Unobserved Heterogeneity, Demographic Mechanisms, and
the Intergenerational Effects of Increasing Women's Schooling

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Increases in women's schooling represent one of the most fundamental and wide-reaching socioeconomic changes of recent decades. In most developing countries girls have made large gains in primary and secondary schooling while young women in many industrialized nations are pursuing post-secondary schooling in unprecedented proportions. Indeed, women now outpace men in rates of college completion in the United States, Canada, and much of Europe (Buchmann and DiPrete 2006). Given the important role that educational attainment plays in processes of social, economic, and health stratification, these expansions in women's schooling have attracted much attention in both the academic literature and the popular press.

Few studies, however, have explored the implications of women's educational gains for intergenerational mobility and educational inequality in future generations. The intergenerational effects of increases in women's schooling are particularly important because parents' education is an important determinant of children's education (Blau and Duncan 1967, Mare 1981). But measuring the intergenerational effects of increases in women's schooling is complicated by the fact that the processes that *create* generations—such as marriage and childbearing—are endogenous to changes in women's schooling. That is, women with different levels of schooling have substantially different patterns of marriage and fertility. Given that schooling is usually completed early in life, increases in women's schooling quite likely change subsequent marriage and fertility choices as well. Any assessment of the intergenerational effects of increasing women's schooling must account for these endogenous population processes that create the very families within which the advantages of schooling will be transmitted from women to their children (Mare 1997, Maralani and Mare 2005, Mare and Maralani 2006, Maralani 2007).

In earlier work, we developed these arguments formally and presented models that are better suited for the analysis of the effects of women's educational attainment on children's attainment. By considering endogenous demographic mechanisms, these models advance the study of social mobility beyond traditional approaches, which often abstract from demographic processes altogether and focus only on the associations between parents' and children's statuses. In the current paper, we build on this previous work by exploring how issues of unobserved heterogeneity affect mobility processes—another important aspect of intergenerational processes often ignored in past research. Although most studies of social mobility use recursive models, assumptions of independence (uncorrelated errors) are often violated. The current paper examines how estimates of intergenerational effects differ based on assumptions of independence between various pathways of intergenerational effects including demographic ones.

We build on our previous approach, which embeds a traditional model of social mobility within a formal demographic model of population projection. Let C_j be the children in the offspring generation with education level j and W_i be the number of women in the mother generation with education level i. Let $r_{jka|i}$ be the number of children who attain education level j, with a father with education level k, born at mother's age a, per woman who has attained education level i. The $r_{jka|i}$ is the rate at which women with a given level of education produce children who go on to attain different levels of education. This can be thought of as an intergenerational transmission rate weighted by differential fertility and marriage. If one knows the educational distribution of women at a given point in time, then this equation can project the educational distribution of children in the next generation:

(1) $$C_j = \sum_i \sum_k \sum_a r_{jka|i} W_i \ .$$

Given the $r_{jka|i}$ one can compute the expected number of children of education level j born to a mother with education level i. One can also simulate the change in C_j if the distribution of W_i were modified or if the distribution of W_i differed by cohort or race.

Marriage, fertility, and intergenerational transmission affect the $r_{jka|i}$ as follows:

(2) $$r_{jka|i} = p^H_{k|ai} \, p^F_{kai} \, p^T_{j|kai} \, ,$$

where the components denote the following:

- $p^{H}_{k|ai}$ denotes the probability that a woman in the i^{th} education category has a partner in the k^{th} education category when she is age a (we allow women to be unmarried by including a category for that status).
- p^{F}_{kai} denotes the probability that a woman in education category i who has a husband in category k (or is unmarried) has a birth at each age a.
- $p^{T}_{j|kai}$ denotes the probability that a child born to a woman in the i^{th} education category at age a with a man in the k^{th} education category (or unmarried) achieves the j^{th} level of schooling.

The components of equation (2) can be estimated using a series of statistical models that represent each of the specified processes (marriage, fertility, transmission of educational status). In their simplest form, these processes can be assumed to be independent and one can estimate a separate statistical model for each component of equation (2). Then, one can use predicted probabilities and actual or hypothetical values of observed characteristics of women and their husbands to compute an estimate of $r_{jka|i}$ and a series of simulations to consider the intergenerational effects of changes in the schooling distribution of women (W_i).

In the current paper, we relax these assumptions of independence. First, we consider a model in which family size (fertility) and children's schooling (transmission) are jointly determined using a random effects structure with one latent variable and a factor loading. That is we estimate p^{F}_{kai} and $p^{T}_{j|kai}$ using a joint model. Second, we present a set of simulations that assess a fixed effect structure rather than the random effects structure to relax the assumption that the unobserved factor is not correlated with women's schooling. Third, we consider a set of simulations that test the population level effects of increased childlessness, which might be the case, say, if certain types of women forgo fertility altogether. This approach is similar to a selection equation approach. Finally, we consider an extreme approach where the effects of women's schooling are assumed to be zero in the transmission process to show that even if endowments and marriage sorting processes explain all of the direct effect of women's schooling on children's schooling, *the intergenerational effects* of increasing women's schooling are usually not zero because of effects that accrue through demographic mechanisms and population level processes. Throughout the analysis, we examine how results differ by race and birth cohort.

The analysis uses the 1968 to 2003 public use waves of the Panel Study of Income Dynamics (PSID). The PSID is a longitudinal survey that began in 1968 with a representative sample of U.S. individuals and their families. For the past three decades, the survey has followed original sample members and all new family members, tracking children from their families of origin to their new households. The survey includes extensive socioeconomic and demographic information and its multigenerational structure is well-suited to the types of models of intergenerational transmission described above.

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