0.3	3.362	14.6
Child's Sex (1=girl)					-0.477	-12.4
Intercept			1.587	77.5		
# Observations	3938		3938		10820	
Log Likelihood	-3944.0		-10161.7		-13155.2	

[a] Cutpoint parameters are not shown.

[b] Ratios of coefficients to standard errors use robust standard errors.

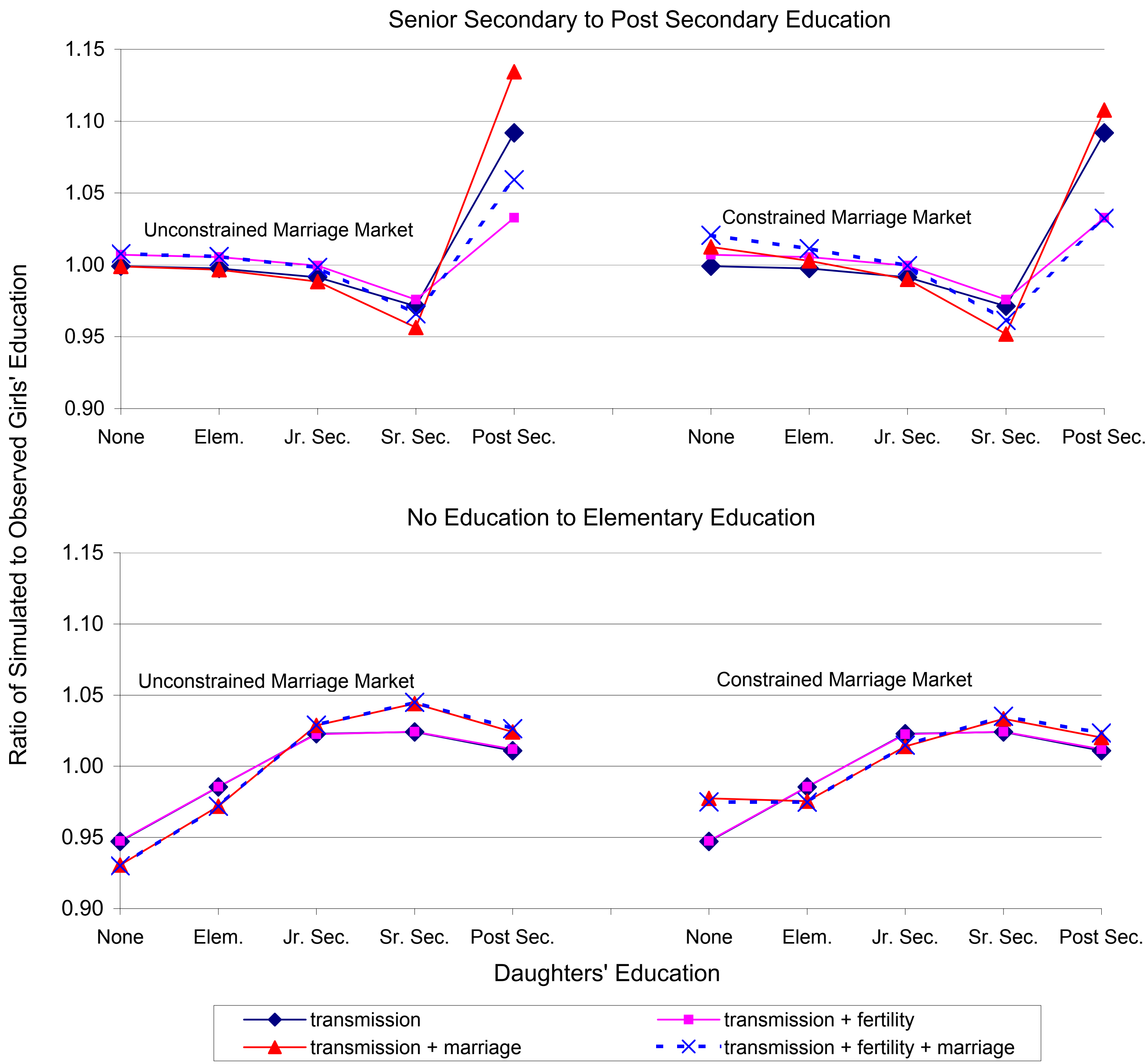

Figure 1. Effects of Redistributing Five Percent of Women Across Adjacent Education Categories

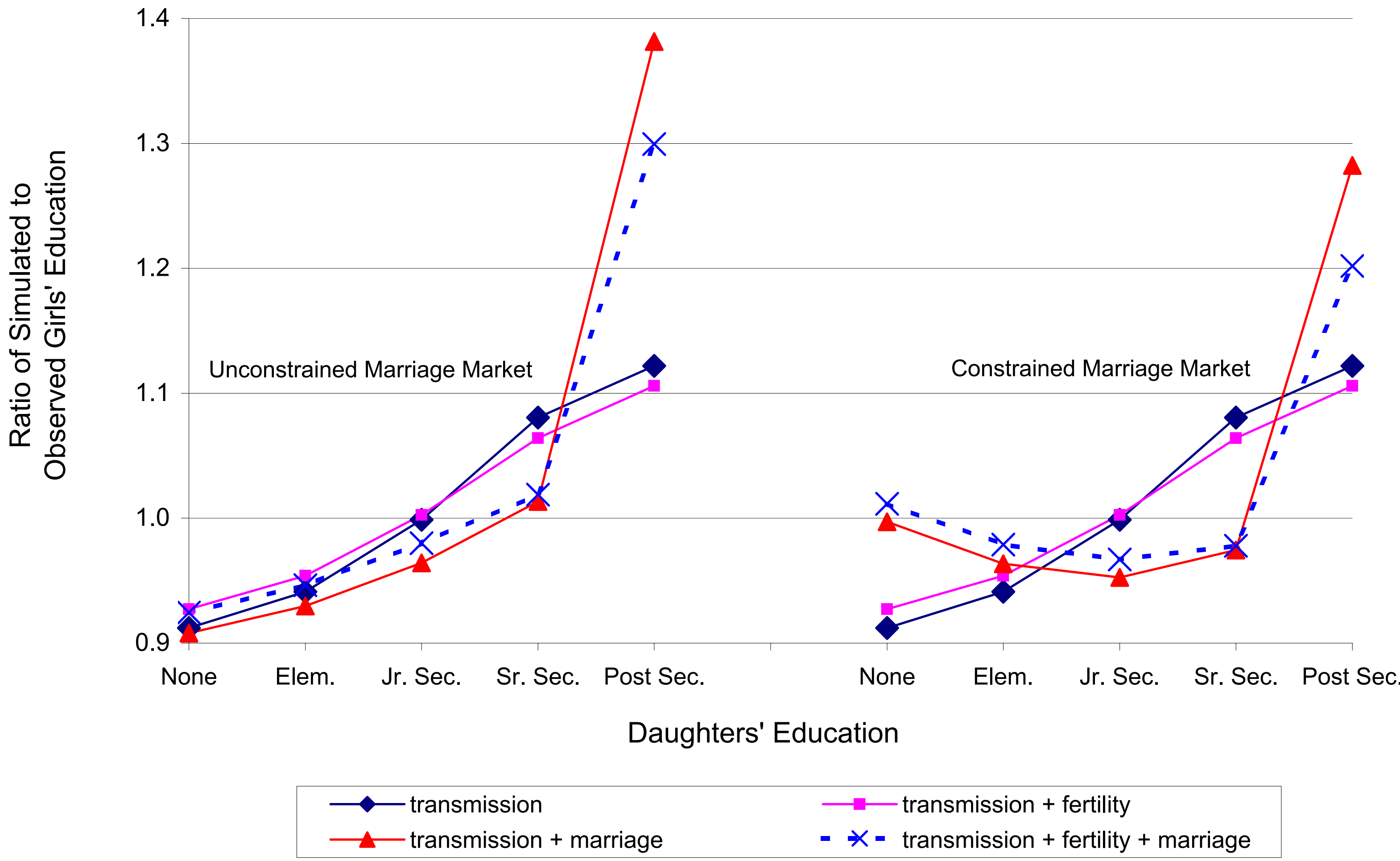

Figure 2. Effects of Redistributing Five Percent of Women from No Education to Post Secondary Education

Appendix Table A1. Ratios of Simulated to Observed Offspring's Education Distributions, Unconstrained Marriage Market

	Sons					Daughters				
	None	Elem.	Jr. Sec.	Sr. Sec.	Post Sec.	None	Elem.	Jr. Sec.	Sr. Sec.	Post Sec.
Simulation	Transmission Only					Transmission Only				
None to Elem.	0.946	0.976	1.015	1.025	1.013	0.947	0.985	1.023	1.024	1.011
Elem. to Jr. Sec.	0.988	0.983	0.984	1.015	1.035	0.988	0.982	0.992	1.026	1.033
Jr. Sec. to Sr. Sec.	0.998	0.995	0.989	0.987	1.054	0.998	0.994	0.985	0.993	1.064
Sr. Sec. to Post Sec.	0.999	0.998	0.994	0.978	1.058	0.999	0.997	0.991	0.971	1.092
None to Post Sec.	0.911	0.932	0.976	1.054	1.125	0.912	0.941	0.999	1.081	1.122
	Transmission + Fertility					Transmission + Fertility				
None to Elem.	0.946	0.977	1.015	1.025	1.014	0.948	0.986	1.023	1.024	1.012
Elem. to Jr. Sec.	0.990	0.984	0.984	1.014	1.038	0.990	0.984	0.991	1.024	1.037
Jr. Sec. to Sr. Sec.	1.004	1.001	0.993	0.984	1.039	1.004	1.000	0.989	0.987	1.049
Sr. Sec. to Post Sec.	1.007	1.006	1.003	0.985	1.011	1.007	1.005	0.999	0.976	1.033
None to Post Sec.	0.926	0.946	0.985	1.044	1.106	0.927	0.954	1.003	1.064	1.106
	Transmission + Marriage					Transmission + Marriage				
None to Elem.	0.929	0.961	1.013	1.042	1.028	0.931	0.972	1.029	1.044	1.024
Elem. to Jr. Sec.	0.983	0.973	0.966	1.014	1.088	0.982	0.971	0.973	1.037	1.087
Jr. Sec. to Sr. Sec.	0.997	0.993	0.981	0.969	1.108	0.996	0.990	0.974	0.976	1.136
Sr. Sec. to Post Sec.	0.999	0.998	0.993	0.968	1.082	0.999	0.997	0.988	0.956	1.134
None to Post Sec.	0.907	0.924	0.953	0.993	1.305	0.908	0.930	0.964	1.013	1.381
	Transmission + Fertility + Marriage					Transmission + Fertility + Marriage				
None to Elem.	0.928	0.961	1.013	1.043	1.030	0.930	0.972	1.029	1.045	1.026
Elem. to Jr. Sec.	0.985	0.975	0.967	1.012	1.095	0.985	0.972	0.973	1.035	1.096
Jr. Sec. to Sr. Sec.	1.004	1.000	0.988	0.969	1.086	1.004	0.997	0.980	0.972	1.114
Sr. Sec. to Post Sec.	1.008	1.006	1.002	0.979	1.025	1.008	1.006	0.998	0.966	1.059
None to Post Sec.	0.924	0.940	0.969	1.003	1.238	0.924	0.946	0.980	1.019	1.300

Appendix Table A2. Ratios of Simulated to Observed Offspring's Education Distributions, Constrained Marriage Market

	Sons					Daughters				
	None	Elem.	Jr. Sec.	Sr. Sec.	Post Sec.	None	Elem.	Jr. Sec.	Sr. Sec.	Post Sec.
Simulation	Transmission Only					Transmission Only				
None to Elem.	0.946	0.976	1.015	1.025	1.013	0.947	0.985	1.023	1.024	1.011
Elem. to Jr. Sec.	0.988	0.983	0.984	1.015	1.035	0.988	0.982	0.992	1.026	1.033
Jr. Sec. to Sr. Sec.	0.998	0.995	0.989	0.987	1.054	0.998	0.994	0.985	0.993	1.064
Sr. Sec. to Post Sec.	0.999	0.998	0.994	0.978	1.058	0.999	0.997	0.991	0.971	1.092
None to Post Sec.	0.911	0.932	0.976	1.054	1.125	0.912	0.941	0.999	1.081	1.122
	Transmission + Fertility					Transmission + Fertility				
None to Elem.	0.946	0.977	1.015	1.025	1.014	0.948	0.986	1.023	1.024	1.012
Elem. to Jr. Sec.	0.990	0.984	0.984	1.014	1.038	0.990	0.984	0.991	1.024	1.037
Jr. Sec. to Sr. Sec.	1.004	1.001	0.993	0.984	1.039	1.004	1.000	0.989	0.987	1.049
Sr. Sec. to Post Sec.	1.007	1.006	1.003	0.985	1.011	1.007	1.005	0.999	0.976	1.033
None to Post Sec.	0.926	0.946	0.985	1.044	1.106	0.927	0.954	1.003	1.064	1.106
	Transmission + Marriage					Transmission + Marriage				
None to Elem.	0.979	0.971	0.999	1.030	1.023	0.978	0.976	1.014	1.033	1.020
Elem. to Jr. Sec.	1.039	0.987	0.953	0.997	1.078	1.035	0.978	0.957	1.021	1.079
Jr. Sec. to Sr. Sec.	1.024	1.004	0.980	0.959	1.089	1.023	0.999	0.969	0.965	1.115
Sr. Sec. to Post Sec.	1.013	1.005	0.995	0.966	1.059	1.012	1.003	0.990	0.952	1.108
None to Post Sec.	1.000	0.968	0.954	0.962	1.217	0.997	0.963	0.953	0.974	1.282
	Transmission + Fertility + Marriage					Transmission + Fertility + Marriage				
None to Elem.	0.977	0.970	0.999	1.031	1.026	0.975	0.975	1.015	1.035	1.023
Elem. to Jr. Sec.	1.039	0.988	0.954	0.996	1.085	1.035	0.979	0.958	1.020	1.088
Jr. Sec. to Sr. Sec.	1.031	1.011	0.986	0.960	1.066	1.030	1.006	0.975	0.960	1.093
Sr. Sec. to Post Sec.	1.021	1.013	1.004	0.977	1.001	1.021	1.011	0.999	0.961	1.032
None to Post Sec.	1.015	0.983	0.969	0.971	1.151	1.011	0.979	0.967	0.978	1.202